WASHINGTON ELECTRIC COOPERATIVE, INC.

2020 INTEGRATED RESOURCE PLAN
2020 – 2039

Submitted by
Washington Electric Cooperative, Inc.

Prepared by
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List of Acronyms

ACP – Alternative Compliance Payment
AMI – Automated Metering Infrastructure
ARRA – American Recovery and Reinvestment Act
CAA – Clean Air Act
CAGR – Compound Annual Growth Rate
CCHP – Cold Climate Heat Pump
CEP – Comprehensive Energy Plan
CWP – Construction Work Plan
DPS – Department of Public Service
DSM – Demand Side Management
DUP – Distributed Utility Planning
EEU – Energy Efficiency Utility
EPA – Environmental Protection Act
EVT – Efficiency Vermont
EV – Electric Vehicles
FCA – Forward Capacity Auction
FCM – Forward Capacity Market
FERC – Federal Energy Regulatory Commission
HQ B – Hydro Quebec Schedule B
HQUS PPA – Hydro Quebec US Purchase Power Agreement
HQ VJO – Hydro Quebec Vermont Joint Owner
ICAP – Installed Capacity
IRP – Integrated Resource Plan
ISO-NE – Independent System Operators of New England
LFG – Landfill Gas
LMP – Locational Marginal Prices
LNG – Liquid Natural Gas
LSE – Load Serving Entity
NEMA – Northeast Massachusetts
NEPOOL GIS – New England Power Pool Generation Information System
NEWSVT – New England Waste Services of Vermont Landfill
NPV – Net Present Value
NSPC – New Source Performance Standards

NYPA – New York Port Authority
PSB – Public Service Board
PV – Present Value
REC – Renewable Energy Credits
RGGI – Regional Greenhouse Gas Initiative
RNS – Regional Network Service
RPS – Renewable Portfolio Standard
RUS – Rural Utility Service
RTLO – Real-Time Load Obligation
SCADA – Supervisory Control and Data Acquisition
SPEED – Sustainably Priced Energy Enterprise Development Program
TOU – Time of Use
T & D – Transmission and Distribution
UCAP – Unforced Capacity
VEC – Vermont Electric Cooperative
VELCO – Vermont Electric Power Company
VEPPI – Vermont Electric Power Producers Inc.
VPPSA –Vermont Public Power Supply Authority
VSA – Vermont Statutes Annotated
VSPC – Vermont State Planning Committee
WEC –Washington Electric Cooperative

Executive Summary

As required by 30 V.S.A. § 218c, Washington Electric Cooperative (WEC) has prepared its 2020 Integrated Resource Plan (IRP) for submission to the Vermont Public Utility Commission (PUC) and the Department of Public Service (PSD or Department). In addition to its regulatory requirements, WEC views the IRP as a valuable planning tool and guiding document. The IRP enables WEC to communicate to various stakeholder groups regarding its plans for power supply, Demand Side Management (DSM), Transmission and Distribution (T&D) system planning and progress towards meeting a variety of state goals related to energy efficiency, distributed resources and strategic electrification.

As part of WEC's mission, it is committed to meeting the following responsibilities, and each is considered in and addressed by the IRP:

- Provide energy to members as inexpensively as possible;
- Educate and advise its members about using energy safely, wisely, and economically;
- Keep its member-owners informed about their Co-op and its business, economic, regulatory, political, and social environments;
- Minimize the environmental impacts of electric generation and operations;
- Support and promote our local economy and community organizations; and
- Provide leadership and take proactive positions on energy and environmental issues.

The intent of the IRP resource modeling process is to provide important information about the costs, features, and risks of various power supply portfolios that WEC could use in the future to meet its system load requirements. The goal is to project cost and cost variance, emissions profiles, and other qualities associated with each portfolio, under a range of future loads, market prices, economic conditions, and other factors affecting performance, such as market or regulatory changes.

Similar to WEC's 2017 and 2014 IRP's, WEC's 2020 IRP filing is not analyzing the need to replace or enter new long-term power commitments. In WEC's 2014 IRP, it completed a rigorous resource analysis in which it analyzed various portfolios and stress tested the assumptions used to calculate costs. Given that little has changed with regards to WEC's power supply commitments since the 2014 and the 2017 filing, completing the same analysis in 2020 was determined to yield little new information and results.

As noted in the Department's IRP guidelines, "utilities should use the IRP process to address questions that are the most relevant to the utility at the time of the IRP." [1] Since little will change in WEC's resource outlook in the next several years, it is focusing less on new power supply commitments and more on other key issues important to WEC (strengthening the grid for reliability; understanding the roles and impacts of distributed generation and strategic electrification; identifying and responding to consumer expectations; controlling costs; and addressing climate change). WEC provides a summary of the 2014 power supply analysis and results for context in its 2020 IRP as this work remains relevant today. The impacts of the analysis and key variables remain important to WEC today and the Co-op provides a high-level summary in this filing of the work completed in 2014.

The planning period for the IRP is January 1, 2020 – December 31, 2039. To follow is a brief summary of WEC's IRP. WEC begins by describing its outlook of its existing resources and future load. WEC also includes an assessment of its resource mix and key drivers to WEC costs from variations in the sources of power. Further, WEC assesses the cost implications that are only relatively controllable by WEC, for example costs associated with the Forward Capacity Market (FCM), charges related to transmission service, and the value of Renewable Energy Credits (REC) which are set by market conditions. WEC provides a summary of its power supply resources and projected requirements as well as its plans for various legislative and regulatory mandates. The report also provides a detailed review of WEC's transmission and distribution (T&D) systems with an initial scoping analysis mapped out to assess future distributed generation penetration.

As noted in the 2016 Comprehensive Energy Plan (CEP), utilities should use the IRP process to address questions that are the most relevant to the utility at the time of the IRP. WEC has done just that in its IRP filings and tailored its work to address key issues of importance to the Coop while meeting the requirements of the 2016 CEP. In addition, WEC met with the Department several times and in advance of the filing to discuss its key issues and questions it desired to address in this filing. WEC and the Department agreed that since (1) WEC is not making large or longer-term power supply decisions for the next five years, and (2) the unlikelihood of seeing significant load shifts due to WEC's load being predominantly (94%) and consistently residentially driven. As a result, WEC's 2020 IRP will focus on key issues identified by WEC and agreed to by the PSD.

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[1] 2016 CEP, Appendix B; Guidance for Integrated Resource Plans and 202(f) Determination Requests, page 5

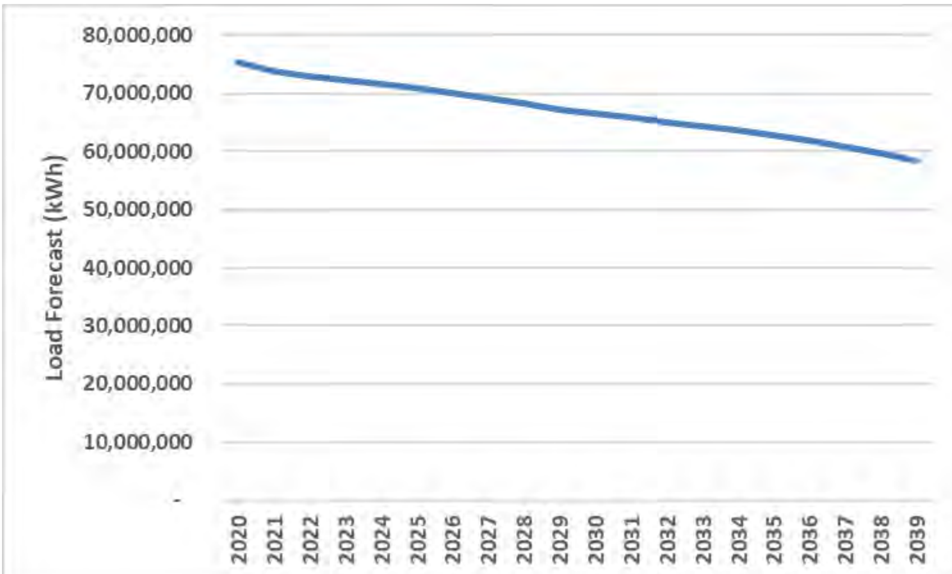
As a result, WEC's IRP is structured to focus on the following areas;

- Revisit key power cost drivers from the 2014 & 2017 IRP analysis and reaffirm relevance of each driver to WEC's current situation and costs;
- Assess ways to control costs and pressures of increasing rates in light of flat to declining load;
- Provide an overview of important regulatory issues and WEC's approach and program responses related to:
    - Act 56 Renewable Energy Standard (Tier I, II and III)
    - Net Metering
    - 2016 Comprehensive Energy Plan
    - Trend towards increased strategic electrification
- Assess impacts of distributed energy resources on the T&D systems;
- Discuss current approaches and future ideas to engage with members particularly as the electric industry evolves;
- Discuss the impacts and abilities to control WEC's peak through Peak Control Programs;
- Discuss WEC's exploration of bringing broadband access to its members;
- Discuss WEC's approach to offer rates that send appropriate and fair price signals through Rate Design;
- Discuss WEC's commitment to continue to serve its members during the COVID-19 pandemic;
- Present the WEC Board of Directors statement regarding climate change, and the roles that the National Rural Electric Cooperative Association (NRECA) and the Northeast Association of Electric Cooperatives (NEAEC) should play to address climate change;
- Briefly discuss the impact of the pandemic on WEC and its members, and WEC's efforts to provide affordable, reliable service throughout this time period.

Load Forecast

The IRP evaluates costs and other features of WEC's portfolios by modeling system energy requirements *after* adjusting the load forecast for the effects of energy efficiency and other programs already in place and likely to be implemented over the forecast horizon.

Figure ES-1. Load Forecast



For the load forecast, WEC used residential sales forecasts results from a rigorous state effort developed by VELCO. VELCO's forecast projected an average annual decline of -0.6% from 2020 to 2030 and an average annual growth of 0.1% from 20230 to 2040.

Figure ES-1 also includes the impacts of forecasted adoption of net metered solar, cold climate heat pumps, heat pump water heaters, and electric vehicles by WEC members. Section 2.4 details and summarizes key assumptions WEC used in its load forecast estimates.

Demand Side Management

On September 30, 1999, the Vermont Public Service Board (now referred to as the PUC) issued an order that created an energy efficiency utility (EEU) to deliver Demand Side Management (DSM) or energy efficiency programs and services to electric consumers in the state. The contract to deliver these programs was awarded to Efficiency Vermont (EVT). The EEU is now mandated to deliver statewide DSM programs in the WEC territory. WEC works closely with the EEU and monitors its own internal offerings of value-added DSM programs. WEC currently offers rebates for residential new construction as well as incentives for a variety of electrically-powered equipment including vehicles, bikes and lawn mowers in its Tier III program referred to as Button Up WEC. Further, WEC continues to implement Button Up 2020 in ongoing compliance with the state Renewable Energy Standard (RES). WEC works cooperatively with the EEU and others to delivery these programs.

WEC will continue to coordinate with the EEU in the deployment of energy efficiency services to all its members. In addition, WEC participates in the Vermont State Planning Committee (VSPC), contributing feedback relative to forecasting and geo-targeting efforts in conjunction with EVT, Vermont Electric Power Company (VELCO), and the other Vermont distribution utilities. These relationships help ensure that WEC and Vermont stakeholders are apprised of DSM efforts, forecasting practices, and other energy issues in Vermont and regionally. In addition, participation assists with the coordination of information exchange among stakeholders.

Power Supply

The power supply section of the IRP reviews and simulates costs for WEC's existing committed mix of resources. The power supply modeling is a tool that helps WEC identify the need for upcoming supply decisions and measure the impacts of those decisions based on cost variance and emissions in WEC's projected resource portfolio scenarios.

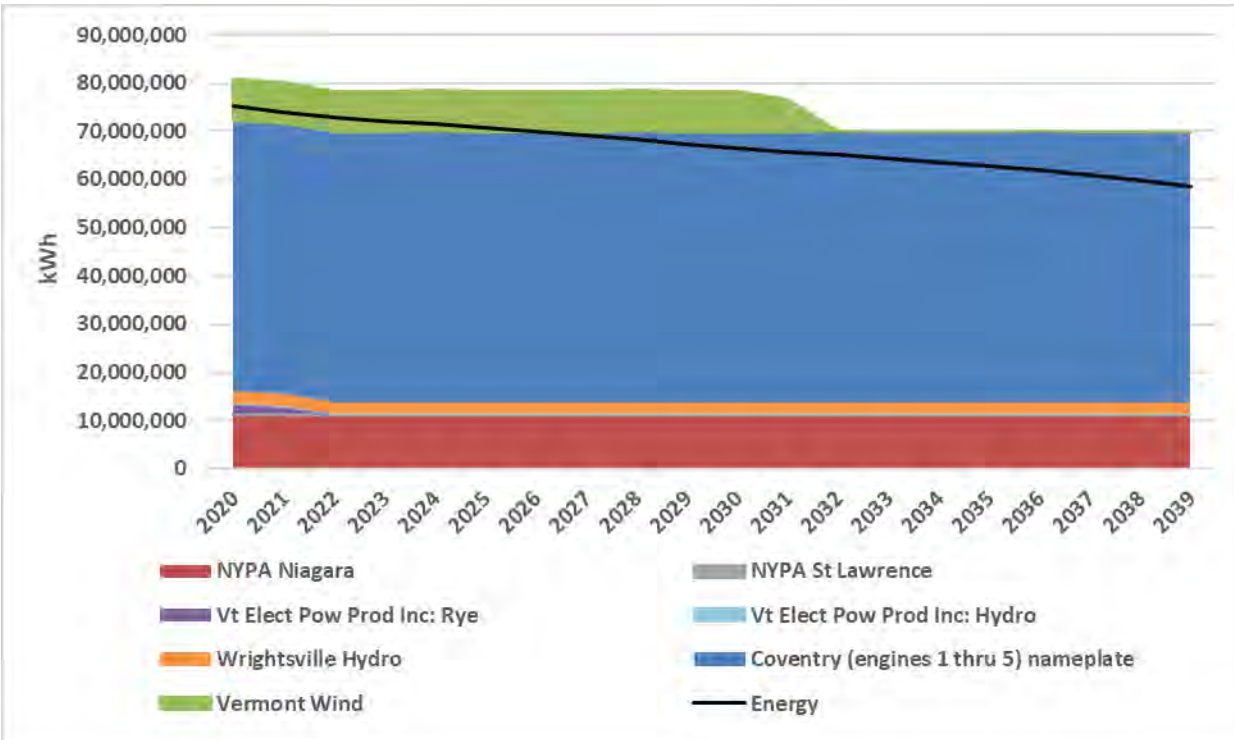
Potential market and operating scenarios were created for two WEC supply portfolios: (1) a Base case scenario[2] reflecting the status quo[3] and (2) a scenario in which generation at WEC's Coventry Landfill plant is reduced by 50%.[4] Given WEC's current supply portfolio, there is minimal practical benefit to modeling another scenario. In large part, this scenario-based portfolio approach reflects the fact that WEC's committed supply resource mix leaves it in a long or excess position relative to its energy needs for almost the entire planning period. Therefore, WEC is well covered by its existing power supply commitments for its energy needs for the next 20 years. This relationship is clearly displayed in Figure ES-2.

[2] A Scenario evaluates a possible future state whereas a sensitivity is looking at the impact from changing one particular variable, i.e. a case with a high REC price.

[3] Status quo is the business as usual case with Coventry operating at 100% generating capacity.

[4] Note that the selection of a 50% reduction of Coventry generation is not based on any potential reality but rather is hypothetical, and only serves to provide an indication of where WEC's risks may reside.

Figure ES-2. Forecast of WEC Annual Energy Position over the IRP Planning Horizon



WEC's key areas of focus, therefore, are how to best control costs, while continuing to engage and reliably serve members, *and* begin to prepare for an increasingly distributed grid incorporating strategic electric technologies (such as electric vehicles, cold climate heat pumps, batter powered lawn equipment, etc).

The IRP summarizes a number of sensitivities of key variables in order to measure the impacts and effects on costs; such as changes in the renewable energy credit (REC) market, the forward capacity market (FCM), and potential increases in transmission costs. The IRP also highlights current distribution-grid improvements and impacts on its grid. Finally, regarding engaging Co-op members, the IRP discusses how strategic electrification may evolve in the Co-op territory. The IRP modeling tests the effects that changes in REC prices, transmission costs, and FCM prices have on the net present value (NPV) of the portfolio by looking at a base, low, and high case for each of these cost variables. Sensitivities were run to look at the impact that changing one cost variable had on the overall NPV of the portfolio. Various rates of adoption for heat pumps and electric vehicles were also tested under the high and low load forecasts.

The objective was to determine how the existing portfolio responds in terms of costs and risk exposure with changes to key variables. Understanding the volatility in costs and identifying which key variables impact WEC the most is an important tool to help manage resources in the near and long-term more effectively. This process helps WEC assure it is positioned to provide its members with cost-effective power supply and stable rates, as well as safe, reliable, and environmentally responsible service.

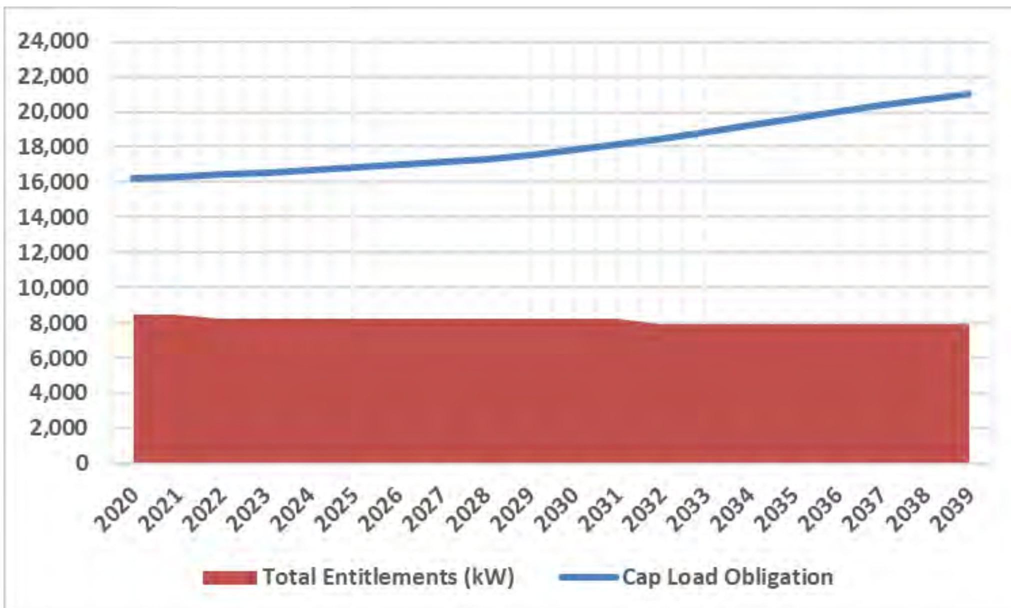
The first step of the process was to determine the most significant external factors that affect WEC's power supply costs. These factors included members' consumption patterns, the state and national economic climate, natural gas and other fuel markets, state and federal legislation and regulations, wholesale electricity market rules, etc. Section 2 outlines in detail how these factors were modeled, and how projections were developed.

The second step required analysis of the effect of alternative load forecasts to determine WEC's total resource needs on a monthly basis through the 20-year planning period. As explained further in Section 2, monthly base, high and low load forecasts were developed for both system energy and peak demand.

The third step assessed WEC's current resource portfolio as compared to the total forecast requirements, after making adjustments for forecasted net metered solar impacts, to arrive at a projected energy excess or shortfall. As Figure ES-2 reveals, WEC's energy position is well hedged through the planning period. In addition, WEC has a backup power purchase agreement (the HQ US PPA) that can be used if a gap were to unexpectable occur. WEC has 4 MW's of the HQUS PPA that many Vermont utilities entered into in 2011. While WEC does not use the power currently in its resource mix, it can do so in the event of a shortfall. WEC has an agreement with Vermont Electric Cooperative whereby VEC assumes WEC's portion of the contract until WEC needs it. WEC can "take back" power from a HQUS PPA if needed, and with certain requirements and stipulations. At this time, however, WEC does not have need to take power back to cover its needs (more discussion on this can be found in Sections 2 and 3).

While WEC is well covered in the energy market, the capacity market does show a gap. This gap was noted in both the 2014 and 2017 IRP. WEC has a capacity market need of roughly 50% that began in 2016 when the HQ VJO contract expired. WEC has been exploring various options to replace the shortfall while pursuing a least cost approach to fill the need. WEC has three options to manage its open capacity position: lower load at the time of the ISO-NE peak, increase its capacity supply while not also increasing energy, or a combination of both. Finding capacity (by contract or to build) to fill the shortfall has been unfruitful thus far. As noted, WEC does not need additional energy but rather only needs capacity. Finding a capacity only resource represents a long-term commitment, and the cost has been higher than the future capacity prices that WEC can use from the market. In the short term, this is a financial risk factor for WEC as half of the market obligation is unhedged. However, leaving this market exposure uncovered has been shown to be the least cost option to WEC members thus far. Therefore, WEC's approach has resulted in lower rates than had it committed to a contract or resource. Through reduced load from load reducers that come on at the same time as the ISO-NE regional peak and other internal generation sources, WEC may be able to mitigate some of the risk. Also, the outlook for capacity prices past 2024 remains uncertain as load regionally is falling, which will put downward pressure on market prices and reduce the cost effectiveness of pursing other resources.

Figure ES-3. Forecast of WEC Annual Capacity Position over the IRP Planning Horizon



The fourth step was to identify appropriate resource portfolio scenarios that could occur in the future along with sensitivities to evaluate specific power cost drivers. In this step, WEC develops cost projections to represent a base, low, and high case for evaluating each variable. These scenarios and sensitivities are summarized in Section 2.

The IRP analyses discussed and explained herein show that WEC will meet its power supply goals in a least cost manner consistent with the guidelines provided in the CEP and consistent with state statute using is its current resource portfolio, which contains a strong contribution from renewable energy resources, and potentially other DSM, distributed generation resources, and T&D investments.

Legislative and Regulatory Directives

WEC outlines in its IRP the impacts of major new legislation and identifies how it plans to comply with significant directives. The IRP will answer how WEC plans to comply with various state required initiatives including net metering, and the Renewable Energy Standard. WEC will also explore issues of a modern electricity grid in which demand fluctuates in new ways due to the build out of more resources like solar and wind and increased use of load for electric vehicles and heating and other beneficial electric uses. WEC will also take into account storage and energy efficiency in its outlook of the future.

As noted in the 2016 Comprehensive Energy Plan, utilities should use the IRP process to address questions that are the most relevant to the utility at the time of the IRP. Regarding regulatory and policy directives, WEC will focus on areas such as the Renewable Energy Standard and net metering, impacts of distributed generation on the T&D systems and considerations in light of ongoing strategic electrification, rate design and customer engagement. In Section 4 of the IRP, WEC identifies and provides updates to major legislative and regulatory directives that it must comply with.

Transmission and Distribution

Section 5 reviews WEC's transmission and distribution plans for improving its system to enable the reliable and efficient provision of electricity to its members. WEC evaluates individual T&D circuits for the optimum economic and engineering configuration while meeting reliability and safety criteria. In this section, WEC outlines how and when the utility updates its planning for T&D and it provides a scoping analysis to assess the impacts of grid modernization such as increased penetration of distributed generation.

WEC receives financing from the Rural Utility Service (RUS) for its electrical system improvements. One of the requirements for RUS borrowers is the periodic development of a Construction Work Plan (CWP). The CWP is developed and written in accordance with the RUS and State of Vermont IRP guidelines, and serves as a foundation for the T&D element of the IRP.

Action Plans

Section 6 is devoted to a discussion of action plans. The IRP is a planning tool that helps guide WEC and frames the direction it intends to head in the future relative to power supply and other major capital investments. It is not intended to be a fixed and prescriptive outline of what WEC will do next, but rather a dynamic and evolving planning tool to help inform and guide WEC decision-making. Consistent with Vermont's statutory policy, WEC will use the IRP as a key component in the development of its own strategic plan and understanding of changing needs to deliver power consistent with its member's interests and policies of WEC.

WEC's objective is to develop plans that support the following goals:

- Maintain financial strength and assure economic equity for members;
- Improve performance of WEC's distribution system for the benefit of members and provide access to local generation sources in WEC's service territory;
- Manage power supply, distribution, and transmission service at lowest cost, with consideration for environmental impacts and social concerns;
- Promote responsible environmental practices at WEC and assist members in achieving this goal;
- Identify the necessary steps, potential challenges and timeline for strategically electrifying the thermal and transportation sectors;
- Maintain strong member, community and government relations in a changing environment; and
- Maintain strong organizational, administrative, and communication services.

As discussed in Section 6, WEC's action plans endeavor to meet the above goals and achieve balance among competing interests. WEC seeks to provide and deliver high quality and affordable electric service to its members consistent with good environmental stewardship. The portfolio WEC developed and the action steps identified to strengthen it reflect tradeoffs between meeting various goals and satisfying its members' needs.

1. Overview and Framing

1.1. About Washington Electric Cooperative

Washington Electric Cooperative, Inc. (WEC) is a not-for-profit member-owned rural electric utility established in 1939. Its approximately 11,613 meters spread over 2,728 square miles, in 41 towns and four counties (Washington, Orange, Caledonia, and Orleans) in north-central Vermont. Washington Electric Co-op's system was energized on December 2, 1939, bringing power to 150 farms and homes over 55 miles of distribution line. Today, the Cooperative serves over 11,613 meters, 94% of whom are residential consumers. It operates approximately 1,200 miles of distribution line, with eight substations.

Founded to bring electricity to rural Vermont communities and to provide its members with a voice in their energy future, Washington Electric Co-op today unites our founders' pioneering spirit with a commitment to environment, our communities, and to our member/owners. As part of its mission, WEC is committed to:

- Providing energy to members as inexpensively as possible;
- Providing energy from clean and renewable sources;
- Helping members use energy efficiently and wisely;
- Providing reliable and safe service throughout our rural territory;
- Involving, informing, and educating our members; and
- Providing leadership and taking proactive positions on energy and environmental issues.

These guiding principles are at the core of WEC's decision-making.

1.2. WEC Membership Demographics

WEC's membership is comprised of several varying groups but WEC primarily serves homes and residences. Based on the number of 2019 members, 94% are residential and seasonal while roughly 6% of the membership consists of commercial or business-driven electric use.

Table 1-1 summarizes the number of WEC's consumer-owners from 2019 by member class.

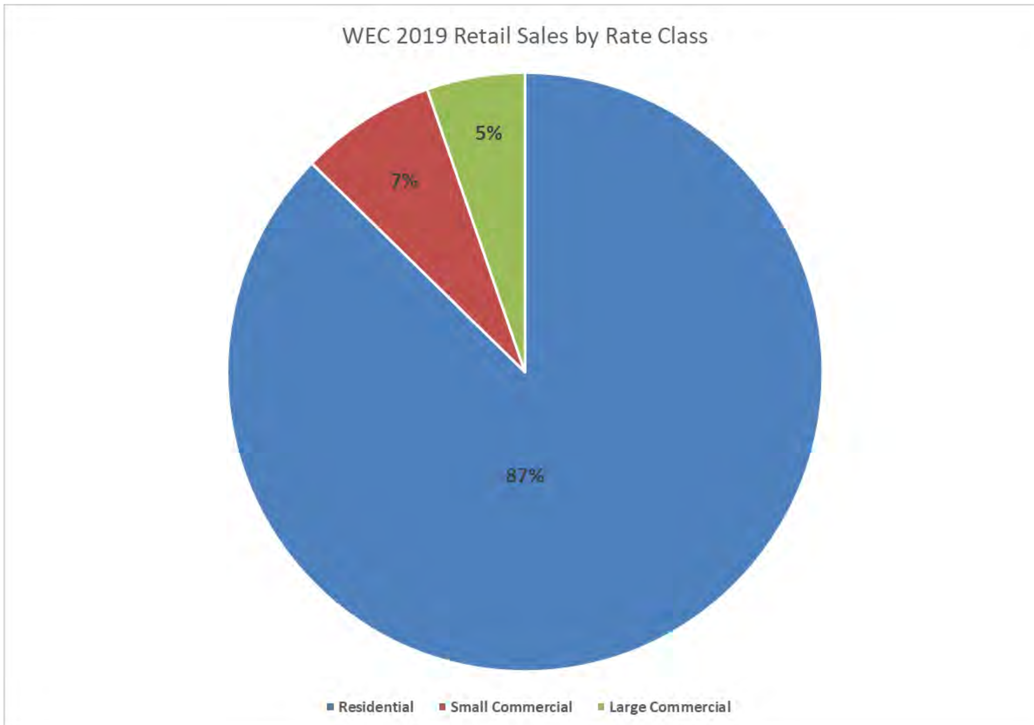
Table 1-1. WEC Member-Meter Distribution by Class

Member Class	2019 Members	% of Total
Residential (incl. Seasonal)	10,941	**94%**
Small Commercial	660	**6%**
Large Commercial	12	**0.1%**
Total	**11,613**	**100%**

As measured on an energy basis, WEC's retail energy sales are overwhelmingly residential (and seasonal residential): about 87%.[5] WEC also has small commercial and large power sales (schools, office buildings, and light manufacturing) making up the remainder, about 7% and 5% of the total, respectively. See Figure 1-1 for a graphic summary of WEC's retail sales by membership class.

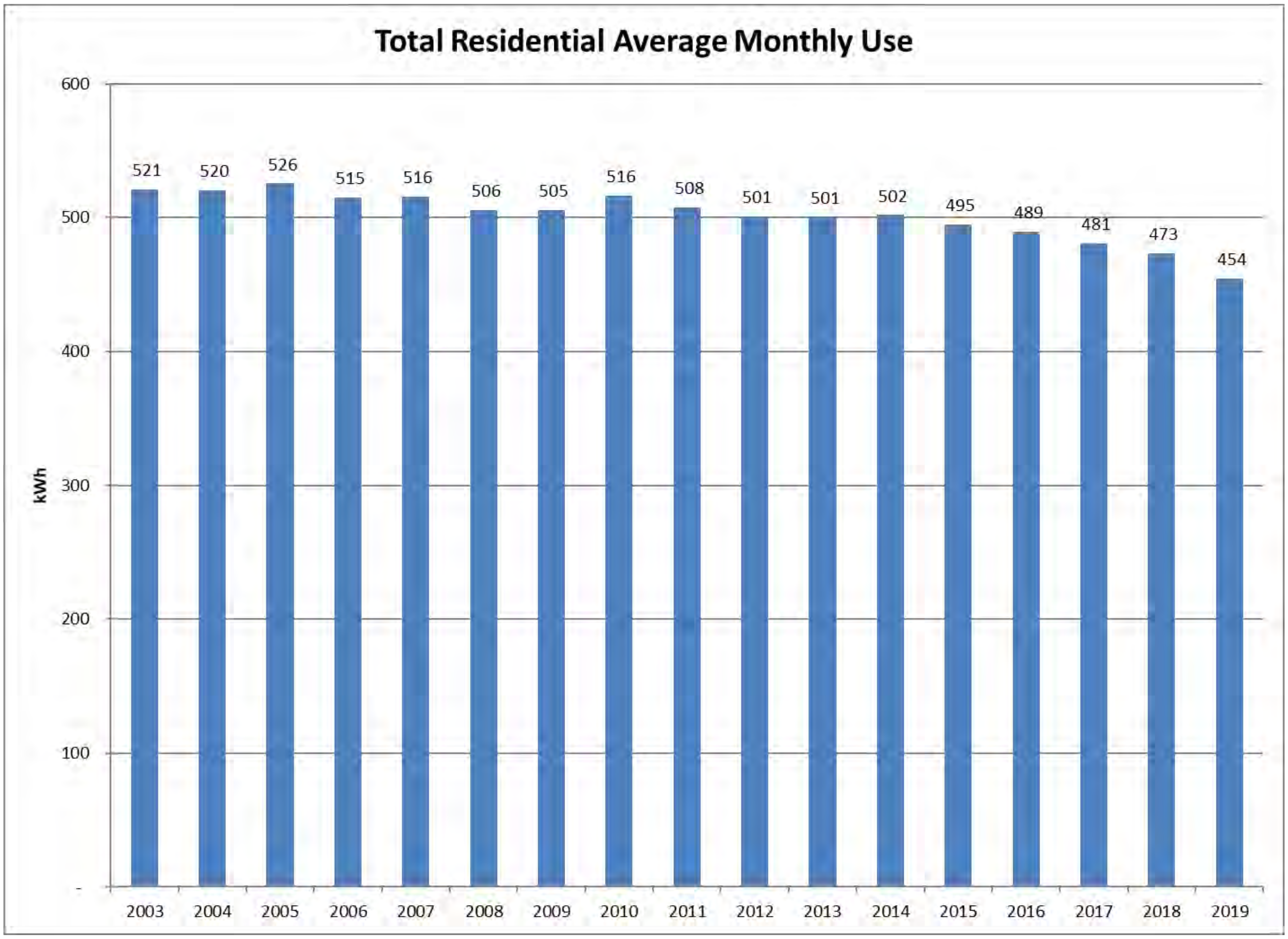
[5] Note that some dairy farms are included in the residential rate class. These members may have larger loads than the average single family home thereby skewing the data slightly for this sector.

Figure 1-1. WEC Retail Sales 2019



Member growth (from additional new members and conversion from seasonal to year round residences) has been responsible for most of any increase in WEC sales. However, WEC's average monthly usage per residential/seasonal member is steadily declining. It was 521 kWh in 2003, 516 kWh in 2007, 489 kWh in 2016, and 454 kWh in 2019. The general declining trend in kWh/month/member consumption since the 1990s reflects the slowdown in the Vermont economy and the longer-term success of the Co-op's and the state's demand side management programs, plus new federal energy efficiency standards and the highly successful net metering program. WEC's overall retail sales have decreased in the past several years, with an annual average growth rate of -1.04% since 2010. Figure 1-2 summarizes this trend graphically.

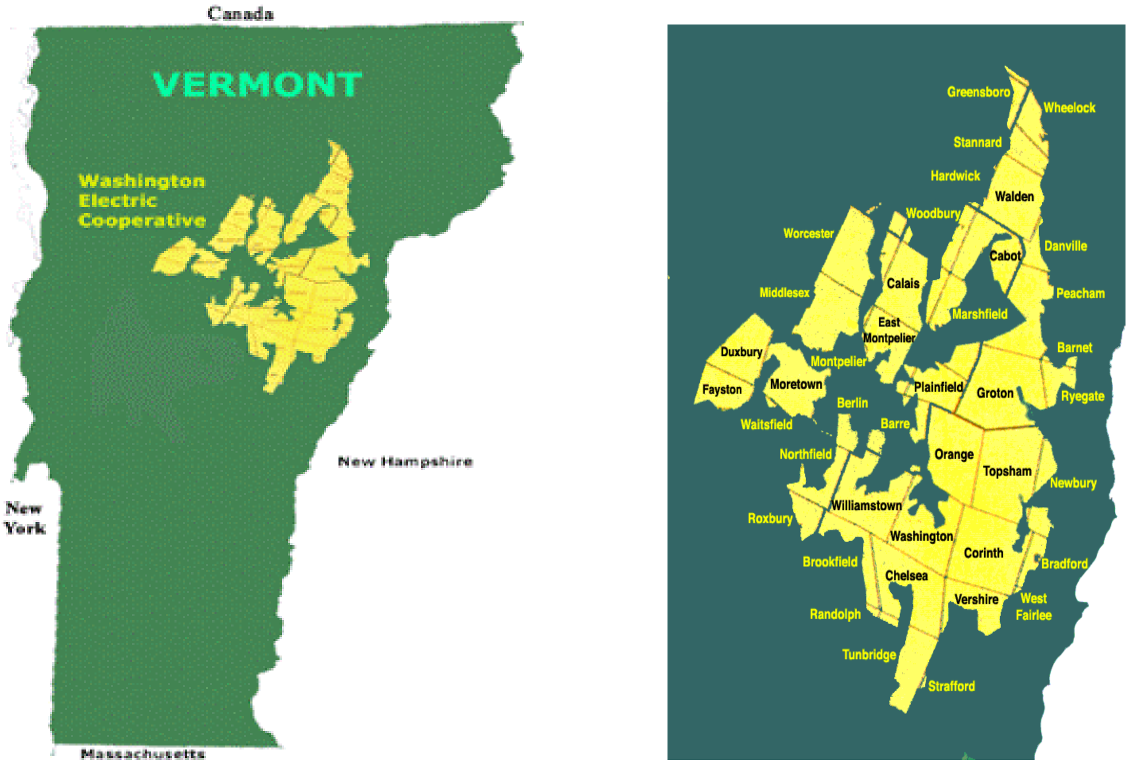
Figure 1-2. WEC Residential Monthly Consumption Trend



1.3. Overview of WEC Service Territory

As displayed in Figure 1-3, WEC operates in a large and dispersed geographic area. Many of the communities WEC services are some of the most rural in the state of Vermont. The figures below portray WEC's service territory in relation to state boundaries. WEC has the least dense system of any Vermont utility in the state, with an average of eight members per mile of electrical distribution service. WEC's service territory is comprised of mostly unpaved roads. While a portion of WEC's lines run along roads, a significant portion does not. Most of WEC's lines run through rugged and challenging terrain. WEC members were some of the last to receive electricity in the state due to the area's remoteness, low populations in the towns, and the expense to build infrastructure. Prior to the Co-op's formation, the people in our towns were simply left without electricity.

Figure 1-3. WEC Service Territory



1.4.Organization Mission, Governing Board, Benefits of Membership

Washington Electric Cooperative's mission remains essentially the same today as when it was founded almost eighty years ago: to provide affordable access to electric power and energy-related products and services for area residents and our communities, through a consumer-owned and locally-controlled cooperative business. As part of that mission, WEC is committed to meeting the following responsibilities:

- Educate and advise its members about using energy safely, wisely, and economically;
- Keep its member-owners informed about their Co-op and its business, economic, regulatory, political, and social environments;
- Minimize the environmental impacts of electric generation and our operations;
- Support and promote our local economy and community organizations;
- Provide leadership and speak out on energy and environmental issues; and

- When applicable, construct cost-effective renewable generation close to load.

The business and affairs of the Cooperative are managed by a Board of nine Directors. At each annual meeting of the members, three Directors are elected to serve a term of three years. The Board of Directors holds regular monthly meetings and the meetings are open to members. In addition to being part of a not-for-profit member owned entity, members benefit and can participate in WEC business matters in several ways:

- **Vote on large long-term power supply contracts:** Under Vermont statutes regulating electric cooperatives, WEC in certain situations, is required to hold a vote of the membership before instituting large and long-term contracts for power generated outside the state. These are defined as contracts of five years or longer, and for power that would constitute more than 3 percent of WEC's peak demand and which is not from renewable sources of power.[6]
- **Vote on major capital expenditures for generation and transmission facilities**: WEC must ask its members' approval of plans to build and construct generating stations and to make major capital expenditures on new transmission facilities. The Coventry landfill facility, which is fueled by landfill methane and which now provides two thirds of WEC's power supply, is an example in which members voted for and approved investing in a major capital expenditure.
- **Attend Board meetings**: Meetings of WEC's Board of Directors are generally held on the last Wednesday of each month, at the member services office off Route 14 in East Montpelier. Meetings are open to members.
- **Run for the Board:** Any qualified member can join the Board if voted in by the membership. Serving on the Board of Directors allows a member to shape policy and organizational decisions of the Co-op and serve the needs of the entire membership.
- **Receive capital credit distributions**: Washington Electric Cooperative is a not-for-profit company. In years when the Co-op's revenues exceed its expenses, those excess dollars, or "margins," are assigned (also known as allocations) to capital credit accounts held in each WEC member's name. These are bookkeeping entries, not actual cash accounts. In 1998, WEC became the first electric co-op in the state to begin disbursements of money (referred to as retirements) to its members, based on values documented in their capital credit accounts. With some alteration—for example, the

[6]. A certificate of public good and vote of the membership is required for some contracts based on the amount being purchased and duration of the agreement. See 30 V.S.A. § 248(a)(1).

disbursements for most people now take the form of credits on their November electric bill—it has continued that practice every year since.

Table 1-2. Capital Credit Retirements

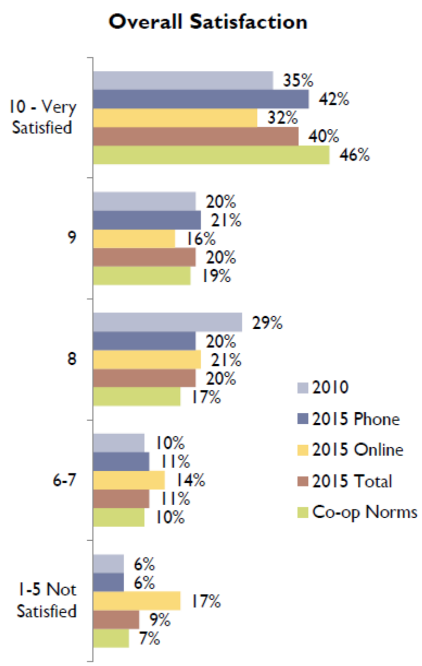
Year	Dollars Given Back to Members
1998	$ 273,173
1999	$ 231,221
2000	$ 287,695
2001	$ 221,316
2002	$ 203,241
2003	$ 204,640
2004	$ 277,129
2005	$ 275,010
2006	$ 272,815
2007	$ 276,258
2008	$ 318,221
2009	$ 275,006
2010	$ 272,999
2011	$ 275,025
2012	$ 275,329
2013	$ 274,949
2014	$ 299,992
2015	$ 349,996
2016	$ 460,001
2017	$ 719,999
2018	$ 750,000
2019	$ 749,998
Total	$ 7,544,013

In total WEC has returned $7.5 million to its members. WEC's annual retirements are summarized in Table 1-2. Each year members see a reduction in their electric bills that can help offset the impact of years WEC must increase rates. The return of capital credits is unique to the co-op model and is a way to reinforce the ownership value in a member-owned utility. Neither municipal nor private utilities in Vermont return dollars to their rate base in the form of annual credits or checks.

1.5. 2015 Member Satisfaction Survey

Every five years WEC conducts a survey of a representative sample of its members. WEC last surveyed members in 2015; the next survey is scheduled for late 2020, which means that the survey results presented here are the same as what was provided in the 2017 IRP. The results of tracking surveys provide value in two ways: by demonstrating when results remain consistent, and by indicating where there has been significant change over time. As noted by the firm carrying out the survey on WEC's behalf, the Co-op experienced events just prior to the 2015 survey, that likely had an impact on members' attitudes and satisfaction including a 3.78% rate increase (July 2014) and a 10-day storm during which up to 55% of the membership was without power (December 2014). Nevertheless, overall satisfaction among WEC's residential members was very good. The mean overall satisfaction rating was 8.49 on a 10-point scale, and 60% give ratings of "9" or "10".

Figure 1-4. Overall Satisfaction Survey Results – 2015 Survey



Members were asked to evaluate nine attributes of service regarding both importance to the member and WEC's performance in each area. On all but one of the attributes measured, the mean ratings for importance were near or above 9.00 on a 10-point scale, indicating very high importance.

The mean ratings for how well WEC was meeting expectations (prior to the 2015 Survey) on each attribute varied. Members gave the highest importance ratings for providing reliable service and having competent and knowledgeable employees. Performance ratings for both of these attributes were also very high, with means near 9.0. The lowest rating for both importance and performance was for helping members learn to manage their energy use. This will be discussed further in Section 4.

Table 1-3. Satisfaction Ranking by Key Attributes

	Importance		Performance		Gap - Difference Between Mean Importance and Performance
	Mean Rating	Rank	Mean Rating	Rank	
Providing reliable service	9.66	1	8.85	3	0.81
Having competent and knowledgeable employees	9.56	2	8.98	2	0.58
Handling individual complaints and problems	9.36	3	8.62	4	0.74
Being friendly and courteous in the service they provide	9.35	4	9.06	1	0.29
Providing a good value for the money spent	9.35	5	7.85	8	1.50
Looking out for members' best interests	9.19	6	8.04	7	1.15
Communicating with members and keeping them informed	9.03	7	8.45	6	0.58
Being committed to the community	8.96	8	8.48	5	0.48
Helping members learn to manage their energy use	8.11	9	7.43	9	0.68

Cost, as measured by the response to value for the money spent, was ranked 5th out of nine key attributes. WEC expected cost to rank higher, especially following a recent rate increase. But the results clearly show that members want reliable service first and foremost, followed by knowledgeable, competent, and courteous employees. A complete copy of the survey is in the Appendix.

Given the various changes with WEC since 2015 (significant uptake in solar net-metering, a rate increase and a change in rate design), it will be interesting to see whether WEC members respond differently in the next survey. Ideally, the next survey will include questions that address WEC members' interest in and plan for strategically electrifying; e.g. how many WEC members plan, at some point in the future, to invest in net-metered solar, electric vehicles, air source cold climate heat pumps and/or storage. This would assist in informing WEC's next IRP by providing some indication of future trends in WEC's territory.

1.6. Power Supply Situational Analysis

WEC has a diverse portfolio of power contracts and resources it uses to cover its energy load requirements, which have been flat to slightly declining for the past several years. WEC remains well positioned long-term to hedge against changing loads and volatile power market prices through stably-priced contracts and owned generation resources.

As discussed earlier, and in keeping with WEC's 2017 IRP filing, the 2020 IRP is not analyzing the need to replace or enter new long-term power commitments. In WEC's 2014 IRP, the Co-op completed a rigorous resource analysis in which it analyzed various portfolios and stress tested the assumptions used to calculate costs. Given that little has changed in terms of WEC's power supply commitments since the 2014 filing, WEC concluded that completing the same analysis for the 2020 filing will not yield new results; the issues that were key drivers to WEC in 2014 remain salient today.

As a result, WEC is submitting its 2020 IRP using an update of its current position and recalibrating its outlook of projected load. WEC will use this information to help plan for its projection of when the Hydro Quebec contract may be needed. It will also be used to evaluate the outlook of its long-term resources and key drivers impacting those resources.

On April 12, 2018 the PUC approved WEC's 2017 Integrated Resource Plan in Case No. 17-3664-PET. In a Memorandum of Understanding (MOU)reached with the Department of Public Service dated November 15, 2017, WEC agreed to seventeen conditions (see MOU in Appendix section). Some of the key conditions that are addressed in this IRP are noted below, and WEC agreed to continue its ongoing duty to:

a) Continue analyzing the cost of service from both a ratepayer and societal perspective in making resource decisions and in future IRPs, to explicitly describe its application of the societal test, including assumptions, identification of impacts and analysis on key variables and possible resource portfolio impacts (item 4);

b) Meet with the Department periodically prior to and during the development of its next IRP (item 5);

c) Monitor key uncertainties and the continued accuracy of assumptions and data in the IRP (item 7a);

d) Continue to reevaluate the merits of the decision-making processes, including but not limited to the analytic methods used, and to adapt such processes to new techniques or information (item 7b);

e) Continue to reevaluate the merits of its decisions (item 7c);

f) Include in this (2020) IRP information regarding strategies WEC is employing and plans to employ regarding strategic electrification and Tier III and cost related impacts, in coordination with the Department (item 9);

g) Perform a quantitative analysis of innovative strategies for peak shaving related to regional coincident and Regional Network Service peaks, including an assessment of battery technology and utility load control devices (item 10); and,

h) Prepare and incorporate an updated load forecast in this (2020) IRP (item 11).

The above is a partial subset of conditions of the MOU that are explicitly called out in this IRP. The Appendix includes a complete copy of the MOU. In the hearing officer's April 12th, 2018 recommendation to approve the MOU, it was recommended that WEC file its next IRP no later than July 19, 2020. In order to allow for more time to work with the Department to review WEC's work on the 2020 IRP, two extensions were requested and approved, with an ultimate filing deadline of November 2, 2020. This document fulfills this filing requirement.

1.7. WEC 2020 IRP Focus and Regulatory Requirements

Pursuant to 30 V.S.A. §218c each regulated electric utility is required to prepare and implement a least cost integrated plan (also called an integrated resource plan or IRP) for provision of energy services to its Vermont customers. The Vermont Electric Plan and Public Utility Commission ("PUC" or "Board") Orders outline requirements that a distribution utility's complete IRP should meet in order to obtain the Department's and Board's approval.

As stated above, the IRP process and the implementation of each Vermont utility's approved plan are intended to meet the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs (30 V.S.A. §218c). The cost and benefit factors to be considered include both direct monetary costs and benefits, and indirect impacts such as environmental and other societal effects.

In addition, as part of the 2016 Vermont Comprehensive Energy Plan, an addendum related to IRP planning and guidelines were prepared by the Vermont DPS. This document outlines key components of an IRP and provides guidelines to utilities as they carry out their planning. WEC completed its present analysis and IRP report with the IRP guidelines and 2016 CEP in mind. The guidelines do not lay out a prescriptive basis as to how to do IRP planning and analysis. Rather, the DPS addendum provides a guide for completing IRPs consistent with state statute VSA §218c covering Least Cost Integrated Planning and the Vermont Comprehensive Energy Plan. The guidelines recognize the ultimate content and organization of an electric distribution utility's plan will be unique to each individual utility.

As noted in the 2016 CEP, utilities should use the IRP process to address *questions that are the most relevant to the utility at the time of the IRP* (emphasis added). WEC met multiple times with the Department in advance of the filing to discuss its key issues and questions it desired be addressed in this filing. WEC and the Department agreed that since WEC is not making large or long-term power supply decisions for the next several years, its IRP will focus on key issues identified by WEC rather than carrying out a new power cost simulation and modeling efforts. WEC and the Department also agreed to using load forecast results from VELCO to assess growth of the residential class rather than spend significant dollars for an independent load forecast.

As a result, WEC's IRP is structured to focus on the following areas;

- Revisit key power cost drivers from the 2014 & 2017 IRP analysis and reaffirm relevance of each driver to WEC's current situation and costs;
- Assess ways to control costs and pressures of increasing rates in light of flat to

declining load;

- Provide an overview of important regulatory issues and WEC's approach and program responses related to:
    - Act 56 Renewable Energy Standard (Tier I, II and III)
    - Net Metering
    - 2016 Comprehensive Energy Plan
    - Trend towards increased strategic electrification
- Assess impacts of distributed energy resources on the T&D systems;
- Discuss current approaches and future ideas to engage with members particularly as the electric industry evolves;
- Discuss the impacts and abilities to control WEC's peak through Peak Control Programs;
- Discuss WEC's exploration of bringing broadband access to its members;
- Discuss WEC's approach to offer rates that send appropriate and fair price signals through Rate Design;
- Discuss WEC's commitment to continue to serve its members during the COVID-19 pandemic;
- Present the WEC Board of Directors statement regarding climate change, and the roles that the National Rural Electric Cooperative Association (NRECA) and the Northeast Association of Electric Cooperatives (NEAEC) should play to address climate change;
- Briefly discuss the impact of the pandemic on WEC and its members, and WEC's efforts to provide affordable, reliable service throughout this time period.

In this IRP, WEC will provide updates to the major risk elements identified in the 2014 analysis and reassessed in 2017, with the 2020 IRP focusing on issues germane to WEC in the next five years. WEC sees its largest question as pertaining to future impacts of changes to demand and grid modernization and climate change. Increased deployment of distributed generation is lowering WEC's energy sales and revenues while peak load impacts are slightly higher. Revenues are down while cost pressures from transmission and capacity markets are driving costs up. WEC will explore ways to be sustainable and serve members' needs in an industry moving toward rapid deployment of smaller distributed sources of generation and increased uncertainty of load. This IRP will discuss WEC's efforts in redesigning its rate structure and deploying a pilot peak load control program as a potential means to keep rates and bills to members stable while the trends toward strategic electrification and distributed resources continues to increase.

In order to keep electric rates and bills affordable, while maintaining environmental considerations and advancing WEC and statewide goals, WEC's recent initiatives in lowering peak use at the time of the ISO-NE peak will be discussed. These include a pilot load control program called PowerShift. WEC also introduced a new rate design which is intended to increase electrification of end uses that will displace fossil fuel uses. Flattening WEC's load shape and minimizing seasonable fluctuations where possible can also potentially help manage costs. WEC will continue to explore ways to reduce regional load while maintaining revenues (such as exploring use of load reducers from internal generation sources) as a way to mitigate rate pressure.

Consistent with previous Board decisions, including WEC's IRP in docket 7432, docket 8181, and docket 3664, WEC seeks approval of its 2020 IRP. Approval extends to the decision-making process, but not to specific decision-making tools, analytical methods, or outcomes described in the IRP herein. This is consistent with previous Board decisions regarding the scope of approval of an IRP. WEC seeks similar approval in this filing.

Load Forecast:

WEC and the Department agreed that a new load forecast would yield minimal new information. Plausible futures of WEC's load were simulated in a rigorous scenario analysis (in which load was varied in a Monte Carlo[7] analysis exercise) completed in the 2014 IRP. This analysis captured potential outcomes of WEC's load in the near term and over the 20-year planning period. WEC notes that its customer demographics have not changed since that load forecast. Also, WEC's load has been flat-to-declining in the past three years due to distributed generation, robust efficiency efforts, and consumer behavior.

WEC developed the load forecast for the planning period by applying the average annual growth rates for the residential sales forecast in the VELCO report to WEC's load.

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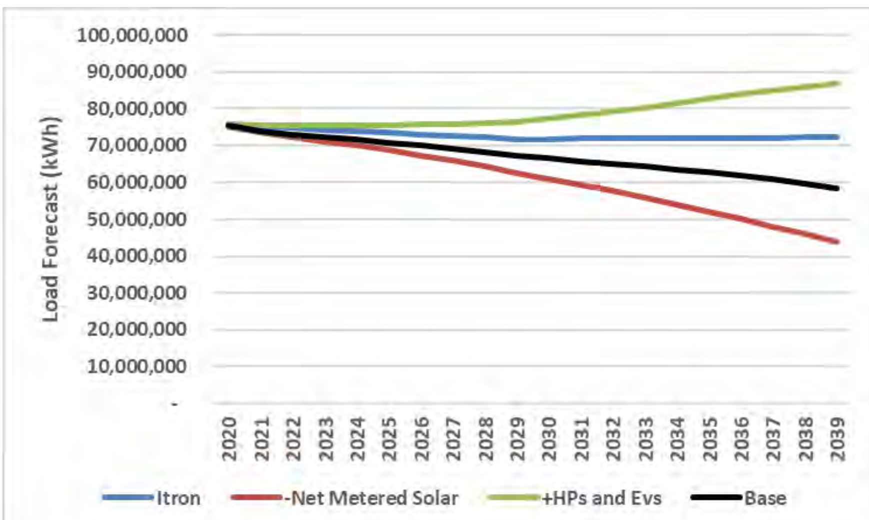
[7] Monte Carlo simulation modeling is a software based simulation tool that is used by decision-makers to answer key questions such as what are the effects to WEC if certain conditions occur. It is used to approximate the probability of certain outcomes by running multiple trial runs, called simulations, using random, distribution defined, and potentially correlated, variables for key inputs into the analysis. The results of numerous trial runs are stored and the outcomes graphed, usually with a frequency distribution, in order to provide a probabilistic assessment of outcomes based on predefined distributions of key input variables.

WEC also included the impact of forecasted adoption of net metered solar, cold climate heat pumps, heat pump water heaters, and electric vehicles in the load forecast as shown in Figure 1-5. The blue line represents WEC's load forecast with Itron's projected annual growth of -.6% for 2020-2030 and .1% for 2030-2040. The red line represents the impact of forecasted adoption of net metered solar when the net metered solar forecast is subtracted from the Itron forecast. The forecasted adoption of net metered solar results in a steep decline in WEC's forecasted load. The green line represents the impact of forecasted adoption of electric vehicles, cold climate heat pumps, and heat pump water heaters when the impact of those technologies are added to the Itron forecast. The black line represents WEC's base load forecast used in the analysis. This forecast starts with the Itron projections, deducts the net metered solar impacts, and adds in the impacts from heat pumps and electric vehicles. The impact from the projected adoption of net metered solar is larger than the impact of electrification from heat pumps and electric vehicles, which causes WEC to have a declining load forecast throughout the planning period.

Figure 1-5. WEC Load Forecast with Net Metering, Heat Pump, and Electric Vehicle Impacts



Power Supply:

Included in the power supply section are updates to all generation resources and power contracts. Due to the rigorous Monte Carlo work in the 2014 IRP, WEC does not expect appreciable change in the results and its outlook of major factors affecting its costs; the key variables and costs identified in the 2014 IRP remain relevant to today's situation and analysis.

In WEC's 2020 IRP we look to update the key variables and assess the impacts each variable will have on WEC's cost.

WEC is not making large or longer-term power supply decisions for the next several years. Therefore, the value of another rigorous power supply centric analysis is of minimal benefit for future decision-making. Current production projections will be based on recent information and contract terms and information relevant to projected energy production of each resource. WEC will use this IRP analysis to project its need for the HQUS PPA "take back" from Vermont Electric Coop and refresh the assessment of the risk each key variable has to WEC's power costs today.

Legislative and Regulatory Directives:

WEC outlines the impacts of major new legislation and identifies how WEC plans to comply with these significant directives. The 2020 IRP answers how WEC plans to comply with a variety of initiatives including Vermont's net metering program and Renewable Energy Standard. WEC also explores issues of a modern electricity grid, in which demand fluctuates in new ways due to the build out of more resources like solar and wind. WEC also takes into account storage, energy efficiency and alternative rate design and beneficial electrification in its outlook.

Distribution System:

WEC receives financing from the Rural Utility Service (RUS) for its electrical system improvements. Therefore, it must address additional long-term planning requirements to satisfy the needs of its lenders. One of the requirements for RUS borrowers is the periodic development of a Construction Work Plan (CWP). The CWP is developed and written in accordance with the RUS Bulletin 1724D-101B guidelines.

An important question to WEC, and a key driver of this IRP, relates to impacts of distributed generation and fluctuation to load on WECs T&D system. In this IRP, WEC outlines big picture questions that will drive T&D analysis in the future, relative to a modern grid. WEC frames key questions relative to impacts on T&D from consumer-centric forces.

In its T&D write up, WEC looks to do a system analysis and analyze impacts on the T&D

system as follows:

- Evaluate benefits of circuit load forecast in conjunction with next CWP (CY 2019-2022);
- Identify a scoping process for work to be done over the next five years
    - Plan for circuit analysis
    - Integrate in our next CWP (file in 2021)
    - Prepare a circuit and system load forecast for this effort;
- Explore distributed generation and solar impacts on our grid
    - How much can the WEC grid handle?
    - Does volume of distributed generation matter by circuit?
    - Explore GMP solar mapping with GMP staff to see if WEC can use their early research to help guide our analysis
    - Map out best and worst locations for distributed generation.

WEC's current CWP, dated October 2018, covers the period from 2019-2022. This plan is still active, with RUS and PUC approved projects scheduled into 2022.

The requirements of the CWP are laid out by RUS and are summarized as follows:

> The Construction Work Plan process is used to determine and document a borrower's 2 to 4 year construction needs that are the most feasible, environmentally acceptable and economical. New construction is periodically required in order to provide and maintain adequate and reliable electric service to all of a system's new and existing members. The CWP should include all recommended electric plant facilities regardless of the financing source (general funds, RUS, or all other lenders). A CWP is a valuable reference for the preparation of annual construction budgets and schedules. The CWP report is also used as an engineering support document for a loan application to finance a proposed construction program. As such, the CWP is used as a means to inform RUS and receive RUS's approval of proposed new construction items (from RUS Bulletin 174D-101B, page 3).

In summary, WEC has prepared its IRP consistent with regulatory guidelines provided by both the state of Vermont and the RUS. The IRP process is intended, in part, to facilitate information exchange among WEC and its members, regulatory agencies, and the public. As part of that effort, WEC held several meetings and discussions with PSD staff at varying times to report and update on its progress while preparing the IRP. WEC is confident this report is consistent with current regulatory requirements and goals as requested by the State of Vermont.

1.8. Objective of an IRP

Vermont Statute 30 V.S.A. § 202a states the purpose of the Energy Policy of the State of Vermont as follows:

> (1) To assure, to the greatest extent practicable, that Vermont can meet its energy services needs in a manner that is adequate, reliable, secure and sustainable; that assures affordability and encourages the state's economic vitality, the efficient use of energy resources and cost-effective demand side management; and that is environmentally sound.
>
> (2) To identify and evaluate on an ongoing basis, resources that will meet Vermont's energy service needs in accordance with the principles of least cost integrated planning; including efficiency, conservation and load management alternatives, wise use of renewable resources and environmentally sound energy supply.

There are many stakeholders involved in the electric utility world. In the case of an electric cooperative such as WEC, the major stakeholders are its consumer-owner members, Board of Directors, regulators, and the management and staff of the utility. The IRP process provides information to these groups to support resource management decisions necessary to manage the cost and reliability of the WEC system and to do so in compliance with regulatory requirements.

The IRP has been referred to as Least Cost Integrated Planning. However, to WEC it is much more. WEC views its IRP as a strategic and informative planning tool that provides WEC stakeholders information on the costs, risks and other impacts of resource portfolio choices. WEC's IRP contains a combination of situational analysis, numerical analysis, risk analysis, and the exercise of judgment. WEC utilizes the IRP to evaluate, based on resource planning principles, different supply resource options alongside alternatives that reduce members' consumption. In addition, the IRP helps inform WEC's stakeholders of its preferred resource plans for the future and its rationale for following a particular strategy.

The IRP frames WEC's future direction relative to power supply and other major capital investments. It is not intended to be a fixed and prescriptive outline of what WEC will do in any particular situation, but rather a dynamic and evolving tool to help inform and guide WEC decision making. The IRP measures and analyzes how various resource options and plans are projected to perform in any number of future market environments, and how well such plans satisfy WEC stakeholders.

WEC has prepared its IRP to satisfy state rules, goals, and directives. WEC also uses the IRP as a key component in the development of its own strategic plan.

WEC's objective is to develop plans that support the following goals:

- Provide energy to members as inexpensively as possible;
- Maintain financial strength and assure economic equity for members;
- Improve performance of WEC's distribution system for the benefit of members and provide access to local generation sources in WEC's service territory;
- Manage power supply, distribution, and transmission service at lowest cost, with consideration for environmental impacts and social concerns;
- Promote responsible environmental practices at WEC and assist members in doing so;
- Maintain strong member, community, and government relations in a changing environment; and
- Maintain strong organizational, administrative, and communication services.

These goals may not be independent of one another. Potential solutions to achieve one goal may be counter-productive to other goals. The portfolio WEC developed will reflect tradeoffs between various goals.

The IRP outlines action plans that are robust under a variety of possible future scenarios. It is intended to be a working document, used to inform the day-to-day and long-term decision-making process throughout WEC. It will be used as a benchmark to ensure coordination between the various activities and practices of WEC so that operations are internally consistent and mutually supportive.

1.9. IRP Report Organization

The IRP is organized by sections and follows the following topical components:

Section 2.	Resource Assessment & Load Forecast
Section 3.	Committed Supply Resources & Projected Requirements
Section 4.	Legislative & Regulatory Directives
Section 5.	Transmission & Distribution System
Section 6.	Action Plan
Section 7.	Appendix

2. Resource Assessment & Load Forecast

2.1. Overview of Resource Modeling Approach

The intent of the IRP resource modeling process is to provide important information about the costs, features, and risks of various power supply portfolios that WEC could use in the future to meet its system load requirements. The goal is to project cost and cost variance, emissions profiles, and other measures associated with each portfolio, under a broad range of future loads, market prices, economic conditions, and other factors affecting performance, such as market or regulatory changes. The IRP process is used to develop methods to evaluate competing future investments and purchase decisions.

As noted in the IRP guidelines, "utilities should use the IRP process to address questions that are the most relevant to the utility at the time of the IRP." [8] Since little is changing in WEC's resource outlook, this plan provides the results of updated modeling from the 2014 and 2017 IRPs. WEC provides a summary in this section of that analysis and the results. For a complete description please refer to WEC's filing of its 2014 IRP.

2.2. Brief Introduction to the New England Power Markets

In this subsection, WEC describes the New England power markets in which WEC operates, products WEC sells as a generation owner, and products WEC purchases to meet its load. A summary of these markets provides a foundation for understanding the work carried out as part of the IRP.

WEC is part of and operates in the New England wholesale power markets, which are administered by the Independent System Operators of New England (ISO-NE). The ISO-NE is responsible for reliability of a regional power grid covering all six New England states, including Vermont. That grid includes more than 300 separate generating plants and more than 8,000 miles of transmission lines—all interconnected and dedicated to ensuring reliability of the New England region. The ISO-NE has three primary responsibilities:

- Reliability: Minute-to-minute reliable operation of New England's bulk electric power

[8] 2016 CEP, Appendix B; Guidance for Integrated Resource Plans and 202(f) Determination Requests, page 5

system, providing centrally dispatched direction for the generation and flow of electricity across the region's interstate high-voltage transmission lines and thereby ensuring the constant availability of electricity for New England's residents and businesses;

- Cost-effective Markets: Development, oversight, and fair administration of New England's wholesale electricity marketplace, through which bulk electric power has been bought, sold, and traded since 1999. These competitive markets provide market-based economic and environmental outcomes for consumers;
- Planning: Management of comprehensive bulk electric power system and wholesale markets' planning processes that address New England's electricity needs well into the future.

Spot Energy Markets

Fuel prices, such as natural gas, and supply and demand conditions in the New England power markets determine the wholesale market price for electricity. Regional conditions and markets affect the cost of other power requirements, including capacity and ancillary services.[9] Consequently, the economic operation of any supply resource that WEC might consider as part of its future supply portfolio is a function of conditions in the wholesale fuel and electric generation markets.

Hourly Locational Marginal Prices (LMPs) are developed and published by ISO-NE for energy delivered at specific points or 'nodes' on the electric system where generation or load interties with the bulk power grid. LMPs for each node are established for two energy markets operated by ISO-NE: day-ahead and real-time. These markets are designed with the goal to achieve efficient economic dispatch of the regional generation fleet, subject to transmission security protocols and/or constraints. Each generating unit providing energy to the spot market at a given location (e.g., at the generator bus, or delivered into pool transmission facilities), in a given hour, receives a clearing price based on the LMP at that location. In general, the LMP reflects the bid price(s) of the most expensive source(s) providing energy to that location in that hour. Under this market structure, generation suppliers have incentive to bid at or near their short-run variable costs of providing energy.[10]

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9 Ancillary services include spinning reserves, regulation, and black start capability that certain generators offer to help keep the regional system operating reliably and safely.

10 A supplier of generation bidding below its short-run marginal costs including fuel runs the risk of losing money on every kWh

ISO-NE Markets—Multi-Settlement System

The ISO-NE market system is a "multi-settlement" system, meaning there are separate settlements between ISO-NE generators and load-serving entities (LSEs). Specifically, ISO-NE pays generation based on nodal, hourly LMPs specific to their locations. In separate transactions with load-serving entities, ISO-NE charges load based on the aggregation of nodal LMPs into zonal averages depending on what state or section within a state the load resides. Therefore, all generation is paid and all load is charged for various markets and services to provide reliability of the grid.

The market is geographically segmented for pricing wholesale electricity relative to load. Pricing zones are established by state boundaries, and in some cases, further refined due to transmission constraints that limit the free flow of power between locations within a given state. There are eight ISO-NE energy pricing zones, or load zones: one for each of the states of Vermont, New Hampshire, Maine, Rhode Island, and Connecticut, and three within Massachusetts.

The economics of WEC's net cost to serve load are based on charges it incurs for load and credits it receives for its various supply resources. Therefore, WEC's costs depend specifically upon the Vermont zonal LMP average, which is charged to WEC load, as well as other products from ISO-NE administered markets. However, these costs are offset by revenues received for WEC's supply resources based on specific nodal LMPs, wherever they are located, and other market credits for power sources.

Regional Energy Prices Modeling and the New England Energy Market

The energy market is the largest component of wholesale power costs in New England, accounting for approximately 78% of the total cost of charges incurred for load from the ISO-NE for energy, capacity, and ancillary service charges in 2019.[11] Energy prices as a share of total load costs are shown graphically in Figure 2-1. For this IRP, regional energy prices for

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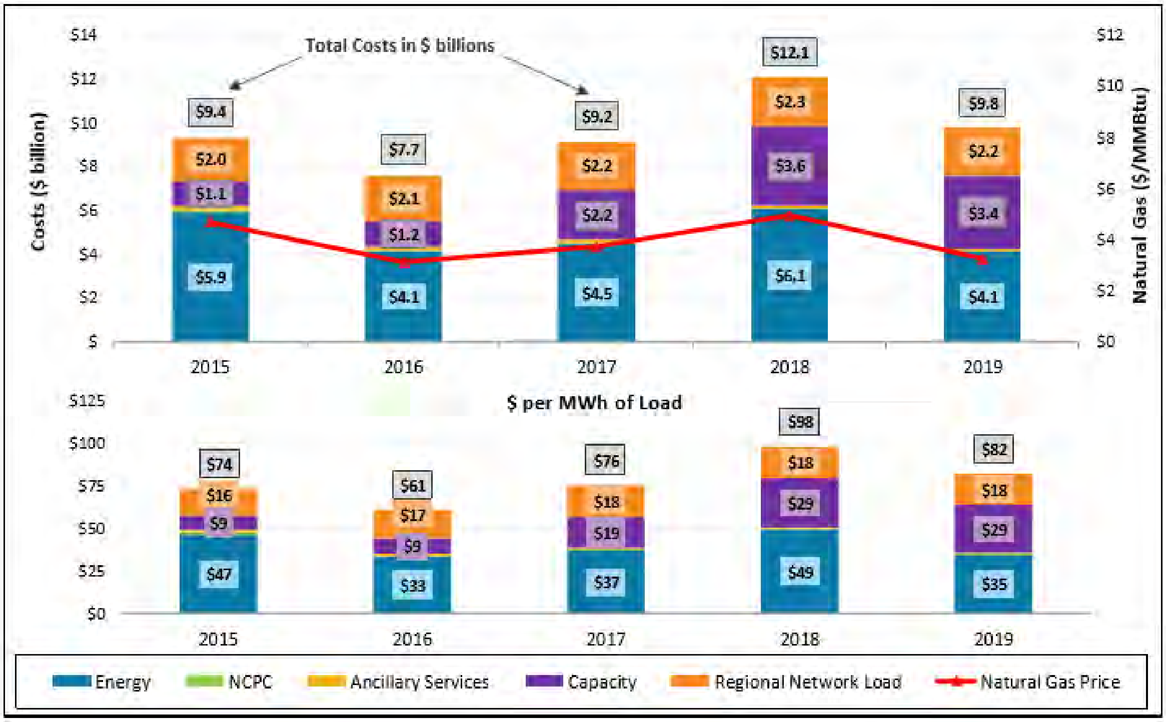
generated if the supplier's short-run marginal cost exceeds the market clearing price. A generation supplier bidding above its short-run marginal cost including fuel is at risk of not being dispatched, and thus foregoing opportunities to earn operating profits (i.e., revenues that exceed short-run marginal costs). Thus, it is assumed that most generation suppliers in the energy market would bid hourly energy prices in the day-ahead and real-time markets that approximate their short-run marginal costs.

11 ISO-NE, *2019 Annual Markets Report,* Figure 1-1, p.4, https://www.iso-ne.com/static-assets/documents/2020/05/2019-annual-markets-report.pdf.

the base case were simulated based on a forward forecast from S&P Global from 2020 to 2029. For 2029 to 2039, an escalation was applied to the last year of forecast data by using an escalation based on the Annual Energy Outlook's (AEO) forecast for natural gas prices. A low and high case for energy prices was developed by taking 15% plus the base case and the base case less 15%.

Figure 2-1. Wholesale Market Costs and Average Natural Gas Prices



Data Source:
https://www.iso-ne.com/static-assets/documents/2020/05/2019-annual-markets-report.pdf

Regional Network Load (RNL) Costs

In 2019, Regional Network Load ("RNL") Costs were 18% of total costs of load. These charges represent the costs of transmission facilities, charges for reliability, and certain ISO-NE administrative services. Of the three cost categories included in RNL (infrastructure, reliability, and administrative), infrastructure costs make up over 90%. RNL costs were 5% lower in 2019 compared to 2018 as a result of reduced demand and lower recovered infrastructure costs.[12]

[12] Ibid

New England Forward Capacity Market (FCM)

After the energy and RNL markets, capacity is the next largest component of wholesale power costs in New England, accounting for approximately 35% in 2019.[13] This market establishes the price ISO-NE must pay to generators for having a sufficient amount of installed capacity (also thought of as brick and mortar resources) which are necessary to assure system reliability under peak conditions.[14] Therefore, FCM can be thought of as a market to assure there are sufficient resources ready and able to operate to meet the maximum energy needs of the grid. FCM establishes the price ISO-NE charges to load to obtain revenues necessary to compensate generators for their installed capacity.

FCM clearing prices are established annually and three years in advance of the delivery period, based on auctions in which various generators and demand response resources bid their costs to supply capacity. The forward capacity auction clearing price is based on the highest bid price cleared in a reverse auction to procure enough capacity to meet ISO-NE projected peak demands in three years, plus reserves, for each planning year beginning in June and ending in May of the following calendar year.

In WEC's IRP study, FCM clearing prices were modeled using different assumptions for the future FCM prices under a base case of $5, a high case of $7, and a low case of $3.

New England Ancillary Services Markets and Other Charges

Ancillary Services and Net Commitment Period Compensation (NCPC) are the smallest component of wholesale power costs in New England, accounting for approximately 1.30% in 2019.[15] Ancillary services include:

- Spinning reserve capacity that can ramp up or down within specified time intervals in response to changes in load or other disruptions to the power grid;

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13 Ibid

14 Broadly speaking, capacity as a power product can be thought of as a call option on energy, and the costs of capacity are largely the fixed or capital costs associated with generating plants providing energy.

15 ISO-NE, *2019 Annual Markets Report,* Figure 1-1, p.4, https://www.iso-ne.com/static-assets/documents/2020/05/2019-annual-markets-report.pdf.

- Regulation service provided by generators that balance supply with local demands over very short time intervals; and
- Black Start capability of generators that can be used to reenergize the power grid after a transmission line outage.

The cost of these products is paid by load-serving entities and is based on clearing prices for these services set in the ISO-NE ancillary services markets.

In WEC's 2019 IRP, ancillary markets were not specifically modeled. Instead, the IRP focused on the net costs to WEC for energy, capacity, regional transmission, and renewable supply requirements over the 20-year planning horizon. That said, WEC is seeing increases in its power costs due to the cost of ancillary markets, in particular from winter reliability charges, and it monitors these costs and the underlying causes through its participation in various ISO-NE committees. Maintaining an understanding of regional issues and changes in energy markets will allow WEC to understand the impacts it could see in the future from ancillary market charges.

2.3. WEC Resource Portfolios

For this IRP, WEC's existing supply resource mix was modeled using three different portfolio assumptions. The portfolios are explained below and summarized in Table 2-1.

Portfolio 1 (the "Status Quo," "Do Nothing," or "Base Case") assumed WEC does not secure any new power supply resources in the future, and does not sell any excess energy except as it does currently via the New England spot markets. All generating resources are assumed to produce at their existing levels (Coventry is projected using actual production levels from 2018-2019 and holding constant through the planning period), and purchase power contracts are modeled consistent with the terms of the contractual arrangements.

Portfolio 2 ("Coventry Landfill Gas (LFG) Reduction to 50% Output") assumed energy and capacity output from the Coventry LFG plant was reduced by 50% from the Status Quo case. This portfolio scenario represents a case where WEC loses half of its most significant source of power in its mix. This case helps WEC assess its current concentration risk: its reliance on a single large source of power from the Coventry LFG facility. A summary of the WEC portfolios is provided in Table 2-1.

Table 2-1. Summary of WEC Portfolios

Portfolio	Coventry Output Adj. Factor
Status Quo Case	0%
Coventry Stress Test	-50%

2.4. Load Forecast Overview

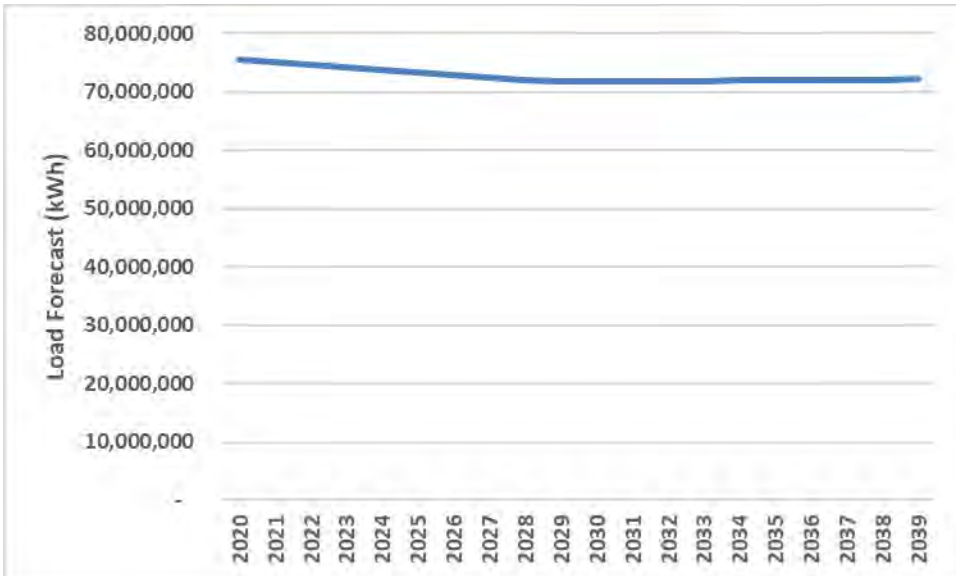
The 2014 and 2017 IRP analyzed WEC's costs for power based on its resource mix and load requirements under various simulations of key variables. The first step in the analysis documents how WEC forecasted load. The analysis then follows up to describe how WEC varied its power resources to meet those load needs. Both the load forecast and overview of the power mix follow.

2.5. Load Forecast Update 2020

WEC's load forecast for the 2020 IRP was updated to include the forecasted growth rates from VELCO's 2020 study. WEC applied the forecast from VELCO to WEC's actual load from July 2019 to June 2020. The VELCO forecast projected an average annual decline of -0.6% decline for 2020 to 2030 and an average annual growth of 0.1% from 20230 to 2040. The VELCO forecast for the residential customer class was used since approximately 87% of WEC's sales are from the residential customers. No specific adjustments were made to the load forecast for energy efficiency since the model used to develop VELCO's forecast captures the impact of end-use efficiency.[16] Figure 2-2 below shows WEC's forecasted load with the VELCO forecast growth rates.

[16] Including impacts of new standards and statewide efficiency programs

Figure 2-2. WEC Forecasted Load with VELCO Growth Rates



After the VELCO growth rates were applied to WEC's historical and actual load from 2019-2020, adjustments were made for forecasted levels of net metered solar, heat pump, and electric vehicle adoption. Those adoptions levels were then layered into the load forecast to arrive at WEC's final forecast for 2020 to 2039.

Net Metered Solar

A forecast for net metered solar installations was created through an adoption model[17] developed by professors at the Rochester Institute of Technology (RIT). Some of the key inputs for the model include capital costs[18], retail price of electricity[19], system size (kW), capacity factor, life of the system, inflation, and the interest rate. Table 2-2 illustrates WEC's forecasted net metered adoption between 2020 and 2039.

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17 Williams, E., Carvalho, R., Hittinger, E., & Ronnenberg, M. (2020). Empirical development of parsimonious model for international diffusion of residential solar. *Renewable Energy*, *150*, 570-577.

18 The Annual Technology Baseline Mid Case for distributed solar PV was used. NREL (National Renewable Energy Laboratory). 2019. *2019 Annual Technology Baseline*. Golden, CO: National Renewable Energy Laboratory. https://atb.nrel.gov/electricity/2019.

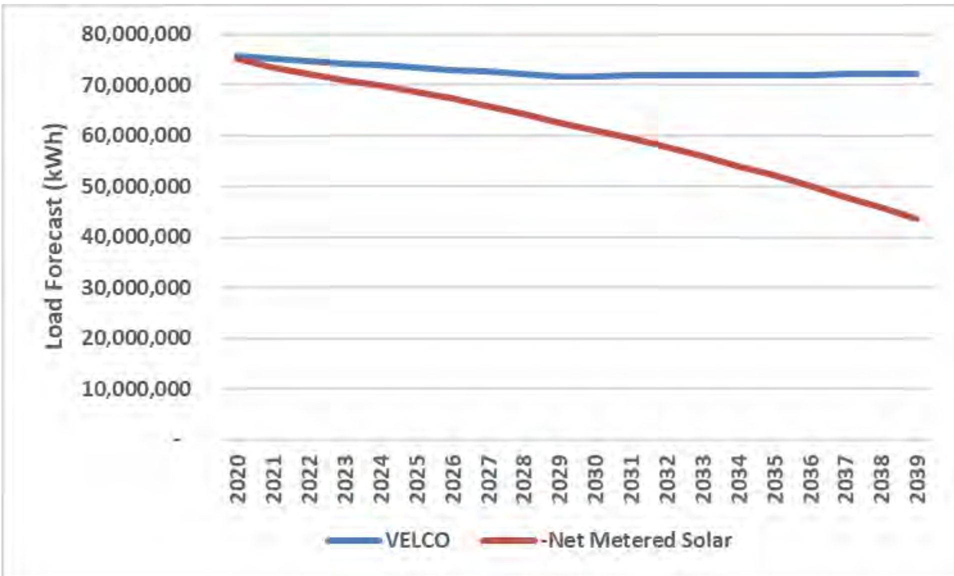
19 Model accounted for WEC's phased in rate changes between 2020 and 2022.

Table 2-2. Forecasted Annual Net Metered Solar from RIT Model

Year	Adoption (MW)
2020	0.92
2021	0.74
2022	0.51
2023	0.47
2024	0.54
2025	0.61
2026	0.70
2027	0.80
2028	0.92
2029	1.05
2030	1.20
2031	1.26
2032	1.32
2033	1.37
2034	1.43
2035	1.49
2036	1.54
2037	1.59
2038	1.62
2039	1.66

The RIT model indicates a similar level of adoption in 2020 to the past few years for WEC. The capital cost assumption input for the model includes the phase out of the solar ITC (26% in 2020, 22% in 2021, and 10% in 2022, and 0% after 2022). The model results forecast a slight decline in net metered solar between 2021 and 2023, at which point the adoption levels start to rise. This continues throughout the rest of the planning period, with annual adoption reaching 1.66 MW in 2039. Figure 2-3 shows the impact that this level of net meter solar has on WEC's load forecast. Clearly, if this level of deployment continues without modifications in how utilities conduct business (e.g. through retail sales), or in the net-metering program specifically, or through some other approach or set of approaches (e.g. demand response combined with alternative rate designs), WEC's financial standing could become unsustainable, resulting in large and significant rate increases for members or other challenges.

Figure 2-3. WEC Forecasted Load with VELCO Growth Rates and Net Metered Solar

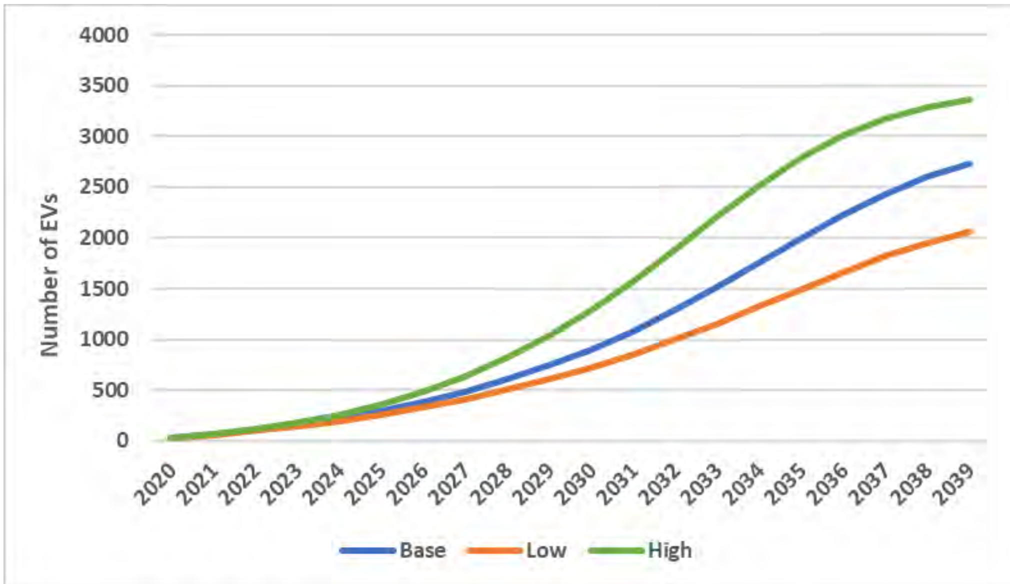


Electric Vehicles

WEC developed a forecast for the adoption of electric vehicles by applying the Vermont Energy Investment Corporation (VEIC) forecasted growth rates to WEC's number of electric vehicles in 2018. VEIC developed forecasts for the adoption of electric vehicles in Vermont across three cases. The high scenario was modeled based on Vermont's Comprehensive Energy Plan to achieve a 90% EV fleet. The medium scenario was based on a 60% electric vehicle fleet, and the low scenario was based on a 40% electric vehicle fleet. Since WEC has a slower pace of electric vehicle adoption when compared to the rest of Vermont, the forecasted average annual growth rates were adjusted downward by 10% for 2020 to 2029. The growth rates for VEIC's high, medium, and low scenario were then applied to WEC's penetration level of electric vehicles[20] to arrive at WEC's forecasted adoption for the base, low, and high cases. Figure 2-4 shows the forecast of electric vehicle adoption for WEC across the base, low, and high case.

[20] WEC had 8 electric vehicles in 2018 and 15 in 2019.

Figure 2-4. WEC Forecasted Adoption of Electric Vehicles



The forecasted adoption of electric vehicles was translated into annual energy impacts by using VEIC's assumption for electric vehicle efficiency from its forecast and 12,000 miles for the vehicle miles traveled.[21] The annual impacts from electric vehicles was then translated into monthly energy by using a monthly load shape based on data from Xcel Minnesota's residential EV charging tariff to capture the seasonal variations in energy use for electric vehicle charging.[22]

Heat Pumps

Similar to the development of the electric vehicle adoption forecast, adoption forecasts were created for Cold Climate Heat Pumps and Heat Pump Water Heaters based on a statewide forecast developed by Efficiency Vermont (EVT). WEC applied the forecasted growth rates from EVT to WEC's actual number of installations in 2019.[23] EVT developed the forecast for Heat Pump Water Heaters based on the assumption that there would be both electric and fossil

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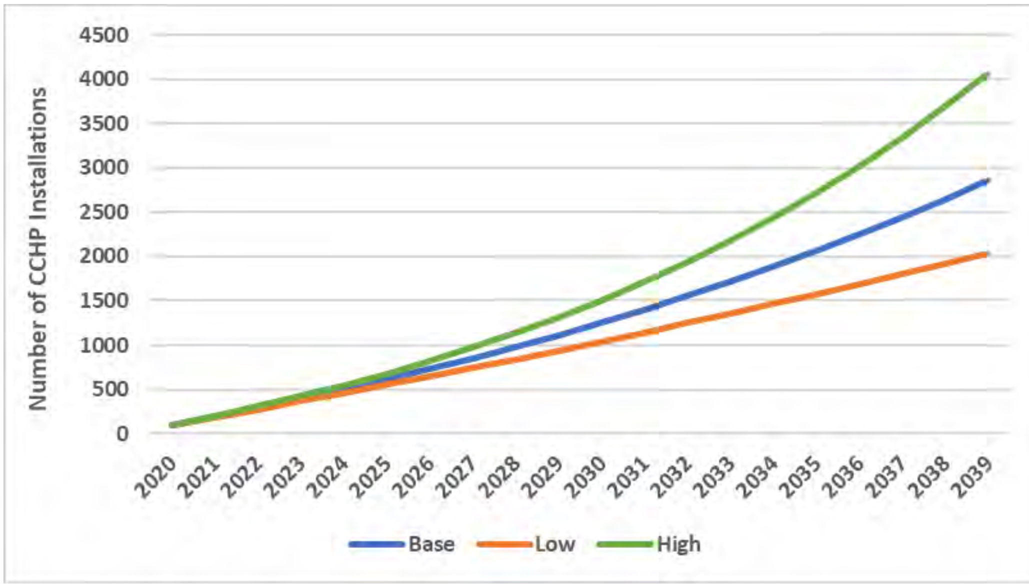
[21] H+T Index. https://htaindex.cnt.org/map/

[22] Monthly load shape developed from Xcel Minnesota residential EV charging tariff data. Average monthly consumption for 2016, 2017, and 2018. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7bB0BF0F6B-0000-CF2D-9F65-F327035855DC%7d&documentTitle=20195-153306-02

[23] WEC had 90 Cold Climate Heat Pumps and 21 Heat Pump Water Heaters installed in 2019.

replacements. For this analysis, it was assumed that the replacements would only be fossil and not electric.

Figure 2-5. WEC Forecasted Adoption of Cold Climate Heat Pumps



Adoption levels for heat pumps were translated into energy impacts by applying cooling and heating usage data from the Vermont Technical Advisory Group.[24]

Figure 2-6 shows the impact that electric vehicle and heat pump forecasted adoption levels have on WEC's load forecast, before the impact of forecasted net metered solar adoption. The impact of the increased load from electric vehicles and heat pumps becomes more prominent between 2030 and 2039 as the penetration of electric vehicles and heat pumps increase.

Figure 2-7 shows the impact of combining WEC's forecast with VELCO rates with the adjustments for forecasted net metered solar, electric vehicle, and heat pump adoption. The black line shows the forecast with just the VELCO rates applied. The red line shows the impact of adding in forecasted net metered solar adoption from the RIT model to the VELCO rate. The green line shows the VELCO rates with the impact from forecasted adoption of electric vehicles and heat pumps. The overall net effect of combining the VELCO rates with the

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[24] Cold Climate Heat Pump annual heating kWh of 2079 and cooling kWh of 145. Heat Pump Water Heater 706 kWh for winter and 272 kWh for summer.

downward load adjustment from net metered solar and the upward load adjustment from electric vehicles and heat pumps is shown by the blue line, or the base case.

