2 Introduction and Challenges We Face

2.1 Introduction

VEC's mission is to serve our Cooperative members with safe, reliable, and affordable energy services.

This Integrated Resource Plan (IRP) plan presents a continued path to ensuring excellence, balance and flexibility. We file this plan every three years with our regulators and engage energy stakeholders throughout the process. Appendix B: Guidance for Integrated Resource Plans and 202(f) Determination Requests lays out the baseline requirements for our IRP and IRP's are required to be consistent with the Comprehensive Energy Plan (CEP). In addition to those requirements, our IRP answers the following questions:

1. What are the potential costs of getting to 100% Carbon Free by 2023 and 100% Renewable by 2030 power portfolio on an annual basis?
2. How can we start to anticipate the incremental costs and challenges of serving VEC's 2030 load with a 100% Renewable energy on an hourly basis (24/7)?
3. What can we do to enable distributed generation and promote affordable renewables?
4. What does the hourly controlled and uncontrolled load shape look like with Cold Climate Heat Pump (CCHP) and Electric Vehicle (EV) growth in 2025, 2030, 2035 and 2040? What are the challenges associated with those?
5. What role does load management play in keeping rates low and preventing system upgrades?
6. Can the grid support the additional load growth?
7. How many additional megawatts (MW) of battery storage can be installed state-wide before VEC's current utility-size battery strategy is uneconomic moving forward?
8. How are we meeting our Energy Transformation goals today and tomorrow?
9. How do we a enable just and fair membership participation in the energy transition?
10. What can we do to support low income members?
11. How are we maintaining reliability amid climate impacts?
12. What are we doing to prioritize cybersecurity efforts?
13. What does resiliency look like for VEC?
14. How do we innovate to meet this challenge?
15. How do we leverage technology in the grid of the future?
16. What do we do to keep our staff and members safe in this new complex electrical grid?
17. How will we develop our staff, retain, and attract talent?
18. What is VEC's role in the energy services sector?

We've been working with the Department of Public Service who has provided input on our plan draft, and will submit this to the Public Utility Commission, where it will have the opportunity for public input. This IRP does not lay out our plan for achieving 100% renewable energy, and our answers to many of the above questions will take further analysis and time to resolve. However, this plan provides background analysis on how we will make some of those decisions

As our electrical systems become more complex, it requires us to be increasingly thoughtful about our investments. Our goal is to be prepared to execute the plans set forth in this document, while remaining nimble and adaptable to a changing future. While this future may bring uncertainty, it also brings an unlimited number of opportunities to meet members' increasing expectations.

2.1.1 Table of Contents

VEC's 2022 Integrated Resource Plan is broken up into six sections:

1. **Executive Summary**
2. **Introduction and Challenges We Face**
   - 2.1. About VEC
   - 2.2. Challenges We Face
3. **Communicating with our Members, Energy Equity, and Innovation**
   - 3.1. Communicating with our Members
   - 3.2. Energy Equity
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4. **Energy Transformation and Power Supply**
   - 4.1. Energy Transformation Programs and Forecast
   - 4.2. Energy Needs and Existing Makeup
   - 4.3. 100% Carbon Free and Renewable on an Annual Basis
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5. **Impacts of a Rapidly Decentralized Grid**
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6. **Data and Technology**
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8. **Assessment of the Transmission and Distribution System**
   - 8.1. Introduction
   - 8.2. Design and Planning
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   - 8.4. Attaching Entities and Broadband
   - 8.5. Safety
9. **Action Plan**
10. **Appendix**

2.1.2 Section 2 Overview

2.1.3 Cooperative Principles

The International Cooperative Alliance defines a cooperative as "an autonomous association of people united voluntarily to meet their economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled business." Electric cooperatives were formed in the early part of the twentieth century to serve rural areas that were not profitable to supply with electricity. The federal government provided support through the Rural Electrification Act of 1936, and volunteers formed cooperatives to bring electricity to previous unserved areas. Cooperatives around the world operate based on a core set of principles that trace their roots back to Rochdale, England in 1844. The seven cooperative principles are as follows:

Figure 2.1.3.A National Rural Electric Cooperative (NRECA) Cooperative Principles

2.1.4 Cooperative Structure and Principles

More than 900 electric cooperatives maintain nearly half of the electric distribution lines in the U.S. These lines cover three-quarters of the U.S. land mass and provide electricity to more than 40 million Americans.

As a member-owned cooperative, VEC is a democratic organization controlled by its members. Members elect local representatives to serve on VEC's twelve-member board of directors to represent geographically based districts and zones. These directors actively participate in setting policies, making strategic decisions, and are accountable to the membership.

As with any cooperative, VEC members are owners of the cooperative who have a direct influence on cooperative policy and financial decisions. They not only have a vote on certain cooperative policy decisions, but they also have a direct, financial stake in the cooperative. The cooperative belongs to the communities it serves, and collectively our staff and board each have a deep commitment and obligation to our members and the communities they live in.

2.2 Who is Vermont Electric Cooperative

Vermont Electric Cooperative (VEC) is a member-owned rural electric cooperative established in 1938 serving approximately 33,000 members (~40,100 meters) spread over 75 towns and 8 counties in northern Vermont.

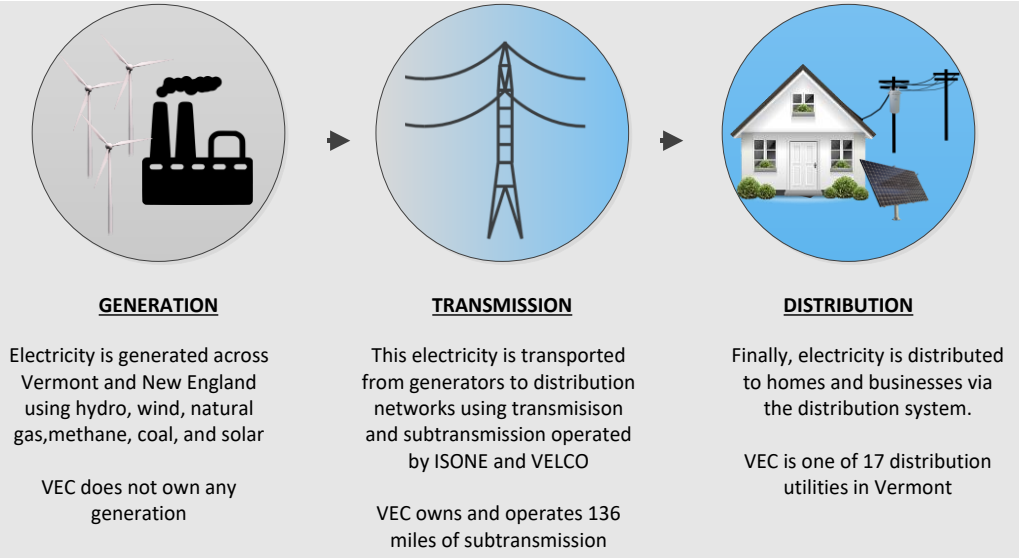
Key statistical metrics for 2021 (the most recently completed fiscal year) include:

- Annual sales were approximately 460,000,000 kWh;
- Residential and seasonal accounts made up approximately 88.2% of all customer accounts and 49.15% of kWh sales;
- Large commercial accounts made up approximately 0.04% of all customer accounts and 22.8% of kWh sales;
- Small commercial and public accounts made up approximately 11.6% of all customer accounts and 27.8% of kWh sales;
- Lighting accounts made up approximately 0.15% of all customer accounts on 0.15% of kWh sales.

Power supply and transmission consists of approximately 63% of VEC's cost to serve, distribution operations, and maintenance consists of approximately 18%, and the remaining 19% consists of administration, member services, depreciation, interest expense and other income.

2.2.1 Our Place in the Electricity Sector

Outside of VEC's system, the regional electric grid has many layers. Vermont Electric Power Company, Inc. (VELCO) manages all transmission resources in the State of Vermont. The Federal Energy Regulatory Commission (FERC) governs electrical and gas bulk transmission and generation assets in North America. ISONE England is the regional enforcement entity that governs Vermont's bulk electrical transmission and generation assets. ISONE is ultimately responsible for grid operation, market administration, and power system planning. ISONE has eight wholesale load zones in New England, and the entire state of Vermont is one of these load zones for the purchase and sale of bulk power.



2.2.2 History of VEC

In 1938, VEC was established by farmers in the town of Eden with the goal of bringing electricity to rural Vermonters who had been bypassed by investor-owned utilities. Early on, VEC extended service into Chittenden and Franklin counties and from 1940 through 1960, VEC's service territory continued to expand in northern Vermont through the construction of new lines and the acquisition of small private companies. In 1969, VEC expanded its territory into southern Vermont through a merger with Halifax Electric Cooperative, and in 1970, VEC acquired the International Electric Company serving the Derby Line area along the Canadian border. VEC more than doubled its membership in 2004 with the acquisition of Citizens Communications Company's Vermont Electric Division.

VEC sold its Southern District in 2006 to Central Vermont Public Service (CVPS) and Western Massachusetts Electric Company (WMECO) as it could be more efficiently served.

Figure 2.2.2.A VEC lineworkers in the 1950s

2.3 Our Regulatory Requirements

This section includes VEC's regulatory requirements including the filing of this IRP. While these are regulatory requirements, at their heart they are the expectations of Vermonters and our members. These requirements outline expectations as to how we meet our mission of safe, reliable, and affordable electricity and address climate impacts.

2.3.1 Vermont Department of Public Service (PSD) IRP Guidance

Appendix B: Guidance for Integrated Resource Plans and 202(f) Determination Requests identifies the baseline requirements that a utility IRP shall include. In addition, IRP's and other utility actions should be consistent with the Comprehensive Energy Plan.

2.3.2 Vermont Comprehensive Energy Plan (CEP)

The CEP is required by 30 V.S.A. § 202b and the Vermont Electric Energy Plan is required by 30 V.S.A. § 202. The PSD coordinates closely with other state agencies and the newly constituted Climate Council created through the Global Warming Solutions Act (Act 153 of 2020) to ensure that the CEP advances policy objectives across multiple areas.

The 2022 CEP lays out Vermont's high-level goal to meet 25% of energy needs statewide from renewable sources by 2025, 45% by 2035, and 90% by 2050. In addition, the CEP continues the Department's prior guidance, recommending that utilities use the IRP process to develop, analyze and ideate methods to meet the goals set forth in the CEP. The 2022 CEP states that we need collaboration to move toward *"a secure and affordable grid that can efficiently integrate, use, and optimize high penetrations of distributed energy resources to enhance resilience and reduce greenhouse gas emissions*".

In addition to collaboration needed to evolve the grid, the 2022 CEP is grounded in equity in its recommendations. "Vermont's electric sector will play a critical role in decarbonizing the transportation and thermal sectors, increasing the importance of affordable electric rates and an electric system that is reliable and resilient for all Vermonters."

2.3.3 Global Warming Solutions Act (GWSA)

In 2020, the Vermont Legislature passed the Global Warming Solutions Act (Act 153 as Enacted), which created legally binding emission reduction targets. The GWSA calls for meeting 100% of the electricity sector needs from carbon-free resources by 2032, with at least 75% from renewable energy, consistent with Vermont's RES.

2.3.4 Service Quality and Reliability Performance (SQRP)

VEC, like other Vermont utilities, operates under the guidelines of a Service Quality and Reliability Plan (SQRP), which defines standards by which VEC's member service, safety, and reliability performance is measured. This plan requires the utility to monitor and report the results of its performance in these areas annually to the Public Utility Commission. VEC's SQRP includes several "service guarantees" – specific credits or financial benefits that go to the affected individual retail customers if the utility fails to meet one of its service commitments.

VEC believes the service guarantees are excellent tools for helping us prioritize our work to be as responsive to members as possible.

Below is how VEC describes our service quality guarantees to our members:

"Committed to our members" means that we back our service to you with the following service guarantees:

Our Service Quality Guarantees	
Guarantee #1:	We guarantee that your bill will be rendered within seven days of your scheduled billing cycle or you will receive a $5 credit toward your account.
Guarantee #2:	We guarantee that the bill presented to you will be accurate. If you receive a bill with a mistake in it, VEC will correct the mistake and you will receive a $5 credit toward your account.
Guarantee #3:	We guarantee that line crews will be on time for scheduled appointments. If our crew has an appointment with you and does not show up within a two-hour window of the appointment, you will receive a $5 credit toward your account.
Guarantee #4:	We guarantee that your meter work will be completed within four business days of the promised delivery date on the service order. If we do not meet this date, you will receive a $5 credit toward your account.
Guarantee #5:	We guarantee that any line work will be completed within five business days of the promised delivery date, providing you have met your requirements. If we do not complete the work within this time frame, you will receive a $5 credit toward your account.

Figure 2.3.4.A VEC SQRP Guarantees

2.3.5 Renewable Energy Standard Requirements (RES)

In June of 2015, Public Act No. 56 established a Renewable Energy Standard (RES) with specific requirements focused on increasing investment in renewable energy resources and decreasing carbon emissions across the state and region. VEC has been successful in meeting its RES requirements to date. This IRP shows that VEC's current committed resources will exceed its projected Tier II obligation through approximately 2030, even after considering load growth from Tier III programs and therefore meets the goals of supporting the development of in-state renewable generation. Thus, VEC's biggest RES-related Power Supply challenge will be managing longer term Renewable Energy Credit (REC) procurement and retirement decisions given the relative uncertainty in retail sales impacts from new net metering installations and pace of electrification in the heating and transportation sectors.

Here are the current RES requirements for each of the three Tiers (as itemized in Table 1-3).

- Tier I requires a defined percentage of retail electric sales from any renewable energy source.
- Tier II requires a defined percentage of retail electric sales from new DER generation. For RES, DERs must have started operations after June 30, 2015 AND be either (1) electric generation facilities of 5 MW or less capacity directly connected to a sub transmission or distribution system, (2) identified plants that defer transmission upgrades, or (3) net-metered systems whose environmental attributes are owned by the distribution utility.
- Tier III requirements can be met either through additional new DERs (as specified in Tier II) or through energy transformation projects with a net reduction in fossil fuel consumption. Examples include building weatherization; air source or geothermal heat pumps and high efficiency heating systems; industrial-process fuel efficiency improvements; increased biofuels use; biomass heating systems; electric vehicles or related infrastructure; and renewable energy storage infrastructure on the electric grid.

2.3.6 National and Regional Requirements

VEC is required to follow guidelines and standards set forth by several national and regional organizations.

The Federal Energy Regulatory Commission (FERC)

FERC, is an independent agency that regulates the interstate transmission of natural gas, oil, and electricity. FERC also regulates natural gas and hydropower projects.

North American Electric Reliability Corporation (NERC)

FERC designated NERC to establish and enforce reliability standards for the bulk power System (BPS). NERC has divided the North American Electric Utilities electrically into 4 large power grids:

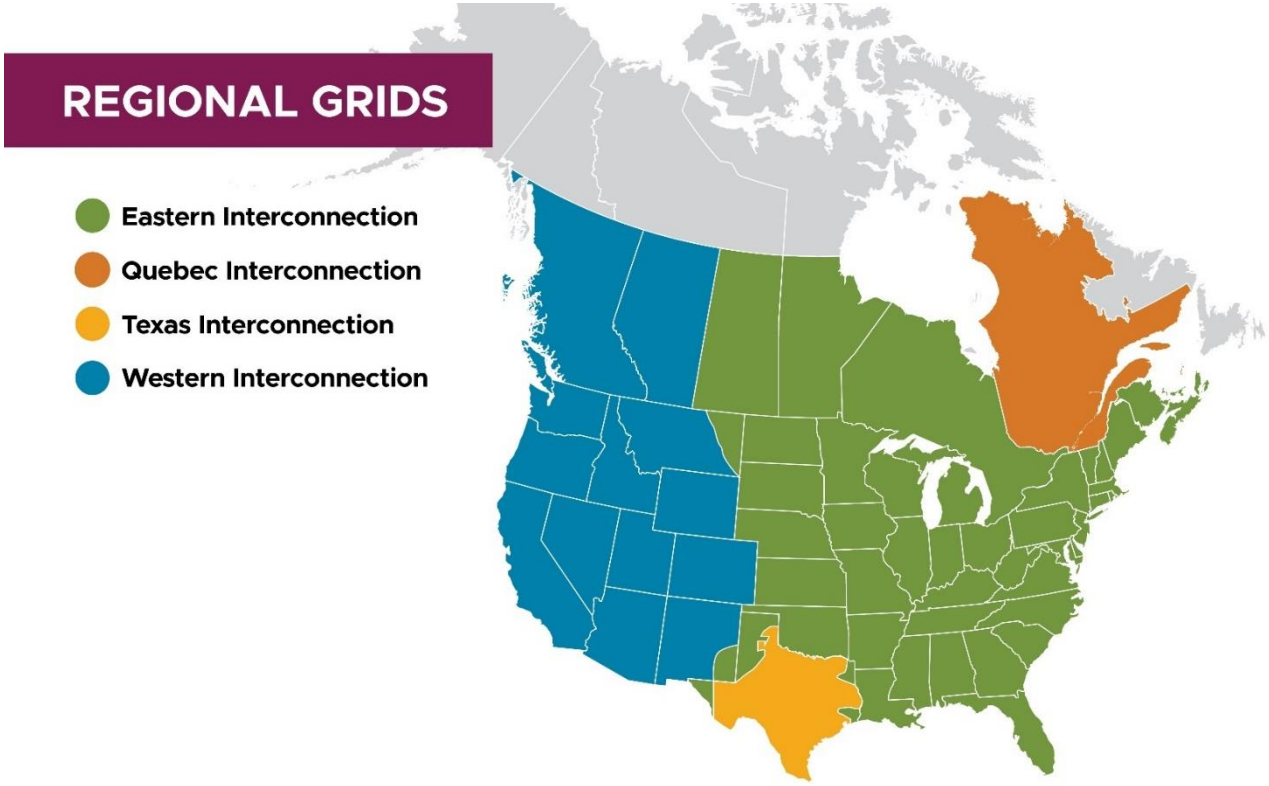


Figure 2.3.6.A Regional grids - (Image by Stephanie King | Pacific Northwest National Laboratory)

NERC also groups North American Electric Utilities geographically into six regions for enforcement of reliability standards.

As an entity under NERC, VEC is registered as a Distribution Provider (DP). Distribution Providers with applicable facilities are subject to 33 separate reliability standards. Because of the amount of load VEC serves (<100MW) and the type of facilities VEC owns, only 16 of the NERC standards are applicable.

Northeast Power Coordinating Council (NPCC)

NPCC is one of seven Regional Entities which, together with the North American Electric Reliability Corporation (NERC), make up the Electric Reliability Organization Enterprise. As a part of the ERO Enterprise, NPCC is committed to the collective vision of a highly reliable and secure North American bulk power system and shares the joint mission of assuring the effective and efficient reduction of risks to the reliability and security of the grid for New York, New England, and Quebec. NPCC also performs the auditing and enforcement of the 93 currently active NERC and Regional Reliability standards. The applicability of these standards is dependent on the type of Entity an electric utility is (e.g., – ISO, Transmission Owner/Operator, Distribution Provider, Load Serving Entity, Generation Owner/Operator, etc.) Applicability of each standard is dependent on the type of entity, amount of load served, and the facilities each entity owns. As an example, a distribution provider that does not provide electric service to a nuclear facility will not be subject to compliance for the reliability standards associated with nuclear facilities.

Independent System Operator – New England (ISONE)

An Independent system operator (ISO) is an independent, federally regulated entity established to coordinate regional transmission in a non-discriminatory manner and ensure the safety and reliability of the electric system. ISONE is the independent, non-profit Regional Transmission Organization, headquartered in Holyoke Massachusetts, serving Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. ISONE is subject to NERC reliability Standards as a transmission operator (TO) and transmission planner (TP).

2.4 The Five Challenges We Face and our Takeaways

In addition to meeting the requirements laid out in Appendix B, we focus our efforts based on the following five challenges:

1. Decarbonizing the energy ecosystem
2. Just transitions and energy equity
3. Maintaining a reliable electric grid
4. Supporting a rapidly shifting centralized and decentralized grid
5. Providing our members with choice

The takeaways from these challenges are discussed further below and more detail can be found within the IRP

2.4.1 Decarbonizing the Energy Ecosystem

In 2021, VEC committed to 100% Carbon Free by 2023 and 100%Renewable by 2030. VEC has unhedged energy in each year b beginning in 2023 and our analysis in this plan anticipates how we might cost effectively meet both targets.

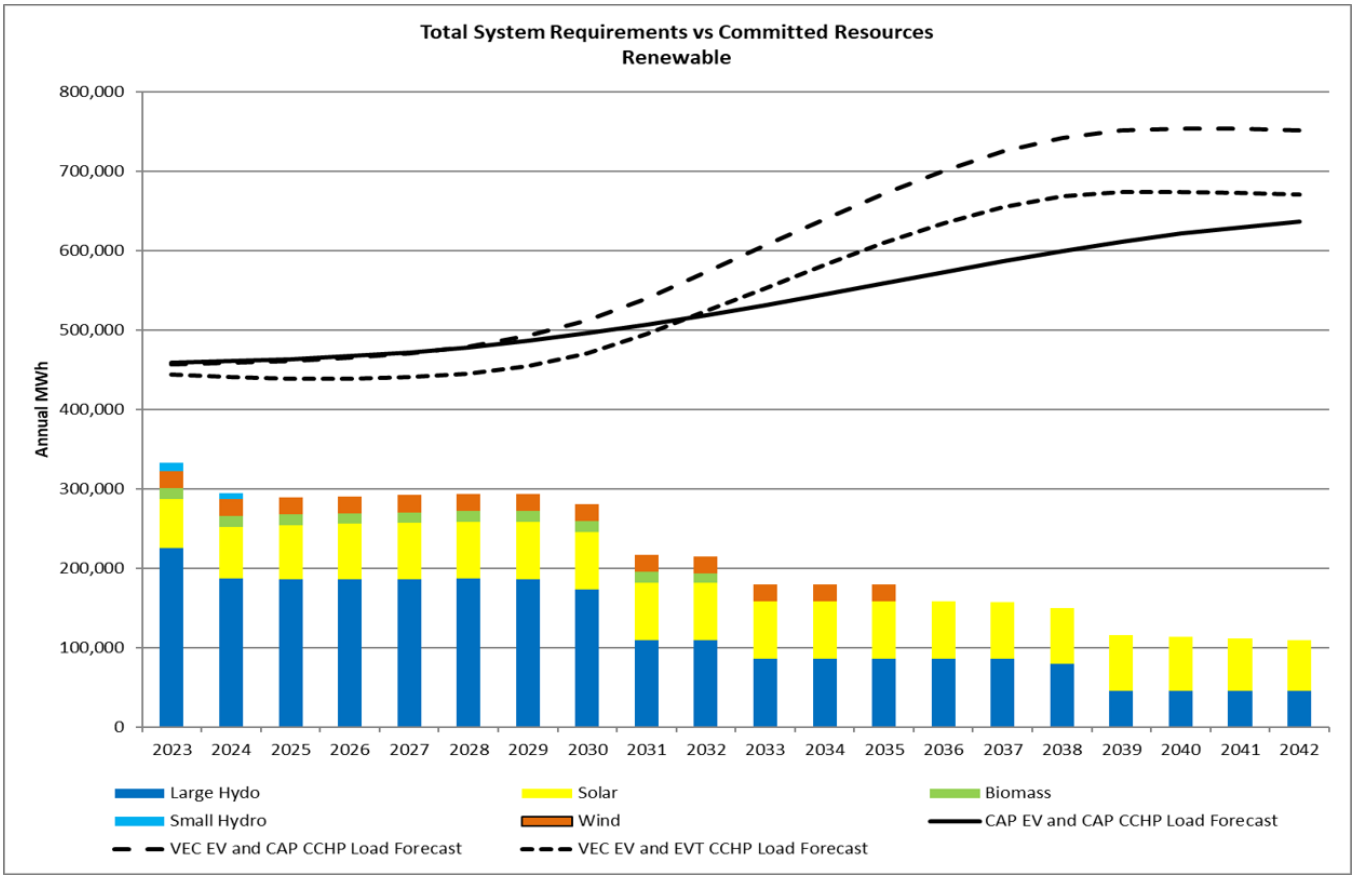


Figure 2.4.1.A VEC Total System Requirements Versus Committed Renewable Resources

In addition, the Global Warming Solutions Act (GWSA) proposes an **80% reduction in carbon** from 1990 levels by 2050. To meet these ambitious goals VEC will need to play a critical part in incentivizing electrification, investing in the electric grid and decarbonizing its generation profile.