Figure 2-6. WEC Electric Vehicle and Heat Pump Load Forecast Impact

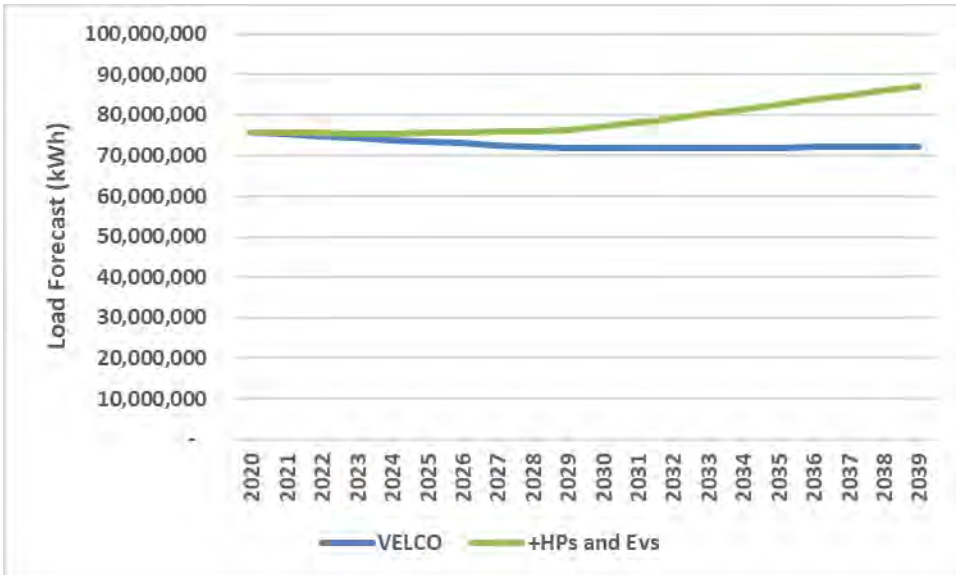
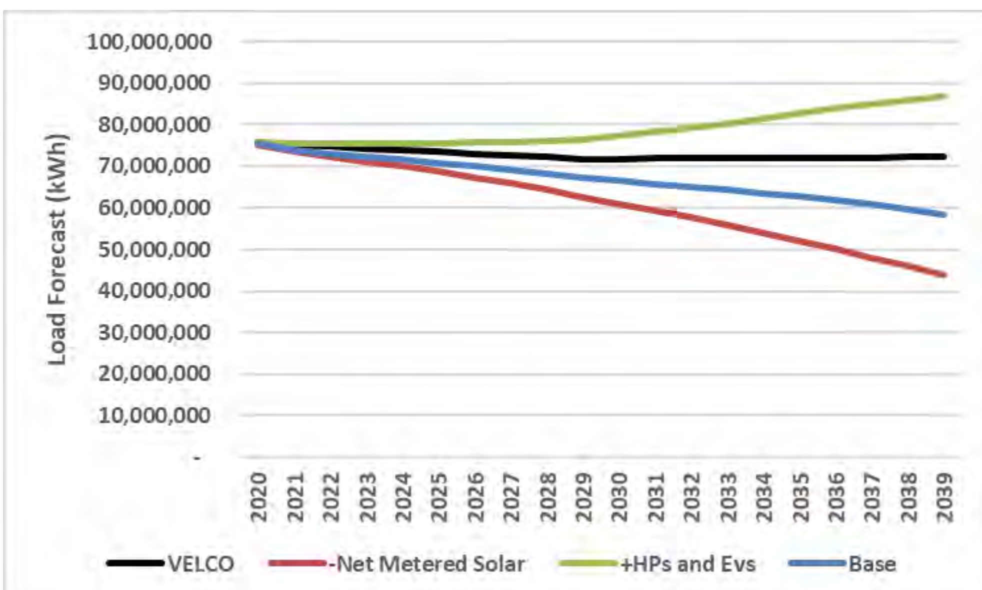
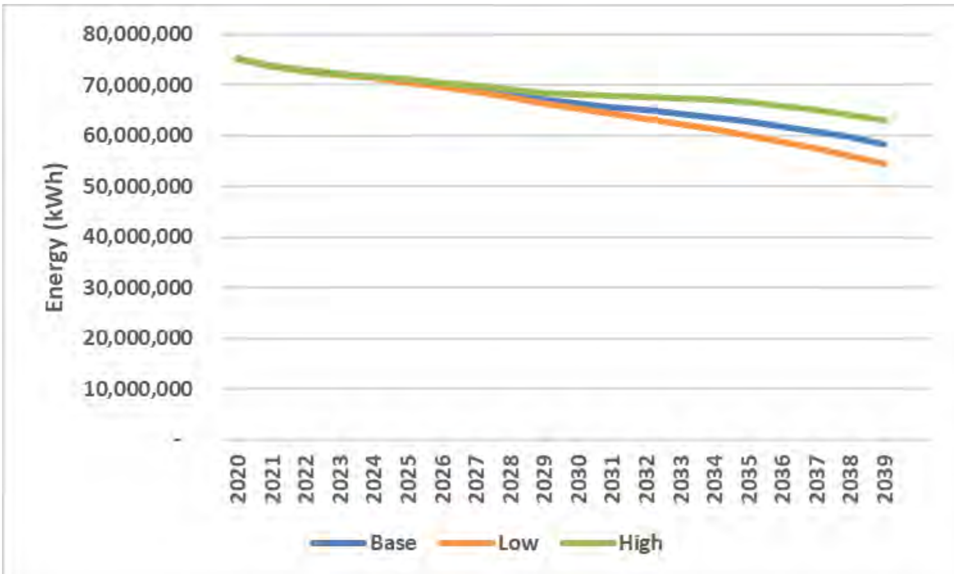


Figure 2-7. WEC Load Forecast with Layered Impact



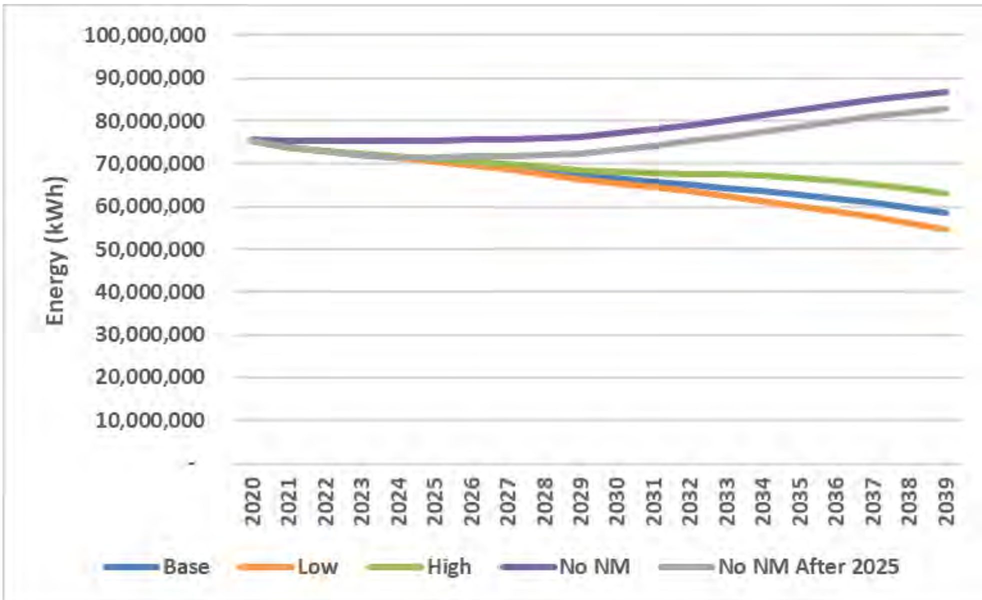
In order to test load as one of the key variables, a high and low forecast was developed based on the different growth assumptions made for electric vehicles and heat pumps. Figure 2-8 shows the three forecasts modeled for this IRP.

Figure 2-8. WEC Base, Low, and High Load Forecast



Two additional load forecasts were developed to illustrate the impact of net metered solar adoption during the IRP planning period. Figure 2-9 shows two additional scenarios, a no new net metered scenario (No NM) where WEC does not have any additional net metered solar added to its system during the planning period, and a scenario where there is no new net metered solar from the RIT model added after 2025. Figure 2-10 underscores the significant impact net metered solar can have on WEC's load forecast.

Figure 2-9. WEC Base Forecasted Adjusted for Different Net Metered Solar Scenarios



Similar to the load forecast, a base, low, and high peak demand forecast were also created based on the three different levels of adoption for heat pumps and electric vehicles. All three forecasts include the summer peak forecast projections developed by Itron for the VELCO report. Itron's forecasted growth for summer peak is .20% for 2020 – 2030 and .40% for 2030 – 2040. Figure 2-10 shows the base, low, and high peak forecasts developed for this IRP analysis.

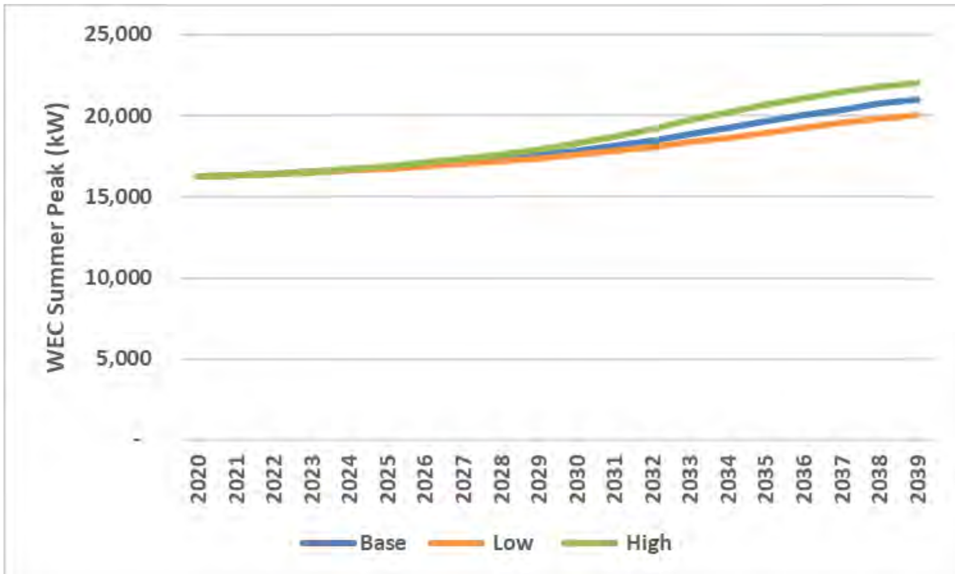
Even though WEC is a winter peaking utility, the time of the ISO-NE peak is during the summer, which means that WEC's peak obligation is dependent upon the coincidence of WEC's peak to that of ISO-NE's peak in the summer. WEC's summer peak in 2018 was 14,347 kW at 10:00 pm and the summer peak in 2019 was 13,252 kW at 6:00 pm. For this analysis, a higher starting summer peak for 2020 was modeled in order to capture ISO-NE's shifting peak toward evening hours. ISO-NE has observed a shift in the peak towards the evening hours due to the amount of solar that has come online.[25] After evaluating the 2020 PV Forecast[26] for the ISO-NE, the projected amount of solar to be installed in ISO-NE will further push the peak into the evening hours. Since WEC's obligation is based on the time of the ISO-

25 ISO-NE reports that 3,000 MWs of solar PV is installed in New England. Retrieved from https://www.iso-ne.com/markets-operations/system-forecast-status/seasonal-system-outlook

26 Retrieved from https://www.iso-ne.com/static-assets/documents/2020/04/final_2020_pv_forecast.pdf

NE's peak, and given the amount of additional solar projected to be installed, modeling a higher summer peak for WEC captures the shifting ISO-NE peak that will result from additional solar. The Itron growth rates were applied to the starting summer peak and the additional demand from electric vehicle charging and heat pumps were added into the summer peak forecast for this IRP analysis.

Figure 2-10. WEC Peak Demand Forecasts



As Figure 2-10 shows, a continued increase in WEC's summer peak is projected during the planning period. Since the ISO-NE peak occurs in the later evening hours, the assumption made for this IRP was that net metered solar did not provide any contribution to help lower WEC's peak.

WEC will compare and contrast its resources to the base load projection in the next sections. WEC's load outlook does not change WEC's outlook for new long-term power supply commitments. The biggest impact from a lower load outlook is it pushes farther into the future WEC's need to take back power from VEC for the HQUS PPA. More is discussed on this outlook in the next section.

2.6. Overview of Key Inputs to Power Supply Analysis

This section describes the assumptions used for the key variables in the WEC 2020 IRP model. The goal of this analysis was to update the key variables impacting WEC's power costs from WEC's prior IRP modeling efforts and assess changes if any based on updated information. In WEC's 2014 & 2017 IRP, projections for the distribution of key variables affecting power supply costs and revenues were developed along with applicable correlations between them. The potential outcomes for the variables were modeled in the Monte Carlo simulation using predefined distribution shapes for each variable. The outlooks and distributions provided the capability to measure the potential cost and cost variability outcomes associated with each portfolio simulation, using combinations of random and correlated 'draws' for each input variable. In the Monte Carlo simulation approach, each portfolio was tested under a broad range of conditions by assigning distributions of potential outcomes for the important input or "key driver" variables. The key input variables for this analysis included:

- ISO-NE Forward Capacity Market (FCM) prices;
- Regional Renewable Energy Credit (REC) prices;
- ISO-NE Regional Network Services (RNS) transmission rate;
- Forecasted WEC load (system energy and peak net requirements) under different adoption rates for heat pumps and electric vehicles; and
- ISO-NE forecasted energy prices.

All of the key drivers in the analysis are beyond the direct and immediate control of WEC. Regardless, it is important to understand the impact these variables can have on WEC in terms of cost and operational considerations. Modeling these variables in order to understand their cost impacts assists WEC in its decision-making, affording it the potential to foresee and to mitigate or hedge against undesirable effects.

The key variables in Table 2-3 were modeled in WECs 2020 IRP work using updated assumptions across a base, low, and high case.

Table 2-3. Summary of Most Key Input Variables

	Base	Low	High
FCM Capacity Market ($/kW-mo)	$5.00	$3.00	$7.00
REC MA Class 1 ($/MWh)	$30.00	$15.00	$45.00
RNS Rate (average growth %)	7%	2%	12%

WEC's forecasted load for the high and low case are modeled under different assumptions of adoption for heat pump and electric vehicles. The forecasted ISO-NE energy prices for the low case are modeled as the base case less 15% and the high case energy prices are modeled as the base case plus 15%.

2.7. Analysis of IRP Modeling Results

The intent of the IRP resource modeling process is to provide important information about the costs, features, and risks of various power supply portfolios that WEC could use in the future to meet its system load requirements. The goal is to project cost and cost variance, emissions profiles, and other measures associated with each portfolio, under a broad range of future loads, market prices, economic conditions, and other factors affecting performance, such as market or regulatory changes.

WEC seeks to balance not only cost but a number of subjective evaluation criteria when it looks at its power supply portfolio. These criteria are used qualitative and are as follows:

- **Diversity**: Fuel, resource, duration, and supplier diversity are valuable in the power supply mix to mitigate impacts from a single event on the overall mix of power. This is very important as New England power markets continue to evolve with a dominance and dependency on natural gas fired power plants. The marginal MWh of energy needed in New England in 2018 to meet load is normally fired by a natural gas unit, resulting in the hourly market price being set over 62% of the time in 2018 by a natural gas fired power plant.[27] The result is wholesale power prices are very closely tied to natural gas prices. In times of natural gas shortages due to regional pipeline constraints,

[27] Figure 4-7, p.20, of 2018 ISO New England Electric Generator Air Emissions Report. Retrieved from https://www.iso-ne.com/static-assets/documents/2020/05/2018_air_emissions_report.pdf

power prices tend to be volatile and reliability concerns occur.

- **Risk**: Operational, credit, and reliability risks can all be used to assess and describe a power mix. By owning generation, operational risk is built into a power portfolio in which mechanical, fuel, and operation risk are added to the list of issues a utility must manage. Credit risk is equally important, as the market has seen a number of bankruptcies making power contracts less than certain long-term. Reliability considerations can apply to owned power plants as well as power contracts in terms of delivery and adherence to contract terms. All of these dimensions must be taken into account when planning and examining a power portfolio.
- **Uncertainty**: Assessing the uncertainty of a power mix can be a valuable tool in understanding how likely changes are to power costs and to measure volatility. Measuring uncertainty can lead to varying resource decisions given prior or upcoming commitments.
- **Environmental Impacts**: Assessing the environmental impacts of a power mix is essential to WEC, as one of WEC's core missions is to minimize the environmental impacts of electric generation and our operations.

2.8. Key Influences on Net Portfolio Costs by Portfolio

The 2014 & 2017 IRP modeling found the key impact variables to be REC prices, the RNS transmission rate, and the FCM resource credit and load charge. The goal of the 2020 IRP analysis was to confirm if these variables continued to be key drivers of cost for WEC. The impact of each variable was evaluated by comparing the NPV percentage difference of the Status Quo and Coventry Stress Test portfolios under the base case with the cases that contained the change to the specific variable. Figure 2-11 below shows the NPV percentage differences REC prices, transmission costs, and the FCM rate for the Status Quo portfolio.

The color of the bar indicates whether the change reflects an increase or decrease to the NPV differential from the Status Quo case. The blue bars indicate a decrease to the NPV while the red bars indicate an increase to the NPV. As an example, the REC price variable has the red bar to the right and the blue bar to the left, indicating the NPV increases as REC prices decrease and vice versa.

For the Status Quo case, the most important variable was REC price. This is not a surprise finding, because WEC's resource portfolio is composed entirely of renewable resources, the largest of which, Coventry LFG, generates RECs and REC revenues.

Figure 2-11. NPV Comparison for Status Quo Case

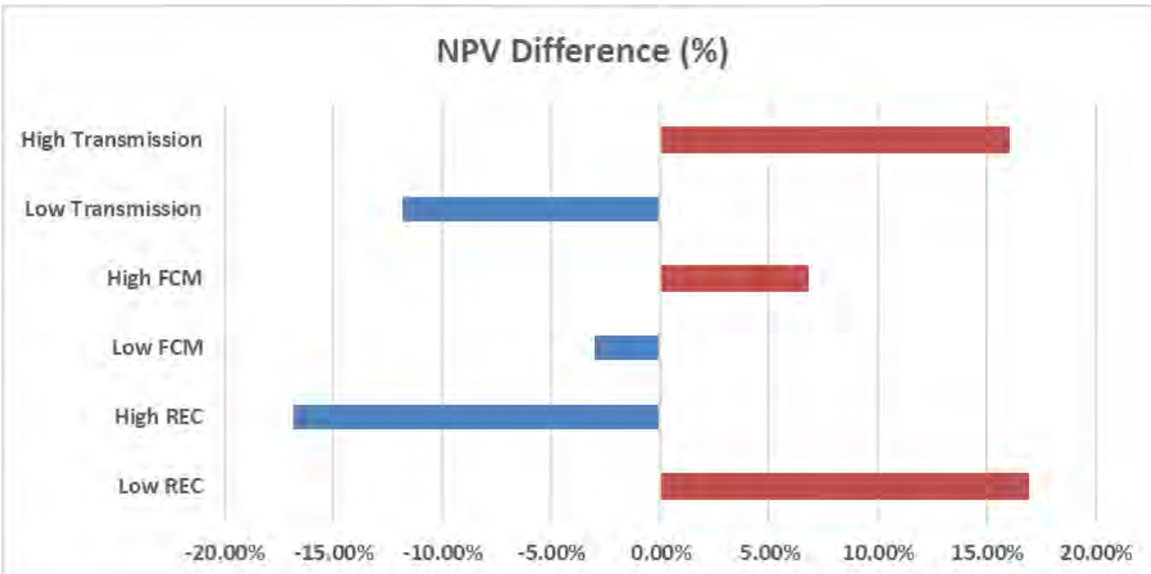
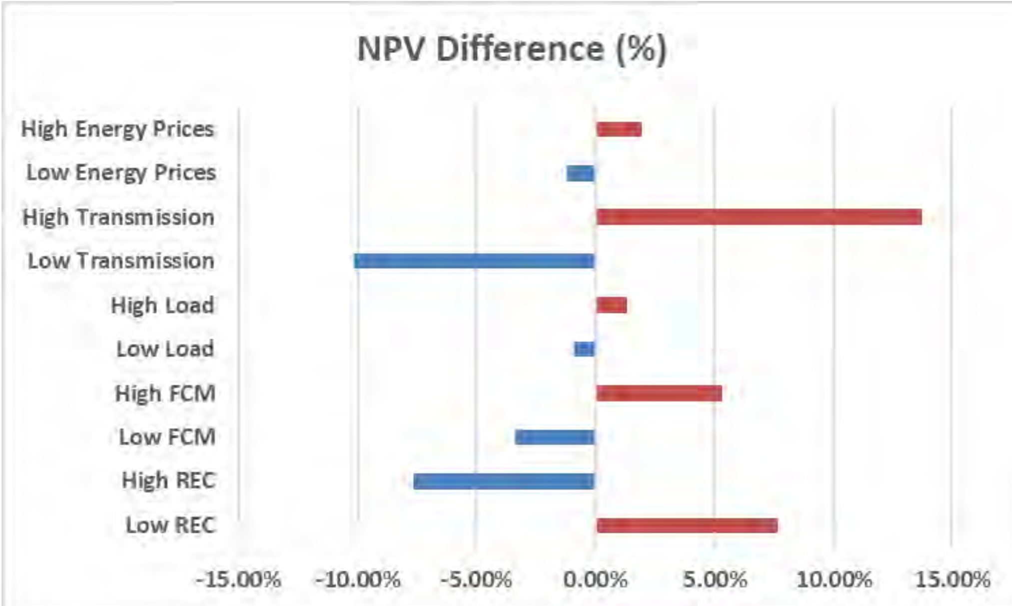


Figure 2-12 shows the variables with the greatest impact on NPV for the Coventry Stress Test portfolio. For this portfolio, the most influential variable becomes the RNS transmission rate. The influence of Massachusetts REC prices is lower in this case, as there is a reduction in potential REC sales from Coventry's reduced operation. The FCM rate also becomes more influential under the Coventry Stress Test case since the capacity shortfall that already exists under the Status Quo case becomes even larger with the loss of half of Coventry. The Coventry Stress Test case is also influenced more by energy prices and the load forecast since WEC his predicted to have more energy market purchases when Coventry is reduced to 50% output.

Figure 2-12. NPV Comparison for the Coventry Stress Test



2.9. Net Portfolio Costs by Portfolio

Table 2-4 provides a summary of the total NPV of costs[28] for each portfolio (in 2020 dollars). The Status Quo case has the lowest total costs, as this case has the highest amount of REC sales to offset energy and other market costs. The Coventry Stress Test increases total energy and capacity costs as the reduction in Coventry output makes WEC more reliant on market purchases and decreases REC sales dramatically.

[28] Costs include energy and capacity load charges; resource contract charges; transmission charges; other charges; the cost of purchasing RECs to green up WEC's supply mix. Costs are net of resource credits and REC revenue.

Table 2-4. NPV of the Costs of Each Modeled WEC Portfolio[29]

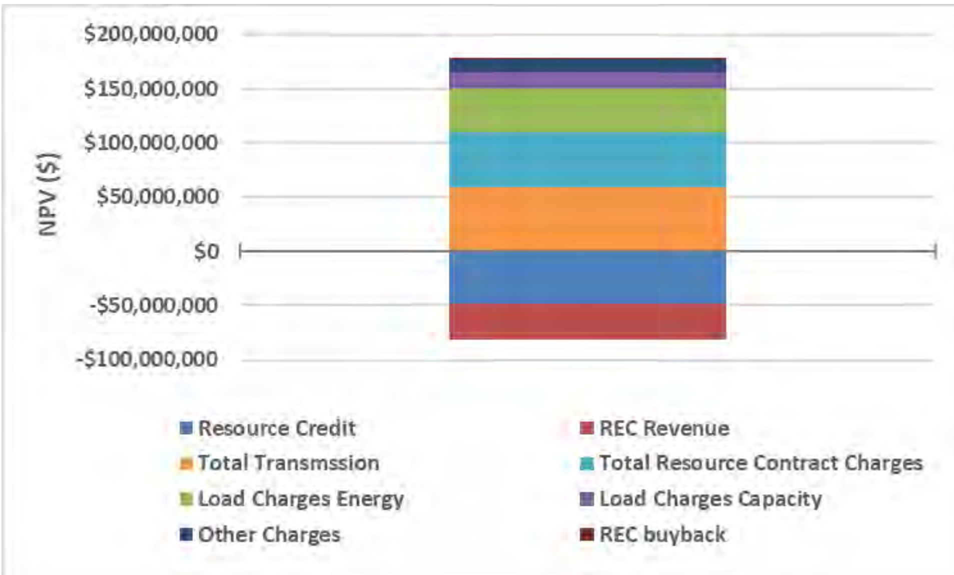
Case	Status Quo	Coventry Stress Test
Base	$96,837,499	$112,817,716
Low REC	$113,164,248	$121,449,758
High REC	$80,510,751	$104,185,675
Low FCM	$93,900,167	$108,986,817
High FCM	$103,340,866	$118,806,211
Low Load	$95,809,815	$111,790,923
High Load	$98,330,845	$114,309,778
Low Transmission	$85,380,481	$101,360,698
High Transmission	$112,311,985	$128,292,202
Low Energy Prices	$97,013,427	$111,486,501
High Energy Prices	$96,513,327	$115,020,995

The base case NPV under the Coventry Stress Test portfolio is about 16.5% higher than the base case under the Status Quo portfolio. This shows that the loss of Coventry does not have as large of an impact on WEC financially as it has in prior modeling. The main reason for this is the lower energy prices, as the shortfall from the lost Coventry output is made up for with market purchases.

Figure 2-18 shows the 20-year NPV breakdown of the different categories of revenues and costs modeled for this analysis. The red and blue bars represent the resource credits and REC sales revenue, respectively. This shows the importance of REC sales in helping to offset some of WEC's power supply costs. The power supply costs show that the largest proportion of power supply costs in this analysis are transmission, resource contract charges, and load charges.

[29] Please note that there may be additional costs related to Installed Capacity Requirement (ICR) violations for the Coventry Stress Test Portfolio. WEC did not model these costs for this IRP analysis.

Figure 2-13. NPV of Revenues and Costs for Status Quo Portfolio



2.10. Effects of Environmental Externalities

Table 2-5 below provides results of the emissions modeling for each portfolio both before and after REC sales are taken into consideration. WEC used emissions based on the NEPOOL GIS residual mix for the underlying energy that is retained in the power mix post REC sale. It is also important to note that the emissions profile for the Status Quo case will be less than previous IRPs as the assumption made for this IRP was that the Ryegate contract ends in 2021.

The Status Quo portfolio has higher post REC emissions and societal costs[30] because there is a larger amount of REC sales in this case. The Coventry Stress Test portfolio has much higher emissions before REC sales compared to the other portfolios because the reduced Coventry generation is replaced by market purchases with an emissions profile reflecting the NEPOOL GIS Residual Mix. In contrast, the Coventry Stress Test portfolio has a much lower

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[30] Social cost of Carbon from Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (May 2013, Revised August 2016). https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html
And Social cost of Sulfur Dioxide and Nitrogen Oxide Externality costs from Environmental Cost Values in Minnesota Docket No. E999/CI-14-643

increase in emissions from REC sales as it has many fewer RECs available for sale from Coventry.

Each resource decision relative to entering contracts, building generation, selling, and/or buying RECs comes with both a monetary cost as well as an environmental cost. In Table 2-5 the NPV costs for each portfolio represent the total dollar impact on WEC's rates from its resource decisions, but this number is calculated without regard to environmental impacts. This metric is referred to as a measurement of rate payer costs. The next two columns, "Societal Cost Pre REC Sales" and "Societal Cost Post REC Sales" represent the cost in terms of rates as well as the cost to the environment of WEC's resource decisions. Both of these metrics include both rate payer and societal costs. By measuring this way, WEC can compare and contrast the impacts of various portfolios. Furthermore, by measuring the portfolio in terms of pre and post REC sales, WEC can measure the impacts of its decision to sell RECs. WEC uses the societal cost impacts to measure and report on the environmental cost implications from its power portfolio decisions.

Table 2-5. Base Case and Societal Cost NPV for Each Portfolio in 2020 $.

Portfolio	Base Case NPV	Societal Cost Pre REC Sales NPV	Societal Cost Post REC Sales NPV
Status Quo	$96,837,499	$96,840,330.78	$139,039,369
Coventry Stress Test	$112,817,716	$130,311,163	$151,389,793

While the revenues received from selling RECs help reduce WEC's rate payer cost, it has the counter effect of increasing its overall societal cost of the power mix. Table 2-6 shows the amount of emissions (in tons) and further quantified in Table 2-7 quantifies the societal cost NPV for each portfolio.

WEC must weigh the value in its power supply decision-making of both low cost power as well as low societal costs. The decision to buy and sell RECs is driven by the impact on WEC's rates as well as the environment. WEC decision-makers put a high priority on keeping rates affordable. WEC decision-makers also put significant emphasis on having low environmental impact. In review of the rate payer cost and societal cost metrics, WEC plans to lower its societal cost by buying back RECs and thereby greening back up the power mix. WEC plans to sell its high value Class 1 market RECs (which helps to keep rates low) but then green back up the mix by buying sufficient lower priced Class 2 market RECs. This will have the effect of lowering WEC's societal costs while preserving the benefits of lower rate payer costs. This action is described in Section 6 in the Action Plan.

Table 2-6. Emissions Modeling Results Summary For Each Portfolio.

	Pre REC Sale			Post REC Sale		
	SO_2	NO_x	CO2	SO_2	NO_x	CO2
Status Quo	0.002	0.25	23.4	942.6	656.9	441,632.7
Coventry Stress Test	391.7	273.0	183,513.9	861.4	600.2	403,557.5

Table 2-7. Societal Cost NPV For Each Portfolio.

	Pre REC Sale			Post REC Sale		
	SO_2 NPV	Nox NPV	CO2 NPV	SO_2 NPV	Nox NPV	CO2 NPV
Status Quo	$15.77	$990	$1,826	$5,274,828	$2,607,287	$34,319,755
Coventry Stress Test	$2,177,742	$1,076,478	$14,239,227	$4,823,092	$2,383,551	$31,365,433

2.11. Conclusions

The 2014 & 2017 IRP analysis documented the impact of projected variations in operating, market, and regulatory conditions on the costs and cost variability of each resource portfolio. This allowed WEC to project expected present value costs for each portfolio, as well as the distribution of possible cost outcomes around an expected value. The 2020 IRP analysis evaluated whether the variables identified in the prior IRP modeling still pose a significant risk to WEC today. A Status Quo portfolio and a Coventry Stress Test Portfolio were modeled with sensitivities to change each of the variables evaluated (REC prices, transmission costs, FCM rate, energy prices, and WEC load). The significance of each variables was assessed by comparing the NPV percentage difference of the base case for each portfolio with the NPV of each sensitivity that changed one of the variables evaluated.

WEC uses portfolio review and the simulation of its long-term power supply commitments to help guide its decision making. The process allows WEC to identify key risk drivers, which allows WEC to create plans to reduce these risks while also reducing cost and volatility. Some of these risks are presented by major market influences and events that are well beyond WEC's control. With such uncertainty in mind, WEC seeks to minimize to the extent possible negative outcomes to its membership, such as impairment of WEC financial performance or increased emissions of its power supply mix.

The biggest risk impacting WEC's financials identified in this analysis are identified in Figure 2-11. Changes to the price of RECs, ISO-NE Transmission charges, and FCM, and were identified as the largest factors that impact variations in WEC's costs. These key variables continue to be relevant today.

For example, in 2016 WEC filed a 6.52% rate increase with the largest driver being due to a decline in the price of RECs (RECs accounted for just over half of the rate increase, or 3.04%), while power costs due to transmission and FCM accounted for another 1.56%. The remainder, or 1.92%, is due to operational costs (service of wires, poles and substations, labor, benefits, and other financial costs). As predicted in the 2014 analysis, a drop in REC prices triggered significant cost pressure to WEC. This occurred as REC prices declined from mid $40s to low $20s. At the same time the REC market dropped off, the cost of transmission and capacity also increased. These three items, in addition to flat sales due to net metering, were 74% of the 2017 rate request. These three items, in addition to decreasing sales, continue to be WEC's greatest financial risks.

REC Risk

WEC uses a portfolio approach to selling its RECs, which emphasizes transaction and timing diversity. In its simplest form, WECs enters several forward trades at various points in time with several counterparties. WEC seeks to capture favorable market prices that average out the ups and downs in the market, and looks to have reasonable credit risk among counterparties. WEC's fundamental goal is to maximize revenue while minimizing risk and price uncertainty. To carry out its goals, the Co-op uses a pragmatic approach and one that doesn't create an undue burden and administrative work to track and manage contracts.

There is no prescriptive number of trades, but WEC also knows the more contracts it has, the more administrative work is needed to execute, track, and process each trade. Hence, it seeks to limit the number of trades to a reasonable number in a given year (generally less than 10). WEC also leaves roughly 10 to 15 percent of its position uncommitted until the end of the year to allow for production variability at Coventry. This also helps to contribute to budget certainty for the year. WEC looks out several years into the future and makes use of forward sales at various points in time. However, the closer to the year of production, the more emphasis is put on securing sales for that year.

WEC's portfolio approach helped to reduce the impacts of the significant fall in REC prices in 2016. While it did see impacts to rates, as WEC needed to file for a rate increase, it would have been far worse had the Co-op not sold RECs prior to the crash in the 2016 REC market.

Prior to 2016, the markets had been in an inverted state for several years, with future years selling lower than periods closer to a year of production. This decreased the desire to enter sales many years into the future. If, however, WEC waits and sells everything close to the year of production, this leaves uncertainty and risk that the markets could fall. WEC seeks to balance these competing interests through its REC sales and portfolio management approach.

Capacity and Transmission Risk

In order to control capacity and transmission costs, utility scale battery storage may be one solution to helping WEC control load at the time of the ISO-NE peak. FCM charges are assessed to load based on WEC's share of load at the single hour of the year that the region uses the most power. To the extent WEC can predict the peak and deploy battery at the time the region peaks, the following year capacity costs will be lower.

Batteries can also help to reduce transmission costs. Transmission is assessed based on monthly peaks. To the extent batteries can be deployed at the time of monthly peaks, transmission costs can be lowered.

In 2019, WEC explored the potential cost savings of battery storage. The preliminary analysis did not indicate significant cost savings for WEC. However, WEC will continue to explore potential battery storage projects and the potential cost savings that peak shaving can have for WEC to help control capacity and transmission costs, particularly as battery costs continue to decrease. Also noted of concern to the long term value of battery storage given recent discussion relative to reconstituting load for behind the meter (BTM) generation. Battery storage is at risk of reduced future value streams and savings. The ISO-NE seeks to increase utility load for not only net metering generation but also battery storage systems in the transmission markets. This issue could also extend into other market such as energy and FCM. This issue is being discussed and vetted by market participants at ISO-NE and throughout New England. Given the uncertainty and risks, WEC will await some conclusion of the discussions relative to BTM generation prior to moving ahead with additional battery analysis.

Methods Used to Evaluate and Mitigate Key Power Cost Risks

WEC's existing power portfolio is reasonably stable and generally known over the next 20 years due to existing long-term contractual commitments and generation resources. Through the IRP analysis WEC has identified that it can minimize costs to its members if it operates under the Status Quo case conditions.

In the 2014 & 2017 IRP, WEC was able to assess the variability of the cost of its power mix by running various simulations of the key variables. The analysis performed for this IRP confirmed the key cost drivers identified in the prior IRP modeling. A decline in REC prices or an increase in transmission costs puts tremendous pressure on WEC's costs and influences WEC's need to increase rates. A sustained loss of half of WEC's Coventry generation can also increase WEC power supply costs.

It should be noted that WEC's Status Quo case has a very low emission profile and resulting societal and emissions cost before considering its REC sale practices, as compared to the other cases. After WEC sells RECs for wind and Coventry, then WEC's emissions profile is higher in the Status Quo case simply due to the sale of RECs. This tradeoff, between lowering cost to members and keeping rates low versus incurring a higher emissions profile, can be changed. In fact, WEC made the decision in 2014 to buy back low cost RECs to green back up its power supply mix after high value RECs are sold and it continues to do that today.

Assessing the Status Quo portfolio based on diversity criteria, WEC has a large single resource risk in Coventry. Coventry provides two thirds of WEC's energy needs in most years through the 20 year planning horizon. As a result, WEC has risk in its portfolio and some degree of uncertainty that it should consider ways to mitigate and manage.

WEC has mitigated a significant portion of loss risk from Coventry through the terms of the sleeve agreement to VEC. As part of the assignment to VEC for WEC's 4,000 kW of HQUS PPA, the arrangement includes a provision that allows for a call back of power of the HQUS PPA contract if WEC has an unplanned outage lasting more than 30 days from any of its existing resources. Therefore, in the event of a significant loss of Coventry in the near term, WEC can use the HQ US PPA as a backstop to cover roughly half of the loss of generating station. This 4,000 kW option is of considerable value to WEC and its members to diversify WEC's portfolio in the event of a loss of Coventry or other existing resources in its mix.

WEC also carries business income loss insurance for the Coventry plant. In the event of loss of revenue due to a catastrophic event, such as fire, tornado, flood, etc., this policy will respond and provide WEC basic coverage due to loss of income from the plant. This is a further protection to WEC and helps to mitigate its reliance on Coventry in the power portfolio.

The other portion of WEC's power portfolio is comprised of various contracts (including large hydro, small hydro, biomass, and wind) and WEC's Wrightsville hydro generation. This portion of the portfolio provides a diverse mix of contracts and resources that represent varying suppliers, different fuel types, and varying durations. This portion of the mix provides reasonable diversity and lowers risk and uncertainty to WEC.

The underlying sources of WEC committed power are all stably priced renewable power sources leaving WEC insulated from volatility in the natural gas markets, which dominate the regional mix of resources in the New England markets today and essentially set the price of power at the wholesale level. Therefore, WEC's portfolio is well hedged against and insulated from short and long-term price swings in the fossil fuel markets.

For the Status Quo portfolio, the most significant variables WEC needs to focus on are REC prices, regional transmission costs, and FCM rates and market obligations. These are key drivers to power and transmission costs to WEC and produce the most chance to increase or decrease WEC's power costs.

In the Coventry Stress Test case, regional transmission costs are the most influential variable, with REC prices, and FCM rates being the other top variables. Energy prices and WEC load become more influential since WEC has significant market exposure due to the loss of Coventry. In this situation, WEC would be exposed to the underlying market prices at the wholesale level. The loss of Coventry also poses emissions risk for WEC as the 50% reduction at Coventry causes WEC to have to make more market purchases for energy. Market purchases have a larger emission profile than WEC's existing resource mix.

3. Committed Supply Resources & Projected Requirements

3.1. Overview of Existing Resources

WEC's current committed power supply mix is summarized in Table 3-1. Following the table is a narrative description of each resource. WEC's current resource mix provides it with long-term stability as well as the ability to react to RPS markets. WEC's power portfolio also meets the State's renewability goals, as all resources are based on renewable sources of power. Another attribute is that WEC's largest sources of power are located close to WEC's load, which helps to alleviate price separation between load and generation.

Table 3-1. WEC Committed Supply Asset Inventory

Name	Nameplate (kW)	Fuel Source	Start Date	End Date
Coventry Landfill Gas	8,000	Landfill Gas	7/1/2005	2038
New York Power Authority	1,570	Hydro	NA	Life of Contract
Ryegate (WEC's Allocation)	273	Wood	2012	2021
Wrightsville Hydro	1,000	Hydro	9/1/1985	Life of Unit
Sheffield Wind	4,000	Wind	10/19/2011	10/19/2031
Hydro Quebec US PPA	4,000	Hydro	11/1/2016	10/31/2038

Coventry Landfill

The Coventry landfill generating facility is located in Coventry, Vermont at the New England Waste Services of Vermont Landfill (or NEWSVT). The facility currently has a maximum generating capability of 8,000 kW, though average output has been between 5,500 kW and 6,500 kW over the past few years. Production is driven by the amount of methane gas produced at the landfill and based on the gas collection system's ability to capture, extract, and process the gas. The facility started with three 1,600 kW engines in 2005, and WEC has since expanded the plant by adding two additional 1,600 kW engines. The generators burn the processed landfill gas that is collected from gas wells at the Coventry landfill.

In 2016, WEC added a new gas scrubbing Siloxane Removal System (SRS), which removes siloxanes from the gas. Siloxane acts as a corrosive when burned in the engines; removing siloxanes reduces the concentration of compounds in the landfill gas. The buildup of siloxane compounds within the engines causes destructive detonation and inefficient operation of the generators, causing additional maintenance and engine downtime. Removing the siloxane compounds will improve engine availability and increase electricity production.

The other major factor impacting production at the Coventry plant is the volume of gas produced and extracted from the landfill. Over the past two years the volume of gas extracted has increased. This was due in part to concerted efforts to increase the level of gas extraction. WEC is working collaboratively with NEWSVT management, staff, and technicians trained in maximizing gas extraction. Work was done to rebalance gas wells for optimal methane to oxygen content, and WEC invested in pumps to dewater wells. It continues to monitor the progress made to date and work continues to optimize gas extraction.

It is important to remember that the Coventry landfill is in a state of constant flux. NEWSVT continues to accept waste and plan for the operation and management of the various physical areas (known as phases and cells) in an ongoing and active process. Many factors can affect the wells and gas volumes, including not only the content of the waste stream but other external issues. Damage from heavy equipment working in and around the landfill, freeze/thaw events which can lead to cracked lines, water in the wells, failed pumps, operational work and redesign of various cells/phases, and compliance with state permits are a few noteworthy factors that impact gas collection.

The NEWSVT landfill has been in continuous operation since 1993. Previous gas generation studies included waste filling data from NEWSVT records through 2013 and a projected future filling rate of 350,000 tons per year. The waste filling records show a total of approximately 425,600 tons, 444,700 tons and 492,400 tons disposed at the NEWSVT landfill in 2014, 2015, and 2016, respectively.

We have been advised by NEWSVT that they project a future waste disposal rate of 475,000 tons per year, although their permit allows up to 600,000 tons per year. The Phase IV landfill is expected to continue receiving wastes through 2022 when it will reach capacity.

Filling will then commence in the newly permitted Phase VI landfill, with a projected 22-year useful life at 475,000 tons per year filling rate, reaching its capacity by 2044. The previously permitted Phase V landfill would begin receiving wastes in 2045 and reach its capacity by 2051.

Based on the filling history, as of the end of 2016 the landfill has 6.87 million tons of waste in place. The currently permitted landfill limits (Phases I – VI) have a total capacity for 23.4 million tons, or approximately another 16.5 million tons of future filling capacity. At the estimated rate of future filling of around 475,000 tons per year, the current landfill has sufficient capacity to continue operating through 2050 and into 2051.

Casella filed permits for a new phase of the landfill (Phase VI). Based on planned gas extraction from the existing phases (I-V) and from the proposed Phase VI, WEC believes the gas production will increase to a level that allows all five engines to run at maximum output. However, Act 148, the state's universal recycling law, calls for food scraps to be diverted from the landfill, with all food waste targeted to end by 2020. Enforcement of this law at the homeowner and small scale producer level is impractical, and therefore the Department of Environmental Conservation (DEC) believes roughly 40% of the state's food scraps will remain in the waste stream; hence DEC experts believe some level of organics will continue.[31]

WEC periodically hires consultants to perform long-term gas flow modeling and a consultant is currently working on an updated model. WEC's latest gas model shows excess gas for the foreseeable future. This report will be helpful and the outlook is based on waste content, operation considerations, and other factors, such as impacts from Act 148.

New York Power Authority (NYPA)

The New York Power Authority provides inexpensive federal preference hydroelectric power to the utilities in Vermont under two contracts. The first contract is a 31 kW entitlement

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[31] While Coventry has enough gas to add additional engines, there are several challenges to justifying an expansion at this time. The Coventry plant is located in a congested and transmission constrained area known as SHEI. Adding more generation to an aera that already has excess generation relative to load and transmission system capability, would exacerbate current SHEI issues (lower LMP's and power plant curtailments). In addition, WEC does not have a need for additional energy at this time and the cost to install new engines is more than the current price of energy in the wholesale market. While WEC does show a need for capacity, using the gas for the capacity market alone in an already congested area is a challenge. However, as Vermont continues to progress towards strategic electrification across all three sectors (power, thermal and transportation), this could create an opportunity for increased renewable electricity generated within Vermont, perhaps for use by other utilities who do need additional energy.

to the Robert Moses Project (a.k.a. "St. Lawrence") located in Massena, New York. The second contract, known as the "Niagara Contract," is for a 1,539 kW entitlement to the Niagara Project located at Niagara Falls, New York. The contract for St. Lawrence has been extended through April 30, 2017. The Niagara Contract has been extended through September 1, 2025.

Ryegate

WEC receives output from the largest IPP resource (the Ryegate wood-fired facility) and is allocated power based on load ratio share. WEC's portion of Ryegate is currently 1.3%, which provides 273 kW of base load power. A new contract with Ryegate was implemented through Docket 7782 in which costs and benefits are distributed to Vermont utilities based on a price set by the Vermont Public Service Board. In 2011, Act 471 mandated the establishment of a standard-offer price for certain baseload renewable power sources. In an Order dated October 29, 2012, the PSB established a standard-offer price schedule for baseload renewable power (Ryegate biomass facility) that is represented by a levelized price of $0.10 per kWh and that included a fuel pass-through mechanism, by which the price will be adjusted to reflect changes in Ryegate's fuel costs. The new contract began November 1, 2012 at the termination of its Rule 4.100 VPX contract. The new contract for Ryegate is in effect for ten years or from 11/2012 through 10/2021.[32]

Wrightsville Hydro

WEC's Wrightsville Hydro unit is a hydroelectric facility with limited ponding capability, and is located below the Wrightsville Dam on the North Branch of the Winooski River in Montpelier, Vermont. WEC owns and operates the facility and utilizes all of its output. The nameplate rating of the facility is 933 kW, but energy production is determined by water flows. Wrightsville began creating power in September 1985, and continues to be a valuable source of economic hydropower for WEC.

In March 2016, WEC successfully converted the hydro unit's status at the ISO-NE from a generator to a load reducer. As a load reducer, the production from Wrightsville goes directly toward lowering WEC's load with the ISO-NE. The effect is the unit is no longer

32 For this IRP analysis, WEC's approach was to stop including Ryegate as a resource once the contract ends in October 2021. This assumption may be different from how other utilities are modeling Ryegate, however, WEC is basing this IRP modeling on known resource decisions. Even though WEC is modeling the end of the Ryegate contract, this does not rule out the possibility that there could be an extension of the contract and Ryegate will remain in WEC's resource mix.

treated as a generator in settlement by the ISO-NE.

This change saves WEC in ancillary market costs, capacity costs, reserves, and many other expenses assessed to load by the ISO-NE. WEC continues to record generation monthly for internal tracking and adjusts load internally as if the generator were not a load reducer. This allows it to measure and track WEC's total member load for planning purposes.

The Wrightsville Hydro facility was issued a 40-year license by the Federal Energy Regulatory Commission (FERC) on November 23, 1982 (FERC No. 5124, also known as North Branch No. 3 Hydroelectric Project). At the time of the license, the project was owned by the Montpelier Hydroelectric Company; it was later transferred to the Washington Electric Cooperative, Inc. (WEC) on June 30, 1983. The current license expires on October 31, 2022. WEC must file its Notice of Intent (NOI) and Pre-Application Document (PAD) between May 1, 2017 (5.5 years prior to license expiration) and October 31, 2017 (5 years prior to license expiration).

WEC is in the last steps of completing the process to relicense the Wrightsville Hydro facility. The last item for WEC to complete is a historical site report for several areas located below the reservoir water line. WEC continues to work through the FERC process. Recent cost pressure and regulation created from the relicense could prevent FERC from issuing a new license in the near future. The new license will allow WEC to continue operating the Wrightsville Hydro station for the next 50 years.

Sheffield Wind

WEC entered a contract to purchase power from the Sheffield Wind facility for a 10% entitlement to power from the 40 MW project. The project was under construction in 2011 and achieved commercial operation on October 19, 2011 in Sheffield, Vermont. WEC's nameplate entitlement is 4,000 kW, and WEC receives a proportionate share of renewable attributes associated with the output from the facility, as well as capacity. Energy production will vary with wind speeds, which are seasonal and diurnal, but an annual capacity factor near 25% is projected for energy production at the facility. The contract for Sheffield wind is in effect until10/19/2031.[33]

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[33] For this IRP analysis, WEC's approach was to stop including Sheffield wind as a resource once the contract ends in October 2031.

Hydro Quebec US Purchase Power Agreement (HQUS PPA)

WEC, along with other Vermont utilities, petitioned the Vermont Public Service Board in 2010 in Docket 7670 to approve various agreements related to obtaining power from H.Q. Energy Services (US) Inc. through a Purchase Power Agreement (HQUS PPA). WEC is participating as a buyer of power under the Vermont Public Power Supply Authority (VPPSA) through a sub-allocation arrangement. WEC will be allocated energy products from the HQUS PPA through VPPSA in the amount of 4,000 kW from November 1, 2016 through October 31, 2038.

The energy from this contract will be delivered seven days a week, from hour ending 08:00 to hour ending 23:00, on a firm basis through an Internal Bilateral Transaction (IBT) settled through the ISO-NE markets. There is no capacity accompanying the energy, but environmental attributes will be delivered with a minimum guarantee that 90% of the power will come from hydro resources.

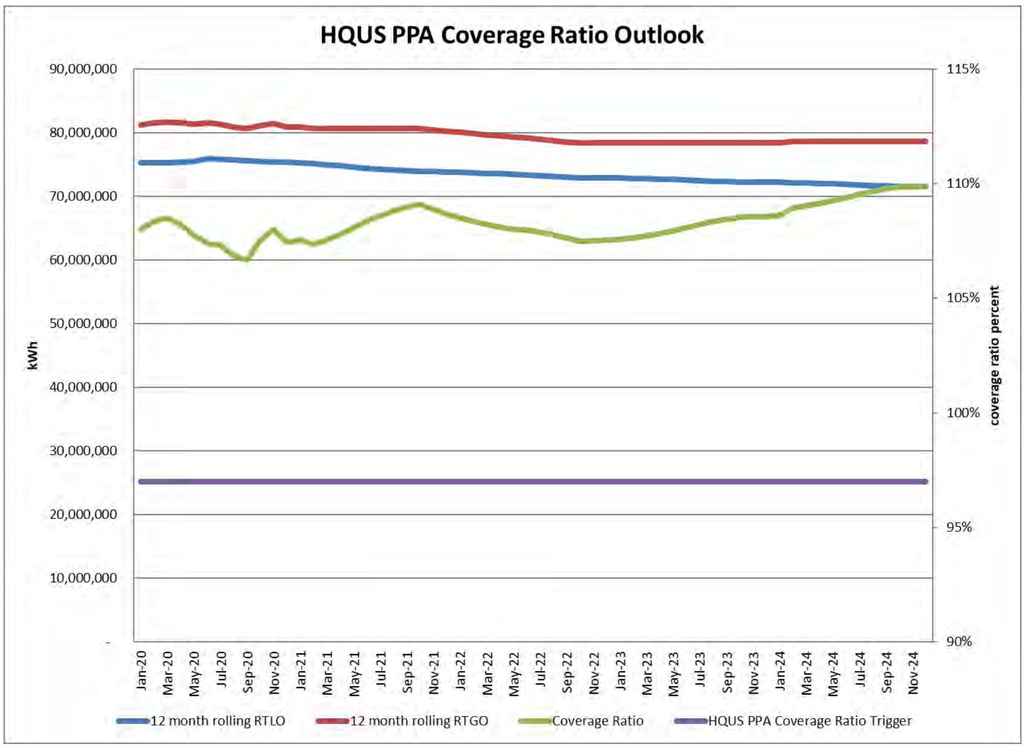
WEC has a contract entitlement from this resource of up to 4,000 kW. Currently WEC assigns this power to Vermont Electric Cooperative (VEC) through a sleeve arrangement. Starting on November 1, 2016, WEC is contractually required to take back this power to meet its load if other committed resources are insufficient. The amount of power WEC may take is specified by a formulaic process in the sleeve agreement. This agreement states:

- WEC must begin to take power back from VEC with a one-year notice period if its coverage ratio[34] falls below 97% over the preceding prior 12 month period;
- The amount of power WEC takes is defined by a formula which includes a coverage band tied to the amount of power needed to bring WEC's coverage ratio to 100%;
- Once WEC takes power back, it must retain that power until the end of the contract term in 2038;
- WEC can temporarily take back power in the event of an unplanned outage from an existing resource.

[34] Coverage ratio is defined as the ratio of the amount of generation from the existing resources in WEC's portfolio divided by WEC's RTLO load and is calculated on a rolling twelve-month basis.

Based on WEC's 2020 load outlook and projections of future resources, WEC will not reach the 97% coverage ratio in the next five years. In fact, based on increasing energy production at Coventry and declining load from net metered solar adoption, it is not anticipated that WEC will need the HQ contract during the 20-year IRP planning period. WEC monitors its needs annually and adjusts its outlook overtime. For illustrative purposes, below is a summary of WEC's five-year outlook.

Figure 3-1. HQUS PPA Ratio Analysis Outlook



Once WEC reaches the 97% coverage ratio, WEC will notify VEC that it will take back an amount of power within one year that will result in a WEC coverage ratio of 100%, capped at WEC's full allocation of 4.0 MW. WEC's coverage ratio will be calculated monthly and the process of taking back power from VEC will continue until WEC's full allocation of the HQUS PPA is returned.

3.2. WEC Existing Energy Resources versus Projected Energy Requirements

WEC has several power contracts and resources it uses to cover its load requirements. As displayed in Figure 3-2, WEC is well positioned into the planning horizon to hedge load against volatile power market prices, with a mix of stably priced contracts and owned generation resources.

Figure 3-2. Annual projected existing resource output compared to the expected value of WEC's real-time load obligation

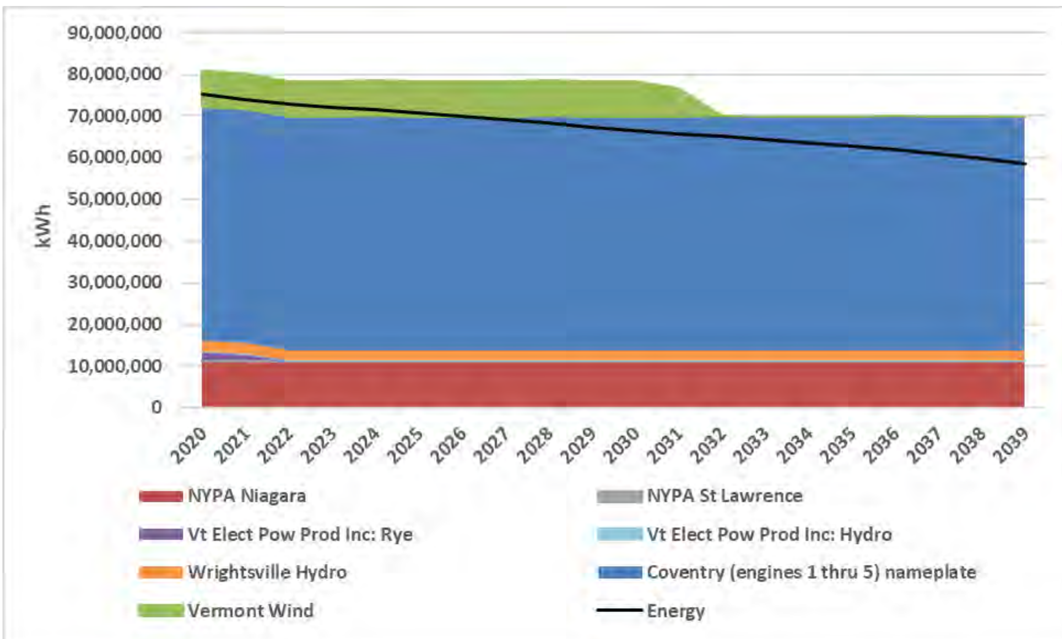
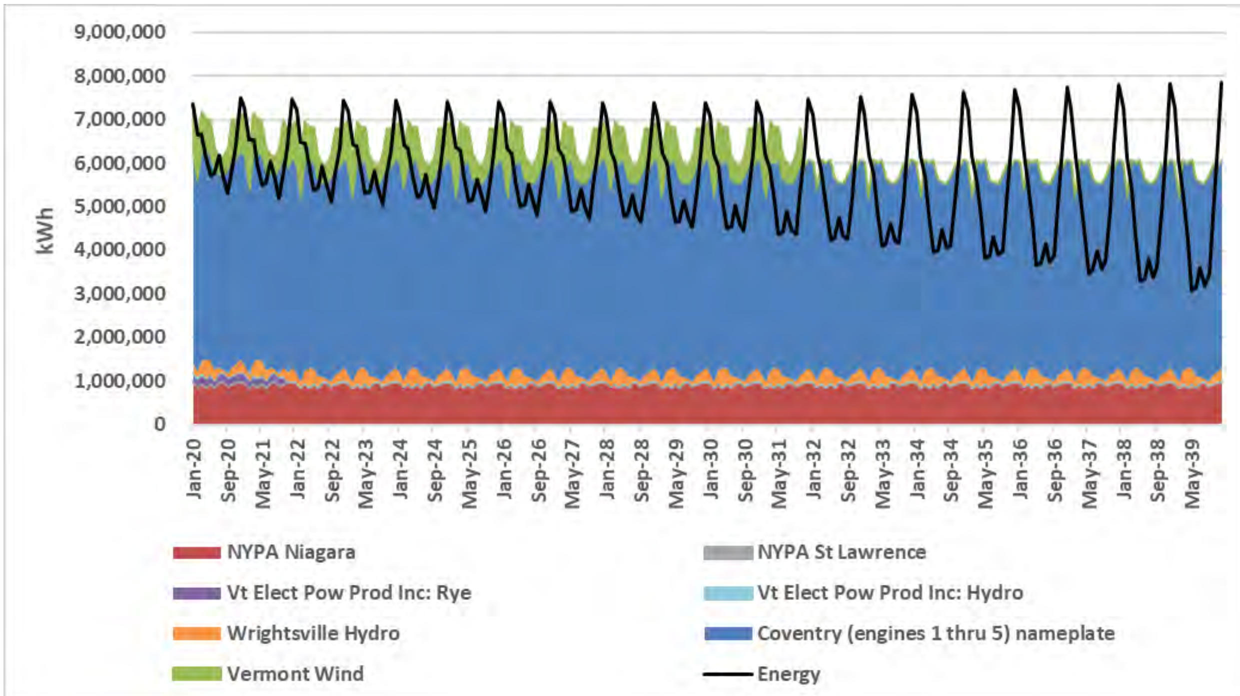


Figure 3-3. Monthly projected existing resource output compared to the expected value of WEC's real-time load obligation



As Figures 3-2 and 3-3 illustrate, in the near term WEC has excess power relative to its needs to serve its members' energy use. With the forecasted adoption of net metered solar installations, WEC projects to steadily increase its coverage ratio from 108% in 2020 to 118% in 2039 due to decreasing loads.

The impact to WEC is that for this IRP filing and for the past two IRP filings, it does not need to make major or long-term resource decisions. In a broader 20-year outlook, WEC's load and resource commitments also show that it is not facing major resource decisions for the foreseeable future. When WEC starts to see a shortfall, the HQ US PPA (which is also sourced from primarily renewable sources) will begin and cover the shortfall well past the planning period.

In effect, WEC's current IRP filing represents an assessment of WEC's current and long-term position and identifies when the HQ contract will be triggered, rather than a justification of any new power supply commitments.

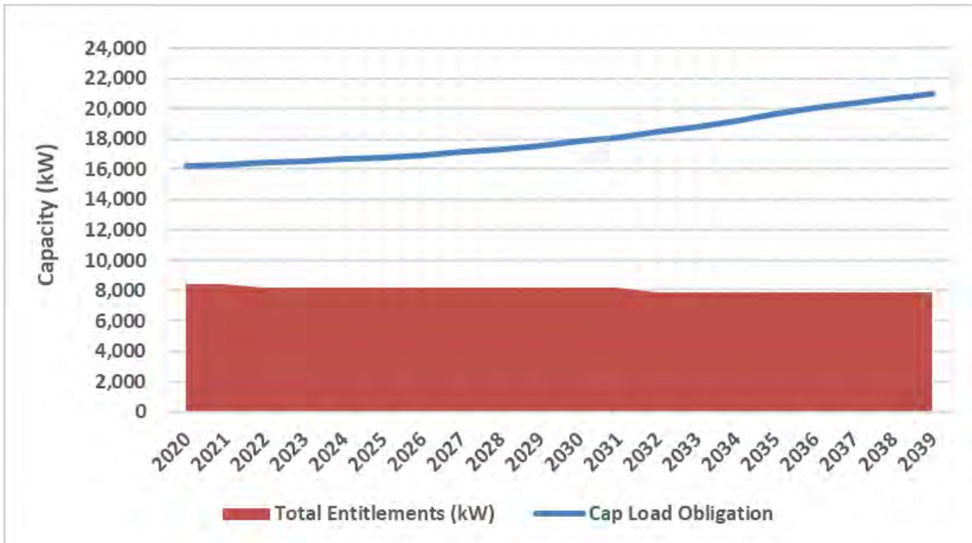
While many Vermont utilities have large shortfalls or gaps of power supply compared to load requirements and are considering replacement sources of power due to expiring contracts, WEC is well positioned long-term with stably priced and long-term renewable power commitments. As a result, WEC is using its IRP to analyzing impacts on its existing power supply mix of major operational, market, and regulatory factors affecting cost, cost variance, and emissions profiles.

3.3. WEC Existing Capacity Resources versus Projected Capacity Requirements

While WEC has energy resources sufficient to cover its load, WEC does show a shortfall or gap in its capacity obligation, as shown in Figure 3-4. After the HQ VJO contract expired, WEC lost 2.6 MW of capacity credits. As a result of this expired contract and lower FCM levels for WEC's other sources, WEC shows a shortfall of roughly eight MW. At this point in time, WEC will be roughly 50% covered, leaving a 50% open position between supply and capacity obligation. From there, the gap remains steady over the next few years and continues to grow throughout the planning period as WEC's capacity obligation grows due to the increase demand from heat pumps and electric vehicle adoption. Even though this IRP includes a significant level of forecasted adoption of net metered solar, the assumption is that since the ISO-NE peak occurs later in the evening, the net metered solar will not be able to provide any capacity contribution offsets during that peak period.

One of the reasons for the increasing gap is that the HQUS contract does not provide WEC with any additional capacity, as it is an energy only contract. However, in the short term this gap is manageable, as the cost of capacity from the market is known three years in advance, and the market price is low relative to the cost to build or contract for alternative capacity.

Figure 3-4. Projected existing resource capacity market credit compared to the expected value of WEC's capacity market obligation



WEC must balance its need to hedge capacity not only with costs, but the fact that it is already long on energy. Therefore, power resources that provide both capacity and energy are not as desirable to WEC as it tries to keep its positions balanced in both markets. Additionally, the price of capacity is known three years in advance in the ISO-NE markets. Therefore, WEC has sufficient time to react to any dramatic price increase and can hedge its open capacity position if it determines there is a more cost-effective option available.

Short Term Contracts

WEC actively seeks interest in a capacity contract to help fill its gap. Thus far it has not been able to secure an agreeable transaction. The Co-op has been in discussions with developers, owners of existing resources, and marketers. Many of these counterparties are looking for bundled deals (energy, RECs, capacity).

Demand Side Efforts

If WEC is able to successfully install control load at the time of the ISO peak, it may be able to lower WEC's capacity obligation and close the gap from the demand side.

WEC is also implementing a flexible load control project with EVT called Powershift to help with peak shaving. Powershift includes load control for electric hot water tanks, heat pump water heaters, and Type II EV chargers. WEC has a target of 200 hot water tanks for the Powershift program. Since Powershift is still in the early stages of development, WEC does not have any findings to report for this IRP, but WEC will be able to provide more detail on lessons learned and program achievements in the next IRP filing.

The combination of actions and hedges noted above is expected to fulfill WEC's long-term capacity need.

4. Legislative & Regulatory Directives

4.1. Changing Energy Landscape

It is not new news that the electricity industry all across the US is undergoing significant transition and, one could say, disruption. The advancement of distributed resources (particularly rooftop solar) combined with new opportunities and challenges associated with the availability of real-time data and the “Internet of Things” (e.g. Nest® thermostats, phone applications that allow building appliances to be controlled) alongside strategic electrification (e.g. shifting from fossil-fuels to provide heating and transportation through cold climate heat pumps and electric vehicles) is calling into question various aspects of the electric utility industry. Increasing penetrations of variable resources such as solar and wind; shifts from large, centralized generation facilities to many smaller, distributed technologies, and; increased engagement by electricity consumers are requiring the electric utility industry to reimagine its role, interactions, grid capabilities, payment structures and on.

WEC recognizes this significant shift in electric planning and regulation. This changing landscape requires WEC to think about the future and how it operates in a new electricity environment. WEC needs to prepare for a modernized and dynamic electric grid that includes increased distributed generation and more demand side management tools. As noted earlier, WEC’s supply side is set through the 20-year planning period. However, other industry-wide trends such as changes in load profiles and increasing strategic electrification are very relevant to WEC’s future planning, providing both challenges and opportunities for the coop.

WEC looks to explore tools and technologies to cost effectively meet electric demand while advancing state policy objectives, such as the Renewable Energy Standard, net metering laws, storage, and rate design. Energy sources still must be balanced, moment by moment, with energy consumed. That said, the trend from large, central power plants to more distributed and locally sourced supply resources is on the increase.

Also, more variable resources, such as utility scale wind and solar, continue to be deployed in Vermont and in the region. This has provided a new paradigm for ISO-NE to respond to grid reliability and generator dispatch protocols. Typically, generators are controlled to respond to demand. In today’s environment, loads are becoming less predictable with the increase in distributed generation and utility scale solar challenging the supply side dispatch paradigm.

Other drivers continue to put cost pressure on WEC, such as other New England state polices for increased renewable power. Winter reliability costs as well as rising capacity and transmission costs continue to put financial pressure on WEC, while loads are flat to declining. This is a recipe for upward pressure on rates.

As discussed in Sections Two and Three, WEC is not immune to these changes. Member adoption of net-metered solar has and will continue to have an impact on WECs load, costs and revenue. This section, "Legislative and Regulatory Directives", discusses:

- Overarching state energy policies, goals and plans (e.g. the Comprehensive Energy Plan and Vermont's decades-long use of energy efficiency as a resource)
- Key requirements that WEC must comply with, such as Net-Metering and the Renewable Energy Standard
- Recent WEC initiatives and areas of future investigation such as changes in rate design and research into battery storage
- AMI and other control technology
- Opportunities for increased engagement by ad with WEC members, such as Project PowerShift
- Highlights ongoing work areas for WEC in making these industry-wide transitions, with greater detail regarding opportunities to address these industry-wide shifts presented in Section 6, "Action Plan".

4.2. State of Vermont Energy Goals and Comprehensive Energy Plan

The Comprehensive Energy Plan (CEP) addresses Vermont's energy future for electricity, thermal energy, transportation, and land use. In the 2016 CEP, Vermont established the goal of sourcing 90% of all energy use in the state from renewable resources by 2050 as a way to meet the statutory goal, established in Act 168 of 2006, of achieving a 50% reduction in carbon levels from a 1990 baseline by 2028 and a 75% reduction by 2050. It is important to note that the reference to energy in the CEP is not limited only to electric utilities, but applies to all sectors including transportation, heating, and process uses of fossil fuels.

Meeting the CEP goal of 90% renewable resources will require major plans and bold changes for everyone in Vermont. The plan also recognizes that we must pursue the goals responsibly, ensuring overall energy costs for our residents and businesses remain regionally competitive. Due to the forward-thinking efforts of the WEC Board, coop members and staff (many years ago), WEC is well positioned to meet the CEP goal before the 2050 date as its underlying investments and contracts in power supply are comprised entirely of renewable resources.

Vermont's Comprehensive Energy Policy notes:

> Electric energy storage technologies are maturing quickly, as are technologies for automating and aggregating control of many different kinds of end uses (beyond the water heater controls that have been deployed for decades). Electric vehicles and heat pumps present new challenges and opportunities. Taken as a whole, these challenges present a new grid paradigm in which both demand and supply have both controllable and non-controllable (but forecastable) aspects.[35]
>
> An integrated grid is now possible because of the proliferation of information technology tools throughout the grid — at supply, on the grid itself, and at the end use. This provides the opportunity to optimize the grid in a way not possible before, with significant yet uncertain potential to contain overall and per unit costs. This paradigm informs Vermont's approach to both managing and meeting electric service demand, as this CEP describes.[36]
>
> Retail electric costs are more than the moment by moment or long-term costs of energy; they are also the costs of building and maintaining transmission and distribution infrastructure, generation capacity for peak times, and utility operations. Utility regulation by the Public Service Board establishes the structure and process for determining total utility revenues and how those revenues are collected from each customer. The design of rates for each customer class is intended to reflect the costs caused by those customers' use of the electric system. This minimizes subsidization of any customer class by other classes, and is considered economically efficient.[37]

[35] 2016 CEP p 181

[36] 2016 CEP p 181-182

[37] 2016 CEP p 182

Utilities and their regulators are guided by the policies established in Vermont law, which include at their core a goal of least cost electric service, including economic and environmental costs, consistent with the principles identified in Section 3 of this CEP. Per unit electric rates reflect all these costs and their allocation, divided among all of the customers, kilowatt hours of energy, and kilowatts of power delivered. Seeking the lowest electric rates and bills, therefore, includes:

- Reducing electric use and acquiring least cost energy and capacity, to avoid direct costs;
- Lowering peak energy use and distributing generation close to load, to reduce Vermont's share of regional transmission costs and avoid the need to build new electric infrastructure; and
- Using existing electric transmission and distribution infrastructure to the fullest, to share its cost over as many energy units as possible and thereby lower rates.[38]

At a high level, global trends in the enabling communication technology and distributed energy resources create opportunities for improvements in the costs, reliability, and environmental performance of the electric utility sector. To facilitate the change, complementary policy, regulation, and utility efforts will be needed sooner rather than later. Distributed energy resources and communications capabilities are still evolving, but the path is relatively clear. Distributed energy resources such as solar and wind, combined with distributed storage, flexible loads (such as electric vehicles and controllable devices), and a centrally managed platform, offer great potential for improving the grid's performance. The central question is: How do regulators, system operators, and electric distribution utilities need to evolve the system to remove barriers, enable the distributed grid to emerge, and motivate the DUs to function as a cooperating partner in facilitating these changes.[39]

WEC is keeping options open and looking to the future to guide it through a changing industry of decentralized generation and changing consumer behavior and loads. As a small utility it will continue to work collaboratively with others in Vermont and the region. Since the 2017 IRP, WEC has looked to others for "lessons learned" regarding battery storage and has

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[38] 2016 CEP p 182

[39] 2016 CEP p 195

just recently deployed a new rate structure that will be phased in over the next two years. WEC will continue to look to make use of others' best efforts and adopt working models to meet the membership's needs. It needs to do this with constant awareness of the cost to serve. WEC is the most rural utility in the state, and rates and bills matter to the membership. Decisions to spend money on future efforts must also be made in a manner that is mindful of financial pressures along with the need to respond to a changing utility landscape.

4.3. Fiber and Broadband Feasibility

Washington Electric Cooperative (WEC) on March 6, 2020 submitted a proposal to Vermont's Public Service Department (PSD or Department) for a Broadband Innovation Grant. On April 7, 2020 WEC was notified it was successful and it will receive funding from the PSD. Grant dollars will be used to assess the feasibility of the Cooperative to assist the expansion of high-speed broadband to its members to provide internet and related services. WEC retained NRTC to perform a broadband feasibility study and business plan.

WEC is evaluating the feasibility of jointly (1) enabling all its members to have access to high-speed broadband internet service, and with the same physical infrastructure, (2) expanding a 2-way high speed internal electronic communication network along its distribution lines to improve its operation and prepare for modern smart grid management. This RFP is funded by a grant from the Vermont Department of Public Service Broadband Innovation Grant.

The proposed study will examine the financial feasibility of installing broadband infrastructure throughout WEC's entire service area, or parts thereof. The study will address whether or not a realistic plan exists for WEC to achieve this vision in the physical and economic landscape it inhabits and range of potential approaches are worth considering. The feasibility study will provide evaluations of construction costs, operating needs, generation of revenue, and the potential for mutually beneficial partnerships along with suggested organizational structures for these partnerships. Pursuit of a detailed business plan will follow after the completion of a successful feasibility study. NRTC is performing an assessment including the following items:

• Detail a plan for a feasibility study to assess the potential for jointly providing high-speed internet to all WEC customers, taking account of differences in its customers' needs depending on their location, and a communication and control network for modernizing

WEC's distribution grid.

• Based on the conditions required of grant and loan funding, evaluate alternate scenarios in which broadband expansion is initially targeted to subsets (pilots) of WEC's territory.

• Identify possible business models to be explored, focusing on partnerships with local CUDs, Internet Service Providers (ISPs), and other utilities.

• Determine to what extent multi-purpose usage of a new broadband network could improve financial viability.

• Identify existing regulatory and legislative barriers that could restrict WEC from setting up a broadband network for both utility and telecommunication applications.

4.4. Energy Efficiency and DSM

In 1999, the PUC (then the Public Service Board) approved a settlement amongst all Vermont electric utilities, the DPS and other interested parties that provided for the creation of a statewide energy efficiency utility that would deliver energy efficiency services to Vermonters throughout the state.[40] Perhaps not unsurprisingly, and as shown in Figure 1-2, WEC members have shown a trend of decreased electricity use since 2010. The state's CEP also discusses impacts of energy efficiency, including a focus on demand side elements. Specifically, the CEP notes the following key elements that WEC takes into account as WEC designs and implements a variety of approaches to electricity planning (e.g. net metering, the RES Tier III, rate design):

> Significant efforts to reduce electric demand should not be translated into a policy in which all increases in electric energy and demand/consumption are avoided. Electric energy must be used efficiently and strategically. As other Sections of the CEP point out, increases in electric energy consumption in certain sectors and for certain end uses are probably in the best interests of the state. For instance, Section 8 calls for policies that will facilitate increases in plug-in electric vehicles, and Section 7 discusses a hypothetical fuel mix for meeting the 90% renewable goal by 2050 whereby some existing fossil fuel heating is switched to electric heating, which would require an increased penetration of cold climate heat pump technology.
>
> Electric energy DSM is not at odds with such policies and concepts; it is another tool to

[40] https://puc.vermont.gov/energy-efficiency-utility-program/history-and-structure

> facilitate their implementation. The goal is to use the cleanest, most efficient, most cost-effective energy for any particular end use. As this Section describes in detail, electric efficiency programs have potential to save Vermonters money on their electric bills while providing the state with significant economic and societal benefits.[41]

The CEP outlines various recommendations and strategies relative to demand issues that WEC sees as germane to its future:

> The PSD should collaborate with energy efficiency utilities and other stakeholders to better document and communicate the benefits of electric efficiency investment to the Vermont Legislature, ratepayers, and other stakeholders.[42]

> Peak reduction has the additional benefit of reducing the need for transmission and distribution infrastructure — if it occurs in areas where the system is constrained by load growth.[43]

> Support continued innovation and design of the most effective programs to assist ratepayers in achieving efficiency savings.[44]

> The PSD should encourage and facilitate innovative program designs and strategies to increase electric efficiency resource acquisition.[45]

As will be discussed in Section 4.5, WEC designs its Tier III Annual Plan, within the Renewable Energy Standard of Act 56, to focus on energy efficiency first through the Button Up WEC program. WEC then offers a coordinated set of incentives for home heat, water heat and other technologies to help members use less energy overall and shift to strategic electrification.[46]

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[41] 2016 CEP p 201- 203

[42] 2016 CEP p 209

[43] 2016 CEP p 211 - 220

[44] 2016 CEP p 213

[45] 2016 CEP p 218

[46] During the writing of this IRP, two additional statewide discussions were underway: (1) a PUC led investigation into the question of how to deliver energy efficiency for "all fuels" (e.g. beyond electricity), and (2) Senate Bill 337, which proposed to allow, for a period of three years, energy efficiency utilities to use a portion of their budgets on programs to reduce greenhouse gas emissions in the thermal and transportation sectors. Both of these initiatives may assist WEC in further

With regards to DSM, or “load control”, WEC rolled out an original “load control” effort before 2000; electric hot water tanks could then be leased with an electro-mechanical timer control, with hundreds of “controlled” electric hot water tanks among the membership. This service required staff to work in members’ premises and maintain the “fleet” of controls to ensure the load would be “off” during the Co-op’s peak hours. By 1998, the cost of maintaining the leased tanks and controls exceeded the value the Co-op was receiving, and the program was terminated as a cost savings measure.

Fast forward to 2018, when WEC and Efficiency Vermont collaborated on a targeted electric efficiency initiative: the Powershift program, designed to control two types of electric hot water tanks and Type II EV chargers. The program objectives are to avoid WEC peak hours - both monthly and annual. Powershift is a “flexible load control” (FLC) project between EVT and WEC; EVT committed to a two-year project and provides project management and customer support to WEC for this initiative. The program is grant funded through the Vermont Low Income Trust for Electricity (VLITE), which supports two software vendors whose dashboard/platform WEC and EVT are used to manage Powershift.

The original program objective was to deploy two groups of 100 each of conventional electric hot water tanks, as well as heat pump water heaters (HPWH). The conventional electric hot water tanks require an after-market Wi-Fi digital thermostat (requiring a licensed electrician and presenting different installation challenges per site) while the HPWH qualifies for Wi-Fi enabled controls. WEC manages both types of controls through (1) a dashboard provided by the original equipment manufacturer (OEM), and (2) a service provider who works with multiple devices enabled by the providers’ dashboard.

Different yet similar, since August 2020, WEC now offers membership a third DSM opportunity associated with the installation of a Type II EV charger. WEC is providing this device without cost (through a VLITE funded grant) to the participating member, who pays a licensed electrician to install the system. WEC and EVT manage the EV chargers with the OEM dashboard.

As of the June 2020 quarterly report, Efficiency Vermont and WEC were working with

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deployment of Tier III requirements, which would generally assist WEC members in transitioning from fossil fuels to electricity in the thermal and transportation sectors. WEC will continue to monitor these initiatives as they progress.

63 WEC members and had called 42 events in the first six months of 2020. Due to COVID-19, the uptake has been less than envisioned, but even with lower participants there appear to be, at first blush, some encouraging lessons learned regarding peak savings. However, given the limited enrollment numbers and interrupted, short time frame for these initiatives thus far, WEC does not have detailed, substantive findings to report at this time.[47]

As of 2021, the future of Powershift is uncertain due to budgetary opportunities. Ultimately, for WEC to achieve the goals and policy initiatives described in this Section 4, WEC needs to learn from the Powershift program and other, future initiatives to continue bringing FLC to the WEC membership. Powershift is not only a member service, expanding the "toolbox" of load management and thermal storage, it is also an opportunity to learn what works, and what does not, within the WEC infrastructure, to meet members' needs, to transition to the utility of the future, and, critically, to reduce peak demand costs.

As will be shown below, WEC continues to explore new opportunities to serve members as affordably, reliably, safely and sustainably as possible. Besides Powershift, described above, and efficiency services (described in Section 4.5), WEC has recently initiated a new rate design (Section 4.6). Section 4.7 will touch upon WEC's recent exploration into battery storage opportunities, while 4.8 addresses AMI and other control technologies. Finally, Section 4.9 addresses WEC's ongoing effort to engage and coordinate with members, as one of the central tenets of the changing electric utility industry is a more active and involved customer.

4.5. Net Metering

Vermont's net metering program was first initiated in 1998. Since then, multiple modifications have been made, culminating with Act 99 of 2014. Act 99 required the Public Service Board (now the Public Utility Commission) to establish a revised net-metering program pursuant to the criteria and standards set forth in 30 V.S.A § 8010. Specifically, the Board was directed to develop a net-metering program that:

> (A) advances the goals and total renewables targets of this Section and the goals of 10 V.S.A. § 578 (greenhouse gas reduction) and is consistent with

[47] The 2019 EVT Interim Report for PowerShift is available at https://www.efficiencyvermont.com/news-blog/whitepapers/interim-report-for-powershift

the criteria of subsection 248(b) of this title;

(B) achieves a level of deployment that is consistent with the recommendations of the Electrical Energy and Comprehensive Energy Plans under sections 202 and 202b of this title, unless the Board determines that this level is inconsistent with the goals and targets identified in subdivision (1)(A) of this subsection. Under this subdivision (B), the Board shall consider the Plans most recently issued at the time the Board adopts or amends the rules;

(C) to the extent feasible, ensures that net metering does not shift costs included in each retail electricity provider's revenue requirement between net metering customers and other customers;

(D) accounts for all costs and benefits of net metering, including the potential for net metering to contribute toward relieving supply constraints in the transmission and distribution systems and to reduce consumption of fossil fuels for heating and transportation;

(E) ensures that all customers who want to participate in net metering have the opportunity to do so;

(F) balances, over time, the pace of deployment and cost of the program with the program's impact on rates;

(G) accounts for changes over time in the cost of technology; and

(H) allows a customer to retain ownership of the environmental attributes of energy generated by the customer's net metering system and of any associated tradeable renewable energy credits or to transfer those attributes and credits to the interconnecting retail provider, and:

(i) if the customer retains the attributes, reduces the value of the credit provided under this section for electricity generated by the customer's net metering system by an appropriate amount; and

(ii) if the customer transfers the attributes to the interconnecting provider, requires the provider to retain them for application toward compliance with sections 8004 and 8005 of this title. [48]

As discussed in WEC's 2017 IRP, WEC filed a revised Net Metering tariff in October 2016 to comply with the new net metering rules per Act 99. It amended this initial filing in January 2017 based on feedback from the PUC to WEC's October filing. In its tariff WEC

[48] PSB Order Implementing the Renewable Energy Standard, issued June 28, 2016 Docket 8550

converted its Grid Service Fee plan participants (those members with distributed generators installed after July 2014) to its Legacy plan structure to comply with the PSB ruling. After 10 years of operation, all pre-existing systems (those installed prior to January 1, 2017) will be paid the statewide blended rate for excess generation per the revised PSB rules. Prior to this 10-year anniversary they will be paid at WEC's highest energy block in its retail rate design. Please see the Appendix for a copy of WEC's net metering tariff.

The 2017 IRP highlighted that, under the pre-existing net metering programs (systems installed before January 2017), 255 members totaling 1.661 MW were net-metering. As provided in 2017, this equated to approximately 10% of WEC's 2016 retail peak load level and roughly 2.6% of WEC's 2017 annual retail sales.

As written in July of 2017, "the pace of new installations (after January 1, 2017) has been tremendous" – and it continues to be. Figure 4-1 below shows the historical pace of net-metering through 2019; 2.89 MWs of net-metered solar have been installed between January 1, 2017 – December 31, 2019, with more than 1 MW of solar installed in 2018 alone.

Figure 4-1. Cumulative Net-Metering Installations 2010-2019

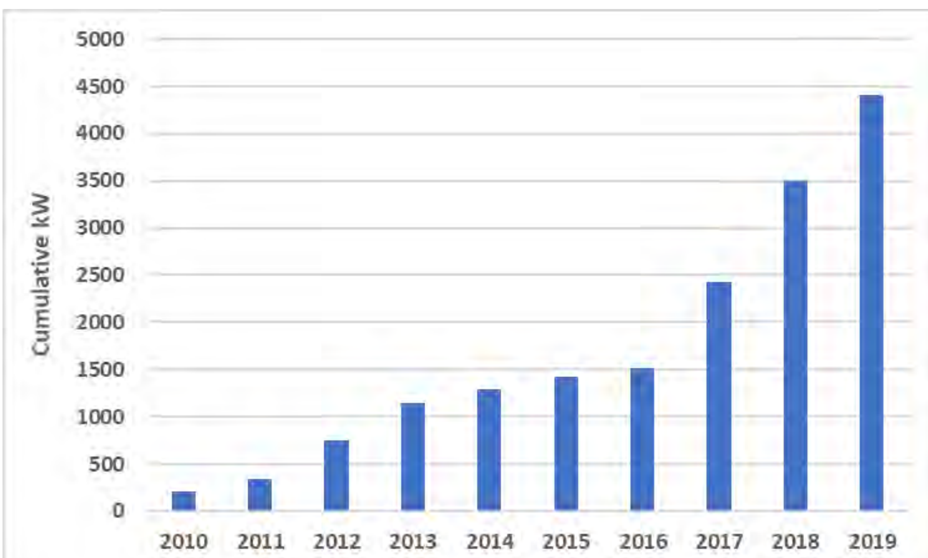
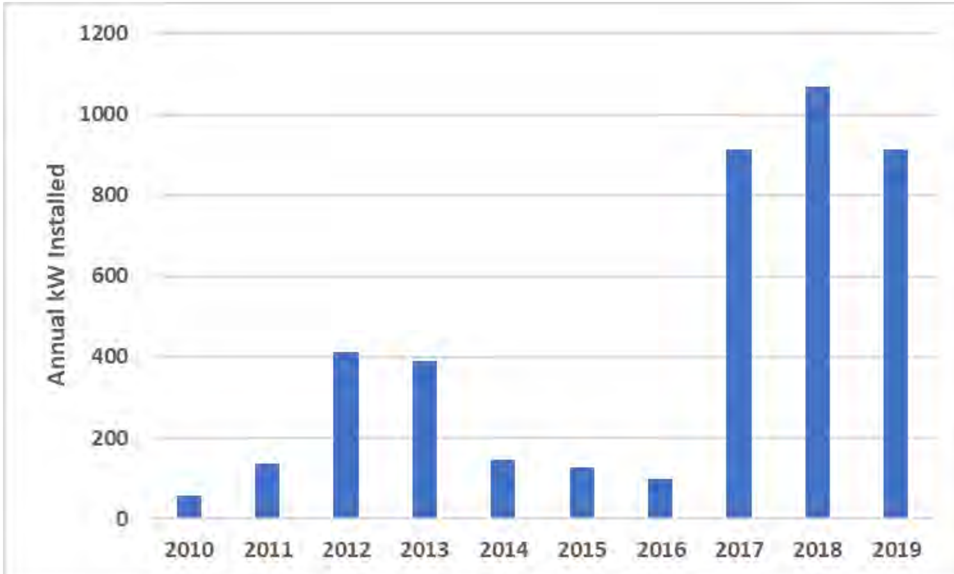


Figure 4-2. Annual Net-Metering Installations 2010-2019



As described in Section 2.6, net-metering presents multiple challenges for the Coop. A WEC filing in Case No. 19-0855-RULE dated November 1, 2019 (provided in the Appendix) stated that "there is a cost shifting between customers from those that net meter to those that do not. The costs are summarized into two areas; power supply related costs and administrative costs…WEC calculated the current year net metering cost has grown to a net loss of $711,563 which is a 5.08% rate impact. These dollars do NOT include added cost for billing, staff, and administering the program…One important finding in this analysis is that the revenue paid to net metering members is greater under the Vintage 2017 program than the Legacy program. The primary reason for this is due to payments for the siting and REC adjuster on gross generation rather than net excess generation…WEC estimates annually based on actual data from 2014 through 2018 that it costs $86,945 per year to administer and run the net metering program. Tallying up the total cost (power supply and administrative expenses), WEC's non-net metering members pay $798,508 (summation of $711,563 + $86,945) per year for the net metering program. This is roughly a 5.70% rate impact to non-net meter members."[49]

[49] Power supply costs include payments to net metered systems for net excess generation and the impact of loss of retail sales revenue from loss of load, while savings result from avoided power supply related expenses. Total costs ranged $0.14428 per kWh for the Legacy program (installed prior to 1/1/2017) and $0.1542 per kWh for the Net Metering Vintage 2017 program (installations 1/1/2017 to the present). Total savings from avoided power supply related expenses are $0.074 per kWh.

WEC recognizes the value within the $0.074 per kWh that net-metered solar provides in savings resulting from avoided power supply related expenses.[50] WEC also recognizes the many intrinsic characteristics of net-metering, including the right to self-generate and the many local jobs created by the solar industry. However, the long-term implications of the current net metering program (e.g. related to finances, equitability, and in some cases increasing costs associated with the need to upgrade the grid) combined with the forecasted reduction in load prior to inclusion of net-metering (discussed in Section 2.6), show clearly that WEC's current trajectory is at worst not sustainable and at best, increasingly expensive and unequal. WEC struggles with this challenge. On the one hand, the WEC Board, staff and countless coop members have actively practiced many of the tenets that are the foundation of "clean energy" policy. In coordination with Efficiency Vermont, WEC has repeatedly espoused the value of energy efficiency and WEC purposely made the transition to 100% renewable in 2011. On the other hand, the costs associated with net-metering and described above, cannot be ignored.

The PUC now conducts a biennial review of Vermont's net metering program that includes assessment of the pace of net-metering and the design of the various credits provided (or not) to net-metered systems. The PUC opened the current investigation in January of 2020, but this was stayed due to COVID-19 until August 2020. Certainly, WEC will remain actively engaged in this discussion. Other WEC efforts integrally related to the changes associated with a more distributed grid, such as rate design, customer-facing demand management programs and exploring storage opportunities are discussed in more detail below.

4.6. Act 56 Renewable Energy Standard

Act 56 created a Renewable Energy Standard (RES) for Vermont electric utilities that requires renewable energy totaling 55% of retail electric sales in 2017, with that requirement growing 4% every three years to 75% in 2032 (Tier I). Of these renewable resources, some (1% of retail sales in 2017 growing to 10% in 2032) are required to be new, small, distributed generators connected to Vermont's distribution grid (Tier II). The act also requires utilities to assist their customers in reducing fossil fuel consumption (Tier III).

The requirements of Act 56 presented in a June 2016 Order are as follows:

[50] It should be noted that, as more solar is added to WEC's system, this value will continue to decrease, as solar production aligns less and less with the regional peak, thereby bringing less financial savings to WEC's avoided costs.