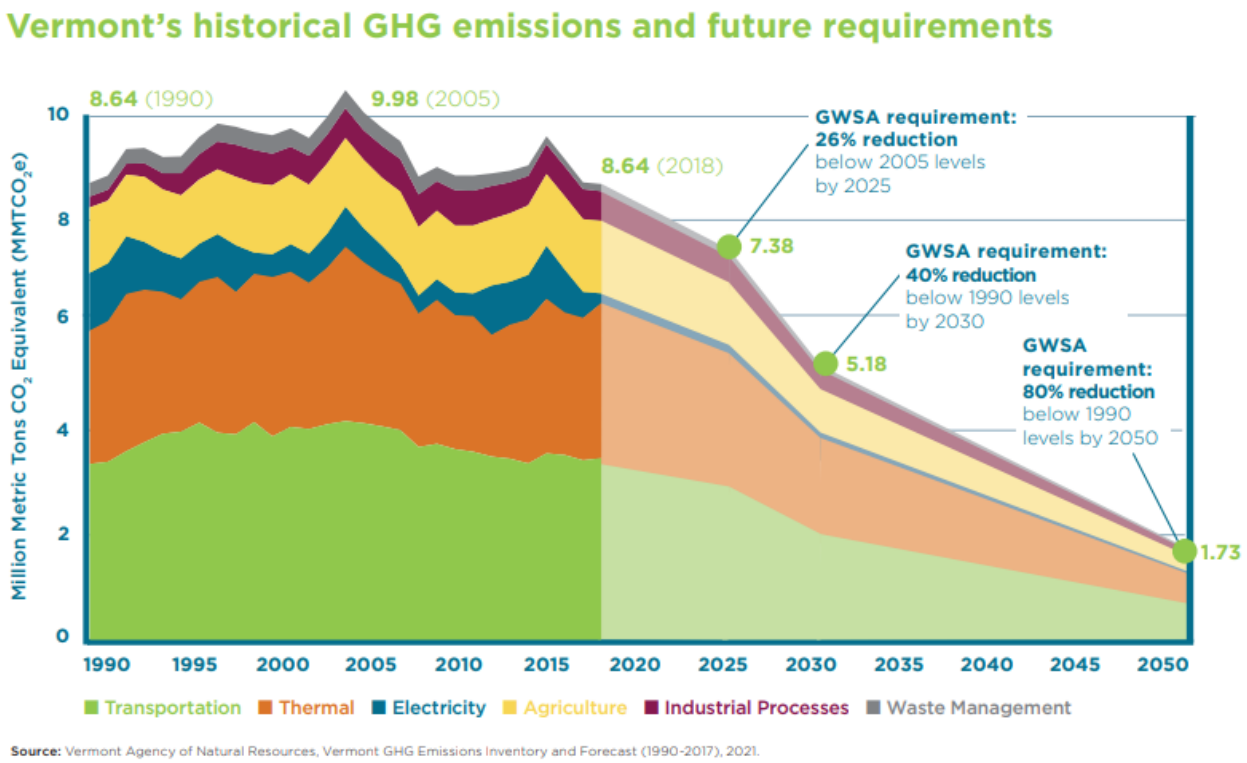


Figure 2.4.1.B Energy Action Network (EAN) progress report

These goals not only help us meet the climate challenges we face but will also decrease the overall energy use of our members' households and businesses. The chart above, along with more detailed information, is available here.

Summary of Takeaways

For each of our challenges we have provided a high-level summary of our takeaways with further discussions occurring within our 10 IRP sections.

Analyses	Takeaways	IRP Section Discussed
What is the cost of going to 100% Carbon Free by 2023 and 100% Renewable by 2030 on an annual basis?	• Buying RECs from existing resources would be the cheapest way to reach 100% Carbon Free. • Off-Shore Wind is the least-expensive new resource, but we need to find a way to be included in the solicitations as these are large projects that historically have negotiated contracts at the state level in Massachusetts and Connecticut. • On-shore wind and utility-developed solar can be reasonably competitive with Off-Shore Wind, but the relatively low capacity factor requires contracting with a significant amount more MW than Off-shore wind to acquire a similar volume of energy. • As more utilities in New England set goals to move to	Section 4

	energy portfolios made up entirely of renewable resources, VEC being 100% renewable on an annual basis will become more difficult and eventually unsustainable.	
What are the costs and challenges of serving VEC's 2030 load with a 100% Renewable energy on an hourly basis (24/7)?	• Diversity in resources is key to maintaining reliability as well as being able to move to 100% renewable. • We need clean, reliable baseload or more cost effective solar to get us through the night and the growing load of the winter • We have work to do to educate ourselves, regulators and energy stakeholders, and this education will be ongoing as new technology and options are developed. • Off-Shore Wind is likely the most cost-effective new renewable resource currently available. • Utility-developed or -procured solar will likely have to a role in reaching our 100% renewable goals cost-effectively as its output shape complements that of Off-shore and On-shore wind an annual basis. • Our current utility scale battery strategy of contracting for peak shaving purposes will likely need to change soon for more flexibility in deployment and to capture other value streams.	Section 5
What can we do to enable distributed generation and promote affordable renewables?	• Educate and collaborate with regulators and energy stakeholders • Enhance the interconnection process through data transparency and new technology • Continue to support SHEI grid constraint mitigation, including system upgrades • Advocate for a statewide Off-Shore Wind procurement where Vermont teams up with another NE state to contract with a developer.	Section 5
How are we meeting our Energy Transformation goals?	• Through Heat Pumps and our Clean Air Program we have exceeded our Tier 3 goals • To continue growth in Energy Transformation, we need to expand partnerships with EVT and Vermont utilities • Infrastructure upgrades are currently enabling energy transformation.	Section 4
Can the grid support the additional load growth?	• We need to continue to invest in infrastructure to meet generation and electrification demands. • Annual system planning and modeling is necessary to stay ahead of infrastructure upgrades. • Load management is a key tool in the toolbox to meeting the load growth needs. • We need to mitigate supply chain constraints	Section 5

What is the cost of going to 100% Carbon Free by 2023 and 100% Renewable by 2030 on an Annual Basis?

In 2021, VEC committed to 100 percent Carbon Free by 2023 and 100 percent Renewable by 2030. Today, about 75 percent of VEC's power comes from non-carbon-emitting sources. The remaining 25 percent comes primarily from natural gas as well as other fossil fuel sources - sources which VEC will be moving away from. VEC's 2020 initial power supply mix is shown in the chart below. This chart does not represent the Renewable Energy Certificates (RECs) associated with the energy, but rather the initial fuel sources of the energy VEC purchased to meet the demand of its membership in 2020.

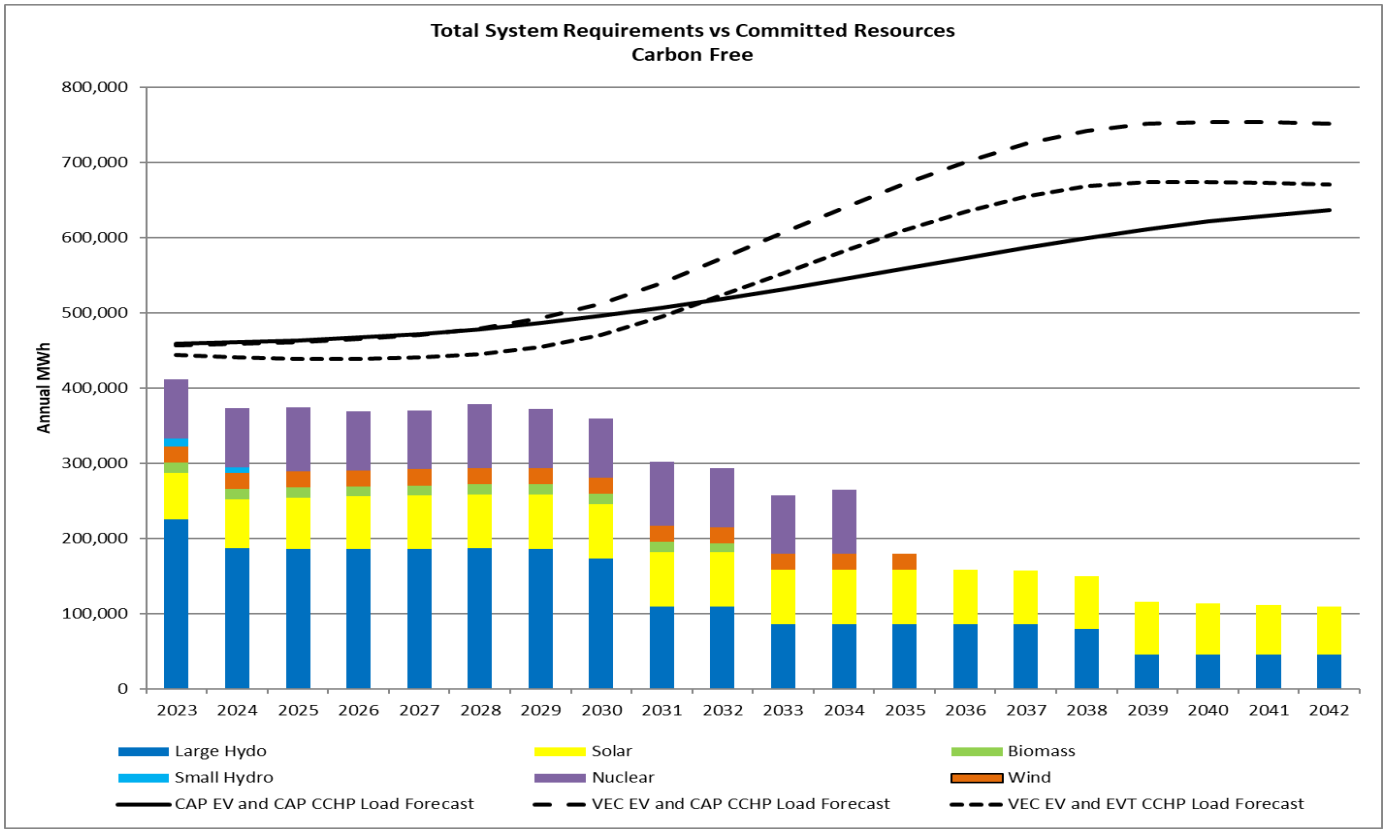


Figure 2.4.1.B VEC Total System Requirements Versus Committed Carbon Free Resources

As VEC moves to 100% Carbon Free from 2023-2029 it will need to acquire RECs, or environmental attributes in the case of energy from a nuclear facility or Hydro-Quebec, equal to 100% of its load on an annual basis. Doing so with environmental attributes from nuclear or Hydro-Quebec or RECs that qualify for Vermont's Tier I RES standard will be the least expensive option.

Technology	Low Rate Impact	High Rate Impact
RECs only	0.3%	1.4%
Existing Resource+ RECs	0.3%	1.9%
New In-state Solar - $80/MWh (~ Utility Scale PPA price)	2.7%	3.8%
New In-State Solar – $140/MWh (~net metering price)	9.2%	10.3%

Figure 2.4.1.C 100% Carbon Free Annual – 2023-2029 Total Rate Impact

The impacts of moving to 100% renewable from 2023-2029 are shown below:

Technology	Low Rate Impact	High Rate Impact
Existing Hydro	0.4%	4.0%
New Off-Shore Wind - $80/MWh	-2.8%	1.5%
New In-state Solar - $80/MWh	-0.5%	3.6%
New In-state Biomass - $100/MWh	3.2%	7.8%
New In-State Solar – $140/MWh	10.4%	16.2%

Figure 2.4.1.B 100% Renewable Annual – 2023-2029 Total Rate Impact

Further analysis of both commitments is discussed in Section 4.

What are the Costs and Challenges of Serving VEC's 2030 Load with a 100% Renewable Energy on an Hourly Basis (24/7)?

As more utilities in New England set goals to move to energy portfolios made up entirely of renewable resources, VEC being 100% renewable on an annual basis will become more difficult and eventually unsustainable. The excess energy from resources needs to be sold to back to ISONE. As the number of load-serving entities purchasing this energy decreases the excess energy will no longer have anywhere to go. Additionally, as has been stated by ISONE, to maintain reliability, there will be a need for baseload resources to fill the gap when wind and solar resources are not available.

No single resource paired with energy storage is a financially feasible in meeting our 100% renewable. The least expensive new renewable resources appear to be Off-shore Wind due to its competitive price compared to other new renewable projects, high capacity factor, and its ability to generate in the middle of the night.

	Solar	**On-Shore**	**Off-Shore**	**Biomass**
Description of Resource	Utility Scale PPA	Wind sited in Vermont	Wind sited outside of Vermont	3 facilities in Vermont
MW of New Resources	1,570	8,280	299	85
MWH of baseload (modeled as battery storage)	2,445	125	40	22
Hours Drawn from Storage to Serve Load - Annual	4,796	14	16	54
MWh Drawn from Battery to Serve Load - Annual	191,297	213	95	204
MWh Sold to ISO from Excess Resources - Annual	1,964,446	23,877,524	967,744	393,028
Revenue from Sales of Excess Energy to ISO - Annual	($119 million)	($1.9 billion)	($72 million)	($25 million)
Net Cost (annual increase)	$83.4 million	$35.7 million	$33.4 million	$46.3 million

Figure 2.4.1.C 100% Renewable Hourly net cost of resources

Moving to 100% renewable on an hourly basis brings the difficult challenges of needing to balance the system. No single resource alone can meet the energy needs of Vermont. It's clear that a combination of resources is needed that complement each other through various times of the day/year.

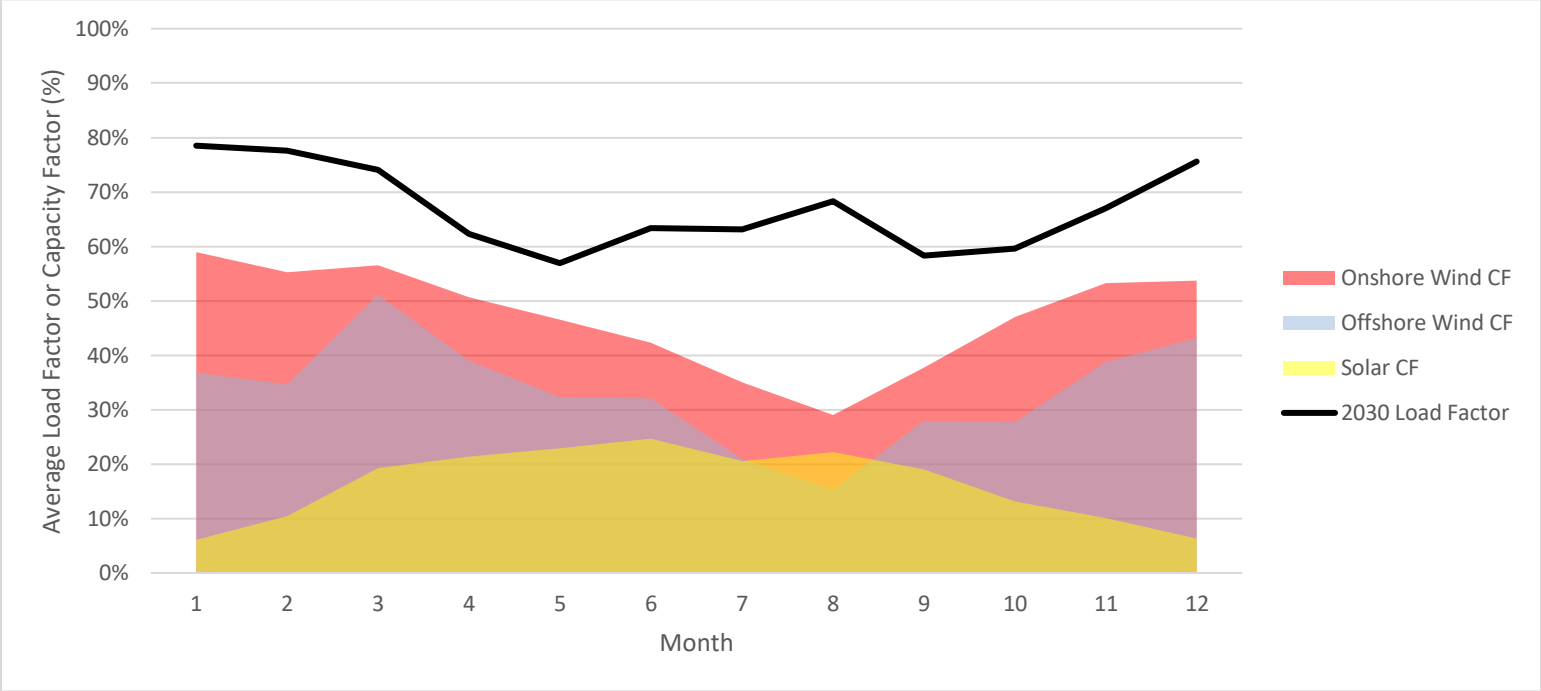


Figure 2.4.1.C Monthly average capacity and load factor of solar and wind.

Solar can be a complement to Off-shore wind because its output increases in the summer while that of Off-shore and On-shore wind tends to decrease in the summer and increase through the fall and winter. However, on an hourly basis there are hours when no combination of solar and wind will meet the load requirements we need to serve.

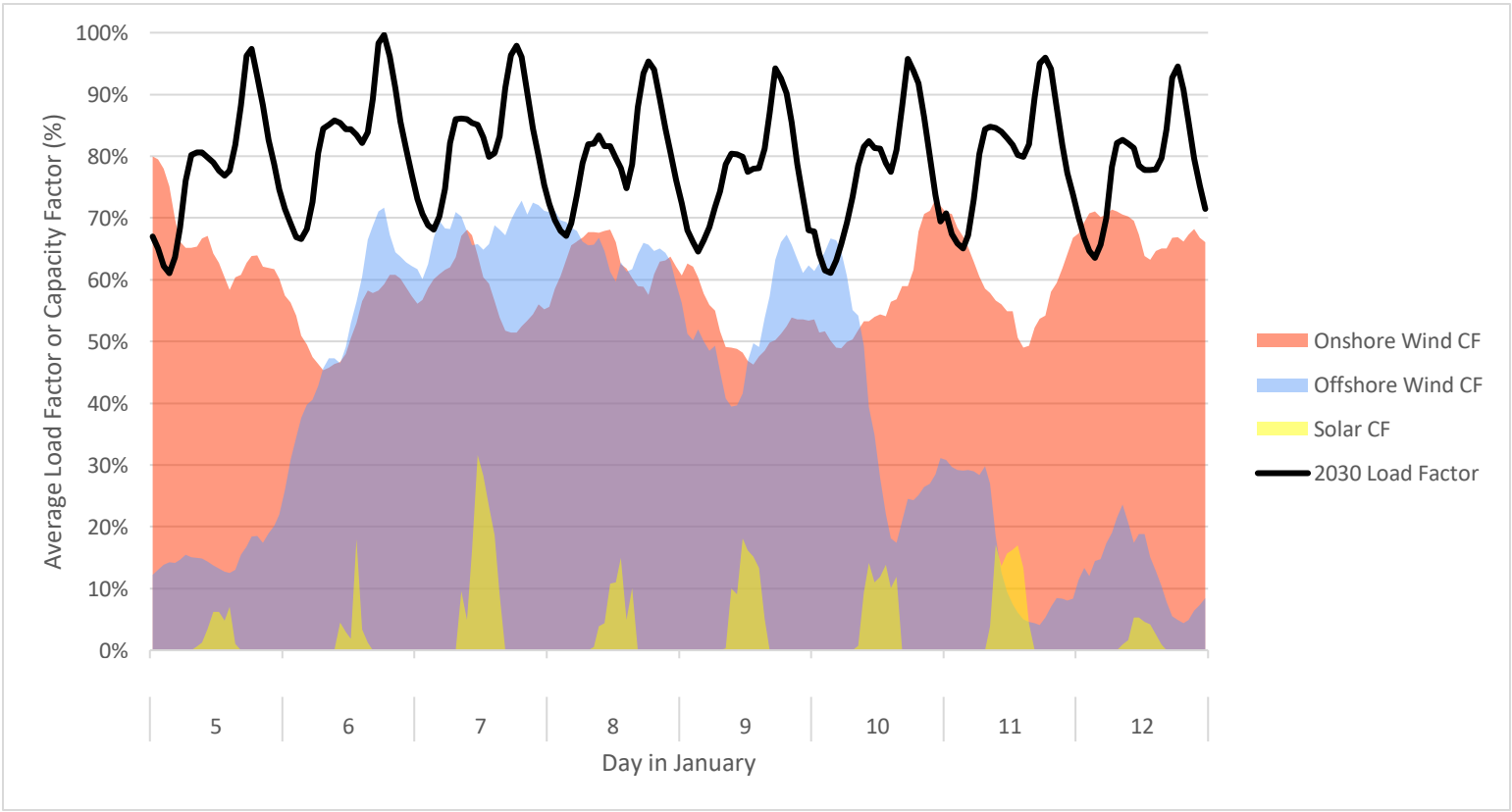


Figure 2.4.1.D Output of wind and solar during a low solar week in January

In all scenarios a significant level of baseload supply, which has been modeled as battery storage, will be required to maintain the reliability of the system at times when intermittent resources are not generating sufficiently and when load and generation change on an instantaneous basis. Further analysis is discussed further in Section 5.

What can we do to enable distributed generation and promote affordable renewables?

VEC currently has almost 46 MW of distributed generation installed on its system (22.8 MW of which is net-metering solar).

Enhance the interconnection process through data transparency and new technology

VEC provides developers, regional planning commissions and its members a map of generation constrained areas on its website. The map is updated as new constraints are identified; however, as part of an effort to make this information more useful and increase transparency VEC is working to make this map and corresponding layers available through its ArcGIS online portal. This effort is discussed further in Section 6. VEC also sees the need for more sophisticated generation hosting capacity tools and is working with vendors to scope out what this might look like.

Educate and collaborate with regulators and energy stakeholders

Our regulators and regional planning commissions rely on us to educate them on both the reliability and affordability impacts of distributed generation. There are lots of challenges we face in meeting the targets of the energy future and we look forward to continuing to collaborate with and educate ourselves alongside regulators and energy stakeholders.

Continue to support SHEI grid constraint mitigation, including system upgrades

VEC's SHEI constraint has created challenges for our members, neighboring distribution utilities, grid operators and renewable developers. Since the load in the region is often low (spring and fall) when generation from wind and hydro tend to be high, there is excess generation that needs to flow out on a constrained transmission system. System upgrades are in progress on the subtransmission and transmission systems that will mitigate many of these constraints given the current quantities of distributed generation in the region. In the meantime, VEC has supported mitigation fees for projects larger than 150kW located in this area. This is discussed further in Section 5.

How are We Meeting our Energy Transformation Goals?

Critical to meeting the challenge of decarbonizing is electrification of the thermal and transportation sectors in Vermont. Since 2017, VEC has exceeded its Tier 3 requirements and provided over 3,000 members with incentives on Heat Pumps, EV's and a whole menu of electric alternatives.

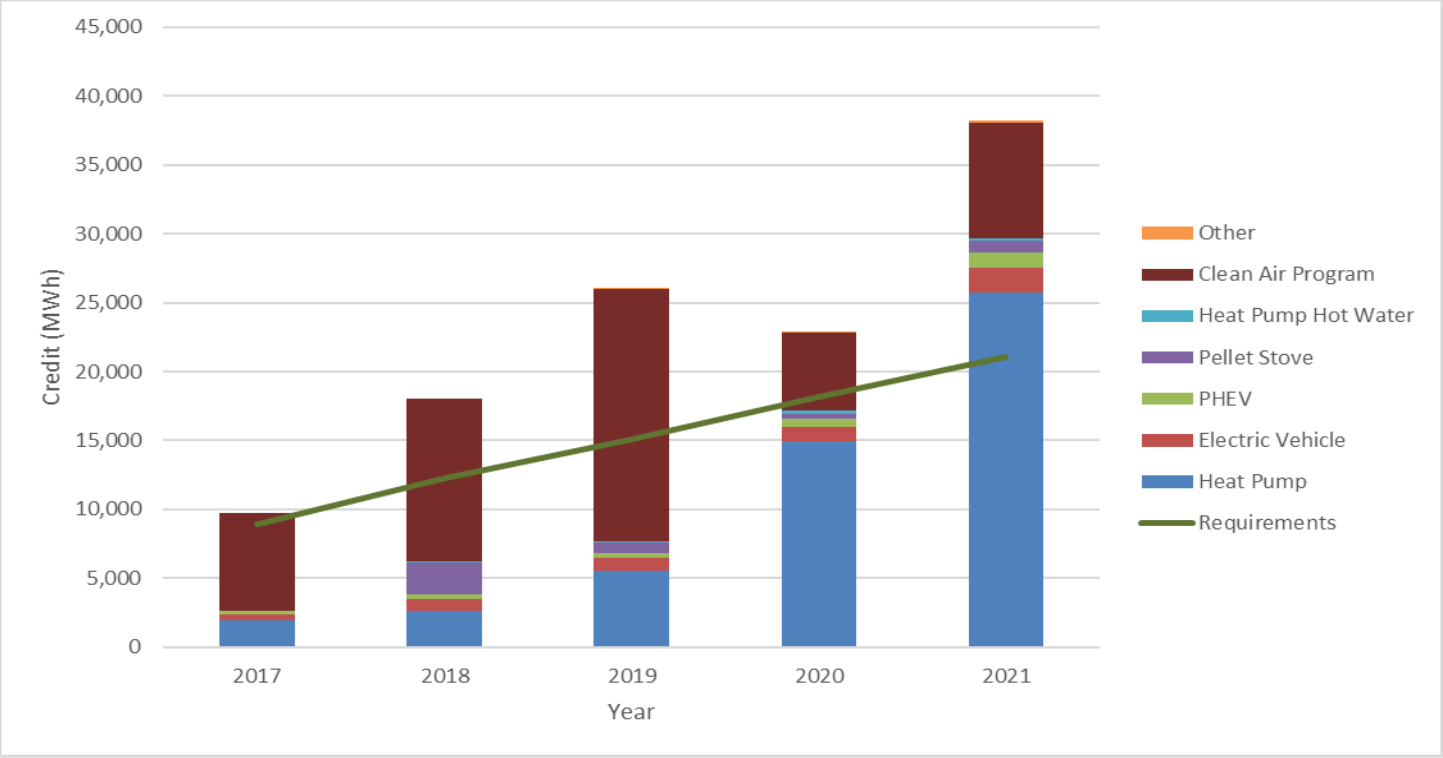


Figure 2.4.1.C VEC Tier 3 requirements and measures 2017-2021

VEC expects to continue meeting these targets through a focus on innovative pilots and partnerships with Vermont's distribution utilities and EVT. This strategy and forecast are discussed further in Section 4.