The Vermont Public Service Board ("Board") directs the implementation of the Renewable Energy Standard program ("RES"), which requires Vermont retail electric providers ("DUs") to acquire specified amounts of renewable energy, in the form of renewable attributes or Renewable Energy Credits ("RECs"), and to achieve fossil-fuel savings from energy transformation projects. Section 8 of Public Act No. 56 of 2015 ("Act 56") directs the Board to implement the RES by means of an "an order, to take effect on January 1, 2017," followed by a rulemaking.

The RES establishes aggressive targets requiring utilities to procure renewable energy for the majority of their generation portfolios. In addition, the RES contains a first-in-the-nation program whereby a DU can meet their portfolio requirements by investing in projects that will reduce fossil-fuel consumption by their customers. These projects could include items like home weatherization projects to reduce fuel oil purchases by customers, the replacement of fossil-fuel-based heating systems with electric or biomass energy, or investments in clean forms of transportation like electric vehicles. In combination, these requirements will work to further reduce Vermonters' reliance on fossil fuels across a range of sectors.

The structure of the RES is divided into three categories or tiers. The first tier ("Tier I") requires DUs to procure an amount of renewable energy equivalent to 55% of their annual retail electric sales for the year 2017. This amount increases by 4% every third January 1 thereafter, eventually reaching 75% in 2032.

The second tier ("Tier II") requires DUs to procure an amount of renewable energy equivalent to 1% of their annual retail sales from distributed generation resources starting in 2017. This amount increases by three-fifths of a percent each year, eventually reaching 10% in 2032. Pursuant to Section 8005(a)(1)(C), Tier II resources are also counted as part of a DU's Tier I requirement.

The third tier of the RES ("Tier III") requires that DUs either procure additional renewable distributed generation eligible for Tier II or acquire fossil-fuel savings from energy transformation projects. Energy transformation projects are those that reduce fossil fuel consumed by DU customers and the emission of

> greenhouse gases attributable to that consumption. For Tier III, the RES establishes a required amount of 2% of a utilities annual retail sales in 2017, increasing by two-thirds of a percent each year and reaching 12% in 2032.
>
> Act 56 created certain rules for the RES but left some issues to be resolved by the Board. Based on the requirements of Section 8 of Act 56, the Board has conducted and Board staff held a series of working group meetings and two workshops with a variety of stakeholders directed at identifying and resolving issues associated with the implementation of the RES. In addition, on March 15, 2016, the Board issued an interim order ruling on several aspects of the RES program. In this current Order, the Board establishes, where necessary, further parameters of the RES, ruling on those issues identified through the process described above, and directs DU's to comply with the RES in the manner described in this Order.[51]

WEC maintains a portfolio that is 100% renewable and therefore it has met the RES 55% renewable goals for 2017 (Tier I). More significantly, WEC has already exceeded the state goal of 75% renewable by 2032 with its existing (2019) mix of energy sources. Since WEC has already exceeded the state's ultimate goal well over 15 years in advance, it does not need to change or plan for new sources of power to meet the state's RES Tier I requirement.

In March 2016, WEC petitioned the PSB in Docket 8550 for a determination that it qualifies as a retail electricity provider meeting the conditions in 30 VSA 8005 (b)(1)(A), which allows it to satisfy the distributed generation requirement of Tier II by accepting net metering systems within its service territory. The PSB approved this petition and WEC was granted the determination that it qualified as a 100% renewable retail electric provider (Docket 8714). The Board's order is included in the Appendix.

As noted above, Tier II requires electric providers to have distributive renewable generation comprising at least one percent of its annual retail sales for the year beginning January 1, 2017. WEC's renewable determination by the Board enables WEC to satisfy Tier II requirements by accepting net metering systems within its service territory. Therefore, WEC is not exempt from offering net metering as a renewable energy provider. Rather, it must offer net

[51] PSB Order Implementing the Renewable Energy Standard, issued June 28, 2016 Docket 8550

metering, but its members are not required to achieve the annual energy targets set forth in Tier II; WEC is relieved of the requirement to provide that 1% of its annual sales are provided by new net metering due to its 100% renewable status. As of the end of 2019, WEC had 4.41 MW of distributed generation installed in its service territory. This equates to an amount of energy produced from all net metered systems (cumulative) of roughly 7.35% of WEC's 2019 annual retail sales. As described above in Section 2.6, utilizing a RIT solar deployment model results in a forecast of an additional 919 kW in 2020, with roughly 1.55% of its 2020 forecasted retail sales served by new net metering systems. This is well beyond the 1% required in the Tier II requirement.

Tier III has been referred to as the energy transformation Tier. This Tier's focus is on efforts that switch members away from fossil fuels in transportation and heating use to non-fossil-fuel energy sources. Since the implementation of the RES, all utilities have been required to create and file an annual plan to meet their Tier III obligations. A copy of WEC's 2020 plan is provided in the Appendix.

Overall, WEC's 2020 Annual Plan describes:

1) Estimated Tier III compliance obligation for 2020;
2) Overall strategy to be implemented to meet the Tier III compliance obligation in 2020; and
3) Types of energy transformation projects that will be undertaken and anticipated number of participants.

WEC will offer a suite of energy transformation measures that have been vetted through the Technical Advisory Group (TAG) screening process. A fundamental component of WEC's plan is to emphasize and match TAG screened measures with heightened weatherization efforts.

Implementation of the projects described in WEC's Annual Plan will be closely coordinated with Vermont Energy Investment Corporation (VEIC) as the administrator of Efficiency Vermont, the statewide energy efficiency utility (EEU). In addition, coordination of data collection, management, reporting, and evaluation and verification activities will be maximized to the extent possible with protocols and schedules already in place for WEC and Efficiency Vermont. In cases where entities other than VEIC and its subcontractors deliver WEC Tier III programs and services independently, WEC will ensure coordination of data collection and reporting to provide a single deliverable to regulators.

The parties have reached an understanding on the implementation of energy transformation projects for WEC members. Efforts will include the coordinated use of member and supply-side incentives, standards for measuring performance, and methods to allocate savings and reductions in fossil fuel consumption and greenhouse gas emissions among VEIC and WEC, with a strong emphasis on weatherization.

The eligible measures for WEC members are detailed below in Table 4-1. The foundation of WEC's Tier III program is found in statute V.S.A. Title10 § 581. Vermont has an aggressive policy goal of weatherizing 80,000 existing residences by 2020; WEC's Tier III program is, in part, intended to assist members to reduce the fossil fuels used today, as well as increase comfort and indoor air quality through comprehensive thermal energy improvements.

Vermont's RES establishes a required amount for Tier III compliance of 4% of a utilities' annual retail sales in 2020, increasing by two-thirds of a percent each year and reaching 12% in 2032. The calculation for this compliance amount for WEC for 2020 is shown in Table 4-1.

Table 4-1. Tier III Resource Targets and Measures

Implementation Model	
Program Year	**2020**
Distribution Utility (100% renewable)	**WEC**
MWh Target	2,754
Maximum Investment (ACP)	$ 176,980
ACP Average (sum of units installed x ACP per unit)	$ 41.69
Modeled Savings Totals	**9,332**
Over/(Under) Target	**6,577**
Non-Incentive Totals	**12,525**
Incentive Totals	**$ 125,250**
Alternative Compliance Payment ($/MWh)	**$ 13.42**

	summary table per PSD template 18-3810 April 2019		12,525	-		2,075,184	544	8,830	
A	measure savings exclusive to WEC								
B	measure savings are shared with Efficiency Vermont	incentive	administrative cost (1)	cost per measure (2)	# of measures	total cost (3)	per measure	savings (MHw)	$/MHw (4)
	Measure								
B	**Multi Zone Cold-Climate Heat Pump (CCHP) with Controls* and High Performing Home**	$ 250	$ 716	$ 3,754	30	$ 112,624	58	1,753	$ 64
B	**Single Zone Cold-Climate Heat Pump (CCHP) with Controls* and High Performing Home**	$ 250	$ 716	$ 2,894	30	$ 86,834	28	825	$ 105
B	**Heat Pump Water Heater (HPWH)**	$ 250	$ 1,789	$ 1,703	75	$ 127,725	19	1,412	$ 90
	Pellet & Wood Heating								
B	**pellet stove**	$ 250	$ 477	$ 4,700	20	$ 94,000		-	
B	**pellet furnace**	$ 1,000	$ -	$ 20,000	1	$ 20,000	125	125	
B	**pellet boiler**	$ 1,000	$ 477	$ 20,000	5	$ 100,000	125	627	$ 159
B	**wood stove**	$ 250	$ -	$ 4,700	20	$ 94,000		-	
A	**All Electric Vehicle**	$ 1,200	$ 2,290	$ 35,000	20	$ 700,000	38	755	$ 927
A	**Plug-in Hybrid Electric Vehicle**	$ 950	$ 907	$ 30,000	10	$ 300,000	28	282	$ 1,065
A	**Electric Bike**	$ 200	$ 286	$ 2,000	15	$ 30,000		-	
A	**Residential Lawnmowers**	$ 250	$ 477	$ 500	20	$ 10,000		-	
B	**Weatherization (shared savings with EVT & Home Performance with Energy Star**	$ 600	$ 1,431	$ 8,000	25	$ 200,000	61	1,525	$ 131
A	**Weatherization Assistance Program (CAPSTONE)**	$ 1,000	$ 2,386	$ 8,000	25	$ 200,000	61	1,525	$ 131
	footnotes								
1	WEC administrative costs to support TIER III follow the template and methods approved with all DUs and PSD per template October 2019								
2	measure cost per TAG/TRM 2019								
2	measure cost by WEC or others								
3	total cost (per PSD RES 18-3810) = (cost per measure x Number of measures)								
4	$/MHw (4) = (total cost/total savings (MHw))								

As noted in the top portion of Table 4-1, WEC's compliance target is 2,754 MWH. Adding a ten percent buffer to this estimate for planning purposes gives WEC 2020 target of 3,067 MWH. This target is based on WEC's most recent 12 months of sales of 68,861,297 kwh's.

Using the Alternative Compliance Payment rate of $63.48, WEC's maximum budget for incentives, program delivery and administration is $176,980. Based on WEC's anticipated offering of measures combined with Weatherization WEC plans to spend up to $131,250 of incentive dollars in its fourth-year effort.

WEC works with many partners to ensure Tier III compliance including Efficiency Vermont and Capstone of Barre. WEC plans to assist in the marketing of, and implement, a variety of programs including: "Button Up WEC", weatherization in coordination with Home Performance with ENERGY STAR® contractors (and for income eligible WEC member , services will be provided through the Weatherization Assistance Program (WAP)), installation of cold-climate heat pumps and heat-pump water heaters, and incentives for electric vehicles and pellet stoves/furnaces.

By building on existing programs, efficiencies and the benefits of shared information, the services to be provided by WEC are expected to increase the number of members who participate in weatherization. WEC's plan and estimates of the number of participants, incentives, and MWh savings are provided in Table 2 (above).While all WEC members are eligible to participate, based on the budget constraint of the Alternate Compliance Payment (ACP), in actuality services are provided on a "first come, first served" basis up to the numbers noted in Table 2.

What this means is once WEC hits the target rates of participation it will no longer offer its extra incentives toward the measures. The EEU program incentive dollars will continue but any incremental WEC incentives will cease if the participation targets are achieved. While the pace of WEC's program incentives are budget constrained, based on the rates of participation in both 2017, 2018, and 2019, WEC does not anticipate turning members away in 2020 and do not expect disruption in offering incentive dollars.

Greater detail regarding proposed measures, program design and WEC's "shared savings" methodology are provided in the Appendix.

4.7. Rate Design

On May 1, 2019, WEC submitted pre-filed testimony to the PUC petitioning for approval of a proposed change in rate design. WEC proposed "(1) to increase the residential customer charge from $14.19 to $25.00 per month; (2) to reduce the low block of its inclining-block rate structure for Residential members from 200 kWh to 100 kWh; and (3) to reduce the kWh rates for the low block form $0.1135 to $0.0800 and for the tail block from $0.25341 to $0.19961."[52] As stated in the pre-filed testimony, the goals and objectives of WEC's proposed rate structure include increasing members' efforts to be energy efficient and practice conservation and seeking to deploy a rate structure that assists in WEC's compliance with various state initiatives, in particular the RES and the Vermont CEP. As WEC states:

> Act 56, (Renewable Energy Standard) passed by the Legislature in 2015, requires utilities to assist their customers (in WEC's case its members) in switching away from carbon-producing fossil fuels in transportation and in thermal (heating) usage. The intent is to help the state reach its goal of obtaining 90 percent renewable energy of all its energy uses by 2050. By switching fossil fuel to renewable electricity, the state's carbon footprint will decline, and the harmful effects of climate change will be mitigated. The concept is referred to as beneficial electricity.

[52] Case No. 19-1270-TF. Washington Electric Cooperative, Inc's tariff filing for rate design changes and a change in rate schedules to be effective on services rendered beginning June 17, 2019. Public Utility Commission. Montpelier, Vermont. December 19, 2019. P. 1.

It should be noted that WEC's power portfolio is 100 percent renewable. Therefore, the more WEC moves members' fossil fuel energy use to electric based renewable resources, the closer it is to achieving Act 56 requirements and the goals of the state Comprehensive Energy Plan to achieve 90% renewable by 2050. WEC created a plan through its Button Up program to encourage and incentivize fuel switching. First and foremost, Button-Up emphasizes the importance of a tight and weatherized home through energy audits and follow-up weatherization efforts. No matter what source of energy people are using to heat the home, they'll use less of it with a tight house. Button-Up also helps people buy and install cold-climate heat pumps, which operate on electricity and reduce the demand for other fossil fuels such as gas or oil burning heating equipment. Additionally, the program supports switching to solar-powered hot water heaters, heat pump water heaters, electric vehicles and woodchip heating systems. WEC also installed five publicly available electric vehicle charging stations to encourage the movement away from gasoline-powered cars and trucks.

WEC programs, including Button-Up, address the goals of Act 56 effectively because our power is 100% renewable. By replacing gasoline to power a car with electricity from WEC, the member completely offsets the gasoline with renewable power. In order to achieve beneficial electrification and send appropriate price signals, the tail block is being realigned to meet new goals. Therefore, WEC seeks to lower the tail block rate in order to make an impact on fossil fuel reduction. Making this an even-more critical consideration is that Act 56 levies financial penalties on utilities that fail to meet their requirements as required in Tier III of the RES. As the requirements of Tier III increase each year, WEC will need to place additional emphasis on meeting the state's goals as set out in the RES.[53]

The goals of WEC's rate design prior to the May 1, 2019, filing was as follows:

> WEC has, for many years, had a two-tier energy rate structure, combined with a very modest monthly fixed charge (currently $14.19 per month). Members have been charged a low energy rate for their first 200 kWh (kilowatt-hours) per month (currently $0.11350 per kWh), and a higher rate (currently $0.25341 per kWh) for power above 200 kWh. The existing goals stemmed from two core principles:
>
> 1. WEC should provide members with enough affordable power to meet their basic needs, and
> 2. Higher cost for electricity in excess of 200 kWh would encourage energy efficiency.
>
> That policy has worked. Over the past decade WEC has experienced annual reductions in the average energy consumption among Washington Electric's members. In fact, 42% of WEC members use less than 500 kWh per month and the average use of 473 kWh per month is well below the statewide average.[54]

A PUC Order regarding WEC's petition, entered on 12/19/2019, found that:

> …the changes proposed by WEC in this case will result in just and reasonable rates, if the residential customer charge increase is phased in over two years, and approves the rate design changes for implementation in three steps…for the change to the customer charge for the Residential class in order to alleviate the initial financial impacts on affected low-income members. WEC is authorized to

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[53] Pre-filed Testimony of Patricia H. Richards Re: WEC Rate Design Change. PUC Case No.____. May 1, 2019. CORRECTED August 16, 2019. P. 15-17.

[54] Ibid. P. 7 – 8.

increase the Residential customer charge to $17 for the first phase, to $21 one year after, and to $25 one year after that and to adjust the energy charge for the tail block to accommodate the phase-in period.[55]

The PUC decision included additional requirements. First, it requires WEC to collaborate with the Department on the development of a program to support low-income members and to report back to the PUC on this effort.[56] Second, WEC is required to file a report by December 19, 2022 on its plans for its next rate design filing as well as on the results of the implementation of the current proposed rate design in achieving the policy goals identified by WEC. And third, that if WEC does not file a time-of-use or electric-vehicle rate structure by December 19, 2020, at that time WEC must file a report with the PUC on its efforts to develop such rates.

Phase 1 of the above approved rate design went into effective during the month of July 2020, with Phase 2 scheduled for July 2021 and Phase 3 scheduled for July 2022. It is currently too soon to tell the impact of the rate changes to WEC members (e.g. low income members) as well as to achieving WEC's objectives (e.g. economic alignment with energy efficiency and conservation in coordination with strategic electrification, or, fuel switching to clean heat and clean transportation).

WEC's approved rate design is provided in the Appendix. It should be noted that, while

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55 Case No. 19-1270-TF. Washington Electric Cooperative, Inc's tariff filing for rate design changes and a change in rate schedules to be effective on services rendered beginning June 17, 2019. Public Utility Commission. Montpelier, Vermont. December 19, 2019. P. 3.

56 It should be noted that, in WEC's prefiled testimony, WEC states that "while we do not have specific income data for WEC members, we believe the stratification of use for low income in other utility service territories is similar to that of the WEC membership. This assertion is based on data received from GMP for its low income program. WEC compared its monthly membership use with that of GMPs and overlaid GMP's low income participation with the data. [The data] demonstrates that GMP has low income use in all the stratification levels and approximately 61% of GMP low income customers use more than 500 kWh per hour. WEC's overall stratification use levels are comparable to GMPs. If we assume the low income results in GMP's service territory are indicative of WEC's low income use, the majority of WEC's low income users will see lower bills from the new rate design." Pre-filed Testimony of Patricia H. Richards Re: WEC Rate Design Change. PUC Case No.____. May 1, 2019. CORRECTED August 16, 2019. P. 25 – 27.

the rate design shows a "Time of Day" rate, there are no members currently utilizing this rate. WEC will closely monitor the net result of the interactions between the new rate structure (which continues to promote efficiency and conservation while now also driving strategic electrification) with Tier III incentives that also support similar policy directives. Meanwhile, WEC will continue to explore opportunities with battery storage along with BTM generation market rule talks as discussed below and in Section 3.3, alongside DSM initiatives (discussed in Section 4.3).

No significant transition, as is now underway in the energy and electricity sector, is achieved in one step. Rather, sweeping transition often requires a series of different initiatives and smaller actions. Hence, while WEC's initial exploration of battery storage (provided below in Section 4.8) did not immediately yield results, other initiatives are underway, such as WEC's integration of rate design and Tier III incentives.

4.8. Battery Storage

As described in Section 3.3, In 2019, WEC explored the potential for utility-scale battery storage. WEC's research explored:

- Three ownership models: utility owned, an energy storage services agreement with a developer who owns the system, and a developer-owned-shared-savings model;
- Potential benefits and risks of both installing and also *not* installing battery storage;
- Costs/benefits;
- Vermont Electric Co-operatives experience with battery storage pilots.

This initial exploration did not result in WEC embarking upon a battery storage project. Also noted is the concern of the long term value of battery storage given recent discussion relative to reconstituting load for behind the meter (BTM) generation. Battery storage is at risk of reduced future value streams and savings. The ISO-NE seeks to increase utility load for not only net metering generation but also battery storage systems in the transmission markets. This issue could also extend into other markets such as energy and the FCM. This issue is being discussed and vetted by market participants at ISO-NE and throughout New England. Given the uncertainty and risks, WEC will await some conclusion of the discussions relative to BTM generation prior to moving ahead with additional battery analysis.

As described throughout the Section, WEC has deployed a number of initiatives to meet members needs as well as state goals and requirements, and WEC will continue with this work.

4.9. Automated Metering Infrastructure (AMI) and Other Control Technology

With the completion of the AMI metering installation, WEC has the ability to review voltages at every member location.[57] The AMI technology has been fully integrated with WEC's Outage Management System (OMS), allowing real time active monitoring of the Distribution System and a wide spectrum of data gathering. In addition to the AMI data collection attributes, the technology is being used to verify reported power outages and to confirm restoration. The inherent features of the AMI system provide for improved operation efficiency and service to the Co-op's members. It is anticipated that this information will be incorporated into the planning and operation of the Co-op system as time allows.

The Supervisory Control and Data Acquisition (SCADA) technology deployed on WEC's electrical system utilizes the data backhaul infrastructure of the AMI system for secure data transmission. SCADA monitoring devices have been installed on critical switches and equipment at all substation locations. The SCADA system provides real time status of the load break switches and circuit reclosers that interconnect the substations with the transmission grid. The system also monitors the voltage, present kW load, and peak demand at each of the substation main feeders. The SCADA system was fully integrated with WEC's outage management systems in 2014.

The combination of AMI metering and the SCADA system have significantly improved the Co-op's ability to more efficiently manage widespread outages, reducing restoration times and providing enhanced operational safety for line crews and the general public. This is particularly important given the severe impact on outages resulting from recent storms (e.g. October 2018 storm), and WEC members' selection of reliability as their number one priority

[57] Note that the current CWP includes $120,000 for replacement AMI meters and an additional $48,000 for AMI related equipment expenditures.

for the coop (see Section 1.5).

It should be noted that future potential initiatives such as incorporating a broad "Time of Day" (or "Use") rate will not be supported by WEC's current AMI infrastructure, as it utilizes a power line carrier (PLC) to transmit data from the site to WEC rather than using radio frequency (RF), which means that data is only received once a day.[58] This is not to say that WEC cannot implement programs that control when power is being used. The industry is evolving rapidly, and end-use technologies, such as that utilized in the PowerShift program, are deployable. It does mean, however, that WEC does not have the same "tools in the toolbox" as some other utilities, and therefore that WEC may have to be more creative with how to engage membership in FLC and real-time power management.

WEC's current PLC system allowed WEC to advance its abilities to interface with its members and to actively manage load as compared to old meter system. However, WEC is currently exploring the electric benefits and capabilities of a modern fiber based system to replace the current PLC model. This work is being conducted in tandem with a broadband feasibility study effort and WEC will file for PUC consideration and funding in the near future.

4.10. Customer Engagement

Described throughout this IRP, and particularly this Section (Section 4), are the many ways in which electric utilities are transitioning to a new business and service model. While not all electricity users are interested in becoming more engaged in understanding how their appliances, homes and vehicles consume energy, many are. As technology provides greater opportunity for individuals to generate power at their properties (e.g. solar), and other, WiFi-enabled technology allows individuals (and/or utilities) to remotely control usage (e.g. the PowerShift program described above), the relationship between electricity user and power

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[58] WEC worked with the DPS and PUC to address the choice of PLC versus RF. Ultimately, WEC deployed PLC because (a) a substantial portion of the membership would not have allowed a RF meter to be installed at their home (~2,000+ out of ~11,000 members), and (b) reception with RF was limited (~35-40%) due to the topography of WEC's service territory (e.g. remote hilltops and valleys). Unfortunately, even if WEC were to have members choose a RF advanced meter to be able to utilize Time of Day rates, this would reach a technological limitation; if more than a certain number of members were to sign up for this, bottlenecking would occur with the data flow back to WEC due to the PLC system speed. Ultimately, if Time of Use rates are desired by the State, it may be required that Vermonters "opt out" rather than "opt in" to AMI. This is not surprising, as other experience has found similar findings with regards to the efficacy of "opt out" compared to "opt in". (See Final Report on Customer Acceptance, Retention, and Response to Time-Based Rates from the Consumer Behavior Studies. American Recovery and Reinvestment Act of 2009, Smart Grid Investment, Grant Program. U. S. Department of Energy. Electricity Delivery and Energy Reliability. November 2016.

provider is becoming more fluid and interactive.

WEC, as a cooperative owned by its membership, has always deeply valued this relationship. According to the 2015 Residential Survey conducted by NRECA Market Research Services, seven in ten members say they regularly or fairly often read the monthly newsletter, "Co-op Currents". Four in ten are aware of SmartHub (an online portal for various tasks such as paying bills, monitoring actual monthly usage, communicating with WEC and registering for notifications) but only 16% have used it.[59] WEC also holds an Annual meeting, regularly communicates with bill inserts, e-mail and text (when members have opted into these) and has a variety of resources available on its website.

The 2015 survey found that the "overall satisfaction among WEC's residential members is good. The mean overall satisfaction rating is 8.49 on a 10-point scale and 60% give ratings of "9" or "10"."[60] This survey also asked members to rank specific attributes in terms of importance and performance. The nine attributes are presented here in the order of highest importance to lowest: providing reliable service, having competent and knowledgeable employees, handling individual complaints and problems, being friendly and courteous in the service they provide, providing a good value for the money spent, looking out for members' best interests, communicating with members and keeping them informed, being committed to the community, and helping members learn to manage their energy use.

With regards to performance, "being friendly and courteous in the service they provide" and "having competent and knowledgeable employees came in 1st and 2nd (respectively), with "providing reliable service" ranking 3rd (which is reasonably impressive, given that the previous winter there had been a ten-day outage due to a storm event). Perhaps unsurprisingly, "providing a good value for the money spent" came in as 8th, given that WEC had just increased rates in 2014, just before the surveys were undertaken. Meanwhile, the surveyed members ranked "helping members learn to manage their energy use" as last (9th) in terms of performance and importance. This could be interpreted as: WEC members feel they are not receiving a good value for the money spent, yet they feel that it's not important for WEC to help them use less energy *and* they don't think WEC does it as well as the other nine attributes. Meanwhile, as shown in Figure 1-2, WEC members are using a significantly lower amount of

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59 2015 Residential Satisfaction. Washington Electric Cooperative. Survey Results Prepared by: NRECA Market Research Services. October 12, 2015. P. 12.

60 Ibid. Page. 4

electricity (454 kWh/month in 2019), compared to the 2018 national average of 914 kWh per month[61], and also to the Vermont average at 565 kWh per month[62].

As WEC strives to meet various Vermont energy policy goals and requirements, transforming to the next frontier of the electricity industry, customer engagement will become increasingly important. Changes in rates and rate structure, opportunities such as those provided through Tier III and initiatives like PowerShift, alongside ever increasing rate pressure due to the combination of decreasing load, increasing deployment of net-metering, ongoing transmission and forward capacity costs means that ongoing communication between WEC, the WEC Board and membership will likely become increasingly important. In the next Residential Survey, WEC will look to tease out some of the conflicting results from the last survey (e.g. “It’s not important for WEC to help me save energy and money, and they don’t do it well, but I’m paying too much for what I get”) as well as to incorporate additional questions as to how to improve connections and engagement with members.

4.11. Looking Back, Addressing Now, Looking Forward

Looking back, WEC has long been a leader in providing sustainable and affordable sources of power. WEC currently has investments in its underlying power supply commitment that originate as renewable sources of power. In fact, all of WEC’s existing generation and power contracts reflect renewable based energy sources. WEC charted this course over the past decade in order to meet its members’ goals of reduced exposure to fossil fuel and nuclear based power sources while reducing its environmental and emissions footprint.

WEC’s investment in the Coventry landfill gas generator, which makes two thirds of WEC’s power supply mix, is a low-cost base load power source that is the anchor to WEC’s sustainable commitments. WEC seeks to maximize Coventry’s production to bring low cost renewable power to the grid and keep WEC members’ costs as low as possible long-term. In addition, WEC’s Wrightsville hydro facility is another owned generation resource where WEC seeks to maximize its value and keep WEC members’ costs as low as possible.

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[61] https://www.eia.gov/tools/faqs/faq.php?id=97&t=3#:~:text=In%202018%2C%20the%20average%20annual,about%20914%20kWh%20per%20month.

[62] https://www.electricitylocal.com/states/vermont/#:~:text=%5E%20Electricity%20consumption%20by%20Vermont%20residents,ranks%2049th%20in%20the%20nation.

WEC's other power supply commitments are contractually oriented and focus on hydro and wind-based technologies. WEC seeks to maximize value from these contract commitments where possible, maintaining its goals for sustainability and affordability of its power mix and commitments, consistent with state and other jurisdictional goals and policy considerations.

In keeping with WEC's long-time focus and commitment to address climate change, the WEC Board of Directors recently voted to approve the following WEC Climate Change Statement:

> The WEC Board of Directors acknowledges that rapid global warming and associated climate instability are real, and are significantly attributable to human activities. We are concerned that global warming presents great risk of serious and negative economic, environmental and health ramifications to humans, along with challenges to the continued existence of numerous other forms of life on this planet.
>
> WEC urges NRECA and NEAEC to support meaningful efforts on the part of the electricity sector to address global warming, including legislation at the federal, state, and local levels to mitigate the harmful effects of climate change. An effective response must also address financial impacts incurred by cooperatives burdened with legacy power supply commitments.

Addressing now, WEC will continue to ensure that the Board and staff address members' current needs. An example of this is WEC's work throughout the coronavirus pandemic to ensure and maintain reliable, reasonably priced power in a manner that is safe, and as equitable and environmentally sustainable as possible. Because WEC primarily serves homes and residences, the need for energy and power has not decreased during the pandemic. This is in contrast to utilities with substantial commercial and/or industrial load. However, as is true for many utilities, WEC has had to address and respond to other needs and impacts resulting from the pandemic. For example, WEC has developed a COVID-19 mitigation plan, supported the VT COVID-19 Arrearage Assistance Program and provided other coronavirus-related resources to members. As the pandemic carries on, WEC will continue to act as a resource for and seek to address members' needs. As coronavirus has revealed, far too many Vermonters do not have access to highspeed internet. WEC's current feasibility study to provide broadband to its members, discussed earlier, is just one example of focusing on addressing current member needs.

Looking forward, the electric (and energy) industry is changing: utilities are being asked and required to assist in strategically electrifying the heating and transportation sectors while managing more variable load profiles through far greater interactions with customers and at many more nodes throughout the utility territory (e.g. rooftop solar, EV charging). As described in this Section, WEC has rolled out a variety of initiatives to continue to meet member needs and comply with state policies and goals. WEC will continue to research, pilot and implement new programs, approaches, and technologies to support the shift towards clean and efficient energy.

5. Transmission & Distribution System

5.1. Distributed Generation and Impacts to the WEC Transmission & Distribution System

As noted in the 2016 Comprehensive Energy Plan:

> Apart from emergency preparedness, utility planning — e.g., integrated resource plans — must consider energy assurance. This includes preparatory actions that help the power stay on, such as careful vegetation management to clear trees away from power lines, and the strategic location of utility infrastructure to avoid risks in the first place (for example, siting substations and generators outside of floodplains and river corridors), or to make restoration of power easier (as by siting power lines along roadways).[63]
>
> The pace of innovation in the electric sector is increasing, especially for distributed energy resources. For instance, solar PV prices have fallen by nearly 60% in the last four years, while the number of electric vehicles in Vermont has increased by more than a factor of 10 and cold climate air source heat pumps are rapidly expanding in availability. During the past five years, Vermont utilities have completed deployment of a statewide smart grid, opening the door for modern information technology tools to manage the electric system. Changes wrought by evolving technology will challenge long‐held paradigms that underpin utility business models, while also providing opportunities for utilities to increase their own fostering of innovation. Vermont must harness this innovation for ratepayers' benefit and use it to help meet our energy goals, thereby advancing economic, environmental, and health priorities.[64]

As noted previously, WEC completed a satisfaction survey of its membership in 2015. Members were asked to rank the importance of various attributes of their electric power and service. Reliability was given the highest importance rating among nine key factors. WEC members ranked reliable service above lower rates and friendly and knowledgeable service. With this directive, WEC seeks to harden its system and decrease the occurrence of power

[63] 2016 CEP p 273

[64] Ibid p 275

outages as well as decrease the time power is out when an outage occurs. To meet this challenge, WEC seeks to invest in its system as outlined in its CWP. WEC also sees that by responding to changes in industry practices, it will develop tools that will enhance and improve reliable service.

As a result of increased distributed generation, growing deployment of energy efficient technologies, and new plug loads, WEC seeks to explore a T&D system analysis to assess a changing industry. WEC will perform an assessment of its system to explore the impacts of growing distributed generation installed on the grid. WEC's analysis will be done to answer broad overarching questions:

- How much distributed generation can the T&D system accommodate?
- Does it matter by circuit/substation/size where distributed generation is located?
- What are the impacts to WEC's T&D system of new plug load (EVs, cold climate heat pumps, etc)?
- What power quality issues does WEC's T&D system need to address in light of a modernizing grid?
- What data is necessary to conduct a more comprehensive and transparent planning process?

WEC seeks to develop a scoping process that will allow it to specify the tools, process, and protocols to be developed in order to plan and operate a modern grid capable of dynamically managing distribution resources, as well as supporting retail markets that coordinate significant distributed generation investment and efficiently manage resources. Engineering and modeling efforts will be used to help convey how WEC plans, operates, and develops its system (where and which types of resources and equipment are best located on WEC's lines). WEC will also seek to balance distributed generation needs and grid modernization with total cost of its system and the impacts to members' rates and bills. In the near term, WEC plans to start a scoping process to outline work it will need to do in the future.

Broader and Long-term Issues:

WEC's operational practices required to operate the grid safely and reliably will continue to evolve based on increasing distributed generation and multi-directional power flows. Operating the distribution system going forward will require a combination of technologies and modernized and improved standards. In the longer term, WEC's plans must incrementally progress from adequately equipping the distribution system with monitoring and communication infrastructure to enabling intelligent, rapid, and precise control.

WEC looks toward deploying automated solutions across the system where it is appropriate and where it offers added value. WEC will focus in the near term on monitoring, observation, and a detailed assessment of its current system and its capabilities as well as its weaknesses. WEC will evaluate the effectiveness of existing systems to determine what modifications may be needed to operate the system safely. It is expected that forecasted distributed generation penetration levels, types, and locations will provide the basis to establish new policies, protocols, and visibility requirements. While WEC's current CWP process encompasses many of the goals noted in the IRP, these are specific items WEC seeks to examine and act on in the upcoming three years:

- Outline and provide an overview of WEC's T&D system;
- Develop and articulate an integrated approach to planning, investment, and operations;
- Develop an open process to promote utility/stakeholder relations, enable third parties the opportunity to provide cost-effective market solutions to identified energy needs, drive member value related to the distribution system, and embrace innovation where cost-effective;
- Specify the expected or potential near-term effects of increased distributed generation penetration on the ability to serve customers, with specific reference to each type of distributed generation and its grid interface;
- Identify the need for system upgrades regardless of distributed generation potential;
- Perform a technical assessment and description of WEC's T&D system with respect to changes from grid modernization (distributed generation, energy efficiency, new plug loads such as EVs and CCHPs);
- Plan for circuit based analysis;
- Identify the level of distributed generation capacity on WEC systems on a given distribution circuit that could be integrated without additional upgrades or expansions;
- Identify system efficiencies (lowering of distribution losses, deferral/avoidance of investments, and rebuild work);
- Develop a plan that will take into account changing load shapes, increased distributed generation, and the effect that these factors will have on the existing system and any planned capital expenditures;

- Identify locations, based on proposed capital plans, where distributed generation has the potential to resolve or mitigate forecasted system requirements that would otherwise necessitate traditional infrastructure investments for system expansion/upgrade and/or maintenance;
- Include effects of storage and behind the meter generation on WEC's system;
- Identify specific system needs allowing stakeholders and market participants to identify opportunities;
- Identify collaboration efforts with other Vermont utilities, VELCO, and the Vermont System Planning Committee (VSPC) process;
- Identify specific areas in WEC's system where there is an impending or foreseeable delivery infrastructure upgrade need;
- Identify specific areas where there is no projected delivery infrastructure need for years to come, and hence the infrastructure avoidance value of distributed generation is likely to be lower or insignificant in the short-term;
- Identify and distinguish operational needs during normal operations and during outage events or other periods of system stress (low voltage condition, near thermal limitations, etc.) and plans to implement reliability enhancing protocols like fault location, isolation, and service restoration;
- Develop information on optimal locations and levels of storage facilities, either on the system or behind the customer's meter, as storage technologies integrated into grid architecture may potentially be used for reliability and to support the deployment of other distributed resources;
- Prepare system data on a substation basis: hourly load curves, voltage, power quality, reliability;
- Prepare individual feeder system data (load data, voltage, power quality, reliability, etc.) for feeders within areas that distributed generation is expected to have more value;
- Consider and propose demonstration projects, as appropriate, in order to continually improve, refine, and otherwise drive toward the state's energy objectives;
- Identify (at a high level), the capability of WEC's system to accept additional solar;
- Explore other utility and public sources related to solar mapping and use early research to help guide analysis.

WEC's T&D planning efforts will be an evolving and dynamic process. As we learn more about our system and perform more detailed studies relative to distributed generation and grid modernization, we will adapt our efforts and report findings through the IRP process. Hence, this is an ongoing and iterative process.

5.2. WEC Construction Work Plan

WEC receives financing from the Rural Utility Service (RUS) for its electrical system improvements. One of the requirements for RUS borrowers is the periodic development of a Construction Work Plan (CWP). The CWP is developed and written in accordance with the RUS Bulletin 1724D-101B guidelines.

WEC's current CWP, dated October 2018 and covering the period from 2019 – 2022, is still active with RUS approved projects scheduled into the fourth quarter of 2022. The completion of WEC's current CWP is on schedule and expected to continue to the end of 2022. A small number of projects from the 2014-2017 CWP were carried forward to the 2019-2022 CWP.

The requirements of the CWP are laid out by RUS and are summarized as follows:

> The Construction Work Plan process is used to determine and document a borrower's 2- to 4- year construction needs that are the most feasible, environmentally acceptable and economical. New construction is periodically required in order to provide and maintain adequate and reliable electric service to all of a system's new and existing members. The CWP should include all recommended electric plant facilities regardless of the financing source (general funds, RUS, or all other lenders). A CWP is a valuable reference for the preparation of annual construction budgets and schedules. The CWP report is also used as an engineering support document for a loan application to finance a proposed construction program. As such, the CWP is used as a means to inform RUS and receive RUS's approval of proposed new construction items (from RUS Bulletin 174D-101B, page 3)

WEC's CWP provides a detailed work plan for improvements to maintain the reliability and efficiency of the electric distribution system. It is also a tool that is used by WEC to manage projects and a guide to:

- Determine the most practical and economical means of serving future loads while maintaining high quality service to members;
- Outline anticipated system changes in terms of major facilities, demand levels and

associated costs; and

- Help forecast future system costs for financial planning and decision-making.

A CWP provides guidance for developing the existing system toward the capacity level which will be required at the end of the planning period, through construction of new facilities and expansion or replacement of existing facility at appropriate times. The plan incorporates critical elements that need to be addressed to provide safe, reliable, and efficient electric service at a reasonable cost.

5.3. WEC T&D System Evaluation

The Comprehensive Energy Plan provides guidance via the IRP addendum relative to utility planning for transmission and distribution system improvements. The addendum states:

> Each electric utility should plan and conduct a comprehensive study evaluating options for improving transmission and distribution (T&D) system efficiency and reliability. Based on the findings of that study, it should then implement a program to bring its T&D system to the level of electrical efficiency that is optimal on a present value of life cycle cost basis within a reasonable period of time. These studies and action plans should be reviewed and updated at reasonable intervals. Finally, each utility should implement a program, as part of its IRP, to maintain T&D efficiency improvements on an ongoing basis.[65]

WEC worked with the PSD engineering staff in the development of its CWP. As stated above, WEC has a new plan (2019 through 2022) and WEC staff will meet with the PSD to review the approach and outline. WEC has also reviewed the IRP guidelines, which call for the following measures:

> Each utility should evaluate individual T&D circuits to identify the optimum economic and engineering configuration for each circuit, while meeting appropriate reliability and safety criteria. The IRP should contain a detailed description of how and when the utility will carry out these evaluations.

[65] 2016 CEP Appendix B: Guideline for Integrated Resource Plans and 202(f) Determination Requests, p 19

Decisions regarding some facilities may affect more than one utility. In such instances, utilities should work together so that their evaluations reflect not only their individual interests, but also the interests of ratepayers generally.

The standard for establishing optimum T&D system configurations and for selecting transmission and distribution equipment is the net present value of life cycle cost. This life cycle cost should be evaluated on both a societal and utility/ratepayer basis. This standard requires consideration of a project's capital costs and life cycle operating costs, as well as benefits resulting from the construction of enhanced system configurations and the installation of energy efficient T&D components. These benefits include avoided operation and maintenance costs, and avoided energy and capacity costs.

Avoided energy costs include the direct costs for energy, the costs for energy consumed as line losses, and T&D delivery costs. Avoided capacity costs include fixed costs and capacity charges for power including on peak line losses, fixed costs and capacity charges for T&D, the cost of Capability Responsibility reserve obligations, the deferral of T&D investments. Other benefits of T&D system efficiency include reduced environmental externalities and reduced market prices due to reduced demand for energy and capacity.

Evaluations should identify and compare all technically feasible investments to improve system reliability and efficiency. At a minimum, evaluations should include (and assess the economics and technical feasibility where appropriate) the following measures:

1) The utility's power factor goal(s), the basis for the goal(s), the current power factor of the system, how the utility measures power factor, and any plans for power factor correction;

2) Distribution circuit configuration, phase balancing, voltage upgrades where appropriate, and opportunities for feeder back-up;

3) Sub-transmission and distribution system protection practices and philosophies;

4) The utility's planned or existing "smart grid" initiatives such as advanced metering infrastructure, SCADA, or distribution automation (see Section 4.6);

5) Re-conductor lines with lower loss conductors;

6) Replacement of conventional transformers with higher efficiency transformers;

7) The utility's distribution voltage settings (on a 120 V base), and whether the utility employs, or plans to employ, conservation voltage regulation or volt/VAR optimization;

8) Implementation of a distribution transformer load management (DTLM) or similar program (see Section 4.2);

9) A list of the locations of all substations that fall within the 100- and 500-year flood plains, and a plan for protection or relocation of these facilities;

10) A discussion of whether the utility has an underground Damage Prevention Plan (DPP), or plans to develop and implement a DPP, if none exists;

11) The location criteria and extent of the use of animal guards;

12) The location criteria and extent of the use of fault indicators, or the plans to install fault indicators, or a discussion as to why fault indicators are not applicable to the specific system;

13) A pole inspection program, the plans to implement a pole inspection program, or a discussion as to why a pole inspection program is not appropriate to the specific utility;

14) The impact of distributed generation on system stability.

The requirements of the comprehensive Construction Work Plan required by RUS parallels the requirements outlined in 1 through 14 above. The proposed CWP that is currently being developed will be expanded to include the 14 items requested in the 2016 CEP.

5.4.Analysis of WEC System

The existing WEC distribution system has approximately 1,140 miles of overhead distribution line and 13 miles of underground primary distribution for a total of 1,153 miles. The distribution system operates at 12.47/7.2 kV.

The distribution system consists of eight substations and one primary metering point. Table 5-1 provides a list of the substations/circuits and the approximate length of primary overhead and underground on each circuit.

Table 5-1. Summary WEC Substations and Circuits

Primary Line Lengths by Substation/Feeder					
			Approx. Length (Mi.)		
Substation	Sub No.	Circuit	Overhead	Underground	Meters
East Montpelier	1	1	35.5	0.8	262
		2	73.8	0.9	830
		3	49.7	1.5	582
Jones Brook MP*	2	1	6.9	0.0	79
Mt. Knox	3	1	69.9	0.0	579
		2	133.7	0.6	1,284
West Danville	4	1	38.4	0.5	446
South Walden	5	1	51.3	0.0	427
		2	43.7	0.0	462
		3	36.3	0.1	281
Jackson Corners	8	1	40.4	0.0	409
		2	52.3	0.3	321
		3	107.9	1.3	1,253
Moretown	9	1	42.1	0.3	466
		2	16.3	1.0	154
		3	50.9	1.6	781
Maple Corners	10	1	28.1	0.4	279
		2	49.8	0.1	564
North Tunbridge	11	1	82.4	0.8	687
		2	27.1	0.1	230
		3	34.64	0.0	257
Totals	8	21	1153	10.3	11,014
*metering point only					

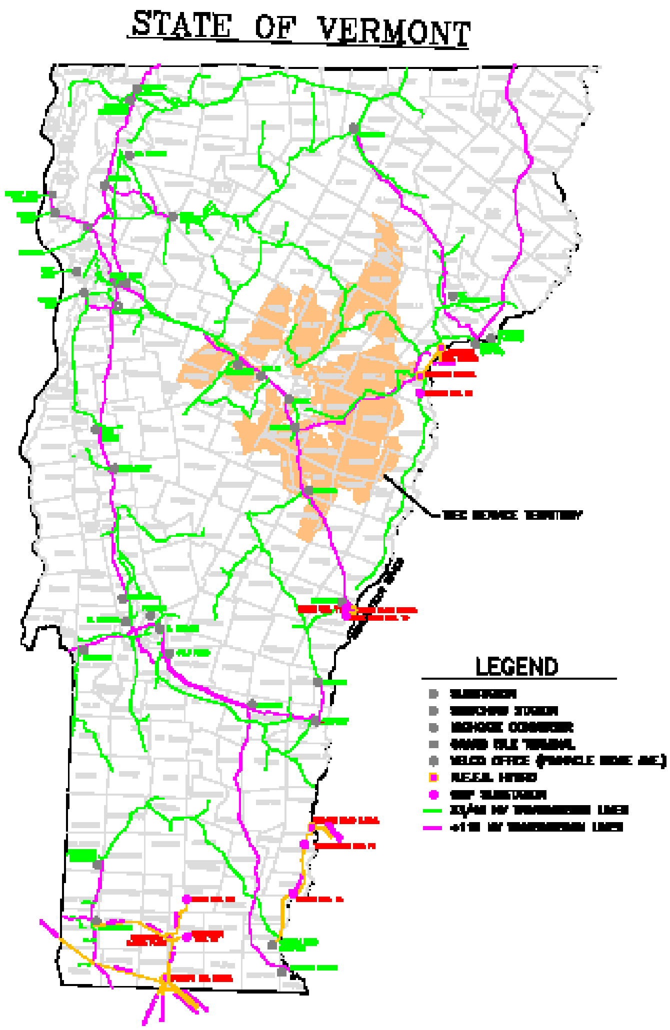
The primary conductor size on the system ranges from 3/12 copperweld to 4/0 aluminum on the overhead portion of the line and 1/0 aluminum cable on the primary underground line, which accounts for approximately .9% of the total system.

Five of the eight substations were originally built as wood pole structures with timber crossarms, varying in age. Four substations, Moretown, South Walden, Maple Corners, and East Montpelier, have been completely rebuilt with modern metal frame construction and increased clearances to meet present requirements. West Danville Substation, while a wood pole structure, was rebuilt in 1986 while major equipment was replaced in 2002, and is therefore in good condition.

Transmission Facilities

The majority of the power distributed to WEC's customers is generated outside of WEC's service area. Therefore, WEC depends on transmission facilities owned by VELCO, GMP and ISO-NE to transmit power to their electrical facilities. The Vermont transmission facilities are shown in the following map of Vermont relative to WEC's service territory.

Figure 5-1. Comparison Forecasts



WEC owns approximately 15.7 miles of 34.5 kV transmission line that completes the link between the transmission facilities owned by others and WEC's substations. These lines interconnect and serve the Jackson Corners, Maple Corners, and South Walden substations. WEC owns an additional 2.6 miles of 46 kV transmission line that serves the North Tunbridge substation and 7.2 miles of 48kV line that connects the Coventry Landfill Gas Plant to the VELCO Irasburg Substation. The specific distances of the transmission line taps are detailed in Table 5-2.

Table 5-2. Summary WEC Transmission Lines

WEC Owned Transmission Lines		
Substation	Voltage	Length (Miles)
Jackson Corners	34.5	4.4
Maple Corners	34.5	9.0
North Tunbridge	46.0	2.6
South Walden	34.5	2.3
Coventry	48.0	7.2
Totals		25.5

Planning criteria are used to establish the rules for assessing WEC's distribution system performance. The criteria include voltage limits, conductor thermal loading limits, and equipment thermal loading limits.

The planning criteria cover WEC's 34.5 kV sub-transmission system and distribution system that ranges in phase to phase voltage from 12.47 to 34.5 kV. The following planning criteria were utilized in preparing this CWP:

- Distribution lines will be limited to 300 amps or the conductor's normal rating, whichever is lower;

- Distribution line voltage will be held between 115 and 125 volts with a maximum swing of six volts between peak and off peak loading. Tap changer compensation will be used where possible to limit daily voltage swings;

- A distribution line will be limited to two levels of line regulation beyond the substation bus;

- Substation transformer and regulator loads will be limited to their nameplate rating;

- The distribution system losses will be evaluated on a regular basis and all cost-effective loss reduction projects will be implemented. Re-conductoring, adding phases, adding capacitors, and new metering points and substations are examples of projects to be considered;

- The most important consideration in developing the work plan projects was condition of wires and poles. After the pole inspection program was completed, the lines with a significant number of deteriorated poles were identified and projects were proposed to replace these lines. In addition, the condition and size of the primary conductor was taken into consideration, with "Amerductor" and Copperweld wire being considered the priority.

The analysis of the current system was significantly simplified by the fact that a Long Range Plan was completed in 2011. The CWP builds on the work completed in this study:

- East Montpelier #1/Maple Corners #10

The East Montpelier #1 and Maple Corners #10 model was run at a 2016 load level of 3,612kW with base losses of 101 kW. There were no line sections below 116 volts.

- Jones Brook #2

The Jones Brook Metering Point was run at a 2016 load level of 107 kW. No problems were encountered. The 2016 voltage at the line end was 118.5 volts.

- Mt. Knox #3

The Mt. Knox #3 model was run at a 2016 load level of 2531 kW, with losses of 147 kW. The main line voltage before the Route 25 regulators is 114.4 volts on the B phase. To correct this issue, the B phase regulator should be moved to just before Barberry road. In addition, a new regulator should be installed on Fairground road. No other issues were found on this substation.

- West Danville #4

The West Danville model was run at a 2016 load of 486 kW. There was no voltage or loading issues in the model. The base line losses were 11 kW.

- South Walden #5

The South Walden model was run at a 2016 load of 1,515 kW, with line losses of 59 kW. A low voltage problem was found in the North Walden area.

Feeder #1 is a single-phase line that is running 78 amps. A project to extend the three phase line to Noyestar Road will resolve this issue. The 3.1 miles of construction will reduce losses on the substation to 48 kW. In addition, the circuit coordination on the line will be improved by allowing a three phase recloser to be used at the substation. This will allow both line and ground fault protection to be used.

- Jackson Corners #8

The Jackson Corners model was run at a 2016 load of 3189 kW with 128 kW in losses, with the Triland Solar facility in Williamstown off. With the solar on, the load if 1146 kW and the losses are 85 kW. An additional 1500 kW of solar is proposed for this substation, pending regulatory approval. No voltage or loading issues were found through the analysis.

- Moretown #9

The Moretown model was run at a 2016 load level of 2461 kW, with losses of 114 kW. The voltage on Upper Crossett Hill is projected to be below 114 volts. A new regulator, installed on Route 100, north of the three phase construction, will relieve this problem for the foreseeable future.

- North Tunbridge #11

The North Tunbridge model was run at a 2016 load level of 1505 kW with 76 kW of losses. Feeders #2 and #3 are both single phase lines and running at approximately 55 amps. The lowest expected voltage, after completion of the proposed projects, is 121 volts. Any pole replacements on the main lines of these circuits should take into consideration the long-range plan to add phases to these feeders. The voltage regulator on Goose Green Road may need to be relocated closer to the end of the three-phase construction to resolve low voltage just in front of the existing location.

Table 5-3. Substation Equipment Summary

Age of Substation Equipment Summary

Substation	Year Constructed	Year of Transformer Installation	Year of Regulator Installation	Year of Recloser Installation	Year of Construction	Condition of Poles
East Montpelier	2011	2011	2011	2011	2011	Steel
Jackson Corners	1968	1991	2000	2010	1968	Good
		1991	2000	2010		
			2000	2010		
Maple Corners	2006	2006	2006	2006	2006	n/a (steel)
Moretown	2001	2000	2000	2000	2001	n/a (steel)
				2010		
Mt. Knox	1971	1975	2000	2006	1970	Fair/Good
		1975	2000	2006		
		2000	2000			
North Tunbridge	1975	1997	2008	2010	1975	Good
		2003	2008	2010		
		2003	2008	2010		
South Walden	2003	2003	2003	2003	2003	Steel
				2010		
West Danville	1986	2002	2002	2002	1986	Good

Substation Transformer Capacity: The capacity of each substation was reviewed as part of the study. There are no substations that are currently experiencing transformer capacity restraints.

The projected load for each of the substations based on the LRP load forecast is shown in Table 5-4. The only substation projected nearing its transformer capacity is Jackson Corners.

Table 5-4. Peak Load Summary

Peak Load Data			
Substation	Substation kVA	2016 Peak Demand	Percent Capacity
East Montpelier*	5000	2512	50%
Jones Brook	n/a	170	n/a
Mt Knox	3750	2523	67%
West Danville	1500	477	32%
South Walden	2500	1500	60%
Jackson Corners	3750	3243	86%
Moretown	3750	2420	65%
Maple Corners*	2500	1100	44%
North Tunbridge	3750	1500	40%
Total System	26500	15445	58%
* The loads are on one metering point			

Voltage Levels and Thermal Overloads: The existing WEC system was modeled in MilSoft Engineering Software at the 2016 load levels to determine if there were any existing deficiencies on the system. The load analysis identified two areas with significant voltage problems which were addressed above. There were not any areas where equipment was near its thermal overload capacity.

Substation Location with Respect to Flood Plains: In 2013, WEC contracted with Dubois and King to complete a study of the location of substations with respect to 100-year flooding. The study found that only one of WEC's substations is within a flood zone. The Maple Corners Substation could experience inundation of various levels, based on the actual failure mode and weather conditions during a dam failure at Curtis Pond. The level of inundation is not expected to create a problem with the operation of the substation but could affect access to the substation while the flood waters are present. The entire load served by the Maple Corners substation can be served by alternate substations that are not located within the 500 year flood plain.

Summary

This section of the report summarizes the recommended projects that are included in this 2019-2022 CWP. The projects are separated by substation in this section. Projects are listed in categories that include system improvements, capacitor installations, equipment additions/replacements and system reliability.

Projects Listed by Substation

East Montpelier #1

Project Description	Miles	Cost	Phases
301-37 Reconductor #3/12 CWC to 1/0 AAAC	0.93	$91,463	1
301-38 Reconductor #3/12 CWC to 1/0 AAAC	1.81	$177,386	1
301-39 Reconductor #3/12 CWC to 1/0 AAAC	0.78	$124,185	1
301-40 Reconductor #3/12 CWC to 1/0 AAAC	1.15	$112,748	1
301-41 Reconductor #3/12 CWC to 1/0 AAAC	0.58	$56,737	1
301-42 Reconductor #3/12 CWC to 1/0 AAAC	0.60	$58,744	1
301-43 Reconductor #3/12 CWC to 1/0 AAAC	1.20	$117,638	1

Overall, 7.05 miles of line will be rehabilitated at an estimated cost of $738,901.

Jones Brook Metering Point #2

Project Description	Miles	Cost	Phases
302-01 Reconductor #4 ACSR to 1/0 AAAC	0.87	$85,179	1

Mt. Knox #3

Project Description	Miles	Cost	Phases
303-42 Reconductor #6 ACSR to 1/0 AAAC	0.73	$72,092	1
303-43 Reconductor #6 SCG to 1/0 AAAC	0.19	$18,776	1
303-44 Reconductor #6 ACSR to 1/0 AAAC	0.38	$37,254	1
303-45 Reconductor #4 AWAC to 1/0 AAAC	0.43	$41,828	1
303-46 Reconductor #4 ACSR to 1/0 AAAC	0.43	$40,898	1

Overall, 2.16 miles of line will be rehabilitated for an estimated cost of $210,848. Project 604 will install a regulator on Route 100, north of where the three-phase line ends to improve the voltage on Crossett Hill Road. The estimated cost is $10,000. Under Code 500 a new airbreak switch is planned for the substation. The estimated cost is $12,500.

<u>West Danville #4</u>

Project Description	Miles	Cost	Phases
304-18 Reconductor #3/12 CWLD to 1/10 AAAC	1.03	$100,665	1
334-19 Reconductor #4 ACSR to 1/10 AAAC	0.10	$9,574	1

Overall, 1.13 miles of line will be rehabilitated at an estimated cost of $110,239.

<u>South Walden #5</u>

Project Description	Miles	Cost	Phases
305-34 Add two 1/10 AAAC Phases	1.09	$60,459	3
305-35 Add two 1/10 AAAC Phases	0.96	$53,078	3
305-36 Add two 1/10 AAAC Phases	1.06	$58,548	3
305-37 Reconductor #8 CWC to 1/10 AAAC	1.67	$163,815	1
305-38 Reconductor #8 CWC to 1/10 AAAC	1.03	$101,223	1
305-39 Reconductor #8 CWC to 1/10 AAAC	0.26	$25,561	1
305-40 Reconductor #3/12 CWC to 1/10 AAAC	0.36	$35,786	1
305-41 Reconductor #6 SCG to 1/10 AAAC	0.10	$10,225	1
305-42 Reconductor #3/12 CWC to 1/10 AAAC	0.16	$15,616	1
305-43 Reconductor #3/12 CWC to 1/10 AAAC	0.19	$18,218	1
305-44 Reconductor #3/12 CWC to 1/10 AAAC	0.76	$74,732	1
305-45 Reconductor #3/12 CWC to 1/10 AAAC	0.71	$69,527	1
305-46 Reconductor #3/12 CWC to 1/10 AAAC	0.64	$62,462	1

Overall, 8.98 miles of line will be rehabilitated at an estimated cost of $749,250.

Jackson Corners #8

Project Description	Miles	Cost	Phases
308-53 Reconductor #8 CWC to 1/0 AAAC	1.90	$320,399	1
308-54 Reconductor #3/12 CWC to 1/0 AAAC	0.26	$25,375	1
308-55 Reconductor #4 ACSR to CWC to 1/0 AAAC	0.57	$56,160	1
308-56 Reconductor #8 CWC to 1/0 AAAC	0.85	$143,980	1
308-57 Reconductor #3/12 CWC to 1/10 AAAC	0.47	$46,010	1
308-58 Reconductor #3/12 CWC to 1/10 AAAC	0.57	$56,235	1
308-59 Reconductor #3/12 CWC to 1/10 AAAC	0.83	$81,796	1
308-60 Reconductor #8 CWC to 1/10 AAAC	1.15	$112,470	1
308-61 Reconductor #3/12 CWC to 1/10 AAAC	0.68	$66,459	1
308-62 Reconductor #3/12 CWC to 1/10 AAAC	0.31	$30,674	1
308-63 Reconductor #3/12 CWC to 1/10 AAAC	0.78	$76,684	1
308-64 Reconductor #3/12 CWC to 1/10 AAAC	0.42	$40,898	1
308-65 Reconductor #3/12 CWC to 1/10 AAAC	0.68	$66,459	1
308-66 Reconductor #3/12 CWC to 1/10 AAAC	1.01	$99,364	1
308-67 Reconductor #3/12 CWC to 1/10 AAAC	0.38	$37,273	1
308-68 Reconductor #4 ACSR#8 CWC to 1/10 AAAC	0.85	$143,980	1
308-69 Reconductor #4 ACSR#8 CWC to 1/10 AAAC	1.25	$210,297	1
308-70 Reconductor #4 ACSR#8 CWC to 1/10 AAAC	0.64	$108,824	1

Overall, 13.6 miles of line will be rehabilitated at an estimated cost of $1,723,337.

Project 1001 is carried over from the 2014-17 Work Plan and will replace porcelain insulators on the Graniteville-Jackson Corners 34.5 kV line. The estimated cost is $110,000.

Moretown #9

Project Description	Miles	Cost	Phases
309-19 Reconductor #3/12 CWC to 1/0 AAAC	1.04	$102,245	1
309-20 Reconductor #3/12 CWC to 1/0 AAAC	0.52	$51,123	1
309-21 Reconductor #3/12 CWC to 1/0 AAAC	0.47	$46,010	1

309-22 Reconductor #4 ACSR to 1/0 AAAC	0.52	$51,123	1

Overall, 2.6 miles of line will be rehabilitated at an estimated cost of $250,501.

Project 604 will install a regulator on Fairground Road, north of where the three phase line ends, to improve the voltage on Crossett Hill Road. The estimated cost is $10,000.

Maple Corners #10

Project Description	Miles	Cost	Phases
310-36 Reconductor #3/12 CWC to 1/10 AAAC	0.97	$94,809	1

North Tunbridge #11

Project Description	Miles	Cost	Phases
311-43 Reconductor #4 ACSR with 1/0 AAAC	0.30	$29,632	1
311-44 Reconductor #3/12 CWC to 1/0 AAAC	0.87	$85,607	1
311-45 Reconductor #3/12 CWC with 1/0 AAAC	0.53	$51,866	1
311-46 Reconductor #6 ACSR with 1/0 AAAC	0.17	$16,824	1
311-47 Reconductor 1/0 URD	0.42	$67,290	1
311-48 Reconductor #3/12 CWC with 1/0 AAAC	0.57	$56,235	1
311-49 Reconductor #3/12 CWC with 1/0 AAAC	0.54	$53,353	1
311-50 Reconductor #3/12 CWC with 1/0 AAAC	1.17	$92,912	1
311-51 Reconductor #8 SCG with 1/0 AAAC	0.52	$41,353	1
311-52 Reconductor #3/12 CWC to 1/0 AAAC	0.82	$80,402	1
311-53 Reconductor #8 CWC with 1/0 AAAC	1.48	$145,188	1
311-54 Reconductor #8 CWC with 1/0 AAAC	1.57	$154,576	1
311-55 Reconductor #3/12 CWC with 1/0 AAAC	0.94	$92,541	1
311-56 Reconductor #4 ACSR with 1/0 AAAC	0.64	$62,741	1
311-57 Reconductor #4 ACSR with 1/0 AAAC	0.27	$26,937	1
311-58 Reconductor #3/12 ACSR with 1/0 AAAC	0.83	$81,703	1
311-59 Reconductor #3/12 ACSR with 1/0 AAAC	0.94	$92,021	1

Overall, 12.58 miles of line will be rehabilitated at an estimated cost of $1,231,181.

Other

610 Install fault indicators $5,000
1002 Replace transmission switches $31,000

Smart Grid Projects

601 AMI Meters system-wide as needed $120,000
601 AMI Repeaters PLC signal repeaters $48,000

Generation Projects

1203 Coventry Landfill Gas to Energy Plant, up grade pipes $351,600

WEC has a complete CWP for 2019-2022 filed as part of its IRP filing. For a detailed analysis of the WEC system and summary of planned projects please see the CWP in the Appendix. Included in the CWP are many other topics as required by the IRP guidelines and RUS. These additional items are listed below:

- Analysis of Current System
- Current Review Rating Summary (RUS Form 300)
- Sectionalizing & Fuse Coordination Studies
- Historical and Projected System Data
- Load Current Measurements
- Voltage Measurements
- System Outages and Reliability
- Demand and Energy Losses
- Pole Replacement and Pole Inspection/Treatment
- Small/Aging Conductor
- Vegetation Management
- Environmentally Sensitive Areas
- Energy Efficiency Services
- Other Operational Issues

Capability of the WEC System to Accept Additional Distributed Generation

WEC currently has 4.8 MW of net metered generation installed on its lines with the dominant technology being solar powered systems. With distributed generation (DG) adoption continuing to increase significantly in WEC's territory, understanding the potential implications to the WEC distribution system becomes increasingly important. As a preliminary, first step in assessing the capability of the WEC system to accept additional distributed generation such as solar, WEC conducted a very high level, theoretical modeling exercise.

The model was structured to reflect WEC's current system, which already includes 4.8 MW of DG. Further, the analysis assumed a relatively even distribution of new DG, installing the same DG load at each consumer. Additionally, it was assumed that no large DG projects would be added to the system. Again, the purpose of this simplified analysis was to start to develop a sense of the system's capability for new DG, at a high level. Clearly, this theoretical approach does not reflect reality, because there have been new, larger projects built within WEC's territory and it is likely that future projects will be proposed.

With the modeling, once a DG system (assuming a solar profile) was applied at each meter, the existing loads (the first column in Table 5–5 below) at each substation were incrementally replaced with increasing levels of DG generation. The output of that generation was then increased until either the lines were overloaded or the voltage rose to an unacceptable level. For these standards, 100% of the thermal rating and 105% of nominal voltage were used as the limits. The load on each substation was then tabulated and compared to the minimum load on the substation at 3:00 in the afternoon. The difference is then assumed to be approximately the amount of DG that could be installed in a more-or-less uniform way across the system (the second column in Table 5-5). The substation results (the third column) were then summed to arrive at the entire WEC system capability to absorb more or incremental DG (in addition to the current 4.8 MW). The analysis concluded an additional incremental 5,467 kW of DG installations could be accommodated.

Table 5-5 below presents these results of the WEC system's saturation points, assuming no significant infrastructure changes to that system. As mentioned previously, this analysis is only a first step, and only so informative (e.g. it is unlikely DG installations will all be the same size and evenly distributed through WEC's territory). However, it does provide some indication of the status of specific substations. For example, Northfield is already at maximum capacity, with Jones Brook the next substation near capacity. Additionally, there were no feeders that approached or exceeded their loading limits during this analysis and each circuit was limited only by the high voltage criteria.

Table 5-5: Capability of WEC System to Accept Additional Solar

	Existing customer load* (kW)	**With no load, max additional solar (kW)**	**Total additional solar that can be installed at each substation (kW)**
Substation			
East Montpelier	690	471	1,161
Mount Knox	1059	394	1,453
West Danville	188	91	279
Jackson Corners	320	128	448
Moretown	350	262	612
Jones Brook	47	16	63
North Tunbridge	400	241	641
South Walden	562	248	810
Northfield at Maximum Capacity			0
Total additional solar that could theoretically be installed across the WEC System			**5,467**
*at minimum load during peak solar hours			

Clearly, the installation of new substations and/or the rebuilding of lines with either larger conductors or additional conductors would allow for additional solar projects to be safely installed but the cost of those upgrades would need to be considered first. Further, different parts of WEC's system would require individual analysis to assess the specific modifications that would be needed to allow for additional DG, once the saturation point had been reached. For example, adding phases to single phase construction, reconductoring lines with larger conductors, and adding line regulators.

Again, this level of analysis provides a high level view only and is limited with regards to its level of granularity and specificity throughout the WEC system. As described throughout this IRP, WEC's responsibility is multi-fold: providing reliable power in a safe manner at an affordable rate and in alignment with state/regional goals and requirements as well as the Board's and members' environmental and equity goals. Therefore, while this analysis shows that additional DG is theoretically possible to incorporate into the WEC system, other outstanding factors need to be considered. This includes the need for location-specific distribution system analysis and (potential) modification of the system to accommodate more DG, the need to assess financial implications, and the need to understand and address equity concerns. This more granular level analysis is complex and would require WEC to obtain electrical engineering modeling expertise to perform sensitivities on each feeder and circuit. The expense of doing this more detailed level of analysis may be beyond WEC's needs as it is a dynamic and evolving state of conditions as each incremental addition of DG impacts the system differently.

6. Action Plan

6.1. Overview of Supply Plan and Action Items

As noted in the 2016 Comprehensive Energy Plan, utilities should use the IRP process to address questions that are the most relevant to the utility at the time of the IRP. WEC met with the Department in advance of the filing to discuss key issues and questions it desired to address in this filing. WEC and the Department agreed that since WEC is not making large or longer term power supply decisions for the next five years, its IRP will be used to provide an update to its power supply situation while focusing more on other areas, such as the Act 56 Renewable Energy standard, net metering, impacts of distributed generation to the T&D systems, and its capacity market needs. In this IRP filing, WEC will provide updates to the major elements of its IRP and will focus on issues germane to it in the next several years.

WEC sees its largest question for the future not in large power supply and resources decisions other than capacity, but rather in costs and benefits and the impacts of changes to demand and grid modernization. Increased deployment of distributed generation is lowering WEC's energy revenues while cost pressures from transmission and capacity markets are driving costs up. To be sustainable and serve our members' needs in an industry moving toward rapid deployment of smaller distributed sources of generation and increased uncertainty of load, WEC looks to rate design and peak load control as a potential means of which to keep rates and bills to members stable while it also attempts to minimize subsidization between customer classes.

Lowering electric rates and bills, while maintaining environmental considerations, requires WEC to look at lower peak use at the time of the ISO-NE peak. In addition, flattening WEC's load shape and minimizing seasonable fluctuations where possible can help manage costs. WEC will also look at exploring ways to reduce its regional load levels while maintaining revenues (such as making more use of load reducers from internal generation sources) as a way to keep rate pressures in check. Rate design and analysis of WEC's cost of service may also help stabilize member bills and address a current dependence on obtaining revenue from the variable component or kWh sales.

The IRP simulations are intended to identify key issues WEC should monitor and assist WEC in charting a course towards an optimal strategic resource mix. The simulations also inform WEC how its existing supply commitments perform over time and under various market conditions. Since WEC does not at this time have a need to make large or long range resource decisions other than capacity, the IRP modeling is meant to serve as a means to identify how WEC's portfolio changes under varying market conditions. This allows WEC to plan for uncertainty and attempt to hedge risk in the day-to-day management of its portfolio. WEC has identified through this effort key drivers that will impact its members, and its action plan is framed to respond to these key variables and risks. While WEC is not making new resource decisions there is still the need to monitor and adjust WEC's decision-making to insulate it against price volatility and unexpected events.

The value of the simulated portfolio analysis is that it allows WEC to identify key variables and cost impacts from those variables to WEC long-term. WEC is better positioned to understand the potential cost volatility of its portfolio if markets change. Many factors will affect the management of WEC's resource portfolio over the 20-year planning horizon. WEC's action plans will respond to the uncertainties inherent in the management of its existing portfolio.

The exact portfolio in any given year will be dependent upon a number of variables analyzed in the IRP, plus variables that were not analyzed including (in no particular order):

- Impact on WEC's Mortgage Covenants including Operating Times Interest Earned Ratio (OTIER), TIER, and Debt Coverage;
- Impact on WEC rates;
- Capital requirements;
- WEC's access to capital;
- Pursuit of renewable power sources;
- Externalities;
- Balance of short-term costs versus long-term savings and vice-versa;
- Local economic impact;
- Supplier credit risk; and
- Credit assurance required of WEC.

The next step is to describe how WEC used the resource modeling to determine its action plan and decision-making. As noted above, the modeling output identifies and measures various market impacts and risks. From the modeling results, EFG spent time analyzing impacts from key variables (see Figure 2-12), reviewing resource costs, and developing a detailed understanding of other key metrics provided from the analysis. The model output was very informative and tells WEC what its biggest market risks are from a cost and volatility perspective. Once EFG assembled the metrics and identified risks, WEC then drafted plausible action plans.

Afterwards, EFG staff presented information and the draft action plans to WEC's Finance Account and Power Planning (FAPP) Committee, which is a subset of the full. The WEC FAPP committee is tasked with developing a more detailed understanding of power supply and financial impacts and subject matter. The FAPP committee acts as a study, screening, and test group and it informs the full board about financial and power supply related issues. In this role, it allows WEC to analyze and make decisions regarding power and operations in a more efficient manner.

For this IRP, WEC also provided the opportunity for all members to learn about and review the IRP findings. Members were notified via the WEC newsletter, and while there had been a handful of registrations, only two members participated (both Board members). The final presentation occurred at a WEC Board meeting in August, in which EFG staff presented model results and the General Manager sought approval for the development of the final action plan and IRP report. The Full Board unanimously approved the IRP results, including submission to the PUC.

This process can be described as a culmination of meetings and an iterative process to arrive at an end result. The decision-making blends a highly analytic exercise through the IRP modeling with qualitative reactions and policy level assessments from WEC's nine member elected Board of Directors. This process makes use of data, but also provides opportunity for member input and relies heavily on public discussion, open dialogue, and debate, rather than pure analysis.

This is standard procedure for any item that comes before the WEC FAPP committee or the WEC Board. For example, WEC identifies in IRP Section 2.8 several qualitative criteria that Board members may use to guide their decision-making. These include not only cost but diversity, risk, uncertainty, and environmental impacts. The FAPP committee and WEC Board use their judgment in weighing each of the criteria described in Section 2.8 to reach their conclusions relative to the IRP. Through meetings and discussions, WEC decision-makers vet data, share thoughts, exchange opinions, and ultimately reach conclusions as a group. These conclusions ultimately informed a final set of decisions and an action plan. WEC believes the synergy between the quantitative model output and the feedback from the WEC Board as policymakers is effective in driving WECs action plan and decision-making.

In the end, the vote to approve and support the WEC IRP and report was a vote of the nine member elected Board of Directors.

Through the analyses summarized in the prior sections of this IRP, WEC has developed action plans that focus on various activities designed to further refine and implement the resources, projects, and/or strategies identified as having potential benefits. The various action plan items are defined below.

6.2. Ongoing IRP Maintenance and Evaluation

WEC plans to supplement its IRP with further analysis, planning, and initiatives intended to minimize adverse impacts and risks:

- Affordability: In light of flat to declining load and rising costs, WEC faces rate pressure affecting affordability for its member owners. WEC will explore cost mitigation measures throughout WEC's operation. WEC will also look at alternative rate structures and means to build load that will offset costs for all members. WEC will explore Time of Use rates and load control efforts that will have a meaningful impact. WEC will examine ways to respond to changing load shape with focus on peak reductions that drive costs (transmission, capacity, etc). WEC will examine load filling mechanisms such as converting energy uses away from fossil fuels in transportation and heating sectors toward electric use where it is cost-effective to the member. WEC will look at cost of service designs and rate structures to equitably share costs among members. WEC will explore and identify real world impacts of legislative mandates that increase cost to WEC members and perform quantitative analysis to help inform policy makers of the impacts to WEC and its members 2020-2023.

- RECs: The analysis identified that the most significant driver to the Status Quo case continues to be the price of RECs. Therefore, this key variable deserves significant attention relative to monitoring and analysis.

  In fact, WEC has filed a 5.95% rate increase, which was in part driven by a fall in the price of RECs (this one item accounted for 3.04% increase to rates), while power costs due to transmission and FCM accounted for another 1.56%. As predicted in the 2014 analysis, a drop in REC prices can trigger significant cost pressure to WEC. This occurred in 2016, as REC prices have declined in the last two years from the mid 40's to low 20s. WEC plans to monitor changes in REC markets and secure contracts to minimize financial risk and maximize revenues. Other efforts are noted below:

  - Examine rate structure. WEC is looking at its cost and rate structure to see if different approaches may lessen the impacts of falling RECs and increased power costs that are beyond WEC's control, such as the price of capacity in the FCM market and cost of transmission. WEC will work with the Department and other stakeholders to explore mechanisms to recover costs from REC market changes outside of the traditional rate setting approach. Examples include a modified version of alternative regulation where deviations in power costs and REC revenues occur on the bill outside a companywide cost of service analysis;
  - Continue to obtain reports and analysis to help inform WEC of market fundamentals (ongoing);
  - Monitor legislative changes in all New England states (ongoing);
  - Monitor legislative changes in Vermont and participate in framing future laws that may impact WEC (ongoing);
  - Review REC portfolio approach (2020-2023);
  - Participate in discussions regarding a Renewable Portfolio Standard in Vermont or other carbon legislation to which WEC is subject, and, if necessary, adjust WEC's portfolio to comply with state/federal law and/or PSB rules, and do so as cost effectively as possible (ongoing);

- Reduce WEC's exposure to the variability in the value of Renewable Energy Certificates by exploring contracts longer than 2-3 years but which are also balanced with tradeoffs to reduce risk (2020-2023):
  - Consider unit contingent sales;
  - Consider sales that transfer changes in market rules to buyer;
- WEC buys back sufficient lower cost RECs to green up its power mix by purchasing and retiring renewable energy credits to not only meet but exceed the 55% target set forth in 30 V.S.A. §8005 (d)(4). WEC's internal goal is to maintain a 100% renewable mix, which it achieved in 2019. It will continue to achieve this goal by purchasing low cost RECs and retaining RECs from some of its existing sources of power. WEC will green up its portfolio and lower its emissions mix by buying back RECs or retiring a portion of RECs from its existing mix of power resources. WEC plans to continue selling high value Class 1 RECs while buying back lower cost RECs in other RPS markets, thus achieving the goal of lower emissions while keeping costs low to its membership (2020-2023).

- Coventry: Based on the results of Portfolio 2, financial ramifications of a large reduction in generation from Coventry affects WEC due to increased energy market purchases and also a loss of REC sales. WEC has insulated a large amount of energy market risk form loss of Coventry through the purchase of the HQUS contract and arrangement with VEC to take power back in the event of a sudden loss of the unit. WEC will explore other risk mitigation opportunities and related costs to protect it from a large reduction in generation:
  - Install new SRS systems (January 2017 - complete);
  - Monitor wells and production from landfill and work with landfill operator to maximize production (ongoing);
  - Work with O&M contractor to install refurbished engines (Q1 2017 - complete);
  - Perform emissions testing that will assure compliance with Title V air quality permit (ongoing);
  - Review existing insurance coverage (on going);
  - Assess value of shortening the length of REC contracts to insulate from lack of production in the event of a major failure at the plant, or lengthen contract

durations and include unit contingent sales (2020-2023);
    - Seek contractual assurances and warranties relative to contracts with key players associated with the landfill and O&M of the facility (on going).

- Wrightsville: FERC relicensing. Complete the historical site report for several areas located below the reservoir water line.
- FCM: Monitor WEC's capacity market position and ISO-NE prices through ISO-NE Market Committee participation. Continue to assess the ability to hedge capacity position long-term (ongoing):
    - Hedge against potential cost increases in the ISO New England capacity market by evaluating specific generating units or contracts for inclusion in the WEC resource mix especially in light of WEC's large open position relative to its capacity needs. Execute contracts if appropriate, particularly if the ISO-NE capacity markets become locational and higher Vermont zone prices become likely (2020-2023);
    - Minimize WEC's Forward Capacity Market expenses by identifying and evaluating ways to manage WEC's load at the time of ISO-NE's annual peak (ongoing);
    - Monitor the ongoing developments of ISO-NE Forward Capacity Market rules and potential impacts on auction results. These potential impacts may affect the economics of capacity resource acquisitions (ongoing);
    - Continue to look for ways to lower WEC's capacity obligation such as through load reducers (similar to the treatment of the Wrightsville hydro station), distributed generation resources, battery storage, and rate design (controllable loads and time of use rates) (ongoing).
- Transmission costs and RNS rates: Monitor ISO-NE Reliability and Transmission committee reports to assess changes and costs that drive RNS rates (ongoing):
    - Minimize WEC's exposure to ISO-NE transmission rates and maintain healthy revenues by cost effectively managing WEC's load at the time of the Vermont monthly peak in order to lower WEC's network load used in the computation of NEPOOL Open Access Transmission tariff and VELCO Transmission tariff charges (ongoing);
    - Continue to look for ways to lower WEC's transmission obligation, such as

    - through load reducers (similar to status change used for Wrightsville) and distributed generation resources (ongoing);
    - Continue to explore storage and demand shaping opportunities such as utility scale battery storage, member load control, and time of use rates (ongoing).
- WEC load forecast and impacts from net metered solar and electrification:
    - Continue to monitor the addition of net meter solar installations on WEC's system to assess the impact on WEC's energy need, including active participation in the biennial net-metering review investigations;
    - Monitor the impact that heat pumps and electric vehicles have on customer use patterns and implications for WEC's load.
- HQ US PPA outlook: Continue to monitor and assess WEC's coverage ratio relative to contract terms of the HQUS PPA and arrangement with VEC until WEC has a need;
- Vermont reliability issues: Monitor and/or participate in discussions and analyses regarding the potential impacts on costs due to the building of new power plants and the retirement of large central plant power plants (such as Vermont Yankee) and other reliability projects through VELCO. WEC notes market prices for the Sheffield project have been depressed due to an oversupply of generation relative to load in this portion of Vermont. Continued build out of generation in this region is forcing renewable sources of power to be backed down. Additionally, WEC is receiving lower credits for the power, which is adding to power costs (ongoing);
- ISO-NE issues: Monitor and/or participate in discussions and analyses regarding the ISO New England's Strategic Planning Initiative, which is designed to address concerns raised by ISO-NE staff regarding the generation mix in New England. The result of these could have a noticeable impact on wholesale power costs in New England. Investigate the use of financial hedging instruments to achieve the same goals as outlined above (ongoing);
- Rates: Explore member interest in and value of a Time of Use (TOU) rate and other rate designs which may encourage new technologies and load growth in off-peak periods (2020-2023);
- CWP: Update CWP 2019-2022 consistent with RUS requirements and with addition of the following elements which are identified in the Vermont Comprehensive Energy Plan IRP Guidelines (2016):

- Implement remaining projects from current CWP (2019-2022);
- Implement a distribution transformer load management (DTLM) or similar program;
- Create a current copy of the utility underground Damage Prevention Plan (DPP) (or provide a plan to develop and implement a DPP, if none exists).

- T&D: As a result of increased distributed generation, growing deployment of energy efficiency and new plug loads, WEC seeks to explore a T&D system analysis to assess a changing industry. WEC seeks to explore distributed generation and solar impacts on the grid through a self-assessment and to answer the broad overarching question: How much distributed generation can the T&D system accommodate? WEC developed a scoping process that will allow it to specify the tools, process, and protocols to be developed in order to plan and operate a modern grid capable of dynamically managing distribution resources, supporting retail markets that coordinate significant distributed generation investment, and efficiently managing resources.

  Engineering and modeling efforts will be used to help inform how WEC plans, operates, and develops its system (where and which types of resources and equipment are best located on WEC's lines). WEC will also seek to balance distributed generation needs and grid modernization with the total cost of our system and ultimately with the impact to members' rates and bills. The scoping process will include:

  - Outline and provide overview of WEC's T&D system;
  - Develop and articulate an integrated approach to planning, investment, and operations;
  - Develop an open process to promote utility/stakeholder relations, enable third parties the opportunity to provide cost-effective market solutions to identified energy needs, drive member value related to the distribution system, and embrace innovation where cost-effective;
  - Specify the expected or potential near-term effects of increased distributed generation penetration on the ability to serve members, with specific reference to each type of distributed generation and its grid interface;
  - Identify need for system upgrades regardless of distributed generation potential;
  - Perform a technical assessment and provide a description of WEC's T&D system with respect to changes from grid modernization (distributed generation,

energy efficiency, new plug loads such as EVs and CCHPs);

- Plan for circuit based analysis;
- Identify the level of distributed generation capacity on WEC systems on a given distribution circuit that could be integrated without additional upgrades or expansions;
- Identify system efficiencies (lowering of distribution losses, deferral/avoidance of investments and rebuild work);
- Develop a load forecast that will lead to a more integrated planning process: changing load shapes, increased distributed generation, and the effect that these factors will have on the existing system and any planned capital expenditures;
- Identify locations based on proposed capital plans where distributed generation has the potential to resolve or mitigate forecasted system requirements that would otherwise necessitate traditional infrastructure investments—for system expansion/upgrade and/or maintenance, including effects of storage and behind the meter generation on WEC's system;
- Identify specific system needs allowing stakeholders and market participants to identify opportunities;
- Identify collaboration efforts with other VT DUs, VELCO, and the VSPC process;
- Identify specific areas in WEC system where there is an impending or foreseeable delivery infrastructure upgrade need, and where upgrades would have immediate benefit;
- Identify specific areas where there is no projected delivery infrastructure need for years to come and hence the infrastructure avoidance value of distributed generation is likely to be lower or insignificant in the short-term;
- Identify and distinguish operational needs during normal operations and during outage events or other periods of system stress (low voltage condition, near thermal limitations, etc.) and plans to implement reliability enhancing protocols such as fault location, isolation, and service restoration;
- Develop information on optimal locations and levels of storage facilities, either on the system or behind the customer's meter, as storage technologies integrated into grid architecture may potentially be used for reliability and to support the deployment of other distributed resources;
- Prepare system data on a substation basis: hourly load curves, voltage, power quality, reliability;
- Prepare individual feeder system data (load data, voltage, power quality,

reliability, etc.) for feeders within areas that distributed generation is expected to have more value;
  - Consider and propose demonstration projects as appropriate in order to continually improve, refine, and otherwise drive toward the state's energy objectives;
  - Develop maps and other means to identify geographically where distributed generation is best suited;
  - Explore other DU and public sources related to solar mapping efforts and use early research to help guide analysis.

  WEC's T&D planning efforts will be an evolving and dynamic process. As we learn more about our system and perform more detailed studies relative to distributed generation and grid modernization, we will adapt our efforts and report findings through the IRP process. Distribution system planning must become more dynamic, and the methods applied must adapt to and account for the changing environment. New approaches to planning (including risk-management techniques and financial incentives) that predict rather than prescribe, and envision flexible rather than static distribution systems, can best reduce redundancy while increasing system reliability and affordability;

- Fiber Assessment - Explore benefits of deploying fiber throughout WEC's service territory.
- Education: Use IRP to communicate to key stakeholders:
  - Public Meeting (2020);
  - Post IRP on WEC website (2020);
  - Information in *Co-op Currents* (2020);
  - Educational material for WEC Board of Directors (ongoing);
- Update IRP in three years (2023).

6.3. Summary Wrap Up

For WEC, the IRP is a planning tool that helps guide resource decisions and charts a path for the future relative to power supply and other major capital investments. It is not intended to be a fixed and prescriptive outline of what WEC will do next, but rather a dynamic and evolving planning tool to help inform and guide WEC decision-making. The approach measures and analyzes how various resource options and plans are projected to perform in any number of future market environments, and on how well such plans satisfy WEC stakeholders' needs.

This report presents the results of an Integrated Resource Plan prepared by EFG and WEC. The plan is consistent with state rules, goals, and directives for an IRP. Consistent with Vermont's statutory policy, WEC uses the IRP as a key component in the development of its own strategic plan and understanding of its changing needs to delivery power consistent with its members' interests and policies of WEC.

WEC's goal is to develop a plan that supports the following:

- Provide energy to members as inexpensively as possible;
- Maintain financial strength and assure economic equity for its member-owners;
- Improve performance of WEC's distribution system for the benefit of members and provide access to local generation sources in WEC's service territory;
- Manage power supply, distribution, and transmission service at lowest cost, with consideration for environmental impacts and social concerns;
- Promote responsible environmental practices at WEC and assist members in doing so;
- Maintain strong member, community, and government relations in a changing environment;
- Maintain strong organizational, administrative, and communication services.

WEC's action plan endeavors to carry out balance among all WEC goals to deliver high quality and affordable electric service to its members. The portfolio WEC developed and the action steps reflect tradeoffs between various goals, costs, and meeting members' needs.

7. Appendix

List of Documents:

A. Summary Count of WEC Members by Town

B. 2016 CEP Appendix B: Guideline for Integrated Resource Plans and 202(f) Determination Requests

C. Memorandum of Understanding between Washington Electric Co-op and the Vermont Department of Public Service 2017 IRP

D. 2015 WEC Residential Satisfaction Survey

E. WEC Net Metering Tariff filed January 17, 2017

F. WEC 2020 Tier III Annual Plan

G. 2019 System Reliability Report

H. Vegetation Plan

I. Docket 8714 Vermont Public Service Board Determination as Renewable Energy Provider Act 56

J. Construction Work Plan 2019-2022 & Project List Update

K. WEC Filing in Case No. 19-0855-RULE

L. Case No. 19-1270-TF. WEC's Tariff Filing for Rate Design Changes and a Change in Rate Schedules. Effective beginning June 17, 2019.

Appendix A.

2020 Summary Count of WEC Members by Town

TOWN	# Of Members
BARNET	2
BARRE	387
BERLIN	80
BRADFORD	128
BROOKFIELD	228
CABOT	464
CALAIS	684
CHELSEA	428
CORINTH	706
DANVILLE	279
DUXBURY	430
EAST MONTPELIER	709
FAYSTON	315
GREENSBORO BEND	48
GROTON	451
HARDWICK	34
MARSHFIELD	196
MIDDLESEX	548
MONTPELIER	19
MORETOWN	310
NEWBURY	102
NORTHFIED	280
ORANGE	456
PEACHAM	180
PLAINFIELD	334
RANDOLPH	20
ROXBURY	105
RYEGATE	55
STANNARD	99
STRAFFORD	6
TOPSHAM	602
TUNBRIDGE	313
VERSHIRE	278
WAITSFIELD	41
WALDEN	582
WASHINGTON	199
WEST FAIRLEE	2
WHEELOCK	23
WILLIAMSTOWN	832
WOODBURY	69
WORCESTER	241
TOTAL	**11265**

Appendix B: Guidance for Integrated Resource Plans and 202(f) Determination Requests

The first portion of this appendix serves to provide a general set of guidelines that should be helpful in development of utility Integrated Resource Plans ("IRPs"). The second portion briefly discusses the process the Public Service Department ("Department") uses under 30 V.S.A. §202(f) in determining whether a proposal is consistent with the *Vermont Electric Plan*.

The *2016 Comprehensive Energy Plan* (2016 CEP) incorporates the Electric Plan. Where the Electric Plan is referenced in statute, the relevant document is the 2016 CEP[1].

Especially relevant to electric utility IRP planning and consistency determinations under 30 V.S.A. §202(f) are Chapters 9, 10, and 11 which directly address electric power. Chapters 12 and 13 outline the state's approach to particular energy resource types (e.g. solar, wind, natural gas, etc.). Natural Gas utilities should see the natural gas section of Chapter 13 for information about the Department's approach to natural gas.

Although those chapters are most relevant, the entire 2016 CEP is the Electric Plan. IRPs and other utility actions that must be consistent with the electric plan should be consistent with 2016 CEP more broadly.

[1] The *2016 Comprehensive Energy Plan* is available on the Department's website at https://outside.vermont.gov/sov/webservices/Shared%20Documents/2016CEP_Final.pdf

Contents

Part A: Integrated Resource Planning Guidelines

Introduction

Pursuant to 30 V.S.A. §218c[2], each regulated electric or gas company is required to prepare and implement a least cost integrated plan (also called an integrated resource plan, or IRP) for provision of energy services to its Vermont customers. The *Vermont Electric Plan* and Public Service Board ("PSB" or "Board") Orders, beginning with Docket 5270, define requirements that a distribution utility's complete IRP should meet in order to pass the Department's review and comply with the Board's approval requirements.[3]

The IRP process and the implementation of each Vermont utility's approved plan are intended to meet the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs. (30 V.S.A. §218c). The cost and benefit factors to be considered include both direct monetary costs and benefits, and indirect impacts such as environmental and other societal effects.