Can the Grid Support the Additional Load Growth?

Infrastructure for Electrification

VEC is forecasting a ~40% impact to peaks without load management. This creates a host of challenges in prioritizing investment to maintain and improve an extensive and aging infrastructure while balancing cost to the membership. In some sections of VEC's territory this infrastructure is approaching its end of useful and in some cases has passed its expected life. Undersized and high loss conductor provide the biggest area of concern. Annual system planning and modeling is necessary to stay ahead of infrastructure upgrades

6A Copperweld, #6 Steel, and 8D Amerductor make up approximately 10 percent (568 conductor miles) of VEC's distribution plant. We hope to remove the #6 Steel, and 8D Amerductor wire by 2030 and continue replacing the 6A Copperweld. This is discussed further in Section 5.

Free Transformer Upgrades for Electrification

Through VEC's tariff VEC can offer economic incentives such as transformer upgrades to members electrification needs for EV or Heat Pump load. The goal of this program is to provide relief from unintended financial consequences such as member purchasing a new EV to reduce carbon but not realizing the transformer serving their home cannot handle the additional load. In addition, VEC is looking into providing incentives towards service upgrades that include moving from a 100-amp to 200-amp panel if the load growth is for electrification of a heat pump or EV. This is discussed further in Section 5.

Load Management

In addition to investing in infrastructure a key component in meeting our electrification targets is load management. The grid is designed to support peak load and being able to shift or manage the load from these new electric devices is critical to maintaining reliability and keeping rates affordable. This is discussed further in Section 4.

Mitigating Supply Chain Constraints

Supply chain issues and inflationary pressures have a significant impact on VEC's ability to provide the most reliable and lowest cost electric service to our members. VEC continuously monitors market intelligence reports and weekly updates from our primary equipment vendor WESCO to understand current impacts, make judicious business decisions (e.g., reprioritization work), and forecast future effects. VEC is addressing these challenges by increasing inventory, sourcing materials from other vendors, and keeping stakeholders across our membership and at VEC informed of status and pricing. While VEC continues to look for innovative ways to mitigate the impacts of the supply chain and increasing inflationary pressure on material prices, we cannot eliminate all risk to our members. This is discussed further in Section 8.

2.4.2 Just Transitions and Energy Equity

The coming years will bring continued cost pressures that will test all utilities' commitment to their members, particularly Low-to-Moderate Income (LMI) members who often have high energy burdens. As a cleaner and more modern energy system evolves over time, there should be long-term cost reductions for VEC members in aggregate. But in the meantime, hurdles remain for many of our members to take that step. The up-front cost of moving to heat pump heating, purchasing an electric vehicle, or moving toward solar energy, can be prohibitive. As is suggested in the state's 2022 Draft Comprehensive Energy Plan, it is imperative that VEC take specific steps to assure equity as the energy economy changes, to guarantee a just transition that serves all VEC members. In fact, the transition presents an opportunity to support Vermonters who have not had access or ability to participate in the building of or participation in, a more inclusive energy system.

Summary of Takeaways

Analyses	Takeaways	IRP Section Discussed
What have we done to keep our rates low? What does the future look like?	• Over the last ten years VEC has had an average rate increase of less than one percent a year, well under the rate of inflation. • We are piloting and implementing cost effective load management programs to reduce transmission costs. • We have consistently achieved financial goals to maintain stability, keep borrowing rates low, and obtain least-cost power supply contracts. • We have and will continue to seek grants to supplement VEC investment.	Sections 3, 4
How do we enable membership-wide participating in energy transformation?	• Promote Low and Middle Income (LMI) incentive adders for electric vehicles and heat pumps. • Implement on bill financing pilot projects. • Seek energy equity in energy transformation programs through eligibility and incentive design.	Section 3
How many LMI and fixed income members do we have?	• Around 50% of our members are on fixed incomes or not employed.	Section 3

	• Around 18% (6,528) of our members have an income at or below 185% of the Federal Poverty Level (FPL).	
What can we do to support LMI members?	• Promote arrearage assistance funded programs. • Implement rural and high energy burden pilot projects. • Advocate for energy equity.	Section 3
How do we promote affordable renewables?	• Educate regulators and energy stakeholders • Continue to share economic impacts to the membership.	Section 5

How do we keep our rates low?

A priority in promoting a just transition for our members is a simple, tried-and-true strategy: keeping rates as low as possible. Over the last ten years VEC has had an average rate increase of less than one percent a year, well under the rate of inflation. We continue to keep this critical strategy front-of-mind during the energy transition.

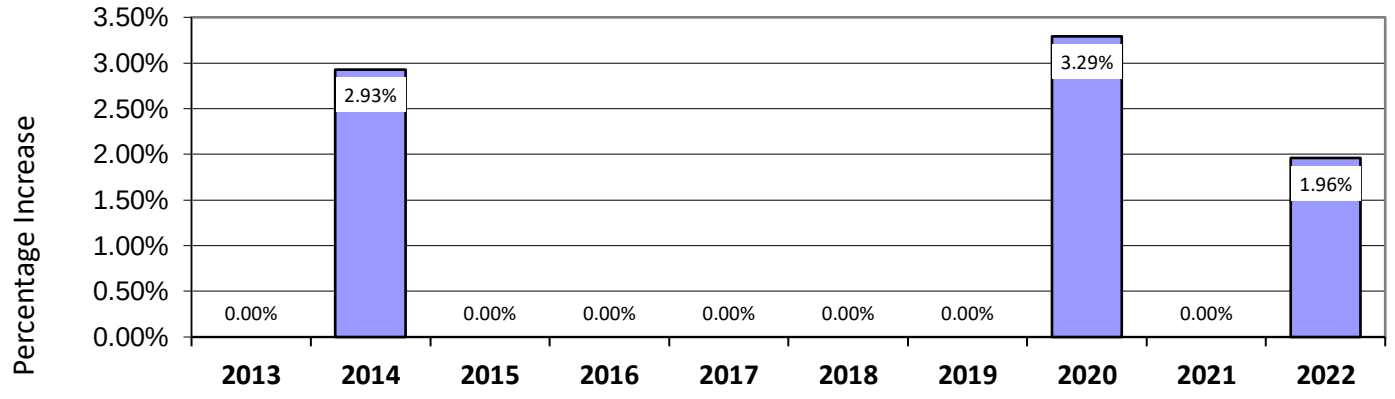


Figure 2.4.2.A VEC Rate increases 2013-2022

With additional transmission investment due to condition and new generation, VEC's transmission costs are expected to rise. To combat this VEC intends to continue investing in load management for peak shaving and working with VELCO to reduce costs.

Load Management for Peak Shaving

VEC's transmission costs are a function of its load in the one-hour Vermont monthly peaks and ISONE annual peak. Current NEPOOL rates for transmission are approximately $10.00/kw-month. VEC can reduce its costs by up to $200,000 in the year if it was able to reduce its load by 1 MW in each of Vermont's 12 monthly peaks and the annual ISONE peak.

	Number of Peaks	Approximate Hours to Hit Peak	Approximate Dollars Saved per MW
VT Monthly	12	340	$130,000
ISONE Yearly	1	60	$70,000
Total	13	400	$200,000

Figure 2.4.2.A VEC estimated hours needed to hit peaks and estimated dollars saved

VEC currently has around 1.3 MW of flexible load resources and details its plan to continue expanding in Section 4- Energy Transformation. Our goal is to pilot programs that are cost effective for our membership and available to all. Both items are discussed further in Section 5.

How do we promote affordable renewables?

Educate communities and energy stakeholders on energy issues

Currently, VEC has almost 46 MW of distributed generation installed on its system and 22.8 MW of that total is net-metering solar. In case No. 22-0334-INV, the department states that: *"Net metering has been, and remains, the most expensive pathway for Vermont to meet its renewable energy goals. In other words, renewable energy can be obtained, and built in State, in a less expensive way … Net-metering also continues to result in a cost shift from participating customers to non-participating ratepayers."*

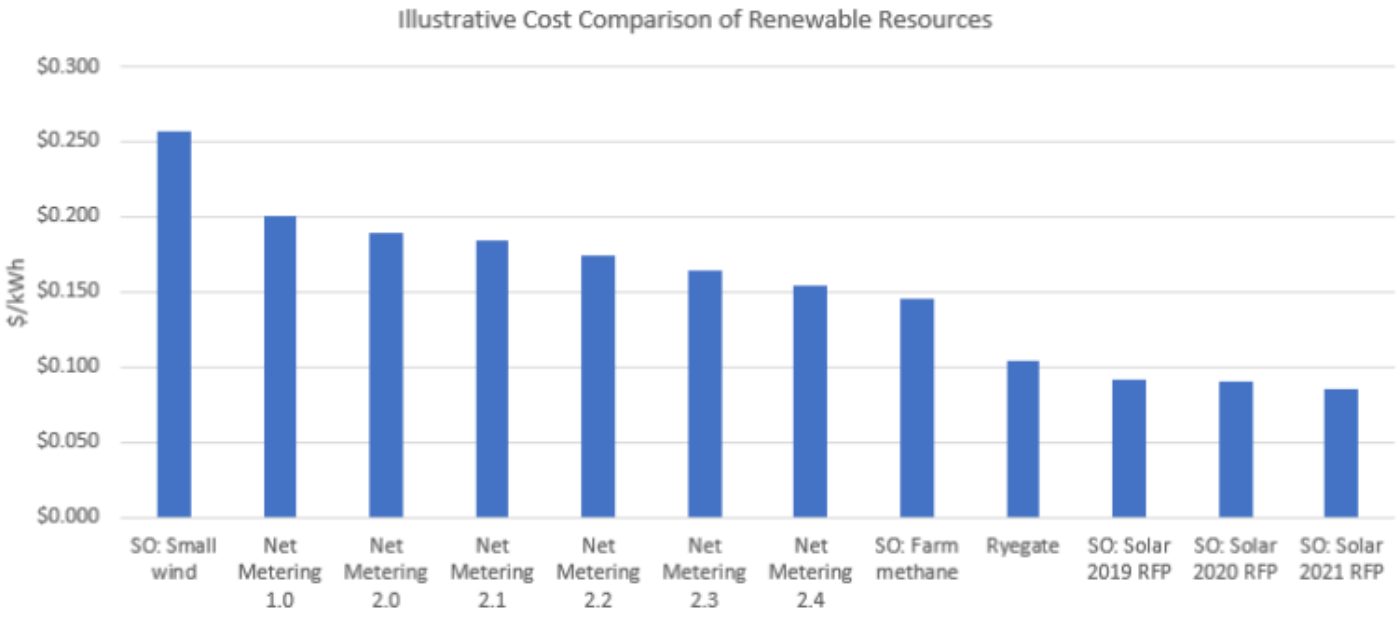


Figure 2.4.2.B Case No. 22-0334-INV Comparison of Renewable Resources

VEC agrees that net metering is the costliest way to develop renewable resources in Vermont. The same project developed through a power purchase agreement or Standard Offer would cost three to four cents less per kilowatt-hour than the rates required under the net metering program. VEC supports the installation of solar at homes and businesses and believes that net metering projects should be limited to those co-located with and sized appropriately for the load they are intending to serve.

VEC discusses net metering and the way we believe we can meet a clean and affordable future in Section 5.