This addendum establishes guidelines for the development of integrated resource plans; however the ultimate content and organization of an electric distribution utility's plan will be unique to each

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[2] 30 V.S.A. §218c. Least cost integrated planning

(a)(1) A "least cost integrated plan" for a regulated electric or gas utility is a plan for meeting the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs. Economic costs shall be assessed with due regard to:

(A) the greenhouse gas inventory developed under the provisions of 10 V.S.A. § 582;

(B) the state's progress in meeting its greenhouse gas reduction goals;

(C) the value of the financial risks associated with greenhouse gas emissions from various power sources; and

(D) consistency with section 8001 (renewable energy goals) of this title.

(2) "Comprehensive energy efficiency programs" shall mean a coordinated set of investments or program expenditures made by a regulated electric or gas utility or other entity as approved by the board pursuant to subsection 209(d) of this title to meet the public's need for energy services through efficiency, conservation or load management in all customer classes and areas of opportunity which is designed to acquire the full amount of cost effective savings from such investments or programs.

(b) Each regulated electric or gas company shall prepare and implement a least cost integrated plan for the provision of energy services to its Vermont customers. At least every third year on a schedule directed by the public service board, each such company shall submit a proposed plan to the department of public service and the public service board. The board, after notice and opportunity for hearing, may approve a company's least cost integrated plan if it determines that the company's plan complies with the requirements of subdivision (a)(1) of this section and is reasonably consistent with achieving the goals and targets of subsection 8005(d) (2017 SPEED goal; total renewables targets) of this title.

[3] Natural gas utilities (of which there is only one in Vermont at this time) are also subject to §218c, but not to §202 which establishes the Electric Plan.

individual utility. The IRP process is intended, in part, to facilitate information exchange among utilities, regulatory agencies, and the public.

Utilities should use the IRP process to address questions that are the most relevant to the utility at the time of the IRP. Where issues or considerations listed in this document are not germane to the utility, the Department and the utility should, in advance of the utility filing, discuss whether those issues should be included. Also, IRP planning should be conducted with other planning exercises, such as the construction work plan or RUS requirements, in mind. Where a forecast or analysis would serve the purpose of meeting multiple planning obligations, utilities should not be obligated to perform multiple analyses. IRPs will reflect the wide range of planning capacity at Vermont's utilities.

Utilities should use the IRP process to develop methods they will use to evaluate competing investment and purchase decisions to meet customer demand. The range of options available to utilities to balance supply and demand are expanding as new generation, load control, storage, and smart grid technologies become available and affordable. The characteristics of supply and demand resources are changing as well. Historically load was viewed as a fixed obligation which utilities planned to meet with dispatchable supply. Higher penetration of intermittent generation and controllable loads mean that utilities must begin to plan for a future in which both demand and supply have some controllable and some uncontrollable aspects. Grid operators must prepare for more complex grid choreography to balance supply and demand.

Act 56 of 2015 created a Renewable Energy Standard (RES) for electric utilities that requires renewable energy totaling 55% of retail electric sales in 2017, with that requirement growing 4% every three years to 75% in 2032 (Tier 1). Of these renewable resources, some (1% of retail sales in 2017 growing to 10% in 2032) are required to be new, small, distributed generators connected to Vermont's distribution grid (Tier 2). The Act also requires utilities to assist their customers in reducing fossil fuel consumption (Tier 3). Implementation of Tier 3 may result in some electrification of transportation and heating which will impact both overall demand and the daily load profiles of various customer classes. The RES will have significant effects on how utilities plan to balance supply and demand within their portfolios.

In this context, utilities should use the IRP process to demonstrate the underlying methodology and a set of specific tools they will use to evaluate options for balancing supply and demand at the lowest present value life cycle cost as they arise. Because the operating environment is rapidly evolving, using the IRP process as an opportunity to develop, test, and demonstrate these methodologies will allow utilities to react with a greater degree of flexibility as economic and technological conditions in the industry change.

The 2016 edition of this document reflects several important changes to the IRP process:

- An emphasis on using methods for load forecasting and evaluating supply options which can effectively account for uncertainty in emerging technologies.

- The addition of an optional financial analysis which anticipates changes to a utility's cost of service under different scenarios.

- Guidance about how utilities should consider higher penetration of distributed energy resources and increased electrification.

- Discussion of the implications of the RES for load forecasting and supply planning.

These guidelines are intended to highlight areas of importance to the Public Service Department and facilitate further discussion between stakeholders. Where this addendum suggests "consideration" of a topic, the topic may be addressed in the written IRP, discussed with the Department prior to submission of the IRP, or both.

Filing and Approval Process

Filing Schedule and Review

Utilities are required to complete a new at least every 3 years, on a schedule directed by the PSB. The document should reference applicable background reports, analyses, and supporting materials, and the utility should hold these for public and Department review. The utility should file an IRP with the Board that is complete and in accordance with the guidelines contained in 2016 CEP, including this appendix, and Board Orders.

Utilities in Vermont vary widely in geographic size, sales, and staffing levels. Utilities should produce IRPs which reflect the complexity and size of their operations.

Department Review

During the three years prior to the utility filing its IRP with the Board, the utility and the Department should meet periodically and work together with the goal of the utility filing an IRP that is supported by the Department. In addition to reviewing whether the IRP meets requirements described in state statute, Board Orders, and the *Vermont Electric Plan*, the Department will review the methodologies used by the utility in undertaking least cost integrated planning and make recommendations as to the soundness of those methodologies. The Department's recommendation of approval or non-approval of the IRP is independent of the particular conclusions of the plan, and contingent only on the efficacy of the employed methodology and consistency with statutes, Board orders, and the *Vermont Electric Plan*. Open communication and interaction between the Department and the utility early in the IRP process should allow the Department to evaluate and support a range planning methodologies.

The Department's review will encompass multiple areas of expertise. The Department's Engineering Division will meet with the utility's engineers to discuss the portions of the plan related to transmission and distribution infrastructure, while load forecasts or power portfolio analysis are the subject of discussions with the Department's Planning and Energy Resources Division. Cost of service and financial implications will bring in the Finance and Economics Division. Timely review and potential support of the IRP depends on effective and engaged communication from both the utility and the Department during these parallel conversations.

Public Service Board Review and Approval

Each regulated electric company shall submit a proposed plan to the Department and the Public Service Board. PSB review will include notice and opportunity for hearing, and based on the evidence of record, a determination as to whether a utility's IRP is consistent with 30 V.S.A. §218c, Docket 5270, and other relevant PSB Orders. The Board may approve the IRP, approve it in part and reject it in part (with or without conditions), or fully reject it. Robust proposals that have included engagement with the Department will improve the likelihood of approval.

Distribution of the IRP

Utilities should file copies of the IRP and any revisions or updates with the Board and the Department; electronically and three hard copies with Department, and such filing with the Board as it may require. Electronic copies should be made available to the Department, the PSB, and the public. Hard copies of the IRP should be made available upon request (at a price not to exceed publication and mailing costs) to parties that intervene in the IRP proceeding and interested citizens of Vermont. The most current IRP should be available on the utility's website.

Required Elements

A robust IRP should contain the following elements:

1. **Executive Summary** suitable for distribution to the public, with an overview of the major components of the IRP.

   The executive summary should also include a description of the utility's current business and system including information such as the number of customers, peak load, which towns the utility serves, the number of substations and circuit miles, current sources of power etc.

2. **Table of Contents** which gives titles and page numbers for sections as well as sub-sections.

3. **Forecasts and Scenarios** which includes load forecasts and alternative scenarios.

4. **Assessment of Resources** which reviews the existing resource mix, identifies a broad range of supply-side options, models the integration of new resources, and leads to the selection of a preferred portfolio.

5. **Financial Assessment** which presents the utility's business plan for the future while providing information on changes in its overall cost of service and electric rates.

6. **Assessment of the Transmission and Distribution System** which evaluates options for improving system efficiency and reliability and presents plans for bulk transmission, grid modernization, and vegetation management.

7. **Assessment of Environmental Impact** which quantifies, assigns a value to, and then considers any significant environmental attributes of the resource portfolio.

8. **Integrated Analysis and Plan of Action** that looks across demand, supply, finances, and transmission and distribution, to identify a least-cost portfolio and a preferred plan of action.

1. Forecasts and Scenarios

IRP analysis begins with a load forecast along with the development of several alternative scenarios. Load forecasting is a long-standing practice of estimating a utility's load based on a range of economic, technological, and weather data. Scenario planning on the other hand considers dynamic or surprising futures that can result from rapidly changing circumstances such as economic downturns, large-scale deployment of new technologies, or changes in customer behavior.

Both forecasting and scenario planning help utilities develop tools to evaluate how they should react to changes in the electric power sector on an ongoing basis in a world where many factors influencing supply and demand are complex and uncertain.

The Department recognizes that utility load forecasts continue to evolve due to many factors including changes in overall economic growth, differential growth across ratepayer groups, volatility in power supply fuel costs, and policy actions. Methodologies used to produce forecasts also continue to evolve as more tools are developed and data become available. Given that historical relationships between these assumptions have changed and are likely to keep changing, the following long-term forecasting guidelines are provided.

1.1. Demand Forecasting

A clear and complete description of the forecast methodology and assumptions should be provided, along with a discussion of the methods and sources used to derive assumptions. If separate models are developed and used for short-term and long-term forecasting, the utility is responsible for providing adequate support for both, along with a clear explanation of methods used by the utility in combining the forecasts.

a. Base Case Forecast

The utility is expected to provide long term forecasts for energy and seasonal (winter and/or summer, as appropriate) peaks, accounting for extreme weather possibilities, to ensure that adequate resources are available to meet customer needs.

b. Weather and Probability

The IRP should include a description for the methodology chosen to incorporate weather into the peak demand forecast. The effects of weather events are a significant factor in developing forecasts of peak demand load. For example, the utility may use historical weather data to create predictions of "average" and "extreme" weather conditions or the utility may develop or use an industry standard 90/10 forecast (a forecast with a 90 percent probability that the actual peak demand will be at or lower than the forecast).

c. Economic Assumptions

Most IRPs will use a commercially available macroeconomic forecast to 'drive' the utility forecast, or at a minimum provide forecasts of key drivers in the model. In doing so, the utility should:

1) Consider referencing one or more alternative forecasts to solicit a range of future outcomes. Alternative forecasts could be averaged to generate a baseline forecast or the spread between forecasts might form the basis for a range in possible economic outcomes;

2) Consider coordinating long term forecasts and planning scenarios by using a baseline forecast that references forecasts by ISO-NE, VELCO, the Vermont System Planning Committee (VSPC) and/or uses similar methodology;

3) Consider the relationship between statewide macroeconomic forecasts and economic activity in the utility's service territory. In other words, consider whether there are significant differences in economic structure and performance in the service territory, such as clear and present seasonal differences from the statewide forecast. If so, the utility should develop proxies for 'local' economic conditions prior to estimating the load forecast;

4) Incorporate into its forecast model economic and structural variables. These variables may include electricity prices, prices and availability of fuel substitution, measures of ability to pay, demographic changes, economic output, or government policy actions;

5) Clearly identify key indicators that drive electric load; and

6) Clearly document the vintage of any macroeconomic forecast used.

d. Policy, Codes & Standards

State and federal policy has a significant impact on electric load. State and Federal building codes and appliance standards affect the amount of overall electricity consumption in the state, both annually and during peak demand periods. Where appropriate, forecast adjustments should be made to incorporate the predicted energy effects of building code updates occurring on a three year basis. Federal appliance and lighting efficiency standards have been established, have known effective dates, and are subject to continual revision. The utility is encouraged to consider, and incorporate where appropriate, the effects of these standards on both energy consumption and available efficiency savings. The codes and standards assumptions and resulting forecast adjustments should be clear and well defined.

e. Renewable Energy Standard (RES) Compliance for Tiers 2 and 3

The Renewable Energy Standard (RES) requires that utilities acquire supply from distributed resources and engage in energy transformation projects to reduce their customers' use of fossil fuels. As of this writing, the Public Service Board has not issued a ruling specifying how utilities should implement the RES; however, the RES makes clear that under Tier 2 utilities are required to obtain significant supply resources from distributed generation. Some of these resources will be "behind the meter" projects that impact net load on an annual, seasonal, and daily basis. For example wide-scale deployment of behind the meter solar both reduces net demand and shifts summer peaks to later in the day.

Under Tier 3 utilities will be aiding customers to reduce their fossil fuel use through a variety of "transformation" projects. These projects may include some efficiency measures that could affect electricity usage as well as fossil fuel usage and they may include measures designed to shift energy use in transportation and heating from liquid and gas fossil fuels to electric-based technology. The addition of these new technologies may drive load upward and shift consumption to different times of day or different seasons. For example, wide-scale adoption of electric heat pumps may increase winter demand for electricity.

When forecasting load, utilities should explicitly consider how their plans for Tier 2 and 3 compliance may impact load from the perspective of total annual sales, and also seasonal and daily use patterns.

f. Demand-Side Management Forecast

Since 2000, energy efficiency services in Vermont have been delivered for most utilities by Efficiency Vermont (EVT), a third party program administrator. EVT forecasts its "statewide" energy and summer peak demand savings with Public Service Board approved planning budgets.

For utilities that deliver their own electric efficiency services, but have specific Board approved planning budgets and savings forecasts, the utility should incorporate those forecasts into the base case and provide a discuss how it expects forecasted energy efficiency savings to affect load.

In both cases, utilities should consider:

1) If and how forecasted efficiency savings will materialize in the utility's customer territory; and

2) How much efficiency investment is embedded in the utility's historical data, affecting its base load forecast.

Utilities may also consider inclusion of alternate scenarios of energy efficiency that depart from the Public Service Board approved 20-year planning budgets.

Independent of efficiency forecasts, the utility should forecast, to the extent applicable:

1) Demand response resources forecasted to be available;

2) Demand impacts of other load management strategies such as rate design; and

3) Energy and power supplied by net metered generators.

4) Where applicable, the forecast should also include projected impacts on load due to or enabled by the adoption of advanced metering infrastructure or other grid modernization technologies.

The utility should consider inclusion of low and high case forecasts for these resources on its system.

g. Emerging Technologies

The utility should explicitly describe its consideration of the expected impact of emerging technologies on its demand forecast, as well as planning for supply and T&D. The utility should also describe its expectations for the adoption of any other new technologies that may increase energy and power needs.

The 2016 Comprehensive Energy Plan explicitly aims to increase electrification in transportation and heating. The RES also creates a Tier 3 obligations will directly impact not only the total amount of energy utilities must provide, but may alter the load shapes of many customer classes. Utilities should consider:

1) Distributed, net-metered generation;
2) Plug-in electric vehicles;
3) Heat pumps;
4) Energy storage; and
5) Other fuel switching technology.

h. Updating the Forecast

Economic and load forecasts should be updated on a regular basis and as significant changes in the environment occur (e.g., economic conditions or government policies that may significantly affect future demand, such as standards or taxes). Utilities should also revise forecasting methods that demonstrate poor performance.

1.2. Alternative Scenarios

In some previous IRPs, scenarios have been developed by adjusting the base-case demand forecast both upward and downward, but without the consideration of disruptive exogenous forces or the possibility of the utility controlling or shaping load itself. Emerging technologies in the electricity sector have the potential to fundamentally reshape how electric power is generated, delivered, consumed, and paid for within the 20-year planning horizon of the IRP. Utilities should use the IRP process as an opportunity to consider not only how load will incrementally grow or shrink, but to evaluate whether and how new technologies and socio-economic forces that are uncertain and outside of the utility's control will impact it and its customers, as well as how new kinds of utility interventions could influence when customers use electricity and how much they use.

Utilities are encouraged to choose a methodology which has sufficient flexibility to evaluate these potentially disruptive and transformative trends for both load forecasting and evaluating supply options. The specific issues the utility considers, and the methodologies it employs to do so are left up to the utility. However, that methodology must be capable of fully addressing uncertainties in electrification, distributed generation, storage, controllable loads and other emerging technologies that may radically change load, supply, and financial solvency of the utility.

One potential method utilities could employ is scenario planning.[4] Scenarios are not predictions of what will happen, but plausible futures that may happen. Utilities can use scenario planning to consider how some of these possible futures may play out and develop tools that will help them react to changing circumstances as they evolve, and actively shape the conditions they will face. Each utility faces a different set of concerns, so scenarios developed by that utility should reflect its unique characteristics.

As utilities consider possible alternative futures, the Department is interested in knowing not necessarily how exactly the utility might respond, but *what tools and methods* it will use to decide how to respond. These tools will likely include modeling as well as decision-making processes, customer/member engagement, and new innovative programs.

a. Sources of Uncertainty

There are many sources of uncertainty for utilities across the 20-year planning horizon. Some are related to emerging technologies and others are related to exogenous economic forces, weather, or demographics, etc. Methods developed by utilities should include ways to evaluate sources of uncertainty. Scenario planning is one such method, but not the only one.

Because the Comprehensive Energy Plan and the RES call for increased distributed energy resources as well as significant electrification in transportation and heating, utilities should use their IRPs to consider how these state-level policies will impact load and supply, as well as the utility's own role in shaping and managing load. Therefore, methods chosen by the utility to forecast load and compare supply options should be capable of considering the best course of action for the utility under a "high DER (distributed energy resources) and electrification scenario." Utilities should consider the rapid development of high levels of behind the meter generation, storage, and controllable loads as well as significant electrification in the transportation and building heat sectors. Distributed energy resources and electrification will impact *both* supply and demand.

Methods developed by the utility should also consider areas of particular relevance to that utility. The list below is provided to stimulate thinking about possible futures which differ significantly from base case scenarios.

1) The cost of energy, capacity, and RNS charges at the regional level is either significantly greater or significantly less than current levels.

2) Small-scale solar generation continues to rapidly deploy, constituting an accelerating percentage of the utility's supply; or changes in various incentives cause a slow-down in solar development.

3) The value proposition for electric storage, at either the utility scale or for end-users, improves significantly, for example such that it and can be used to more

[4] For a description of scenario planning in the context of electric utilities, see NARUC's Scenario Planning in a Utility Regulatory Context. Available at http://www.naruc.org/Publications/FINAL%20Full%20Colorado%20SERCAT.pdf.

closely coordinate intermittent supply with demand; or electric storage for end-users remains out of reach.

4) Customers can significantly reduce their net load to the grid by procuring their own generation and storage and they do so in increasing numbers; or customers continue to purchase the vast majority of their needs from the grid, but play a larger role in supply, load control, and/or storage. Note that this could vary significantly by rate class.

5) Electric load grows significantly as transportation and heating are electrified; or penetration of electric cars and heat pumps remains low.

6) Socio-economic forces cause a dramatic increase or decrease in load because of either economic boom or bust.

7) There is an increase in dramatic weather events which cause many more outages and require greater emergency response from the utility.

b. Impacts to Utility Operations

After the utility has identified relevant future scenarios, it should develop methods to consider how it will balance supply and demand, while maintaining or enhancing power quality and reliability. Unlike incremental changes to load, disruptive circumstances will impact the timing and scale of system peak and total energy usage. For example, increased solar production is shifting net peak demand later in the day and may require resources or infrastructure to be planned for later in the day.

Depending on how these sources of uncertainty play out, the least-cost path to balancing demand and supply while ensuring safety, reliability, and power quality will create impacts and require the utility to acquire a different portfolio of resources (broadly defined). To balance supply and demand, utilities should consider both traditional centralized supply solutions as well as distributed energy resources. Utilities should take an integrated look, considering not only the cost of the resource, but the impact of that resource on the grid including any necessary or avoided upgrades.

The IRP should present strategies to address the impact of future scenarios on the following aspects of utility operations:

1) Seasonal load profiles for different types of rate classes;

2) Power supply portfolios on summer and winter peaking days;

3) Timing and magnitude of system peak;

4) Transmission and distribution system upgrades;

5) Recovery of sunk costs;

6) Rates;

7) Total load and supply;

8) RES compliance.

c. **Ongoing Application**

The utility should develop methods to consider the various possible futures they develop which can be deployed between IRP cycles to evaluate demand, supply, business model, and infrastructure options as they are evolving. These tools might include cost of service models, decision trees for selecting least cost options, methods for considering attributes such as resilience or microgrids, and geo-targeting of efficiency or other DER measures. These methods and tools should be deployed when utilities make major decisions about power supply, load control, and system upgrades.

1.3. Data, Models, and Information

a. **Data and Models**

In developing forecasts and scenarios, utility should utilize relevant historical data. To aid in review, numerical data should be made available in electronic formats usable by the Department and Board.

The development of forecasts for the 20-year planning period should include consideration of the following information:

1) Customer counts, by class;

2) Total sales of electricity by customer class (annual or by season, as appropriate);

3) Peak load (annual or by season, as appropriate); and

4) Annual sales and coincident system peak contribution for each major customer class.

The IRP or its technical appendices should also document:

1) Source and vintage of independent economic models employed:

2) Description of the forecast model including the relevant variables, coefficients, and the form of the final model;

3) All historic values used in estimating model coefficients;

4) Summary statistics and diagnostics performed on the final model;

5) Characterization of the process used in the development of the final model including variables considered and rejected;

6) Description, including sources, for assumptions including end use detail where applicable;

7) Reason(s) for including any qualitative (dummy) variables, composite variables, and trend variables used in the model; and

8) Historic and forecast values for independent drivers of the forecast, fully documenting the basis for projecting them.

2. Assessment of Resources

The assessment of resources provides an inventory of existing resources and presents supply options along with relevant information about the characteristics of that supply. Throughout the resources section of the IRP, utilities should integrate their plans to meet RES obligations under Tiers 1, 2, and 3.

2.1. Existing Resources

A complete assessment of the utility's existing resources should include an evaluation of the following:

1) Existing and committed base case generating capacity and firm power transactions currently under contract;

2) Potential changes to existing resource commitments, including, but not limited to, re-powering, fuel switching, and life extension of power plants or power contracts;

3) Loss reduction in transmission and distribution systems, and improvements in generation and/or T&D areas;

4) Existing renewable resources;

5) Utility construction and jointly developed projects;

6) Power and REC purchases, including:

    - Purchases through the Standard Offer program;
    - Purchases to satisfy utility RES obligations under Tiers 1 and 2;
    - Purchases from independent power producers;
    - Purchases from other utilities;
    - Customer owned generating capacity;
    - Resources developed through pooling, wheeling, coordination arrangements, or through other mechanisms; and
    - Any other Board approved bid solicitation programs.

2.2. Supply Options Inventory

In describing supply options to consider over the planning period, the utility should identify options in some or all of the following classes:

1) Existing utility owned resources that will serve as future resources should be described, including potential costs.

2) New supply resources that a utility has considered should be discussed, including construction cost, construction schedule, and expected in-service date.

3) Power pooling, power agreements and inter-utility coordination.

4) Opportunities to purchase energy and/or capacity from other utilities or entities should be identified, including a description of the resource potential and costs.

5) Planned purchases necessary to meet reserve margin requirements, and planned energy hedge trades which provide price certainty and reduce exposure to volatility.

6) Existing non-utility generation in the utility's service territory, including customers with generation capability for self-generation, peak shaving, or emergency back-up, which may reduce the need for new capacity.

7) New non-utility owned generating facilities or technologies available, along with options likely to be available during the planning period. It may be appropriate to consider generic examples of particular technologies, rather than specific potential facilities. The utility should also describe the potential for such facilities by technology and fuel type, the likely amounts of capacity and energy available from such facilities at various prices, ownership, the environmental impacts of such facilities, and the availability of such capacity and energy during the 20-year planning period.

8) Interruptible service offerings to improve system capacity utilization.

9) Off-system sales contracts when the utility has excess capacity. When a utility has excess capacity, analysis should be provided in the IRP concerning how it intends to increase efficiency and pursue least-cost service through management of off-system sales.

2.3. Assessment of Alternative Resources

For potential generating facilities and technologies identified as credible options for meeting load during the planning period, the utility should provide the specific information in items 1-10 below.

For consideration of a generic resource and technology (e.g. solar PV, utility-scale wind, natural gas combined cycle, or market purchases) rather than consideration of a particular facility, generic assessments of these characteristics may be appropriate.

1) Description of supply resource – Where available, list the name and location of each station, unit number, type of unit, installation year, heat rate, rated capacity and net capability, capacity factors, net (dependable) summer and winter capability, and installed environmental protection measures.

2) Availability of resource – Delineate the planned and unplanned outage rates and capacity factors of the units or technologies assessed in the IRP.

3) Operating costs – Describe the costs to acquire, operate, and maintain the technology (in addition to fuel costs). The utility should identify historic, fixed, and variable costs for producing energy for the past five years, and projected fixed and variable costs of producing energy over the planning horizon.

4) Maintenance requirements - A comprehensive maintenance program is important in providing reliable, low-cost service. The utility should identify expected remaining useful life, maintenance requirements and outages for base load, intermediate and peaking units.

5) Fuel supply – The utility should specify and describe fuel types, fuel procurement policies, and potential for fuel switching/substitution.

6) Fuel supply reliability – The utility should describe its contingency plan regarding potential supply disruptions, and strategy to meet the goal of having a reliable supply of low cost fuel.

7) Fuel prices – Describe historical fuel prices for the past five years and projected fuel prices over the planning horizon (the fuel forecast should be consistent with the range of load forecasts). The price forecast methodology should be clearly stated and defined.

8) Condition assessment – For resources owned and/or maintained by the utility, describe the utility's plan to maintain and operate supply resources, where economically feasible, at their current levels of efficiency and reliability.

9) RES compliance – Whether the resource satisfies Tier 1, Tier 2, or Tier 3 requirements.

10) Economic risks associated with environmental costs – Where applicable, the utility should identify the quantities of air pollutants, liquid wastes, and solid wastes that are produced by any generation option per unit of electricity produced. In addition, the utility should identify the environmental risks affecting existing and alternative supply resources.

2.4. Smart Rates

IRPs should discuss whether current rate designs for each major customer class are consistent with other components of the IRP, and consider how potential future changes in rate design could facilitate IRP goals. Load control programs should be compared for cost-effectiveness with alternative resources.

The *2016 Comprehensive Energy Plan* requires utilities with AMI infrastructure to develop a plan to move to smart rates as the standard option. Smart rates could include time-of-use rates, critical peak pricing, dynamic peak pricing, peak-time rebates, and real-time pricing. The IRP should include such plans for smart rate deployment and estimate the impact smart rates may have on total demand, peak demand, and infrastructure requirements.

A utility's choice of one of these pricing structures for its customer classes could have significant impacts on the demand for both capacity and energy, the relationship between components in a power supply portfolio, and the necessary transmission and distribution infrastructure to deliver the required energy to customers. An IRP should address how the utility plans to incorporate new dynamic pricing structures or rate designs or qualify for the exception outlined in the 2016 CEP (p. 226). The IRP should discuss the expected or projected impact of these planned or potential rate structures on load, power portfolios, and infrastructure requirements, or describe plans to characterize these impacts.

3. Financial Assessment

The financial assessment, new to this edition of the IRP guidelines, is optional for IRPs completed under this guidance document, although utilities are strongly encouraged to submit a financial assessment as part of their IRPs. The Department anticipates making the financial assessment mandatory for the next planning cycle after reviewing the optional submissions.

Should utilities choose to complete a financial assessment, it should present a strategic direction for business. It should consider the impact of the utility's preferred action plan (see Section 6) on revenue, expenses, income, and financing. The financial assessment should describe the utility's expected cash flow and describe its financing plan for any capital expenditures. It should also present the expected financial results of the utility's business plan while providing information on changes in its overall cost of service and electricity pricing.

Relatively simple 5-year financial projections can be made by applying an inflation rate to known, current business expenses and adding in the cost of any known new capital expansions.

3.1. Cost of Service

A utility has an obligation to its ratepayers to manage risk and minimize its system cost. Utilities should evaluate and balance the expected costs, business risks, and long-run public policy goals in developing and selecting a business model portfolio with the best cost-risk combination.

Resource portfolio analysis provides input to the cost of service model that determines the impact on customer rates of each portfolio. The cost of service model includes the impacts of lost sales in the rate calculations for each portfolio. This allows for the assessment of rate impacts of the resource portfolios.

A utility's cost of service model would recognize a utility's financial objectives while meeting energy resource needs through a balanced, lowest cost portfolio, with supply, demand, and energy efficiency options.

Included in the financial section of a utility's IRP filing should be its expected revenue requirement and cost of service for the next 5 years that could include but would not be limited to:

1) Production;
2) Transmission;
3) Distribution;
4) Customer accounts;
5) Sales;
6) Administration & general;
7) Depreciation;
8) Taxes other than income taxes;
9) Other interest expense;
10) Income taxes;
11) Cost to finance rate base;
12) Total cost of service;
13) Expected rate revenues;
14) Rate base;
15) Financing plans including cash flows and planned capital expenditures.

Information on the utility's financial metrics and ratios over the IRP planning horizon should also be provided. The financial ratios could include but would not be limited to:

1) Interest coverage ratio (operating income plus depreciation, divided by interest expense);
2) Debt service ratio (operating income plus depreciation, divided by interest expense plus principal payments);
3) Equity to debt ratio (total equity divided by the total debt outstanding);
4) Return on equity and weighted average cost of capital;
5) Credit rating of the firm; and
6) Each of its outstanding debt instruments.

4. Assessment of the Transmission and Distribution System

Each electric utility should plan and conduct a comprehensive study evaluating options for improving transmission and distribution (T&D) system efficiency and reliability. Based on the findings of that study, it should then implement a program to bring its T&D system to the level of electrical efficiency that is optimal on a present value of life cycle cost basis within a reasonable period of time. These studies and action plans should be reviewed and updated at reasonable intervals. Finally, each utility should implement a program, as part of its IRP, to maintain T&D efficiency improvements on an ongoing basis.

4.1. T&D System Evaluation

Each utility should evaluate individual T&D circuits to identify the optimum economic and engineering configuration for each circuit, while meeting appropriate reliability and safety criteria. The IRP should contain a detailed description of how and when the utility will carry out these evaluations.

Decisions regarding some facilities may affect more than one utility. In such instances, utilities should work together so that their evaluations reflect not only their individual interests, but also the interests of ratepayers generally.

The standard for establishing optimum T&D system configurations and for selecting transmission and distribution equipment is the net present value of life cycle cost. This life cycle cost should be evaluated on both a societal and utility/ratepayer basis. This standard requires consideration of a project's capital costs and life cycle operating costs, as well as benefits resulting from the construction of enhanced system configurations and the installation of energy efficient T&D components. These benefits include avoided operation and maintenance costs, and avoided energy and capacity costs.

Avoided energy costs include the direct costs for energy, the costs for energy consumed as line losses, and T&D delivery costs. Avoided capacity costs include fixed costs and capacity charges for power including on peak line losses, fixed costs and capacity charges for T&D, the cost of Capability Responsibility reserve obligations, the deferral of T&D investments. Other benefits of T&D system efficiency include reduced environmental externalities and reduced market prices due to reduced demand for energy and capacity.

Evaluations should identify and compare all technically feasible investments to improve system reliability and efficiency. At a minimum, evaluations should include (and assess the economics and technical feasibility where appropriate) the following measures:

1) The utility's power factor goal(s), the basis for the goal(s), the current power factor of the system, how the utility measures power factor, and any plans for power factor correction;

2) Distribution circuit configuration, phase balancing, voltage upgrades where appropriate, and opportunities for feeder back-up;

3) Sub-transmission and distribution system protection practices and philosophies;

4) The utility's planned or existing "smart grid" initiatives such as advanced metering infrastructure, SCADA, or distribution automation (see Section 4.6);

5) Re-conductor lines with lower loss conductors;

6) Replacement of conventional transformers with higher efficiency transformers;

7) The utility's distribution voltage settings (on a 120 V base), and whether the utility employs, or plans to employ, conservation voltage regulation or volt/VAR optimization;

8) Implementation of a distribution transformer load management (DTLM) or similar program (see Section 4.2);

9) A list of the locations of all substations that fall within the 100 and 500 year flood plains, and a plan for protection or relocation of these facilities.

10) A discussion of whether the utility has an underground Damage Prevention Plan (DPP), or plans to develop and implement a DPP, if none exists;

11) The location criteria and extent of the use of animal guards.

12) The location criteria and extent of the use of fault indicators, or the plans to install fault indicators, or a discussion as to why fault indicators are not applicable to the specific system.

13) A pole inspection program, the plans to implement a pole inspection program, or a discussion as to why a pole inspection program is not appropriate to the specific utility.

14) The impact of distributed generation on system stability.

4.2. T&D Equipment Selection and Utilization

Each utility should describe the process(es) used to select all major equipment (not limited to transformers) according to least-cost principles.

Utilities should develop and adopt any necessary procedures to meet the following standards:

1) All transformer selection and purchase decisions fully reflect the value of projected capacity and energy losses over the equipment lifetime with due regard for expected loadings and duty cycles;

2) Inventory of transformers in use and on hand is to be managed to match transformer loss characteristics with customer load factors; and

3) An ongoing system to monitor and adjust transformer loading for optimal economic benefit is in place.

4.3. Implementation of T&D Efficiency Improvements

As individual circuit evaluations are completed, utilities should schedule the implementation of all cost-effective measures within a reasonable period of time. A utility's IRP should note any progress- to-date in the evaluation of circuits, the development of implementation plans for circuits in which evaluations have been completed, and the completion of efficiency measure installations.

4.4. Maintenance of T&D System Efficiency

Transmission and distribution systems are dynamic in nature, i.e., their configurations and capacities change over time to meet the changing needs of customers. Consequently, the implementation of a set of efficiency measures on a given circuit should not mark the end of the attention given to that circuit. Rather, T&D system optimization should be pursued as an ongoing effort.

Utilities should, as part of their planning efforts, set out a program for maintaining optimal T&D efficiency. This program and progress in it should be reported thoroughly in the utility's IRP and describe, through operating procedures, design criteria, equipment replacement standards, etc., the manner in which optimal T&D efficiency will be maintained. All subsequent cost-effectiveness analyses performed under this program should maintain the standard of present value of life cycle costs.

4.5. Other T&D Improvements

In addition to the improvements outlined above, utilities should comply with the following T&D- related improvements, which address several areas important to T&D least cost planning and system reliability.

a. Bulk Transmission

VELCO, as the responsible planner for Vermont's bulk transmission system on behalf of Vermont ratepayers and utilities, should give special consideration not only to the efficiency of its own facilities, but also to the impact its actions may have on the efficiency of sub-transmission and distribution. Where appropriate, VELCO should support and cooperate with others, including the state’s electric distribution utilities, in undertaking regional T&D optimization studies. The societal test coupled with suitable reliability analysis and attention to strategic planning issues should form the basis for planning and technical evaluation. Where additional transmission capacity is determined to be required following consideration of all non-transmission alternatives, the preferred method for increasing transmission capacity should be upgrading existing facilities within existing transmission corridors (unless it can be demonstrated that such a measure would have a substantial adverse impact on the electric system or societal costs). The utility’s IRP should describe the process undertaken to facilitate inter-utility coordination relative to transmission planning. Transmission projects are reviewed by VSPC established pursuant to PSB Docket 7081. Active utility participation and information sharing in the VSPC should increase the state’s ability to meet reliability requirements in a least-cost manner.

b. Sub-Transmission

Sub-transmission planning should take into account broader interests than those of individual utilities. Where appropriate, integrated regional reliability improvements and sub-transmission system optimization should form the basis for the basic planning and technical evaluation criteria. Utilities should cooperate as needed to assure efficient operation and installation of sub-transmission plant while also assuring an acceptable level of reliability, justified by suitable probabilistic analysis. If necessary, joint utility or utility-regulatory processes should be established to coordinate this activity; collaboration under the auspices of the VSPC may facilitate this coordination. The utility’s IRP should describe the actions taken facilitate inter-utility coordination relative to sub-transmission planning.

b. Distribution

The Board is authorized by statute (30 V.S.A. § 249) to designate exclusive service territories for electric utilities in order to reduce or eliminate the existence of duplicate electric facilities. Where duplicate electric facilities exist, the companies responsible should seek to eliminate the duplication to the extent possible.

In the process of building, rebuilding or relocating lines to roadside, electric utilities should coordinate with the appropriate telephone and cable TV companies during the planning and construction phases to ensure that, wherever possible, no permanent duplicate facilities are installed along the same road and that the transfer of existing facilities to new or replaced poles is done in an expeditious manner.

The Department encourages all utilities to use the NJUNS software to track transfer of utilities and dual pole removal. The utility's IRP should describe the efforts undertaken to ensure coordination with relevant telephone and cable companies relative to transmission and distribution planning.

While there can be significant benefits from roadside relocation of distribution lines, this activity can have a significant adverse impact on Vermont's scenic landscape. Therefore, companies proposing extensive roadside relocation programs should work with all interested stakeholders (ANR Department of Forests, Parks and Recreation; Public Service Department; Regional Planning Commissions; local governments; and the Agency of Transportation as appropriate) to address aesthetic concerns, including techniques or approaches that mitigate the impact on aesthetics. Where the relocation would have only a minimal impact on visual resources, little or no mitigation may be required. However, for projects in areas with high-value visual resources more extensive mitigation procedures should be considered including:

1) Relocation to the less sensitive side of the road;
2) Use of alternative construction techniques such as spacer cable, armless construction, and relocation underground;
3) Development of a site specific vegetation management plan; and
4) Alternative routing.

These discussions should also consider other important factors such as cost, reliability, and worker and public safety.

4.6. Grid Modernization

"Grid Modernization" and "Smart Grid" generally refer to a class of technology that is being used to modernize utility electricity delivery systems by implementing measurements of circuit parameters, two-way communications technology, and computer processing. This technology includes "advanced meters" which are digital meters that play a key role in grid modernization by measuring voltage, demand (kW), and energy (kWh) at hourly or sub-hourly intervals, and by enabling two way communications. For example, utilities could use these voltage measurements to optimize the voltage on a distribution circuit, and employ conservation voltage reduction where appropriate. The potential benefits are that a smart grid would enable utilities and their customers to track and manage the flow of energy more effectively (including the cost of electricity at a given time), curb peak demand, lower energy bills, reduce blackouts, and integrate renewable energy sources and storage to the grid (including electric and plug-in hybrid vehicle batteries). The smart grid also has the potential to increase energy efficiency, thereby reducing environmental impacts of energy consumption, and empower consumers to manage their energy choices. Distribution Automation is also a term that includes technologies that enable a utility to remotely monitor and operate its distribution system, which should result in improved reliability and operational efficiencies. The Department encourages utilities to investigate grid modernization technologies and to implement those that are cost effective.

4.7. Vegetation Management Plan

Each utility should describe its current vegetation management plan (including both cyclic ROW trimming and hazard/danger tree removal) or, if they have not already done so, they should evaluate the merits of implementing a systematic vegetation management plan. Some of the information required in this section may be common to several of the smaller utilities, providing a potential opportunity for these utilities to share in the cost of collecting the information for their respective reports. However, each utility should submit its own report because each utility is responsible for ensuring that the vegetation management program in its service territory is undertaken in a least-cost manner.

A utility may find it useful to work with the Department of Forests, Parks and Recreation to improve the utility's line clearing standards, train utility clearing crews, and update its vegetation management plan. Public information and education is an area in which materials developed by one utility could be shared by other utilities, thus reducing costs. It is important for utilities to make their customers aware of the dangers of trimming near utility lines and the importance of planting low-growing species beneath power lines.

In describing its current vegetation management plan, each utility should provide the information specified in the table below. In addition, the utility should provide a detailed explanation of why its current vegetation management program represents the least cost program, including details on the relative composition of tree species present in its service territory, the annual growth rates of these species, and the vegetation management techniques used (including when, where, and how herbicides are used). Each utility should discuss in its IRP the means used to evaluate the effectiveness of the vegetation management program, including monitoring the number of tree related outages as compared to the total number of outages, and analyzing and comparing the cost of proactive vegetation management versus the cost of responding to storms.

<table>
<tr><th colspan="2"></th><th colspan="2">Total Miles</th><th colspan="2">Miles Needing Trimming</th><th colspan="2">Trimming Cycle (years)</th></tr>
<tr><td colspan="2">Sub-transmission</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Distribution</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2"></td><td>Y-2</td><td>Y-1</td><td>Y</td><td>Y+1</td><td>Y+2</td><td>Y+3</td></tr>
<tr><td colspan="2">Amount Budgeted</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Amount Spent</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Miles Trimmed</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Note: Y = the last full calendar year.

4.8. Studies and Planning

Each utility should include a description of all engineering and operational studies conducted since its last IRP, and all studies planned for the next three years. The utility should also include a list of all capital projects completed since its last IRP or in progress. Capital projects planned for at least the next three years should be included in the action plan (see Section 6.4).

4.9. Emergency Preparedness and Response

In its IRP, each utility should describe storm/emergency procedures, such as securing contract crews, dispatch center, participating in utility conference calls, and updating vtoutages.com. This should include a discussion regarding how often vtoutages.com is updated, and, if applicable, what could be done to update it more frequently. Also discuss the utility's operating procedure for internal and external public notifications of planned and unplanned outages.

4.10. Reliability

Each utility should provide in its IRP the data for the last five full calendar years for CAIDI and SAIFI as reported pursuant to PSB Rule 4.900 (i.e., without major storms excluded). These data may be presented in either tabular or graphical format. The utility should discuss the trends of these data, and, if applicable, what additional actions may need to be taken.

5. Assessment of Environmental Impact

The IRP should demonstrate an understanding and due consideration of any significant environmental attributes of the resource portfolio, current or planned. These impacts should be quantified where possible. This could include consideration of greenhouse gas emissions, NOx, and SOx, along with any other environmental impact such as waste disposal. The utility should consider any environmental impacts that it deems material to the outcome of its load management and supply portfolio analysis. If it chooses to exclude any particular pollutants or impacts from analysis, should give an explanation as to why it chose to do so. The utility should clearly demonstrate the derivation of the values used to estimate environmental impacts, including emissions rates, lifetime emissions, and the dollar value of emissions or other environmental costs.

The RES internalizes the cost of many of the externalities associated with greenhouse gas emissions; although the requirements of the RES phase in over time and do not fully eliminate greenhouse gas emissions from the utility portfolio. As the RES phases in, the externalized costs of greenhouse gas emissions should be reduced in IRPs to coincide with reductions of greenhouse gas emissions in the portfolio.

30 V.S.A. section 218c requires due regard of the financial risks associated with greenhouse gas emissions, and the value of such risks should be incorporated into least cost planning where possible. The statute requires that:

> "Economic costs shall be assessed with due regard to:
>
> (A) the greenhouse gas inventory developed under the provisions of 10 V.S.A. § 582;
> (B) the state's progress in meeting its greenhouse gas reduction goals;
> (C) the value of the financial risks associated with greenhouse gas emissions from various power sources; and
> (D) consistency with section 8001 (renewable energy goals) of this title."

6. Integrated Analysis and Plan of Action

The IRP should integrate its use of existing and planned supply resources, T&D improvements, and demand-side resources into a consistent plan that meets the need for energy and capacity. The plan should minimize total costs relative to benefits, showing all financial, regulatory, and other significant assumptions including how environmental externalities have been considered. Utilities should, to the extent feasible, report the results of their IRPs in at least the following areas:

1) Expected capital and operating costs of the resource plan and its effect on utility revenue requirements;

2) Impact on costs passed to customers;

3) Impact on the environment;

4) Effects on fuel and technology diversity;

5) Increased coordination between T&D planning and power portfolio planning;

6) Impact on reliability of the system;

7) Impact on the utility's financial condition;

8) Impact on the state and local economies, to the extent feasible; and

9) Use of renewable resources and trajectory for achieving statutory and other targets or goals.

6.1. Risk and Uncertainty Analysis

IRP analysis should characterize the principal sources of uncertainty and the associated risks to utilities and their customers. It should go beyond uncertainties in load to consider other factors that may present risks to the utility and its customers such as fuel prices, loss of a major source of supply, and other key forecast drivers and assumptions behind the base case forecast and resource mix. Where analysis reveals unacceptable levels of risk to the utility and its customers with its present portfolio, the utility should characterize avenues for addressing such concerns.

Analyses should be conducted to examine the risks and uncertainties associated with meeting the customers' energy service needs. The IRP should discuss such analyses which are particularly informative to the development of the action plan. Discussion with the Department during the preparation of the IRP may include discussion of risks not included in the final IRP document. Risks and uncertainties to be considered include, but are not limited to:

1) Fuel prices for electricity production and for customer end-uses;

2) Assessment of current economic conditions;

3) Variation in economic factors;

4) In service dates of supply and demand resources;

5) Unit availability;

6) Market penetration rates for, and the cost-effectiveness of, demand-side programs;

7) Inflation in plant construction costs and the cost of capital;

8) Changes in discount rates;

9) Possible federal or state legislation or regulation;

10) New technological developments; and

11) Unit decommissioning or dismantlement costs.

6.2. Identification of Least-cost Portfolio

Utilities should evaluate a variety of portfolio strategies, noting the uncertainty and sensitivity of each. Strategies that deliver the lowest cost under optimal conditions, but are highly sensitive to the operating environment, may not be the most appropriate choice. Strategies that achieve a relatively low cost under a variety of contingencies may be preferable. Utilities should explicitly account for the critical interactions among potential supply options.

The critical requirement in developing a least cost portfolio of resources is to maintain an unbiased evaluation of options to increase supply and modify demand and to fairly balance costs, risks, and societal impacts. Given the uncertainties inherent in this process, there may be a variety of projects available with identifiable costs and benefits that do not differ widely. Benefits and costs should be evaluated using both a societal test and a utility or ratepayer test; other tests or metrics (such as rate impacts or robustness to uncertainty) may also be appropriate to include.

The integration section of a complete and robust IRP includes a thorough discussion of the following:

1) Identification of an optimal portfolio of supply and distributed energy resources, bulk transmission, T&D, and rate design projects, with a summary of the expected annual energy and capacity costs or savings contribution of each selected option over the planning horizon. Significant concerns of managing the optimal portfolio that relate to financing, project timing, line loss and reserve requirements, and organizational factors should be identified along with any critical externalities that influenced inclusion of the option.

2) Discussion of the methodology and assumptions used to derive the optimum portfolio, with discussion of the sensitivity of results to important assumptions.

3) Discussion of reasonably competitive projects not included in the optimum portfolio, including reasons for exclusion, and whether or not projects will be available for consideration if the strategic environment changes.

4) Discussion of contingency plans associated with the higher risk components of the selected portfolio, including events that would alter the portfolio and trigger a utility's decision to either adopt or terminate a measure.

6.3. Preferred Plan

A complete IRP develops a preferred least-cost plan that fully explains, justifies, and documents the manner in which it was developed, including an explanation of how it ensured internal consistency in avoided costs and retail electricity prices. Where the utility's preferred plan does not minimize net societal costs, the IRP should discuss the utility’s reasoning for pursuing the plan selected.

6.4. Implementation or Action Plan

A complete IRP includes effective strategies for implementing the least-cost integrated portfolio identified in the preferred plan. Provisions for research and data collection necessary to improve planning performance (saturation surveys, supply and demand marketing studies, distribution system mapping) can also be included as proposed action items.

A sound and complete implementation plan should include the following:

1) An overview of the preferred least cost portfolio, briefly discussing how it will be administered and updated.

2) For each near-term program project identified in the preferred plan and scheduled for implementation within three years, provide the following:

    - General procedures for implementing, monitoring, and evaluating the project;

    - General work plan for the project; and

    - Identification of important contingencies that may arise as the strategic environment changes and projects evolve, including adjustment to project plans that should be made to minimize adverse impacts.

3) For any program project identified in the preferred plan and scheduled for implementation after three years, provide a list of expected decision points.

6.5. Ongoing Maintenance and Evaluation

After its IRP is approved, a utility is responsible for administering approved projects, evaluating and reporting on progress, and effectively maintaining its IRP.

Part B: Consistency Determination

The Department under 30 V.S.A. §202(f) reviews certain proposed actions by electric utilities to determine the consistency of those actions with the current adopted version of the *Vermont Electric Plan,* which is the *2016 Comprehensive Energy Plan* (2016 CEP). Companies contemplating proposals for actions subject to PSB approval under 30 V.S.A. §108 or §248(b) should also request a determination in writing from the Director of Planning and Energy Resources under 30 V.S.A. §202(f).

In addition to determining consistency with the specific text of the *Comprehensive Energy Plan*, the Department will look for consistency with statutory state policies, goals, and requirements, including the goals and policies established in 30 V.S.A. sections 202a(1), 202a(2), 218c, 218e, and 8001.

1. Process

a. Notification

Any company making such a proposal should notify the Director at least 60 days in advance of the proposed action and include, at a minimum, the following information:

1) A description of the proposed action;
2) The nature of the arrangements being proposed;
3) The capacity and/or energy and the terms of the arrangements being proposed;
4) An explanation of the objectives the company seeks to accomplish with the proposed action;
5) How it relates to the company's short and long-range power supply plans;
6) How it relates to the 2016 CEP; and,
7) Any other relevant information.

b. Regulatory Response

The Department will advise the company if additional information on the proposed action will be needed. If so, the Department will make appropriate information requests. The Department will issue the resulting determination as quickly as feasible following the receipt of requested information.

The Department wishes to expedite the review and determination process in every way compatible with its responsibility to conduct a thorough review of proposed actions. For that reason, companies are encouraged to initiate discussion of major proposed actions at an early date.

2. Filing Components

Typical information needed for utility power supply projects or purchases includes the following components. Other actions are likely to require different kinds of information.

a. Economic Analysis

Calculation of the societal costs and benefits of a proposed supply action and of the supply and DSM alternatives the utility has considered. The underlying data, including production simulations and DSM program data, should be included. Submitted analysis should also include discussion (and where possible, calculation) of the opportunity cost of the proposed action.

b. Sensitivity Analysis

Since the results of societal test analyses are highly sensitive to key assumptions that may be hard to predict, it is necessary to determine how varying those assumptions may alter the competitiveness of the proposed action. For this reason, the utility should conduct additional studies incorporating variations of those assumptions (utilizing tools such as Monte Carlo or scenario analysis and including correlations among variables where practicable). All assumptions subject to changes that would have a significant impact on the analysis results should be reviewed. The variations to be studied may be developed with the Department in advance of filing.

c. Diversity Calculations

To help gauge the degree of dependence on the proposed project, a utility's analysis should show the percentage of its energy and capacity requirements the proposed action will provide during the project's life, based on production simulation results.

Similar calculations should be shown for the aggregate energy and capacity from the proposal plus all other entitlements of the utility that use similar technology and fuel.

Appendix C.

STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 17-3664-PET

Petition of Washington Electric Cooperative, Inc.
for approval of its 2017 Integrated Resource Plan

MEMORANDUM OF UNDERSTANDING BETWEEN WASHINGTON ELECTRIC COOPERATIVE, INC. AND THE VERMONT DEPARTMENT OF PUBLIC SERVICE

WHEREAS, on July 17, 2017, Washington Electric Cooperative ("WEC") filed a Petition with the Vermont Public Utility Commission ("PUC") seeking approval of its 2017 Integrated Resource Plan ("IRP") pursuant to 30 V.S.A. § 218c;

WHEREAS, WEC and the Department of Public Service ("Department") have engaged in discussions and negotiations regarding the content of WEC's 2017 IRP;

NOW THEREFORE, in consideration of the mutual promises and representations contained herein, the parties agree and stipulate as follows:

TERMS AND CONDITIONS

1. The parties agree that WEC's 2017 IRP, as conditioned by paragraph 8, should be approved by the PUC pursuant to 30 V.S.A. §218c(b) in that it describes a decision-making process that is likely to meet the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs.

2. WEC's IRP, as conditioned by paragraph 8 below, is found to be consistent with the State's Comprehensive Energy Plan ("CEP").

3. WEC and the Department agree that the IRP describes a decision making process that is consistent with meeting the Renewable Energy Standard set forth in 30 V.S.A. § 8004.

4. WEC's IRP articulates how societal cost data is utilized in resource decision making. WEC agrees to continue analyzing the cost of service from both a ratepayer and societal perspective in making resource decisions. In future IRPs, WEC agrees to explicitly describe its application of the societal test, including assumptions utilized in the societal test, and identification of impacts and analysis on key variables and possible resource portfolio impacts.

5. WEC and the Department met on several occasions and engaged in valuable and substantive discussions regarding the IRP throughout 2016 in advance of WEC's petition for approval. WEC agrees to meet with the Department periodically prior to and during the development of its next IRP with the goal of WEC filing an IRP that is supported by the Department.

6. The Department and WEC agree that approval of the IRP shall constitute approval of the decision-making process described in the IRP only and shall not constitute approval of any of the specific decision-making tools, analytic methods, or outcomes described in the IRP.

7. The Department and WEC agree that approval of the IRP shall not relieve WEC of its ongoing duty to:

a. monitor key uncertainties and the continued accuracy of assumptions and data in the IRP;

b. continue to reevaluate the merits of the decision-making processes, including but not limited to the analytic methods used, and to adapt such processes to new techniques or information; and

c. continue to reevaluate the merits of its decisions.

8. WEC, under the United States Department of Agriculture Rural Utilities Service's (RUS) financing requirements, must complete a Construction Work Plan ("CWP") and supporting documents as part of its loan application which outlines construction and work plans for its electrical distribution systems. WEC has completed several CWPs using guidelines put forward by RUS, which are outlined in RUS' System Planning Guide for Construction Work Plans (Bulletin 1724D-101B). The development of a new CWP (2018 – 2021) is in progress, and will include all of the transmission and distribution related criteria that the Department generally requests to be articulated within an IRP. The stipulating parties agree that requiring information to be provided in the 2017 IRP that is duplicative of requirements of the CWP being developed is neither efficient nor in the ratepayers' interest. Thus, the stipulating parties agree that WEC will engage with the Department in developing the 2018 – 2021 CWP to ensure that the transmission and distribution related criteria that the Department generally requests to be articulated within an IRP are included in the CWP, and that the 2018-2021 CWP will be filed with the PUC by June 30, 2018.

9. WEC will consider including in its 2020 Integrated Resource Plan information regarding strategies WEC is currently employing and plans to employ regarding strategic electrification and Tier III and cost related impacts. WEC will work with the Department in advance of the 2020 IRP filing relative to this provision.

10. WEC will perform a quantitative analysis of innovative strategies for peak shaving related to regional coincident and Regional Network Services peaks, including an assessment of battery technology and utility load control devices, for inclusion in its 2020 Integrated Resource Plan.

11. WEC will prepare and incorporate an updated load forecast for its 2020 Integrated Resource Plan.

12. The stipulating parties have made compromises in order to reach this MOU. Accordingly, by agreement of the stipulating parties, this MOU shall not be construed by any party or tribunal as having precedential impact on any future proceedings involving the parties, except as necessary to implement this MOU or to enforce an order of the PUC resulting from this MOU. The stipulating parties reserve the right in future proceedings to advocate positions that differ from the positions set forth in this MOU, and this MOU may not in any future proceeding be used against any undersigned party, except for enforcement of this MOU or the PUC's Order adopting this MOU.

13. The parties, in accordance with 3 V.S.A. § 811, hereby waive the opportunity to file exceptions and present briefs and oral arguments with respect to a proposal for decision to be issued in this case, provided that the proposal for decision is consistent in all material respects with this MOU.

14. This MOU is expressly conditioned upon the PUC's acceptance of all of its provisions substantially in its entirety. In the event the PUC fails to approve this MOU substantially in its entirety, then at the option of either party, the Parties' agreements as set forth herein may terminate, and each shall have the same rights as each would have had absent this MOU.

Exercise of the option to terminate this MOU shall be by written notice delivered to the Department and the PUC no later than ten days after issuance of a PUC Order triggering the option.

15. This MOU may be executed in multiple counterparts, which together shall constitute one agreement.

16. This MOU is governed by Vermont law and any disputes under this MOU shall be resolved by the PUC.

17. The Department will support issuance of the orders and findings of the PUC specified herein subject to the Department's obligations under Title 30 of the Vermont Statutes Annotated.

Dated at Montpelier, Vermont, this 14th of November, 2017.

VERMONT DEPARTMENT OF PUBLIC SERVICE

By: ______________________________
Sheila Grace, Esq., Special Counsel

Dated at Montpelier, Vermont, this ___ day of November, 2017.

WASHINGTON ELECTRIC COOPERATIVE, INC.

By: ______________________________
Ronald A Shems, Esq.
Counsel on behalf of WEC

Appendix D.

NRECA

A Touchstone Energy® Cooperative

2015 RESIDENTIAL SATISFACTION

10/12/2015

Washington Electric Cooperative

Survey Results Prepared by:

NRECA MARKET RESEARCH SERVICES

WASHINGTON ELECTRIC COOPERATIVE

Final Report

Table of Contents

2015 Residential Satisfaction

WASHINGTON ELECTRIC COOPERATIVE

EXECUTIVE SUMMARY

Following are the top-line findings based on the results of a telephone/online survey of 480 residential members of Washington Electric Cooperative (WEC) conducted in September of 2015:

- Overall satisfaction with Washington Electric Co-op is very good, with a mean rating of 8.49 on a 10-point scale. Satisfaction is higher among phone respondents (8.67) than online respondents (7.95), which is typical when comparing scaled questions from an interview-administered survey to one that is self-administered. The mean rating for overall satisfaction does not differ significantly from the co-op's 2010 study, although the proportion giving the highest ratings of "9" or "10" has increased. The co-op's American Customer Satisfaction Index (ACSI) is 80, which is the same as WEC's 2010 survey and higher than Touchstone Energy and the IOU industry leaders.
- The nine performance quality attributes are also evaluated very positively; seven have mean ratings above 8.0 on a 10-point scale, which can be considered good. The four attributes evaluated most positively are in regards to the *service reliability* and the employees being *competent/knowledgeable, friendly/courteous* and *able to handle complaints and problems*. Performance ratings for all four of these attributes significantly improved from the 2010 study. This is good news because these are also the attributes deemed most important to members, with mean importance ratings well above 9.0.
- The attributes on which the co-op is evaluated least well, with mean performance ratings below 8.00 are *helping members learn to manage their energy use* and *providing a good value for the money spent*. The attributes with the largest gaps between mean importance and performance ratings are *providing a good value for the money spent* and *looking out for members' best interests*. It is very typical that these cost-related attributes are found to be the areas with the most room for improvement in members' perceptions.
- More than six in ten members (63%) feel it is very important that WEC provides them with renewable energy sources, giving a rating of "9" or "10". Three in ten feel that renewable energy from large to moderate central plants is the most important type of generation among those tested. Although still very high, the overall perceived importance of renewables has declined significantly from the 2010 study.
- Nearly half of the members say they would probably or definitely use a time-of-use rate program if one were available from WEC. Younger members, newer members, and those with households of three or more people are especially interested in this option.

BACKGROUND

Washington Electric Cooperative (WEC) is a consumer-owned electric distribution cooperative headquartered in East Montpelier, Vermont. The co-op currently serves more than 10,500 members in Washington, Orange, Caledonia, and Orleans Counties in north central Vermont with approximately 1,200 miles of electric line.

WEC has previously conducted residential member satisfaction studies, with the most recent completed in 2010. The results of tracking surveys provide value in two ways: by demonstrating when results remain consistent and by indicating where there has been significant change over time. The co-op has experienced some recent events that are likely to have an impact on members' attitudes and satisfaction:

- The co-op last raised rates in July 2014.
- In the past year the co-op has introduced solar hot water installations and online credit/debit payments.
- The area experienced a 10-day storm in December 2014 during which up to 55% of the membership was without power.

OBJECTIVES

This residential member survey addresses but is not limited to the following informational objectives:

- ***Overall Satisfaction and ACSI***: Assess how satisfied members are with Washington Electric Cooperative and determine their American Customer Satisfaction Index (ACSI) and retention percentage.
- ***Performance Quality Attributes***: Evaluate how residential members perceive the importance of and WEC's performance on various service aspects (e.g., problem resolution, co-op employees, community commitment, reliability, value, etc.).
- ***Performance Quality Trends and Benchmarks***: Compare the results to past studies to identify trends and benchmark the results against co-ops nationwide using NRECA's Co-op Norms Database (where possible).
- ***Programs, Services, and Communication***: Explore members' interest in a time-of-use program, awareness and use of SmartHub, and newsletter readership.
- ***Member Identity***: Estimate the proportion of consumers who identify themselves as member-owners, member-customers, or just customers of the co-op.
- ***Member Demographics and Segmentation***: Provide demographics of the residential member base and identify differences in attitudes between segments.

METHODOLOGY

Data were collected through telephone and online surveying. Telephone interviewers were thoroughly trained on interviewing techniques and on the questionnaire prior to initiating the survey. During this training, the survey instrument was reviewed to ensure that all surveys would be completed in the same manner. On average, the telephone interviews lasted approximately 9.5 minutes.

Telephone surveys were completed with a total of 302 residential members of WEC between September 8 and 24, 2015, with random sampling done proportionate to average electric use. Of those contacted, 161 declined to participate, resulting in a response rate of 65%. Additionally, 129 of the phone numbers attempted were disconnected.

An e-mail invitation was sent to a random sample of 1,001 members for whom Washington Electric Cooperative has an e-mail address, with 95 returned as being undeliverable. A total of 178 surveys were completed online, resulting in a response rate of 20%. The data are weighted so that the online methodology represents 25% of the total data.

The margin of error at the 95% confidence level for the entire sample is plus or minus 4.4 percentage points. This means that a result of 50% in the survey may range between 45.6% and 54.4% in an infinite number of residential samples this size.

ANALYSIS

The graphics presented in this report are based on data collected from the current study and tracking results from a study conducted in 2010. Comparisons are also made to results from similar studies conducted by 74 co-ops among 30,000 residential members across the nation between July 2012 and June 2015. These "Co-op Norms" are not taken from the universe of all cooperatives; rather these are co-ops who value, monitor and measure the satisfaction of their members and therefore represent higher performing co-ops, not all co-ops. Because previous studies were conducted as phone surveys, comparisons to previous years are made to just the phone respondents.

Differences between member segments, such as differences by age or service tenure, are pointed out and characterized as being either statistically significant or not. When the term "significant" is used, this refers to the certainty of a difference, not the magnitude or size of the difference. Significance is measured at the 95% confidence level, meaning that the difference is not likely a matter of chance (there is sufficient evidence to reject the null hypothesis of no difference).

When evaluating the mean ratings in this report, on a 10-point scale a mean of 9.00 or above should be considered "excellent" and a mean between 8.00 and 8.99 is considered "good". Means below 8.00 may be cause for concern and those below 7.50 indicate problems and a need for improvement.

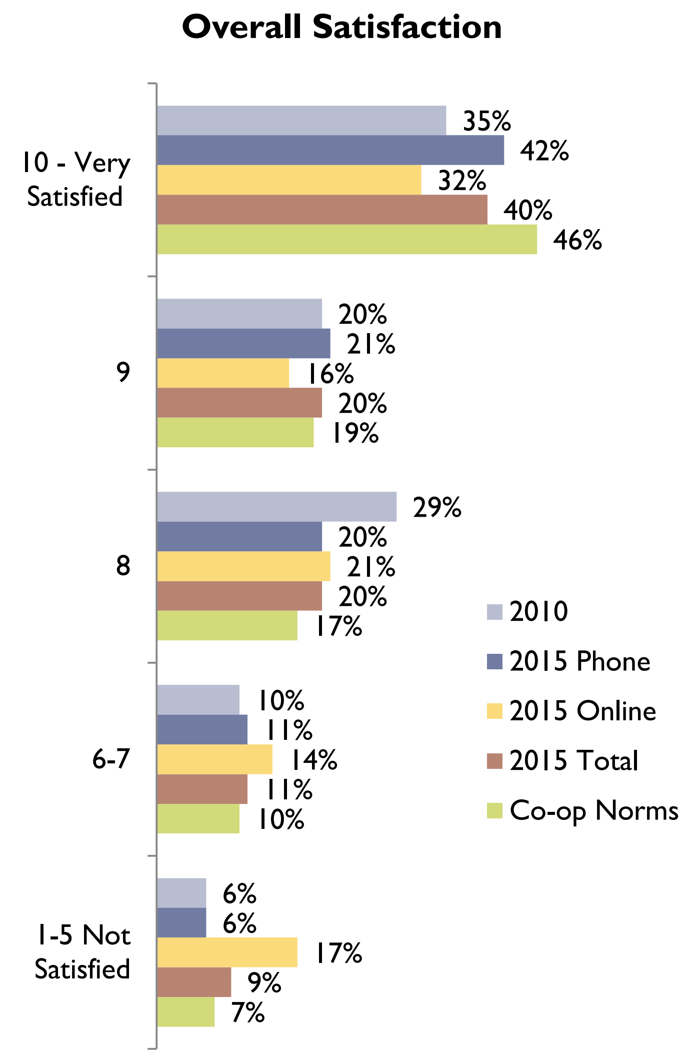
KEY FINDINGS

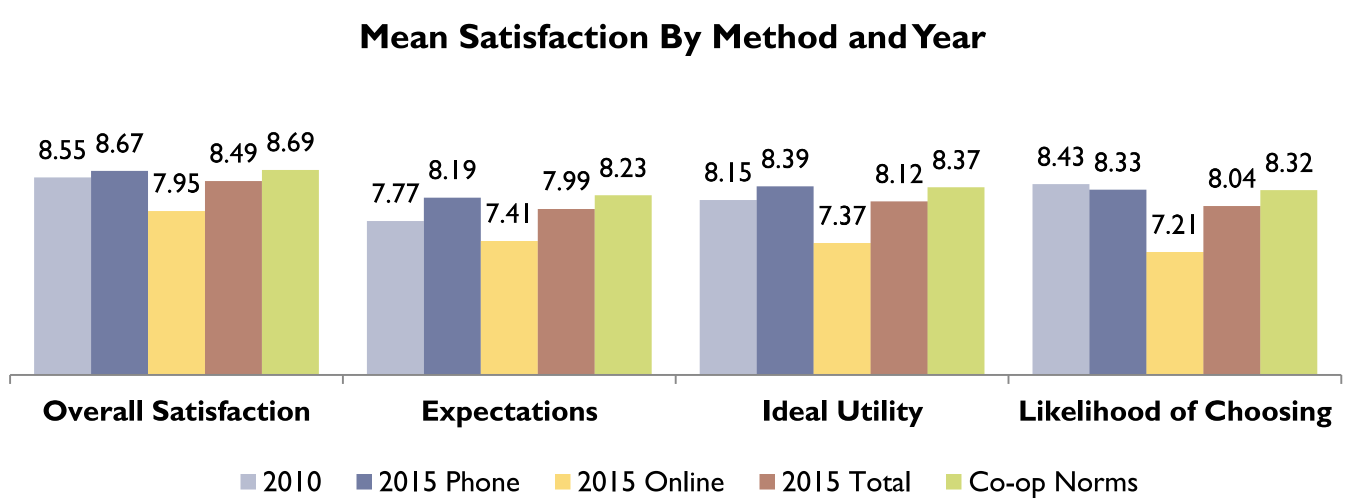
Overall Satisfaction and ACSI

Overall satisfaction among WEC's residential members is good. The mean overall satisfaction rating is 8.49 on a 10-point scale and 60% give ratings of "9" or "10".

As is typical, phone respondents give significantly higher ratings than do online respondents. Among phone respondents, the mean rating has not changed significantly from 2010, but the proportion of members giving the highest ratings of "9" or "10" has increased significantly. Conversely, overall satisfaction among WEC members is somewhat lower than the Co-op Norms.

Mean ratings for the other ACSI measures – *lives up to expectations, comparison to the ideal utility*, and *likelihood of choosing the co-op* – are also lower than the Co-op Norms. However, evaluations for *meeting expectations* and *comparison to the ideal utility* are significantly higher than 2010.





WEC's composite ACSI rating is 80, which is higher than Touchstone Energy and the IOU industry leaders. The retention estimate is 73%, which is lower than Touchstone Energy and industry leaders.

This ACSI is the same as WEC's 2010 survey, although the retention estimate is lower, declining from 79% to 73%. It is typical for a co-op to see their ACSI and Retention fall two to three points when the survey methodology changes from only phone surveys to a mix of phone and online surveys.

ACSI		RETENTION PERCENTAGE	
Washington Electric Co-op	**80**	CenterPoint Energy	82
CenterPoint Energy	79	DTE Energy	81
Sempra Energy	79	Sempra Energy	81
Atmos Energy	78	Atmos Energy	80
Touchstone Energy	**77**	First Energy	79
Largest Cooperatives	76	NextEra Energy	79
First Energy	76	Southern	79
Southern	76	**Touchstone Energy**	**78**
All Other Cooperatives	75	Largest Cooperatives	78
Edison International	75	Edison International	78
Xcel Energy	75	Ameren	78
Largest Investor Owned Utilities	72	Xcel Energy	78
Largest Municipal Utilities	72	Largest Municipals	76
All Other Municipal Utilities	72	Largest Investor Owned Utilities	76
All Other Investor Owned Utilities	71	**Washington Electric Co-op**	**73**

The American Customer Satisfaction Index (ACSI) is provided through Touchstone Energy and is only available to cooperatives that are Touchstone Energy members. It is designed to provide a continuous update of residential consumer evaluations of the top electric, gas, and combination electric and gas energy utilities in the country. ACSI began operations in 1994 and updated results are published every quarter. The central ACSI component is the core customer satisfaction index. The index is a weighted average of three questions on a 0 to 100 scale: overall consumer satisfaction, meeting consumers' expectations, and comparing one's own utility to an ideal utility. The second component of the ACSI measurements is the retention percentage, which is calculated using consumers' ratings of their likelihood to stay with their cooperative if they had a choice. For a detailed analysis of the process, please consult the 2015 Second Quarter ACSI report in Appendix D.

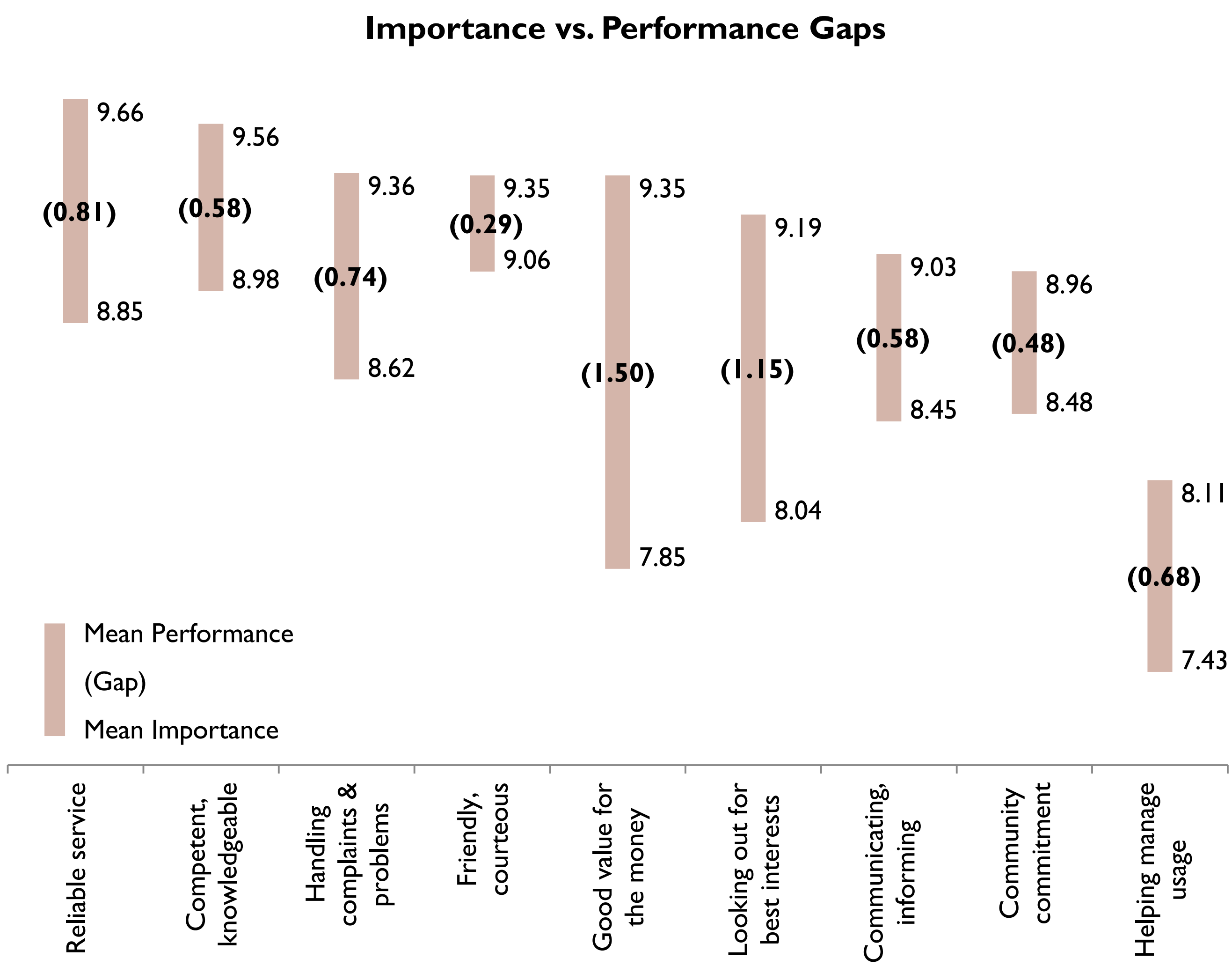
Attributes of Service

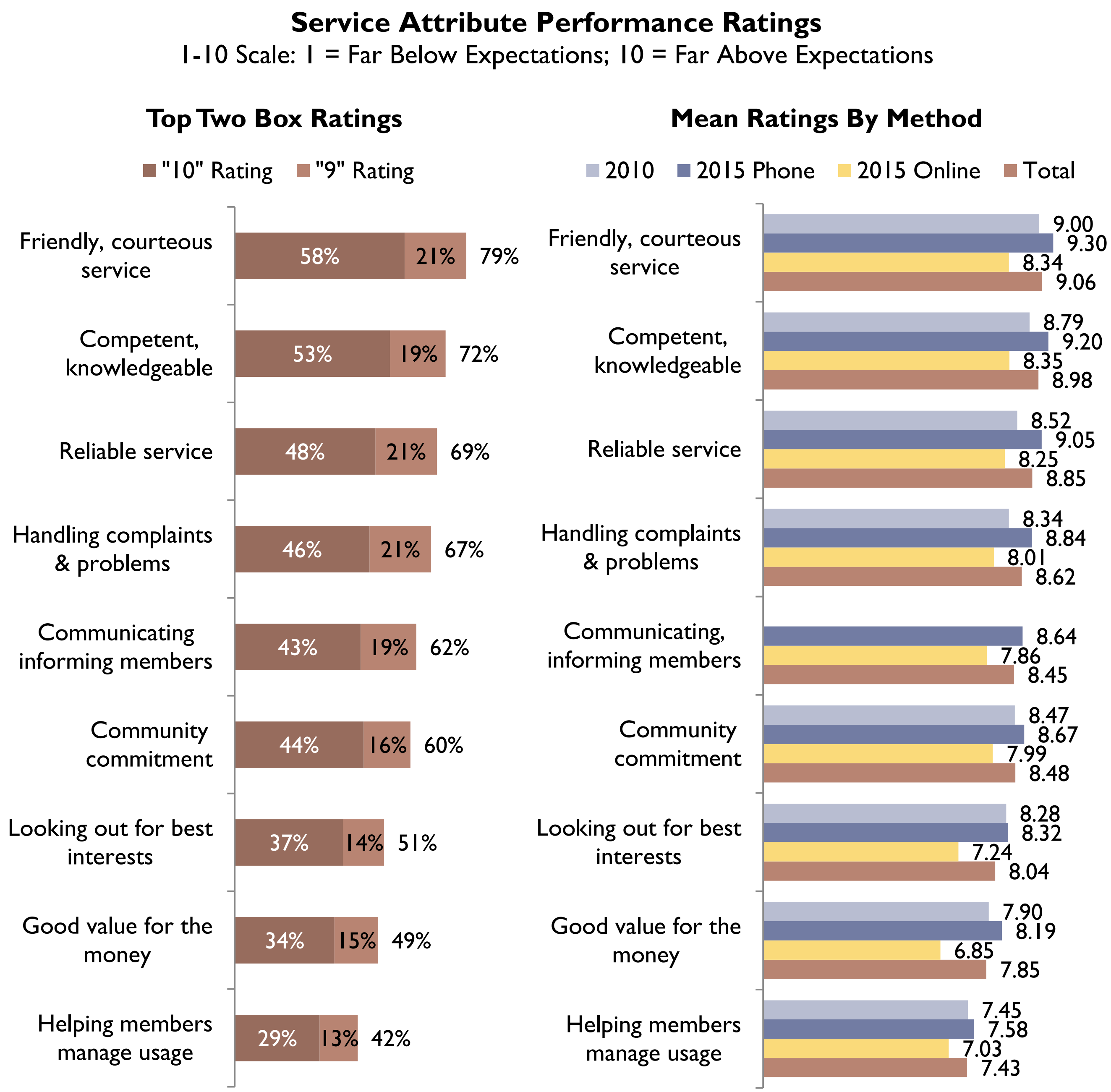
Members were asked to evaluate nine attributes of service regarding both importance to the member and WEC's performance in each area. On all but one of the attributes measured, the mean ratings for importance are near or above 9.00 on a 10-point scale indicating very high importance. The mean ratings for how well WEC is meeting expectations on each attribute vary.

Members give the highest importance ratings for *providing reliable service* and *having competent and knowledgeable employees*. Performance ratings for both of these attributes are also very high, with means near 9.0. The lowest rating for both importance and performance is for *helping members learn to manage their energy use*.

	Importance		Performance		Gap - Difference Between Mean Importance and Performance
	Mean Rating	Rank	Mean Rating	Rank	
Providing reliable service	9.66	1	8.85	3	0.81
Having competent and knowledgeable employees	9.56	2	8.98	2	0.58
Handling individual complaints and problems	9.36	3	8.62	4	0.74
Being friendly and courteous in the service they provide	9.35	4	9.06	1	0.29
Providing a good value for the money spent	9.35	5	7.85	8	1.50
Looking out for members' best interests	9.19	6	8.04	7	1.15
Communicating with members and keeping them informed	9.03	7	8.45	6	0.58
Being committed to the community	8.96	8	8.48	5	0.48
Helping members learn to manage their energy use	8.11	9	7.43	9	0.68

The largest gaps between mean importance and performance are for *delivering good value for the money* and *looking out for members' best interests*. Not surprisingly, value is an area that is rated as very important to members, with a mean importance rating of 9.35. Also typical for a cost-related attribute, value receives the second-lowest performance rating with a mean of 7.85. *Looking out for members' best interest* is a measure of members' trust in the cooperative, and is often highly correlated with their perceptions of the rates and fees.





As is typical, phone respondents give significantly higher ratings than online respondents on how well WEC is meeting their expectations on each attribute. Among phone respondents, performance ratings are significantly higher than 2010 for all eight comparable attributes, although not all of the differences are statistically significant. Those that have improved significantly are:

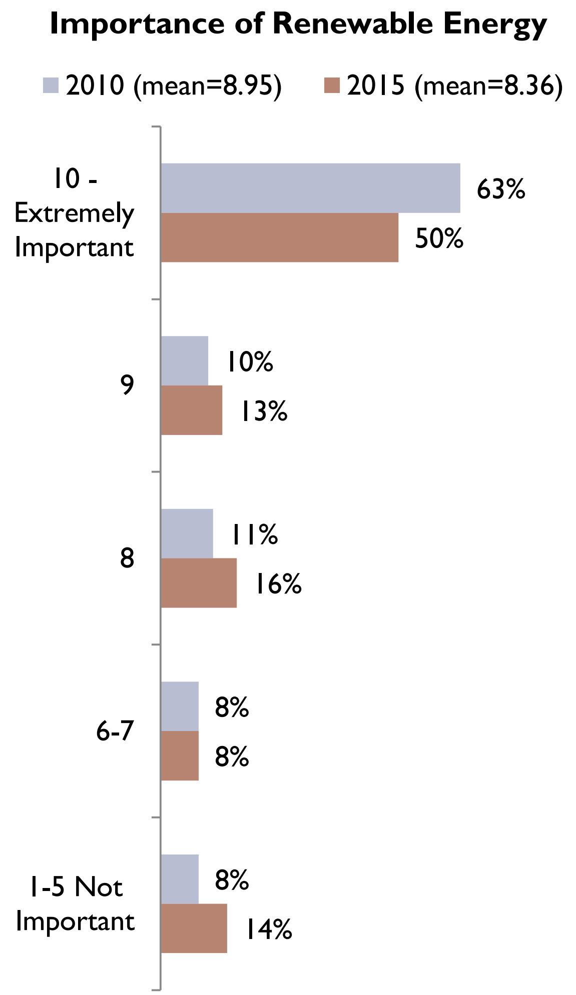
- Handling individual complaints and problems
- Being friendly and courteous in the service they provide
- Having competent and knowledgeable employees
- Providing reliable service

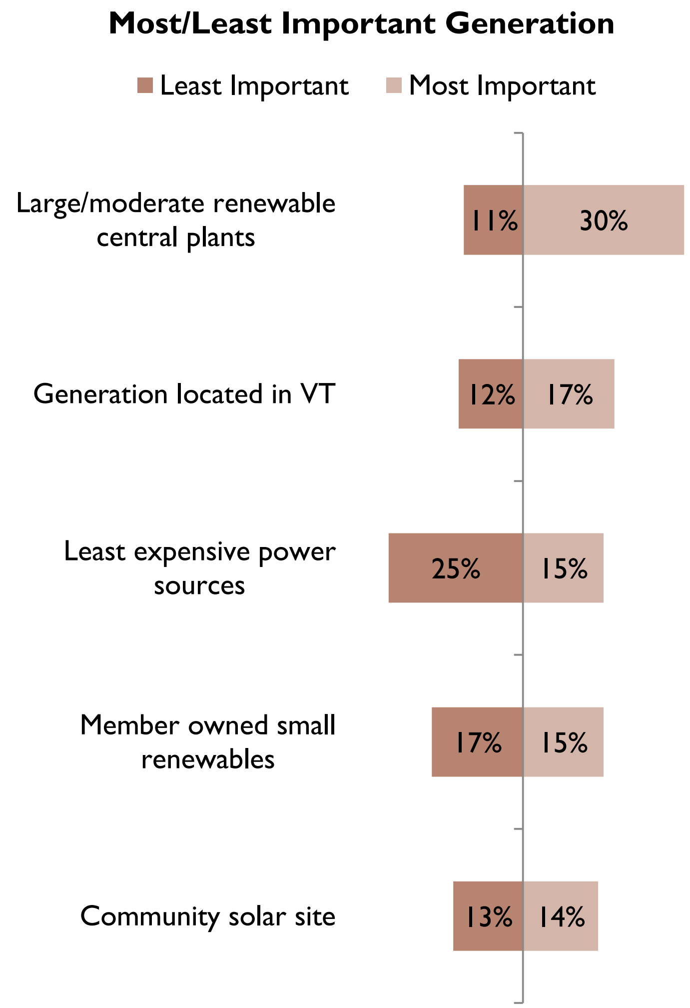
Renewable Energy and Energy Conservation

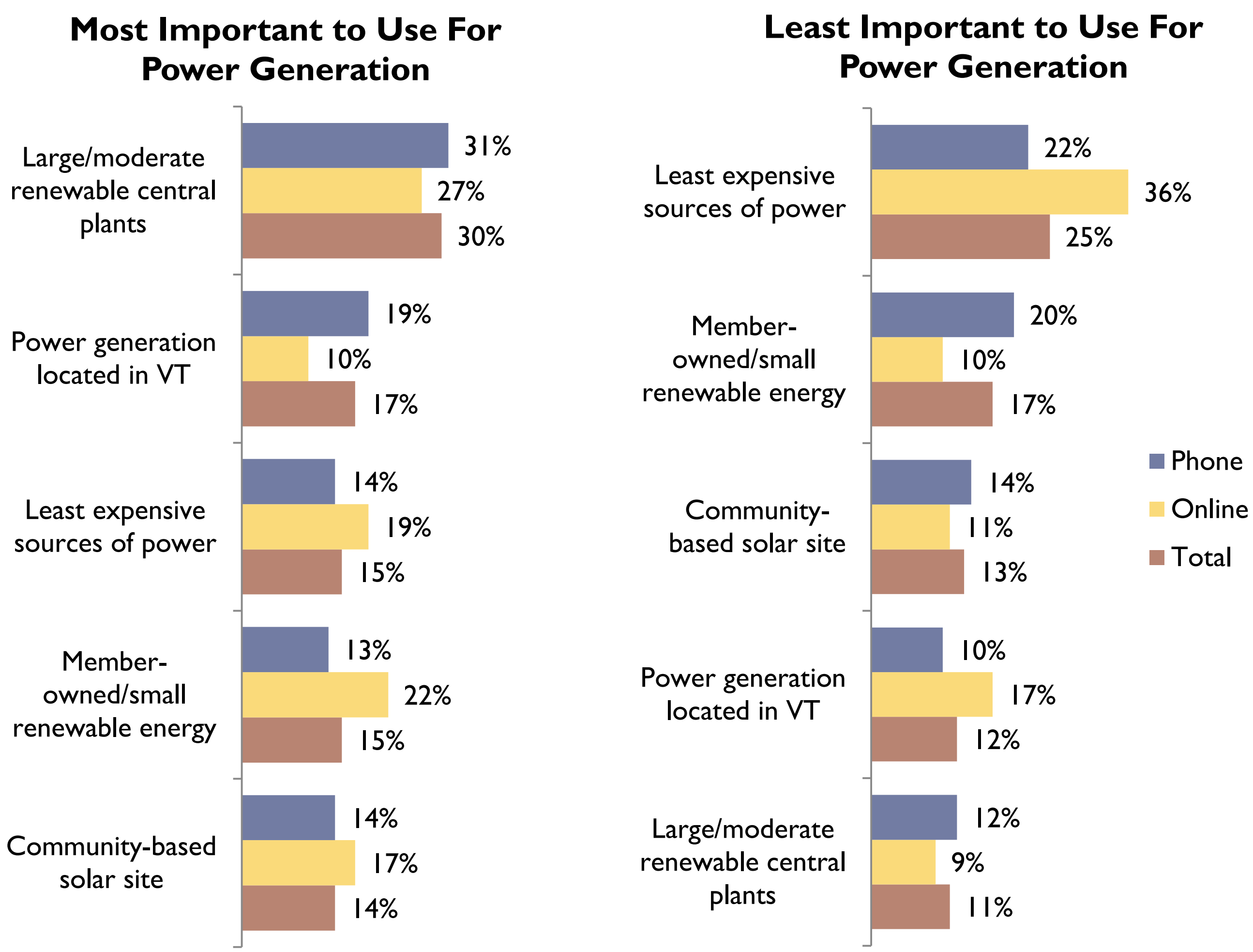
Sixty-three percent feel it is very important that WEC provides them with renewable energy sources, giving a rating of "9" or "10". Thirty percent feel that renewable energy from large to moderate central plants is the most important type of generation of those tested.

Although still very high, the perceived importance of WEC providing members with renewable energy sources has declined significantly from the 2010 study. Those more satisfied with the co-op overall, those using less electricity, and females are significantly more likely than their individual counterparts to feel it is very important.

Of the five types of power generation tested, renewables from large to moderate central plants is most often chosen as the most important. Conversely, one-quarter say that using the least expensive sources of power regardless of the fuel source is the least important.





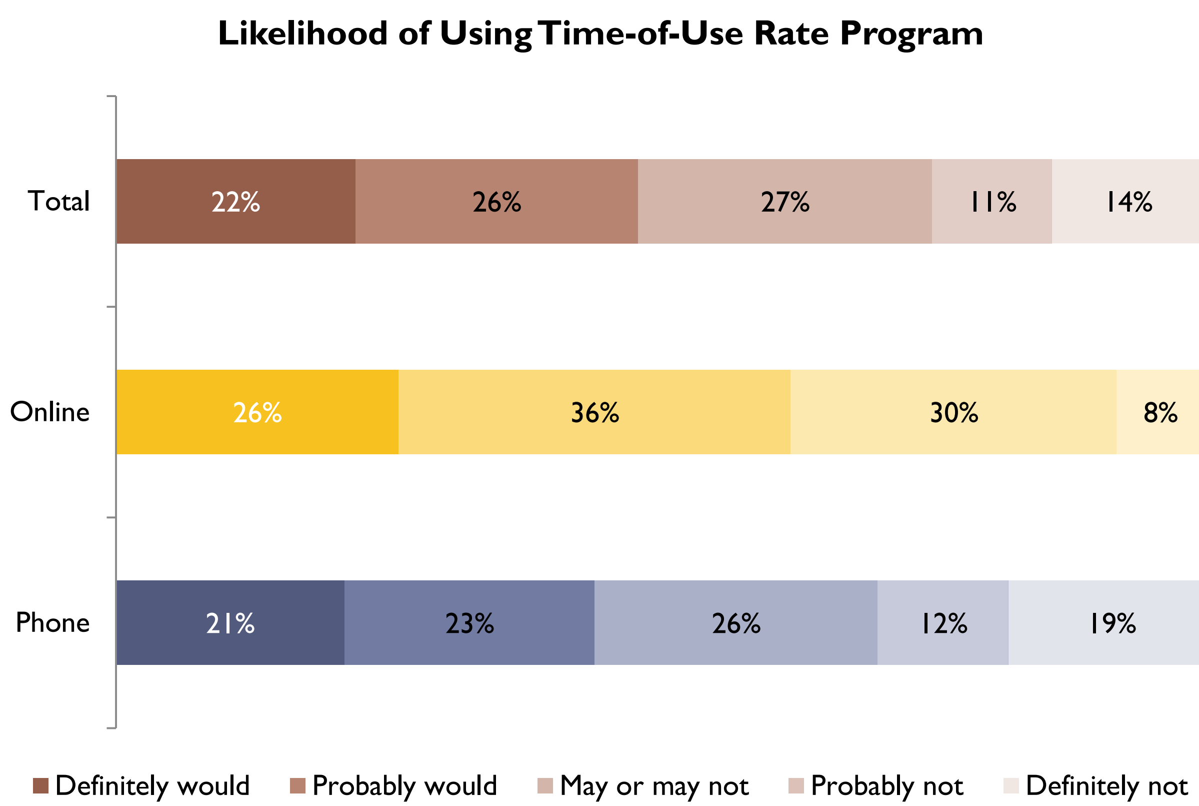


Interestingly, online respondents are significantly more likely than phone respondents to view member-owned and small renewable energy generation like solar panels as most important while phone respondents are significantly more likely to view power generation located in Vermont as most important. Online respondents are significantly more likely than phone respondents to view using the least expensive sources of power regardless of the fuel source and power generation located in Vermont as least important.

Member segments that are significantly more likely than their counterparts to view renewable energy sources from large to moderate central plants as most important include those who are more satisfied with the co-op overall and those living in smaller households. Older members (55 or older) are significantly more likely than those under 45 years of age to view community-based solar projects as most important.

Nearly half of the members say they would probably (26%) or definitely (22%) use a time-of use rate program if one were available from WEC. Twenty-seven percent are not sure whether or not they would use such a plan.

Online respondents, those less satisfied with the co-op overall, younger members, newer members, those living in larger households, those living in a single family dwelling, and those using more electricity are significantly more likely than their individual counterparts to be interested in participating in a time-of-use program.



Communication

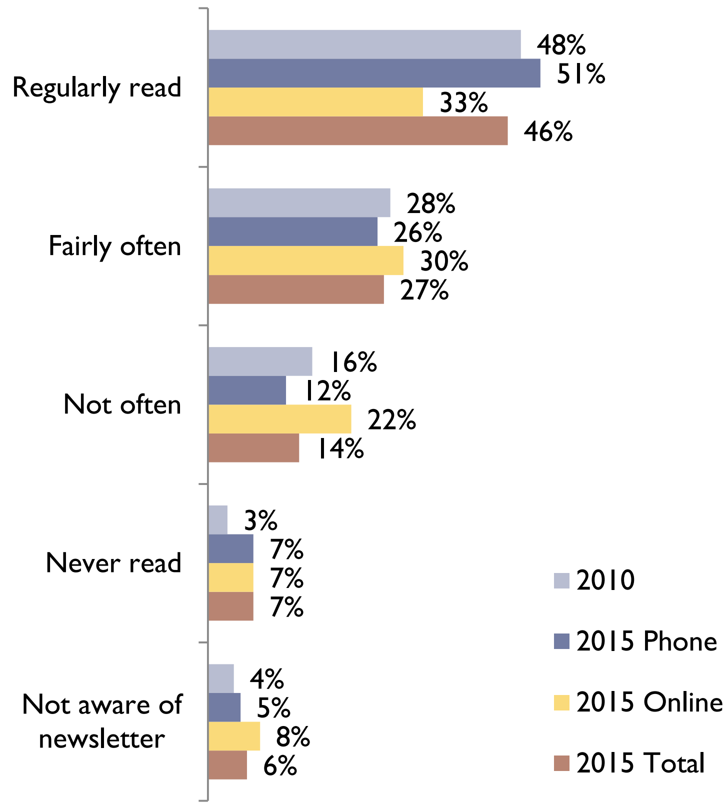
More than seven in ten members say they regularly or fairly often read the monthly newsletter. While four in ten are aware of SmartHub, just 16% have used it.

Newsletter readership has not changed significantly from the 2010 study, with about half of the phone respondents saying they read the newsletter regularly. Phone respondents, those more satisfied with the co-op, older members, longer-tenured members, those living alone or with one other person, and homeowners are significantly more likely than their counterparts to say they read it regularly.

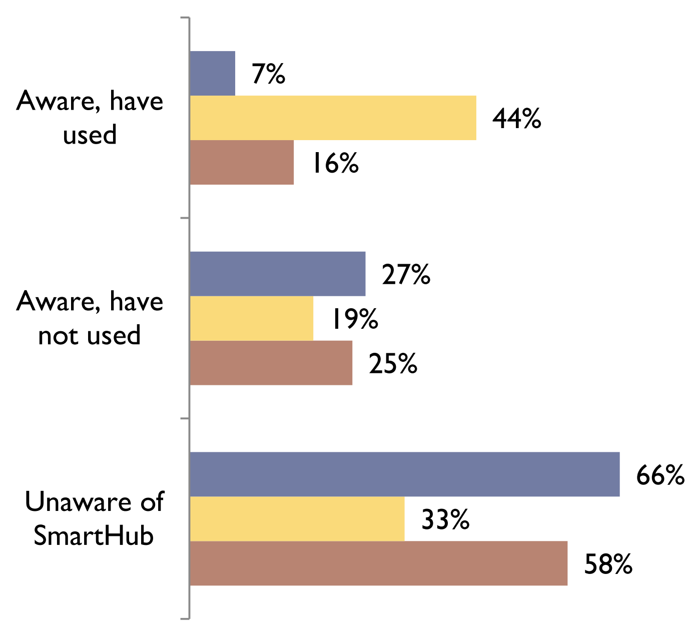
Online respondents, those rating their satisfaction as "5" or lower, younger members, those in larger households, and those using more electricity are significantly more likely than their counterparts to have used SmartHub.

Media Use by Age	Regularly Read *Co-op Currents*	Used SmartHub
Under 45	16%	28%
45-54	29%	25%
55-64	43%	13%
65+	64%	11%

Readership of *Co-op Currents* Newsletter



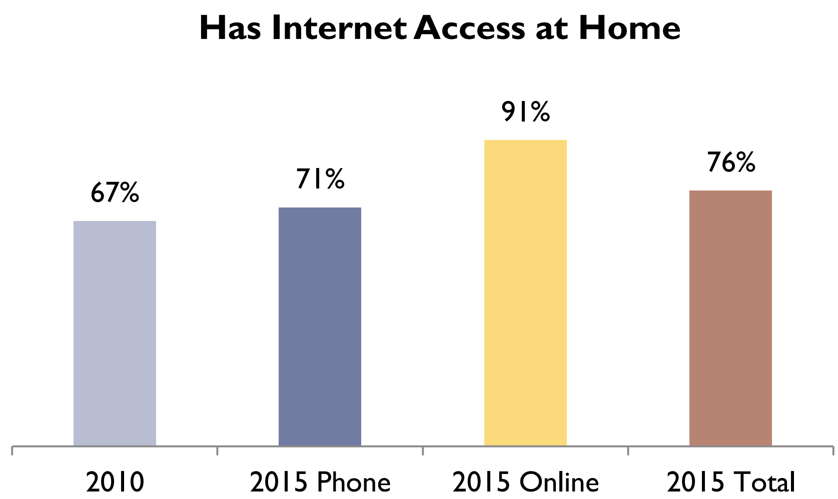
SmartHub Awareness/Use

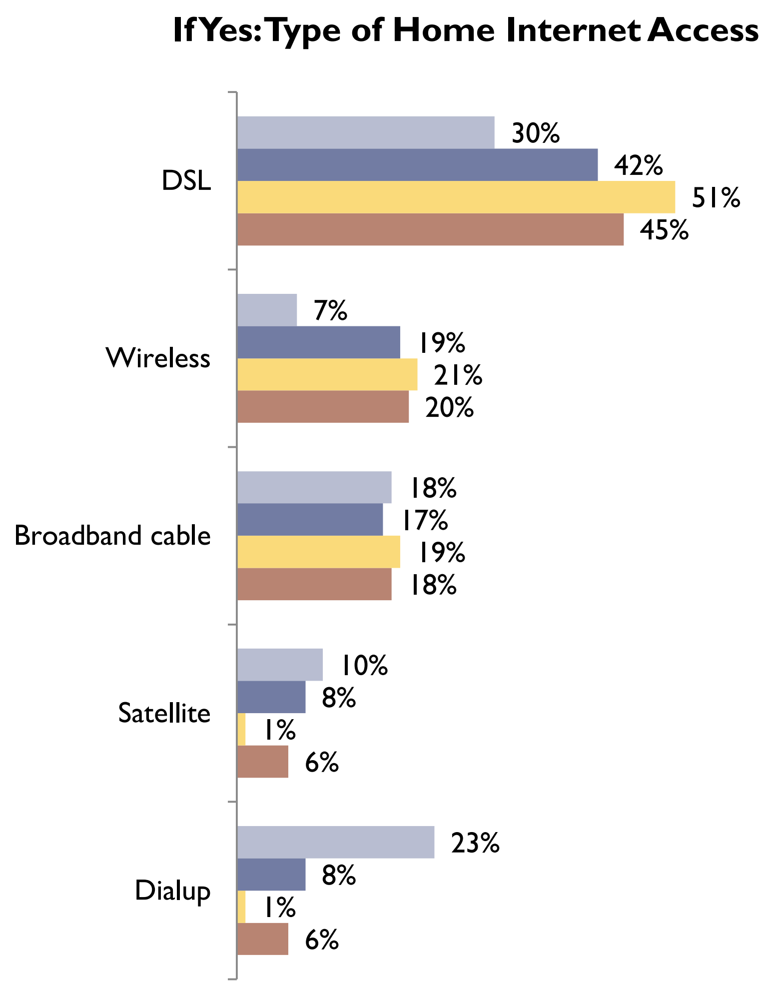


Three-quarters of the members say their family accesses the internet from home. Internet access from home has not changed significantly from 2010 among phone respondents. Not surprisingly, online respondents are significantly more likely than phone respondents to have internet access at home.

Younger members, newer members, those living with at least one other person, those living in single-family homes, and those with higher electric use are significantly more likely than their individual counterparts to have internet access at home.

Although overall home internet access has not changed significantly from the 2010 study, it is not surprising that the proportion of members who have DSL and wireless access has increased significantly while those who have a dial-up connection has decreased.





Member Identity

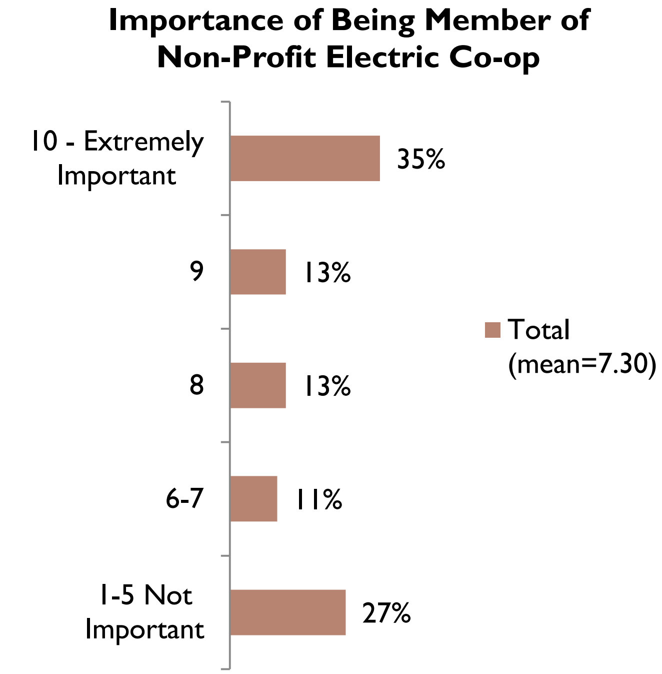
Fifty-four percent identify themselves as a member-owner or both a member-owner and a customer of the cooperative, as opposed to being a customer only. We say these respondents have "member identity".

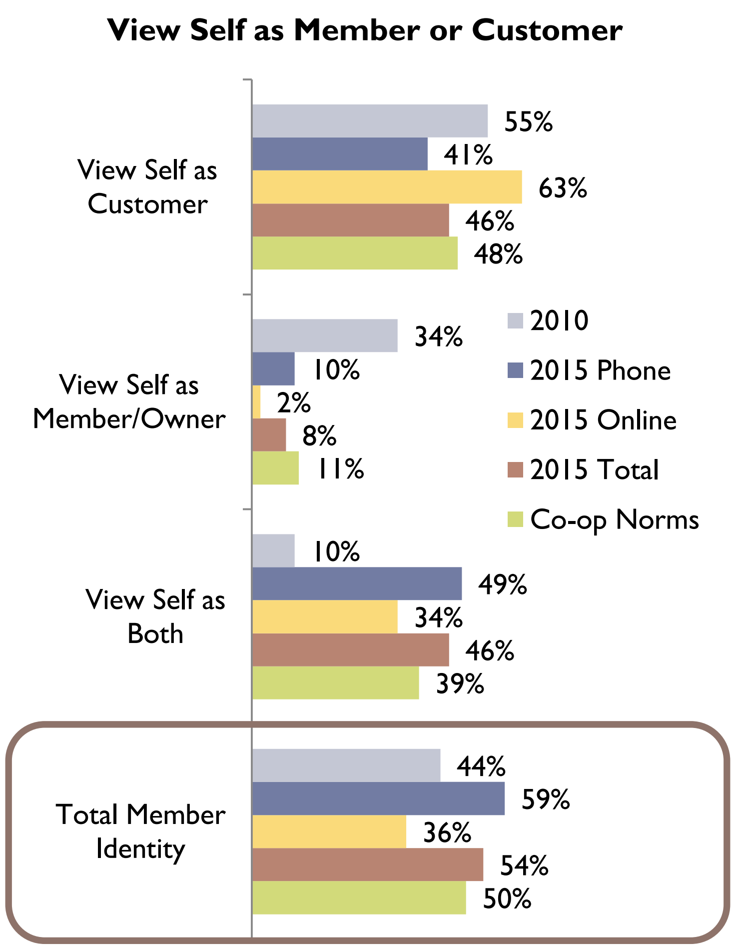
Among phone respondents, member identity has increased significantly from the 2010 study. More than one-third say it is extremely important (rating of "10") to be a member of a non-profit electric co-op.

Member segments that are significantly more likely to have member identity and give higher ratings than their counterparts for the importance of being a co-op member include phone respondents, those more satisfied overall with WEC, older members, longer-tenured members, those in smaller households, and those using less electricity.

Those with member identity give significantly more positive evaluations than do those who view themselves as "customers" on all of the performance attributes as well as overall satisfaction and the other ACSI measures.

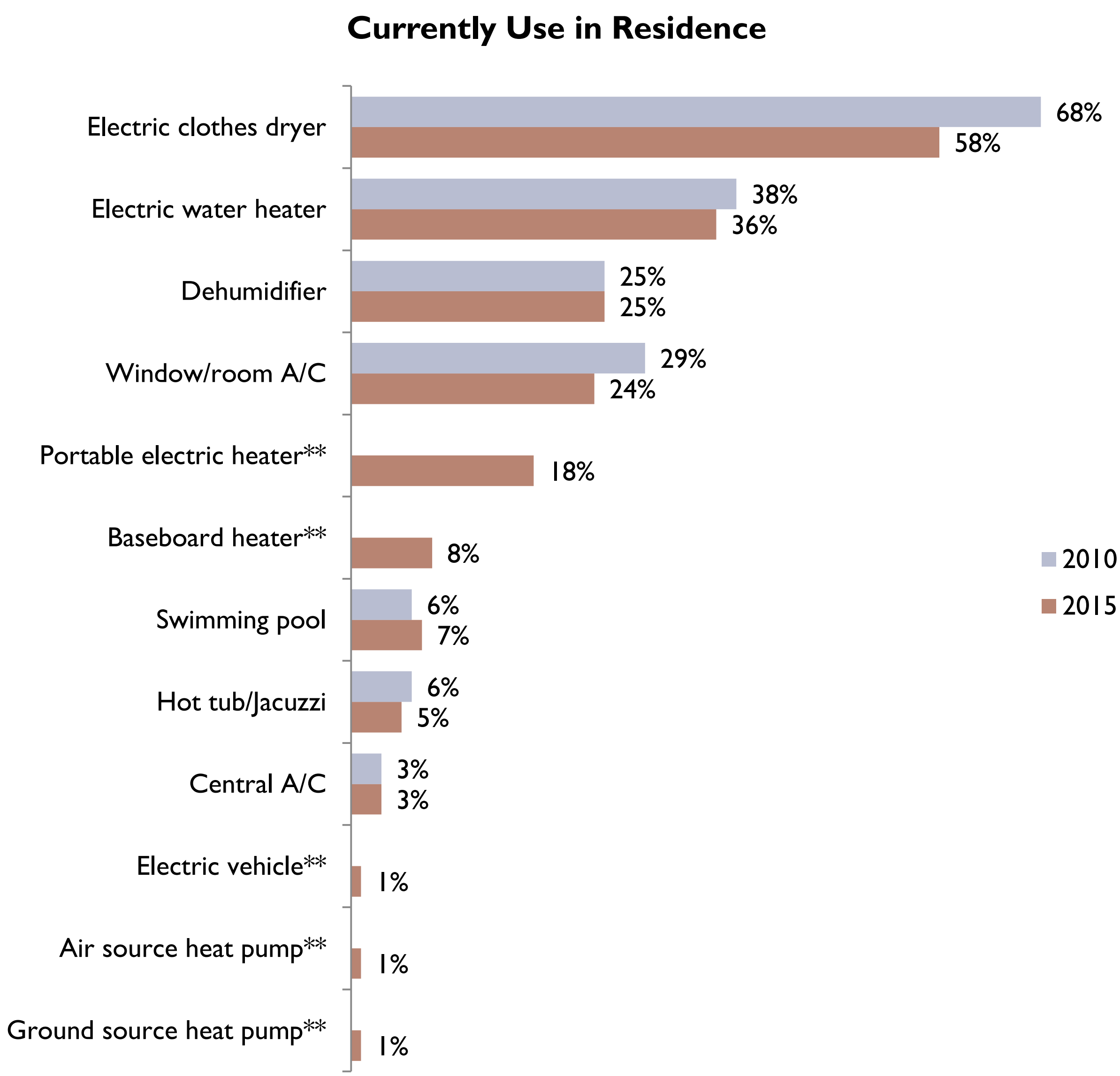
"Members" are also significantly more likely to feel it is important to be provided with power from renewable energy sources and be a member of a non-profit electric co-op. Conversely, "customers" are significantly more likely to have internet access at home and use SmartHub.





Appliance Saturation

The most used electric appliance in members' homes continues to be the electric clothes dryer, followed by electric water heater. The use of electric clothes dryers has decreased significantly from 2010.



** Not asked in 2010

Member Demographics and Segmentation

Almost half of the responding members are 65 years of age or older and 60% have been served by Washington Electric Cooperative for more than 20 years.

Compared to the Co-op Norms, WEC members are older, longer-tenured, and live in smaller households. The membership in 2015 is significantly older and more likely to live alone than in 2010.

	2015	2015 (Online)	2015 (Phone)	2010	Co-op Norms
Younger Than 55	30%	41%	27%	42%	37%
55 to 64	22%	30%	20%	27%	24%
65 or Older	48%	30%	53%	31%	39%
Served 10 Years or Less	21%	39%	15%	N/A	38%
Served 11 – 20 Years	20%	18%	21%	N/A	21%
Served >20 Years	60%	44%	65%	N/A	41%
1 or 2 in Household	73%	63%	76%	69%	69%
Single Family Home	84%	85%	84%	86%	N/A
Own Home	97%	96%	97%	95%	N/A

Older members (55 or older) are significantly more satisfied with Washington Electric Cooperative than are those younger than 55. Longer-tenured members and those with smaller households are also significantly more satisfied than their counterparts.

These demographic segments also give more positive evaluations of the other ACSI measures and WEC's performance on the various service attributes, with differences usually being statistically significant. Females also evaluate the service attributes significantly more positively than do males.

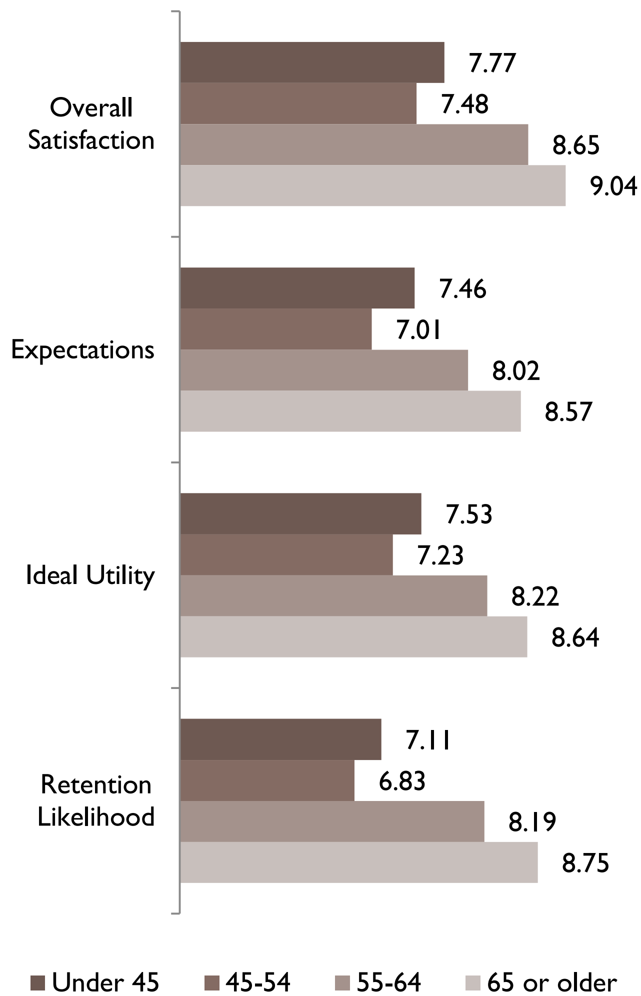
In addition to giving lower performance ratings, younger members are significantly <u>less</u> likely than older members to:

- Feel that community-based solar projects are the most important of the types tested
- Read the monthly *Co-op Currents* newsletter
- Feel it is important to be a member of a non-profit electric co-op
- View themselves as a member/owner of the co-op

Conversely, younger members are significantly <u>more</u> likely than older members to:

- Feel that power generation from member-owned and small renewable energy generation like solar panels on a home is most important
- Show interest in a time-of-use rate program
- Have internet access at home and use SmartHub

Mean Ratings by Age



Members with lower electric use – especially those averaging 7 kWh per day or less – also evaluate the four ACSI measures and many of the service attributes significantly more positively than do those with higher usage (especially 30 kWh or more).

Similarly, the following service attributes are evaluated significantly more positively by those with lower usage:

- Handling complaints and problems
- Being friendly and courteous
- Looking out for best interests
- Commitment to the community
- Good value for the money
- Help managing energy use
- Communicating, keeping members informed

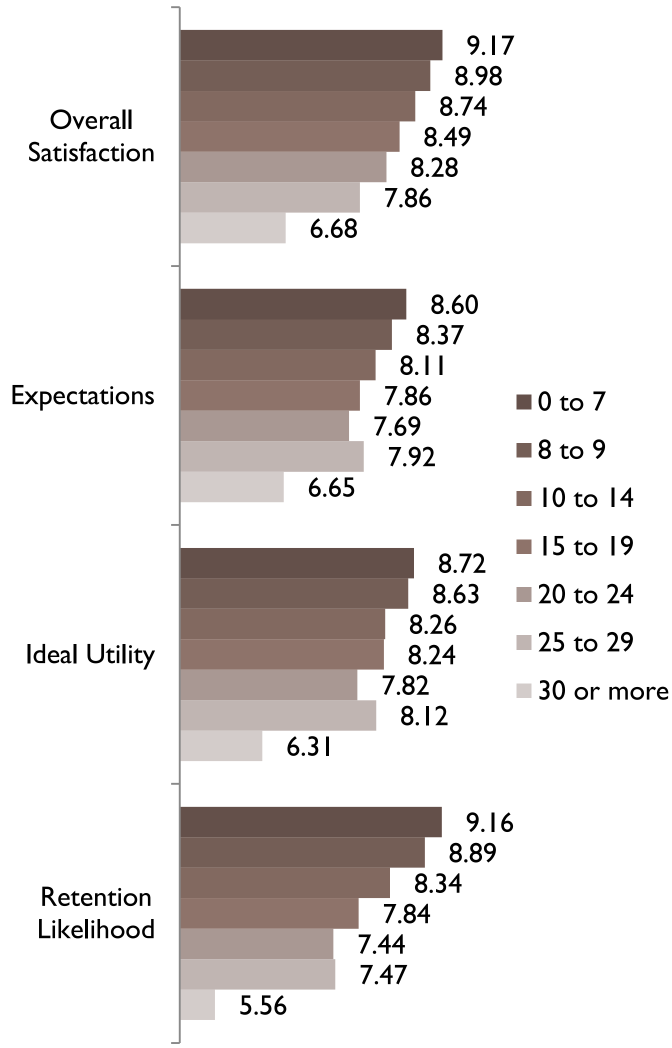
In addition to giving lower performance ratings, those with an average daily usage of 30 kWh or more are significantly:

- More likely to use a time-of-use rate program
- More likely to have used SmartHub
- Less likely to read *Co-op Currents*

Those with an average daily usage of 7 kWh or less are significantly:

- More likely to say being a co-op member is important and have member identity
- Less aware of SmartHub
- Less likely to access the Internet from home

Mean Ratings by Average Daily kWh Use



Because only eight members surveyed use net metering, statistical tests for significance are not valid. However, the four ACSI measures are rated somewhat higher among those with net metering than among those without.

Verbatim Comments

At the conclusion of the survey, members were given the opportunity to share any comments, concerns, or questions they had. Fifty-two percent of the respondents offered input.

Among those who commented, the following table provides a breakdown of the subjects mentioned and the number of comments that were positive, negative, or neutral. A full listing of comments can be found in Appendix B.

Subject/Topic	Total # Comments	Positive	Negative	Neutral
Operations/Engineering – blinks, outages, tree trimming, AMI/AMR	70	47	18	5
Overall Satisfaction	59	59	0	0
Rates/Fees	39	2	31	6
Renewable Energy	38			
Member Services/Marketing – resolving issues, member service reps	30	20	8	2
Management/Board	14	9	5	0
Problems With Bills	12	2	7	3
Member Identity/Loyalty	10	7	3	0
Additional Services	8	1	1	6
Energy Efficiency/Energy Audits	7	0	2	5
Newsletter/Information	2	1	0	1

Appendix A:
Verbatim Responses

WASHINGTON COOPERATIVE VERBATIM RESPONSES

ADDITIONAL COMMENTS

In order to present comments in their entirety, verbatim responses may appear under more than one heading. The portion of the comment pertaining to the section is in black, while portions covered under other areas are colored in gray.

Overall Satisfaction – Positive Responses

I'm satisfied/Good company/No problems/Good work (59 general comments like this)

Management/Board – Positive Responses

A well-oiled operation. Always quick to answer the phone and depending on the location and weather condition, quick to respond and restore service. It's too bad that larger companies can't follow WEC policy and procedures. That is: Customer Service, is a Satisfied Customer, is a Company with satisfied employees, and is a smooth working, well-oiled company. Thank you for all you do.

Considering we live at the edge of your grid (Bradford), and where some of the electric lines run (Orange Heights), the co-op service is remarkably dependable. When storm related outages occur, power is usually restored promptly. Good job :) We really appreciate your efforts to be environmentally responsible. I took the tour of the Coventry Station - as a science teacher and customer, I was impressed.

I am satisfied. It has got a good reputation and is locally owned.

I appreciate interactions with Bill Powell. He's very helpful. I like that WEC is 100% renewables. I like that it is a co-op. I hope that the co-op's mission can remain progressive and cutting edge and do lots of smart-grid technology.

I think the President is doing a great job, for the long time he has been there. Broadband internet would be great to have.

I think they have come a long way from providing electricity. They are right up there in the latest technology.

They have been real good and I think their leadership has been good.

They run the organization pretty good and are real good people to deal with.

Additional Comments
Management/Board – Positive Responses
(continued)

They seem like they are on the right track. It would be nice if I could have a solar panel on my house that wouldn't cost so much, or to be able to make payments on it, comparable for what the electric bill is now.

Management/Board – Negative Responses

I heard last week that they went to a corn maze. I don't think they need to be going there. That's a third grade class trip. I don't like it that they are sending employees and paying them by the hour to go to a maze. A few years ago, we sold the beach to Danville. It's quite a beach and they sold it for a dollar. It's so outrageous. I don't like these Open House things. That's customers dollars that they are wasting. I think the new manager is doing these things. They need to be more conservative.

I understand that, and I might be wrong, Washington Electric has a wood burning plant somewhere around the Berry/Montpelier area and has been buying up lots of firewood from the providers around where I live (in the Bradford Vermont area) and causing the cost of firewood to go skyrocketing. Firewood is my main source of heating and I'm not crazy about my electric company making it harder for me to afford winter.

Sell out to Green Mountain Power.

Small solar units like on houses do not and cannot push power back to the grid. (If you disagree then you are disagreeing with actual science. Do some actual research for once.) Quit stealing my money to fund this outdated concept and the people that take advantage of this politically motivated concept. Solar is not effective and never will be. Look at the science, not the politics. I've been in co-ops and they are generally cheaper than for-profit, but I would gladly switch back to GMP. Too many special programs and self-interest projects exist in this co-op to the point it is likely almost criminal.

Operations/Engineering – Positive Responses

I'm satisfied with their service. (2 mentions)

A well-oiled operation. Always quick to answer the phone and depending on the location and weather condition, quick to respond and restore service. It's too bad that larger companies can't follow WEC policy and procedures. That is: Customer Service, is a Satisfied Customer, is a Company with satisfied employees, and is a smooth working, well-oiled company. Thank you for all you do.

Any time I have had an issue, it has been taken care of in a timely fashion. When I have had power outages, my power has never been out for more than a few hours. WEC does a wonderful job!

Additional Comments
Operations/Engineering – Positive Responses
(continued)

Considering we live at the edge of your grid (Bradford), and where some of the electric lines run (Orange Heights), the co-op service is remarkably dependable. When storm related outages occur, power is usually restored promptly. Good job :) We really appreciate your efforts to be environmentally responsible. I took the tour of the Coventry Station - as a science teacher and customer, I was impressed.

Every time the power goes out, they are pretty quick to get it fixed.

For the most part I am pleased with Washington Electric. Power outages appear to be less than other companies, but my bill is higher. I like the fact that WEC has Coventry and is always exploring better, environmentally friendly alternatives.

I always have good service. They come right away if I call.

I am happy with the service.

I am really very happy with their service and their quick response and I am happy to be their customer.

I am very happy with them. We don't have many power outages.

I am very pleased with the service the co-op has provided over the years, but the building they serve is a camp, so I'm not sure my answers are very valuable.

I have always had good service. Power outages are infrequent and usually understandable due to severe weather. Service has been restored in a reasonable time frame. I have had limited contact with employees; however the contact I have had has always been professional, helpful, and pleasant.

I have been very happy with the service that I have received from Washington Electric. Thank you all.

I have never been without power overnight.

I have very good service.

I like the newsletter. We have good service considering where we live and it is seasonal.

I think overall they do a very good job. My big gripe is I wanted to do a solar array and all we got was the run around. By the time all was said and done, we missed the federal deadline. We missed it and it was frustrating. It didn't seem like they were willing to help in any way. I was surprised to hit this brick wall. I'm wishing they would be more cooperative and helpful. They have come a long way and we used to be out of power all the time. The service has greatly improved in the last five years.

Additional Comments
Operations/Engineering – Positive Responses
(continued)

I think they are doing a great job. They get out in all kinds of weather. I'm impressed.

I am impressed when the power goes out because of the response time. We are not without power for very long. They need a pat on the back for that.

I'm pretty happy with their service. I've been with them for years. Overall, I'm very happy with Washington Electric.

It seems like they are doing a good job. Over the years the outages have decreased a lot. They have kept things well maintained.

Just don't leave us in the winter. Through a lot of stuff that we went through last winter, they provided reliable service to us. I appreciate the guys that have to keep the power going.

Keep the juice running.

Keep up the good work. They do a good job of keeping the lines clear, which helps a lot.

Last December, when the power was off so many times, they did the best they could. They were so diligent getting it taken care of. They put in so much effort to get the power back on. They did a fine job.

My wife is on oxygen so we are very aware and have a generator back-up. The co-op has been very good about making sure we have electric.

Thank you for a nice service. The last line trimming that they did helped tremendously with reliability.

Thank you for the service.

Thanks for all the hard work in horrible weather conditions, finding and repairing outages.

This year they have stepped up their program. They have done more tree trimming to prevent the trees from creating an outage. The crew they hired this year to trim was very friendly, they were good, and they responded to our concerns. They were very professional. We want buried lines.

They are great. They give us fair warning on outages. Outages are restored quickly.

They have been very reliable.

They have done a great job. Every time we call them about an outage, they get right on it and get the power restored.

Additional Comments
Operations/Engineering – Positive Responses
(continued)

They provide the best service with no outages.

Washington Electric has provided good service. Our one and only complaint is the rates. They seem to be very high compared to others. Our survey answers were based on this opinion. Thanks.

We appreciate the boys' hard work during the winter months.

We are fine - we a have a generator for backup.

We are very happy with the service. It is a lot better than it used to be. We have less outages than Green Mountain Power.

We have been very happy with the service.

We have very reliable power.

We like it and it is very reliable.

We own a seasonal cabin in Cabot and have always had good service from Washington Electric. I just hate the monthly billing. We used to be billed just two times a year, now we have to send a check every month even when no one has been there.

We think they do an admirable job in the winter months with some of the jobs that they do.

When I have called with concerns, I have been spoken down to and been told they can discuss the concerns with my husband. Also, if I had an opportunity to use a different provider, I would seriously look in to my options. However, I have to say, if we have ever been without electricity due to a big storm, etc., their crews/technicians are quick to respond.

When we had that straight line storm a few years ago, when many lines were down, they did a terrific job.

We have a lot of outages, but they always respond when called.

Operations/Engineering – Negative Responses

Come cut the tree down. We have called and called asking them to come cut the tree before it knocks down the lines, but they haven't responded.

Additional Comments
Operations/Engineering – Negative Responses
(continued)

A couple of years ago, WEC installed new utility poles on the right-of-way, which is essentially at the edge of our front yard. Twelve trees were taken down to make that happen and we had no prior knowledge of this being done. A representative came to talk with us about it and was very apologetic and polite. It was a done deal, so nothing we could do after the fact to move rare plants that were growing in that area where the new poles were installed. Now, there are two sets of poles in front of our place, because the old ones are still there. I wish WEC could aid in expediting the removal of the old poles. We were told it could be years. That just seems unacceptable. Thank you.

Eliminate the fee and I would pay online. We cut down on our use and then you raise the rate. The smart meters are a fire hazard and people should be aware of this when you put them in.

I don't like having so many power outages in the winter. I lost $2,000 worth of meat when the power was off for 11 days. I need them to call me about the billing for 198 Kibling Hills in Cumbridge. I haven't received a bill.

I have two dead trees that I have been trying to get Washington Electric to take care of.

I have concerns about long term power outages. I am new to this service and community.

I think that Washington Electric Co-op should give up on renewable energy. It is too expensive. Also, in my area the utility lines are so overgrown with tree branches it would not be surprising to me if we lose power for another week this winter. I would think that to help prevent another week-long outage there would be a focus on cutting back tree branch overgrowth from utility lines. I could be wrong though, I'm not a professional when it comes to electricity grid maintenance.

It would be nice to not have so many power outages.

Rates are high. I would like more incentive for residential solar. Utility crews need to be more efficient on non-emergency line work due to high labor cost.

The cost is too high and there are intermittent outages that, while only last seconds, are very disruptive. Great survey. Thanks for asking us to participate.

The lines at my house need some maintenance. Yes, I would like to talk to them.

The power is not always reliable, which is more important to me than the price or the source.

They strung some new poles in our area and all the old poles and guide wires are still there. They need to be removed. I have to move around them and they are hazardous.

There are a lot of trees that need trimming.

Additional Comments
Operations/Engineering – Negative Responses
(continued)

There was a recent tree cutting and they cut a wide swathe. It was totally unnecessary. I have lost my privacy from the road. I had trees I've been nurturing for nine years. These trees were not a threat to the lines. And then they didn't leave the wood for me to use. For 12 years, this has never been an issue and they ruined my yard. I can't believe they did this. They ruined my property. None of my trees were near the power lines. I'm angry, depressed, and hurt. I can't believe they did this to me. I feel very violated. It's like they stole everything I owned.

We have a lot of outages.

We need to stop losing power all the time. Their rates are too high.

We have a lot of outages, but they always respond when called.

Operations/Engineering – Neutral Responses

It would be nice if our lines were changed over so if a limb falls on them the power just doesn't go out.

Last December we were without power for over a week. When they got here, power was restored quickly. We called them and it was very hard to get them to come out. Lines were down, but once they got here, it was an easy fix.

Should have had a N/A in assessment section and we (WEC) need continuous reliable energy from a stable resource.

Some of the scores are low, but it is no fault of WEC as their lines go deep into the woods, and being member owned, they don't have the state of the art utility lines, etc. that a larger electric company has.

This year they have stepped up their program. They have done more tree trimming to prevent the trees from creating an outage. The crew they hired this year to trim was very friendly, they were good, and they responded to our concerns. They were very professional. We want buried lines.

Member Services/Marketing/Communications – Positive Responses

A well-oiled operation. Always quick to answer the phone and depending on the location and weather condition, quick to respond and restore service. It's too bad that larger companies can't follow WEC policy and procedures. That is: Customer Service, is a Satisfied Customer, is a Company with satisfied employees, and is a smooth working, well-oiled company. Thank you for all you do.

Additional Comments
Member Services/Marketing/Communications – Positive Responses (continued)

Any time I have had an issue, it has been taken care of in a timely fashion. When I have had power outages, my power has never been out for more than a few hours. WEC does a wonderful job!

Bill Powell and customer service were very responsive and helpful when I've asked for help.

Bill Powell has helped us with a few things related to our energy use and he is awesome! Talk about going above and beyond.

I am a non-resident customer and appreciate all that Washington Electric has done for me when I have needed their help. Good work!

I appreciate interactions with Bill Powell. He's very helpful. I like that WEC is 100% renewables. I like that it is a co-op. I hope that the co-op's mission can remain progressive and cutting edge and do lots of smart-grid technology.

I believe they do as good of job as they can do for what they have. Employees are very knowledgeable.

I had excellent service last year. I received a letter saying that my usage was way over my normal usage and what my bill was going to be. I appreciated that very much.

I have always had good service. Power outages are infrequent and usually understandable due to severe weather. Service has been restored in a reasonable time frame. I have had limited contact with employees; however the contact I have had has always been professional, helpful, and pleasant.

I have no problem with them. They have always been really nice.

I met with a gentleman there named Bill Powell. He was very informative and helpful.

I think they handle problems very promptly. I think they are always trying to improve.

It is a very good company and the office people are very friendly.

They are great. They give us fair warning on outages. Outages are restored quickly.

They have been very helpful being my husband is on oxygen.

They have very friendly good service.

They were very helpful when we had a re-wiring project.

Additional Comments
Member Services/Marketing/Communications – Positive Responses (continued)

This is the most expensive electric service I've ever had. Your customer service is fine, but I pay too much.

WEC is EXTREMELY consumer and customer friendly. Whether there is an interruption of service issue, storm related problem or question, power outage, drooping tree limb, billing query, or anything else, from the person who answers the phone to the folks who come out to the residence, all WEC personnel are very courteous, informative AND helpful in getting the issue resolved efficiently and effectively.

Whenever I need to call for any sort of information, it is a call I look forward to. I do not dread it as I often do other places I have to call.

Member Services/Marketing/Communications – Negative Responses

I think they need to provide greater communication. I would like to find out why my bill is so high. I have absolutely nothing on during the day except a refrigerator and yet my bill is $150 a month. My neighbors have bills of $60, so I'm wondering why my bill is so high. I'm totally against all the monthly charges. They are charging me for the honor of a being a customer.

It is virtually impossible to get information during a power outage. Knowledge of possible duration would allow me to manage options; Ex: generator and fuel use and duration. Messages could be available by phone, on the web for mobile use, or texted to cell phones of customers.

Sending out notices for scheduled power outages came late.

The one time we lost power for more than a minute was not handled well. The toll free number for customer service, to report an outage, needs to be improved. Reporting an outage should be fully automated; in this case I HAD to speak to someone, who then asked stupid questions like "did you check your breakers" to make sure it wasn't THAT causing the outage. The person seemed unaware there were any problems on your network and made me explain that I was not the only house in the neighborhood that had lost power. All in all, it was a poor experience coming the one time I actually had a service issue.

They need to improve their customer relations. Every time I call, the tone and attitude from their customer service gives me the impression they don't care.

When I have called with concerns, I have been spoken down to and been told they can discuss the concerns with my husband. Also, if I had an opportunity to use a different provider, I would seriously look in to my options. However, I have to say, if we have ever been without electricity due to a big storm, etc., their crews/technicians are quick to respond.

Additional Comments
Member Services/Marketing/Communications – Negative Responses (continued)

When there is a power outage in the winter, it is hard to get in touch with them.

Whenever I've needed to speak with them, they have often been rude. I find the service over-priced and I sure wish I could choose my own electric company, co-op, or not. Where is the support for solar?

Member Services/Marketing/Communications – Neutral Responses

Better communication during long outages would be helpful.

Power was out for a time this morning and I would like to know what the problem was.

Billing/ Finance – Positive Responses

I am always behind on my bill and they let me make payment arrangements, which is very helpful. After the survey, I will be paying more attention to reading the newsletter.

I'm a single woman. I work two jobs to make ends meet. I heat with propane, but it's still hard to make ends meet. Last year at Christmas, I was running short on money and I called in and asked for an extra day to help me out. I couldn't believe their response. I asked for a "day" and they gave me two weeks. I fell in love with them for giving me two weeks. It made me feel so much better that I didn't have to struggle so much. It was comforting to know that if I get in a bind, they will understand and help me. It meant the world to me.

Billing/Finance – Negative Responses

Charging for online payments shows poor business practice. Other businesses save money and get more regular payments online, but somehow WEC manages to punish members for using it by charging them and discourages them by saying it is to be used only if necessary. This only indicates a lack of business skill and the recurrence of long-dead thinking from the era when co-ops were begun.

Eliminate the fee and I would pay online. We cut down on our use and then you raise the rate. The smart meters are a fire hazard and people should be aware of this when you put them in.

Additional Comments
Billing/Finance – Negative Responses
(continued)

I had to contact them. My payment was stolen. I called in to see what to do and they were not very helpful. I never have to call them and the one time I need their help, they didn't come through for me. They did tell about paying online and I tried to enter the program. It only gave me five seconds to enter my account number and when I couldn't enter it in that time frame it kicked me out of the program. I was frustrated that the program wasn't more user friendly.

There should be no reason why a person needs to bring in a doctor's note each month when they are not able to pay their electric bill and need electricity to stay on for the refrigeration of their medications. I was forced by Washington Electric to bring in a new doctor's note each month. This was a major inconvenience for my doctor and I, being that I am disabled and therefore I had to travel two hours back and forth from my home. To send the same doctor's note, but with a different date each month to Washington Electric.

Washington Electric Co-op projects itself as a very friendly caring place, but if you are a little late on paying your bill - even though you have always paid your bill for over 30 years - they treat you like a bum.

We own a seasonal cabin in Cabot and have always had good service from Washington Electric. I just hate the monthly billing. We used to be billed just two times a year, now we have to send a check every month even when no one has been there.

We would like to be able to pay bill online without a surcharge. We love WEC. Keep working to create a renewable power source supplied electrical system. No fossil fuels.

Billing/Finance – Neutral Response

I don't like having so many power outages in the winter. I lost $2,000 worth of meat when the power was off for 11 days. I need them to call me about the billing for 198 Kibling Hills in Cumbridge. I haven't received a bill.

It is a campsite and I use very little electric. I would like to pay every six months. Is this possible?

They could do a better job of explaining the electric use on the statement.

Rates/Fees – Positive Responses

I am happy and the bill is pretty low.

I have been happy with them. I like that their rates are a lot lower than Green Mountain Power.

Additional Comments
Rates/Fees
(continued)

Rates/Fees – Negative Responses

Eliminate the fee and I would pay online. We cut down on our use and then you raise the rate. The smart meters are a fire hazard and people should be aware of this when you put them in.

Even after doing energy usage audit and replacing high energy users in my home, my bill in the winter time is still really high. WEC winter rates are very high. No need to contact me, have already discussed with WEC with no sensible answer.

For the most part I am pleased with Washington Electric. Power outages appear to be less than other companies, but my bill is higher. I like the fact that WEC has Coventry and is always exploring better, environmentally friendly alternatives.

I am very concerned about our high rates. I have other utilities that are close by and are a lot less expensive than Washington Electric. It sounds like another rate increase coming. They have got to be competitive. I think they are doing a good job, but they are too costly. I am not happy with this energy tax. I can't see where I am getting any benefit from that at all.

I am very disappointed in our electric rates. Green Mountain Power rates are substantially lower than Washington Electric rates. Why is that? I am within five utility poles of lowering my rates by 30%. This is not logical that WEC should be so much more expensive than GMP.

I believe our rates per kilowatt hour are too high. I also believe that if I elect to put in my own solar power source that Washington Electric should not be capping what they will pay me for the power I produce. Currently, you cannot get money back. You get a credit towards your account, but you have a ceiling on what you can bank.

I think I pay way too much for electricity. I know people on GMP that pay NOTHING compared to what I pay and I think it's ridiculous that my bill is so outrageous!

I think that this company has good intentions, but are a lot higher than a few other power companies like GMP and if where I lived had another company available, I would probably switch my services based on the cost.

I think they have been great. I have to pull the meter every year. It would be better to not charge me a monthly fee or cheaper for them.

I think they need to provide greater communication. I would like to find out why my bill is so high. I have absolutely nothing on during the day except a refrigerator and yet my bill is $150 a month. My neighbors have bills of $60, so I'm wondering why my bill is so high. I'm totally against all the monthly charges. They are charging me for the honor of a being a customer.

Additional Comments
Rates/Fees – Negative Responses
(continued)

I wish the rates would go down.

In regards to my answers, I am not as happy as I could be because we pay a huge bill every month and are not home all day, but others in town are paying a fraction of what we pay and are home.

It would be nice if the rates were lower.

Keep working on keeping our rates down. The bigger companies have lower rates.

Lower the rates.

Make the rates go down.

Please focus on reducing the cost to your customers. All the rest of the programs should be voluntary, thanks.

Prices need to come down.

Rates are high. I would like more incentive for residential solar. Utility crews need to be more efficient on non-emergency line work due to high labor cost.

Rates are very high, and the lack of availability for owners to access renewable energy net metering credits is a big negative.

The bill jumped up a lot, so we called, finally. I wish someone at the co-op could have told us sooner what to look for.

The cost is too high and there are intermittent outages that, while only last seconds, are very disruptive. Great survey. Thanks for asking us to participate.

The rates are high.

Their prices are unaffordable. They are three times higher than other companies. I believe that IDS should be left in the private sector.

There has been too many rate increases. It is getting quite expensive.

This is the most expensive electric service I've ever had. Your customer service is fine, but I pay too much.

Too expensive.

Additional Comments
Rates/Fees – Negative Responses
(continued)

Very expensive power.

Washington Electric has provided good service. Our one and only complaint is the rates. They seem to be very high compared to others. Our survey answers were based on this opinion. Thanks.

We need to stop losing power all the time. Their rates are too high.

Whenever I've needed to speak with them, they have often been rude. I find the service over-priced and I sure wish I could choose my own electric company, co-op, or not. Where is the support for solar?

Rates/Fees – Neutral Responses

I have been very pleased with them. I have been surprised about the rate increases in the last two years.

I think that they should increase the rates with a small percentage each year rather than waiting four years then having a big rate increase. Increase the rates slowly over time.

It would be nice if we could have winter rates as opposed to summer rates, instead of having them the same rates.

Offer the most competitive rates they can.

Small solar units like on houses do not and cannot push power back to the grid. (If you disagree then you are disagreeing with actual science. Do some actual research for once.) Quit stealing my money to fund this outdated concept and the people that take advantage of this politically motivated concept. Solar is not effective and never will be. Look at the science, not the politics. I've been in co-ops and they are generally cheaper than for profit, but I would gladly switch back to GMP. Too many special programs and self-interest projects exist in this co-op to the point it is likely almost criminal.

Some of these questions did not pertain to me as we do rent the property out mostly in the summer, so I tried to answer the questions accordingly. I would say that I am interested in small electric sources however cost is important too and do not feel there was a category to respond to that. You may contact me, but I am out of state and would like residents to weigh in. It is very important to me that this is a cooperative that I am very pleased to be a part of. Thank you.

Additional Comments (continued)

Energy Efficiency/Energy Audits - Negative Responses

Dump Efficient Vermont. I really like the co-op otherwise.

I like Coventry that is an excellent source of renewable. I do not like Efficiency Vermont it puts a high tax on the bill.

Energy Efficiency/Energy Audits - Neutral Responses

I am hoping that the company can help me do an energy audit of my home and assist me in planning long term energy improvements to make, in order of importance. I have already been in touch about this.

I think they should have free energy audits every five years.

I want to know what we can do to reduce our usage. If they could put out more information on usage reduction, that would be my suggestion.

I would like to know what is the best time of day for me to wash and dry clothes.

We would love to make our home more efficient.

Additional Services – Positive Responses

For the most part I am pleased with Washington Electric. Power outages appear to be less than other companies, but my bill is higher. I like the fact that WEC has Coventry and is always exploring better, environmentally friendly alternatives.

Additional Services – Negative Responses

Small solar units like on houses do not and cannot push power back to the grid. (If you disagree then you are disagreeing with actual science. Do some actual research for once.) Quit stealing my money to fund this outdated concept and the people that take advantage of this politically motivated concept. Solar is not effective and never will be. Look at the science, not the politics. I've been in co-ops and they are generally cheaper than for profit, but I would gladly switch back to GMP. Too many special programs and self-interest projects exist in this co-op to the point it is likely almost criminal.

Additional Comments
Additional Services
(continued)

Additional Services – Neutral Responses

I often wonder why the co-op doesn't provide internet service. The organization has the pole infrastructure.

I think the President is doing a great job, for the long time he has been there. Broadband internet would be great to have.

I wish I could determine my instantaneous electric usage, not the averaged usage.

I'd be interested in them offering more incentive programs for solar water heaters. Other companies also have incentives for heat pumps. I'd like to see them go in that direction.

Please focus on reducing the cost to your customers. All the rest of the programs should be voluntary, thanks.

Rent pole space for fiber to each home for high speed Internet.

Newsletter/Information/Social Media – Positive Responses

I like the newsletter. We have good service considering where we live and it is seasonal.

Newsletter/Information/Social Media – Neutral Responses

I am always behind on my bill and they let me make payment arrangements, which is very helpful. After the survey, I will be paying more attention to reading the newsletter.

Member Identity/Loyalty – Positive Responses

I appreciate interactions with Bill Powell. He's very helpful. I like that WEC is 100% renewables. I like that it is a co-op. I hope that the coop's mission can remain progressive and cutting edge and do lots of smart-grid technology.

I fully support them and am glad to be part of the co-op.

I have been very satisfied with them all these years. I even get a rebate check once in a while.

Additional Comments
Member Identity/Loyalty – Positive Responses
(continued)

I'm pleased to be a member. They do a good job. They are an excellent co-op. I'm proud to be a member.

Love being a part of Washington Electric!

Some of these questions did not pertain to me as we do rent the property out mostly in the summer, so I tried to answer the questions accordingly. I would say that I am interested in small electric sources however cost is important too and do not feel there was a category to respond to that. You may contact me, but I am out of state and would like residents to weigh in. It is very important to me that this is a cooperative that I am very pleased to be a part of. Thank you.

We are proud to be members and happy you are doing such great work--especially concerning renewable resources.

Member Identity/Loyalty – Negative Responses

I think that this company has good intentions, but are a lot higher than a few other power companies like GMP and if where I lived had another company available, I would probably switch my services based on the cost.

When I have called with concerns, I have been spoken down to and been told they can discuss the concerns with my husband. Also, if I had an opportunity to use a different provider, I would seriously look in to my options. However, I have to say, if we have ever been without electricity due to a big storm, etc., their crews/technicians are quick to respond.

Whenever I've needed to speak with them, they have often been rude. I find the service over-priced and I sure wish I could choose my own electric company, co-op, or not. Where is the support for solar?

Renewable Energy

Alternative energy is good, but Vermont is not built for it. Hydro Quebec is the best. I would prefer to invest in Hydro Quebec than any solar system. Solar doesn't make sense with our 93 average days of sunshine. Wind power is a mechanical device that will wear out. Productivity is short lived with wind power. Hydro is where it's at for Vermont.

Every home should have a solar panel on it and sell the extra energy to the co-op.

Additional Comments
Renewable Energy
(continued)

For renewable energy I would prefer that multiple projects and options exist, not picking just one. This is extremely important and the survey doesn't allow that to be captured. Different homes will benefit from different options.

Go solar and wind.

Great electric co-op. I am very happy all electricity is from renewable resources.

I am a little disappointed in the lack of solar incentive.

I appreciate interactions with Bill Powell. He's very helpful. I like that WEC is 100% renewables. I like that it is a co-op. I hope that the coop's mission can remain progressive and cutting edge and do lots of smart-grid technology.

I appreciate the solar panel program, where I get credit.

I believe our rates per kilowatt hour are too high. I also believe that if I elect to put in my own solar power source that Washington Electric should not be capping what they will pay me for the power I produce. Currently, you cannot get money back. You get a credit towards your account, but you have a ceiling on what you can bank.

I have very little experience with the co-op, but it has been very good. My negatives are related to wanting to use residential solar and finding that an impossible option because of policies. That forces me to have a generator as my backup power source and that is the worst option in many ways. You should enable people to generate enough solar to run their wells and septic pumps and emergency needs if the grid goes down.

I hear from friends of mine that went to the meeting. They went to a closed door session. I hear that one of the members has a solar company, which is totally inappropriate.

I like Coventry that is an excellent source of renewable. I do not like Efficiency Vermont it puts a high tax on the bill.

I read about a special that they were heading up about solar panels. It sounded like someone was supposed to contact me after I submitted the papers and no one did. I would like to find out how cost effective that would be.

I think I would like to go with some solar panels for my own home. I would like the co-op to reopen that program so more people can generate with solar.

Additional Comments
Renewable Energy
(continued)

I think it's terrible that Washington Electric does not pass on solar energy credits to the homeowner who puts up the solar panels. Because of this I refuse to put them up even though I would very much like to. This has dampened my image of Washington Electric tremendously!

I think overall they do a very good job. My big gripe is I wanted to do a solar array and all we got was the run around. By the time all was said and done, we missed the federal deadline. We missed it and it was frustrating. It didn't seem like they were willing to help in any way. I was surprised to hit this brick wall. I'm wishing they would be more cooperative and helpful. They have come a long way and we used to be out of power all the time. The service has greatly improved in the last five years.

I think that Washington Electric Co-op should give up on renewable energy. It is too expensive. Also, in my area the utility lines are so overgrown with tree branches it would not be surprising to me if we lose power for another week this winter. I would think that to help prevent another week-long outage there would be a focus on cutting back tree branch overgrowth from utility lines. I could be wrong though, I'm not a professional when it comes to electricity grid maintenance.

I think there could be more things that customers could do to be using renewables, like solar. There are all kinds of information about rebates, but there's truly not enough information. They need to tell how much a system costs. They need to tell all the support they will receive from the co-op. You need more information so you can make an informed decision.

I understand why WEC has the "deal" that it does for residential solar, but it is so discouraging when many of my friends, in town and nearby, are on Green Mountain Power, and we all went solar at the same time.

I wanted to have SunCommon install grid tied solar power and WEC said no way. I am now working with Catamount solar on an off grid system so I won't need WEC anymore.

I was disappointed to discover that their policies on selling back to the grid are poor. I was exploring the possibilities of adding solar panels to my home and once the vendor finds out I'm with WEC, they discourage me from pursuing this kind of electric generation. When this happens, it makes me think, they aren't committed to solar.

I wish that solar was affordable for everybody. I would like to have solar if it was affordable.

I'd be interested in them offering more incentive programs for solar water heaters. Other companies also have incentives for heat pumps. I'd like to see them go in that direction.

I'd like to know what Washington Electric has to offer. We own two homes that are served by Green Mountain Power. They are allowing people to buy into a "solar" array and we've decided to participate. I'm wondering if Washington Electric has something like that. Yes, I would like them to call me.

Additional Comments
Renewable Energy
(continued)

I'd like to see more information on how they are looking at solar in the long run.

If there was more net meter allowable, it would be better. Right now it's very limited. The rules state that you don't get paid for the full energy you give them. You only get paid for a certain amount.

I'm curious about using solar for my water heater. I'm considering it.

I'm glad I have a company that generates our electricity without using fossil fuels or nuclear.

Rates are high. I would like more incentive for residential solar. Utility crews need to be more efficient on non-emergency line work due to high labor cost.

Rates are very high, and the lack of availability for owners to access renewable energy net metering credits is a big negative.

Small solar units like on houses do not and cannot push power back to the grid. (If you disagree then you are disagreeing with actual science. Do some actual research for once.) Quit stealing my money to fund this outdated concept and the people that take advantage of this politically motivated concept. Solar is not effective and never will be. Look at the science, not the politics. I've been in co-ops and they are generally cheaper than for profit, but I would gladly switch back to GMP. Too many special programs and self-interest projects exist in this co-op to the point it is likely almost criminal.

The co-op should not sell electric panels to the customer for retail price.

They seem like they are on the right track. It would be nice if I could have a solar panel on my house that wouldn't cost so much, or to be able to make payments on it, comparable for what the electric bill is now.

We are proud to be members and happy you are doing such great work--especially concerning renewable resources.

We asked if we could introduce solar electricity to our property and were told that WEC has reached the maximum amount of customers who are using solar.

We have a perfect location for wind and solar on a small scale, but can't afford to do it. We could supply our neighborhood if we had wind and solar.

We would like to be able to pay bill online without a surcharge. We love WEC. Keep working to create a renewable power source supplied electrical system. No fossil fuels.

Additional Comments
Renewable Energy
(continued)

Whenever I've needed to speak with them, they have often been rude. I find the service over-priced and I sure wish I could choose my own electric company, co-op, or not. Where is the support for solar?

Other Comments

I am very concerned about our high rates. I have other utilities that are close by and are a lot less expensive than Washington Electric. It sounds like another rate increase coming. They have got to be competitive. I think they are doing a good job, but they are too costly. I am not happy with this energy tax. I can't see where I am getting any benefit from that at all.

I don't want to answer personal questions. I don't want to answer questions about promotions like Smart Hub or Time of Use Rate programs. If this is a survey it shouldn't include promotions. I have written surveys and your questions are skewed.

I have two accounts. I am completing one survey which applies to both.

I think it is interesting that they are doing a phone survey, because it is a hard thing to do. I get so many telemarketers and I am glad I listened to you.

If they look at my survey they will know how I feel.

Please don't give out my number.

Should have had a N/A in assessment section and we (WEC) need continuous reliable energy from a stable resource.

Some of these questions did not pertain to me as we do rent the property out mostly in the summer, so I tried to answer the questions accordingly. I would say that I am interested in small electric sources however cost is important too and do not feel there was a category to respond to that. You may contact me, but I am out of state and would like residents to weigh in. It is very important to me that this is a cooperative that I am very pleased to be a part of. Thank you.

Thank you for asking my opinion.

The cost is too high and there are intermittent outages that, while only last seconds, are very disruptive. Great survey. Thanks for asking us to participate.

Additional Comments
Other Comments
(continued)

The property I own serviced by WEC is a commercial building with a residential unit so I don't actually live there.

They need to rethink this survey. How many people deal with their utility enough to know if they are customer friendly?

This is a second home for us, and so we may be atypical.

This is a vacation home.

This property is a seasonal cabin.

Used at a Summer Camp.

We are here for the summer only. The home is on a class-4 road and access is not available during the winter season. We often feel like second class users because of regulations and fees applied to part time occupancy. Some of the questions in this questionnaire are a little vague and difficult to answer. I wonder if they will provide a true picture.

What is stimulating this survey?

Will the results be published?

Appendix B: Questionnaire

2015 Washington Electric Cooperative
RESIDENTIAL MEMBER SATISFACTION SURVEY

ACSI Questions in Blue
Final 8-11-15

INTRODUCTION:
May I please speak with the head of household who has or shares responsibility for the electric utility bills? Hello, my name is ___________ and I am with NRECA Market Research Services. We are conducting a confidential survey for Washington Electric Cooperative on the service they provide you. Your household was chosen at random to participate in this survey. **LET ME ASSURE YOU WE ARE NOT SELLING OR SOLICITING ANYTHING.**

[If hesitant, please offer the following option.] If you would like to first verify the legitimacy of this survey with Washington Electric Cooperative (Phone 800-932-5245), I would be happy to schedule a convenient time to call you back.

Our survey will take about 8 minutes. May I continue now?

[ ] Yes … ***Continue*** [ ] No … When would be a more convenient time for me to call back?
Date to call: ___________ Time to call: ____________ (Central time)

---

1. How long have you received your electric service from Washington Electric Cooperative? Has it been … *[Read]*
   [ ]1 Less than 1 year [ ]3 3 to 7 years [ ]5 11 to 20 years
   [ ]2 1 to 2 years [ ]4 8 to 10 years [ ]6 Over 20 years [ ]8 Don't Know/Refused

ACSI Questions

2. Using a 10-point scale where 1 is "very dissatisfied" and 10 is "very satisfied," how satisfied overall would you say you are with Washington Electric Cooperative?
   Very Dissatisfied 1 2 3 4 5 6 7 8 9 10 Very Satisfied

3. Considering all of your expectations, to what extent has Washington Electric Cooperative fallen short or exceeded your expectations? Please use a 10-point scale where 1 means "falls short of your expectations" and 10 means "exceeds your expectations."
   Falls short 1 2 3 4 5 6 7 8 9 10 Exceeds expectations

4. Now, I'd like you to imagine an ideal utility company. [***Pause***] How well do you think Washington Electric Cooperative compares with that ideal utility company? Use a 10-point scale where 1 means "not very close to your ideal" and 10 means "very close to your ideal."
   Not close 1 2 3 4 5 6 7 8 9 10 Very close to ideal

5. Assume for a moment that you could choose your electric service provider from among more than one utility. Using a 10-point scale where 1 means "very unlikely" and 10 means "very likely," how likely would you be to choose Washington Electric Cooperative?
   Very unlikely 1 2 3 4 5 6 7 8 9 10 Very likely

Performance Attributes

6. Please tell me how important each of the following aspects of Washington Electric Cooperative's service is to you. Use a 10-point scale where 1 means it is "not at all important" and 10 means it is "extremely important." How important is … *[RANDOMIZE]*

		Not at all Important		Extremely Important	DK
a.	Handling individual complaints and problems	1	…………………	10	11
b.	Being friendly and courteous in the service they provide	1	…………………	10	11
c.	Having competent and knowledgeable employees	1	…………………	10	11
d.	Looking out for your best interests	1	…………………	10	11
e.	Being committed to the community	1	…………………	10	11
f.	Providing a good value for the money you spend	1	…………………	10	11
g.	Providing reliable service	1	…………………	10	11
h.	Helping you learn to manage your energy use	1	…………………	10	11
i.	Communicating with you and keeping you informed	1	…………………	10	11

7. Now, for the same attributes please tell me how well you think Washington Electric Cooperative is performing to meet your expectations. Please use a 10-point scale where 1 means they are "performing far below your expectations" and 10 means they are "performing far above expectations." How is Washington Electric Cooperative performing on … *[RANDOMIZE]*

	On …	Far Below Expectations		Far Above Expectations	DK
j.	Handling individual complaints and problems	1	…………………	10	11
k.	Being friendly and courteous in the service they provide	1	…………………	10	11
l.	Having competent and knowledgeable employees	1	…………………	10	11
m.	Looking out for your best interests	1	…………………	10	11
n.	Being committed to the community	1	…………………	10	11
o.	Providing a good value for the money you spend	1	…………………	10	11
p.	Providing reliable service	1	…………………	10	11
q.	Helping you learn to manage your energy use	1	…………………	10	11
r.	Communicating with you and keeping you informed	1	…………………	10	11

Cooperative Commitment

8. WEC is a cooperative, organized as a not-for-profit corporation. How important to you is being a member of a non-profit electric co-op? Again use a scale of 1 to 10 where 1 means it is "not at all important" and 10 means it is "extremely important."

   [RECORD RATING 1 - 10]: ____
   11 Don't know
   12 Refused

9. Do you view yourself as a member/owner or as a customer of your electric cooperative, or both?

   [ ]1 Member/owner [ ]2 Customer [ ]3 Both [ ]4 Don't Know / Refused

Renewable Energy

10. You may be aware that Washington Electric Co-op provides their customers with electricity from renewable sources. Again using a scale of 1 to 10 where 1 means it is "not at all important" and 10 means it is "extremely important," how important is to you to have Washington Electric Co-op provide you with renewable energy sources?
    [RECORD RATING 1 - 10]: ____ 11 Don't know 12 Refused

11. When it comes to power generation, which of the following five types is the most important and which is the least important to you? *[RANDOMIZE]*

Most Important	Attribute	Least Important
○	Renewable energy sources from <u>large to moderate central plants</u> *(examples include Coventry landfill gas generator, run of river hydro, and Hydro Quebec)*	○
○	<u>Member-owned and small</u> renewable energy generation like solar panels on a home used to serve an individual's energy use	○
○	<u>Community-based</u> projects where Washington Electric Cooperative would build and maintain a solar site at a central location	○
○	Using the <u>least expensive</u> sources of power regardless of the fuel source	○
○	Power generation located <u>in Vermont</u>	○

Programs and Services

12. If a time-of-use rate program were available from Washington Electric Cooperative, where you could potentially save energy costs by shifting your energy use from a higher daytime peak use rate to a lower evening off-peak rate, how likely would you be to use it? Would you…
[ ] Definitely use it [ ] Probably use it [ ] May or may not use it [ ] Probably not use it, or [ ] Definitely not use it

13. WEC provides all members with online access to their electric usage, and access to payment options, and notifications for outages and restoration. This online access is called SmartHub. Were you aware of SmartHub? (If yes,) have you used SmartHub?
    [ ] Have Used SmartHub [ ] Aware of SmartHub but Have Not Used [ ] Unaware

Communication

14. Are you aware that each month, Washington Electric Cooperative sends a monthly newsletter called "Co-op Currents" to your home? [ ] Yes [ ] No [ ] Don't Know

15. ***(If Q14 = YES)*** How often do you read "Co-op Currents"? Would you say you never, not often, fairly often, or regularly read "Co-op Currents"?
    [ ] Never [ ] Not often [ ] Fairly Often [ ] Regularly Read [ ] Don't Know

16. Does your family access the internet from home? [ ] Yes [ ] No [ ] Don't Know

17. ***(If Q16 = Yes)*** How does your family connect to the internet from home? (Do not read list. If necessary, say "What kind of connection do you use?"
    [ ] Dialup
    [ ] Broadband cable
    [ ] DSL
    [ ] Satellite
    [ ] Wireless
    [ ] Other __________________
    [ ] Don't Know

Demographics – *The next few questions are for classification purposes only.*

18. Into which category does your age fall? ***[Read list]***
    - ☐ 18 to 34 ☐ 45 to 54 ☐ 65 or older
    - ☐ 35 to 44 ☐ 55 to 64 ☐ Refused

19. Which of the following is the best description of your home?
    - ☐ Single-family home ☐ Apartment, duplex, townhouse, or condominium ☐ Something else
    - ☐ Mobile home or trailer ☐ Pre-fabricated or modular home ☐ Refused

20. Washington Electric Cooperative would like to know if you have the following in your residence (read each)

a.	Ground source heat pump	[ ] Yes *(skip to d)*	[ ] No	[ ] Don't Know
b.	Air source heat pump	[ ] Yes *(skip to d)*	[ ] No	[ ] Don't Know
c.	Central air conditioner	[ ] Yes	[ ] No	[ ] Don't Know
d.	Window or room air conditioner	[ ] Yes	[ ] No	[ ] Don't Know
e.	Baseboard electric space heater(s)	[ ] Yes	[ ] No	[ ] Don't Know
f.	Portable electric space heater(s)	[ ] Yes	[ ] No	[ ] Don't Know
g.	Electric water heater	[ ] Yes	[ ] No	[ ] Don't Know
h.	Electric clothes dryer	[ ] Yes	[ ] No	[ ] Don't Know
i.	Dehumidifier	[ ] Yes	[ ] No	[ ] Don't Know
j.	Swimming pool	[ ] Yes	[ ] No	[ ] Don't Know
k.	Hot tub/Jacuzzi	[ ] Yes	[ ] No	[ ] Don't Know
l.	Electric vehicle	[ ] Yes	[ ] No	[ ] Don't Know

21. How many people currently live in your residence?
    [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] More than 5

22. Do you own or rent your home? [ ] Own [ ] Rent

23. Gender of respondent: ***[Do not ask]*** [ ] Male [ ] Female

Additional Comments you would like to make about Washington Electric Cooperative: ____________________
____

Thank you so much for your participation. Have a wonderful evening.

Respondent's First Name (for verification purposes): ____________________________________

Telephone Number: ____

Appendix C:
American Customer Satisfaction Index

American Customer Satisfaction Index

Second Quarter 2015
Confidential Report on the Energy Utilities Industry for Corporate Subscribers

July 2015

Customer Satisfaction (ACSI) Results

Introduction to ACSI Review of Energy Utilities Industry

Starting in 2011, ACSI has created separate categories for the largest investor-owned (the 24 largest), municipal (the 3 largest), and cooperative (the largest) utility plus aggregates of the all other smaller utilities within each of the three categories. For Q2 2015, the cooperative utilities category continues to carry the highest scoring among the three categories (76), followed by investor-owned utilities (IOUs) and municipal utilities (tied at 72). This represents a significant 4-point decline for cooperative utilities from Q1 2015, and a statistically insignificant 2-point and 1-point drop, respectively, for IOUs and municipal utilities. The 6-point wide distance between first place cooperative utilities and second place IOUs displayed in the previous quarter, is now shortened to 4 points.

The Best Utilities, Q2 2015

With a tie at 79, CenterPoint Energy and Sempra share the top spot among all utilities regardless of category in Q2 2015, the former dropping 2 points from last quarter and the latter remaining unchanged. Atmos Energy, the long-term leader of the pack in the previous three quarters, suffers a 4-point decline to 78 and is now in the 3rd place among all utilities. Cooperative utility player Touchstone follows closely behind at 77, down 3 points from last quarter, trailed by electric utility provider First Energy and Southern Company with a tie at 76.

Significant ACSI Improvements and Declines from Q1 2015 to Q2 2015

14 out of the 31 individual measured utilities across the three categories make significant drops this quarter, while none shows any significant growth in customer satisfaction. In addition to the 4-point decline for Atmos, CMS Energy also drops 4 points, moving from 2 points above last quarter's IOU industry average of 74 to a tie with this quarter's IOU industry average at 72. However, this is not yet the largest slide for the quarter: Municipal utility provider Salt River Project plunges 6 points to 74, followed by Dominion Resources (73), CPS Energy (72) and AEP (69), each drops a significant 5-point. Other significant decliners include Touchstone (77), First Energy (76), NiSource (75), PPL (75), Cooperative utility "all others" (75), Entergy (74), Ameren (73), Eversource Energy (formerly Northeast Utilities, 63), all down 3 points. More specifically, Eversource Energy, for the second quarter in a row, sits at the bottom of the industry, with Exelon and AEP share the 2nd

lowest spot at 69. Overall, a declining trend exhibits across all three categories this quarter, with 24 utilities showing some decline, only 3 somewhat improve, and 4 unchanged.

Customer Expectations

Customer expectations are highest for the cooperative energy utilities category at 80, followed by investor-owned at 77 and municipal utilities at 76, roughly consistent with the three categories' positioning on customer satisfaction. While cooperative energy utilities and IOUs each takes a minor 1-point drop from last quarter, municipal utilities shows a significant 3-point decline. Across all three utility categories, none makes any significant gains in expectations while 6 have a significant decline: Salt River Project and Dominion each fall 4 points to 78 and 76 respectively, while Atmos Energy (80), NiSource (78), CMS Energy (76), and AEP (74) are all down 3 points.

Led by Sempra and CenterPoint Energy (tied at 81) and closely followed by Atmos, First Energy, Southern, NextEra Energy and Touchstone (all at 80), all seven utilities with significantly above-average expectations (80 or higher) also rank well above the average for customer satisfaction (75 or higher). However, among the four utilities with statistically lower than average expectations (74 or lower), only AEP and Eversource have lower than average customer satisfaction (69 or lower). The other two utilities, Pepco (74) and LADWP (73), each has a slightly higher customer satisfaction at 70. The largest gaps between customer satisfaction of the actual service received and what they expect to receive (ACSI score compared to expectation score) lie in Eversource Energy (9 points), Duke Energy, CPS Energy and Exelon (6 points each). By contrast, no utility has satisfaction that matches or exceeds expectations for this quarter.

Perceived Quality

Perceived quality rates highest among customers of cooperative utilities with a score of 81, down 2 points from the previous quarter, followed by investor-owned utilities at 78 (-2 points) and municipal utilities at 77 (-4 points). Quality is the most important driver in determining overall satisfaction with the customer experience, and the wide range of quality scores from top (83 for Atmos, CenterPoint and Sempra) to bottom (ConEd at 73 and Eversource Energy at 71) is consistent with yet shifts downward from the previous quarter, where Atmos, CenterPoint and Salt River Project topped at 86 and LADWP and Eversource lagged at 74 and Con Ed at 73. In addition to the industry leader Atmos, CenterPoint and Sempra, Southern and Touchstone Energy (tied at 81) are also noteworthy for offering quality well above the industry average of 78. Salt River Project slides a significant 6-point to 80, losing its leading role from last quarter. Atmos and CenterPoint each makes a 3-point decline yet manages to remain on the top. Other big movers this quarter include Dominion and CPS Energy (each down 6 points), CMS Energy and AEP (both down 5 points), PPL and NiSource (each down 4 points), First Energy, Ameren, Entergy, Pepco, and Eversource Energy (each down 3 points). The drop for Eversource puts it at the bottom of all utilities. The rest of the utilities show no significant increase or decrease.

Power Reliability and Restoration

In ACSI modeling, perceived quality is nearly always the main driver of customer satisfaction. It combines an overall perception of quality with measures of how well the service fits the customer's needs and generally how reliable the service is. A separate, specific measure of electric service reliability also is collected for electric utilities, but is not included in the ACSI model. A second question, asked of electric utility customers but not used in the model, addresses power restoration performance (note that neither question is asked of Centerpoint Energy or Atmos Energy customers, who are purely natural gas customers). For the first time starting in Q1 2010 and transformed historically online for the energy utilities industry, these two questions are presented as 0-100 index scores rather than means on a 0-10 scale. Because the index scores for these questions are based on single scaled items rather than multiple indicators, the significant difference threshold is slightly greater than for the other ACSI variables such as satisfaction, expectations, quality, etc. Differences of 4 points or greater for these two questions are significant beyond margin of error.

First, customers are asked to rate the ability of the company they use "to provide reliable electric service." Cooperative utilities score highest on this metric at 84, followed by municipal utilities at 83 and investor owned utilities at 82. Salt River Project, despite dropping 4 points to 86, continues to be the top rated utility for providing reliable electric service, followed closely by Southern Company and Sempra at 85. In addition to Salt River Project, four utilities experience sharp drops from last quarter: Entergy and Dominion each fall 5 points, while Ameren, AEP and Eversource Energy each make a 4-point drop. This places Eversource (76) at the bottom of all three categories, with AEP, Con Ed, PSEG, and NiSource sitting closely above at 78. No utility makes a significant improvement in reliability this quarter.

The second question assesses the ability of each utility to restore power after an electric outage. For this metric the three categories perform similarly as for the reliability metric, with cooperatives in the lead with a score of 83, followed by municipal utilities at 79 and investor owned utilities last at 77. Touchstone leads all utilities for this metric with a score of 83, followed by Southern Company at 82, and Salt River Project and Sempra (both at 81). Four utilities fall sharply in power restoration from last quarter: Dominion falls 5 points to 77, Salt River Project (81), Entergy (78) and AEP (73) each drops 4 points. Eversource Energy makes an insignificant 1-point drop yet remains at the bottom of the utilities industry, sharing a tie with NiSource (down 3 points) at 69.

Perceived Value

Cooperative utilities boast the highest customer perceptions of value for money with a score of 75, followed by investor-owned utilities and municipal utilities, both much lower at 71. Among individual utilities, Sempra leads the pack at 79, followed by two gas-only providers, Atmos Energy and CenterPoint Energy at 78 and 77, respectively. The next highest on value are Touchstone Energy and First Energy, tied at 75. Several utilities lag the average considerably, with the lowest being Exelon at 67, AEP and Con Ed both at 66 and Eversource Utilities at the bottom with a score of 60.

Seven utilities drop their value proposition compared to Q1 2015 while none has significant improvement. CMS Energy, AEP Energy and Dominion Resources have the largest slide in value, each down 5 points. CPS Energy drops 4 points, while Entergy, Atmos Energy and Salt River Project each falls 3 points. Despite the drop, Atmos Energy still holds the 2nd highest rating in value among all utilities.

Customer Complaints

The investor owned utilities category bears the lowest level of customer complaints at 11%, closely followed by cooperative utilities at 12%, while municipal utilities are much higher at 17%. The differentiation among individual utilities is strong and highly correlated with customer satisfaction, ranging from a low of only 7% for PG&E and Xcel Energy to a high of 25% for LADWP. Salt River Project (8%) also has a complaint level well below industry average. On the other end of the spectrum, CPS Energy joins LADWP with a much higher level of complaints at 18%. Eight utility shows a meaningful drop in complaints from last quarter, but only one registers a statistically significant increase: PSEG drops 6 percentage points to 14% while Entergy drops 5 percentage points to 9%; Exelon (12%) and DTE (9%) each dips 4 percentage points; Duke (12%), Pepco (11%), First Energy (9%) and PG&E (7%) all drop by 3 percentage points. As a contrast, Edison International jumps 3 percentage points to 16%, joining CPS Energy (18%) and AEP Energy (17%) as the second highest group in customer complaints.

Company Customer Loyalty and Retention

Customer loyalty is highest for cooperatives at 76, followed very closely by municipals at 75 and investor-owned utilities at 74. Customer retention naturally follows suit, with cooperatives at 78% and investor owned and municipals both at 76%. While deregulation of energy exists in some areas, generally speaking for this industry unlike most, these measures are often hypothetical; that is, what a customer would do if given a choice among different energy providers within their service area.

For loyalty, CenterPoint Energy leads at 84, followed by Sempra in a fair distance at 80, not surprisingly the top two performers in customer satisfaction as well. Just a notch below but still well above industry are Atmos (79), DTE (78) and Southern Company (77). LADWP is the biggest gainer in loyalty this quarter, up 5 points to equal the IOU average of 74, while DTE climbs up 4 points to 78 to be in third place among all utilities, and Duke improves 3 points to 71. Salt River Project (76), AEP (71) and CMS (70) share the biggest drops of 5 points each, followed by Touchstone (76), Entergy (73), PPL (73) and Eversource Energy (63) with a 4-point dip. The last group that makes a smaller yet still statistically significant 3-point decline includes Atmos (79), Dominion (74), MidAmerican (73), and PSEG (71).

For customer retention the rankings are virtually the same, with CenterPoint (82%), Sempra (81%) and DTE (81%) on top and Eversource (65%), AEP (71%) and Con Ed (71%) at the bottom and well below the average. DTE is the only one that makes meaningful gains, up 4 percentage points to 81%, while AEP experiences the largest drop off, falling 6 percentage points to 71%. CPS Energy (75%) and Eversource (65%) are down 5 percentage points, while Salt River Project (78%) and CMS (75%) each drops 4 percentage points.

Appendix E.

WASHINGTON ELECTRIC COOPERATIVE, INC.

NET METERING TARIFF

POLICY BULLETIN NO. 38 NM

A. Application.

The following tariff shall apply to members who: (1) take service under a rate within this electric service tariff, (2) have received approval pursuant to 30 V.S.A. sections 248 from the Vermont Public Service Board ("Board") for an individual net metered system or a group net metered system as defined below, and (3) employ an eligible system (defined below in sections C(1) and D(1)) to generate electricity primarily for their own use and which from time to time generates electricity in excess of the member's then current needs and is connected to deliver such excess electricity to the Washington Electric Cooperative, Inc.'s ("WEC" or "Co-op"") distribution system. Members must conform to all applicable requirements of 30 V.S.A. sections 248 and to Vermont Public Service Board Orders, Rules, Regulations, electrical safety, power quality, current WEC bylaws and membership application provisions, and interconnection requirements pertaining to self-generation of energy for net metering. This tariff provision shall not supersede any terms and conditions of any other tariff provision under which the member takes service from WEC, which other terms and conditions shall continue to apply. In the event of changes to Vermont Public Service Board Orders and/or Rules that pertain to net metering, the terms of this tariff are subject to amendment and/or revision.

A net metering system or facility installed after the effective date of this tariff as referenced herein shall include any new construction and/or commissioning of a net metering system that requires a Certificate of Public Good from the Board or any Major Amendment to a Pre-Existing System as defined under Vt.P.S.B. Rule 5.100 *et seq.*

B. Certificate of Public Good and Energy Efficiency Audit.

Any member seeking to take service in accordance with this tariff provision shall be required to submit written application for a certificate of public good under 30 V.S.A. sections 248 to the Board on forms specified by the Board, follow all procedures specified in those forms and Vt.P.S.B. Rule 5.100 *et seq.*, and obtain such a certificate from the Board before connecting any eligible *system* to WEC's distribution system or any portion of the member's own electric system that is itself connected to WEC's electric distribution system.

A certificate of public good for a net metering system is automatically transferred when the property with the net metering system is sold or otherwise conveyed. The new owner may commence net metering provided that the new owner: (1) agrees to operate and maintain the net metering system according to the terms and conditions of the certificate of public good and in compliance with Board Rule 5.100 and; (2) files a transfer form provided by the Board with the Co-op and the Board. Any monetized credits remaining on the previous owner's account shall not be transferred to the new owner.

An Energy Efficiency Audit will be required and applies to members who install net metering systems (both individual and any member participating in a group net metering system) after the date of the filing of this tariff. Any residential member seeking to take new service in accordance with this tariff, with historic energy consumption of 750 kWh or more per month that is based upon the past two years average kWh consumption, or any commercial or industrial member regardless of average use shall be required to obtain an Energy Efficiency Audit prior to submitting an application to the Public Service Board as set forth above.[1] The Energy Efficiency Audit may be provided by Efficiency Vermont or any other vendor/contractor approved by WEC. The Energy Efficiency Audit must provide a summary of energy efficiency options, savings, and recommendations. The member, at its discretion, shall decide whether or not to implement the recommendations of energy efficiency audit. However, this requirement for an energy efficiency audit shall be waived by WEC in the event the member can demonstrate that its home and/or building that is taking service under this tariff received a 5 Star energy efficiency rating or equivalent rating or conducted an Energy Efficiency Audit accepted by WEC in the past ten years. In the event WEC approves an audit from someone other than Efficiency Vermont or consents to a waiver of the Efficiency Audit upon satisfaction of the criteria set forth above, WEC shall provide such approval or waiver in writing. The member shall provide such written approval, waiver, or evidence of the completed Efficiency Vermont audit in its application for a Certificate of Public Good prior to the installation of the net metering system.

C. Individual Net Metering System.

1) **Definition**. An eligible individual net metering system is defined as a facility for generation of electricity that is no more than 500 kW capacity rated as Alternating Current (AC) at the point of interconnect to the WEC distribution system; that obtains a certificate of public good[2] and conforms to Vt. P.S.B. Rule 5.100 et seq., or any other net metering system installed and approved by the

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[1] . In the event of a new residential member seeking to take service under this tariff does not have two years of prior usage history, and the new member is not otherwise required to complete an Efficiency Audit under WEC's line extension tariff, prior usage shall be determined by reviewing prior historic usage of the member of a minimum of two months or the historic usage of the preexisting property owner.

[2] . When the term "Certificate of Public Good ("CPG") is used herein, the reference shall include the registration form and process required of Category 1 systems of up to 15 kw.

Vermont Public Service Board prior to the adoption of this new tariff; operates in parallel with facilities of WEC's distribution system; is intended primarily to offset part or all of the member's own electricity requirements; is located on the member's premise and employs a renewable energy source using a technology that relies on a resource that is being consumed at a harvest rate at or below its natural regeneration rate pursuant to 30 V.SA. § 8002(17) or is a qualified micro-combined heat and power system with a capacity up to 20 kW (AC) that meets the definition of a combined heat and power facility under 30 V.S.A. section 8015(b)(2) (hereinafter referred to as "eligible system" or "facility"). The member shall be responsible for the maintenance, safety, interconnection requirements, and condition of the eligible system.

2) (a) **Energy Measurement for Net Metering Facilities Installed *Prior* To The July 7, 2014, Tariff.** The Co-op shall measure the net electricity produced or consumed during each billing period. A digital utility meter with bi-directional functionality, owned by the Co-op and appropriate for the member's rate class will be provided. Such meter will measure both the kWh produced by the member's eligible system, as well as the net consumption of energy supplied by the Co-op. For members who desire a second meter for their own information, the Co-op shall supply an appropriate additional meter and the Member shall pay for the equipment and installation at the cost set in ¶ D.7. The meter shall be installed in accordance with the Co-op's standards-and shall be the property of the Co-op. Such additional meter shall be accessible to the Co-op at all reasonable times, and shall not be removed or otherwise disturbed by the member without advance written notice to and permission from the Co-op. Such additional meter shall be located in reasonable proximity to the existing meter and subject to testing by the Co-op at any time at the Co-op's own expense upon reasonable advance written notice to the member.

2)(b) **Energy Measurement for Net Metering Facilities Installed *After* July 7, 2014.** The facility shall be interconnected directly to the Co-op's grid with a separate, second production meter. The Co-op shall measure and calculate both the gross amount of electricity produced from the facility and the gross electricity consumed from WEC by the member during the billing period. There will be two meters, both shall be owned by WEC. The first meter will be a digital utility meter, installed and paid for by WEC. This meter shall be used to measure and calculate gross energy consumed by the member. The second meter, supplied by WEC, shall measure and allow WEC to calculate total or gross production from the facility. The member shall pay for the second meter including the equipment and installation at the costset in ¶ D.7. Both meters shall be installed in accordance with the Coop's standards. Both meters shall be accessible to the Coop at all reasonable times, and shall not be removed or otherwise disturbed without advance written notice to and permission from the Coop.

3)(a) **Billing for Net Metering Facilities Pre-existing the Effective Date of this Tariff.** If, at the end of a billing period, the electricity generated and fed back to the distribution system by the member exceeds the electricity supplied by the Co-op, then the Co-op shall calculate a monetary credit to the member as follows:

(i) For a period of ten years from the commissioning of the net metering facility, by multiplying the excess kWh generated during the billing period by the Co-op's highest residential block rate.

(ii) At the end of the 10-year period, for an additional 10 years, members using pre-existing net metering systems shall be credited for excess generation at the Co-op's blended residential rate. Until such time as the Vermont Public Service Board's net-metering regulations change, pre-existing systems still operating beyond 20 years will be credited at the blended residential rate. .

The Co-op shall apply the monetized credit to any remaining charges on the member's current electric bill for that period, provided the pre-existing net metering system is within ten years of its initial commissioning. After ten years from initial commissioning, monetized credits shall not be applied to non-bypassable charges as defined in Vt. P.S.B. Rule 5.100 et seq. If application to such charges does not use the entire balance of the credit, the remaining balance of the credit shall appear on the member's bill. When the net metering system is served via a time-of-use rate class and more generation is produced within a time period than was consumed in that time period, then the excess kWh generation shall be used to offset any net kWh consumption in any other time period within the billing period prior to the monetization calculation.

(i) However, if a time of use member who has a qualifying net generating facility interconnected directly to WEC, whose generation does not offset consumption and is measured through a separate meter, where its primary purpose is to measure the energy generated by the system, then the member's bill credits shall apply to all kWh generated by the net metering system and shall be calculated at WEC's highest residential block retail rate.

3)(b) **Billing for Net Metering Facilities with a completed CPG application filed with the Vermont Public Service Board after the effective date of this Tariff.** At the end of a billing period, WEC shall measure and calculate the gross generation consumed and the gross generation produced. If measurement and calculation of gross generation consumed is greater than the gross generation produced, the member shall be billed, based upon their respective customer class tariff for the net consumed, less any monetized credits accumulated in the preceding 12 months other than non-bypassable charges. In addition, the following monetized credits and charges shall be computed to the member's account on a monthly basis:

(i). If at the end of a billing period, the gross electricity generated and fed back to the distribution system by the member exceeds the gross electricity consumed by the member, then the Co-op shall calculate a monetary credit by multiplying the excess kWh generation times the blended residential rate as defined in Vt. P.S.B. Rule 5.100 et seq.

(ii) For the first 10 years after the net metering system is commissioned any positive Siting or REC adjustor set forth in the net metering facility's CPG is multiplied by the kWh for the respective billing period for gross generation and applied to the bill as a credit. For illustration purposes only, the $0.01/kWh siting adjustor for net-metering systems 15kW or less will result in such systems receiving a bill credit of $0.01/kWh multiplied by all kWh generated by the system.

(iii) Any negative Siting or REC adjustor set forth in the net metering facility's CPG is multiplied by the kWh for the respective billing period for gross generation and applied to the bill as an additional charge and will be applied in perpetuity. For illustration purposes only, the -$0.03/kWh REC adjustor for net-metering systems that retain their RECs will result in such systems receiving a bill charge of $0.03/kWh multiplied by all kWh generated by the system.

These credits shall be applied as set forth in subsection (5) below

4) 5.132 charges (meter reading, accounting, account correction, account maintenance, and meter cost).

WEC shall bill the following service fees and charges:
(a) Account set up fee for individual accounts: $33.00.
(b) Monthly account maintenance fee: $2.85 per month.
(c) Production/Time-of-Use Meter/per meter cost: $222.56

5) Accumulated Credits. Any accumulated monetary credits shall be used by the member within twelve months or shall revert to the Co-op without any compensation to the individual net metering system member. Monetized credits shall not be applied to past due balances prior to the commissioning of the net metering system. Accumulation of monetary credits shall not result in any financial payments to the member. The Co-op shall apply monetized credits from previous billing periods using credits that are scheduled to expire soonest first.

(a) For net metering members who had a completed CPG application filed with the Vermont Public Service Board after the effective date of this Tariff, the credit shall be applied to all charges on a member's electricity bill other than non-bypassable charges as defined in Vt.P.S.B. Rule 5.100 et seq.

(b) For net metering members who had a completed CPG application filed with the Vermont Public Service Board prior to the effective date of this Tariff and for a period of 10 years following the commissioning of the net metering system, the credit shall be applied to all charges on the member's electric bill. For the period following ten years from the commissioning of the net metering system, the credits shall be applied to all charges on the member's electric bill, not otherwise consisting of non-bypassable charges as defined in Vt.P.S.B. Rule 5.100 et seq.