Develop new strategies to boost Community Solar participation

VEC has three community solar projects

- Alburgh Solar (3,996 panels, 1 MW, 100% sponsored)
- Magee Hill Solar (4,914 panels, 1.3 MW, 50% sponsored)
- Grand Isle Solar (19,490 panels, 4.8 MW)

We continue to see our members participating in our program and have sponsored 23% of the total capacity of the three sites. This equates to over 6,500 panels or about 1.7 MW). We are pursuing grant funding to subsidize the enrollment of income-qualified members into VEC's Community Solar program. Participation in the program will provide direct benefits to members through monthly bill credits for a 10-year term, thus reducing their bills. Participation would also engage these members in our energy transformation future. This is discussed further in Section 5.

How many LMI and fixed income members do we have?

When Efficiency Vermont published the 2019 Energy Burden report https://www.efficiencyvermont.com/news-blog/whitepapers/vermont-energy-burden VEC was not surprised to learn that VEC serves eight of the ten towns, and three of the top five counties, with the highest energy burdens in the state. In VEC's 2021-member survey of over 1,000 members, almost 50 percent of respondents were on fixed incomes or not employed. Within VEC districts, and between VEC districts, we have significant income diversity. We have an older and rural demographic (lower and fixed incomes) in many parts of our service territory.

VEC implements a professionally designed and statistically significant member survey annually where we collect self-reported household size and income data from a sample of VEC members. Approximately one-half of reporting members are on fixed incomes, approximately 13 percent of survey respondents would classify at or below 100 percent FPL and 18 percent would classify at or below 185 percent FPL. Within VEC districts, and between VEC districts, there is significant income diversity.

How do we enable membership-wide participating in energy transformation?

An important goal, that we continue to track, is for our energy transformation program uptake to reflect our energy equity goals. In 2021, there were 493 (self-reported) low- and moderate-income (LMI) member participants in VEC's energy transformation program out of 3,060 total participants (16%). We have increased our targets for 2022 and continue to offer special incentive adders for electric vehicles. In 2022, we will be implementing an LMI heat pump program with financial support of Vermont Low Income Trust for Electricity (VLITE) and in partnership with Efficiency Vermont (EVT). In 2022, VEC also plans to participate in the on-bill financing pilot project in partnership with Vermont Housing Finance Agency (VHRA). VEC will continue to help members save money and avoid volatile fossil fuel prices.

What can we do to support LMI members?

In addition to keeping rates low and implementing cost effective renewables, VEC is focused on a variety of programs to assist members in paying their bills and participate in the energy transition. Energy burden is defined as the percentage of gross household income spent on energy costs. According to DOE's Low-Income Energy Affordability Data (LEAD) Tool the national average energy burden for low-income households is 8.6%, three times higher than for non-low-income households which is estimated at 3%. A survey in 2021 found that over 60% of Americans could not afford a home-related emergency that costs $1,000. Electrification of a home costs thousands of dollars in up-front costs but saves money over time in the form of on-going fuel cost reductions

VEC vigorously promotes the Vermont Emergency Renters Assurance Program (VERAP) arrearage assistance for income-qualified members. The VERAP assistance program (for income qualified renters) is still active. This is a program for residential renters who are facing eviction, are income qualified, and affected by COVID-19. The State just determined that members who recertify may now qualify for another additional three months of assistance

(paying up to eighteen months of bills). To date we have received $380,470 on behalf of our members. This program requires considerable effort from our member services and billing team. https://erap.vsha.org/

2.4.3 Maintaining a Reliable Electric Grid

Overall, VEC has seen a decline in both in duration and quantity of outages. Prior to 2009 large substation outages that were few in number had high member impacts affected much of VEC's system. After completing significant investment into these facilities, we are more focused downstream of these substations.

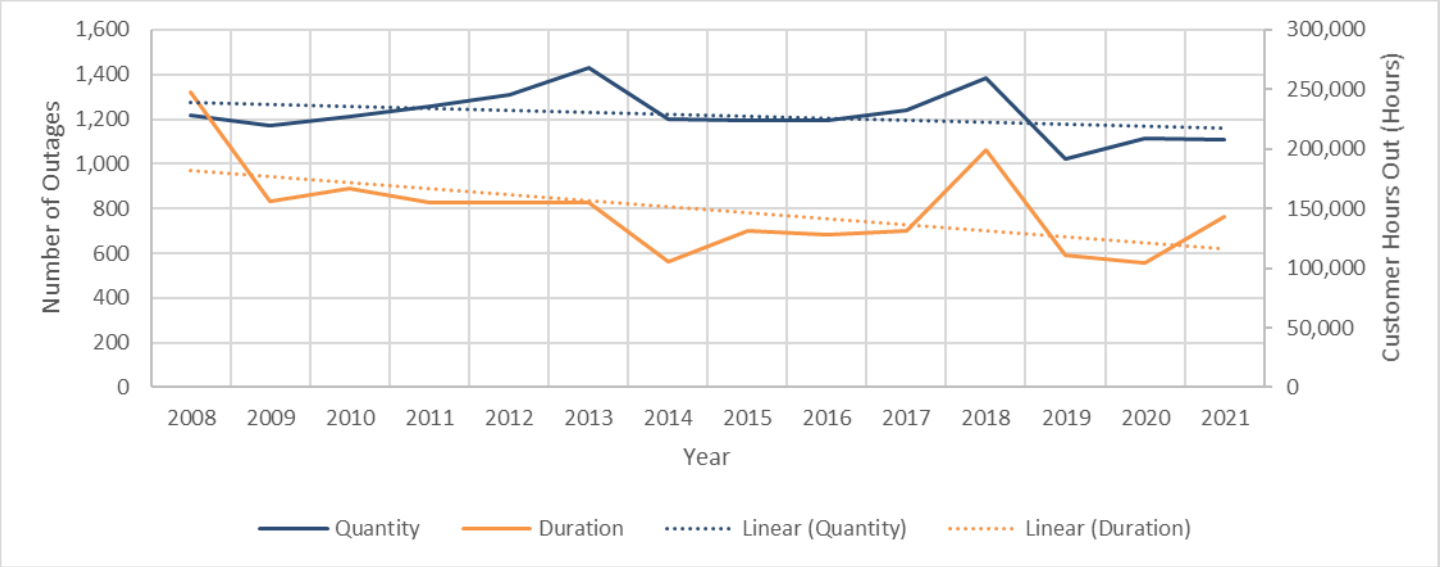


Figure 2.4.3.A VEC's outage quantity and duration 2008-2021

VEC continues to see increased outages due to more frequent weather events such as wind storms, wet snow or ice, and thunderstorms. Additionally, capacity constraints are increasing throughout the country and in the winter months for New England. VEC's priority remains to maintain reliability and balance investment in system resiliency.

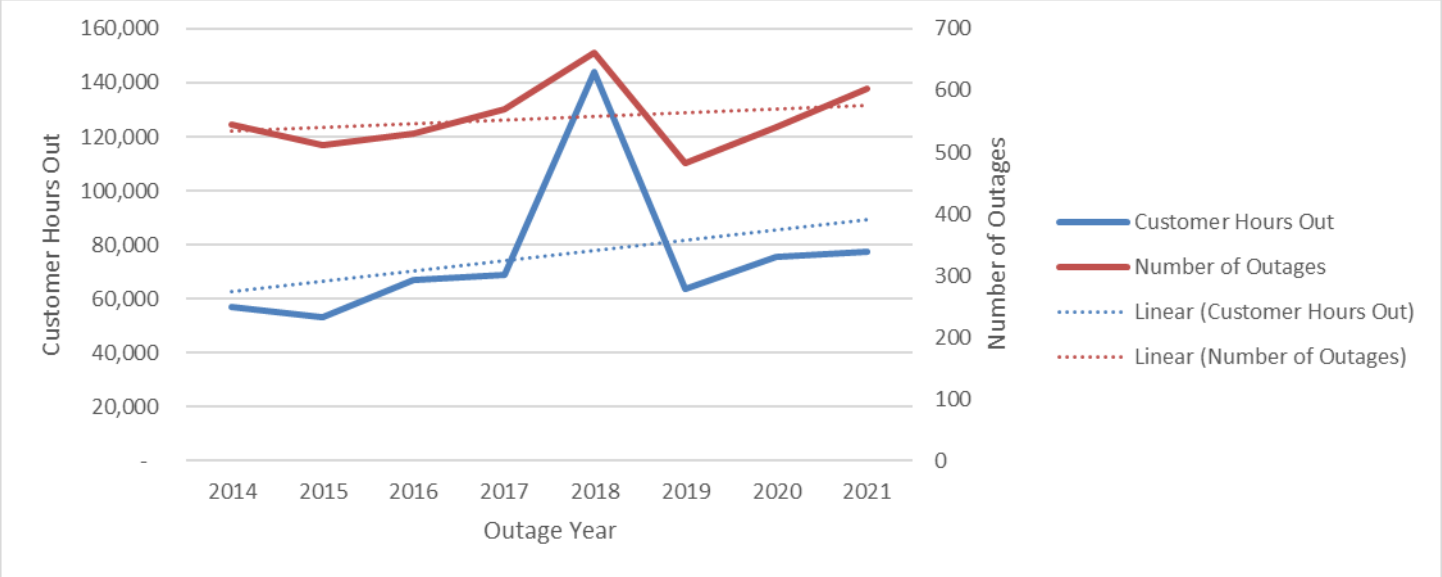


Figure 2.4.3.B VEC's weather related outages 2014-2021

Summary of Takeaways

Analyses	Takeaways	IRP Section Discussed
How are we maintaining reliability?	• Overall our outage quantity and customer hours out are decreasing. • Doing proactive maintenance through our systemwide Maintenance Plan will extend asset life in the long run and reduce preventable outages. • Reducing our vegetation cycle is also working but we need to explore nontraditional Vegetation Management strategies through satellite imagery and drones to gain further benefit. • Our outage management technology is fundamental to outage response, how do we identify and respond to outages quicker? • Our system is well sectionalized and protected which has reduced the number of members impacted during an outage event.	Section 7
How are climate impacts affecting our reliability?	• We are seeing an increase in weather related outages. • VEC is seeing an increase in minor storms. • The future will become warmer and wetter.	Section 7
Are we worried about transmission supply constraints and what are we doing?	• We are very worried about natural gas constraints at ISONE during winter months. The war in Ukraine has further exacerbated limitations in natural gas supply that are critical to the New England grid. • We need to expand our capacity to connect to Hydro Quebec during emergencies. • VEC is preparing for these challenges and implementing the Vermont Utilities Winter Preparedness Task Force recommendations. • Continuing to explore transmission level storage and federal funding opportunities will help.	Section 7
What are we doing to prioritize cybersecurity efforts?	• Find the balance between cyber resources and compliance. • Dedicate resources to threat detection and management. • Ensure internal KPI and C2M2 compliance. • Adhere to industry wide best practices and companywide training.	Section 6
What does resiliency look like for VEC?	• Investing in strategic line relocations, feeder backup, and undergrounding has improved reliability for our members. • We will need to explore resiliency as a service if we want resiliency in homes. • Microgrids are a tool in the resiliency toolbox. To implement them, we need to educate communities, find grants and partnerships and learn from others.	Section 7

How are Climate Impacts Affecting our Reliability?

An August 2021 report prepared by NorthView titled "Extreme Weather and Climate Change in Vermont: Implications for VEC's Asset and Storm Planning" indicated that *"High confidence results show that Vermont's climate*

is warming and becoming wetter, both of which will likely continue to increase into the future… Overall weather-produced distribution system outage impacts are expected to increase by approximately 6% through 2049."

Additionally, VEC's analysis shows that the number of minor storms is trending up, especially for VEC and GMP. In January of 2021, GMP and VEC collaborated on a multi-year review of the frequency and impact of minor storms to validate this information. VEC defined a minor storm day as any day where at least 2.5 percent of customers were out and there was a minimum of 15 outages for VEC and 75 for GMP.