D. Group Net Metering System.

1) Definition. An eligible group net metering system is defined as a group of members, or a single member with multiple electric meters, all located within the Co-op's service territory, where the members have elected to share energy and monetized excess generation credits created by a net metered system defined as a facility for generation of electricity that is no more than 500 kW AC capacity; that obtains a certificate of public good and conforms to Vt.P.S.B. Rule 5.100 et seq.,, or any other group net metering system installed and approved by the Vermont Public Service prior to the adoption of this tariff, ; operates in parallel with facilities of the Co-op's distribution system; is intended primarily to offset part or all of the group net metering system member's own electricity requirements;; and employs a renewable energy source produced using a technology that relies on a resource that is being consumed at a harvest rate at or below its natural regeneration rate pursuant to 30 V.S.A. § 8002(17) or is a qualified micro-combined heat and power -system with a capacity up to 20 kW that meets the definition of a combined heat and power facility under 30 V.S.A. § 8015(b)(2). Unmetered municipal street lighting accounts are not eligible to be members of a group. An account cannot be a member of more than one group. The cumulative capacity of net-metering systems allocated to a single member may not exceed 500 kW.

2) The group net metering system members shall be responsible for the cost, maintenance, safety and condition of the eligible system.

3) A group net metering system shall file with the Board, the Department of Public Service and WEC a completed net metering application provided by the Board including the-following information:

(a) The meters identified by account number to be included in the group system.

(b) A procedure for adding and removing meters included in the group net metering system and directions as to the manner in which the Co-op shall allocate any accrued credits among the meters included in the system as outlined further below.

(c) A designated person responsible for all communications between the group net metering system and WEC except for communications related to individual account billing, payment and disconnection.

(d) A binding process for the resolution of any disputes within the group net metering system relating to net metering that does not rely on the Co-op, the Board, or the Department of Public Service. This process does not apply to disputes between WEC and the individual group members regarding billing, payment, and disconnection.

4) WEC shall bill directly and send all communications regarding billing, payment and disconnection directly to each individual group net metering system account. All charges for each individual account shall be based on the individual meter for that account and the rate class associated with that meter, unless otherwise specified herein.

5)(a**) Energy Measurement for Group Net Metering Facilities Installed Prior to The Filing of The July 7, 2014, Tariff.** The Co-op shall measure the net electricity produced or consumed during each billing period for the group net metering system meter that has the generation interconnected. A digital utility meter with bi-directional functionality, owned by the Co-op and appropriate for the group's rate class will be provided. Such meter will measure both the kWh produced by the generating account as well as the net consumption of energy supplied by the Co-op. For group net metering systems who desire a second production meter for their own information, the Co-op shall supply an appropriate additional meter. The group net metering system members shall pay for the equipment and installation of the second production meter at the cost set in ¶ D.7. The meter shall be installed in accordance with the Co-op's standards and shall be the property of the Co-op. Such additional meter shall be accessible to the Co-op at all reasonable times, and shall not be removed or otherwise disturbed by the group net metering system members without advance written notice to and permission from the Co-op. Such additional meter shall be located in reasonable proximity to the existing meter and subject to testing by the Co-op at any time at the Co-op's own expense upon reasonable advance written notice to the group net metering system designated person.

5(b) **Energy Measurement for Group Net Metering Facilities That Commence Service After July 7, 2014.**

The Co-op shall measure both the gross amount of electricity produced from the facility and gross electricity consumed from WEC by the members during the billing period. The facility shall be interconnected directly to the Co-op's grid with a separate production meter. This production meter, supplied by the Co-op, shall measure and allow WEC to calculate total production from the facility. The group net metering members shall pay for this production meter including the equipment and installation at the cost set in ¶ D.7. This production meter shall be installed in accordance with the Co-op's standards. This production meter shall be accessible to the Co-op at all reasonable times, and shall not be removed or otherwise disturbed without advance written notice to and permission from the Co-op.

6)(a**) Billing For Group Net Metering Facilities Pre-existing the Effective Date of this Tariff Where Generation is Physically Connected to Billing Meter and Offsets Consumption of The Member.**

If, at the end of a billing period, the electricity generated and fed back to the distribution system by the generating account exceeds the electricity supplied to that account by the Co-op to the particular billing meter, then the excess kWh shall be allocated to the group member accounts on a percentage or other acceptable basis proposed by the group and agreed upon by the Co-op pursuant to the allocation instructions provided by the group. The allocated kWh shall then be credited and monetized as follows:

> (i) For a period of ten years from the commissioning of the net metering facility, by multiplying the excess kWh generated during the billing period by the Co-op's highest residential block rate.
>
> (ii) At the end of the 10-year period, for an additional 10 years, members using pre-existing net metering systems shall be credited for excess generation at the Co-op's blended residential rate. Until such time as the Vermont Public Service Board's net-metering regulations change, pre-existing systems still operating beyond 20 years will be credited at the blended residential rate.

The Co-op shall apply the monetized credit to any remaining charges on the group member's current bill for that period, provided that pre-existing net metering system is within ten years of its initial commissioning. After such date, monetized credits shall not be applied to non-bypassable charges as defined in Vt. P.S.B. Rule 5.100 et seq. If application to such credits to charges does not use the entire balance of the credit, the remaining balance of the credit shall appear on the individual member's bill. Any accumulated monetary credits shall be used by the individual member within twelve months or shall revert to the Co-op without any compensation to the group net metering system members. Accumulation of monetary credits shall not result in any financial payments to the member.

When the generating account of a group net metering system is served via a time-of-use rate class and more generation is produced within a time period than was consumed in that time period, then the excess kWh generation shall be used to offset any net kWh consumption in any other time period within the billing period for that account prior to the allocation of excess kWh to group members.

6(b) **Billing For Group Net Metering Facilities Pre-existing the Effective Date This Tariff Where Generation is Interconnected to The Grid Such That**

Generation Does Not Offset Consumption to The Member or Group.

Where generation is directly interconnected to the Co-op such that the generation does not offset consumption of the member or group, total production shall be allocated to the group members for the billing period in the manner prescribed by the group and a monetized credit shall be calculated as follows:

> (i) For a period of ten years from the commissioning of the net metering facility, by multiplying the excess kWh generated during the billing period by the Co-op's highest residential block rate.
>
> (ii) At the end of the 10-year period, for an additional 10 years, members using pre-existing net metering systems shall be credited for excess generation at the Co-op's blended residential rate. Until such time as the Vermont Public Service Board's net-metering regulations change, pre-existing systems still operating beyond 20 years will be credited at the blended residential rate.

The Co-op shall apply the monetized credit to any remaining charges on the group member's current bill for that period, provided that pre-existing net metering system is within ten years of its initial commissioning. After such date, monetized credits shall not be applied to non-bypassable charges as defined in Vt. P.S.B. Rule 5.100 et seq. If application to such credits to charges does not use the entire balance of the credit, the remaining balance of the credit shall appear on the individual member's bill. Any accumulated monetary credits shall be used by the individual member within twelve months or shall revert to the Co-op without any compensation to the group net metering system members. Accumulation of monetary credits shall not result in any financial payments to the member.

6(c) **Billing For Group Net Metering Facilities With A Completed CPG Application Filed With The Vermont Public Service Board After The Effective Date of This Tariff.**

Total production for the billing period shall be allocated to the group members in the manner prescribed by the group and a monetized credit shall be calculated as follows:

> (i). multiplying the excess kWh generated times the blended residential rate as defined in Vt. P.S.B. Rule 5.100 et seq.
>
> (ii) For the first 10 years after the net metering system is commissioned any positive siting or REC adjustor set forth in the net metering facility's CPG is multiplied by the gross kWh produced by the system for the respective billing period and applied to the bill as a credit. For illustration purposes only, the $0.01/kWh siting adjustor for net-metering systems 15kW or less will result in such group net meter member(s) receiving a

bill credit of $0.01/kWh multiplied by the allocated kWh on the production meter.

(iii) Any negative siting or REC adjustor set forth in the net metering facility's CPG is multiplied by the gross kWh produced by the system for the respective billing period and applied to the bill as an additional charge and will be applied in perpetuity. For illustration purposes only, the -$0.03/kWh REC adjustor for net-metering systems that retain their RECs will result in such systems receiving a bill charge of $0.03/kWh multiplied by the allocated kWh on the production meter.

The Co-op shall apply the monetized credit to any remaining charges on the group member's current bill for that period, except such credits shall not be applied to non-bypassable charges as defined in Vt. P.S.B. Rule 5.100 et seq. If application to such credits to charges does not use the entire balance of the credit, the remaining balance of the credit shall appear on the individual member's bill. Any accumulated monetary credits shall be used by the individual member within twelve months or shall revert to the Co-op without any compensation to the group net metering system members. Accumulation of monetary credits shall not result in any financial payments to the member.

7) **5.132 charges (meter reading, accounting, account correction, account maintenance, and meter cost).**

WEC shall bill the following service fees and charges:

(a). Account set up fee for the group account: $111.00. This charge shall be divided equally amongst the group members.
(b). Monthly account maintenance fee: $2.85 per month per member participating in the group system.
(c) Production/Time-of-Use Meter/per meter cost: $222.56

8) **Allocation of Group Net Metering.** Allocations may only be changed on written notice to the Co-op by the designated person of the group net metering system. The Co-op shall implement appropriate changes to the allocation of credits within thirty days after receiving written notification from the designated person. Allocations can be changed no more than twice per calendar year and shall not be applied retroactively. Changes are subject to the Co-Op's approval, which shall not be unreasonably withheld.

E. Renewable Energy Credits.

1. For Net Metering Facilities With a Completed CPG Application Filed

With The Vermont Public Service Board After The Effective Date of This Tariff.

At the time an application for authorization to construct the net-metering system is filed with the Vermont Public Service Board, the applicant must elect whether to retain ownership of any RECs generated by the system or whether to transfer such RECs to the Co-op. This election is irrevocable. The Co-op must retire all RECs transferred to it by a net metering customer.

2. For Net Metering Facilities Pre-Existing the Effective Date of This Tariff, and installed after July 7, 2014:

WEC shall retain all renewable energy credits and associated environmental attributes ("RECs") generated by the net metering system. WEC may sell, transfer or retire the RECs at its sole and full discretion.

F. REC and Siting Adjustors.

These adjustors are applicable to net metering system facilities with a completed CPG application filed with the Vermont Public Service Board after the effective date of this tariff.

1. REC Adjustors.

At the time the Board issues the net-metering facility a CPG, a zero or positive REC adjustor shall be applied for a period of 10 years from the date the system is commissioned; a negative REC adjustor applies in perpetuity. The adjustors are as follows:

a. REC Adjustor (Transfer) = 3 cents per kwh.
b. REC Adjustor (Retention) = negative 3 cents per kwh.

Hydro electric facilities net metering under this rule are not subject to a REC adjustor.

2. Siting Adjustors.

At the time the Board issues the net metering facility a CPG, a zero or positive siting adjustor shall be applied for a period of 10 years from the date the system is commissioned; a negative siting adjustor applies in perpetuity.

a. Category I (as defined in Vt.P.S.B. Rule 5.100 et seq.) = positive 1 cent per kwh.

b. Category II (as defined in Vt.P.S.B. Rule 5.100 et seq.) = positive 1 cents per kwh.

c. Category III (as defined in Vt.P.S.B. Rule 5.100 et seq.) = negative 1 cent per kwh.

d. Category IV (as defined in Vt.P.S.B. Rule 5.100 et seq.) = negative 3 cents per kwh.

Hydroelectric facilities have no siting adjustors.

G.. Liability Insurance.

Net metering members shall maintain a liability insurance policy in an amount of no less than those proscribed by the Public Service Board's rules. Proof of insurance shall be furnished annually to the Coop.

H.. Interconnection Requirements.

The Cooperative shall require a customer to comply with generation interconnection, safety and reliability requirements, as determined by the Board by rule or order.

If the Co-op determines that the capacity of the distribution system is insufficient for the designed generation the member shall be required to pay for the cost of Co-op improvements necessary to interconnect, establish, and distribute power from the net metering facility.

If the Co-op determines through preliminary analysis that interconnection and operation of the proposed net metering system may negatively impact the power quality, reliability or safety of the Co-op's distribution system, the Co-op may perform at the member's expense detailed analysis as provided for in Board Rule 5.500.

I. Disconnection of Net Metering Facility.

Any eligible system shall be subject to emergency disconnection of the system. These emergency disconnection procedures do not supplant Board Rules 3.300 and 3.400 or other tariff rules and regulations related to Co-op disconnections.

In general, an emergency shall be considered to occur when the interconnection of an eligible system represents a condition which is likely to result in significant disruption of service to the Co-op's members or is likely to endanger life or property.

If the Co-op performs an emergency disconnection of an eligible system, the Co-op shall notify the member within twenty-four hours after the disconnection. If the emergency is not caused by the eligible system, then the Co-op shall reconnect the system upon cessation of the emergency. If the emergency is caused by the eligible system, then the Co-op shall communicate the nature of the problem with the member within five days, and attempt to resolve the issue with the member. The Co-op shall file a disconnection petition with the Board if the Co-op and the member have not reached a mutually agreed-upon resolution within thirty days of the emergency disconnection.

Non-emergency disconnections of an eligible system by the Co-op shall follow the same process as set out above for emergency disconnections of such system, except that the Co-op shall give written notice of the disconnection no earlier than ten days and no later than three working days prior to the first date on which the disconnection of the system may occur. Such prior notice shall communicate the reason for the disconnection and the expected duration of the disconnection. If the eligible system is not the reason for the system's disconnection, the Co-op shall reconnect the system as soon as the activity necessitating the disconnection ceases. Temporary, non-emergency disconnections due to the removal of the meter by the Co-op or their representatives such as those related to a meter exchange or meter test shall not require prior notice.

A member shall be prohibited from reclosing a disconnect device, which has been opened and tagged by the Co-op, without the prior approval of the Co-op, or, in event of dispute, the Board.

A member who initiates a permanent disconnection of an eligible system shall promptly notify the Co-op.

Effective Date: January 1, 2017.

Appendix F.

WASHINGTON ELECTRIC COOPERATIVE

2020 ANNUAL PLAN FOR TIER III COMPLIANCE

WITH VERMONT'S RENEWABLE ENERGY STANDARD

I. INTRODUCTION

In compliance with requirements from the Vermont Public Utility Commission's Order 19-4452-INV, and Dockets 8550 and 17-4632, Washington Electric Cooperative (WEC) submits its 2020 Annual Plan for Tier III compliance with Vermont's Renewable Energy Standard (RES)

This Tier III Annual Plan is submitted by WEC, with support from Vermont Energy Investment Corporation (VEIC), to the Vermont Public Utility Commission ("PUC" or "Commission") and to the Public Service Department ("PSD" or "Department"). This Annual Plan addresses the strategy that WEC will use to meet its Tier III compliance obligation for 2020.

This version of WEC's 2020 TIER III plan is responsive to the PSD comments dated 2 December 2019 on WEC's original compliance filing.

Overall, this Annual Plan will describe:

1) the estimated Tier III compliance obligation for 2020;
2) the overall strategy to be implemented to meet the Tier III compliance obligation in 2020; and
3) the types of energy transformation projects that will be undertaken and anticipated number of participants.

WEC's 2020 Annual Plan expands the suite of energy transformation measures that have been screened and vetted through the Technical Advisory Group (TAG) screening process. A fundamental component of WEC's plan is to emphasize and match these TAG screened measures with heightened weatherization efforts. WEC's plans are fully detailed herein.

II. PARTNERSHIP-BETWEEN WEC AND VEIC

Implementation of the projects described in this Annual Plan will be closely coordinated with Vermont Energy Investment Corporation as the administrator of Efficiency Vermont, the statewide energy efficiency utility (EEU). In addition, coordination of data collection, management, reporting, and evaluation and verification activities will be maximized to the extent possible with protocols and schedules already in place for Efficiency Vermont. In cases where entities other than VEIC and its subcontractors deliver WEC Tier III programs and services independently, WEC will ensure coordination of data collection and reporting to provide a single deliverable to regulators.

The Parties have reached an understanding on the implementation of energy transformation projects for WEC's member/customers that will include the coordinated use of customer and supply-side incentives, standards for measuring performance, and methods to allocate savings and reductions in fossil fuel consumption and greenhouse gas emissions among VEIC and WEC with a strong emphasis on weatherization. The details of WEC's plan as well as discussion of roles and responsibilities of each party are outlined in table 1, which remain consistent with WEC's original 2017 filed design.

Table 1: Roles and Responsibilities for 2020 Tier III Programs

Washington Electric Cooperative	Efficiency Vermont

• Leverage local presence and relationships with members
• Utilize multiple communications channels to reach members
    • Newsletter
    • Member Service Rep staff
    • Promotional material
• Leverage existing EEU programs like Button Up to deploy savings
• Provide call center support
	• Maintain program delivery model
	• Maintain contractor and supplier network
	• Statewide marketing
	• Call center support
	• Capture sales data
	• Custom and upstream incentives

III. 2020 WASHINGTON ELECTRIC COOPERATIVE TIER III COMPLIANCE OBLIGATION AND OVERALL STRATEGY

WEC continues to participate with VEIC and other distribution utilities through the Technical Advisory Group (TAG) process; all measures included in the 2020 WEC program either meet TAG standards for characterization and energy savings, or have been approved by Order of the Commission[1].

One distinction for measure screening which adds additional value to WEC program is due to the Co-op's qualification as 100% renewable, as defined statutorily. Utilities which have not yet met the Vermont renewability standard, based on the portfolio of power sources today, use a

[1] See 17-4632 Order of 24 August 2018

"blended" portfolio in the TAG modeling process; a blended portfolio reduces the savings claims for the same measure(s) compared to a utility with 100% renewability today.[2]

A. 2020 WEC Tier III Requirements

Vermont's RES establishes a required amount for Tier III compliance of 4.00% of WEC's 2020 forecast of retail sales. *WEC uses the most recent 12 months of kwh sales as its 2020 forecast for this calculation. The calculation for this compliance amount for WEC for 2020 is shown in Table 2:*

Table 2: Tier III Requirements

Implementation Model	
Program Year	2020
Distribution Utility (100% renewable)	WEC
MWh Target	2,754
Maximum Investment (ACP)	$ 176,980
unit)	$ 41.69
Modeled Savings Totals	**9,332**
Over/(Under) Target	**6,577**
Non-Incentive Totals	**12,525**
Incentive Totals	**$ 125,250**
Alternative Compliance Payment ($/MWh)	**$ 13.42**

	summary table per PSD template 18-3810 April 2019		12,525	-		2,075,184	544	8,830	
A	measure savings exclusive to WEC								
B	measure savings are shared with Efficiency Vermont	incentive	administrative cost (1)	measure (2)	measures	total cost (3)	per measur	savings (MHw)	$/MHw (4)
	Measure								
B	**Multi Zone Cold-Climate Heat Pump (CCHP) with Controls" and High Performing Home**	$ 250	$ 716	$ 3,754	30	$ 112,624	58	1,753	$ 64
B	**Single Zone Cold-Climate Heat Pump (CCHP) with Controls" and High Performing Home**	$ 250	$ 716	$ 2,894	30	$ 86,834	28	825	$ 105
B	**Heat Pump Water Heater (HPWH)**	$ 250	$ 1,789	$ 1,703	75	$ 127,725	19	1,412	$ 90
	Pellet & Wood Heating								
B	**pellet stove**	$ 250	$ 477	$ 4,700	20	$ 94,000		-	
B	**pellet furnace**	$ 1,000	$ -	$ 20,000	1	$ 20,000	125	125	
B	**pellet boiler**	$ 1,000	$ 477	$ 20,000	5	$ 100,000	125	627	$ 159
B	**wood stove**	$ 250	$ -	$ 4,700	20	$ 94,000		-	
A	**All Electric Vehicle**	$ 1,200	$ 2,290	$ 35,000	20	$ 700,000	38	755	$ 927
A	**Plug-in Hybrid Electric Vehicle**	$ 950	$ 907	$ 30,000	10	$ 300,000	28	282	$ 1,065
A	**Electric Bike**	$ 200	$ 286	$ 2,000	15	$ 30,000		-	
A	**Residential Lawnmowers**	$ 250	$ 477	$ 500	20	$ 10,000		-	
B	**EVT & Home Performance with Energy Star**	$ 600	$ 1,431	$ 8,000	25	$ 200,000	61	1,525	$ 131
A	**(CAPSTONE)**	$ 1,000	$ 2,386	$ 8,000	25	$ 200,000	61	1,525	$ 131
	footnotes								
1	WEC administrative costs to support TIER III follow the template and methods approved with all DUs and PSD per template October								
2	measure cost per TAG/TRM 2019								
2	measure cost by WEC or others								
3	total cost (per PSD RES 18-3810) = (cost per measure x Number of measures)								
4	(MHw))								

[2] See Appendix C

As noted in Table 2 WEC's compliance target is 2,754 MWH. Adding a ten percent buffer to this estimate for planning purposes gives WEC a year one target of 3,067 MWH. This target is based on WEC's most recent 12 months of sales of 68,861,297 kwh's.

Using the Alternative Compliance Payment rate of $63.48, WEC's maximum budget for incentives, program delivery and administration is $176,980. Based on WEC's anticipated offering of measures combined with Weatherization WEC plans to spend up to $131,250 of incentive dollars in its fourth year effort.

Shared savings methodology example (responsive to PSD's comment)

- WEC & EVT have had a Memorandum of Understanding to share marketing, tracking and evaluation and TIER III savings since 2017. The savings claims are calculated based on TAG/TRM characterization.

- The allocation of savings between WEC and EVT is based solely on the financial contribution from each entity. An example is a pellet stove. EVT provides a $400 "upstream" incentive; WEC provides a $250 incentive ONLY when the member is displacing fossil-fired space heating energy. Under this example, there is a total of ($400 + $250) = $650 of incentive paid collectively to the member.

- The savings claimed are proportionate to the $ incentive; 62% accrue to EVT, 38% to WEC. This method is also applied to shared savings claims for pellet furnaces and boilers, wood stoves and furnaces, Home Performance with ENERGY STAR (*this is responsive to a subsequent PSD request for clarification, below)*. WEC is paying the incentives for and claiming 100% of fossil-fuel replacements for heat pump water heaters (HPWH) and eligible cold climate heat pumps when installed in buildings meeting minimum thermal standards.

B. Proposed Measures & Program Design

- Working with Efficiency Vermont (EVT) WEC has promoted "**Button Up WEC**", using cooperative marketing support for a well-recognized residential weatherization campaign.

- **Weatherization** – These measures claim savings for the installation for insulation and air leakage reduction measures in a residential or commercial application. Savings will be calculated on a custom basis by project. Participation with Home Performance with Energy Star contractors, and project data provided to Efficiency Vermont with HERO will continue to be a requirement for WEC weatherization projects to be eligible for WEC incentives. Any savings claims to be shared with EVT.

Weatherization (WX) for income eligible WEC member residences will be coordinated with Capstone of Barre. Income eligibility based on current Vermont Department of Human Services (DHS) levels. Such **Weatherization Assistance Program (WAP**) savings are due to WEC's Button Up program marketing, but are not included in the shared savings claims with EVT.

Any WAP thermal conservation savings claims are created under a contractual agreement with Capstone. These WAP thermal savings claims are documented by Capstone using the Hancock data platform used by the Office of Economic Opportunity (OEO) and are not otherwise claimed by any entity other than WEC.

- **Cold-Climate Heat Pumps** - This measure claims savings for the installation of single or multi head variable speed mini-split heat pumps in a residential application, within a thermal shell meeting a performance standard. The measure is characterized as a custom retrofit measure claiming thermal energy savings for heating and electric heating and cooling penalties versus the installation of a baseline heat pump. The TAG approved savings claim for an eligible CCHP has been reduced for 2020, compared to prior TAG characterization; the effect of this change is to require a higher target of CCHP sales in 2020.

- **Heat-Pump Water Heaters** - This measure claims savings for the installation of an ENERGY STAR heat pump water heater (HPWH) in place of an existing fossil-fueled water heater in a residential or commercial application. The measure is characterized for retrofit applications. Savings are presented dependent on the existing fossil water heater fuel type. HPWH fossil fuel efficiency savings has been reduced to account for a heating penalty is assessed to account for the impact of the heat pump water heater on the water heating load.

- **EV Incentive -** WEC will continue to offer an incentive of up to $1900 per EV purchased in 2020 by low and moderate income WEC households. WEC will use current income eligibility levels as provided by the state of Vermont Agency of Human Resources. In 2020 WEC will also promote the income eligible EV incentives sponsored by the Vermont Agency of Transportation (AOT).

- **Pellet stove and pellet furnace incentive** – Efficiency Vermont began its pellet stove and pellet furnace incentive effective 1 November 2018. WEC has revised its 2020 Button Up incentives to include incentives for all forms of pellet heating system and wood stoves.

Shared savings methodology example (responsive to PSD's comment)

WEC and Efficiency Vermont share heat pump water heater (HPWH) and pellet equipment measure savings proportionate to the relative incentive provided by each party, as described previously.

- E-bike, e-mower incentive for 2020; *WEC will share savings claims with EVT proportional to the incentive provided by each party, as described previously.*

C. Estimated Number of Participants, Program Goals and Shared Responsibilities

By building on existing programs, efficiencies and the benefits of shared information, the services to be provided by WEC are expected to increase the number of members who participate in weatherization. Marketing Button Up across WEC's membership will also increase the installation of measures such as qualifying heat pump hot water heaters (HPWH) and cold climate heat pumps above what would have happened in absence of WEC's Tier III program, and thereby grow the market for the measures targeted by the Project.

WEC's plan and estimates of the number of participants, incentives, and MWh savings are provided in Table 2 (above).While all WEC members are eligible to participate, based on the budget constraint of the Alternate Compliance Payment (ACP), in actuality WEC will promote the Button Up services on a "first come, first served" basis up to the numbers noted in Table 2.

What this means is once WEC hits the target rates of participation it will no longer offer its extra incentives toward the measures. The EEU program incentive dollars will continue but any incremental WEC incentives will cease if the participation targets are achieved. The pace of the program incentives is budget constrained, and will be monitored closely for alignment with savings goals. WEC and VEIC will coordinate on field results, and project completions to ensure achievement of both parties' goals. Based on the rates of participation in both 2017 and 2018, WEC does not anticipate turning members away in 2020. We do not expect disruption in offering incentive dollars.

D. WEC plans to perform the bulk of the work necessary for program reporting, verification and tracking responsibilities. Efficiency Vermont will track measure details and savings and by March 15, 2020, WEC shall submit a report to the Commission and the Department that establishes its savings claim regarding its 2020 energy transformation projects. Adjustments and final claims will be filed following PUC determination of verified savings.

E. Low Income Plan – WEC has followed the State of Vermont Agency of Human Resources income eligibility criteria for WEC members; in 2020 the same income criteria will be applied to determine eligibility for the 2020 EV incentive.

F. Tier II Distributed Generation – The Commission noted in its order June 28, 2016 Order in Docket 8550 that utilities that are considered 100% renewable would have limitations regarding the use of Tier II RECs and counting toward Tier III goals.

The Department argued that a provider qualifying under Section 8005(b)(1) should only be allowed to count Tier II RECs towards its Tier III obligation to the extent that those

Tier II RECs exceed what the provider's Tier II compliance obligation otherwise would have been absent the language of Section 8005(b).

We believe the Commission should adopt this recommendation and allow WEC to use Tier II RECs in the event we exceed the Tier II obligation absent the language of Section 8005 (b). To deny use of REC's that are over and above the Tier II requirement levels that are implemented for non reduced amount providers limits an option to those DUs that are 100 percent renewable and have already invested significantly in achieving the state's goals early. WEC seeks to only to use RECs that exceeds the standard had it not been granted eligible for reduced amounts as a 100% renewable utility.

The Commission noted in its order:

> Any DU that qualifies for the modified requirement is likely to possess a meaningful portfolio of generation eligible for Tier II. Allowing such generation to count towards Tier III is likely to eliminate, or at least substantially reduce, a DU's Tier III obligation. As we find that this was not the intent of the statute – had it been, there would have been no need to include the additional mechanism reducing Tier III requirements – we conclude that a qualified DU seeking to apply generation from Tier II-eligible units must also show that this generation was in excess of that used to meet its ongoing obligation to demonstrate its ownership of RECs or renewable attributes under Section 8005(b)(1).

WEC seeks to use only Tier II RECs that are in excess of its obligation (ie greater than 1.67% of its retail energy sales in year one) had it not qualified as 100% renewable under Section 8005(b)(1) In this way WEC will retain the flexibility to offer incentives or roll out efforts that enhance Tier II participation in its service territory.

APPENDIX A (BACKGROUND)

BACKGROUND

On June 11, 2015, the Governor of Vermont signed into law Public Act No. 56, an act relating to establishing a renewable energy standard ("RES"). Vermont's RES is categorized into three tiers of required resources that must be met by Vermont electric utilities to meet the requirements of the States' renewable energy standard: total renewable energy, distributed renewable generation and energy transformation.

The third tier of the RES ("Tier III") (Energy Transformation Tier) requires that DUs either procure additional renewable distributed generation eligible for Tier II or acquire fossil-fuel savings from energy transformation projects. Energy transformation projects are those that reduce fossil fuel consumed by DU customers and the emission of greenhouse gases attributable to that consumption. For Tier III, the RES establishes a required amount of 2% of a DU's annual retail sales in 2017, increasing by two-thirds of a percent each year and reaching 12% in 2032.

This category encourages Vermont retail electricity providers to support additional distributed renewable generation or to support other projects to reduce fossil fuel consumed by their customers and the emission of greenhouse gases attributable to that consumption. A retail electricity provider may satisfy the energy transformation requirement through distributed renewable generation in addition to the generation used to satisfy subdivision (a)(2) of this section or energy transformation projects or a combination of such generation and projects.

"Energy transformation projects" are defined in 30 V.S.A. § 8002(25) to mean:

"an undertaking that provides energy-related goods or services but does not include or consist of the generation of electricity and that results in a net reduction in fossil fuel consumption by the customers of a retail electricity provider and in the emission of greenhouse gases attributable to that consumption. Examples of energy transformation projects may include home weatherization or other thermal energy efficiency measures; air source or geothermal heat pumps; high efficiency heating systems; increased use of biofuels; biomass heating systems; support for transportation demand management strategies; support for electric vehicles or related infrastructure; and infrastructure for the storage of renewable energy on the electric grid."

(C) Eligibility criteria. For an energy transformation project to be eligible under this subdivision (a)(3), each of the following shall apply: (i) Implementation of the project shall have commenced on or after January 1, 2015. (ii) Over its life, the project shall result in a net reduction in fossil fuel consumed by the provider's customers and in the emission of greenhouse gases attributable to that consumption, whether or not the fuel is supplied by the provider. (iii) The project shall meet the need for its goods or services at the lowest present value life cycle cost, including environmental and economic costs. Evaluation of whether this subdivision (iii) is met shall include analysis of alternatives that do not increase electricity consumption. (iv) The project shall cost the utility less per MWH than the applicable alternative compliance payment rate. Act 56 p.18 (3)(A)

Section 8 of Vermont's Renewable Energy Standard (RES) requires the Vermont Public Utility Commission ("Commission") to commence a rulemaking proceeding to determine details for the implementation of Tier III. The outcome of this rulemaking requires that a DU shall file a Tier III annual plan no later than the November 1st immediately prior to the start of the next compliance year.

This Annual Plan is filed to meet this requirement.

APPENDIX C

WEC qualifies as a 100% renewable distribution utility, as defined by statute:

(b) Reduced amounts; providers; 100 percent renewable.

(1) The provisions of this subsection shall apply to a retail electricity provider that:

(A) as of January 1, 2015, was entitled, through contract, ownership of energy produced by its own generation plants, or both, to an amount of renewable energy equal to or more than 100 percent of its anticipated total retail electric sales in 2017, regardless of whether the provider owned the environmental attributes of that renewable energy; and

(B) annually each July 1 commencing in 2018, owns and has retired tradeable renewable energy credits monitored and traded on the New England Generation Information System or otherwise approved by the Commission equivalent to 100 percent of the provider's total retail sales of electricity for the previous calendar year.

(2) A provider meeting the requirements of subdivision (1) of this subsection may:

(A) satisfy the distributed renewable generation requirement of this section by accepting net metering systems within its service territory pursuant to the provisions of this title that govern net metering; and (B) if the Commission has appointed the provider as an energy efficiency entity under subsection 209(d) of this title, propose to the Commission to reduce the energy transformation requirement that would otherwise apply to the provider under this section.

(i) The provider may make and the Commission may review such a proposal in connection with a periodic submission made by the provider pursuant to its appointment under subsection 209(d) of this title.

(ii) The Commission may approve a proposal under this subdivision (B) if it finds that:

(I) the energy transformation requirement that would otherwise apply under this section exceeds the achievable potential for cost-effective energy transformation projects in the provider's service territory that meet the eligibility criteria for these projects under this section; and

(II) the reduced energy transformation requirement proposed by the provider is not less than the amount sufficient to ensure the provider's deployment or support of energy transformation projects that will acquire that achievable potential.

(iii) The measure of cost-effectiveness under this subdivision (B) shall be the alternative compliance payment rate established in this section for the energy transformation requirement.

Appendix G.

WASHINGTON ELECTRIC COOPERATIVE, INC. (“WEC”)

2019 SYSTEM RELIABILITY REPORT

Background Washington Electric Cooperative serves just under 11,000 members via an electrical distribution system that includes 25 miles of WEC-owned transmission line and 1276 miles of distribution line. The system includes 8 distribution substations, 7 of which depend on a third party transmission provider (Green Mountain Power) for service. The remaining substation is served via a WEC owned transmission line interconnected to Vermont Electric Power Company’s (VELCO) high voltage substation in Chelsea, VT. WEC’s distribution lines are located throughout 41 towns in Central Vermont and serve remote locations composed of rural residential homes and small hill-side farms. There are less than 8 service locations per mile of line, many of which are located on dirt roads in small valleys within the 41 towns. The distribution system was constructed during a time when much of the land was open fields and pasture. It has since grown in and is now composed of Boreal forest through which the lines traverse. The remote location of the lines and abundance of fast growing species such as Red Maple, Poplar and White Birch coupled with changing weather severity, significantly increases the exposure of the lines to tree-related outages which can only be combated through hardening of the lines and increased maintenance clearing. WEC records data associated with all power outages occurring over the calendar year and provides a year end Service Reliability Report to the Vermont Public Utilities Commission as required.

In order to more effectively compare trends in WEC’s reliability performance and associated efforts to make improvements in those performance areas, this report generally excludes those outages associated with weather events determined to be “Major Storms” as defined in WEC’s Successor Service Quality and Reliability Performance Plan. However, a distinctive increase in “Major Storms” is significantly contributing to a steady decline in service reliability across most of WEC’s service territory and therefore must be taken into consideration when analyzing service reliability and planning for improvements. While it is true that major weather events do create conditions that exceed the design capability of the electrical delivery system it remains obvious that design criteria and maintenance schedules must be improved to meet the increased severity of these events.

Reliability Data and Summary The rolling 3-year average number of outages (exclusive of major storms) is 677, down considerable from the previous rolling average of 765. In 2019, there were 589 separate outages on Washington Electric Cooperative’s system compared to 787 in 2018, 655 outages in 2017 and 865 outages in 2016. The total number of consumer-hours-out in 2019, exclusive of major storms, was 93,459 and 40,932 of those hours were the result of Green Mountain Power losing high voltage transmission service to WEC’s substations. The average annual number of consumer-hours-out over the last three years is 84,425, exclusive of major storms. In 2019 there was a continuing decline in consumer-hours-out as a result of faults (problems) occurring on WEC’s electrical system. There was a significant increase in consumer- hours-out as a result of Power Supplier related issues.

Worst Performing Circuits An analysis of the 2019 outage data indicates the Mount Knox to Corinth feeder served by WEC's Mount Knox substation is statistically the worst performing circuit on WEC's system. The feeder is the longest line on WEC's system and serves more member locations than any other circuit. WEC's system is set up such that every main line, every radial line and main-line tap is protected by an Oil Circuit Recloser or Line Fuse. These devices isolate any given fault and minimize the number of members effected. A closer look at the outage data indicates that nearly 75% of storm and non-storm related outages occurring on WEC's system take place beyond the last set of protective devices on a line. This pattern holds true for each feeder out of every WEC substation. The cause of this phenomenon is simple. The number one cause of the outages is tree contact with the conductor. The end of the lines on WEC's system need to be cleared of vegetation that can contact the conductor.

Impact of Major Weather Events In 2019, WEC experienced 4 weather events that met the criteria for "Major Storm". Weather events comprised of severe winds and violent electrical storms or severe winds coupled with wet-snow and icing moved through WEC's service territory causing widespread and severe damage to WEC's Distribution infrastructure on February 8/9, February 25/26, March 22-24, and October31-November 6 . The October 31event met the criteria for a statewide emergency declaration for federal assistance. In every major event the primary causes of the outages were either healthy trees, from outside of the Right-of-Way (ROW) corridor, falling onto or through the primary conductors as a result of high winds or trees adjacent the lines making contact with the lines as a result of heavy wet snow-loading. It is interesting to note that the seasonal timing of the major storm events for 2017, 2018 and 2019 have been very similar. In 2017 and 2018, GMP owned 34.5kv transmission lines serving WEC's substations failed during many of the Major Weather events, substantially adding to the impact of the event. In 2019, the GMP owned transmission lines serving WEC substations once again failed during several Major Weather events as well as during non-weather events. The GPM line serving WEC's Jackson Corners substation was down for over 13 hours in the November event. The substation serves 2,072WEC members.

Reliability Indices The SAIFI and CAIDI performance measures established in WEC's Successor Service Quality and Reliability Plan are **3.8** and **2.7** respectively. The SAIFI and CAIDI indices for 2019**, exclusive of major storms, were 3.2 and 2.6, respectively**. The SAIFI and CAIDI indices have **averaged** 3.2 and 2.4 over the previous three years and the 2019 data continues to reflect efforts to reduce outages, to improve response times and decrease outage duration. However, the 40,932 consumer-hours-out due to Power Supplier (GMP) issues out of a total 93,459 consumer-hours-out (for all causes), very negatively impacted service reliability to all WEC members in 2019. In addition, the impact of the "Major Storms" experienced in 2017, 2018 and 2019 had a devastating real-world effect on service reliability for WEC's members. It is important to note that severe weather that does not rise to the level of a "Major Storm" (based on SQRP impact criteria) can and does cause significant year to year variations in service reliability indices. While it has been common over the last 10 years to see noticeable variation in the outage frequency index (SAIFI), the outage duration index (CAIDI) has remained below the target index of 2.7. In 2017 the duration index jumped to 3.6 and the increase was directly related to the severity of the damage caused by weather events that did not meet the criteria to be classified as a "Major Storm". However, in 2018 most of the storm events rose to the level to be exempted from the reliability calculations and the CAIDI index dropped to 2.1. In 2019, the CAIDI index fell to just below the target value of 2.6. The index would have been significantly lower had it not been for the increased number of Power Supplier outages that occurred which tend to be long duration events.

Emerald Ash Borer (a new threat to service reliability) In 2018, the Emerald Ash Borer (EAB) was detected in Orange County which is the heart of WEC's service territory. The EAB is an insect of Asiatic origin that bores into the Ash tree and lays eggs. The resulting larvae feed off the soft tissue of the tree below the bark effectively girdling the tree and cutting off the flow of water and nutrients to the tree's canopy, killing the tree. Based on experience in other states, the EAB is expected to devastate most Ash trees located within any infected area. Historically, utilities have purposely left the Ash tree to populate along and adjacent electric line corridors as it was a hardy and resilient species. Unfortunately, the Ash trees once infected with the EAB are expected to be dead within 2 to 4 years and hence become a significant threat to electric lines and therefore service reliability. In 2019 WEC targeted and removed 7,116 danger trees, 516 of which were Ash trees that were a danger to the lines.

Action Plan Over the last 25 years WEC has been adhering to construction standards that help harden the distribution system from the effect of increased storm severity. These practices are funded through a RUS approved Construction Work Plan (CWP) process. The CWP is focused on continued improvement and enhanced reliability of WEC's transmission and distribution system. The new CWP calls for two-thirds (2/3) of the dollars being spent on reconstruction to occur on circuits that consistently were among the worst performing areas of WEC's service territory. The CWP also outlines system-hardening improvements including, but not limited to, the following: replacement of small and aged conductors, installation of capacitors to reduce line loss, the replacement of deteriorated poles, the addition of mid-span poles to reduce conductor span lengths and the reconstruction of approximately 40 miles of poor condition and deteriorated line. The CWP will specifically correlate the replacement of approximately 851 aged poles with site specific projects. System reliability will continue to improve as projects are completed.

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Over the last 10 years, 100% of WEC's pole plant has been inspected and treated to help prevent decay. WEC has recently conducted an inspection of all primary underground installations to ensure they meet RUS and NESC requirements and present no inherent safety or reliability issues. The results of these inspections have been used to assess the current condition of WEC's pole plant, and the treatment of the poles will maximize their life cycle value. The inspection data was crucial in determining pole condition and the inspection results were fully integrated into the approved 2019 -2022 CWP.

In 2019, WEC's Board of Directors approved a significant increase in the ROW clearing budget. The increased funding is targeted toward clearing those lines directly affected by the wet snow loading that occurred in November of 2018 and again in November of 2019. The additional funding will allow the clearing of nearly 128 miles of distribution line in 2019, most of which will be that line located beyond the last set of system protective devices. The 2019 ROW clearing budget will fund a distribution system trim cycle of just less than 8.5 years and a transmission trim cycle of approximately 6 years. The additional funding provided over the last 2 budget years was mostly allocated to WEC's 3 phase main line feeders and danger tree removal. The additional trimming did provide improved reliability to those lines. WEC continues to pursue and investigate the potential use of alternate methods of ROW clearing including excavator mounted Right-of-Way clearing. WEC's Board of Directors continues to work closely with staff to allow for an effective and affordable ROW maintenance program while remaining cognizant of potential rate impact. Adequate and appropriate funding of the ROW program and ultimately the reliability of WEC's electrical system remains a primary objective.

WEC continues the practice of conducting "foot patrol" inspections of its entire 34.5 and 46 kV transmission lines in the spring and fall of each year. In 2020 WEC staff will continue identifying, marking and removing Ash trees that pose a direct threat to the lines. An infrared hot spot scan of equipment and equipment connections within the substations will also be completed.

WEC has already approached Green Mountain Power regarding the need to reduce outages on GMP owned 34.5kv line that serve WEC substations. This is an on-going effort and if successful, will significantly improve reliability to WEC's system.

The 2018 Reliability Report is being submitted to the Board by mail and email. A CD containing the same information is also enclosed.

Respectfully submitted,

Dan Weston
Director of Operations & Engineering

Appendix H.

WASHINGTON ELECTRIC COOPERATIVE, INC.

VEGETATION MANAGEMENT PLAN

July 2006

I. Purpose

The primary purpose of this document is to provide guidance on methods to be used to manage vegetation within Washington Electric Cooperative's (WEC) rights-of-way (ROW) in a safe, efficient and environmentally sound manner. In providing this guidance, it is understood that all line clearing, maintenance and other vegetation management work shall be performed in strict conformance with all applicable federal, state and local government laws and regulations, including OSHA Rule 29 CFR 1910.269, Electric Power Generation, Transmission and Distribution Regulations.

II. Background

WEC currently serves approximately 10,000 members in 41 rural Vermont towns in the counties of Washington, Orange, Caledonia and Orleans. Today, WEC's electric system consists of 1,237 miles of distribution line and 18 miles of local transmission line, plus an additional 7.4 miles of transmission line in Coventry. Of those line miles, approximately 800 miles of distribution line and 10.47 miles of local transmission line require tree trimming.

The terrain in WEC's service territory is described as hilly, often rugged and for the most part heavily forested with various deciduous and coniferous species. While distribution lines were constructed across fields in the early years of the Co-op in order to minimize time and the cost of construction, WEC has been routinely relocating those lines nearer to roadsides during major rehabilitation projects whenever possible. However, in many cases, it is likely that landowners will be reluctant to allow WEC to relocate their lines due to aesthetic and environmental impacts.

For the last several years, the WEC Board of Directors has authorized increased funding of the annual ROW budget in an effort to improve reliability. The amount of money budgeted and spent on tree trimming in each of the past four years is as follows:

<u>Distribution System and Danger Tree Removal</u>

Year	2003	2004	2005	2006
Budgeted	$351,000*	$418,000	$436,000	$467,620
Actual	$347,496	$410,993	$435,751	$467,539

* Original 2003 budget was $378,000, but funding had to be curtailed due to budget constraints.

<u>Transmission System</u>

Year	2003	2004	2005	2006
Budgeted	$13,000	$13,400	$13,500	$14,000
Actual	$11,522	$8,121	$10,267	$13,966

The number of miles of line that WEC has cleared and maintained, and the number of danger trees removed, in each of the last three years is as follows:

2003

Distribution Miles Cleared:	54.26	Distribution Miles Maintained:	83.48
Transmission Miles Cleared:	1.20	Transmission Miles Maintained:	2.03
Danger Trees Removed:	700		

2004

Distribution Miles Cleared:	59.94	Distribution Miles Maintained:	85.62
Transmission Miles Cleared:	.78	Transmission Miles Maintained:	1.30
Danger Trees Removed:	900		

2005

Distribution Miles Cleared:	55.12	Distribution Miles Maintained:	84.80
Transmission Miles Cleared:	.98	Transmission Miles Maintained:	1.51
Danger Trees Removed:	1,000		

III. Policy

WEC shall strive to maintain its transmission and distribution ROW corridors in accordance with Policy 80, attached hereto as Appendix A, as well as in the following manner:

a. In a safe, professional, efficient and environmentally sound manner, while being sensitive to the concerns of property owners and the general public.

b. In a manner that will provide reliable electrical service in conformance with the Electrical Safety Code;

c. In a manner that protects all electrical system infrastructure necessary to transmit power between substations;

d. In a manner that uses the services and knowledge of employees and contract ROW crews who are professionally trained and inherently concerned with proper ROW techniques in conjunction with safe work practices.

IV. ROW Management Practices

<u>Inspections:</u>

As part of WEC's annual pole inspection and treatment program, and in accordance with RUS operational planning requirements, a visual inspection of ten percent (10%) of WEC's electrical T&D system shall be conducted on an annual basis. In addition to noting the physical condition of the poles and wires, ROW vegetation growth conditions shall be noted.

Species:

It is the practice of WEC to control the following tree species the full width of the ROW:

Ash	Cherry	Locust	Pine
Basswood	Fir	Maple	Poplar
Beech	Hemlock	Oak	Spruce
Birch	Larch		

This practice of vegetation management control allows for safe passage by WEC employees and contractors within the ROW for maintenance purposes, and removes potential fire and safety hazards to humans and animals in the area.

In general, it is desirable to use or enhance existing natural vegetation that does not interfere with the distribution of electricity. Herbs, most shrubs and low maturing trees should be left in the ROW to suppress the invasion of tall-growing trees. Following is a partial list of some of the low shrubs and plants that are native to WEC's service territory:

Alpine Azalea	Juniper	Rhododendron
American Yew	Laurel	Serviceberry
Dogwood	Leatherwood	Steeplebush
Dwarf Willow	Meadowsweet	Virginia Creeper
Eastern Redbud	Partridge Berry	Wintergreen
Fern	Pussy Willow	Witch Hazel
Gooseberry	Raspberry/Blackberry	

Notification:

In general, the Cooperative membership and affected property owners will be notified prior to any ROW clearing or reclearing maintenance work, except during emergency restoration or if hazardous conditions exist. Such notification shall include one or more of the following:

First: by a general article in *Co-op Currents* listing all ROW maintenance projects scheduled for the year

Second: by a mailed postcard to the member, or to the property owner if different from the member and readily known, who will be affected by the ROW maintenance work

Third: by either an automated or personal telephone call to the member, or to the property owner if different from the member and readily known, informing them that ROW maintenance work is about to commence

<u>General Practices</u>

A. The Removal of Trees by Manual Means (Chainsaws)

This method of control is primarily used for softwood and hardwood trees which have the potential for interfering with line reliability. The principal method of dealing with this type of vegetation is to cut it at ground level (flat cutting) using chainsaws and brush saws. Whenever trees are removed, all stumps are to be cut as close to the ground as practical so as to discourage multi-stemmed sprout regrowth. Side trimming and danger tree removal work are to be performed in conjunction with flat cutting.

B. Trimming/Pruning

It may not always be necessary, economically feasible or aesthetically acceptable to flat cut all trees within the ROW. This may be in response to a property owner's request, when the tree is a compatible, non-interfering vegetation variety, or it may be that while the tree itself is in the required clearance zone, only its branches immediately threaten the electric line. In these cases, it may be appropriate to prune or trim the tree.

Limbs to be removed are those that are dead, decayed, insect damaged, or structurally weak, including limbs which could break at weak points and strike conductors when swinging down in an arc. Pruning guidelines are as follows:

1. <u>Tree Under Conductor – Under Trimming</u>

   Under-trimming is cutting back large portions of the upper crown of a tree. Under-trimming is required when a tree is located directly beneath a line. The main leader or leaders are cut back to a suitable lateral. (The lateral should be at least one-third the diameter of the limb being removed.) Most cuts should be made with a saw; the pole pruner is used only to trim some of the smaller lateral branches.

   For the sake of appearance and the health of the tree, it is best not to remove more than one-third of the crown when under-trimming.

2. Tree at Side of Conductor – Side Trimming

   Side trimming consists of cutting back or removing the side branches that are threatening the conductors. Side trimming is required where trees are growing adjacent to utility lines.

   Limbs shall be removed to the trunk or to a lateral that is growing parallel to or away from the conductors.

   Where possible, or as designated by WEC, the contractor shall eliminate all branches growing within 10 feet beneath and toward the conductors.

3. Tree Over Conductors – Overhead Trimming

Overhead trimming consists of removing limbs beneath the tree crown to allow wires to pass below. Most of the natural shape of the tree is retained in this type of trimming, and the tree can continue much of its normal growth. Overhanging limbs should be removed as dictated by the species of the tree, location, and the general condition of the tree. When trimming, remove all dead branches above the wires, since this dead wood could easily break off and cause an interruption.

The contractor shall remove all weakly attached overhanging limbs that are capable of hitting the conductor if the limb were to split at the point of attachment.

Where possible, all branches within ten (10) feet above conductors shall be removed as dictated by the species of the tree, location, and the general condition of the tree.

Overhead trimming must be performed in accordance with current VOSHA/OSHA trimming regulations.

4. Combination Trimming

It is often necessary to use judgment in combining several types of arborcultural trimming techniques in order to achieve a good looking job and provide adequate clearances.

5. Improper Trimming Techniques

a. Pollarding: This is done by stubbing off major limbs until the tree assumes the desired shape. The result is not only unsightly, but a multitude of fast-growing suckers will sprout from the stubs, resulting in a line clearance problem more serious than before. The stubs are quite likely to fall victim to decay and disease.

b. Rounding Over: Rounding over or shearing is done by making small cuts so that the tree top is sheared in a uniform line. This creates an unhealthy condition and results in rapid regrowth of suckers directly toward the electrical conductors.

c. Side Trim Stubbing: This is done by stubbing off portions of limbs along the side of the tree to obtain clearance. This method of trimming, like pollarding and rounding over, creates many fast growing suckers that become a serious line clearance problem. These trimming methods should be avoided.

d. Topping: Removing top and upright branches should be avoided. Where necessary, use natural or directional pruning methods.

C. Proper Trimming Techniques

Various trimming shapes were previously described. The following provides the details for WEC standard line clearance and can be used for overhead trimming, side trimming, under trimming, and combinations. Pollarding, rounding over and side trim stubbing shall be avoided.

All trimming shall be performed to direct the growth of a tree away from the conductors. Branches shall be cut back toward the center of a tree to a suitable lateral branch, parent limb or the tree trunk. This is commonly called drop crotch, lateral or natural trimming (see Figure 1). When cutting back to a lateral branch, the diameter of the lateral branch must be at least one-third of the diameter of the branch being removed in order to sustain growth. Almost all cuts are made with a saw and very little pruner work is required. If a proper lateral branch is not available, the branch shall be cut back to the parent limb or tree trunk.

Trimming shall be done in such a manner as to protect tree health and condition.

All saw and pruner cuts shall be made back to the branch collar at an angle equal to but opposite of the branch bark ridge on the parent limb or trunk in order to leave no stubs.

No damage by loosening or stripping of the bark or splitting of branches shall be caused during trimming.

All severed limbs and branches (hangers) shall be removed from trees after trimming.

C. Removal of Trees by Mechanical Means (Brontosaurus)

WEC shall utilize the Brontosaurus wherever possible to clear ROW. The Brontosaurus is an excavator on steel tracks that utilizes a hydraulically driven shearing mechanism that pulverizes the tree and root system. Having utilized this machine over the past several years, WEC's field observations indicate that it effectively reduces the rate of resprout in many species. The Brontosaurus effectively removes trees, shrubs and brush within a ROW, however, this method still requires contract ROW crews to revisit the ROW to do side trimming and danger tree removals which adds to the cost of this method of clearing. Use of the Brontosaurus is limited due to its inability to safely work in narrow ROWs, and near roadsides and members' homes.

D. Danger Tree Removal

A danger tree is any tree, due to its location, species and condition, which is tall enough to pose a threat to WEC's electric lines. Many of the trees at the edge of the ROW have crowns that are heavily grown in towards the line, and when they fall, are likely to make contact with the electrical conductors. Danger tree removal is most effective towards reducing outages associated with high wind storms, prolonged rain incidents and routine outages due to "rotten trees". This, in effect, targets short-term and long-term reliability while also reducing the duration of outages due to excessive damage. For every danger tree that is targeted and removed, a future outage is avoided. (See Figure 2 for minimum clearances for danger tree removal.)

Since 2002, WEC has been aggressively targeting and removing danger trees in an effort to improve reliability. In 2005, approximately 1,000 danger trees were removed at a cost of $96,333.

E. "Hot Spot" Clearing

Selective clearing of ROW line sections outside the normal reclearing schedule helps to improve reliability to those members located at the end of a single-phase line. Identification of these problem line sections normally comes from the members who are affected by poor reliability. Devoting resources to "hot spot" line sections improves reliability and/or power quality to specific problem areas, improves line crew access and outage restoration time, and improves overall reliability of a particular line. Hot spot trimming is the least efficient method of ROW clearing, but is essential to good member relations.

F. ROW Clearing During Emergency Restoration and When Hazardous Conditions Exist

In the best interests of employee and public safety, any tree making contact with WEC's electric system conductors shall be immediately removed to mitigate the hazard. It is not reasonable to provide advance notification to property owners under these conditions.

In the event of a power outage caused by trees within or outside of WEC's ROW, the trees shall be cut to the extent that is necessary to safely restore power. Advance notification to property owners is not possible under these conditions.

Under both of the above circumstances, a WEC employee shall coordinate with WEC's ROW Management Coordinator to arrange for any necessary cleanup.

G. Clearing Within Muncipal Street or Highway ROW

In situations where the Cooperative does not hold a valid ROW easement along a public street or highway, whether for a new service or for relocation of an existing line, no tree within that street or highway shall be cut in the construction, relocation, maintenance or repair of electric power lines without the written consent of the adjoining property owner(s) or occupant, unless the transportation board or selectmen of the town in which the tree is situated, after due notice to the parties and upon provision for a hearing, shall decide that such cutting is necessary (Title 30 VSA, § 2506), or unless such decision is made by the appointed municipal tree warden for the town (Title 24 VSA, § 67).

H. Clearing Within Wetlands

Wetlands are considered to be sensitive areas for vegetation management practices. These may include swamps, marshes and bogs, and other areas identified in the National Wetlands survey, and will be identified by WEC's representative prior to ROW management activities. Handcutting will be used near wetland areas where necessary to control undesirable vegetation. If extensive wetlands are encountered, WEC may elect to carry out the work in winter because of improved access. Vegetation in wetland areas will be managed according to the Vermont Department of Environmental Conversation's policy on wetlands.

I. Clearing Within Stream Corridors

Stream buffers are areas adjacent to streams requiring special vegetation management, and these areas shall generally be maintained to a minimum width of 75 feet on each side of the stream. Where distribution lines cross streams, standing woody vegetation, shrubs and low mature height trees will be allowed to grow within the ROW if consistent with the terrain and existing land use. This cover will protect fish habitat, service wildlife travel lanes, and control soil erosion.

Where the electric line spans a ravine, streamside vegetation may be allowed to grow taller as specified by WEC's representative. Where an undesirable woody species becomes taller than 12 feet, it will be removed to ensure protection of line conductors. In general, provision of the Vermont Agency of Environmental Conservation policy on river and stream bank management shall be followed.

J. Clearing Where Electric Lines Cross Roads

Electric lines that cross roads will be treated similarly to streams. Low woody shrubs, such as Sweet Gale and other compatible plant species identified on page 4, which have a low height at maturity, will be permitted and encouraged at road crossings in order to provide screening of the electric lines.

K. Clearing Within Wildlife Travel Areas

Wildlife travel areas shall be maintained to promote the movement of white-tail deer and other wildlife across the corridor of extended cross-country distribution and transmission lines. In general, WEC's objectives will be to favor vegetation that can support snow and thereby keep the snow depth on the ground shallow enough for deer to move about and to conceal wildlife as it crosses through wildlife travel lanes. Treatment will be similar to high visibility ROW areas, and preference may be given where practical to preserving a conifer canopy. WEC shall use the Vermont Agency of Natural Resources policy on wildlife management as a guide to maintaining wildlife travel lanes.

L. Stump Height

ROW clearing will be limited during winter months. Deep snow during winter months often results in unsightly ROWs because of excessive stump height, which oftentimes need to be recut in the spring, which adds to the cost. Excessive stump height also encourages the regrowth of saplings. At other times of the year whenever trees are removed, all stumps will be cut as close to the ground as practical so as to discourage multi-stemmed regrowth of the original species.

M. Cherry Tree Disposal Precaution

Wilted leaves from cherry trees are poisonous to livestock. Therefore, in areas frequented by livestock, any cherry cuttings shall be disposed of immediately by removing any cuttings from the enclosed livestock grazing area.

V. Trees and Debris Removal

Disposal techniques for each ROW section will be determined by WEC's representative, taking into account federal, state and local regulations, the practicality of certain disposal methods, the potential for wood utilization, and the wishes of the property owner. Whenever roadside trimming is performed, all log length material shall be picked up by a log truck as soon as possible and disposed of in accordance with the property owner's request. All other brush and wood material shall be removed from the ditch and municipal ROW and appropriately chipped or stacked at the tree line. If the ROW maintenance area is located more than fifty (50) feet from a public road or highway, then the log or tree length wood shall be moved to the tree line. All brush shall be windrowed at the edge of the ROW in order to provide unobstructed access for maintenance purposes. All other wood material shall be cut in four foot lengths and stacked at the tree line (see Figure 3). There will be no brush left in stream beds, across fence lines, stone walls, paths or roadways.

VI. Prioritization of ROW Clearing

WEC's Vegetation Management Plan promotes the prioritization of ROW clearing as it statistically relates to reliability of service. In general, the focus of the ROW management program shall be as follows:

1. Transmission Lines

   - Annually patrol 18 miles of local transmission line as well as 7.4 miles of 46 kV transmission line in Coventry for purposes of identifying potential equipment problems and marking danger trees for removal.

   - Flatcut WEC's 10.47 miles of local transmission line as needed to ensure maximum reliability to WEC's substations.

   - Flatcut WEC's 7.4 miles of Coventry transmission line as needed based on annual patrol to ensure 100% availability.

2. 3 Phase Lines

Three-phase circuits are critical links from substations to all members. Damage to one conductor of a three-phase line require the entire three conductors to be de-energized when repairs are made. WEC's three-phase lines are prone to greater damage for any given tree contact due to construction type and phase-to-phase voltage levels. The reliability of three-phase circuits, like substations, have a direct impact on the reliability of all single-phase lines. Improving the reliability of WEC's three-phase circuits is essential to achieving state mandated SAIFI and CAIDI indices.

3. Two-Phase Lines

Two-phase lines shall be treated similarly to three-phase lines as they serve a greater number of members than do single-phase lines.

4. Single-Phase Lines

Maintain single-phase line ROWs based on member density.

5. Worst-Performing Circuits

At the beginning of each year, WEC shall analyze circuit performance for the previous calendar year and identify the five worst performing circuits based on annual reliability. The reliability of the worst-performing circuits shall be further analyzed to determine if there are conditions that can be changed to improve the reliability of the circuits, including danger tree removals, flat cutting, line relocation and reconstruction if needed. In all cases, the circuit analysis shall take into consideration year-to-year fluctuations and longer-term trends to identify root causes of the reliability problems.

VII. CLEARANCE ZONE REQUIREMENTS

In general, single phase primary and/or secondary conductors shall be cleared of trees within 15 feet of each side of the pole line center. Three phase primary conductors shall be cleared 25 feet each side of the pole line center. (See Figure 4 for clearance zone dimension measurements.)

VIII. ROW Contractor Training and Requirements

ROW contractors hired by WEC are required to become familiar with the procedures and requirements of this plan and to utilize safe and proper ROW clearing techniques that are in compliance with state and federal laws and regulations. Each ROW crew must have two (2) qualified line clearance tree trimmers. Minimum qualifications include the following:

- Annual CPR and first aid training
- Annual electrical hazard awareness training
- Ability to perform an aerial rescue from a minimum height of 35 feet in four minutes or less. Aerial rescue must be practiced at least once a year.

- Knowledge of electric line voltages and minimum approach distances
- Annual inspection and dielectric testing of bucket trucks to be used for tree trimming
- *Need to add all references to OSHA 1910.269 material*

This plan has been prepared and adopted in order to provide a broad assessment of WEC's ROW vegetation management goals and policy objectives, and the operational methods and practices that shall be used in attaining those goals and objectives. The procedures outlined herein are designed to provide general guidelines for the safe operation and maintenance of electrical distribution and transmission lines, while minimizing visual and other environmental impacts within the communities served by WEC.

Appendix I.

STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. 8714

Request of Washington Electric Cooperative, Inc. for a determination that it qualifies as a retail electricity provider under 30 V.S.A. § 8005(b)(1)(A))

Order entered: 11/18/2016

I. Introduction and Procedural History

In this proposal for decision, I recommend that the Vermont Public Service Board ("Board") determine that Washington Electric Cooperative, Inc. ("WEC") qualifies as a 100% renewable retail electric provider under 30 V.S.A. § 8005(b)(1)(A).

On March 23, 2016, WEC filed a request that the Board determine that it qualifies as a retail electricity provider under 30 V.S.A. § 8005(b)(1)(A). Section 8005(b) provides for modified compliance requirements under the Renewable Energy Standard ("RES") established under Section 8004 for retail electricity providers that meet the following criteria:

> (A) as of January 1, 2015, was entitled, through contract, ownership of energy produced by its own generation plants, or both, to an amount of renewable energy equal to or more than 100 percent of its anticipated total retail electric sales in 2017, regardless of whether the provider owned the environmental attributes of that renewable energy; and
>
> (B) annually each July 1 commencing in 2018, owns and has retired tradeable renewable energy credits monitored and traded on the New England Generation Information System or otherwise approved by the Board equivalent to 100 percent of the provider's total retail sales of electricity for the previous calendar year.[1]

WEC requested a determination that it meets the statutory standard outlined in Section 8005(b)(1)(A) above and provided supporting exhibits to demonstrate that it meets that standard.

1. 30 V.S.A. § 8005(b)(1).

On May 2, 2016, the Board opened this investigation to consider WEC's request and designated me as hearing officer.

On May 26, 2016, I held a prehearing conference in this proceeding.

On June 22, 2016, the Vermont Department of Public Service ("Department") filed its comments on WEC's requested determination.

II. FINDINGS

1. As of January 1, 2015, WEC was entitled, through contract, ownership of energy produced by its own generation plants, or both, to an amount of renewable energy exceeding 100% of its anticipated total retail sales in 2017. This finding is supported by findings 2 through 4, below.

2. WEC's projected total retail sales in 2017 are 69,545,205 kWh. Exh. WEC-2.

3. As of January 1, 2015, WEC had contracted for 71,087,683 kWh of renewable generation, equivalent to 102% of its projected 2017 retail sales. Exh. WEC-1.

4. WEC's contracted renewable energy includes approximately 2,000 MWh of biomass generation,[2] approximately 13,000 MWh of hydoelectric generation, approximately 9,000 MWh of wind generation, and approximately 51,000 MWh of landfill gas generation. Exh. WEC-1.

III. DISCUSSION AND CONCLUSION

The Department recommends that the Board determine that WEC qualifies as a 100% renewable provider under 30 V.S.A. § 8005(b)(1)(A). Based on the evidence submitted in this proceeding, I agree with the Department that WEC meets the standard laid out in the statute.

The Department also observes that Section 8005(b)(1)(B) requires that, beginning in 2018, a qualified provider annually demonstrate that it owns and has retired renewable energy credits monitored and traded on the Generation Information System operated by the New England Power Pool ("NEPOOL GIS"). The Department recommends that the Board require

2. Although the Board has not issued a final determination on the eligibility of biomass generation for the RES generally, it has determined that biomass-sourced energy from the Ryegate Power Station will qualify as renewable under the RES. *See* Docket 8550, *Investigation into the Establishment of the Renewable Energy Standard,* Order of 10/27/16 ("RES Implementation Order") at 3.

WEC to annually demonstrate that it meets the requirements of Section 8005(b)(1)(B) by using the NEPOOL GIS in a manner consistent with that outlined by the Board in its orders implementing the RES.

I concur with the Department's recommendation. Accordingly, I recommend that the Board require that WEC annually demonstrate its compliance with Section 8005(b)(1)(B) in a manner consistent with the requirements of Paragraphs 1 through 3 of the RES Implementation Order, or any future rule that the Board may adopt governing the manner of demonstrating compliance with the RES.

Because this proposal for decision is not adverse to any party and is consistent with both parties' recommended resolution of this proceeding, it has not been circulated to the parties for review and comment.

Dated at Montpelier, Vermont, this 18th day of November, 2016.

Kevin C. Fink
Hearing Officer

IV. ORDER

IT IS HEREBY ORDERED, ADJUDGED, AND DECREED by the Public Service Board ("Board") of the State of Vermont that:

1. The findings, conclusions, and recommendations of the hearing officer are adopted.

2. Washington Electric Cooperative, Inc. ("WEC") shall qualify as a 100% renewable retail electric provider under the provisions of 30 V.S.A. § 8005(b)(1)(A).

3. WEC shall annually demonstrate its compliance with 30 V.S.A. § 8005(b)(1)(B) in a manner consistent with the requirements of Paragraphs 1 through 3 of the RES Implementation Order, or any future rule that the Board may adopt governing the manner of demonstrating compliance with the RES.

Dated at Montpelier, Vermont, this 18th day of November, 2016.

______________________	)	
	)	PUBLIC SERVICE
	)	
______________________	)	BOARD
	)	
	)	OF VERMONT
______________________	)	

OFFICE OF THE CLERK

FILED: November 18, 2016

ATTEST: Judith C. Whitney
Clerk of the Board

NOTICE TO READERS: This decision is subject to revision of technical errors. Readers are requested to notify the Clerk of the Board (by e-mail, telephone, or in writing) of any apparent errors, in order that any necessary corrections may be made. (E-mail address: psb.clerk@vermont.gov)

Appeal of this decision to the Supreme Court of Vermont must be filed with the Clerk of the Board within thirty days. Appeal will not stay the effect of this Order, absent further Order by this Board or appropriate action by the Supreme Court of Vermont. Motions for reconsideration or stay, if any, must be filed with the Clerk of the Board within ten days of the date of this decision and order.

Appendix J.

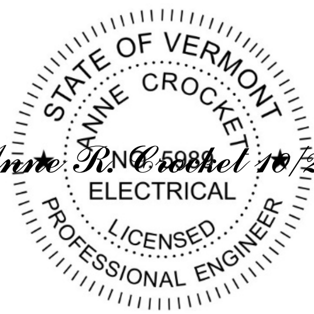
WASHINGTON ELECTRIC COOPERATIVE, INC.

CONSTRUCTION WORK PLAN FOR 2019-2022

TABLE OF CONTENTS

Engineer Certification:

I hereby certify that this 2019-2022 Construction Work Plan was prepared by me and that I am a registered Professional Engineer in the State of Vermont #5989.



Anne R. Crocket 10/24/18

I. EXECUTIVE SUMMARY

Washington Electric Cooperative (WEC) receives financing from the Rural Utilities Service (RUS) for its electrical system improvements. One of the requirements for RUS borrowers is the periodic development of a Construction Work Plan (CWP) in accordance with RUS Bulletin 1724D-101B guidelines. This report fulfills the RUS requirement.

Crocket Engineering, LLC has prepared this work plan, building on other studies that have recently been completed, including the 2014 Load Forecast[1] and 2012-2021 Long Range Plan. In addition, this plan meets the requirements of the Comprehensive Energy Plan 2016 issued by the Vermont Department of Public Service.

This CWP, which spells out a detailed work plan for improving the reliability and efficiency of the electrical distribution facilities, is a management tool and a guide for the following:

- The most practical and economical means of serving future loads while maintaining high quality service to consumers.
- An outline for anticipated system changes in terms of major facilities, demand levels and associated costs.
- An indication of future system costs for financial planning and decision making.

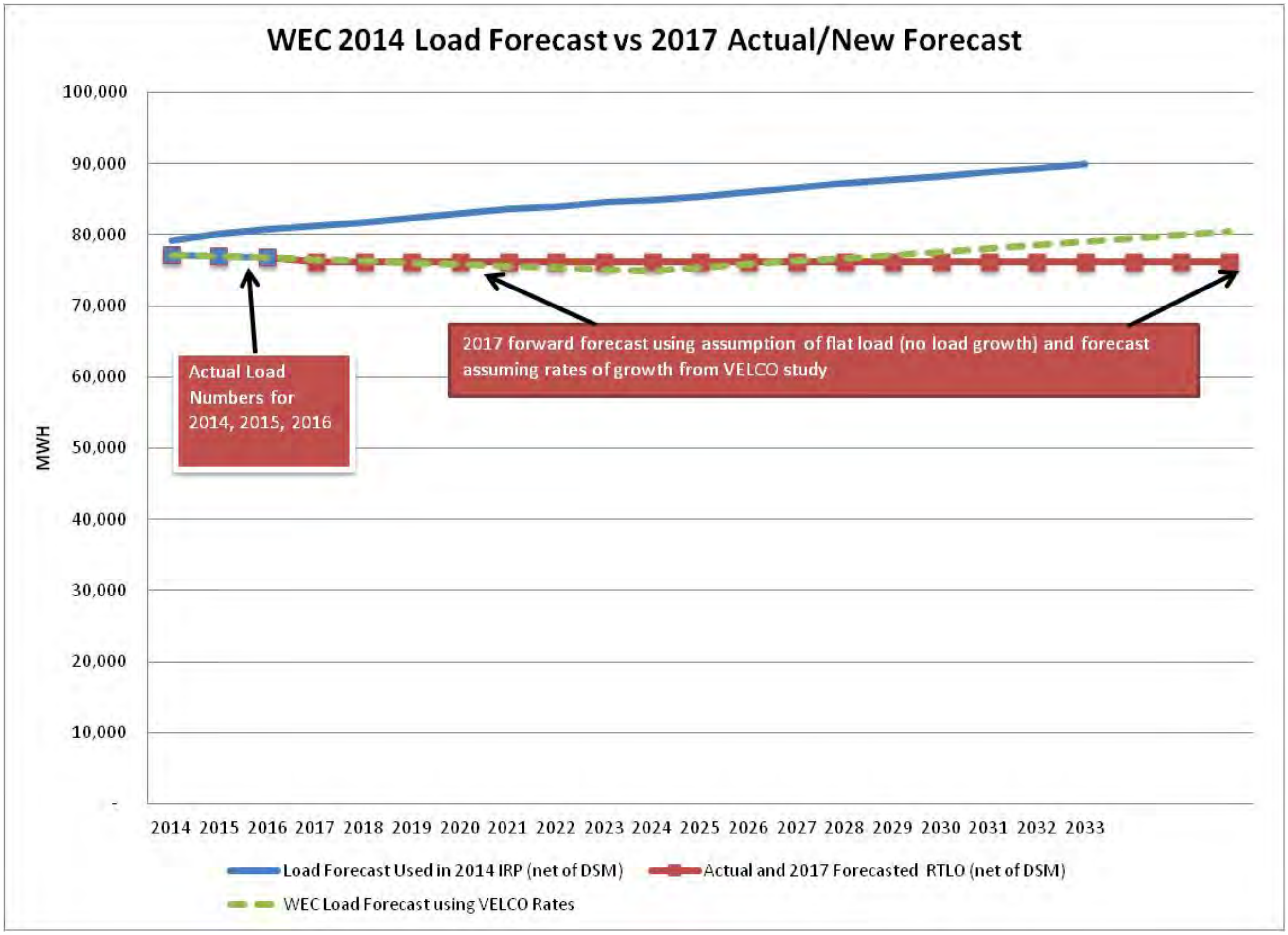
A CWP provides a guide for developing the existing system toward the capacity level which will be required at the end of the planning period, through construction of new facilities and expansion or replacement of existing facilities at appropriate times. The plan incorporates critical elements that need to be addressed to provide safe, reliable and efficient electric service at a reasonable cost.

The analysis for the development of project recommendations for the 2019-2022 CWP is supported by WEC's design criteria, distribution line and equipment costs, past system studies and the review of various historical system data.

The Load Forecast was developed in the Washington Electric Cooperative's 2017 Load Forecast as provided in its updated IRP, and is summarized in Chart 1 and Table 1 below.

[1] WEC is using the 2014 Load Forecast, updated to include 2014-2016 data, as approved in a letter to WEC dated 2/14/17. See Appendix

Chart 1 – Adjusted Coincident Winter Peak Forecast



The following Table 1 shows five years of historical data for WEC's load obligation at the ISO-NE settlement level (inclusive of distribution and transmission losses) energy sales and peak demand that were used in developing the forecasted loads.

Table 1 System Load Data							
	2012	2013	2014	2015	2016	Avg Annual % Increase	Net 4 Yr % Increase
Energy Sales(MWh)	76,506	73,694	75,757	75,620	75,274	0.07%	0.30%
Peak Demand(kW)*	15,373	15,682	16,011	15,914	15,724	0.57%	2.28%
No. of Consumers**	10,660	10,796	10,856	10,936	11,014	0.82%	3.32%
*Coincident Peak demand of all substations **Year end consumers							

The following Table 2 shows five years of forecasted data for energy sales and peak demand that were used in developing the construction work plan.

Table 2 System Load Data								
	Actual	Projected					Avg. Annual % Increase	Net 5 Yr. % Increase
	2016	2017	2018	2019	2020	2021		
Energy Sales (MWh)	75,275	76,222	76,222	76,222	76,222	76,222	0.00%	0.00%
Peak Demand (kW)*	15,724	15,724	15,724	15,724	15,724	15,724	0.00%	0.00%
No. of Consumers**	11,014	11,104	11,195	11,287	11,380	11,473	0.82%	4.17%
*Coincident Peak demand of all substations **Year end consumers								

The recommendations in the proposed CWP are based on the projected load growth and should be adequate to serve loads through 2021. However, WEC will monitor actual load growth at the end of each year to determine if observed patterns warrant changes in project priorities.

The CWP is developed to follow the recommendations and the intent of the 2012-2022 Long Range Plan (LRP) completed in March 2011[2]. Following is a brief explanation of the proposed spending and how it corresponds to the LRP and an explanation of the two spreadsheets attached (2019-2022 CWP Budget Proposal and Project List for the specific projects included in the CWP).

2019-2022 CWP Work Plan Budget (See Table 1 of the Cost Summaries[3])

The spreadsheet provides a cost breakdown for each of the RUS construction categories with a brief description of the major work being done in each area. The budget for several of the categories was developed based on historical data. The table provides the following information:

- 2014-2017 CWP spending approved by RUS in the current work plan.
- The actual expenditures through August 2017.
- CWP projected spending for 2019-2022 by category.

[2] 2012 LRP developed by Crocket Engineering, LLC was utilized for planning purposes and remains a valid plan
[3] See also the RUS Form 740C, included in the cost summaries.

The CWP addresses the major recommendations of the LRP as follows:

Pole Replacement - One of the primary concerns addressed in the LRP was the aging condition of the plant. The pole inspection/treatment program has inspected and treated 100% of the poles. The proposed project list identifies replacing approximately 300 aged poles in the system and 885 of the recommended poles in the specific line reconstruction projects, for a total of 1185 poles. Additional poles will be replaced during the CWP as a result of requests by customers for relocations or requests by cable and telephone companies. These will not necessarily be the system's oldest poles.

Aged Wire - The plan proposes replacing 47.5 miles of small conductor in the specific projects listed in the CWP. This represents approximately 33% of the small, deteriorated conductor on the system. There will be approximately 108 miles of smaller, aged wire remaining at the end of this work plan.

The Project List, Table 7 of the Cost Summaries, provides detail on each of the proposed reconductoring projects. The list accomplishes one of the goals in the LRP of trying to identify projects that maximize the dollars spent by collectively reducing small conductor, replacing structurally deficient poles and improving reliability.

Substation Work (500) - The 2019-2022 Work Plan does not include replacement of any existing substations. $12,500 was budgeted for miscellaneous equipment replacement.

Other Equipment Additions (600)

- Meters (601) – The plan includes $120,000 for replacement AMI meters and an additional $48,000 for AMI related equipment expenditures.

- Sectionalizing Equipment (603) – The prior work plan completed the AB Chance line cutout replacement program. $8,000 is budgeted for additional transformer cutout replacement. An additional $15,250 was budgeted for reclosers.

- Voltage Regulators (604) – The plan budgets $21,030, for the replacement or addition of two line regulators during the four year plan.

- Capacitor Installation (605) – The plan budgets $9,892 for new capacitors to maintain voltage and reduce line losses.

- Pole Replacements (606) –The plan budgets $450,000 for the replacement of old and condemned poles. The amount will replace approximately 1013 poles.

- Miscellaneous Distribution Replacements (607) - The budget allows $8000,000 for replacement of failed and aged distribution equipment.

- Conductor Replacements (608) -The plan budgets $400,000 for the replacement of small and deteriorated conductors.

- Fault Indicators (610) – The Budget carries over $5,000 of the unspent budget for fault indicators from the 2014-2017 Work Plan.

- Transmission Insulators (1001) – The Budget carries over $110,000 to replace the insulators on the Jackson Corner 34.5 kV line from the 2014-2017 Work Plan.

- Transmission Switches (1002) – The Budget carries over $31,000 of the unspent budget for switches in the 2014-2017 Work Plan.

The 2019-2022 CWP overall spending request is in line with the 2012 LRP and incorporates projects that meet the goals advanced in the LRP.

Table 1, in the Cost Summaries**,** shows that WEC is requesting $7,778,242 for its 2019-2022 CWP. The funding request is $2,753 higher than the 2014-2017 Work Plan, essentially level funding the plan.

As you will see later in the report in Section IV, WEC completed the majority of the items recommended in the previous work plan. The projects that were not completed have been carried forward into this work plan, with some exceptions.

II. PURPOSE OF THE REPORT

WEC receives financing from the Rural Utilities Service (RUS) for its electrical system improvements. One of the requirements for RUS borrowers is the periodic development of a Construction Work Plan (CWP) in accordance with RUS Bulletin 1724D-101B guidelines. This report fulfills the RUS requirement.

“The Construction Work Plan process is used to determine and document a borrower’s two to four year construction needs that are the most feasible, environmentally acceptable, and economical. New construction is periodically required in order to provide and maintain adequate and reliable electric service to all of a system's new and existing members. The CWP should include all recommended electric plant facilities regardless of the financing source (general funds, RUS, or all other lenders). A CWP is a valuable reference for the preparation of annual construction budgets and schedules. The CWP report is also used as an engineering support document for a loan application to finance a proposed construction program. As such, the CWP is used as a means to inform RUS and receive RUS's approval of proposed new construction items.”[4]

A CWP spells out a detailed work plan for improving the reliability and efficiency of the electrical distribution facilities and is a management tool and a guide for the following:

- The most practical and economical means of serving future loads while maintaining high quality service to consumers.

- An outline for anticipated system changes in terms of major facilities, demand levels and associated costs.

- An indication of future system costs for financial planning and decision making.

A CWP provides a guide for developing the existing system toward the capacity level which will be required at the end of the planning period, through construction of new facilities and expansion or replacement of existing facilities at appropriate times. The plan incorporates critical elements that need to be addressed to provide safe, reliable and efficient electric service at a reasonable cost.

In addition, WEC is required to submit an Integrated Resource Plan every 3 years. This report will address the Transmission and Distribution analysis requirements of the IRP, meeting the requirements listed in Appendix B of the State’s Comprehensive Energy Plan 2016 as follows:

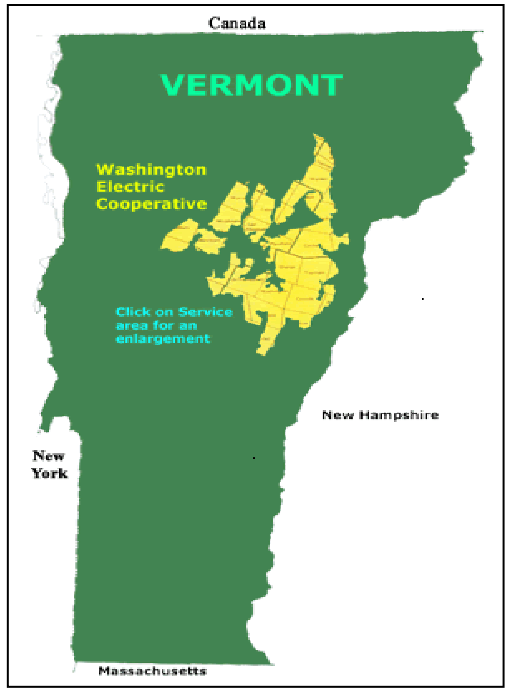
Assessment of the Transmission and Distribution System:

T&D System Evaluation……………………………….see pages 19-20
T&D Equipment Selection and Utilization ………….see page 25
Implementation of T&D Efficiency Improvements….see pages 24-28
Maintenance of T&D System Efficiency…………….see pages 24-28
Other T&D Improvements…………………………….see pages 36-38
Distributed Generation………………………………..see pages 15-19

[4] From RUS Bulletin 1724D-101B, Page 3.

III. WEC BACKGROUND INFORMATION

A. WEC Location and Background Information



Washington Electric Cooperative, Inc. (WEC) is a member owned rural electric company established in 1939. WEC serves over 11,014 meters, 97% of which are residential (including regular and seasonal consumers). The WEC service area covers approximately 2,728 square miles in north-central Vermont including portions of 41 towns in Washington, Orange, Caledonia and Orleans counties. It operates approximately 1,153 miles of distribution line, with eight substations. The balance of customers is a mix of small commercial and larger commercial customers. The largest commercial customer is Harwood Union High School in Duxbury.

WEC is committed to providing its members with safe, reliable, efficient and economical power and periodically prepares a construction work plan to improve the performance of its electrical system. However, there are financial considerations and the WEC Board makes difficult decisions to allocate the limited resources available to the areas that will provide the most benefit for the dollars spent.

B. Distribution Facilities

The existing WEC distribution system has approximately 1,140 miles of overhead distribution line and 13 miles of underground primary distribution, for a total of 1,153 miles. The distribution system operates at 12.47/7.2 kV.

The distribution system consists of eight substations and one primary metering point. Table 3 provides a list of the substations and the approximate length of primary overhead and underground on each.

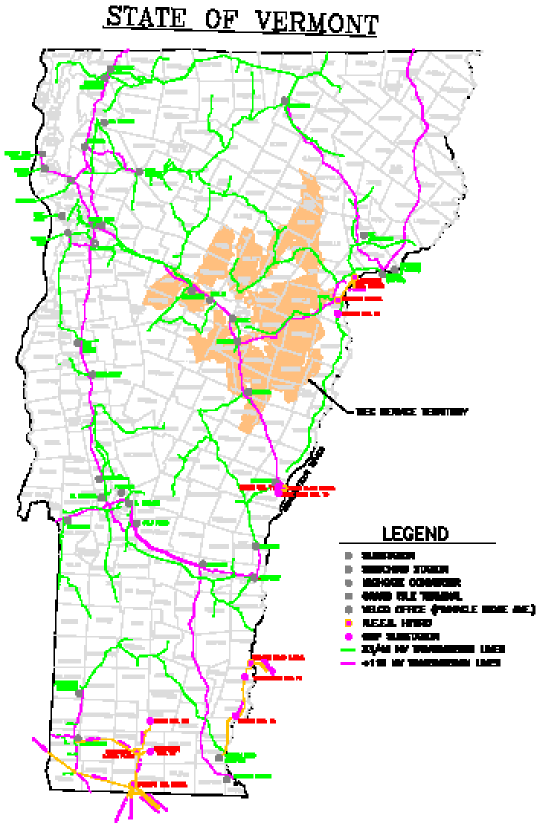
Table 3 Primary Line Lengths by Substation/Feeder					
			Approx. Length (Mi.)		
Substation	Sub No.	Circuit	Overhead	Underground	Meters
East Montpelier	1	1	35.5	0.8	262
		2	73.8	0.9	830
		3	49.7	1.5	582
Jones Brook MP*	2	1	6.9	0.0	79
Mt. Knox	3	1	69.9	0.0	579
		2	133.7	0.6	1,284
West Danville	4	1	38.4	0.5	446
South Walden	5	1	51.3	0.0	427
		2	43.7	0.0	462
		3	36.3	0.1	281
Jackson Corners	8	1	40.4	0.0	409
		2	52.3	0.3	321
		3	107.9	1.3	1,253
Moretown	9	1	42.1	0.3	466
		2	16.3	1.0	154
		3	50.9	1.6	781
Maple Corners	10	1	28.1	0.4	279
		2	49.8	0.1	564
North Tunbridge	11	1	82.4	0.8	687
		2	27.1	0.1	230
		3	34.64	0.0	257
Totals	8	21	1153	10.3	11,014
*metering point only					

The primary conductor size on the system ranges from 3/12 copperweld to 4/0 aluminum on the overhead portion of the line. The primary underground line, which accounts for approximately .9% of the total system, consists of 1/0 Al, 15 kV cable.

Five of the eight substations were originally built as wood pole structures with timber crossarms, varying in age. Four substations, Moretown, South Walden, Maple Corners, and East Montpelier have been completely rebuilt with modern metal frame construction and increased clearances to meet present requirements. West Danville Substation, while a wood pole structure, was rebuilt in 1986 while major equipment was replaced in 2002, and is therefore in good condition.

C. Transmission Facilities

The majority of the power distributed to WEC's customers is generated outside of WEC's service area. Therefore, WEC depends on transmission facilities owned by VELCO and GMP to transmit power to its electrical facilities. The Vermont transmission facilities are shown in the following map of Vermont relative to WEC's service territory.



WEC owns approximately 15.7 miles of 34.5 kV transmission line that completes the link between the transmission facilities owned by others and WEC's substations. These lines interconnect and serve the Jackson Corners, Maple Corners and South Walden substations. WEC owns an additional 2.6 miles of 46 kV transmission line that serves the North Tunbridge substation and 7.2 miles of 48 kV line that connects the Coventry Landfill Gas Plant to the VELCO Irasburg Substation. The specific distances of the transmission line taps are detailed in Table 4.

Table 4
WEC Owned Transmission Lines

Substation	Voltage	Length (Miles)
Jackson Corners	34.5	4.4
Maple Corners	34.5	9.0
North Tunbridge	46.0	2.6
South Walden	34.5	2.3
Coventry	48.0	7.2
Totals		25.5

D. Power Supply

WEC's power supply is comprised of generating resources that are directly interconnected to WEC's distribution facilities and those that are outside of WEC's service territory whose output must be wheeled to WEC over transmission lines owned by others.

There are three significant power resources that interconnect into WEC's electrical facilities. These are the Wrightsville and Moretown Hydro generating facilities and the Williamstown Solar project. The Wrightsville Hydro generating station is owned and operated by WEC and has an output capacity of 933 kVA. The plant is located on the northern edge of the City of Montpelier. The Wrightsville Hydro plant output interconnects to WEC's distribution facilities through Circuit 3 of the East Montpelier Substation.

The Moretown Hydro plant is a 1000 kVA privately owned generating station that interconnects into Circuit 1 of WEC's Moretown Substation. This small power producer primarily generates during the high water periods of the year such as the spring season and other times of heavy precipitation.

The Williamstown Solar project is a 2.2 MW privately owned solar energy plant that interconnects with Circuit 3 of the Jackson Corners Substation. A second large solar project (2.2 MW) came on line on WEC's 48 kV transmission line in Coventry in 2014. Both projects provide power under the state of Vermont's Standard Offer programs. A third large solar project (1.5 MW) is planning to interconnect to WEC's distribution lines at George Road, in Williamstown.

In addition, WEC owns and operates the Coventry Landfill Gas Generating Station in Coventry, Vermont. In 2009 a fifth unit was installed at the plant bringing the total capacity to 8.0 MW. The plant supplies in excess of 60% of the Co-op's annual power requirements.