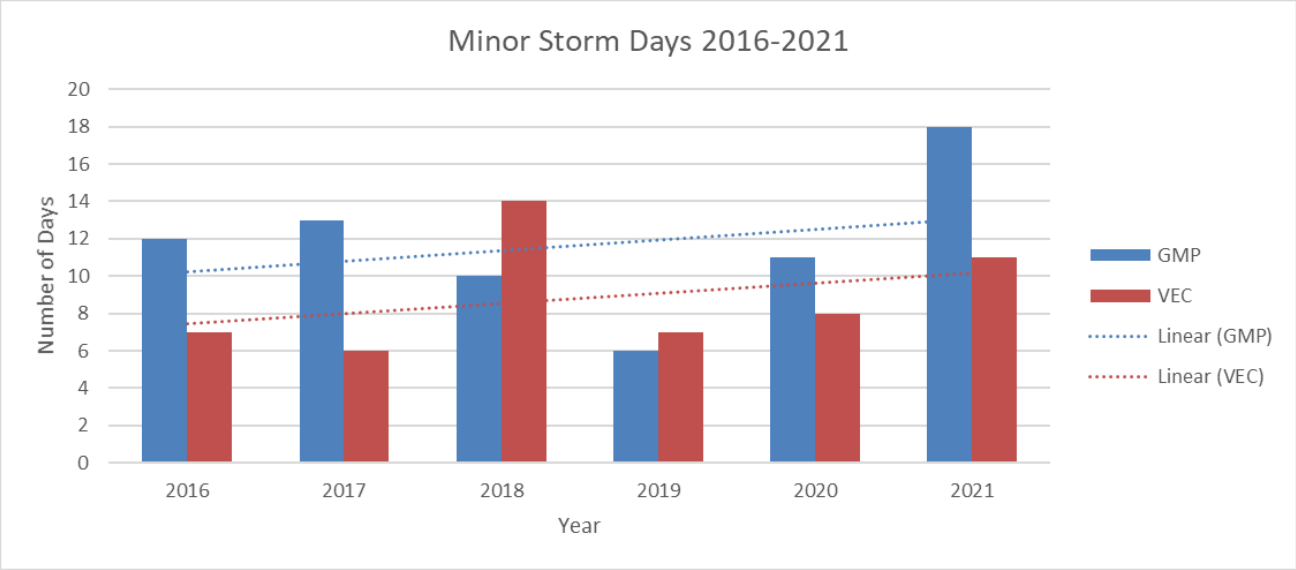


Figure 2.4.3.B Minor Storm Days (2016-2021)

VEC maintains close relationships with research institutions, weather forecasters, and weather-related industry partners to continue to understand how climate is impacting our electrical grid. This is discussed further in Section 7.

How are we Maintaining Reliability?

Explore satellite imagery Vegetation Management strategies and use of drones

Over the past 13 years, VEC executed its plan with a commitment to meet annual mile targets while remaining flexible to address immediate safety, reliability, and member concerns (e.g., hot spotting, danger trees, and Emerald Ash Borer). We are looking into satellite-powered vegetation management options to reduce costs and improve reliability. Satellites can provide in-depth monitoring of transmission and power lines and right of way encroachments from space with the goal of automating decision making to cut down on operating and maintenance (O&M) related costs.

Continue systemwide Maintenance Plan and condition-based assessments/replacements

We are almost finished with our third of five years of assessing and repairing/replacing assets throughout our system. Doing proactive maintenance through our systemwide Maintenance Plan will extend asset life in the long run and reduce preventable outages.

Expand outage management technologies and strategies for faster restoration

Our outage management technology is fundamental to outage response and we continually seeking new ways to identify and respond to outages quicker. Through implementing our ICS management platform Disastertech and further expanding our OMS we hope to meet those targets.

Monitor system protection as load continues to grow

Our system is well sectionalized and protected which has reduced the number of members impacted during an outage event. With 50-60% load growth projected on the system we will need to continually monitor the impacts to system protection to ensure reliability.

Are We Worried about Transmission Supply Constraints and What are We Doing?

Simple answer, very much so. In the winter months there is an increased concern of an energy emergency directly resulting from a multi-day extreme cold weather event in New England. During such an event, availability of natural gas is limited to a point at which power generation cannot be sustained. If equipped, generators switch to on-site fuel storage such as liquefied natural gas, liquid petroleum, and coal. These onsite fuel sources are finite and must be replenished to maintain the availability of those resources. Replenishment is anticipated to be difficult and not likely to be sustainable.

Vermont Utilities Winter Preparedness Task Force

VELCO has formed the Utilities Winter Preparedness Task Force to assist the Vermont's electric and natural gas utilities in coordinating an extended load shed event lasting beyond the immediate short-term mitigation actions required to preserve the integrity of the Bulk Electric System within Vermont and New England. VEC is preparing for these challenges and implementing the Vermont Utilities Winter Preparedness Task Force recommendations

Expanding our capacity to connect to Hydro Quebec (HQ)

VEC has four interconnections with HQ that could be used during a capacity deficiency scenario, if one was declared by ISONE. Utilizing and expanding the substations connected through these interconnections has the potential for significant positive impacts to VEC members during a capacity deficiency (e.g., reduce or eliminate the necessity for "rolling blackouts" to meet a load reduction declaration). HQ provides sustainable reliable, renewable, base load that is not part of the ISONE grid.

Transmission level storage

We believe that there will be a host of solutions needed to enable 100% clean energy 24/7 and long duration storage is one of those. This could come in the form of batteries or hydrogen. At this point in time neither are cost effective but we are interested in exploring then further, especially if grants or funding are made available.

These solutions and more are discussed further in Section 7.

What are We Doing to Prioritize Cybersecurity Efforts?

Find the balance between security and compliance

While many of the principles of compliance and security overlap one does not ensure the other. Our goal is to prioritize controls that prevent impact to our systems, staff, and members. Finding the right balance of time spent investing in compliance versus technical controls is critical for our small electrical cooperative.

Furthermore, with the increased use of technologies such as SCADA and AMI, VEC's various business and operations systems have become better able to communicate with each other. These integrated, autonomous, and complex systems have accelerated evolution of more sophisticated threats and attacks.

Ensure internal KPI and C2M2 compliance

VEC follows the Department of Energy (DOE) Electric Sector Cybersecurity Capability Maturity Model (DOE ES-C2M2) to evaluate, prioritize, and improve cybersecurity capabilities. Each year VEC looks to improve one Maturity Indicator Level (MIL) in at least two domains as outlined by the C2M2 model. VEC measures success by working toward achieving an overall Maturity Indicator Level (MIL) score of 3 in each domain. Annually, we develop specific key performance indicators approved by the Board of Directors that hold the company and specific personnel accountable to improving one MIL score in each of two domains.

Adhere to industry wide best practices and companywide training

VEC believes a strong cyber-security culture is essential to our future to ensure the reliability of the electric grid. We focus our efforts in three areas: system detection & prevention of cyber threats, mitigating the risk of human actions, and system restoration in a worst-case scenario. The most significant risk is human behavior. Social engineered attacks, those designed to exploit the weaknesses of people rather than systems, are the most common and dangerous. Our staff training is critical to mitigating threats coming our way.

VEC's cybersecurity program is discussed further in Section 6.

What does Resiliency Look Like for VEC?

In addition to focusing on keeping the lights on every day, VEC is balancing investments that can reduce the duration and severity of these events or, in some cases, eliminate the impacts significantly.

Strategic Line Relocations and Undergrounding

Over 60 percent of VEC's lines are "off-road" and difficult to access with appropriate large equipment for restoration activities, often extending outages. Additionally, VEC has over 200 miles of #6 Steel and 8D Amerductor wire many of which correspond to the same off-road line locations. This type of wire is extremely brittle and requires an outage to conduct any work on the wire. We plan to replace all our #6 Steel and 8D Amerductor wire by 2030 and relocate as much line as possible.

In VEC's service territory, on average a 12.47 kV underground distribution line costs approximately two times the cost to construct an overhead line, mainly due to the increased labor, increased indirect costs (e.g., conduit, vaults, drainage systems, etc.), and specialized equipment used for cable pulling. By contrast, when looking at yearly and lifetime maintenance costs, overhead construction can be more than four times the lifetime cost of underground primarily due to vegetation management costs and a higher susceptibility to outages.

	Per Mile Yearly Maintenance Cost	Lifetime Cost (50 Years)
Single Phase Overhead	$ 5,071	$253,550
Single Phase Underground	$1,222	$61,100

Table 2.4.3.C Yearly and lifetime cost of underground conductor

Microgrids

Microgrids have the potential to mitigate long-term outages from extreme weather events, provide grid services, and improve reliability. Microgrids improve resilience by disconnecting from the main grid during an outage and using local resources, including storage, small generators, and/or renewables to keep power flowing to communities. VEC is evaluating the types of microgrids, and where microgrids might be a net benefit to the grid in our service territory.

Feeder Backup

Around 57% (around 28% percent of VEC's total membership) of the members who are on radial subtransmission lines are also served from a substation that does not have full feeder backup. Feeder backup enhances reliability and reduces cost by adding greater flexibility to the system.

Explore resiliency as a service

The financial ramifications from outages include operating costs and as well as societal financial impact. We plan to explore how we can incentivize the purchase of a standby generator or home battery to eliminate outages at the home altogether to improve resiliency and reduce financial impacts to the home or business. These solutions and more are discussed further in Section 7.

2.4.4 Supporting a Rapidly Shifting Centralized *and* Decentralized grid

As DER, such as distribution generation and electric vehicles penetration levels increase we are seeing a rapid shift from a centralized and simple grid architecture to a more decentralized and complex system that needs to be orchestrated. The decentralized grid will need new technology, talent, and creative solutions to manage while the centralized transmission infrastructure will need to expand to meet the needs of new generation and this load. In regards to the latter item, the ISONE Regional System Plan (RSP) shows that over the next five years we anticipate an increase in asset management and transmission projects in the region further increasing VEC's transmission costs.

We anticipate our 2040 load without electrification to be similar to our load today with a peak similar to our 2022 peak of around 80MW

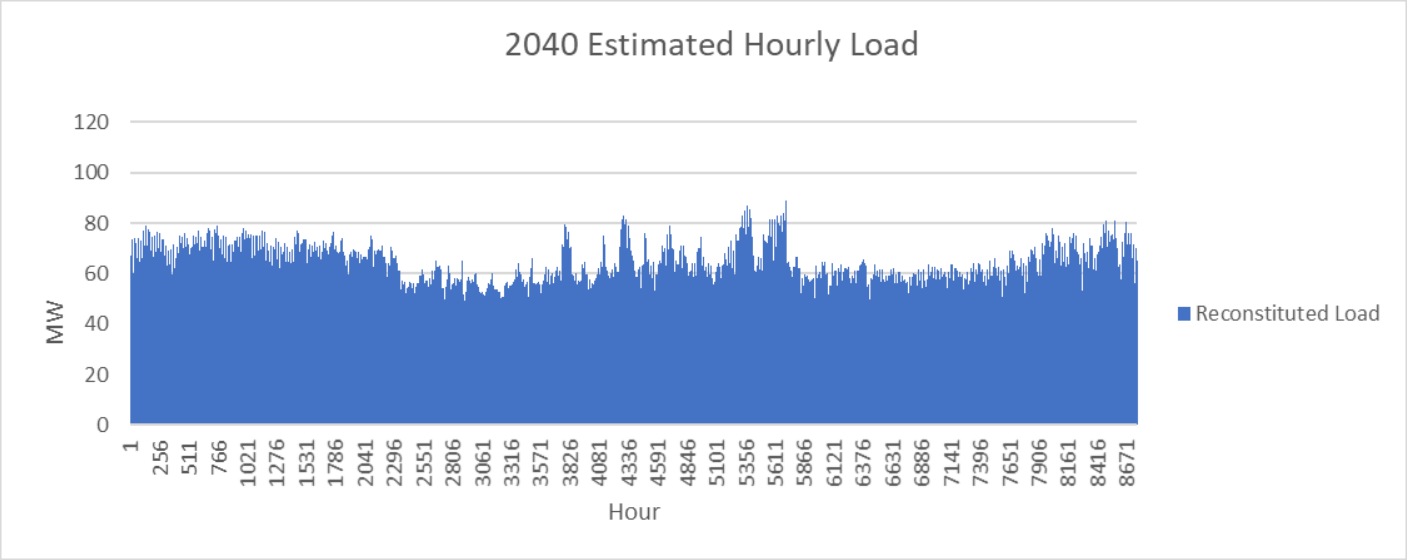


Figure 2.4.4.A 2040 Estimated Hourly load without electrification

However, when we add unmanaged electrification load from CCHPs and EVs the load in certain months can exceed 120 MW which is an almost 50% increase in where the system is designed to today.