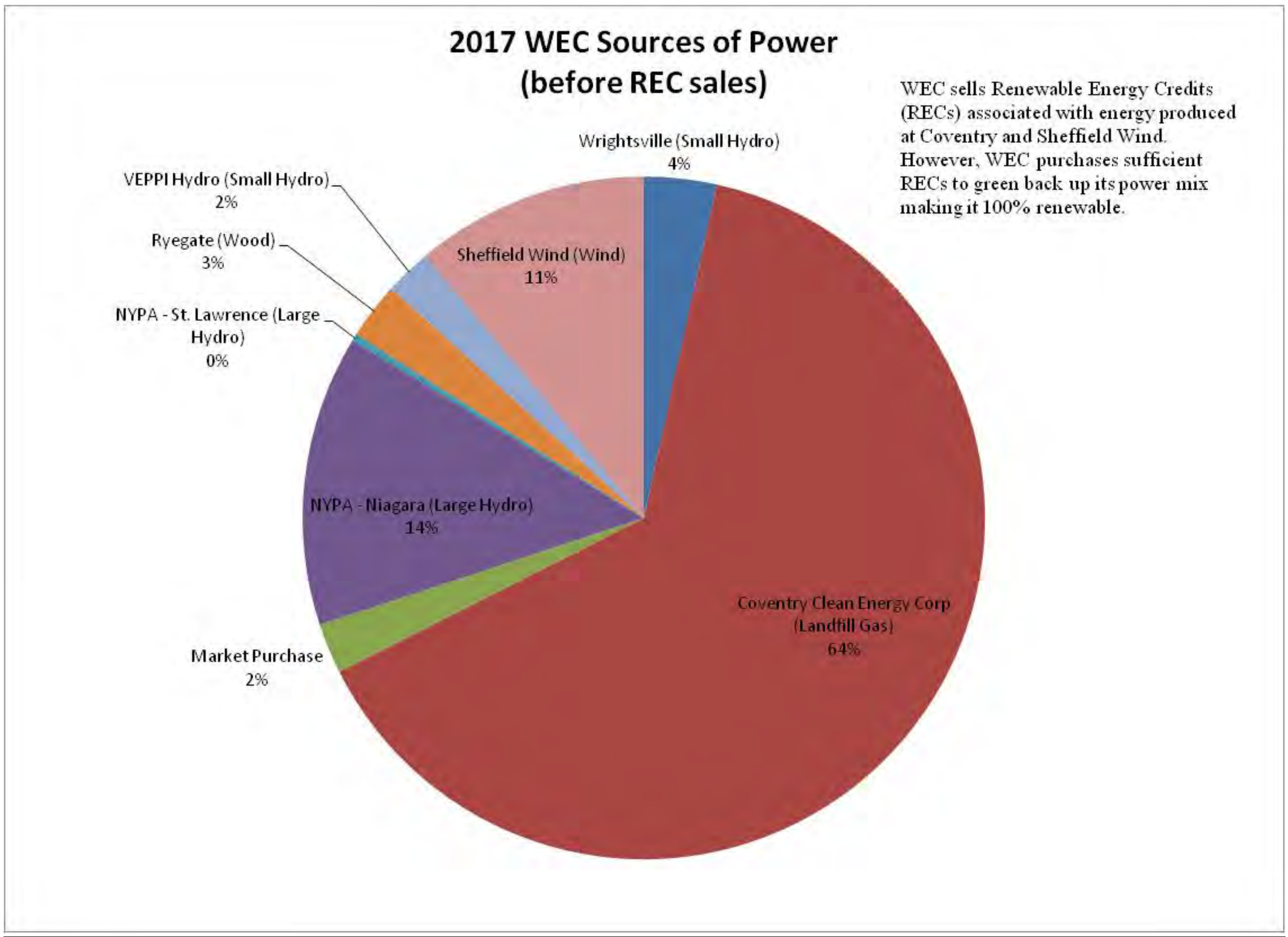
There are also 2,473 kW of small solar arrays (through the net metering program) operated by WEC members and connected to the WEC distribution system. Four additional large solar arrays have applied for interconnection but have not yet been approved: Triland George Street, 1500 kW (Standard Offer), Fairmont Farms, 250 kW (net metering), Fairmont Farms, 150 kW (net metering) and Judgement Ridge Solar, 135 kW (net metering).

From the 2017 WEC Financial Report, the following Table 5 and Chart 2 shows that WEC's current sources of power are renewable and fairly well diversified, reflecting landfill gas, hydroelectric, biomass, wind and system power (primarily natural gas generation). WEC's resource mix is much cleaner than the regional mix as a whole. WEC has made a conscious effort over the years to reduce the use of fossil fuels and nuclear generation, while increasing the use of renewable.

Table 5

2017 WEC Sources of Power before REC Sales & Purchases					
Resources (kWh)	Type	kWh	Percent of RTLO	Percent of Retail Load	Percent of Total Resources
Wrightsville (Small Hydro)	Hydro	2,852,391	4%	4%	3%
Coventry Clean Energy Corp (Landfill Gas)	Landfill Methane	53,075,555	70%	77%	64%
Market Purchase	ISO-NE System Mix	1,968,000	3%	3%	2%
NYPA - Niagara (Large Hydro)	Hydro	11,413,011	15%	17%	14%
NYPA - St. Lawrence (Large Hydro)	Hydro	277,580	0%	0%	0%
Ryegate (Wood)	Wood	2,237,071	3%	3%	3%
VEPPI Hydro (Small Hydro)	Hydro	1,824,077	2%	3%	2%
Sheffield Wind (Wind)	Wind	9,144,771	12%	13%	11%
Total		82,792,456	109%	120%	100%

Chart 2



IV. ANALYSIS OF THE EXISTING SYSTEM

This section of the report contains a description of all of the information that was used to prepare WEC's CWP for 2019-2022. This section includes the design criteria, line and equipment costs, status of 2014-2017 CWP items, analysis of current system studies and historical/projected system data.

The existing system analysis was conducted to determine how well the current facilities are meeting the needs of the system and to identify areas of concern. The analysis looks at the past five years of data covering historical load growth, substation capability, system line losses and reduction techniques, service reliability, vegetation management and overall system performance. In addition, the review examined the age of poles and small/aging conductor.

A. Planning/Design Criteria

Planning criteria are used to establish the rules for assessing WEC's distribution system performance. The criteria include voltage limits, conductor thermal loading limits and equipment thermal loading limits.

The following planning criteria cover WEC's 34.5 kV sub-transmission system and its distribution system that ranges in phase to phase voltage from 12.47 to 34.5 kV. The following planning criteria were utilized in preparing this CWP:

- Distribution lines will be limited to 300 amps or the conductor's normal rating, whichever is lower[5].

- Distribution line voltage will be held between 115 and 125 volts with a maximum swing of 6 volts between peak and off-peak loading. Tap changer compensation will be used where possible to limit daily voltage swings.

- A distribution line will be limited to two levels of line regulation beyond the substation bus.

- Substation transformer and regulator loads will be limited to their nameplate rating.

- The distribution system losses will be evaluated on a regular basis and all cost effective loss reduction projects will be implemented. Re-conductoring, adding phases, adding capacitors, and new metering points and substations are examples of projects to be considered.

- The most important consideration in developing the work plan projects was condition of wires and poles. With the completion of the pole inspection program the lines with a significant number of deteriorated poles have been identified and projects were proposed to replace these lines. In addition, the

[5] 4/0 AAAC has a normal rating of 395 amps, for example.

condition and size of the primary conductor was taken into consideration, with "Amerductor" and Copperweld wire being considered the priority.

B. Cost Estimates

The estimates below reflect the average per mile cost of constructing line based on 2014 – 2017 CWP actual costs. An annual inflation rate was applied to project costs which are reflected in the 2019-2022 Work Plan Budget (Cost Summary Table 1).

Single phase line rebuild, 1/0 AAAC, in place:............................. $98,155/mile
Single phase line rebuild, 1/0 AAAC, relocated: $159,033/mile
Three phase line rebuild, 4/0 AAAC, in place: $162,000/mile
Add a third phase, 4/0 AAAC:.. $22,000/mile
Add two phase, 1/0 AAAC $55,440/mile
Pole replacement.. $3900/pole

C. Status of Previous (2014-2017) CWP

A new 2019-2022 CWP is being proposed because the work identified in the 2014-2017 CWP has been nearly completed. A small, select number of relevant projects were carried forward to the new 2019-2022 CWP.

The status of each item contained in the work plan is provided below. Actual data is available through September 1, for each category.

- Category 100 – Service Connections for New Members
  Service connections for new members represented a small percentage of the resources in the 2014-2017 CWP.

- Category 300 – Conversions and Line Changes
  WEC completed approximately 84% of the projects targeted for this category in the previous four-year CWP. A total of 43 projects were identified for upgrading the system in the 2014-2017 CWP, 36 of which were completed or anticipated to be completed. The remaining projects will be carried over to the 2019-2022 Work Plan.

- Category 400– New Substations
  The 2014-2017 CWP did not propose any new substations.

- Category 500 – Substation Rebuilds
  The 2014-2017 CWP did not propose any substation rebuilds.

- Category 500 – Substation Changes
  None of the $12,500 budgeted for Substation Changes in the 2014-2017 CWP was spent, to date.

- Category 600 – Miscellaneous Distribution Equipment

- 601 – Transformers
  The 2014-2017 CWP estimated a total of 1,000 transformers would be required based on historical data. A total of 668 energy efficient transformers were purchased as of July 31, 2017.

- 601 – Meters
  The 2014-2017 CWP estimated a total requirement $101,448 with $50,690 actually spent.

- 602 – Service Improvements
  As of September 1, a total of 15 service upgrades were made compared to the anticipated 60 in the 2014-2017 CWP.

- 603 – Sectionalizing Equipment
  Two new line reclosers were installed under the 2014-2017 CWP.

- 604 – Voltage Regulators
  No new voltage regulators were installed in the 2014-2017 CWP.

- 605 – Capacitors
  No capacitors were installed during the 2014-2017 CWP.

- 606– System Improvement Pole Changes
  A total of 307 poles were changed as part of this category. Of the $1,213,252 budgeted, $1,199,425 was used by the end of July 2017.

- 607 – Miscellaneous Distribution Replacements
  The budget for this category was $600,350 and to date $432,403 of work was completed by the end of July, 2017.

• Category 700 – Other Distribution Items

  - 702 – Security Lights
    A total of 33 security lights were installed as of July, 2017 at a cost of $24,405.

  - 703 – Monitoring Equipment
    None of the $11,505 budgeted for Monitoring Equipment was spent.

D. Distributed Generation and Impacts to the WEC Transmission & Distribution System[6]

From the 2017 IRP:

> Apart from emergency preparedness, utility planning — e.g., integrated resource plans — must consider energy assurance. This includes preparatory actions that help the power stay on, such as careful vegetation management to clear trees away from power lines, and the strategic location of utility infrastructure to avoid

[6] From the 2017 IRP

risks in the first place (for example, siting substations and generators outside of floodplains and river corridors), or to make restoration of power easier (as by siting power lines along roadways).[7]

The pace of innovation in the electric sector is increasing, especially for distributed energy resources. For instance, solar PV prices have fallen by nearly 60% in the last four years, while the number of electric vehicles in Vermont has increased by more than a factor of 10 and cold climate air source heat pumps are rapidly expanding in availability. During the past five years, Vermont utilities have completed deployment of a statewide smart grid, opening the door for modern information technology tools to manage the electric system. Changes brought by evolving technology will challenge long-held paradigms that underpin utility business models, while also providing opportunities for utilities to increase their own fostering of innovation. Vermont must harness this innovation for ratepayers' benefit and use it to help meet our energy goals, thereby advancing economic, environmental, and health priorities.[8]

As noted previously, WEC completed a satisfaction survey of its membership in 2015. Members were asked to rank the importance of various attributes of their electric power and service. Reliability was given the highest importance rating among nine key factors. WEC members ranked reliable service above lower rates and friendly and knowledgeable service. With this directive, WEC seeks to harden its system and decrease the occurrence and duration of power outages. To meet this challenge, WEC seeks to invest in its system as outlined in its CWP. WEC also sees that by responding to changes in industry practices, it will develop tools that will enhance and improve reliable service.

As a result of increased distributed generation, growing deployment of energy efficient technologies, and new plug loads, WEC seeks to explore a T&D system analysis to assess a changing industry. WEC will perform an assessment of its system to explore the impacts of growing distributed generation installed on the grid. WEC's analysis will be done to answer broad overarching questions:

- How much distributed generation can the T&D system accommodate?
- Does it matter by circuit/substation/size where distributed generation is located?
- What are the impacts to WEC's T&D system of new plug load (EVs, cold climate heat pumps, etc)?
- What power quality issues does WEC's T&D system need to address in light of a modernizing grid?
- What data is necessary to conduct a more comprehensive and transparent planning process?

WEC seeks to develop a scoping process that will allow it to specify the tools, process, and protocols to be developed in order to plan and operate a modern grid capable of dynamically managing distribution resources, as well as supporting retail

[7] 2016 CEP p 273
[8] Ibid p 275

markets that coordinate significant distributed generation investment and efficiently manage resources. Engineering and modeling efforts will be used to help convey how WEC plans, operates, and develops its system (where and which types of resources and equipment are best located on WEC's lines). WEC will also seek to balance distributed generation needs and grid modernization with total cost of its system and the impacts to members' rates and bills. In the near term, WEC plans to start a scoping process to outline work it will need to do in the future.

Broader and Long-term Issues:

WEC's operational practices required to operate the grid safely and reliably will continue to evolve based on increasing distributed generation and multi-directional power flows. Operating the distribution system going forward will require a combination of technologies and modernized and improved standards. In the longer term, WEC's plans must incrementally progress from adequately equipping the distribution system with monitoring and communication infrastructure to enabling intelligent, rapid, and precise control.

WEC looks toward deploying automated solutions across the system where it is appropriate and where it offers added value. WEC will focus in the near term on monitoring, observation, and a detailed assessment of its current system and its capabilities as well as its weaknesses. WEC will evaluate the effectiveness of existing systems to determine what modifications may be needed to operate the system safely. It is expected that forecasted distributed generation penetration levels, types, and locations will provide the basis to establish new policies, protocols, and visibility requirements. While WEC's current CWP process encompasses many of the goals noted in the IRP, these are specific items WEC seeks to examine and act on in the upcoming three years:

- Outline and provide an overview of WEC's T&D system;
- Develop and articulate an integrated approach to planning, investment, and operations;
- Develop an open process to promote utility/stakeholder relations, enable third parties the opportunity to provide cost-effective market solutions to identified energy needs, drive member value related to the distribution system, and embrace innovation where cost-effective;
- Specify the expected or potential near-term effects of increased distributed generation penetration on the ability to serve customers, with specific reference to each type of distributed generation and its grid interface;
- Identify the need for system upgrades regardless of distributed generation potential;
- Perform a technical assessment and description of WEC's T&D system with respect to changes from grid modernization (distributed generation, energy efficiency, new plug loads such as EVs and CCHPs);
- Plan for circuit based analysis;
- Identify the level of distributed generation capacity on WEC systems on a given

distribution circuit that could be integrated without additional upgrades or expansions;

- Identify potential system efficiencies (lowering of distribution losses, deferral/avoidance of investments, and rebuild work);
- Develop a plan that will take into account changing load shapes, increased distributed generation, and the effect that these factors will have on the existing system and any planned capital expenditures;
- Identify locations, based on proposed capital plans, where distributed generation has the potential to resolve or mitigate forecasted system requirements that would otherwise necessitate traditional infrastructure investments for system expansion/upgrade and/or maintenance;
- Include effects of storage and behind the meter generation on WEC's system;
- Identify specific system needs allowing stakeholders and market participants to identify opportunities;
- Identify collaboration efforts with other Vermont utilities, VELCO, and the Vermont System Planning Committee (VSPC) process;
- Identify specific areas in WEC's system where there is an impending or foreseeable delivery infrastructure upgrade need;
- Identify specific areas where there is no projected delivery infrastructure need for years to come, and hence the infrastructure avoidance value of distributed generation is likely to be lower or insignificant in the short-term;
- Identify and distinguish operational needs during normal operations and during outage events or other periods of system stress (low voltage condition, near thermal limitations, etc.) and plans to implement reliability enhancing protocols like fault location, isolation, and service restoration;
- Develop information on optimal locations and levels of storage facilities, either on the system or behind the customer's meter, as storage technologies integrated into grid architecture may potentially be used for reliability and to support the deployment of other distributed resources;
- Prepare system data on a substation basis: hourly load curves, voltage, power quality, reliability;
- Prepare individual feeder system data (load data, voltage, power quality, reliability, etc.) for feeders within areas that distributed generation is expected to have more value;
- Consider and propose demonstration projects, as appropriate, in order to continually improve, refine, and otherwise drive toward the state's energy objectives;
- Develop maps and other means to identify geographically where distributed generation is best suited;

- Explore other utility and public sources related to solar mapping and use early research to help guide analysis.

WEC's T&D planning efforts will be an evolving and dynamic process. As we learn more about our system and perform more detailed studies relative to distributed generation and grid modernization, we will adapt our efforts and report findings through the IRP process. Hence, this is an ongoing and iterative process.

E. Analysis of Current System

WEC conducts a comprehensive evaluation of the T&D System every 4 years in conjunction with RUS requirements for a Construction Work Plan. As such, WEC believes no additional studies are necessary at this time but notes a new Long Range Plan is scheduled within the next 4 years. T&D Studies completed since 2000 include:

- EPRO study in 2001 (individual circuit and transformer loading, protection coordination, reliability, losses, and ROW vegetation management)
- Electrical Distribution Study in 2002 done by WEC (optimization study, with load balancing, CVR, and cap placement)
- 2001- 2004 Construction Work Plan including comprehensive system evaluation
- 2004- 2008 Construction Work Plan including comprehensive system evaluation
- 2008- 2011 Construction Work Plan including comprehensive system evaluation
- 2012-2021 Long Range Plan in 2011
- 2011- 2015 Construction Work Plan including comprehensive system evaluation
- 2014- 2017 Construction Work Plan including comprehensive system evaluation
- 2018- 2021 Construction Work Plan including comprehensive system evaluation
- Long Range Plan in 2021

- **East Montpelier #1/Maple Corners #10**

  The East Montpelier #1 and Maple Corners #10 model[9] was run at a 2016 load level of 3,612 kW with base losses of 101 kW. There were no line sections below 116 volts and no single phase lines above 50 amps.

- **Jones Brook #2**

  The Jones Brook Metering Point was run at a 2016 load level of 107 kW. No problems were encountered. The voltage at the line end was 118.5 volts.

- **Mt. Knox #3**

  The Mt. Knox model was run at a 2016 load level of 2531 kW, with losses of 147 kW. The main line voltage before the Route 25 regulators is 114.4 volts on the B phase. To correct this issue, the B phase regulator should be moved to just before

[9] These substations were run together to take into consideration the common metering at East Montpelier and the 34.5kV transmission losses.

Barberry Road. In addition, a new regulator should be installed on Fairground Road. No other issues were found on this substation.

- **West Danville #4**

  The West Danville model was run at a 2016 load of 486 kW. There were no voltage or loading issues in the model. The base line losses were 11 kW.

- **South Walden #5**

  The South Walden model was run at a 2016 load of 1,515 kW, with line losses of 59 kW.

  Feeder #1 is a single phase line that is running 78 amps. A project to extend the three phase line to Noyestar Road will resolve this issue. The 3.1 miles of construction will cost approximately $172,000 and reduce losses on the substation to 48 kW. In addition, the circuit coordination on the line will be improved by allowing a three phase recloser to be used at the substation. This will allow both line and ground fault protection to be used.

- **Jackson Corners #8**

  The Jackson Corners model was run at a 2016 load of 3189 kW with 128 kW in losses, with the Triland Solar facility in Williamstown off. With the solar on, the load is 1146 kW and the losses are 85 kW. An additional 1500 kW of solar is proposed for this substation, pending regulatory approval. No voltage or loading issues were found through the analysis.

- **Moretown #9**

  The Moretown model was run at a 2016 load level of 2,461 kW, with losses of 114 kW. The voltage on Upper Crossett Hill is projected to be below 114 volts. A new regulator, installed on Route 100, north of the three phase construction, will relieve this problem for the foreseeable future.

- **North Tunbridge #11**

  The North Tunbridge model was run at a 2016 load level of 1,505 kW with 76 kW of losses. Feeders #2 and #3 are both single phase lines and running at approximately 55 amps. The lowest expected voltage, after completion of the proposed projects, is 121 volts. Any pole replacements on the main lines of these circuits should take into consideration the long range plan to add phases to these feeders. The voltage regulator on Goose Green Road may need to be relocated closer to the end of the three phase construction to resolve low voltage just in front of the existing location.

F. Current Review Rating Summary (RUS Form 300)

RUS comments from the last review and evaluation of WEC's electrical system and WEC's response (in italics) to each deficiency noted are provided below. The full summary is provided in Appendix A.

WEC complies with the conditions normally needed to justify a rating of 3 in the RUS Bulletin 1730-1, Electric System Operation and Maintenance, for all items that have received a rating of 3 on the RUS Form 300.

The following is a narrative for the items that have received a rating of 2:

WEC's outage statistics received ratings of 2, which continue to be addressed with ROW maintenance, pole replacement and reconductoring.

G. Sectionalizing & Fuse Coordination Studies

WEC has completed the program proposed in the 2001 E/PRO Engineering Study to add tap fuses and re-coordinate the distribution lines. The program has since been expanded to include the replacement of failing porcelain cutouts with polymer based cutouts. From the 2010 Reliability Report: "*The fourth leading cause of outages was the failure of the A.B. Chance line disconnect devices which accounted for 9.5% of the total number of outages and 25.7% of the total customer hours out.*" This project was completed in 2013.

WEC uses three phase electronically controlled reclosers for each substation feeder and has multiple hydraulic line reclosers on its lines, whose placement is based on line length and configuration. Single phase side taps are generally fused. WEC recently installed TripSaver reclosers in place of the hydraulic reclosers on the Middlesex feeder. The range of settings on the TripSavers will allow much closer coordination between the K type fuses and the three phase reclosers. This change will be monitored and, if it proves successful, this strategy will be implemented over the entire WEC system.

H. Historical and Projected System Data

During the course of the various study work completed in 2001, E/PRO examined a wide range of data for WEC's system. The data included load data, circuit loading, transformer loading, reliability data, losses, pole data, vegetation management, conductor data and energy efficiency services. Each of these items is discussed in more detail below.

1. Annual Energy, Load, and Consumer Data

The load growth for this plan was based on the 2017 Load Forecast. The distribution system is modeled using MilSoft Engineering Software and correlates individual consumer load on the system to determine projected feeder load allocation to the system. This information is then modified to reflect the actual peak demands recorded for substations.

2. Substation Transformer and Circuit Loads

Substation Condition WEC recently completed a survey of all its substations. The survey included verifying the make and age of equipment, equipment settings, and inspection of the pole structures. Table 6 provides a summary for the age of the substation, transformers, regulators and reclosers.

Table 6						
Age of Substation Equipment Summary						
Substation	Year Constructed	Year of Transformer Installation	Year of Regulator Installation	Year of Recloser Installation	Year of Construction	Condition of Poles
East Montpelier	2011	2011	2011	2011	2011	Steel
Jackson Corners	1968	1991	2000	2010	1968	Good
		1991	2000	2010		
			2000	2010		
Maple Corners	2006	2006	2006	2006	2006	n/a (steel)
Moretown	2001	2000	2000	2000	2001	n/a (steel)
				2010		
Mt. Knox	1971	1975	2000	2006	1970	Fair/Good
		1975	2000	2006		
		2000	2000			
North Tunbridge	1975	1997	2008	2010	1975	Good
		2003	2008	2010		
		2003	2008	2010		
South Walden	2003	2003	2003	2003	2003	Steel
				2010		
West Danville	1986	2002	2002	2002	1986	Good

Substation Transformer Capacity: The capacity of each substation was reviewed as part of the study. There are no substations that are currently experiencing transformer capacity constraints.

The projected load for each of the substations based on the LRP load forecast is shown in Table 7. The only substation projected to be nearing its transformer capacity is Jackson Corners.

Table 7			
Peak Load Data			
Substation	Substation kVA	2016 Peak Demand	Percent Capacity
East Montpelier*	5000	2512	50%
Jones Brook	n/a	170	n/a
Mt Knox	3750	2523	67%
West Danville	1500	477	32%
South Walden	2500	1500	60%
Jackson Corners	3750	3243	86%
Moretown	3750	2420	65%
Maple Corners*	2500	1100	44%
North Tunbridge	3750	1500	40%
Total System	26500	15445	58%
* The loads are on one metering point			

Voltage Levels and Thermal Overloads: The existing WEC system was modeled in MilSoft Engineering Software at the 2016 load levels to determine if there were any existing deficiencies on the system. The load analysis identified two areas with significant voltage problems which were addressed above. There were not any areas where equipment was near its thermal overload capacity.

Substation Location with Respect to Flood Plains: In 2013, WEC contracted with Dubois and King to complete a study of the location of substations with respect to 100 year flooding. Only WEC's Maple Corner substation falls within the 100 year or 500 year flood plain and when the substation was designed/constructed the equipment was placed on elevated platforms to mitigate flood impact. In addition, the entire load served by the Maple Corners substation can be served by alternate substations that are not located within the 500 year flood plain.

3. Load Current Measurements

The CWP preparation utilized substation billing data. No additional load current measurements were made.

4. Voltage Measurements

With the completion of the AMI metering installation, WEC has the ability to review voltages at every member location. It is anticipated that this information will be incorporated into the planning and operation of the Co-op system as time allows.

5. System Outages and Reliability

The outage statistics over the past three years are summarized in Table 8 below.

Table 8
SAIFI and CAIDI Indices

Category	2012	2013	2014	2015	2016	5 Year Avg.
CAIDI	2.3	2.1	2.1	2.2	2.1	2.16
SAIFI	3.7	3.9	3.2	2.5	3.5	3.36

Pursuant to Public Service Commission Rule 4.900, WEC submits an Annual System Reliability Report to the Commission. The 2016 Report is included in Appendix B. Highlights of the action items presented in the 2016 Report include:

3. **Pole Treatment.** In 2013, United Pole Technologies completed their comprehensive pole inspection and treatment program involving approximately 25,300 poles. To date, approximately 100% of WEC's pole plant has been inspected and treated to help prevent decay. The results of these inspections have been used to assess the current condition of WEC's pole plant, and the treatment of the poles will maximize their life cycle value. The inspection data has been crucial in determining and prioritizing the work projects outlined in the most recent Construction Work Plan.

- **Use of Fault Indicators.** In February 2011 WEC installed approximately 285 strobe type adaptable trip fault indicators on remote sections of three-phase and single-phase feeders, some of which will be replacing older units that were installed in previous years. (Fault indicators are strategically placed to minimize unnecessary patrolling of the line to locate a given fault.) WEC has received ARRA funding to assist in the cost of purchasing and installing approximately 200 of the fault indicators. This has been completed.

- **Vegetation Management Plan.** In 2006, WEC's Board of Directors approved a new and comprehensive Vegetation Management Plan that correlates the management of WEC's ROWs to system reliability and specifically to the worst performing areas. Increased funding has since been made available to provide an enhanced level of right-of-way maintenance. The 2015 transmission and distribution ROW budget amount is $918,000 which is adequate to fund a distribution system trim cycle of just less than 8.5 years and a transmission trim cycle of approximately 7 years. The additional funding provided over the last 2 budget years was mostly allocated to WEC's long, single phase lines located in the worst performing areas of the system. The additional trimming did provide improved reliability to those lines. WEC continues to maintain ROW associated with line reconstruction independently of the budgeted ROW efforts. In 2016, WEC was able to remove over 1200 danger trees and in 2017 will again locate, identify and remove a large number of danger trees that pose a threat to the distribution system. WEC has significantly reduced the amount of "maintenance cutting" of its right-of ways during the winter months in an effort to control sapling regrowth rates. The majority of the maintenance cutting is performed during the summer months while danger trees are removed during the winter months.WEC continues to pursue and investigate the potential expanded use of alternate methods of ROW clearing including excavator mounted Right-of-Way clearing. WEC's Board of Directors continues to work closely with staff to allow for an effective and affordable ROW maintenance program while remaining cognizant of potential rate impact. Adequate and appropriate funding of the ROW program and ultimately the reliability of WEC's electrical system remains a primary objective.

- **Animal Guards.** WEC utilizes wildlife guards in accordance with RUS construction standards and requirements. Wildlife guards are installed on open leads and equipment where wildlife can reach an energized contact point via a grounded contact point such as the lead from the transformer hi-side bushing to the lightning arrester. RUS standards are being evaluated to further reduce wildlife contact by minimizing perch points.

- **Power Supplier.** WEC continues to work with Green Mountain Power, Morrisville Light and Power and Hardwick Electric to secure improvements to the reliability of the 3319, 34.5 kV transmission line which supplies WEC's South Walden substation as well as substations in Hardwick and Morrisville.

6. Demand and Energy Losses

The percentage of energy losses on the WEC system has trended down over the past 10 years. Energy losses are calculated by totaling the amount of energy WEC purchased along with the amount generated by WEC during the year and then subtracting the amount of energy sold to consumers plus the energy used in WEC owned facilities. The difference is assumed to be losses and that amount is divided by the total energy purchased and generated. This provides the energy loss percentage for the year. One of the inherent problems of calculating the losses is that the meter readings recording the consumers' usage do not coincide with the actual dates of purchases and generation. While there is no existing method for measuring the exact losses on WEC's system, this calculation does provide a good annual estimate. Using a consistent formula for calculating energy losses provides a trend line showing the progress of loss reductions.

Historically, in the early 1990's, WEC's system losses were averaging approximately 10.3% per year and continue to improve.

Table 9
System Losses
Average 2007-2012

	Avg. 2005-2010	2011	2012	2013	2014	2015	2016
% Losses	8.2	8.28	7.98	8.35	7.21	7.44	8.09

Substation Transformers

Sixteen of WEC's 22 substation transformers have been replaced since 2000. As part of that process, WEC has worked closely with the Department of Public Service (DPS) to purchase energy efficient transformers for these sites. Each transformer was modeled in the DPS Transformer Loss Evaluation Program to assure that the transformer being considered met the least cost societal test.

Distribution Transformers

Conventional distribution transformers are utilized to step-down primary feeder voltages to customer utilization voltages. Distribution transformers exhibit losses which are proportional to the square of the load being served (load losses) and constant losses in the core steel of the units (no-load or core losses).

In the last decade, manufacturers have developed transformers utilizing low loss amorphous metal and high efficiency silicon steel core transformers that can reduce no-load (core) losses by up to 80% over standard silicon steel core designs of a generation earlier. High efficiency transformers have a higher initial purchase cost than conventional units.

WEC utilizes a competitive bidding process to secure its annual and spot distribution transformer requirements. WEC's purchase process evaluates the life cycle owning cost of a distribution transformer as the initial purchase price plus a cost per watt for core losses and a cost per watt for winding losses. The cost per watt for core losses and coil losses is based on WEC's long term avoided cost for capacity and energy and the anticipated loading cycle over the transformer's life. Transformer manufacturers are provided with these loss penalty factors by WEC which allows them to optimize their transformer designs to achieve a lowest evaluated cost for WEC. This process assures WEC will achieve the most efficient and long term cost transformer. Distribution transformer manufacturers' pricing and policies and WEC 's distribution transformer loss penalty factors are high enough to assure that high efficiency distribution transformers are purchased.

WEC has also worked with the DPS to evaluate the life cycle cost of distribution transformers. WEC had been purchasing amorphous core high efficiency transformers with no load losses considerably lower than the no load losses in standard steel core transformers since 1991. In 2002, the cost of amorphous core transformers increased substantially making the purchase of them not cost effective based on the DPS modeling criteria. Since 2002, WEC has been purchasing silicon steel core transformers which have no load losses lower than the standard steel core transformer. The no load losses in a silicon steel unit range from 10 watts in a 5 kVA unit to 54 watts in 25 kVA unit. In addition to the purchase of new units, WEC also tests the core losses of any transformer removed from the system and it is not reinstalled at another location on the system unless it meets the RUS transformer loss guidelines. Those guidelines establish a level of 33 watts for a 5 kVA unit up to 105 watts for a 25 kVA unit.

The other method of reducing distribution transformer losses is the proper sizing of transformers for the load and minimizing, to the extent possible, the number of transformers installed by utilizing secondary networks to serve multiple residential loads from a single transformer. The Electrical Distribution Study completed in 2002 for WEC addressed the issues of transformer loading and installation of secondary networks. The report included a methodology for properly sizing a transformer for a single customer, as well as a matrix for sizing a transformer for multiple customers with a variety of usage levels. The study also provided charts to be utilized in selecting and installing secondary cable. The charts provide a guide for the size and distance a cable can be installed at various load levels.

With the completion of the AMI program, WEC is collecting more detailed customer load information. When the customer and transformer data bases have been linked the loading profile of each transformer may be reviewed on a periodic basis to assure that overloaded and under loaded transformers are identified. In the interim, WEC continues to review transformer loading when a pole is replaced, installing the correct size transformer for the existing or proposed load. However, with the advent of residential net-metering solar projects, WEC has been increasing the size of transformers to accommodate the generation capacity of many installations. These installations are requiring transformers significantly in excess of the actual customer load.

WEC will continue to utilize both programs to reduce transformer losses on the system.

<u>Conservation Voltage Regulation</u>

Conservation Voltage Regulation (CVR) analysis is normally conducted in accordance with the guidelines provided in the Vermont Twenty Year Electric Plan, dated December 1994 and reiterated in the 2005 Plan[10]. The 1994 Twenty Year Electric Plan describes CVR as an "energy efficiency program applied to an electric utility's distribution system,

[10] Page A8

involving measures and operating strategies designed to provide electrical service at the lowest practicable voltage level, and in a cost-effective manner, while meeting all applicable voltage standards."

American National Standards Institute (ANSI) requires that under normal operating conditions, the voltage delivered to residential customers, as measured at customers' service entrances, be 120 volts plus or minus 5 percent (114 to 126 volts). This requires 118 volts to be maintained at all points along the distribution feeder, with a service typically experiencing a 4 volt drop from the distribution transformer and service run.

The objective of CVR is to create the flattest voltage profile possible while maintaining 114 volts at the customer's meter. This reduces energy losses on the line while allowing appliances to operate at a higher level of efficiency.

There are two phases of work in a CVR analysis. Phase 1 involves analyzing the existing electrical facilities to examine the voltage drop at various load levels to determine line drop compensation settings for tap changing transformers and voltage regulators. Phase 2 work is evaluating the cost effectiveness of electrical system improvements that reduce the voltage drop along distribution feeders. Feeder improvements include re-conductoring, distribution capacitors, line voltage regulators, voltage conversion, low-loss distribution transformers, etc. All recommended improvements are being addressed in WEC's current or proposed work plan as outlined in the 2019-2022 CWP.

The 2002 Electrical Distribution Study (EDS) completed a system wide CVR analysis and made voltage regulation setting recommendations to enhance system performance and reduce line losses. WEC implemented the recommendations of the 2002 Electrical Distribution Study on all of its substation and distribution regulators and continues to review the regulator settings on a periodic basis. In addition, the use of CVR enhances the ability of a feeder to serve solar projects by reducing the voltage during the day when the solar is on.

Feeder Configuration and Load Balancing

Optimum electrical distribution system performance is achieved when the load is evenly balanced between phases. Balanced loading minimizes losses and maximizes voltage performance for a circuit. It is desired to have no more than a 15% deviation between the load on any single phase and the average current on the three phase conductors. This allows for better ground relay settings and reduced current flow (losses) on the neutral. Achieving a balanced condition at some locations would require the installation of an additional conductor at a significant capital investment, which may not be cost effective.

The 2002 EDS for WEC evaluated the overall balance of the circuits. Utilizing MilSoft Engineering Software, the system was reviewed for load balancing opportunities and recommendations were made that enhanced system performance and reduced losses. This CWP updated the model based on the projected loads and makes additional recommendations.

Electric distribution companies install switches between distribution circuits that allow for load transfer between circuits for back up during emergencies and for planned maintenance of equipment. The system is normally operated with these switches in the open position.

The location of the tie points or normally open points should be examined periodically to determine if they are located in the optimal locations. Load additions or seasonal load changes may require changes in the open switch locations in order to maintain the optimal open point. Future CWP's should examine the need for additional line upgrades to provide for adequate backup redundancy of substation feeders. Substation feeder tie points should be checked for proper sizing.

Capacitor Placement and Power Factor

The installation of capacitor banks on the system is used for power factor correction. The correction of the power factor reduces line losses by providing the reactive component of the load locally, instead of from the generation source, thereby reducing the total current flow on the system. If the installation of the capacitor bank results in excessive leading power factor, there will be an increase in the line losses for the feeder.

The installation of a shunt capacitor bank on the distribution circuit can produce a proportional uniform voltage increase out to the point of application. The capacitor bank helps reduce the peak load voltage drop, particularly in areas where the power factor is lagging. The correct installation of the capacitors can provide for an increase in the efficiency of the distribution feeder by reducing energy losses.

Capacitors can be installed as either constant (fixed) or controlled (switched) banks. Fixed banks are more economical (about 1/3 the initial cost) to install than switched banks. The application of switched capacitors is generally for feeders that have a large ratio between the peak and off-peak KVAR loads in a twenty-four hour period. Fixed capacitor banks require minimal maintenance.

The 2002 EDS recommended the addition of 1900 KVAR of fixed bank capacitors at various locations throughout the system. WEC has completed the installation of these capacitors. The 2019-2022 Work Plan budgets for the addition of 2 capacitors, with the locations not specified.

Strategic Placement of Distributed Generation Facilities

The installation of generation facilities to reduce system line losses was evaluated in the 1995 Long Range Plan update and deemed not to be cost effective at that time. WEC is a signed party to Vermont Public Service Board (PSB) Docket 6290, which is designed to identify constrained distribution areas in Vermont and establish a separate collaborative process known as an Area Specific Collaborative (ASC) to develop the most cost effective solution to the problem. WEC currently has no identified constrained areas and is not participating in any ASC initiative. One of the considerations within the ASC is the use of distributed generation to minimize construction costs and losses on the system.

Since the focus of the CWP is the replacement of deteriorated plant, the installation of large or small scale solar projects will not eliminate nor defer any projects.

A 2100 kW privately owned/funded solar project was constructed in Williamstown. This project required a line upgrade in order to serve it but does not provide any significant system benefits that will defer capacity additions or upgrades.

7. Pole Replacement and Pole Inspection/Treatment

In 2013, United Pole Technologies completed their comprehensive pole inspection.

Table 10 approximates the average age of WEC's poles, and estimates the average age at the end of the 10 year planning period:

Table 10							
WEC Pole Aging Analysis							
					2021		
2017	Poles	Present Age	Weighted		Poles	Age	Weighted
1940's[1]	1225	70	85750		40	75	3000
1950's	1588	60	95280		1588	65	103220
1960's	3389	50	169450		1776	55	97680
1970's	4931	40	197240		4450	45	200250
1980's	2605	30	78150		4102	35	143570
1990's	2823	20	56460		3397	25	84925
2000's	4643	10	46430		4765	15	71475
2010's	3405	5	17025		4616	5	23080
Total	24609		30.3		24734		29.4

This table assumes that the poles in each decade are evenly distributed and thus average to the middle year of the decade. In addition, the table assumes that the proposed reconductoring will replace 885 poles and that 75 poles per year will be replaced for various other reasons.

As shown by the table, with the proposed reconductoring and miscellaneous pole replacement rate, the average age of WEC's poles will drop slightly to 29.4 years. In addition, given the priority of reconductoring, the oldest poles (1940's) on the system should be largely eliminated by the end of the Work Plan.

The planned distribution line rebuilds will replace 70 condemned poles, 578 poles with significant decay and 178 poles with moderate decay.

8. Small/Aging Conductor

WEC has approximately 1,100 miles of primary overhead line on its system. There are several types of conductors currently on the system:

- AAAC--This is an aluminum alloy conductor. WEC uses three sizes of this conductor, 4/0, 1/0 and #2. The conductors are either bare or covered, to reduce tree contacts. This conductor is strong and not prone to corrosion.

- ACSR--This consists of aluminum conductors surrounding a galvanized steel core. The aluminum provides conductivity while the steel provides strength. The galvanized steel will eventually corrode and the wire will become brittle. WEC has not experienced a significant failure rate with its installed ACSR. WEC has 4/0, 2/0, 1/0, #2, #4, and #6 ACSR.

- AWAC--This is similar to ACSR but the steel strands are extruded with an aluminum coating, thicker than galvanization. The steel strands are also not in the center of the conductor, in the type that WEC installed. This conductor is very high strength and was used to allow lines to be reconductored without pole replacements. There are two problems with this type of conductor. First, the nature of the intermixed steel and aluminum strands makes it hard to splice. Second, the use of soft aluminum conductors results in single strands burning off due to tree contacts. The burned strand will then often start to unravel and when the tail is long enough, it may contact the neutral wire causing an outage. These tails can be very hard to locate. WEC historically installed #4 AWAC.

- Hard drawn copper--This consists of single or multiple strands of copper in many sizes. WEC has only #4 installed. While it is old, this wire stands up well to aging and is not in dire need of replacement.

- Copperweld is a three-strand wire made from extruding steel and copper wire together. It is very high strength but relatively low in conductivity, due to the small amount of copper. WEC has this wire in a three-strand version that uses #12 wires. Structurally this wire is still in good shape but the lack of conductivity results in significant voltage drop.

- Copperweld-copper--This is a three-strand wire with one copperweld wire and two pure copper wires. WEC has it in a #6 size. In general, this wire is in good shape but similar to the 3/12 copperweld wire, it lacks sufficient capacity for the present load levels.

- Steel--WEC has .9 miles of galvanized steel wire. While originally very high strength, the galvanized coating has disappeared and the steel is corroding. In addition, the lack of conductivity makes the losses and voltage drop relatively high.

- Amerductor--This wire consists of a galvanized steel strand with two copper wires. WEC has this wire in #8 and #6 sizes. The galvanized coating of the steel has disappeared and the steel and copper are forming a galvanic cell, eating away the steel. This makes the wire very brittle and subject to failure in cold weather due to increased tension.

As noted in the above descriptions, some of the conductors have deteriorated to a point where they fail on a regular basis when making contact with a tree. While all conductors may fail when contacting a tree, small deteriorated conductors will fail more easily. In all cases, the fuse protecting the line will blow, deenergizing the line alleviating any concern for public safety. The overall quality of power delivered to the members is affected in two ways: there is an outage as a result of the wire breaking and there is often a momentary interruption as the circuit breaker tries to isolate the problem. So, while some members see a sustained outage, others see a momentary interruption. While the Co-op has removed a significant amount of these wires from the system over the last 3 work plans, there remains 145.3 miles on the system. Table 11 lists the miles of the remaining small conductors and prioritizes the conductors based on structural integrity and loss savings. It also shows the declining miles of wire as the lines are reconductored through the planning period. A total of 37.2 miles of small conductor is scheduled for removal during the CWP planning period.

As shown in Table 11, 6/8 SCG (Amerductor), has the highest priority, based on its condition, and will be essentially eliminated by the end of 2021. The 3/12 CWC (Copperweld) is the next priority and with the 85.2 remaining miles of it, will take up the remainder of the budgeted funds. At the end of 2021, there will be approximately 60 miles of 3/12 CWC left and a total of 108 miles of all small conductors.

In addition to the structural issues with the small wires, there are loss and voltage problems. The high resistance of these wires results in higher losses and greater voltage drops than for the 1/0 AAAC wire that will be used to replace these wires. For example, 80 kW of load on a ten mile section of 1/0 AAAC produces 1 kW of losses and a 0.4% volt drop. The same 80 kW on a ten mile section of 6A copperweld wire produces 3 kW of losses and a 4.1% volt drop. While the loss savings will not entirely pay for the replacement of the conductors, the offset losses will contribute to the overall efficiency of the system.

Table 11

Conductor	2004	2017	Work	2021	Resistance	Losses
Size/Type	Totals	Totals	Plan	Totals	ohms/1000 ft	Versus 1/0 AAAC**
#3/12 CWC	100.9	85.2	24.9	60.4	8.69	45
#8A CWC	13.3	9.8	9.8	0.0	3.82	20
#8 SCG	5.5	0.0	0.0	0.0	3.82	20
#8A SCG	1.1	0.0	0.0	0.0	3.82	20
#6A CWC	6.7	1.4	0.0	1.4	2.4	12
#6/8 CWC	33.9	27.0	0.0	27.0	2.4	12
#6/#8 SCG	5.5	0.1	0.0	0.1	2.4	12
#6 SCG	16.0	1.5	0.8	0.7	2.4	12
#6 Steel	5.6	0.6	0.0	0.6	17.7	91
#4 AWAC	10.1	17.0	0.4	16.6	2.7	14
#6 ACSR*		2.9	1.29	1.6	0.806	4
Totals	198.5	145.3	37.2	108.2		

*****#6 ACSR not formerly shown
****.**195 ohms/1000 ft for 1/0 AAAC

9. Vegetation Management

Historically, the WEC mission was to provide power to rural consumers and farmers, and much of the earlier construction took the shortest route possible, which meant off road construction. While the majority of the service territory is still rural, the nature of the service has changed. WEC's consumers have increased expectations of power reliability and quality. Cross-country lines are more difficult to access and costly to maintain.

The WEC Board of Directors approved a new Vegetation Management Plan in 2006 and budgeted $508,000 for right-of-way management in 2007. In 2018, the right-of-way (ROW) budget is $765,624. As shown in Table 12 below, the Board is currently budgeting to improve the trimming cycle for WEC's distribution system. Since 70 – 90% of all outages are tree related in any given year, improved service reliability can be most directly impacted by reducing the number of tree related incidents. WEC does not utilize herbicides as part of its ROW management program. Therefore, flat cutting of the ROW beneath the line is essential to vegetation management and ROW access. The removal of danger trees within and outside the established ROW is paramount in the prevention of tree related outages. Therefore, WEC patrols the transmission and three phase distribution lines in both the fall and spring, identifying potential danger trees that are subsequently removed. Danger trees located on single-phase distribution lines are removed as part of the ROW maintenance program (flat cutting).

Table 12
VEGETATION MANAGEMENT

	Total Miles		Miles Needing Trimming		Trimming Cycle	
Transmission	26		16		7 Years	
Distribution	1,262		882		10 Years	
	2011	2012	2013	2014	2015	2016
Amount Budgeted	$711,967	$726,207	$751,625	$863,444	$805,689	$918,451
Amount Spent	$718,076	$726,968	$748,975	$731,551	$825,843	$892,534
Miles Trimmed	92	95	88	77	78	89

The projected ROW clearing budget for the next three years is shown in Table 13 below. Note that Miles Maintained are equal to the miles trimmed times 1.28 to account for spans that are free of trees. In addition, these numbers do not account for clearing done to facilitate line reconstruction.

Table 12a Projected ROW Clearing				
Year	**ROW Budget**	**Miles Trimmed**	**Miles Maintained**	**Danger Trees Removed**
2018	$765,624	84	108	1280
2019	$839,627	101	130	241
2020	$856,420	107	137	209

WEC has been relocating cross country lines to roadways as part of its strategy to improve system reliability and reduce vegetation management costs. In addition, the on-going reconstruction of lines will reduce the effects of tree related outages by replacing brittle wire and deteriorated poles. The instances of broken poles and wires due to trees will be cut back to only those instances where very large trees fall on the line. This will not cut back the number of tree outages but will significantly improve the time needed to restore service. The 2018 budget for vegetation management is $765,624.

10. Environmentally Sensitive Areas

WEC has developed a policy to balance the operational needs of the company, including such things as containing maintenance costs, improving reliability and reducing restoration time, with the environmental and aesthetic impacts of line construction.

The policy establishes guidelines for evaluating aesthetics and environmental concerns in the engineering design phase for each line relocation or new line construction. It also promotes underground primary lines as an alternative to overhead construction in cases where the aesthetics or environmental impacts of the project would be significant.

In addition, WEC will be filing a Borrower's Environmental Report with the Rural Utilities Service. This report is required of RUS borrowers to comply with federal environmental standards and is roughly equivalent to an environmental impact statement required of federal projects.

11. Energy Efficiency Services

WEC has historically maintained a strong demand side management plan, investing more than $4 million during the 1990's and being recognized for its achievements by the Department of Public Service (DPS). Co-op members are eligible for efficiency services funded by their Energy Efficiency Charge (EEC) through the Statewide Efficiency Utility. Members are eligible for Co-op energy services as well. WEC provides retrofit efficiency services for all eligible members and acts as a subcontractor to Efficiency Vermont to deliver the Vermont Energy Star Homes program to WEC members.

12. Other Operational Issues

<u>National Joint Utility Notification System (NJUNS)</u>

WEC strives to minimize the environmental and aesthetic impact of its Transmission and Distribution system. WEC uses the National Joint Utility Notification System to track, notify other utilities and coordinate the transfer of utility attachments. The system allows each participating utility a real-time status of current requests, which helps minimize the existence of dual poles and facilities that are in need of transferring.

<u>Underground Facilities Damage Prevention</u>

WEC owns and maintains approximately 22 miles of primary underground distribution lines throughout its service territory. WEC recognizes the potential hazards of dig-ins occurring and has in place a Damage Prevention Plan designed to minimize that risk. WEC's Damage Prevention Plan piggy-backs the National 1-800 DIGSAFE system of notification. Notifications of excavation are emailed from DIGSAFE directly to members of WEC's Damage Prevention Team. The location of the proposed excavation is identified on WEC's system maps and checked against the location of WEC's underground lines. If WEC has facilities in the immediate area the lines are identified and marked in conjunction with DIGSAFE requirements and procedures. If WEC does not have any WEC owned underground facilities in the proposed excavation area then DIGSAFE and the proposed excavating contractor are notified accordingly. WEC marks only WEC owned facilities. If a request involves digging in a location where a WEC member owns and maintains their underground secondary service and WEC is aware of the presence of the underground line, WEC informs the requesting party of the presence of the member-owned service wire.

Storm and Emergency Response

Washington Electric Cooperative's (WEC) primary mission is to provide safe, reliable and economical electric service to the member/owners it serves in 41 towns in the counties of Washington, Orange, Caledonia and Orleans. Events occasionally occur that affect the power distribution system and require WEC personnel to coordinate a comprehensive collaborative effort to restore power in the most safe and effective manner possible.

As part of the RUS requirements for borrowers and in accordance with RUS Bulletin 1730-1 WEC maintains an up to date Emergency Restoration Plan that details appropriate steps and procedures to be followed power to the T&D System in the event of wide spread and catastrophic events. The Plan includes a list of current Mutual Aid resources, resource contacts, and key suppliers, local, state officials including Town Clerks, Road Foreman, Town Emergency Disaster Coordinator and Cooperative Mutual Aid resources nation-wide. The plan also establishes inventory stock levels for critical items and provides a recovery plan in the event WEC's main headquarters is neutralized. The plan established the Operational response that includes a detail of what each position within WEC will do in the event of a widespread outage event. The Plan defines the role off the line crews, the Field Assessment Technicians, the MSRs, administrative and logistical staff as well as the System Dispatchers and the Storm Coordinators. The Plan is all inclusive, reviewed and approved by RUS and updated annually.

In regards to notification of outages WEC, sends out Emails to members where such contact information is available for most non emergency planned outage of less than 4 days notice. Where advance notice can occur, WEC sends out Phone calls, Emails, and Post-cards to members effected by the outage.

During widespread outages WEC update Vtoutages.com every 2 hours or less depending on the restoration progress. WEC maintains its own Website and outage page which reflects real-time outages occurring on WEC's system. At this time it is cost prohibitive to have custom software created so that WEC's Outage Management System writes directly to Vtoutages.com. Member feedback indicates WEC members utilize the WEC OMS Web page for information pertaining to outage restoration updates. However, WEC will continue to update the Vtoutages.com site as requested during widespread outage events. WEC will continue to investigate options to have our OMS system communicate directly with the Vtoutages.com site.

I. Coventry Landfill Gas to Energy Project Pipe Upgrade

Washington Electric Cooperative Inc. owns and operates an 8 megawatt Landfill Gas to Energy Plant located at the Coventry Landfill in Coventry, Vermont. The plant was built and went on line in 2005 with 3 CAT 3520 engine-generator units. Over the years, as the landfill has expanded and more gas has come available, WEC added 2 additional generating units bringing the total to 5. The landfill is now producing enough gas to allow all 5 engine-generators to operate at maximum output. However, undersized gas header pipe located between the main knockout tank (moisture removal tank) and the gas header pipe within the plant is causing a restriction in the form of excessive vacuum drop. This vacuum drop is adding significantly to the plant's parasitic load and preventing the plant blower system from applying additional vacuum to the landfill site's well-field. Additional details and information follow.

The availability and volume of landfill gas at the NEWSVT landfill site has been steadily increasing over the past year as waste input increases and Casella expands the gas collection system. This trend is expected to continue as Casella looks to obtain approval for the addition of the Phase VI landfill. The Coventry LFGTE Plant gas recovery equipment utilizes 4 blower units that apply necessary vacuum to the landfill to extract the gas. The 4 units (75hp each) are nearing their maximum capacity and on recent occasions were unable to recover sufficient gas to avoid odor problems at the site without being supplemented by NEWSVT's flaring system blowers. **A critical reason the LFGTE Plant blowers are near capacity is the excessive vacuum needed at full flow to overcome losses(associated with small diameter pipe, 90 degree elbows etc) between the main header inlet to the gas conditioning system and the landfill.** Vacuum measurements indicate head losses of 25 to 30-inches of water column (w.c.) have occurred between the plant knockout (KO) filter tank and the well-field delivery point, with the engines fully loaded. Approximately 20% of this loss is through the KO filter tank, 50% of the loss is through the large moisture knockout (KO) tank and short run of pipe just outside the plant with the remainder occurring between the large moisture KO and the edge of the well field and the well-field collection system.

The existing KO filter vessel (just inside the plant) was originally designed for 3 engines and currently causing a 5 to 6 inch vacuum drop and is connected to a 14 inch header pipe (adds 12 to 15 inches of vacuum-drop) leading back to the large in-ground moisture removal tank which adds an additional 8 to 10 inches of vacuum drop to the system. The pipe is currently HDPE (High Density Poly-Ethylene) and is buried below ground. The proposed plan utilizes 24 inch

Stainless Steel pipe (currently comparable to HDPE in cost and less problematic for above ground installations). The proposed pipe upgrades and refit of the KO filter vessel will result in a 50% or better reduction in vacuum drop. Reducing these head losses would reduce parasitic electrical load, apply much needed vacuum at the far end of the landfill, improve methane quality and free up blower capacity for future increased LFG flows.

A quote for fabrication and supply of the proposed Phase 1 LFG collection and condensate management system improvements as shown on the SHA drawings using 304SS materials was prepared by Cross Machine, Inc. of Berlin, NH on June 26, 2018. The quote excluded installation, insulation, heat tracing and jacketing. The quote amount was just under $121,000. The estimated cost for installation of the stainless steel pipe and fittings is $42,000 for a total estimated installed cost of $163,000. However, the quote from Cross Machine excluded the 4 – 24" gate valves which have an estimated cost of $42,500 each or $130,000 for all four valves increasing the total project cost estimate to $293,000. A 20% contingency factor is recommended increasing the total estimated installed cost with contingency to $351,600.
As a comparison, a quote was also received by NEWSVT for the furnishing and installation of the proposed Phase 1 LFG and condensate management system improvements using HDPE materials for a total of $171,000 excluding the 4 – 24" gate valves. The 4 gate valves have an estimated installed cost of $130,000 totaling $301,000, including the gate valves.

V. RECOMMENDED PROJECTS

A. Summary

This section of the report summarizes the recommended projects that are included in this 2019-2022 CWP. The projects are separated by substation in this section. Projects are listed in categories that include system improvements, capacitor installations, equipment additions/replacements and system reliability. The overall budget for 2019-2022 is provided in Section VI. See the attached map (Appendix F) for project locations.

B. Projects Listed by Substation

East Montpelier #1

Project Description	Miles	Cost	Phases
301-37 Reconductor #3/12 CWC to 1/0 AAAC	0.93	$91,463	1
301-38 Reconductor #3/12 CWC to 1/0 AAAC	1.81	$177,386	1
301-39 Reconductor #3/12 CWC to 1/0 AAAC	0.78	$124,185	1
301-40 Reconductor #3/12 CWC to 1/0 AAAC	1.15	$112,748	1
301-41 Reconductor #3/12 CWC to 1/0 AAAC	0.58	$56,737	1
301-42 Reconductor #3/12 CWC to 1/0 AAAC	0.60	$58,744	1
301-43 Reconductor #3/12 CWC to 1/0 AAAC	1.20	$117,638	1

Overall, 7.05 miles of line will be rehabilitated at an estimated cost of $738,901.

Jones Brook Metering Point #2

Project Description	Miles	Cost	Phases
302-01 Reconductor #4 ACSR to 1/0 AAAC	0.87	$85,179	1

Mt. Knox #3

Project Description	Miles	Cost	Phases
303-42 Reconductor #6 ACSR to 1/0 AAAC	0.73	$72,092	1
303-43 Reconductor #6 SCG to 1/0 AAAC	0.19	$18,776	1
303-44 Reconductor #6 ACSR to 1/0 AAAC	0.38	$37,254	1
303-45 Reconductor #4 AWAC to 1/0 AAAC	0.43	$41,828	1
303-46 Reconductor #4 ACSR to 1/0 AAAC	0.43	$40,898	1

Overall, 2.16 miles of line will be rehabilitated at an estimated cost of $210,848.

Project 604 will install a regulator on Route 100, north of where the three phase line ends to improve the voltage on Crossett Hill Road. The estimated cost is $10,000.

Under Code 500 a new airbreak switch is planned for the substation. The estimated cost is $12,500.

West Danville #4

Project Description	Miles	Cost	Phases
304-18 Reconductor #3/12 CWLD to 1/0 AAAC	1.03	$100,665	1
334-19 Reconductor #4 ACSR to 1/0 AAAC	0.10	$9,574	1

Overall, 1.13 miles of line will be rehabilitated at an estimated cost of $110,239.

South Walden #5

Project Description	Miles	Cost	Phases
305-34 Add two 1/0 AAAC Phases	1.09	$60,459	3
305-35 Add two 1/0 AAAC Phases	0.96	$53,078	3
305-36 Add two 1/0 AAAC Phases	1.06	$58,548	3
305-37 Reconductor #8 CWC to 1/0 AAAC	1.67	$163,815	1
305-38 Reconductor #8 CWC to 1/0 AAAC	1.03	$101,223	1
305-39 Reconductor #8 CWC to 1/0 AAAC	0.26	$25,561	1
305-40 Reconductor #3/12 CWC to 1/0 AAAC	0.36	$35,786	1
305-41 Reconductor #6 SCG to 1/0 AAAC	0.10	$10,225	1
305-42 Reconductor #3/12 CWC to 1/0 AAAC	0.16	$15,616	1
305-43 Reconductor #3/12 CWC to 1/0 AAAC	0.19	$18,218	1
305-44 Reconductor #3/12 CWC to 1/0 AAAC	0.76	$74,732	1
305-45 Reconductor #3/12 CWC to 1/0 AAAC	0.71	$69,527	1
305-46 Reconductor #3/12 CWC to 1/0 AAAC	0.64	$62,462	1

Overall, 8.98 miles of line will be rehabilitated at an estimated cost of $749,250.

Jackson Corners #8

Project Description	Miles	Cost	Phases
308-53 Reconductor #8 CWC to 1/0 AAAC	1.90	$320,399	1
308-54 Reconductor #3/12 CWC to 1/0 AAAC	0.26	$ 25,375	1
308-55 Reconductor #4 ACSR to CWC to 1/0 AAAC	0.57	$56,160	1
308-56 Reconductor #8 CWC to 1/0 AAAC	0.85	$143,980	1
308-57 Reconductor #3/12 CWC to 1/0 AAAC	0.47	$46,010	1
308-58 Reconductor #3/12 CWC to 1/0 AAAC	0.57	$56,235	1
308-59 Reconductor #3/12 CWC to 1/0 AAAC	0.83	$81,796	1
308-60 Reconductor #8 CWC to 1/0 AAAC	1.15	$112,470	1
308-61 Reconductor #3/12 CWC to 1/0 AAAC	0.68	$66,459	1
308-62 Reconductor #3/12 CWC to 1/0 AAAC	0.31	$30,674	1
308-63 Reconductor #3/12 CWC to 1/0 AAAC	0.78	$76,684	1
308-64 Reconductor #3/12 CWC to 1/0 AAAC	0.42	$40,898	1
308-65 Reconductor #3/12 CWC to 1/0 AAAC	0.68	$66,459	1
308-66 Reconductor #3/12 CWC to 1/0 AAAC	1.01	$99,364	1
308-67 Reconductor #3/12 CWC to 1/0 AAAC	0.38	$37,273	1
308-68 Reconductor #4 ACSR/#8 CWC to 1/0 AAAC	0.85	$143,980	1
308-69 Reconductor #4 ACSR/#8 CWC to 1/0 AAAC	1.25	$210,297	1
308-70 Reconductor #4 ACSR/#8 CWC to 1/0 AAAC	0.64	$108,824	1

Overall, 13.6 miles of line will be rehabilitated at an estimated cost of $1,723,337.

Project 1001 is carried over from the 2014-17 Work Plan and will replace porcelain insulators on the Graniteville-Jackson Corners 34.5 kV line. The estimated cost is $110,000.

Moretown #9

Project Description	Miles	Cost	Phases
309-19 Reconductor #3/12 CWC to 1/0 AAAC	1.04	$102,245	1
309-20 Reconductor #3/12 CWC to 1/0 AAAC	0.52	$51,123	1
309-21 Reconductor #3/12 CWC to 1/0 AAAC	0.47	$46,010	1
309-22 Reconductor #4 ACSR to 1/0 AAAC	0.52	$51,123	1

Overall, 2.6 miles of line will be rehabilitated at an estimated cost of $250,501.

Project 604 will install a regulator on Fairground Road, north of where the three phase line ends, to improve the voltage on Crossett Hill Road. The estimated cost is $10,000.

Maple Corners #10

Project Description	Miles	Cost	Phases
310-36 Reconductor #3/12 CWC to 1/0 AAAC	0.97	$94,809	1

North Tunbridge #11

Project Description	Miles	Cost	Phases
311-43 Reconductor #4 ACSR with 1/0 AAAC	0.30	$29,632	1
311-44 Reconductor #3/12 CWC to 1/0 AAAC	0.87	$85,607	1
311-45 Reconductor #3/12 CWC to 1/0 AAAC	0.53	$51,866	1
311-46 Reconductor #6 ACSR with 1/0 AAAC	0.17	$16,824	1
311-47 Reconductor 1/0 URD	0.42	$67,290	1
311-48 Reconductor #3/12 CWC with 1/0 AAAC	0.57	$56,235	1
311-49 Reconductor #3/12 CWC with 1/0 AAAC	0.54	$53,353	1
311-50 Reconductor #3/12 CWC to 1/0 AAAC	1.17	$92,912	1
311-51 Reconductor #8 SCG with 1/0 AAAC	0.52	$41,353	1
311-52 Reconductor #3/12 CWC to 1/0 AAAC	0.82	$80,402	1
311-53 Reconductor #8 CWC with 1/0 AAAC	1.48	$145,188	1
311-54 Reconductor #8 CWC with 1/0 AAAC	1.57	$154,576	1
311-55 Reconductor #3/12 CWC with 1/0 AAAC	0.94	$92,541	1
311-56 Reconductor #4 ACSR with 1/0 AAAC	0.64	$62,741	1
311-57 Reconductor #4 ACSR with 1/0 AAAC	0.27	$26,937	1
311-58 Reconductor #3/12 CWC with 1/0 AAAC	0.83	$81,703	1
311-59 Reconductor #3/12 CWC with 1/0 AAAC	0.94	$92,021	1

Overall, 12.58 miles of line will be rehabilitated at an estimated cost of $1,231,181.

Other

610	Install fault indicators	$ 5,000
1002	Replace transmission switches	$31,000

Smart Grid Projects

601 AMI Meters system-wide as needed $120,000
601 AMI Repeaters PLC signal repeaters………………… $ 48,000

Generation Projects

1203 Coventry Landfill Gas to Energy Plant, up grade pipes $ 351,600

Cost Summary--Table 1

2019- 2022 Work Plan Budget

RUS Category	2014-2017 Work Plan Budget	2014-2017 Work Plan Actual Completed/WIP*	2019-2022 Proposed Budget 2019	2020	2021	2022	Total
100 Line ext (OH and URD)	$715,948	$1,166,922	$174,689	$178,183	$181,747	$185,382	$720,001
200 Tie Lines	$0	$0	$0		$0	$0	$0
300 Line Conversions (projects)	$4,021,061	$2,230,877	$1,260,248	$1,285,453	$1,311,162	$1,337,385	$5,194,249
400 New Substations	$0	$0	$0	$0	$0	$0	$0
500 Substation Equipment(Carry-over)	$12,500	$0	$12,500	$0	$0	$0	$12,500
600			$0	$0	$0	$0	$0
601 Transformers	$654,738	$565,774	$101,009	$103,029	$105,089	$107,191	$416,318
601 Meters	$101,448	$103,835	$29,115	$29,697	$30,291	$30,897	$120,000
601 AMI Equipment	$72,377	$0	$11,646	$11,879	$12,116	$12,359	$48,000
602 Misc. Ser Improvements	$20,081	$5,190	$5,338	$5,444	$5,553	$5,664	$22,000
603 Transformer Cutouts	$116,041	$56,378	$1,941	$1,980	$2,019	$2,060	$8,000
603 Line Reclosers	$0	$0	$3,700	$3,774	$3,850	$3,926	$15,250
604 Voltage Regulators	$39,745	$19,341	$5,102	$5,204	$5,309	$5,415	$21,030
605 Capacitors	$10,041	$1,469	$2,400	$2,448	$2,497	$2,547	$9,892
606-Misc Pole Replacement	$610,391	$1,612,538	$109,181	$111,365	$113,592	$115,864	$450,001
607-Misc Dist. Replacement	$1,213,252	$432,403	$194,099	$197,981	$201,941	$205,980	$800,002
608 Misc Conductor Replacement			$97,050	$98,991	$100,970	$102,990	$400,001
610 Fault Indicators	$11,505	$0	$1,213	$1,237	$1,262	$1,287	$5,000
700			$0	$0	$0	$0	$0
702 Security/Street Lighting	$20,081	$23,857	$3,639	$3,712	$3,786	$3,862	$15,000
1001 Insulators-JC line (Carry-over)	$110,000	$0	$110,000	$0	$0	$0	$110,000
1002 Transmission Switches	$31,000	$0	$0	$18,500	$12,500	$0	$31,000
1203 Conventry Pipe Upgrade	$0	$0	$351,600	$0	$0	$0	$351,600
1600 Not Budgeted For	$0	$628,625	$0	$0	$0	$0	$0
Permanent Disc		$0	$0	$0	$0	$0	$0
CIAOC Contribution In Aid of Const	$614,077	$293,791	-$146,781	-$151,184	-$155,720	-$160,392	-$620,000
	$8,374,286	$7,141,000	$2,327,690	$1,907,694	$1,937,966	$1,962,418	$8,129,843

*through October 2017

NEW LINE EXTENSIONS (CODE 100)

SERVICE EXTENSIONS FOR NEW MEMBERS	2014-2017	2019	2020	2021	2022	TOTAL
1. Number of New Members Connected						
a. Overhead--Code 102	253	63	63	63	63	253
b. Underground--Code 101	25	6	6	6	7	25
Total	278	69	69	69	70	278
2. Average Length per Build						
a. Overhead	188	188.3	188.3	188.3	188.3	9 miles
b. Underground	603	602.8	602.8	602.8	602.8	2.84 miles
3. Average Cost per Build						
a. Overhead	$3,723	$2,297.45	$2,297.45	$2,297.45	$2,297.45	$581,254
b. Underground	$8,995	$5,550	$5,550	$5,550	$5,550	$138,747.71
4. Cost of New Members						
a. Overhead	$942,078	$145,313	$145,313	$145,313	$145,313	$581,253.69
b. Underground	$224,878	$34,687	$34,687	$34,687	$34,687	$138,747.71
Total	$1,166,956	$174,689	$178,183	$181,747	$185,382	$720,001
5. Net Cost of New Members to WEC (after C.I.A.C.)						
a. Overhead	$139,351	$26,046	$26,046	$26,046	$26,046	$104,185
b. Underground	-$5,597	-$1,046	-$1,046	-$1,046	-$1,046	-$4,185
Total	$133,754	$25,000	$25,000	$25,000	$25,000	$100,000

MISCELLANEOUS DISTRIBUTION EQUIPMENT (CODE 601)

TRANSFORMER AND METER DATA	2014-2017	2019	2020	2021	2022	TOTAL
1. Number of New Transformers						
a. Overhead	555	102	102	102	102	408
b. Underground	29	6	5	5	5	21
Total	584	108	107	107	107	430
2. Average Installed Cost per Unit						
a. Overhead	$ 891	$ 865	$ 882	$ 900	$ 918	N/A
b. Underground	$ 2,454	$ 2,118	$ 2,429	$ 2,478	$ 2,528	N/A
3. Total Installed Cost						
a. Overhead	$ 494,602	$ 88,302	$ 90,068	$ 91,870	$ 93,707	$ 363,947
b. Underground	$ 71,172	$ 12,706	$ 12,961	$ 13,220	$ 13,484	$ 52,371
Total	$ 565,774	$ 101,009	$ 103,029	$ 105,089	$ 107,191	$ 416,318
4. Number of New Meters	438	110	110	109	109	438
5. Average Installed Cost	$ 237	$ 265	$ 270	$ 278	$ 283	N/A
6. Total Cost	$ 103,835	$ 29,115	$ 29,697	$ 30,291	$ 30,897	$ 120,000
7. AMI Equipment Cost	$ -	$ 11,646	$ 11,879	$ 12,116	$ 12,359	$ 48,000

MISCELLANEOUS DISTRIBUTION EQUIPMENT (CODE 602)

SYS IMPR0VEMENTS FOR EXIST MEMBERS	2014-2017	2019	2020	2021	2022	TOTAL
1. Number of Services Improved						
a. Overhead	15	16	16	16	16	64
b. Underground	0	0	0	0	0	0
Total	15	16	16	16	16	64
2. Average Installed						
a. Overhead	$606	$585	$596	$608	$620	
b. Underground	$0	$0	$0	$0	$0	
3. Cost of Service Improvements						
a. Overhead	$9,096	$9,354	$9,541	$9,732	$9,927	$38,554
b. Underground	$0	$0	$0	$0	$0	$0
Total Cost		$9,354	$9,541	$9,732	$9,927	$38,554
4. Net Cost of Service Improvements to WEC(after C.I.A)						
a. Overhead-CIAC	$3,906	$4,016.41	$4,096.74	$4,178.67	$4,262.25	$16,554
b. Underground CIAC	$0	$0	$0	$0	$0	$0
Total	$5,191	$5,338	$5,444	$5,553	$5,664	$22,000

MISCELLANEOUS DISTRIBUTION EQUIPMENT (CODES 603-608)

	2014-2018	2019	2020	2021	2022	TOTAL
603 SECTIONALIZING EQUIPMENT						
Number of Cutouts		8	8	8	8	32
Cutouts	$56,378	$1,941	$1,980	$2,019	$2,060	$8,000
Number of Reclosers		1	1	1	1	4
Reclosers	$0	$3,700	$3,774	$3,850	$3,926	$15,250
604 VOLTAGE REGULATORS						
Number of Regulators		0.5	0.5	0.5	0.5	2
	$19,341	$5,102	$5,204	$5,309	$5,415	$21,030
605 CAPACITORS						
Number of Capacitors		1	1	1	1	4
	$1,469	$2,400	$2,448	$2,497	$2,547	$9,892
606 MISCELLANEOUS POLE REPLACEMENTS						
Number of Poles		254	253	253	253	1013
	$1,612,538	$109,181	$111,365	$113,592	$115,864	$450,001
607 MISCELLANEOUS DISTRIBUTION REPLACEMENT						
	$432,403	$194,099	$197,981	$201,941	$205,980	$800,002
608 MISECLLANEOUS CONDUCTOR REPLACEMENT						
Conductor Miles		9.25	10	10	10	39.25
	0	$ 97,050	$ 98,991	$ 100,970	$ 102,990	$ 400,001
610 FAULT INDICATORS						
Number of Fault Indicators		2	2	2	2	8
	$0	$1,213	$1,237	$1,262	$1,287	$5,000

OTHER DISTRIBUTION EQUIPMENT (CODE 700)

	2014-2017	2019	2020	2021	2022	TOTAL
SECURITY LIGHTS--Code 702						
1. Number of Lights	33	4	4	4	4	20
2. Average Cost	$722.91	$910	$928	$947	$966	$750
3. Total Installed Cost	$23,856	$3,639	$3,712	$3,786	$3,862	15000
TOTAL 700'S						
	$23,856	$3,639	$3,712	$3,786	$3,862	$15,000

GENERATION

	2014-2017	2019	2020	2021	2022	TOTAL
Generation						
Code 1203-Coventry Pipe Upgrade	0	351,600	0	0	0	$351,600
TOTAL 1200's						$351,600

UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL UTILITIES SERVICE

REVIEW RATING SUMMARY

BORROWER DESIGNATION: VT 08

DATE PREPARED: June27, 2018

Ratings on form are:	0: Unsatisfactory -- No Records	2: Acceptable, but Should be Improved -- See Attached Recommendations
NA: Not Applicable	1: Corrective Action Needed	3: Satisfactory -- No Additional Action Required at this Time

PART I. TRANSMISSION and DISTRIBUTION FACILITIES

1. Substations (Transmission and Distribution)	(Rating)
a. Safety, Clearance, Code Compliance	3
b. Physical Conditions: Structure, Major Equipment, Appearance	3
c. Inspection Records - Each Substation	3
d. Oil Spill Prevention	3

2. Transmission Lines	(Rating)
a. Vegetation and Line Maintenance	3
b. Right-of-Way: Clearing, Erosion, Appearance, Intrusions	3
c. Physical Condition: Structure, Conductor, Guying	3
d. Line Patrol Program and Records:	3
e. Pole Inspection Program and Records	3

3. Distribution Lines - Overhead		(Rating)
a. Pole Inspection - Program and Records		3
b. Line Patrol Program and Records		3
c. Compliance with Safety Codes:	Clearances	3
	Foreign Structures	3
	Attachments	3
d. Observed Physical Condition:	Right-of-Way	2
	Other	3

4. Distribution - Underground Cable	(Rating)
a. Grounding and Corrosion Control	3
b. Surface Grading, Appearance	3
c. Riser Pole: Hazards, Guying, Condition	3

5. Distribution Line Equipment: Conditions and Records	(Rating)
a. Voltage Regulators	3
b. Sectionalizing Equipment	3
c. Distribution Transformers	3
d. Pad Mounted Equip: Safety - Locking, Dead Front, Barriers	3
e. Pad Mounted Equip: Appearance - Settlement, Condition	3
f. Kilowatt-hour and Demand Meter Reading and Testing	3

PART II. OPERATIONS and MAINTENANCE

6. Line Maintenance and Work Order Procedures		(Rating)
a. Work Planning & Scheduling		3
b. Work Backlogs:	Right-of-Way Maintenance	2
c. Work Backlogs:	Poles	3
d. Work Backlogs:	Retirement of Idle Services	3
e. Work Backlogs:	Other	N/A

7. Service Interruptions

a. Average Annual Minutes/Consumer by Cause (Complete for each of the previous 5 years)

PREVIOUS 5 YEARS	POWER SUPPLIER	MAJOR EVENT	PLANNED	ALL OTHER	TOTAL	(Rating)
(Year)	a.	b.	c.	d.	e.	
2017	7.30	6,274.90	51.00	5.60	6,338.80	2
2016	13.08	59.10	49.60	363.80	485.58	2
2015	1.10	0.70	29.80	285.70	317.30	2
2014	151.60	1,892.50	34.00	270.20	2,348.30	2
2013	38.48	367.00	31.20	401.50	838.18	2

	(Rating)
a. Service Interruptions - outage reporting	3
b. Emergency Restoration Plan	3

8. Power Quality	(Rating)
a. General Freedom from Complaints	3

9. Loading and Load Balance	(Rating)
a. Distribution Transformer Loading	3
b. Load Control Apparatus	N/A
c. Substation and Feeder Loading	3

10. Maps and Plant Records	(Rating)
a. Operating Maps: Accurate and Up-to-Date	3
b. Circuit Diagrams	3
c. Staking Sheets	3

11. Oil Storage & Handling	(Rating)
a. Spill prevention containment and control (SPCC) plan	3

12. Avian Protection and Response Plan	(Rating)
a. Avian Protection Plan	N/A

PART III. ENGINEERING

13. System Load Conditions and Losses		(Rating)
a. Annual System Losses	7.10%	3
b. Annual Load Factor	51.3%	3
c. Power Factor at Monthly Peak		3

14. Voltage Conditions	(Rating)
Substation Transformer Output Voltage Spread	3

15. Load Studies and Planning	(Rating)
a. Long Range Engineering Plan	3
b. Construction Work Plan	3
c. Sectionalizing Study	3
d. Load Data for Engineering Studies	3
e. Power Requirements Study	3
f. Energy Efficiency and Conservation Program QA	0

Rating Summary a/k/a Form 300: This form has been modified to include Bulletin and CFR updates through 10/2016.

PART IV. OPERATION AND MAINTENANCE BUDGETS

YEAR	For Previous 2 Years		For Present Year	For Future 3 Years		
	2015	2016	2017	2018	2019	2020
	Actual $ Thousands	Actual $ Thousands	Budget $ Thousands	Budget $ Thousands	Budget $ Thousands	Budget $ Thousands
Normal Operation	1,852	1,945	2,003	2,083	2,166	2,253
Normal Maintenance	1,998	2,356	2,173	2,260	2,350	2,444
Additional (Deferred) Maintenance				0	0	0
Total	3,850	4,301	4,176	4,343	4,517	4,697

16. Budgeting: Adequacy of Budgets for Needed Work 3 *(Rating)*

17. Date Discussed with Board of Directors 7/25/2018 *(Date)*

§1730.24 The borrower's management will discuss this review and evaluation with its Board of Directors

EXPLANATORY NOTES

ITEM NO.	COMMENTS
	Washington Electric Cooperative (WEC) complies with the conditions normally needed to justify a rating of 3 in the Bulletin 1730-1, Electric System, Operation and Maintenance, for all items that received a ration of a 3 on the RUS Form 300.
Part 1.1.b	Field Observations:
	1. Moretown Substation: No issues.
	2. Jackson Corners: No issues.
	3. North Tunbridge: Southeast corner has gap between crushed rock and fence greater than 3 inches. Southwest corner ground rod is above ground.
	4. Mount Knox: No issues.
	The following is a narrative for the items that have received a ration of 2:
Part 1.3.d and Part 2.6.b	WEC currently performs Distribution ROW clearing on a 9 year cycle. WEC has a 5 year service interruption average of over 2000 minutes/yr. WEC should consider increasing the frequency of the ROW clearing cycle. WEC experiences financial pressures due to the unusually high penetration of solar in their service territory and net metering. This presents challenges in budget priorities while trying to maintain rates.
Part II.7.a	WEC records "Major Events" based on the definition established by the Vermont PSB. If permitted by the Vermont PSB, WEC should consider following the recommendations in Bulletin 1730A-119, Part 3, Interruption Analysis.

	NAME	TITLE	DATE
RATED BY:	Dan Weston	Director of Engineering	06/27/18
REVIEWED BY:	Patricia Richards	General Manager	06/27/18
REVIEWED BY:	Sara K. Jordan	RUS GFR	06/27/18

WASHINGTON ELECTRIC COOPERATIVE, INC. (“WEC”)

2017 SYSTEM RELIABILITY REPORT

The rolling 3 year average of outages due to “all causes” (exclusive of major storms) is 758, up slightly from the previous rolling average of 755. In 2017, there were 655 separate outages on Washington Electric Cooperative’s system compared to 865 outages in 2016, 721 outages in 2015 and 681 in 2013. The three year rolling average has increased slightly due to the elevated number of outages that occurred in 2016. The total number of consumer hours out in 2017, exclusive of major storms, was 103,504. The average annual number of consumer hours out over the previous three years (2016, 2015 and 2014) is 71,018 and 72,908 over the three years before that (2011, 2012, and 2013) exclusive of major storms. In 2017 there was a substantial (43%) increase in the consumer outage hours out compared to the previous 3year- successive running averages. There are several specific reasons for the increase in total consumer hours out that occurred in 2017 and they are evaluated in the following discussion of service reliability.

In order to more effectively compare trends in WEC’s reliability performance and associated efforts to make improvements in those performance areas, this report generally excludes those outages associated with weather events determined to be “major storms” as defined in WEC’s Successor Service Quality and Reliability Performance Plan in Docket 6984. In 2017 WEC did experience multiple weather events that met the criteria for “major storm”. On May 5/6, May 18/19, July8/9/10, October 29 to November 8 and December 19/20 weather events comprised of severe winds and violent electrical storms or severe winds coupled with wet-snow and icing moved through WEC’s service territory causing widespread and severe damage to WEC’s distribution infrastructure. The 5 major storm events resulted in over 40 broken poles and hundreds of spans of wire on the ground. In every major event the primary cause of the outage was healthy trees, from outside of the Right-of-Way (ROW) corridor, falling onto or through the primary conductors. During the October 29 to November 8 event, GMP owned 34.5kv transmission lines serving 3 of WEC’s substations failed substantially adding to the impact of the severe weather events.

The SAIFI and CAIDI indices for 2017**, exclusive of major storms, were 2.6 and 3.6, respectively**. The SAIFI and CAIDI indices have **averaged** 3.2 and 2.2 over the previous three years and the 2017 data clearly reflects the impact of the severe weather experienced in 2017. While it has been common over the last 10 years to see noticeable variation in the outage frequency index (SAIFI) the outage duration index (CAIDI) has remained well below the target index of 2.7. In 2017 the duration index jumped to 3.6 and the increase is directly related to the severity of the damage caused by weather events that did not meet the criteria to be classified as a “Major Storm”. More specifically, WEC experienced multiple weather events in 2017 where large and healthy trees were blown over onto main-line feeders serving several hundred WEC members. The events often resulted in at least one or more broken poles. The extent of the damage and need to replace the poles in-order to restore power resulted in extended outage duration to a large number of WEC members. The SAIFI and CAIDI performance measures established in

WEC's Successor Service Quality and Reliability Plan are 3.8 and 2.7 respectively. **With the 2017 CAIDI index being the exception, WEC's three and five year averages of these reliability indices continue to improve and are significantly better than the established performance indices.**

Within the last ten years, WEC received funds associated with the American Recovery and Reinvestment Act (ARRA) to supplement the on going effort to implement a system wide coordination scheme of the distribution system. The System Coordination Plan involved, in-part, the replacement of the porcelain A.B.Chance line disconnect devices with a polymer based device. The Plan also required the installation of numerous new disconnects at predetermined locations on the lines. The failure of these line disconnect devices (cutouts) has historically been a leading cause of outages and represents a significant safety hazard for line workers. WEC's efforts to replace these devices have been instrumental in decreasing the number of outages caused by equipment failure over the last 10 years. In 2013, WEC completed the task of replacing/adding all **primary main - line** disconnects identified in the System Coordination Plan. In 2014 WEC gained RUS approval of a new four (4) year Construction Work Plan that continues the effort to strengthen the fault protection scheme of the T&D system. The 2014 – 2017 CWP, in part, targets the replacement of porcelain cut-outs that remain in service and are specific to distribution transformer installations. A significant amount of the remaining replacements occurred in 2014 and therefore did not substantially add to the number of planned outages in 2015 or 2016. However, in 2017, WEC continued an aggressive effort to replace polychlorinated biphenyl (PCB) contaminated transformers which had been installed prior to 1981. Since many of the targeted transformers are located on some of the shortest and oldest poles, an outage is often necessary to safely remove them. As a result the total number of "Company Initiated" outages on WEC's system in 2017 remained above the trending average at 140 but down slightly from 161 in 2016. In addition planned outages were necessary to install and transfer wires onto the 40 or so poles broken during storm events. Regardless, the impact of planned outages remains minimal as the 140 outages contributed only 9,235 consumer hours out.

Trees continue to be the leading cause of outages, accounting for at least 42% (closer to 57% as the "unknown category was likely temporary tree contact) of the total outages and approximately 70% of the total consumer hours out in 2017. In addition approximately 70% of the Company initiated outages took place in order to safely remove trees from distribution lines and transfer conductors from poles broken during storms to new poles. As mentioned earlier, there were multiple wind events that did not meet the criteria to qualify as a "Major Storm" but caused significant damage to the infrastructure on the distribution system. The majority of these outages were the result of large trees located well outside of the cleared Right-of-Way falling onto 3 phase main-line feeders. The "Company Initiated" category came in as the second greatest contributor to total outages and accounted for 21% of the outages but only 8.9% of the total consumer hours out. There was one Power Supplier related outage resulting in 2,537 consumer hours out in 2017 exclusive of those that occurred during the Major Storm events.

In 2017, members served by WEC's Mount Knox substation continued to experience significantly improved service reliability (compared to 2015 and 2016). The areas served by the Mount Knox substation are no longer the least reliable in WEC's service territory. **The Northfield Feeder served by the Jackson Corners substation** was the least reliable area on WEC's system in 2017, net of Major Storm. The Northfield Feeder serves 1,301 WEC members and is remotely located and crosses through some of the most rugged terrain in central Vermont. In 2017 nearly 100 diseased and decayed trees were removed along and adjacent the ROW corridor. Regardless of that effort, the line was subjected to continued outages caused by severe winds which toppled healthy trees onto the line breaking several poles during multiple weather events. On November 10, 2017, ROW crews commenced a comprehensive effort to flat cut and remove any danger trees (healthy or not) from the substation all the way (15 miles) to the end of the 3 phase line. It is expected to take the majority of 2018 for the ROW crew to fully complete tree removal and ROW clearing.

Action Plan

In 2018 WEC will put into place a new 2018-2021 Construction Work Plan (CWP). The CWP is aimed at the continued improvement and enhanced reliability of WEC's transmission and distribution system. The new CWP calls for two-thirds (2/3) of the dollars being spent on reconstruction to occur on circuits that consistently were among the five worst performing circuits. The CWP also outlines improvements including, but not limited to, the following: replacement of small and aged conductors, installation of capacitors to reduce line loss and the increased replacement of deteriorated poles. The CWP will specifically correlate the replacement of approximately 851 aged poles with site specific projects. WEC's reconstruction efforts are on track with the current 2011 - 2020 Long Range Plan (LRP) and the 2017 Integrated Resource Plan (IRP). System reliability will continue to improve as projects are completed.

Fused disconnects installed at strategic locations minimize the number of members affected by any given fault, thereby improving reliability. The line disconnects are composed of a time-proven polymer compound used extensively in the industry on other electrical equipment applications. A closer look at the causes of outages occurring on WEC's system shows a **very significant decline** in consumer hours out due to line disconnect failures. Analysis further shows that systematic replacement of main line disconnects in conjunction with the implementation of fuse coordination, continue to limit the number of members affected by any specific fault. In 2018 WEC will continue the effort to replace any remaining line disconnects associated with transformers in conjunction with a Transformer Right-Sizing program aimed at reducing transformer losses.

In 2013, United Pole Technologies completed their comprehensive pole inspection and treatment program involving approximately 25,300 poles located on WEC's Transmission and Distribution system. In 2014 WEC conducted an inspection of all primary underground installations to ensure they meet RUS and NESC requirements and present no inherent safety or reliability issues. Over the last 10 years, 100% of

WEC's pole plant has been inspected and treated to help prevent decay. The results of these inspections have been used to assess the current condition of WEC's pole plant, and the treatment of the poles will maximize their life cycle value. The inspection data was crucial in determining pole condition and the inspection results were fully integrated into the approved 2014 -2017 CWP. In 2016 WEC launched another 10 year cycle of pole inspection and treatment. In 2017 approximately 10% of the pole plant and ROW corridors were inspected and the effort will be repeated in 2018.

In 2006, WEC's Board of Directors approved a new and comprehensive Vegetation Management Plan that correlates the management of WEC's ROWs to system reliability and specifically to the worst performing areas. Increased funding has since been made available to provide an enhanced level of right-of-way maintenance. The 2015 transmission and distribution ROW budget amount is $918,000 which is adequate to fund a distribution system trim cycle of just less than 8.5 years and a transmission trim cycle of approximately 7 years. The additional funding provided over the last 2 budget years was mostly allocated to WEC's long, single phase lines located in the worst performing areas of the system. The additional trimming did provide improved reliability to those lines. WEC continues to maintain ROW associated with line reconstruction independently of the budgeted ROW efforts. In 2016, WEC was able to remove over 1200 danger trees and in 2017 another 774 were removed. In 2018 we will again locate, identify and remove a large number of danger trees that pose a threat to the distribution system. WEC has significantly reduced the amount of "maintenance cutting" of its right-of ways during the winter months in an effort to control sapling regrowth rates. The majority of the maintenance cutting is performed during the summer months while danger trees are removed during the winter months.WEC continues to pursue and investigate the potential expanded use of alternate methods of ROW clearing including excavator mounted Right-of-Way clearing. WEC's Board of Directors continues to work closely with staff to allow for an effective and affordable ROW maintenance program while remaining cognizant of potential rate impact. Adequate and appropriate funding of the ROW program and ultimately the reliability of WEC's electrical system remains a primary objective.

WEC continues the practice of conducting "foot patrol" inspections of its entire 34.5 and 48 kV transmission lines in the spring and fall of each year. An infrared hot spot scan of equipment and equipment connections within the substations is also done annually. In both cases, any issues are addressed asap and potential outages are avoided.

WEC continues to work with Green Mountain Power, Morrisville Light and Power and Hardwick Electric to secure improvements to the reliability of the 3319 and 3317, 34.5 kV transmission lines which supply WEC's South Walden, East Montpelier and Maple Corner substations. The effort will likely result in the installation of a motorized air break switch at the Morrisville 619 location and CT based breakers at their #5 substation which will allow fault detection and distance location as well as remote switching capability on the Morrisville end of the 3319 line. The effort will improve reliability of the 3319 line and shorten the outage duration if a permanent fault does occur.

In 2017 WEC continued leveraging the significant benefits of the power line carrier (PLC) based AMI meter system. It allows WEC to quickly determine which members are without power and is integrated directly with the Outage Management System allowing for more efficient restoration efforts. The AMI system is a major contributor in the reduction in outage duration over the last several years especially during widespread outage events. In 2018 we will be optimizing the attributes of the AMI system in a continuing effort to further reduce the frequency and duration of outages. We will be using the AMI system to analyze line disturbances in an effort to prevent outages before they can occur. In general, WEC members experienced service reliability that was comparatively among the highest levels in the last 20 years despite an increasing level of weather intensity.

The 2017 Reliability Report is being submitted to the Board by mail and email. A CD containing the same information is also enclosed.

Respectfully submitted,

Dan Weston
Director of Operations & Engineering

WASHINGTON ELECTRIC COOPERATIVE, INC.

VEGETATION MANAGEMENT PLAN

July 2006

I. Purpose

The primary purpose of this document is to provide guidance on methods to be used to manage vegetation within Washington Electric Cooperative's (WEC) rights-of-way (ROW) in a safe, efficient and environmentally sound manner. In providing this guidance, it is understood that all line clearing, maintenance and other vegetation management work shall be performed in strict conformance with all applicable federal, state and local government laws and regulations, including OSHA Rule 29 CFR 1910.269, Electric Power Generation, Transmission and Distribution Regulations.

II. Background

WEC currently serves approximately 10,000 members in 41 rural Vermont towns in the counties of Washington, Orange, Caledonia and Orleans. Today, WEC's electric system consists of 1,237 miles of distribution line and 18 miles of local transmission line, plus an additional 7.4 miles of transmission line in Coventry. Of those line miles, approximately 800 miles of distribution line and 10.47 miles of local transmission line require tree trimming.

The terrain in WEC's service territory is described as hilly, often rugged and for the most part heavily forested with various deciduous and coniferous species. While distribution lines were constructed across fields in the early years of the Co-op in order to minimize time and the cost of construction, WEC has been routinely relocating those lines nearer to roadsides during major rehabilitation projects whenever possible (see Policy 80 attached). However, in many cases, it is likely that landowners will be reluctant to allow WEC to relocate their lines due to aesthetic and environmental impacts.

For the last several years, the WEC Board of Directors has authorized increased funding of the annual ROW budget in an effort to improve reliability. The amount of money budgeted and spent on tree trimming in each of the past four years is as follows:

<u>Distribution System and Danger Tree Removal</u>

Year	2003	2004	2005	2006
Budgeted	$351,000*	$418,000	$436,000	$467,620
Actual	$347,496	$410,993	$435,751	$467,539

* Original 2003 budget was $378,000, but funding had to be curtailed due to budget constraints.

<u>Transmission System</u>

Year	2003	2004	2005	2006
Budgeted	$13,000	$13,400	$13,500	$14,000
Actual	$11,522	$8,121	$10,267	$13,966

The number of miles of line that WEC has cleared and maintained, and the number of danger trees removed, in each of the last three years is as follows:

2003

Distribution Miles Cleared:	54.26	Distribution Miles Maintained:	83.48
Transmission Miles Cleared:	1.20	Transmission Miles Maintained:	2.03
Danger Trees Removed:	700		

2004

Distribution Miles Cleared:	59.94	Distribution Miles Maintained:	85.62
Transmission Miles Cleared:	.78	Transmission Miles Maintained:	1.30
Danger Trees Removed:	900		

2005

Distribution Miles Cleared:	55.12	Distribution Miles Maintained:	84.80
Transmission Miles Cleared:	.98	Transmission Miles Maintained:	1.51
Danger Trees Removed:	1,000		

III. Policy

WEC shall strive to maintain its transmission and distribution ROW corridors in accordance with Policy 80, attached hereto as Appendix A, as well as in the following manner:

a. In a safe, professional, efficient and environmentally sound manner, while being sensitive to the concerns of property owners and the general public.

b. In a manner that will provide reliable electrical service in conformance with the Electrical Safety Code;

c. In a manner that protects all electrical system infrastructure necessary to transmit power between substations;

d. In a manner that uses the services and knowledge of employees and contract ROW crews who are professionally trained and inherently concerned with proper ROW techniques in conjunction with safe work practices.

IV. ROW Management Practices

Inspections:

As part of WEC's annual pole inspection and treatment program, and in accordance with RUS operational planning requirements, a visual inspection of ten percent (10%) of WEC's electrical T&D system shall be conducted on an annual basis. In addition to noting the physical condition of the poles and wires, ROW vegetation growth conditions shall be noted.

Species:

It is the practice of WEC to control the following tree species the full width of the ROW:

Ash	Cherry	Locust	Pine
Basswood	Fir	Maple	Poplar
Beech	Hemlock	Oak	Spruce
Birch	Larch		

This practice of vegetation management control allows for safe passage by WEC employees and contractors within the ROW for maintenance purposes, and removes potential fire and safety hazards to humans and animals in the area.

In general, it is desirable to use or enhance existing natural vegetation that does not interfere with the distribution of electricity. Herbs, most shrubs and low maturing trees should be left in the ROW to suppress the invasion of tall-growing trees. Following is a partial list of some of the low shrubs and plants that are native to WEC's service territory:

Alpine Azalea	Juniper	Rhododendron
American Yew	Laurel	Serviceberry
Dogwood	Leatherwood	Steeplebush
Dwarf Willow	Meadowsweet	Virginia Creeper
Eastern Redbud	Partridge Berry	Wintergreen
Fern	Pussy Willow	Witch Hazel
Gooseberry	Raspberry/Blackberry	

Notification:

In general, the Cooperative membership and affected property owners will be notified prior to any ROW clearing or reclearing maintenance work, except during emergency restoration or if hazardous conditions exist. Such notification shall include one or more of the following:

First: by a general article in *Co-op Currents* listing all ROW maintenance projects scheduled for the year

Second: by a mailed postcard to the member, or to the property owner if different from the member and readily known, who will be affected by the ROW maintenance work

Third: by either an automated or personal telephone call to the member, or to the property owner if different from the member and readily known, informing them that ROW maintenance work is about to commence

General Practices

A. The Removal of Trees by Manual Means (Chainsaws)

This method of control is primarily used for softwood and hardwood trees which have the potential for interfering with line reliability. The principal method of dealing with this type of vegetation is to cut it at ground level (flat cutting) using chainsaws and brush saws. Whenever trees are removed, all stumps are to be cut as close to the ground as practical so as to discourage multi-stemmed sprout regrowth. Side trimming and danger tree removal work are to be performed in conjunction with flat cutting.

B. Trimming/Pruning

It may not always be necessary, economically feasible or aesthetically acceptable to flat cut all trees within the ROW. This may be in response to a property owner's request, when the tree is a compatible, non-interfering vegetation variety, or it may be that while the tree itself is in the required clearance zone, only its branches immediately threaten the electric line. In these cases, it may be appropriate to prune or trim the tree.

Limbs to be removed are those that are dead, decayed, insect damaged, or structurally weak, including limbs which could break at weak points and strike conductors when swinging down in an arc. Pruning guidelines are as follows:

1. <u>Tree Under Conductor – Under Trimming</u>

   Under-trimming is cutting back large portions of the upper crown of a tree. Under-trimming is required when a tree is located directly beneath a line. The main leader or leaders are cut back to a suitable lateral. (The lateral should be at least one-third the diameter of the limb being removed.) Most cuts should be made with a saw; the pole pruner is used only to trim some of the smaller lateral branches.

   For the sake of appearance and the health of the tree, it is best not to remove more than one-third of the crown when under-trimming.

2. Tree at Side of Conductor – Side Trimming

   Side trimming consists of cutting back or removing the side branches that are threatening the conductors. Side trimming is required where trees are growing adjacent to utility lines.

   Limbs shall be removed to the trunk or to a lateral that is growing parallel to or away from the conductors.

   Where possible, or as designated by WEC, the contractor shall eliminate all branches growing within 10 feet beneath and toward the conductors.

3. Tree Over Conductors – Overhead Trimming

Overheat trimming consists of removing limbs beneath the tree crown to allow wires to pass below. Most of the natural shape of the tree is retained in this type of trimming, and the tree can continue much of its normal growth. Overhanging limbs should be removed as dictated by the species of the tree, location, and the general condition of the tree. When trimming, remove all dead branches above the wires, since this dead wood could easily break off and cause an interruption.

The contractor shall remove all weakly attached overhanging limbs that are capable of hitting the conductor if the limb were to split at the point of attachment.

Where possible, all branches within ten (10) feet beneath conductors shall be removed as dictated by the species of the tree, location, and the general condition of the tree.

Overhead trimming must be performed in accordance with current VOSHA/OSHA trimming regulations.

4. Combination Trimming

It is often necessary to use judgment in combining several types of arborcultural trimming techniques in order to achieve a good looking job and provide adequate clearances.

5. Improper Trimming Techniques

a. Pollarding: This is done by stubbing off major limbs until the tree assumes the desired shape. The result is not only unsightly, but a multitude of fast-growing suckers will sprout from the stubs, resulting in a line clearance problem more serious than before. The stubs are quite likely to fall victim to decay and disease.

b. Rounding Over: Rounding over or shearing is done by making small cuts so that the tree top is sheared in a uniform line. This creates an unhealthy condition and results in rapid regrowth of suckers directly toward the electrical conductors.

c. Side Trim Stubbing: This is done by stubbing off portions of limbs along the side of the tree to obtain clearance. This method of trimming, like pollarding and rounding over, creates many fast growing suckers that become a serious line clearance problem. These trimming methods should be avoided.

d. Topping: Removing top and upright branches should be avoided. Where necessary, use natural or directional pruning methods.

C. Proper Trimming Techniques

Various trimming shapes were previously described. The following provides the details for WEC standard line clearance and can be used for overhead trimming, side trimming, under trimming, and combinations. Pollarding, rounding over and side trim stubbing shall be avoided.

All trimming shall be performed to direct the growth of a tree away from the conductors. Branches shall be cut back toward the center of a tree to a suitable lateral branch, parent limb or the tree trunk. This is commonly called drop crotch, lateral or natural trimming (see Figure 1). When cutting back to a lateral branch, the diameter of the lateral branch must be at least one-third of the diameter of the branch being removed in order to sustain growth. Almost all cuts are made with a saw and very little pruner work is required. If a proper lateral branch is not available, the branch shall be cut back to the parent limb or tree trunk.

Trimming shall be done in such a manner as to protect tree health and condition.

All saw and pruner cuts shall be made back to the branch collar at an angle equal to but opposite of the branch bark ridge on the parent limb or trunk in order to leave no stubs.

No damage by loosening or stripping of the bark or splitting of branches shall be caused during trimming.

All severed limbs and branches (hangers) shall be removed from trees after trimming.

C. Removal of Trees by Mechanical Means (Brontosaurus)

WEC shall utilize the Brontosaurus wherever possible to clear ROW. The Brontosaurus is an excavator on steel tracks that utilizes a hydraulically driven shearing mechanism that pulverizes the tree and root system. Having utilized this machine over the past several years, WEC's field observations indicate that it effectively reduces the rate of resprout in many species. The Brontosaurus effectively removes trees, shrubs and brush within a ROW, however, this method still requires contract ROW crews to revisit the ROW to do side trimming and danger tree removals which adds to the cost of this method of clearing. Use of the Brontosaurus is limited due to its inability to safely work in narrow ROWs, and near roadsides and members' homes.

D. Danger Tree Removal

A danger tree is any tree, due to its location, species and condition, which is tall enough to pose a threat to WEC's electric lines. Many of the trees at the edge of the ROW have crowns that are heavily grown in towards the line, and when they fall, are likely to make contact with the electrical conductors. Danger tree removal is most effective towards reducing outages associated with high wind storms, prolonged rain incidents and routine outages due to "rotten trees". This, in effect, targets short-term and long-term reliability while also reducing the duration of outages due to excessive damage. For every danger tree that is targeted and removed, a future outage is avoided. (See Figure 2 for minimum clearances for danger tree removal.)

Since 2002, WEC has been aggressively targeting and removing danger trees in an effort to improve reliability. In 2005, approximately 1,000 danger trees were removed at a cost of $____________.

E. "Hot Spot" Clearing

Selective clearing of ROW line sections outside the normal reclearing schedule helps to improve reliability to those members located at the end of a single-phase line. Identification of these problem line sections normally comes from the members who are affected by poor reliability. Devoting resources to "hot spot" line sections improves reliability and/or power quality to specific problem areas, improves line crew access and outage restoration time, and improves overall reliability of a particular line. Hot spot trimming is the least efficient method of ROW clearing, but is essential to good member relations.

F. ROW Clearing During Emergency Restoration and When Hazardous Conditions Exist

In the best interests of employee and public safety, any tree making contact with WEC's electric system conductors shall be immediately removed to mitigate the hazard. It is not reasonable to provide advance notification to property owners under these conditions.

In the event of a power outage caused by trees within or outside of WEC's ROW, the trees shall be cut to the extent that is necessary to safely restore power. Advance notification to property owners is not possible under these conditions.

Under both of the above circumstances, a WEC employee shall coordinate with WEC's ROW Management Coordinator to arrange for any necessary cleanup.

G. Clearing Within Muncipal Street or Highway ROW

In situations where the Cooperative does not hold a valid ROW easement along a public street or highway, whether for a new service or for relocation of an existing line, no tree within that street or highway shall be cut in the construction, relocation, maintenance or repair of electric power lines without the written consent of the adjoining property owner(s) or occupant, unless the transportation board or selectmen of the town in which the tree is situated, after due notice to the parties and upon provision for a hearing, shall decide that such cutting is necessary (Title 30 VSA, § 2506), or unless such decision is made by the appointed municipal tree warden for the town (Title 24 VSA, § 67).

H. Clearing Within Wetlands

Wetlands are considered to be sensitive areas for vegetation management practices. These may include swamps, marshes and bogs, and other areas identified in the National Wetlands survey, and will be identified by WEC's representative prior to ROW management activities. Handcutting will be used near wetland areas where necessary to control undesirable vegetation. If extensive wetlands are encountered, WEC may elect to carry out the work in winter because of improved access. Vegetation in wetland areas will be managed according to the Vermont Department of Environmental Conversation's policy on wetlands.

I. Clearing Within Stream Corridors

Stream buffers are areas adjacent to streams requiring special vegetation management, and these areas shall generally be maintained to a minimum width of 75 feet on each side of the stream. Where distribution lines cross streams, standing woody vegetation, shrubs and low mature height trees will be allowed to grow within the ROW if consistent with the terrain and existing land use. This cover will protect fish habitat, service wildlife travel lanes, and control soil erosion.

Where the electric line spans a ravine, streamside vegetation may be allowed to grow taller as specified by WEC's representative. Where an undesirable woody species becomes taller than 12 feet, it will be removed to ensure protection of line conductors. In general, provision of the Vermont Agency of Environmental Conservation policy on river and stream bank management shall be followed.

J. Clearing Where Electric Lines Cross Roads

Electric lines that cross roads will be treated similarly to streams. Low woody shrubs, such as Sweet Gale and other compatible plant species identified on page 4, which have a low height at maturity, will be permitted and encouraged at road crossings in order to provide screening of the electric lines.

K. Clearing Within Wildlife Travel Areas

Wildlife travel areas shall be maintained to promote the movement of white-tail deer and other wildlife across the corridor of extended cross-country distribution and transmission lines. In general, WEC's objectives will be to favor vegetation that can support snow and thereby keep the snow depth on the ground shallow enough for deer to move about and to conceal wildlife as it crosses through wildlife travel lanes. Treatment will be similar to high visibility ROW areas, and preference may be given where practical to preserving a conifer canopy. WEC shall use the Vermont Agency of Natural Resources policy on wildlife management as a guide to maintaining wildlife travel lanes.

L. Stump Height

ROW clearing will be limited during winter months. Deep snow during winter months often results in unsightly ROWs because of excessive stump height, which oftentimes need to be recut in the spring, which adds to the cost. Excessive stump height also encourages the regrowth of saplings. At other times of the year whenever trees are removed, all stumps will be cut as close to the ground as practical so as to discourage multi-stemmed regrowth of the original species.

M. Cherry Tree Disposal Precaution

Wilted leaves from cherry trees are poisonous to livestock. Therefore, in areas frequented by livestock, any cherry cuttings shall be disposed of immediately by removing any cuttings from the enclosed livestock grazing area.

V. Trees and Debris Removal

Disposal techniques for each ROW section will be determined by WEC's representative, taking into account federal, state and local regulations, the practicality of certain disposal methods, the potential for wood utilization, and the wishes of the property owner. Whenever roadside trimming is performed, all log length material shall be picked up by a log truck as soon as possible and disposed of in accordance with the property owner's request. All other brush and wood material shall be removed from the ditch and municipal ROW and appropriately chipped or stacked at the tree line. If the ROW maintenance area is located more than fifty (50) feet from a public road or highway, then the log or tree length wood shall be moved to the tree line. All brush shall be windrowed at the edge of the ROW in order to provide unobstructed access for maintenance purposes. All other wood material shall be cut in four foot lengths and stacked at the tree line (see Figure 3). There will be no brush left in stream beds, across fence lines, stone walls, paths or roadways.

VI. Prioritization of ROW Clearing

WEC's Vegetation Management Plan promotes the prioritization of ROW clearing as it statistically relates to reliability of service. In general, the focus of the ROW management program shall be as follows:

1. Transmission Lines

    - Annually patrol 18 miles of local transmission line as well as 7.4 miles of 46 kV transmission line in Coventry for purposes of identifying potential equipment problems and marking danger trees for removal.

    - Flatcut WEC's 10.47 miles of local transmission line as needed to ensure maximum reliability to WEC's substations.

    - Flatcut WEC's 7.4 miles of Coventry transmission line as needed based on annual patrol to ensure 100% availability.

2. 3 Phase Lines

Three-phase circuits are critical links from substations to all members. Damage to one conductor of a three-phase line require the entire three conductors to be de-energized when repairs are made. WEC's three-phase lines are prone to greater damage for any given tree contact due to construction type and phase-to-phase voltage levels. The reliability of three-phase circuits, like substations, have a direct impact on the reliability of all single-phase lines. Improving the reliability of WEC's three-phase circuits is essential to achieving state mandated SAIFI and CAIDI indices.

3. Two-Phase Lines

Two-phase lines shall be treated similarly to three-phase lines as they serve a greater number of members than do single-phase lines.

4. Single-Phase Lines

Maintain single-phase line ROWs based on member density.

5. Worst-Performing Circuits

At the beginning of each year, WEC shall analyze circuit performance for the previous calendar year and identify the five worst performing circuits based on annual reliability. The reliability of the worst-performing circuits shall be further analyzed to determine if there are conditions that can be changed to improve the reliability of the circuits, including danger tree removals, flat cutting, line relocation and reconstruction if needed. In all cases, the circuit analysis shall take into consideration year-to-year fluctuations and longer-term trends to identify root causes of the reliability problems.

VII. CLEARANCE ZONE REQUIREMENTS

In general, single phase primary and/or secondary conductors shall be cleared of trees within 15 feet of each side of the pole line center. Three phase primary conductors shall be cleared 25 feet each side of the pole line center. (See Figure 4 for clearance zone dimension measurements.)

VIII. ROW Contractor Training and Requirements

ROW contractors hired by WEC are required to become familiar with the procedures and requirements of this plan and to utilize safe and proper ROW clearing techniques that are in compliance with state and federal laws and regulations. Each ROW crew must have two (2) qualified line clearance tree trimmers. Minimum qualifications include the following:

- Annual CPR and first aid training
- Annual electrical hazard awareness training
- Ability to perform an aerial rescue from a minimum height of 35 feet in four minutes or less. Aerial rescue must be practiced at least once a year.

- Knowledge of electric line voltages and minimum approach distances
- Annual inspection and dielectric testing of bucket trucks to be used for tree trimming
- *Need to add all references to OSHA 1910.269 material*

This plan has been prepared and adopted in order to provide a broad assessment of WEC's ROW vegetation management goals and policy objectives, and the operational methods and practices that shall be used in attaining those goals and objectives. The procedures outlined herein are designed to provide general guidelines for the safe operation and maintenance of electrical distribution and transmission lines, while minimizing visual and other environmental impacts within the communities served by WEC.

USDA Rural Development

United States Department of Agriculture
Rural Development

RECEIVED

FEB 21 2017

WASHINGTON ELECTRIC CO-OP, INC.
EAST MONTPELIER, VT

FEB 14 2017

Ms. Patricia H. Richards
General Manager
Washington Electric Cooperative
P.O. Box 8
East Montpelier, Vermont 05651-0008

Dear Ms. Richards:

We have received your February 3, 2017 letter requesting a Section 7 CFR 1710.204 waiver/modification of 7 CFR 1710.204(a)(2), which requires submitting a new load forecast to Rural Utilities Service (RUS) for review and approval not less frequently than every 24 months.

We realize that a new 2016 Load Forecast will be a substantial burden on Washington Electric Cooperative (WEC), its members and will result in unnecessary costs since WEC is filing for a rate increase of 5.95%. We understand that WEC revisited the 2014 load forecast work and updated the 2014 forecast data with actual numbers for the past 3 years which results in a flat peak growth and flat energy growth into the future. We find the information provided as acceptable and we waive the requirement to submit a 2016 Load Forecast to RUS for approval. For the next load forecast, WEC can follow the filing requirement in 7 CFR 1710.204 (a) (1) or (a) (2).

Please feel free to contact my office with any questions you may have.

Sincerely,

CHRISTOPHER A. MCLEAN
Acting Administrator
Rural Utilities Service

Washington Electric Cooperative, Inc

P.O. Box 8, 40 Church Street
East Montpelier, Vermont 05651

Telephone: 802-224-2324; Fax 802-223-6780
www.washingtonelectric.coop

Sent by email

February 3, 2017

Sara R. Jordan
General Field Representative | Electric Program
Rural Development | Rural Utilities Service
United States Department of Agriculture
P.O. Box 667
Huntingtown, Maryland 20639

RE: Load Forecast Waiver/Modification

Dear Sara:

WEC is writing to request a modification for load forecast work relative to its upcoming Construction Work Plan and loan application. Specifically, WEC seeks to use its last comprehensive load forecast (2014) as an informational item, to understand factors that drive WEC's load, but update the results for actual outcomes of peak and energy. In this update we will use an expectation of the future that WEC will have flat peak growth and flat energy growth into the future. This outlook is based on actual energy and peak results from the past several years.

WEC understands the requirements and importance of load forecasting as noted and provided in Subpart E—Load Forecasts of Title 7. RUS policies for the preparation, review, approval and use of load forecasts and load forecast work plans is very detailed and specific.

Please note that WEC has consistently complied with RUS's load forecast requirements and we have a wealth of information pertaining to projections of load. As noted in the title, a load forecast is a thorough study of a borrower's electric loads and the factors that affect those loads in order to estimate, as accurately as practicable, the borrower's future requirements for energy and capacity. We understand an approved load forecast, if required by this subpart, is one of the primary documents that a borrower is required to submit to support a loan application.

There is also a section that notes (§1710.210) for good cause shown by the borrower, the Administrator may waive any of the requirements applicable to borrowers in this subpart if the Administrator determines that waiving the requirement will not significantly affect the accomplishment of RUS' objectives and if the requirement imposes a substantial burden on the borrower. The borrower's general manager must request the waiver in writing.

For its upcoming CWP, WEC seeks to use the underlying results of its 2014 load forecast but with updates to the results based on actual data from 2014 through 2016. By way of background, WEC hired LaCapra Associates in 2013 and they produced a load forecast designed to meet RUS requirements. WEC's last load forecast and 2014 -2017 CWP were approved by RUS. The CWP work we did was based on energy and peak results from the 2014 load forecast. Also sent by email is an attachment for reference purposes the 2014 WEC load forecast.

WEC revisited the 2014 load forecast work and updated the forecast data with actual numbers for the past 3 years. We found the 2014 forecast to be significantly higher than what is actually occurring for energy and peak on our system. WEC notes that its actual loads from 2014 to 2016 as compared to the single point forecast are considerably lower than the forecast used in 2014. WECs loads are lower by 2.6%, 3.9%, and 5.0% in the years 2014, 2015, and 2016, respectively.

In 2016, WEC's load requirement in the New England energy market plus internal owned generation (Wrightsville) was 76,736,361 kWh. WEC reached a peak of 15,633 kW on February 19, 2016 at hour ending 19:00 (7 pm) which continues WEC's long standing trend as a winter peaking utility. WEC's summer peak was 13,248 kW which occurred on August 11, 2016 at hour ending 21:00 (9 pm).

Over the past several years, WEC's load has remained relatively flat and it is summarized in Table 1-1. As displayed in Table 1-1, WEC's load decreased by 0.35% from 2015 to 2016. This year's decline is attributed to a mild winter with temperatures above seasonal norms and continued installation by members of distributed generation systems (predominantly solar systems participating in WEC's net metering program). In prior years, WEC's load has also been flat to slightly declining. From 2008 to 2016 WEC's compound annual growth rate was 0.043% while from 2013 to 2016 loads **dropped** by 1.3% over 4 years.

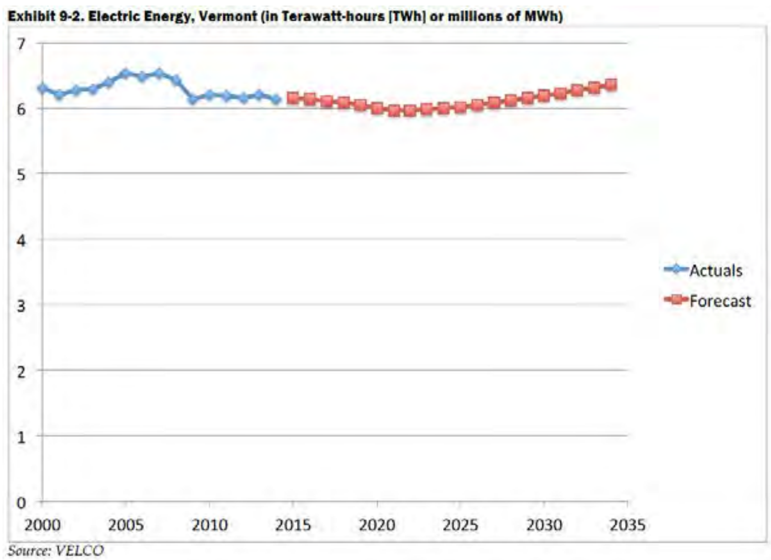
Table 1-1. WEC Actual vs Outlook Forecasts

	Year	Load Obligation (RTLO)	Percent Increase (Decrease)
Actual	**2008**	**76,473,855**	
Actual	**2009**	**76,862,354**	**0.51%**
Actual	**2010**	**77,693,187**	**1.08%**
Actual	**2011**	**77,293,942**	**-0.51%**
Actual	**2012**	**76,504,343**	**-1.02%**
Actual	**2013**	**77,729,681**	**1.60%**
Actual	**2014**	**77,176,986**	**-0.71%**
Actual	**2015**	**77,007,769**	**-0.22%**
Actual	**2016**	**76,736,361**	**-0.35%**
Projected	2017	76,222,268	-0.67%
Projected	2018	76,222,268	0.00%
Projected	2019	76,222,268	0.00%
Projected	2020	76,222,268	0.00%
Projected	2021	76,222,268	0.00%

Based on past data, WEC's load is expected to remain flat with load projected to be 76,222,268 from 2017 to 2021.

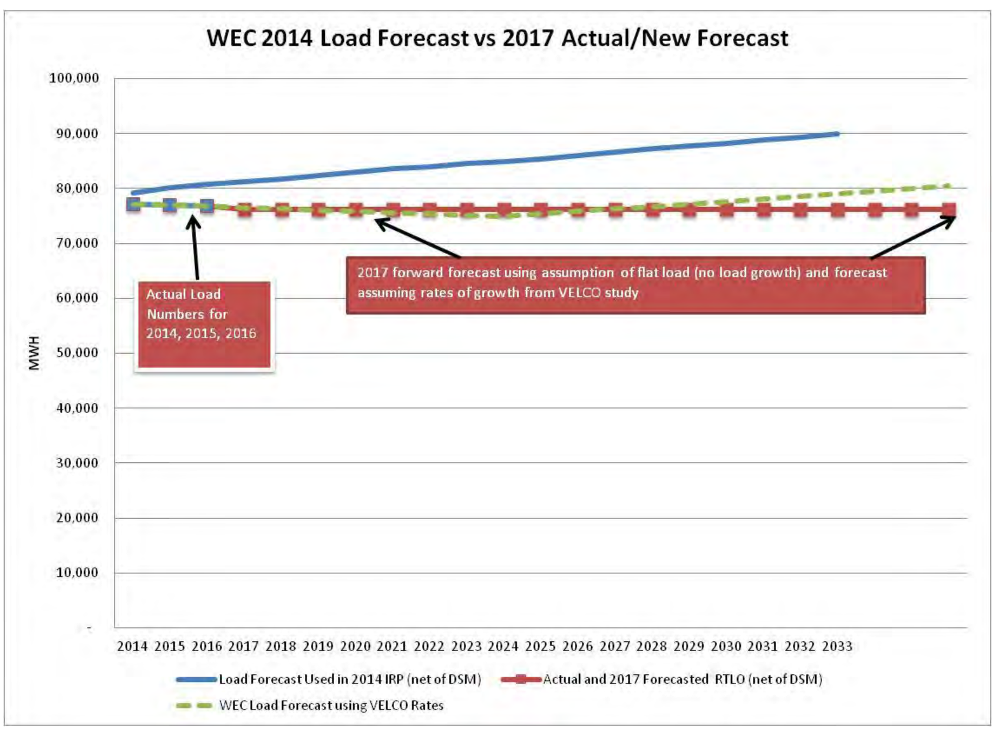
WEC also looked at other recent forecast efforts in the state to confirm our outlook of flat load. VELCO is Vermont's transmission owner and they conducted a comprehensive forecast for the state of Vermont in 2016. Their results call for an average annual electric use **decline** of 0.3% through 2024, followed by an average increase of 0.6% per year through 2034. The VELCO forecast is a thorough, business as usual snapshot of projected electric load growth.

Figure 1-1. VELCO Forecast



Combining WEC's outlook of flat load with VELCO's rates of decline and growths as a benchmark, we note these projections on the same chart as WEC's 2014 forecast for comparison purposes. The results are summarized graphically in Figure 1-2

Figure 1-2. Comparison Forecasts



As shown in Figure 1-2, WEC's flat load projection through the planning period is very similar if we use VELCO's rates of decline and growth that were modeled for the state in aggregate. As a proxy for a robust forecasting effort, WEC believes a flat growth line is appropriate to use in its upcoming CWP. Furthermore, the VELCO forecast work from the 2016 is a good benchmark to support this trend and outlook.

WEC is also using a flat load growth outlook in other major reports and planning documents. In WEC's 2017 Integrated Resource Plan filing with the Vermont Public Service Board, we are using a flat load forecast outlook as well. WEC simply seeks to apply this outlook to the CWP as we think it is accurate and indicative or our future load requirements. We believe it is highly accurate and predictive based on the current known trends of distributed generation, warmer winters, and lower average member use (see figure 1-3 for average member use trends).

We believe using a flat load and peak will not significantly affect accomplishment of RUS's objectives or WEC's CWP. Our last CWP was based on significantly higher loads and no stress points on the system were noted. By using lower loads, this forecast will not alter that outlook of our system as it is already built to accommodate much higher loads.

We also note the load forecast work is very expensive (estimated to be in the range of $35,000 to $40,000). WEC is filing for a rate increase of 5.95% and we are looking at all ways to control costs. Therefore, we believe a new load forecast similar to the 2014 effort is a substantial burden on WEC and its members and will result in unnecessary costs.

Average use among WEC residential members continues to decline. This trend is shown in the Figure 1-3.

Figure 1-3. Residential Average Monthly Use

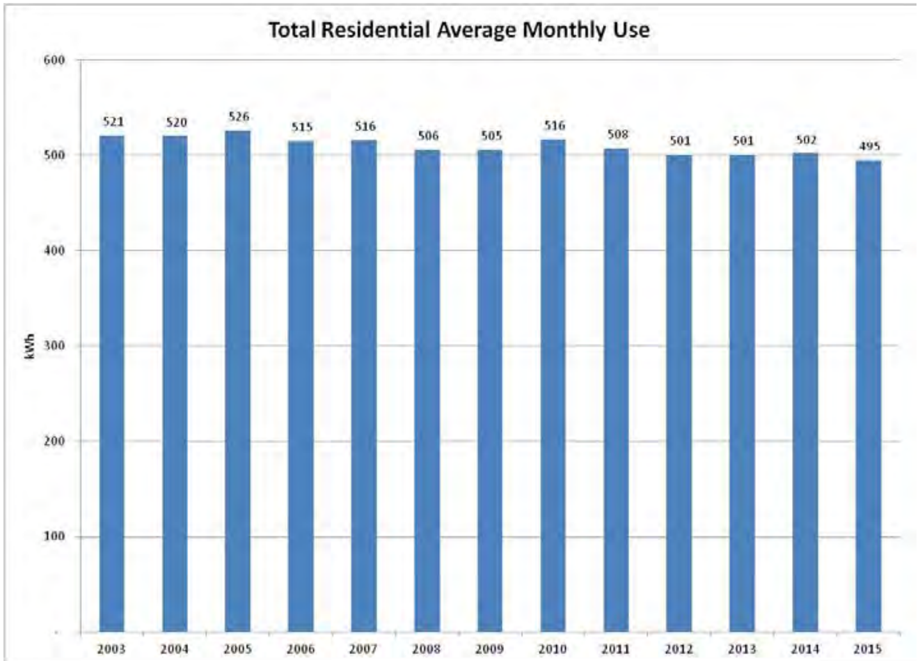
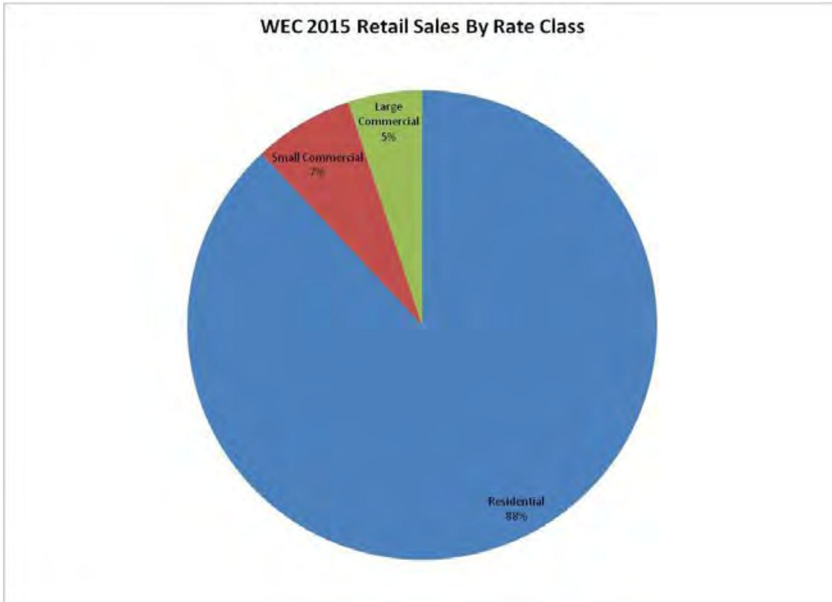


Table 1-2 - WEC Member Distribution by Class

Member Class	2015 Members	% of Total
Residential (incl. Seasonal)	10,325	**95%**
Small Commercial	559	**5%**
Large Power	11	**0.1%**
Total	**10,895**	**100%**

As measured on an energy basis, WEC's retail energy sales are overwhelmingly residential (& seasonal residential), about 88%. WEC also has small commercial and large power sales (schools, office buildings and manufacturing) making up the remainder, about 7% and 5% of the total, respectively. See Figure 1-4 for a graphic summary of WEC's retail sales by membership class.

Figure 1-4 WEC Retail Sales 2015



The importance of showing the member demographics is to note the key driver to changes in WEC's total load. WEC's total load is predominantly driven by its residential member class which does not fluctuate tremendously from year to year. We simply do not have the volatility in load from economic factors which typically drive change to commercial and industrial load. Due to our heavy weighting on residential members, we are focused on understanding changes in the residential sector. By using the underlying analysis in 2014 we understand WEC's electric loads and the factors that affect those loads in order to estimate, as accurately as practicable.

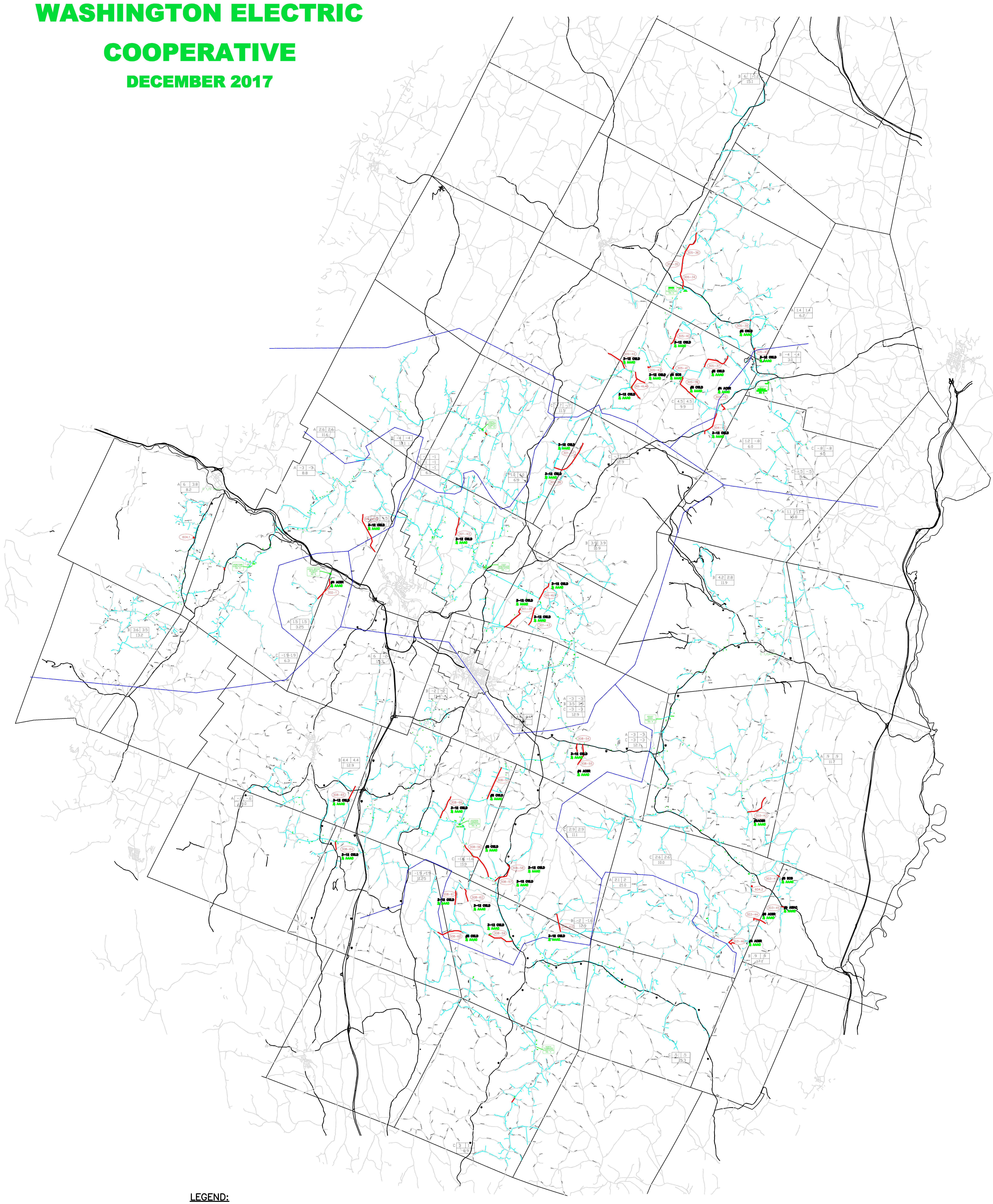
We hope you will consider this request. I am happy to talk in more detail with you about our load and to answer any questions.

Sincerely,

Patricia H. Richards
Washington Electric Cooperative, General Manger

WASHINGTON ELECTRIC COOPERATIVE

DECEMBER 2017



LEGEND:

	DISTRIBUTION SYSTEM
C #6/8 CWC ABC 4/0 AAAC	EXISTING CONDUCTOR, PHASE PROPOSED CONDUCTOR, PHASE
	EXISTING SUBSTATION
	PROPOSED WORK LOCATION
BEFORE AFTER A B C	REGULATED VOLTAGE DROP, 120 VOLT BASE
	MILES TO SUBSTATION

Crocket Engineering, LLC
PO Box 5205, Essex Junction, VT 05453

CONTRACT DWG NO.	PROJECT

WASHINGTON ELECTRIC COOPERATIVE

2018–2021 CONSTRUCTION WORK PLAN

DRAWN: DRC	DWG. No.
LOCATION:	
CHECKED: DRC	APPROVED:
SCALE: n/a	DATE: 12/5/2017 SHEET 1 of 1

Appendix K.

Washington Electric Cooperative, Inc

P.O. Box 8, 40 Church Street
East Montpelier, Vermont 05651

Telephone: 802-224-2324; Fax 802-223-6780
www.washingtonelectric.coop

sent by ePUC

November 1, 2019

Ms. Judy Whitney, Clerk
Vermont Public Utility Commission
112 State Street, 4th floor
Montpelier VT 05620-2358

RE: Case No. 19-0855-RULE Request for Additional Information and Discussion of Next Steps Order Dated 08/22/2019

Dear Ms. Whitney:

Please find comments from Washington Electric Cooperative, Inc. ("WEC"), regarding the Public Service Board's net metering order dated August 22, 2019

WEC is a longtime supporter of renewable power and it is committed to assuring its members use electricity as efficiently as possible. It is proud to offer its members one hundred percent (100%) renewable power today, which is well before the state plan of 90 percent renewable by 2050. WEC seeks to continue to promote renewable power and offer a net metering program to all of its members in manner that is fair among all its membership and meets the requirements of Act 99.

The PUC in its order requested information on the following questions.

1. Is the current net-metering compensation system causing a cost shift between customers who net-meter and those who do not? Please quantify this cost shift and provide all calculations supporting your response.

Yes, there is cost shifting between customers from those that net meter to those that do not. The costs are summarized into two areas; power supply related costs and administrative costs.

Power supply costs include payments to net metered systems for net excess generation, savings from avoided power supply related expenses, and the impact of loss of retail sales revenue from loss of load. WEC calculated the current year net metering cost has grown to a net loss of $711,563 which is a 5.08% rate impact. These dollars do NOT include added cost for billing, staff, and administering the program (these items are addressed in more detail in the next section). WEC calculated power supply related savings of $0.074 per kWh. Cost for net excess generation, siting and REC adjusters were also calculated based on the state's current net metering rates. To follow is a summary of the analysis. A copy of the supporting excel file is being provided in WEC's filing as WEC Exhibit 1.

Total NM kW Installed before 1/1/2017		1,580			
Estimated Gross kWh Generated (13% Capacity Factor)		1,799,110	One Meter for majority of systems - Must apply capacity factor to estimate gross production		
Avoided Retail Rates	$	0.21219	Total Revenue/Total kWh		
Amount Paid Net Excess Generation	$	0.25341	Tail block rate		
Gross Dollar Paid Net Excess Gen	$	67,906	<====from finance	14.89%	Percent paid Net Excess Generation
Gross Dollar Avoided Retail Sales	$	324,894		85.11%	Percent of KWh then used for avoided retail rate
Rate Power Supply Savings	$	0.0740			
Dollars from power Supply Savings	$	(133,220)			
Net Impact Loss to WEC Members	**$**	**259,580**	1		
Net Cost of Legacy NM ($/kWh)	$	0.14428			
Total NM kW installed after 1/1/2017 (thru 9/15/2019)		2,471			
Estimated Gross kWh Generated (13% Capacity Factor)		2,814,510			
Avoided Retail Rates	$	0.21219			
Amount Paid Net Excess Generation	$	0.1517			
Gross Dollar Paid for Net Excess Generation	**$**	**63,585**			
Rate for REC and Siting Adjusters	$	0.0350	Category 1 & 2 Systems (150 kW and less)		
Dollars Paid for REC and Siting Adjuster	**$**	**88,543**	WEC has one Category 3 system (250 kW) and it was removed to caluclate dollars paid for REC and siting adjuster		
Avoided Retail Rates	$	0.21219			
Dollar Loss from Avoided Retail sales	**$**	**508,262**			
Rate Power Supply Savings	$	0.0740			
Dollars from power Supply Savings	**$**	**(208,407)**			
Net Impact Loss to WEC Members	**$**	**451,983**	2		
Net Cost of 2017 Vintage NM ($/kWh)	$	0.1606			
Total Net Dollar Loss All NM Systems	**$**	**711,563**	=1+2		
Total kWh Generated NM Systems		4,613,620			
Net Cost of NM Systems ($/kWh)		0.1542			
total kW installed 9/2018		4,051			
Percent Rate Impact		5.08%			

WEC found the current version of net metering (those systems coming online after January 1, 2017) also known as Net Metering Vintage 2017 is more expensive to WEC non-net meter members than the prior version (WEC's Legacy Net Metering plan which applied to those systems coming online before 2017). The Legacy program net cost to WEC and its members is $0.14428 per kWh generated which is equal to a cost of shift of $259,580 to non-net metered members. The Vintage 2017 program results in a loss of $0.1606 per kWh which is a cost of $451,983 to non-net metered members. The power supply savings are the same in both cases (offset for power supply is $0.0740 per kWh). The aggregate cost combining both net metering programs is a loss to WEC of $0.1542 for every kWh generated by Net Metering systems for a total cost shift of $711,563.

One important finding in this analysis is that the revenue paid to net metering members is greater under the Vintage 2017 program than the Legacy program. The primary reason for this is due to payments for the siting and REC adjuster on **gross** generation rather than net excess generation. This has made the Vintage 2017 program more expensive to WEC and its members. Conversely, it has made the program more financially attractive to people installing net metering systems while the cost of solar is on the decline making the returns and payback more attractive to build. This explains why the pace of installations ramped up so significantly after January 2017. Prior to the Vintage 2017 program's implementation, WEC had 252 members participating in net metering totaling 1,580 kW (roughly 10% of WEC's peak). In 2017 we had the largest single year increase with 131 new systems coming online accounting for 911.57 kW of additional net metering. In 2018 we had another 97 participate for 1,068.20 kW. As of September 15, 2019 we have 56 new participants bringing on line an additional 491.70 kW in 2019 thus far. As of September 15, 2019, WEC has 501 members in the net metering programs with total installed generation of 4,051.47 kW. This is over 25% of WEC's peak.

The next area of expenses that WEC incurs are administrative related. In this bucket, costs include direct and indirect expenses related to installing meters, billing systems, programing, answering member questions regarding bills, calculating and verifying bills, as well as staff time to implement and run the program. WEC estimates annually based on actual data from 2014 through 2018 that it costs $86,945 per year to administer and run the net metering program. Please see WEC Exhibit 2 for a summary and accounting of administrative related costs.

WEC Admin and Indirect Costs

Installation Costs for 2nd Meter -								
Description of Charges	**2014**	**2015**	**2016**	**2017**	**2018**	**YTD Aug 2019**	**Total**	
Labor & OH's	$ 915	$ 1,603	$ 1,233	$ 12,490	$ 9,649	$ 5,933	$ 31,824	
Materials (Meter)	$ 1,739	$ 3,185	$ 1,702	$ 19,079	$ 20,112	$ 11,942	$ 57,759	
Transportation & Misc OH's	$ 611	$ 948	$ 828	$ 7,140	$ 5,550	$ 3,562	$ 18,639	
Total Charges	$ 3,265	$ 5,736	$ 3,763	$ 38,710	$ 35,311	$ 21,437	$ 108,222	Total WEC Paid over the years
Member Payment for Meter and Install Costs	$ (2,473)	$ (4,609)	$ (2,671)	$ (28,488)	$ (21,811)	$ (10,746)	$ (70,797)	Total Member Contributions
Sub Total	$ 792	$ 1,127	$ 1,092	$ 10,222	$ 13,501	$ 10,691	$ 37,425	Net Cost to WEC
						Average	$ 5,347	
Other Costs - Activity Code 415 Net Meter	**2014**	**2015**	**2016**	**2017**	**2018**	**YTD Aug 2019**	**Total**	
Legal	$ 8,715	$ 2,759	$ 4,440	$ 464	$ 1,519	$ -	$ 17,897	
Billing (NISC Programming)	$ 3,900	$ -	$ -	$ 7,838	$ 1,725	$ -	$ 13,463	
Misc Exp Net Metering	$ 45	$ 22	$ 126	$ -	$ -	$ -	$ 193	
	$ 12,660	$ 2,781	$ 4,566	$ 8,302	$ 3,244	$ -	$ 31,553	
						Average	$ 6,311	
Internal Labor Estimate for Billing and other NM Issues	**2014**	**2015**	**2016**	**2017**	**2018**	**YTD Aug 2019**	**Total**	
General Manager (10% of total)	$ 20,012	$ 22,717	$ 25,328	$ 26,214	$ 28,934	$ 19,298	$ 142,503	
Billing Supervisor (50% of 903.07)	$ 22,617	$ 31,190	$ 39,745	$ 46,349	$ 49,760	$ 36,981	$ 226,642	
Director of Prod & Serv (10% of 908.01)	$ 10,462	$ 11,563	$ 13,148	$ 14,066	$ 14,333	$ 9,792	$ 73,364	
	$ 53,091	$ 65,470	$ 78,220	$ 86,629	$ 93,027	$ 66,072	$ 442,508	
						Average	$ 75,287	
						Total Average	**$ 86,945**	

Tallying up the total cost (power supply and administrative expenses), WEC's non-net metering members pay $798,508 (summation of $711,563 + 86,945) per year for the net metering program. This is roughly a 5.70% rate impact to non-net meter members.

2. Please quantify the effect of current net-metering compensation on your retail rates. Please provide all calculations and information supporting your response.

WEC estimates its retail rates are 5.70% higher due to net metering or a loss of $798,508 per year. See WEC Exhibits 1, WEC Exhibit 2, and WEC's response to Q1 above for more detail.

3. If current net-metering compensation is having a significant effect on retail rates, please describe how compensation should be changed so that the net-metering program does not have a significant effect on retail rates.

WEC supports net metering and believes the state should continue offering this successful program. However, the rates of compensation paid for net metering are far too generous as measured by the effect of cost shifting to non-net metered members (for WEC this equates to a cost shift of $798,508). WEC notes the requirements of Act 99 as identified in 30 V.S.A. §§ 8010(c)(1)(A) through (G) address the need for net metering programs to meet certain criteria. The requirements of the law call for, among other things, that future net metering programs achieve the following elements:

- avoid cost shifting,
- account for all cost and benefits of net metering,
- ensure everyone has an opportunity to participate,
- balance the pace of installations over time,
- balance the impacts on rates, and
- account for technology cost changes.

Several criteria of Act 99 are not being met by the Vintage 2017 program design. Specifically, WEC is experiencing cost shifting to non-net metering members and the pace of installations under the 2017 plan is more aggressive than the pace under the Legacy plan. WEC does not find the Vintage 2017 program achieves balance on the impacts on rates, and it does not account for technology cost changes. WEC has quantified that it has significant cost shifting occurring in the amount of $798,508 to non-net metered members, rates are higher by 5.70% and the pace of installation is unsustainable. As the installed cost of solar, which makes up almost all net metering installations, continues to decrease, the rates paid should be adjusted and lowered. However, the WEC finds that under the Vintage 2017 plan it actually pays more for solar than net metering programs rolled out previously. Therefore, the criteria of Act 99 are not being met by the current program.

WEC supports paying its net metering customers at a rate close to what the power is worth in terms of avoided power supply expenses. Savings to WEC from avoided power supply expenses (as measured by energy, capacity, transmission, and ancillary market charges) equates to $0.0740 per kWh in 2018 (see WEC Exhibit 1). WEC supports paying net metering members at the avoided power supply rate; this value has ranged from $0.0702 to $0.0957 per kWh over the past four years. (See WEC Exhibit 1).

WEC also notes that as more solar is installed we are moving away from being able to capture transmission related savings from peak periods, as the peak has moved to nighttime and evening hours when solar is not producing energy. Therefore, the value of the next increment of solar is worth less than that which was installed previously due to lower amounts of transmission savings benefits. This will further reduce the power supply savings as more solar is installed.

4. Please state the amount of new net-metering capacity the utility will need to meet Vermont's Renewable Energy Standard in total and on average per year.

WEC is a utility that qualifies as 100% renewable and therefore meets the exemption status of the statute for Tier II under the RES. As an exempt renewable utility, WEC must offer a state approved Net Metering program but it does not have to meet the kWh targets of the RES. However, in the event WEC's renewable status were disallowed, the RES Tier II requirements would apply. Therefore, the annual targets of the RES remain important to WEC.

A summary of WEC's annual energy estimates is provided in the table below. WEC's Tier II requirements increase from 604 kW in 2107 to 6,190 kW by 2032. WEC already has 2,135 kW that qualifies under the RES Tier II program (systems online as of 7/2015 count toward Tier II), and WEC has therefore more than its requirement in the current year.

	Tier II	WEC Retail Load (kWh)	Tier II Requirement (kWh)	kW Nameplate
2017	1.0%	68,821,561	688,216	604
2018	1.6%	70,493,884	1,127,902	990
2019	2.2%	70,493,884	1,550,865	1,362
2020	2.8%	70,493,884	1,973,829	1,733
2021	3.4%	70,493,884	2,396,792	2,105
2022	4.0%	70,493,884	2,819,755	2,476
2023	4.6%	70,493,884	3,242,719	2,847
2024	5.2%	70,493,884	3,665,682	3,219
2025	5.8%	70,493,884	4,088,645	3,590
2026	6.4%	70,493,884	4,511,609	3,962
2027	7.0%	70,493,884	4,934,572	4,333
2028	7.6%	70,493,884	5,357,535	4,705
2029	8.2%	70,493,884	5,780,498	5,076
2030	8.8%	70,493,884	6,203,462	5,447
2031	9.4%	70,493,884	6,626,425	5,819
2032	10.0%	70,493,884	7,049,388	6,190

5. Please identify all the benefits that net-metering provides (for example, energy, capacity, reduced regional network service charges, etc.).

WEC estimated the benefits from lower power supply related savings total $0.0740 per kWh. The estimate is summarized below by energy, capacity, transmission, and ancillary market savings.

Net Metering

Summary Solar Impacts Power Costs Reduction

Category	Updated 2018 Dollars/kWh 2018
Energy	$ 0.0408
Forward Capacity Market	$ 0.0270
Ancillary Market Products	$ 0.0031
ISO-NE Transmission	$ 0.0015
GMP Transmission	$ 0.0012
VELCO Transmission Cost Avoidance	$ 0.0004
Grand Total Reduction in Power Costs ($/kwh)	**$ 0.0740**

For more detail see answer to Q1 and WEC Exhibit 1.

6. For each benefit identified, please state whether the value of the benefit accrues to the net-metering customer, ratepayers, the utility, or society in general.

All cost and benefits are noted from the utility perspective which in turn those costs are transferred onto ratepayers that are non-net metered members. As previously discussed in WEC's response to Q#1 – Q#5, net metering is resulting in a monetary cost to WEC and its membership in the amount of $798,508. This translates into rate impact to WEC ratepayers of higher rates in the amount of 5.70%.

7. For each benefit, please describe how the Commission should estimate the value of that benefit. Please identify what data sources the Commission should use to make such estimates. If you have an estimate of the value of a particular benefit, please provide the estimate, along with supporting documentation showing how the estimate was derived.

In terms of power supply benefits, the avoided costs are captured in terms of savings to a number of power related markets that WEC accounts for its power supply costs and markets administered by the ISO-NE. These markets include energy, capacity, transmission (ISO-NE transmission, VELCO transmission, and GMP transmission), and ancillary markets administered by the ISO-NE (reserves, settlement charges related to load, regulation, ISO-NE tariff expenses related to load, GIS expenses, etc). The benefits of net metering to the utility are captured in these market products. As noted earlier, savings to WEC from avoided power supply expenses (as measured by energy, capacity, transmission, and ancillary market charges) equates to $0.0740 per kWh in 2018 (see WEC Exhibit 1). WEC supports paying net metering members at the avoided power supply rate; this value has ranged from $0.0702 to $0.0957 per kWh over the past four years. (See WEC Exhibit 1).

8. When estimating the value of the benefits of net-metering, what time horizon should the Commission consider? Why?

The commission should be looking at the net value of solar today and also what it is worth into the future when valuing benefits. The value of the next increment of net metering changes relative to its impacts on the grid and energy market system. As WEC notes in response to Q3, the more solar that is installed, the less of an effect it has to reduce transmission and other peak related savings. This is due to the fact that peak periods for transmission and other peak driven markets are moving to later hours in the day (night and evening hours) when solar is producing very little if any energy. Therefore, the value of the **next increment** of solar is worth less than that which was installed previously. As transmission savings benefits decrease it will further reduce the power supply savings as more solar is installed. The PUC should consider lowering the rates paid for net metering due to the decline in benefits. If the PUC does not lower the rates utilities pay, the net cost of net metering to the utility will increase which causes more cost shifting to WEC's non-net metered membership.

9. Please identify all costs of net-metering. Please describe how the Commission should account for these costs so that they can be compared to the benefits of net metering.

WEC estimates the total net cost (power supply and administrative expenses), WEC's non-net metering members pay is $798,508 (summation of $711,563 + 86,945) per year for the net metering program. This is roughly a 5.70% rate impact to non-net meter members.

See response to Q1 and Q3 WEC Exhibit 1 and WEC Exhibit 2.

10. For each cost, please identify who pays the cost (ratepayers, the utility, society).

The extra cost incurred by WEC of $798,508, the utility pays for this added expense. In turn these costs are recovered and transferred to ratepayers and society through higher rates. See response to Q1 and Q3 WEC Exhibit 1 and WEC Exhibit 2.

11. Please compare the benefits of net-metering to the cost of net-metering under the current net-metering rule.

WEC concluded from its analysis that the cost of net metering far exceeded the benefits. The gross total cost which includes the value paid for net excess generation, siting and REC adjusters, and loss of sales from lower retail load is $1,053,190. WEC's cost to the administer and run the program is $86,945 per year. Meanwhile, the benefits of reduced power supply related expenses only totaled $341,627. The net effect is a **cost** to WEC, ratepayers, and society of $798,508.

Gross Total Payments and Cost From Lost Retail Sales		$	1,053,190
	Gross Total Admin Cost	$	86,945
	Gross Total Power Supply Benefit	$	(341,627)
	Net Cost (Benefit)	$	798,508

For more detail please see responses to Q1 through Q3, and WEC Exhibit 1 and WEC Exhibit 2.

12. If the current net-metering compensation system does not balance the costs and benefits of net-metering, please describe how the compensation system could be changed to better balance costs and benefits.

WEC supports paying its net metering customers at a rate that is aligned with what the power is worth in terms of avoided power supply expenses. Savings to WEC from avoided power supply expenses (as measured by energy, capacity, transmission, and ancillary market charges) equates to $0.0740 per kWh in 2018. WEC supports paying the true savings to net metering members and this value has ranged from $0.0702 to $0.0957 per kWh over the past four years. See responses to Q1, Q3, and Q9.

13. Would using time-of-use retail rates to set net-metering compensation better align the costs and benefits of net-metering? Should the Commission require net-metering customers to be on time-of-use rates?

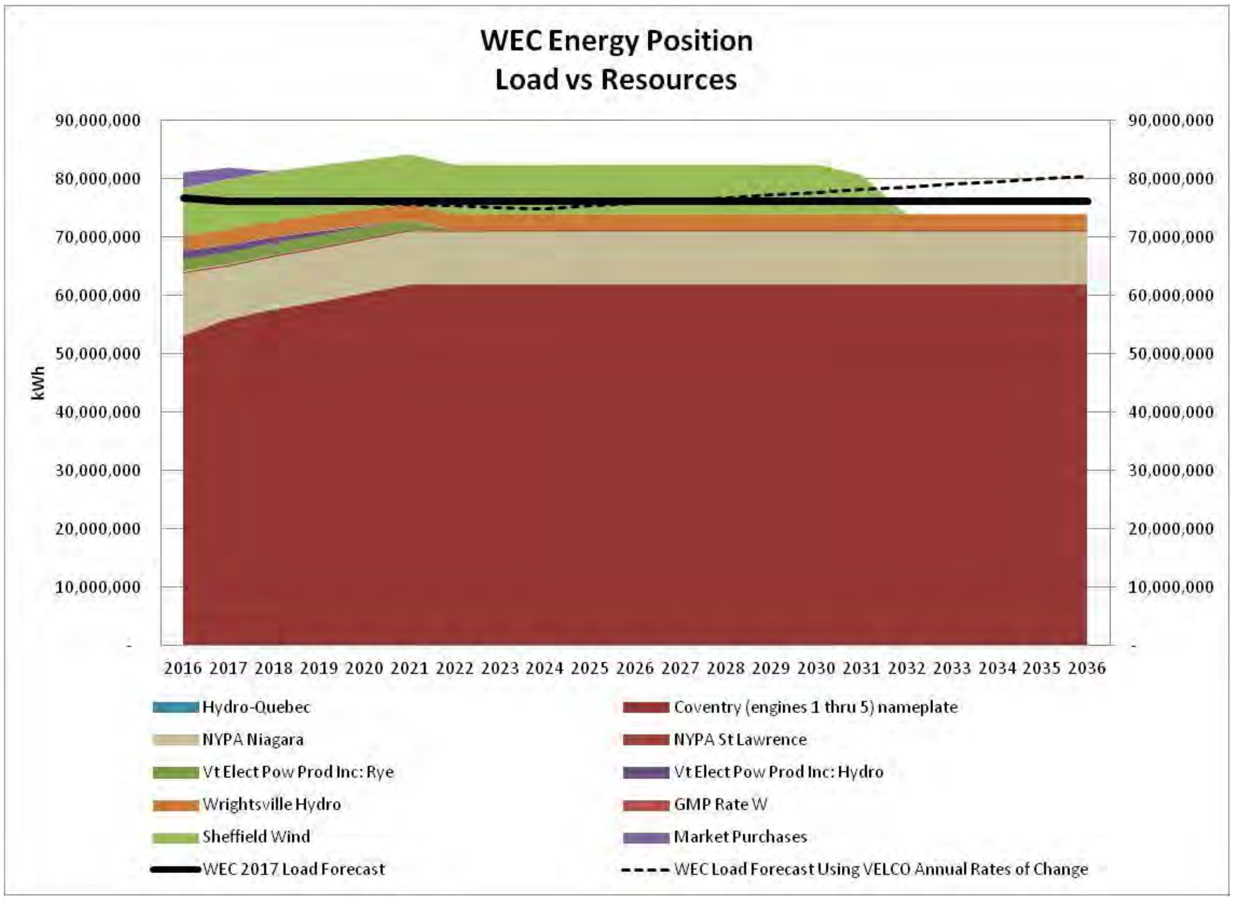
It is unclear how and if a time-of-use rate would better align costs and benefits for net metering consumers. Energy prices are fluid and move with market conditions. Solar produces power based on sunlight hours and is not a power source that can ramp up and down with real time pricing and other market conditions that require timing.

WEC also believes a time-of-use rate would be difficult for net metering members to implement as they are making use of monetized hours of excess generation rather than working to control loads at their home or business. WEC essentially acts as a battery or a bank on behalf of the net metered member.

WEC asserts that lowering the amounts paid for net metering generation is the best means to align the true benefits with costs. See response to Q3 and Q12. The administrative complexity of billing for a time-of-use rate would also be an issue. WEC has limitations as to what it can do in terms of a time-of-use rates due to its AMI system limitations (WEC reads daily load rather than hourly load).

14. Should the Commission allow utilities that provide their customers 100% renewable energy to propose alternative net-metering tariffs? If so, what minimum requirements should the Commission adopt for such tariffs?

WEC's power supply mix is 100% renewable and WEC has more renewable power than it needs to meet its membership's energy load requirements over the course of a year. As noted in WEC's last IRP and summarized in the following graphic, WEC is excess renewable power for the foreseeable future.



Therefore, any power produced from net metered systems is simply avoiding the use of other renewable forms of power in WEC's resource mix. Therefore, a net metered system has far less value to WEC as a 100% renewable energy provider like WEC that is long and excess power for the upcoming 20 years.

WEC supports being allowed to offer an alternative net metering program as it is 100% renewable but does note this can cause consumer confusion as members and developers may have difficulty navigating various net metering programs among utilities. However, if the rate was set such that what was paid for the value of net metering matched what WEC saved, then WEC would be indifferent as it would be financially neutral and shifting of costs would not occur.

15. Should the Commission adopt a limit on the amount of new net-metering resources? If so, how should the Commission determine the amount?

Yes. WEC asserts that a cap for net metering systems is appropriate and warranted due to the magnitude and number of installed systems. WEC currently has over 4 MW of installed net meter systems while WEC's peak is 16 MW of load. Therefore, WEC has 25% of its peak in installed net metering systems. WEC supports reinstituting a cap to the program.

Also, many new systems coming online are causing WEC to charge interconnection costs due to ground fault over voltage issues on the lines and equipment. Rather than creating savings relative to infrastructure costs, we are finding more net metering systems are triggering and causing expensive upgrades to the distribution system grid.

B. Preferred sites

The Commission proposed to remove joint letters of support from the definition of "preferred site" for two reasons. First, we have heard concerns about whether the current regulation fails to provide standards or criteria for regional and local bodies to apply when determining whether a site is "preferred." The second reason is that Rule 5.103 did not provide any procedures for local bodies to follow before designating a site as preferred. The Commission wants to ensure adequate notice and opportunity for input from the public. We request additional comment on the specific topics identified below. We will schedule a workshop to discuss these issues at a future date.

16. What standards or criteria should regional and local bodies apply to determine whether a site should be designated as "preferred"?

The impact of net metering on many communities is growing due to aesthetics and the sheer volume of systems coming online across the state. WEC supports local community involvement to determine suitability of installations that are consistent with local town ideals and desires for orderly development. WEC defers to communities to express their particular town's interest in this issue. As power generation becomes more dispersed and distributed, local impacts and considerations from communities is imperative.

The definition of preferred site should be amended to take into account various areas of the grid that have constraints. In areas of the grid that have constraints (too much generation, limited loads, and limitations from the grid such as the SHEI region in northern Vermont) additional power development is creating issues for existing renewable power plants. Development in constrained areas should not receive a preferred site designation. Adding new generation in already constrained areas worsens the situation and causes further erosion of value for existing renewables.

17. Which entity should be responsible for making a determination that a preferred site meets the applicable standards and criteria? Should it be the local planning body, the regional planning body, or the local legislative body? Or all three?

WEC believes the determination of preferred site should be made by the PUC but all voices should be allowed to express their concerns in an orderly way.

18. What procedures should regional and local bodies follow before designating a site as preferred? Should notice be provided to adjoining landowners and the public before this decision is rendered?

WEC supports transparency and involvement in siting issues and therefore, supports notice being provided to adjoining landowners and the general public. The impact of net metering on many communities is growing due to aesthetics and the sheer volume of systems coming online. WEC supports local community involvement to determine suitability of installations. WEC defers to communities to express their particular town's interest in this issue.

19. What information should applicants be required to provide to regional and local bodies before a site is designated as preferred?

WEC does not have a detailed opinion on this matter but supports local community involvement to ascertain what is necessary interms of drawings and detailed information that should be provided.

20. Should a local determination that a site is or is not a preferred site be subject to review by the Commission? If so, what procedures should the Commission use to review such determinations?

Yes. WEC believes this should be determined by the PUC but all voices should be allowed to express their concerns in an orderly way.

C. Administrative Issues
The Commission is seeking to streamline the net-metering registration/interconnection process and to reduce the need for amendments to net-metering registrations. Attached to this order is a worksheet (Attachment B) with questions related to the fields contained in the net metering registration form. The goal is to determine whether the form is collecting necessary information and whether any fields should be altered, added, or removed.

The net metering registration form is very useful and generally adequate for WECs interconnection needs. With the rise of new technologies, we are seeing frequent pairing of net meter systems with other home electricity related technologies (such as batteries, electric vehicle charging equipment, cold climate heat pumps, etc). WEC seeks to add information to the registration form that will help WEC to install appropriately sized transformers and other grid interconnection equipment. It would be helpful to know if the member has or is planning to install battery system (type and size). It would also help to know about certain high loads such as electric vehicle charging and cold climate heat pumps.

If you need additional information do not hesitate to contact us.

Sincerely,

Patricia H. Richards
Washington Electric Cooperative
General Manager

Appendix L.

STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 19-1270-TF

Washington Electric Cooperative, Inc.'s, tariff filing for rate design changes and a change in rate schedules to be effective on services rendered beginning June 17, 2019	Hearing at Montpelier, Vermont October 22, 2019

Order entered: 12/19/2019

PRESENT: Anthony Z. Roisman, Chair
Margaret Cheney, Commissioner
Sarah Hofmann, Commissioner

APPEARANCES: Daniel C. Burke, Esq.
for Vermont Department of Public Service

Ronald A. Shems, Esq.
Tarrant Gillies & Richardson
for Washington Electric Cooperative

ORDER APPROVING RATE DESIGN WITH IMPLEMENTATION IN THREE PHASES

I. INTRODUCTION

This case concerns the Vermont Public Utility Commission's ("Commission") investigation into Washington Electric Cooperative Inc.'s ("WEC") petition for rate design changes. When a utility proposes rate design changes, there is no change to the total amount of revenue that the utility is authorized to recover from its ratepayers. Rather, rate design changes may include adjustments to reallocate costs among rate classes (e.g., residential, commercial, and large-power) or among the components of charges (e.g., customer charge and energy rates per kWh), or both.

In this proceeding, WEC proposes (1) to increase the residential customer charge from \$14.19 to \$25.00 per month; (2) to reduce the low block of its inclining-block rate structure for Residential members from 200 kWh to 100 kWh; and (3) to reduce the kWh rates for the low block from \$0.1135 to \$0.0800 and for the tail block from \$0.25341 to \$0.19961. The proposal similarly increases the customer charges for Small Commercial and Large Power rate classes and reduces the energy rate for the small commercial class from $0.20747 to $0.19005. WEC does not propose any changes that would reallocate costs among the rate classes. The bill impacts of WEC's proposed changes would depend on each member's energy-usage level. Members in the Residential class using 500 kWh or more per month would see lower overall bills, and members using less than 500 kWh would see higher overall bills. WEC recognizes the adverse financial impacts of the proposed changes on its low-income members at low energy-usage levels.

WEC asserts that its rate design proposal has been vetted through extensive outreach efforts to its members including focus groups, public meetings, newsletters, and "vigorous debate among its democratically-elected Board of Directors."[1] WEC explains that its members and Board of Directors "strongly believe" that implementation of the proposed rate design changes "most fairly achieves the mutual goal of strategic electrification and does not sacrifice other critical policy goals of fairness, stability, energy efficiency, and balanced rate design."[2]

The Vermont Department of Public Service ("Department"), the only other party to this proceeding, advocates for an alternative rate design proposal that would eliminate WEC's inclining-block rate structure to further strategic electrification goals. The Department does not oppose WEC's proposed increases to customer charges but recommends a four-step implementation phase-in period for the Residential class. The bill impacts of the Department's proposal similarly affects WEC's members based on each individual member's usage; higher energy users would see their bills decrease and lower energy users would see their bills increase. The Department recommends that WEC be required to collaborate with the Department and report back to the Commission within 12 months on the feasibility of developing a support mechanism for low-income members.

The Department also recommends that the Commission institute a 12-month deadline for WEC to file proposed time-of-use and electric-vehicle rates or a report on why implementation of such rates is not feasible. The Department recommends that an electric vehicle rate be designed to recognize the flexible nature of the new electric vehicle load and incorporate opportunities for WEC to manage that load. The Department states that WEC should design time-of-use rates that are more attractive to and understandable for consumers and "send a more

[1] WEC Brief at 2.
[2] WEC Brief at 2.

compelling price signal." The Department also notes that the time-of-use rates may be beneficial to some members who are most adversely affected by the proposed rate design changes.[3]

In today's Order, the Commission finds that the changes proposed by WEC in this case will result in just and reasonable rates, if the residential customer charge increase is phased in over two years, and approves the rate design changes for implementation in three steps. These changes shall be permitted to take effect on a service-rendered basis no sooner than 3 days after the Commission issues its Order approving compliance tariffs. These compliance tariffs shall include a three-phase implementation period for the change to the customer charge for the Residential class in order to alleviate the initial financial impacts on affected low-income members. WEC is authorized to increase the Residential customer charge to $17 for the first phase, to $21 one year after, and to $25 one year after that and to adjust the energy charge for the tail block to accommodate the phase-in period. As a condition of our approval, WEC is required to file compliance tariffs that comply with the terms of this Order, including the necessary adjustments to the energy rate, within 7 days of the issuance of this Order.

Because the proposed rate design changes will significantly impact low-income members with low energy usage levels, we are requiring WEC to implement the change to the Residential customer charge in three phases over two years. In further recognition of these financial impacts on low-income members, we are also requiring that WEC collaborate with the Department on the development of a program to support low-income members. WEC shall report back to the Commission on these efforts within 12 months of the issuance of this Order. In addition, WEC is required to file a report within 3 years of the issuance of this Order on its plans for its next rate design filing as well as on the results of the implementation of the current proposed rate design in achieving the policy goals identified in this case. Lastly, if WEC has not filed time-of-use or electric-vehicle rates within 12 months of the issuance of this Order, at that time it shall file a report with the Commission on its efforts to develop such rates.

II. PROCEDURAL HISTORY

On May 1, 2019, WEC filed its proposed rate design reallocation, requesting changes

[3] Potter pf. at 8-9.

to the design of its rate structure. This petition included prefiled testimony and exhibits sponsored by Patricia Richards and Jason A. Strong.

On June 3, 2019, the Department recommended that the Commission open an investigation into WEC's proposed rate design changes.

On June 13, 2019, the Commission issued an order opening this investigation.

On June 28, 2019, the Commission held a scheduling conference.

On July 31, 2019, the Commission held a workshop on WEC's petition.

On August 5, 2019, the Commission conducted a public hearing in East Montpelier, Vermont. One member of the public spoke in support of the proposed rate design changes.

On August 19, 2019, WEC filed supplemental testimony and exhibits of Ms. Richards in response to questions that the Commission raised at the July 31 workshop. WEC also made corrections to Ms. Richard's initial testimony.

On September 4, 2019, the Department filed testimony and exhibits sponsored by Daniel Potter, Sean Foley, and Carol Flint.

On September 25, 2019, WEC filed rebuttal testimony and exhibits sponsored by Ms. Richards and Mr. Strong.

On October 22, 2019, the Commission conducted an evidentiary hearing in the Susan M. Hudson Hearing Room at the Commission's offices in Montpelier, Vermont. The parties stipulated to the admission of all prefiled testimony and exhibits.

On November 7, 2019, WEC and the Department filed briefs. Reply briefs were filed by both parties on November 14, 2019.

III. Public Comments

A public hearing in this proceeding was held at the Old Brick Church, in East Montpelier, on August 5, 2019. One member of the public spoke in support of WEC's rate design change petition. There were no other comments at the hearing. The Commission received written comments opposing WEC's rate design change petition from three of WEC's members. These comments included concerns related to WEC's rates in general as well as the impact of the proposed rate design changes on low-use and low-income members' bills. The public comments were helpful to the Commission's identification of issues to explore with the parties in this matter.

IV. Findings

A. Rate Design Elements

1. WEC is a duly organized public service cooperative formed under 30 V.S.A. Chapter 81 and a not-for-profit corporation. WEC is a company as defined by 30 V.S.A. § 201 and is subject to the Commission's jurisdiction pursuant to 30 V.S.A. § 203. Petition at 1.

2. WEC's power supply is comprised of 100% renewable power resources. Richards pf. at 13.

3. WEC's proposed rate design changes are based on a class cost-of-service study that uses a fully distributed cost-allocation methodology. The test year is the adjusted rate year ending December 31, 2019. Strong pf. at 11.

4. Cost allocation is the process of allocating costs among customer classes based upon cost causation. Costs are directly allocated only when specific investments or expenses serve only a particular member or group of members. Strong pf. at 10.

5. The results of the class cost-of-service study show that each class of customers (Residential, Small Commercial, Large Power, and Lighting) is relatively close to recovering the cost to serve that class and is providing a return on member investments. Strong pf. at 20.

6. WEC proposes no changes to the revenue levels for the Residential, Small Commercial, Large Power, and Lighting classes. Strong pf. at 21.

7. The results of the class cost-of-service study indicate that fixed costs, particularly as reflected in the customer charge, could be higher than the amount that WEC recovers through currently effective tariff rates. Strong pf. at 21.

8. WEC proposes revenue-neutral changes including (1) increased customer charges for the Residential, Small Commercial, and Large Power rate classes to better reflect the customer-related costs identified in the class cost-of-service study and (2) reduced energy charges. Strong pf. at 21.

9. Under WEC's proposal,

a. the monthly customer charge for the Residential class increases from $14.19 to $25.00. The baseload block reduces from 200 kWh to 100 kWh;

b. the kWh energy rate for the baseload block reduces from $0.11350 to $0.08000; and

c. the kWh energy rate of the tail block (usage after the first 100 kWh) reduces from $0.25341 to $0.19961. Exh. WEC-2-PR-2.

10. Under WEC's proposal, for the Small Commercial class, the monthly customer charge increases from $14.14 to $25.00 and the energy rate decreases from $0.20747 to $0.19005. Exh. WEC-2-PR-2.

11. Under WEC's proposal, for the Large Power class, the monthly customer charge increases from $24.13 to $30.00 and the energy rate decreases from $0.11014 to $0.10792. Exh. WEC-2-PR-2.

12. WEC is the "least dense" electric distribution utility in Vermont and serves 8 customers per mile of distribution line. The City of Burlington Electric Department is the "densest utility" and serves 159 customers per mile of distribution line. Vermont's largest electric distribution utility, Green Mountain Power Corporation, serves 23 customers per mile of distribution line. Vermont Electric Cooperative, the only other cooperative-owned electric distribution utility in Vermont, serves 14 customers per mile. Richards supp. pf. at 4.

13. The utility's "density" may affect its rates because fixed costs, such as costs associated with distribution line maintenance, must be covered by a smaller group of customers per mile of distribution line than for other utilities. Richards supp.pf. at 4.

14. Several rural cooperative electric utilities in the Northeast are moving toward higher monthly customer charges and are effectively capturing more fixed costs in these revenues. New Hampshire Electric Cooperative's monthly residential customer charge ranges from $29.32 to $58.64. The monthly residential customer charge for members of Adams Electric Cooperative of Pennsylvania is $35.75. In New York State, Delaware County Electric Cooperative charges $21.50 per month, Otsego Electric Cooperative charges $25.66 per month, and Steuben Rural Electric Cooperative charges $25.75 per month. Richards supp. pf. at 5.

15. Traditionally, WEC has maintained a relatively low customer charge, which has resulted in nearly all of the residential fixed costs needing to be included in the energy charge.

Increasing the customer charge allows WEC to make gradual progress toward a more balanced alignment of cost recovery with cost causation. Strong pf. at 25.

16. Increasing the monthly customer charge also improves equity and fairness to members using WEC's distribution system by more accurately charging for the cost of service based on cost-causation principles. Richards pf. at 18.

17. Recovering more fixed costs through the monthly customer charge makes gradual improvements in efforts to stabilize and ensure more aligned collection of operating revenue which is needed to meet operating expenses, margins, and debt service covenant obligations. Richards pf. at 18.

B. Bill Impacts

18. WEC's membership is predominantly residential (which also includes some small farms). 94% of meters in WEC's territory receive service under the Residential rates. Of WEC's 11,963 total meters, 11,280 are Residential, 671 are Small Commercial, and 12 are Large Power. Richards pf. at 8.

19. WEC's retail energy sales are 87% Residential, 7% Small Commercial, and 6% Large Power. Richards pf. at 8.

20. Average electricity usage for WEC's Residential class members is 473 kWh per month. Richards corrected pf. at 13.

21. After the rate design changes are implemented, Residential members using 500 kWh or more per month will see lower overall bills and members using less than 500 kWh per month will see higher overall bills. 58% of members will see lower bills and 42% will see higher bills. Richards pf. at 21-22.

22. Members using 200 kWh per month will see their bills increase by 44% from $36.89 to $52.96 per month. Richards pf. at 21.

23. Members using 400 kWh per month will see their bills increase by 6% from $87.57 to $92.88. Exh. WEC-SUP1-PR-3.

24. For members using approximately 500 kWh per month, the rate design changes are essentially revenue neutral. Richards pf. at 21.

25. Members using 800 kWh per month will see their bills decrease by 9% from $188.94 to $172.73 per month. Exh. WEC-SUP1-PR-3.

26. Approximately 16% of WEC's members use 200 kWh or less per month, and 10% of members use more than 1000 kWh per month. Exh. WEC-6-PR-6.

27. Low-income members who have low usage will experience adverse financial impacts as a result of the rate design changes. For example, for households with a $1,000 monthly income and 200-kWh monthly electricity usage, the increase represents more than 2% of their monthly income. At least 400 WEC members may suffer financial hardship as a result of the rate design changes. Flint pf. at 8-9.

28. Implementing the monthly customer charge increase for the Residential class in phases rather than all at once will mitigate the financial impacts on low-income members but will not eliminate the underlying affordability concern for these members. Flint pf. at 9.

29. It is important for WEC, the Department, and the Commission to revisit this affordability issue in the near future to determine whether it is necessary to develop an energy assistance program or similar mechanism for WEC's members. Flint pf. at 9-10.

C. <u>Policy Goals</u>

30. The Board of Directors, who are elected by WEC's members, are responsible for representing WEC and conducting WEC's business and affairs. WEC held focus groups and a membership meeting to solicit feedback from members on the proposed rate design and included 20 articles in its newsletter to educate members. Richards pf. reb. at 4.

31. The purpose of WEC's proposed rate design changes is to increase strategic electrification. Because of WEC's renewable energy power supply portfolio, any fossil-fuel use that is replaced with electric power will work toward combatting the harmful effects of climate change. Richards pf. 6.

32. Lowering the energy charge rates helps remove the disincentive for members to invest in strategic electrification opportunities. Potter pf. at 3.

33. WEC members want to incentivize strategic electrification while continuing to encourage energy efficiency and limiting the economic impacts of bill increases. Richards pf. at 29-31.

34. Maintaining an initial block of lower-priced energy mitigates the bill impacts on WEC's members with lower levels of electricity usage and helps encourage and promote energy efficiency. Richards pf. reb. at 5, 9.

V. Discussion

The Department supports most aspects of WEC's proposed rate design, including the proposal to increase the monthly residential customer charge. The Department agrees that the proposed rate design changes will better align WEC's rates with State energy policies that promote greenhouse-gas reductions through beneficial electrification. The Department supports WEC's proposal to limit the impact of its inclining-block rate structure by reducing both the size of the initial block and the kWh difference between WEC's initial and tail block rates in order to send a better price signal for strategic electrification. However, the Department contends that public policy would be better served by wholly removing the inclining-block structure from WEC's rates.[4] The Department argues that an inclining-block rate structure is a barrier to consumers investing in electric transportation and heating. If the Commission rejects this proposal, the Department recommends that WEC be required to file rate design changes within five years that eliminate the inclining-block structure or a report on why WEC believes that it should continue to maintain the inclining-block structure.

The Department also recommends that the Commission require that WEC phase in its proposed increased customer charge for the Residential class to limit rate shock and to better promote rate stability. Additionally, the Department urges the Commission to require WEC to collaborate with the Department on the feasibility of developing a support mechanism for low-income members and to report back within twelve months. The Department also recommends that WEC either file proposed time-of-use rates within one year or report to the Commission why such rates are not feasible.[5]

In response to the Department's recommendation that the inclining-block rate structure be removed, WEC states that the Department's proposal: (1) is not supported by a specific

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[4] Department Brief at 1-2.
[5] Department Brief at 2.

analysis or study, (2) was not developed in consultation with other agencies, utilities, organizations, or with public or legislative review, and (3) is not supported by 30 V.S.A. § 218(b), which requires that rate designs promote efficiency and include the consideration of an inclining-block rate structure for residential customers. We do not need to address these arguments because we conclude that maintaining the inclining-block rate structure will help to mitigate the financial impacts of the rate design changes on low-energy users.[6] We therefore conclude that it is not appropriate to adopt the Department's proposal at this time.

The Department states that its recommendation to remove the initial block of lower-priced power is "driven in large part by the infrequency of rate design filings from WEC." [7] WEC has historically filed rate design tariff changes approximately every ten years. The Department's recommendation to require WEC to remove the inclining-block rate structure within five years or to file a report explaining why WEC has decided not to do so appears to be intended to address these concerns. We do not believe it is appropriate to impose a requirement that WEC eliminate its inclining-block rate structure within a prescribed time period. However, we wish to emphasize the importance of WEC continuing to regularly evaluate (and certainly more often than once every 10 years) the effectiveness of its inclining-block rate structure in light of the State's policy goals to encourage beneficial electrification. WEC states its willingness to work with the Department to "develop metrics on the efficacy of its proposed rate design that could determine the timing of WEC's next rate design adjustment."[8] We encourage collaboration between WEC and the Department in this regard. Further, we direct WEC to file a report within three years of the issuance of this Order on when it expects to file its next rate design changes, including detailed information on the criteria used to determine the timing of that filing as well as an evaluation of the success of the currently proposed rate design changes in achieving the policy goals identified in this case.

The Department does not oppose WEC's proposal to increase the residential customer charge from $14.19 to $25.00 per month to offset a reduction to its kWh rates.[9] However, the

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[6] If the initial block of power is removed, then all members- including low-income, low-usage members- will pay more for the initial block of power than they pay now. Maintaining the inclining-block rate structure allows members who continue to use very low levels of energy to benefit from the lower-priced energy for the initial block.

[7] Department Brief at 7.

[8] WEC Brief at 22.

[9] Department Brief at 1.

Department recommends that WEC be required to phase-in implementation of the residential customer charge increase in four adjustments over a three-year period. We agree that a phased-in implementation period is an appropriate measure to mitigate immediate rate shock for residential members caused by the large increase in the monthly customer charge. WEC has concerns with a four-step phased-in implementation period because "this number of changes to rates would be very confusing to members and lacks stability which WEC members value and desire."[10] To minimize confusion and lessen the administrative burden of implementing the rate design in multiple phases, we conclude that a three-step implementation period to phase in this large increase to the monthly customer charge is adequate. Accordingly, WEC is required to make the necessary adjustments to its tariffs to reflect an initial increase to $17, a second increase to $21 effective one year after, and a third increase to $25 effective one year after that, with adjustments to the energy charge for the tail block to accommodate the phase-in period.

As described above, we have decided that WEC should maintain the inclining-block rate structure to help alleviate bill impacts on low-energy-use members. Even with the inclining block rates in place, the proposed rate design changes will significantly impact low-use members whose households fall within the category of low-income.[11] The Department states that this proceeding has highlighted affordability concerns within WEC's service territory, specifically with regard to the approximately 400 low-income members who will be most directly affected by the new rate design structure. At the evidentiary hearing, WEC stated that "monitoring impacts of [its] rates on low-use and low-income [members] is something that we would want to pay attention to."[12] For these reasons, we accept the Department's recommendation that WEC be required to consult with the Department and report back to the Commission within one year on its efforts to develop a low-income support mechanism or program.

In its brief, the Department recommends that WEC be required to file either an electric-vehicle specific rate or time-of-use rates within one year of the issuance of a final Order in this proceeding.[13] If WEC believes that such rates are "impractical or cost-prohibitive," the

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[10] Richards pf. reb. at 7.

[11] For instance, members who use less than 350 kWh per month will see double-digit percentage bill increases even with the inclining-block structure in place. *See* Exh. WEC-SUP1-PR-3.

[12] Tr. 10/22/19 at 28 (Richards).

[13] Department brief at 8.

Department recommends that WEC instead be required to file a report with the Commission detailing the reasons why it has decided not to propose these rates. In its rebuttal testimony, WEC objected to the Department's initial recommendation that it be required to propose time-of-use rates within six months. According to WEC, it "needs sufficient time to implement this [current] rate design before embarking on a time-of-use rate structure."[14] However, the Department now recommends a 12-month evaluation period to either propose new rates or to explain why such rates are not feasible, and we conclude that 12 months will allow WEC to continue to assess innovative rate design options that may help achieve the State's policy objectives. We therefore include this requirement as a condition of our approval of WEC's rate design changes.

VI. CONCLUSION

In conclusion, based on the evidence presented in this case, the Commission finds that WEC's rate design will result in just and reasonable rates if the residential customer charge increase is phased in over two years. The proposed changes to WEC's tariffs are approved with the conditions stated below.

[14] Richards pf. reb. at 13.

VII. ORDER

IT IS HEREBY ORDERED, ADJUDGED, AND DECREED by the Vermont Public Utility Commission ("Commission") that:

1. The rates proposed by the Washington Electric Cooperative, Inc. ("WEC") are just and reasonable if the residential customer charge increase is phased in over two years and are therefore approved for implementation in two steps.

2. The monthly customer charge for the Residential class shall be implemented in three phases. The first phase will increase the charge to $17 per month. One year after, the second phase will increase the charge to $21 per month. WEC shall implement the third step increasing the charge to $25 per month one year after the second phase. WEC shall adjust the energy charge for the tail block to accommodate the phase-in period.

3. Within 7 days, WEC shall file tariffs in compliance with this Order that reflect the approved rate design, the appropriate effective date, and any other tariff changes if applicable. This compliance filing shall be filed in this case in ePUC.

4. WEC shall consult and collaborate with the Department on developing a program to support low-income members. WEC shall report back to the Commission on these efforts within 12 months after the issuance of this Order. This filing shall be made in a new case in ePUC.

5. WEC shall file a report within three years of the issuance of this Order on when it expects to file its next rate design changes, including detailed information on the metrics used to determine the timing of that filing and an evaluation of the success of the implementation of the current rate design changes in achieving the policy goals identified in this case. This filing shall be made in a new case in ePUC.

6. If WEC has not filed time-of-use or electric-vehicle rates within 12 months of the issuance of this Order, at that time it shall file a report with the Commission on its efforts to develop such rates. This filing shall be made in a new case in ePUC.

Dated at Montpelier, Vermont this 19th day of December, 2019.

Anthony Z. Roisman	)	PUBLIC UTILITY
	)	
Margaret Cheney	)	COMMISSION
	)	
Sarah Hofmann	)	OF VERMONT

OFFICE OF THE CLERK

Filed: December 19, 2019

Attest: Judith C. Whitney
Clerk of the Commission

Notice to Readers: This decision is subject to revision of technical errors. Readers are requested to notify the Clerk of the Commission (by e-mail, telephone, or in writing) of any apparent errors, in order that any necessary corrections may be made. (E-mail address: puc.clerk@vermont.gov)

Appeal of this decision to the Supreme Court of Vermont must be filed with the Clerk of the Commission within 30 days. Appeal will not stay the effect of this Order, absent further order by this Commission or appropriate action by the Supreme Court of Vermont. Motions for reconsideration or stay, if any, must be filed with the Clerk of the Commission within 28 days of the date of this decision and Order.

PUC Case No. 19-1270-TF - SERVICE LIST

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