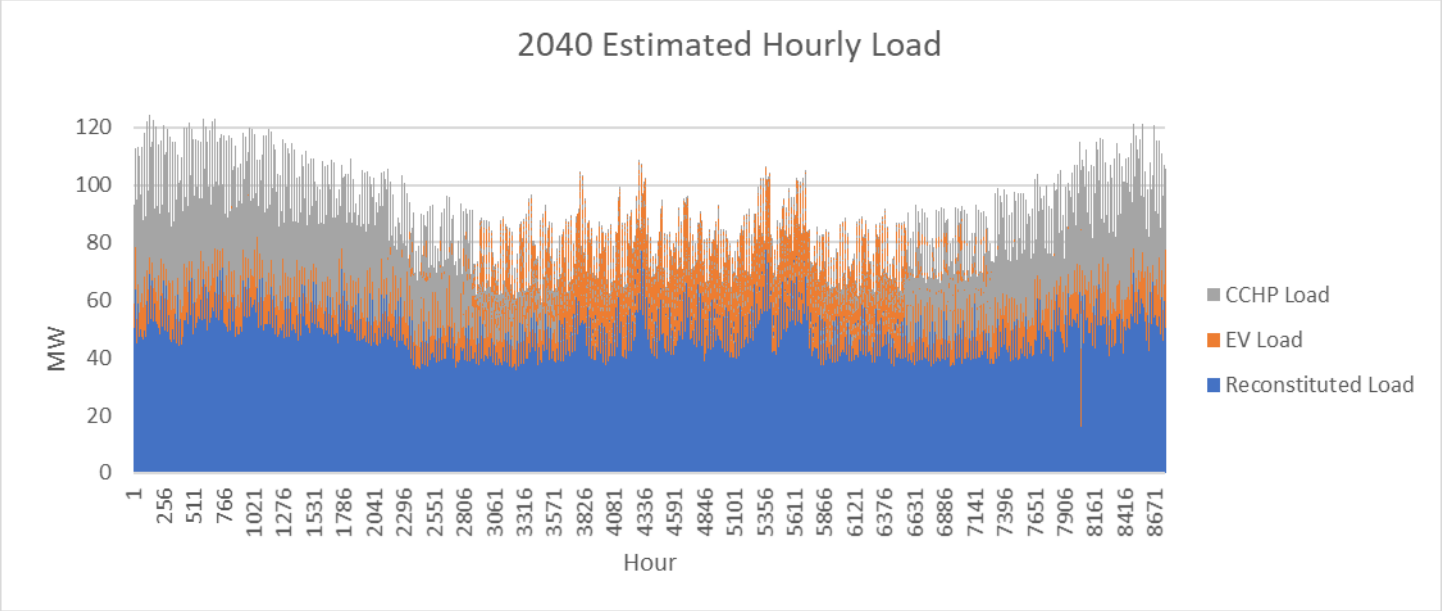


Figure 2.4.4.A 2040 Estimated Hourly load without electrification

This sort of impact would put significant pressures on our electric system infrastructure. VEC anticipates ~30% of its substation transformers would not be able to handle this increase and many single phase and legacy conductor would also be pushed to their design limits. VEC anticipates a continued investment in load management to ensure that this load growth does not occur at times when the grid is already heavily loaded. This will reduce the likelihood of system upgrades attributable to new load.

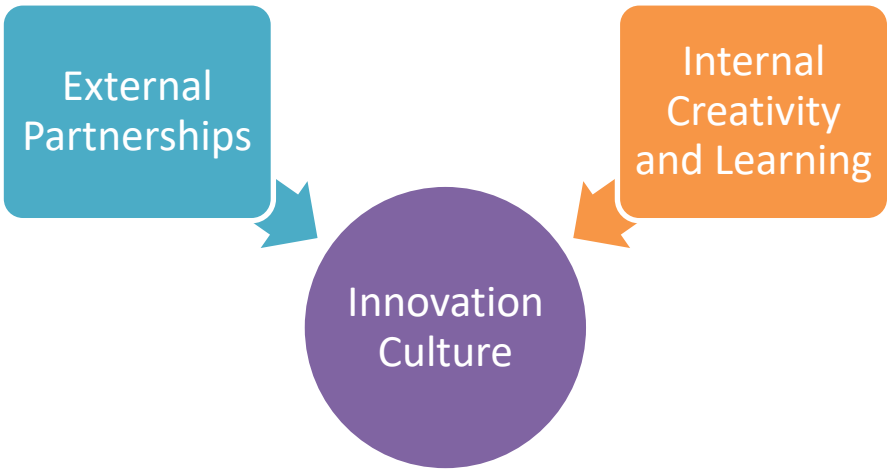
Summary of Takeaways

Analyses	Takeaways	IRP Section Discussed
How do we innovate to meet this challenge?	• VEC is well positioned through strategic partnerships with rural cooperatives and national organizations. • We will need to collaborate and expand those relationships to be successful. • Establish our Innovation Farm and develop an innovation strategy will help get us there. • Building a culture of learning and innovation will take time but yield future benefit.	Section 3
What role does technology play in the grid of the future?	• We have great technology but have opportunities to increase their use within VEC. • Our AMI platform is near end of life and we will need to research and implement next generation AMI metering platform. • Integrating our operational tools to orchestrate DERs will ensure reliability on the distribution system. • We need to empower staff with technology that breaks down silos and enables new insights.	Section 6
How do we keep our staff and members safe in this new complex system?	• Our safety program is recognized statewide and we should strive to maintain VOSHA VPP designation. • Ensure compliance with standards, especially DER.s	Section 8

	• Enact global improvements to the safety program.	
How will we develop our staff and attract talent?	• The grid of the future requires breadth of understanding and we need to train employees and provide them with experience. • The future of work is shifting and collaboration will operate in hybrid spaces. Creating a working environment that is flexible, rewarding, and stimulating will ensure we meet the challenges of tomorrow. • Diversity and inclusion at all levels of the organization are needed.	Section 3

How do we innovate to meet this challenge?

The challenge of rapid change will need new creative ideas, technology, and changes to our culture. VEC's goal is to build an innovation culture that encourages internal creativity and fosters external partnerships. Our approach embraces a culture of learning and creativity and seeks out likeminded utilities, research entities, and subject matter experts from outside VEC so that they can bring their unique perspectives, experience, skills, ideas to VEC.



Building a culture of learning and innovation will take time but yield future benefit. Innovation is more than just following a set of processes. To create the necessary cultural shift at VEC, we need to establish our innovation farm which is made of up six key components:

Our Crops

Innovation Leadership and Champions

The Insight Harvester

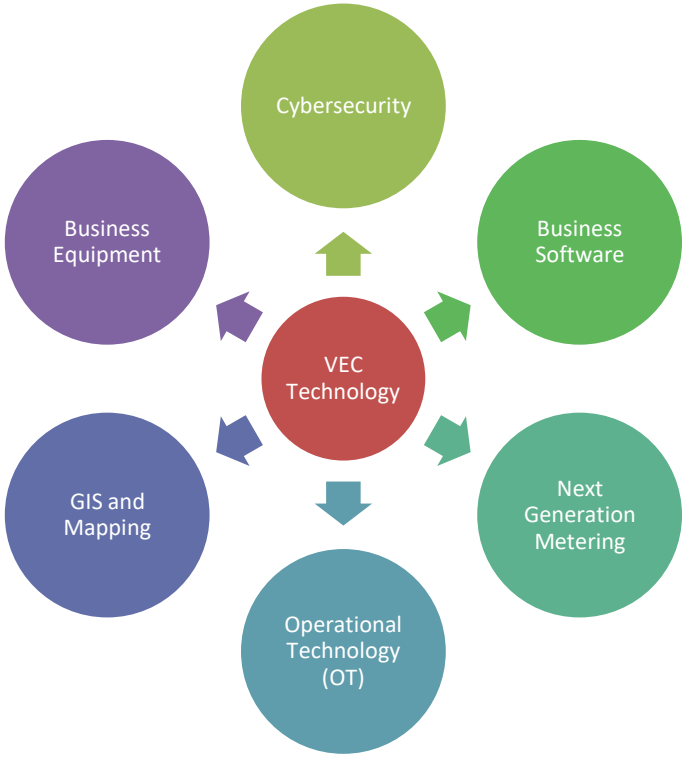
Implementation Through Pilots

Evaluation and Programs

VEC's innovation strategy is discussed further in Section 3.

What Role Does Technology Play in the Grid of the Future?

Technology is one of the key pieces to maintaining reliability and affordability and is more important than ever with high penetrations of DERs. VEC's goal will next update its long-term technology strategy in Q4 of 2022. This includes a review of several key focus areas:



- **Cybersecurity –** We will maintain and enhance security of the enterprise, to protect member and employee data. VEC continues to focus on our cybersecurity posture with a combination of training and new technology.
- **Business Software** – Through training and additional products we will enhance business performance and communications. We will work on methods to enhance data collection and leverage data from advanced technologies.
- **Next Generation Metering -** Our metering system is end of life and with increased grid complexity, we will need higher resolution data and offerings to our members.
- **Operational Technology (OT)** – We will implement tools that orchestrate DERs and integrate existing technology. In addition, we will maintain existing hardware and software.
- **GIS and Mapping –** We will focus on expanding internal abilities through new tools and providing external stakeholders with more capabilities through online access.
- **Business Equipment** – We will modernize the technology resources on which the new products and tools run. VEC continues to focus on mobile technologies and to identify ways to enhance remote work capabilities.

VEC's existing technology and long-term strategy is discussed further in Section 6.

How do we Keep our Staff and Members Safe in this New Complex System?

As the grid becomes more decentralized, it becomes increasingly complex and with that complexity comes increased safety risk to our staff and members. VEC takes the safety of our members, employees, and the community-at-large

seriously. We share recommendations on generator safety, how to prepare and what to do during an outage, and produce regular safety videos which are all available on our website https://vermontelectric.coop/electric-system/safety.

Vermont's Occupational Safety and Health Administration (OSHA) awarded Vermont Electric Co-op the Green Mountain Voluntary Protection Program (VPP) health and safety designation in 2017 and we have maintained that status ever since.

VEC is the only power distribution utility in New England currently with the high-level recognition, and joins just five other non-utility organizations across Vermont with the certification. Our relationship with VOSHA propels us to make continuous improvements to all aspects of our safety program, which includes internal and external focuses. VEC's Safety program is discussed further in Section 8 – Transmission and Distribution.

How will we develop our staff and attract talent?

The grid of the future requires information sharing across the organization with the understanding that good ideas percolate up from many sources. Our goal is to break down silos and create a culture of creativity, experimentation, and innovation throughout our workforce.

The future of work is shifting and the ability to easily interact with coworkers who are working remotely offers new opportunities to attract talented employees and consultants. Creating a working environment that is flexible, rewarding, and stimulating will ensure that VEC continues to be an employer of choice where people want to work.

We know that new ideas and approaches are more likely when we have a diversity of experiences and voices at the table. We will strive to create an inclusive culture that welcomes diverse viewpoints.

2.4.5 Providing Our Members with Choice

Our members are our owners and our customers, with high expectations for the role and reliability of electricity in their lives. We survey our members annually, in addition to hearing from them regularly in other formal and informal ways. We know they want clean electricity, that affordability is the most important characteristic of energy supply, and that reliability is more critical than ever as work, school, and tele-health have moved remote and transportation and heating more frequently rely on electricity.

Summary of Takeaways

Analyses	Takeaways	IRP Section Discussed
What is VEC's role in the energy services sector?	• We are exploring what that looks like. • Experimentation through pilots is key. Innovative rate designs and incentives to support economic development, member choice and convenience. • Monitor adoption of load management programs and time of use rates.	Section 4, 5
How do we enhance member interactions?	• Continue to develop communication options for members, particularly leveraging technology. • Improve member interaction through SmartHub, outage information, and proactive communication.	Section 3

What can we do to provide more data to our members?	• Develop and implement new C&I offerings to increase visibility of usage and peak impacts. • Increase our understanding of members wants and needs through data gathering and analysis.	Section 4

Many members also want to play an active role in their energy transformation and expect programs that support those choices such as our community solar and battery storage programs. Other members are only focused on cost and reliability – they want the electricity to work at the least cost possible and whenever they need it. Our goal is to serve all these members, and those in between by providing opportunities for choice, participation, and ease of use for all our programs. As we balance a grid that has centralized and decentralized components, how that plays out is in large part due to the choices of our members. Their adoption of battery storage, rooftop solar, or other distributed resources drives much of the decentralization, and our work will support that. In addition, the centralized grid will continue to be fundamental in supporting all members especially those with distributed resources that rely on the grid during the night.

Our future grid will also require the participation of our members to help keep costs low. We are specifically focused on vehicle charging as the most flexible, and most significant, of future loads. How much and when that charging load happens will make a huge difference on the cost and infrastructure required to serve that load. Working with our members now to ensure there are programs, education, and incentives in place to encourage grid-friendly charging is just the start of the ways we will work closely with our members to build our future grid.

As we continue to work with proactive data, try out innovative pilots and programs for both residential and commercial members, their involvement, engagement, and support is necessary. At the same time, we continue to ask our members what works for them, what they need to power their lives, and what types of technology, behavior change or incentives most inspire their own energy transformation. We hope this will help us answer what role we will play in the energy future, whether we will expand further from the services provide today or concentrate on what we have always done best; providing safe, affordable, and reliable electric power.

2.5 Thank You

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