

1 Executive Summary

1.1 Introduction from our CEO

Vermont Electric Cooperative is pleased to file this Integrated Resource Plan with the Public Utility Commission.

VEC's mission is to serve our Cooperative members with safe, reliable, and affordable energy services. This plan presents a continued path to ensuring excellence, balance and flexibility. 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. VEC will continue to initiate solutions to meet the challenges of managing this ever-more-complex grid, while making it simpler and easier to use and understand for our cooperative member-owners.

VEC will also continue to do our part to meet the important goal of carbon reduction. We will explore cost effective opportunities to reduce carbon in our energy supply portfolio and support energy transformation in our members' homes and businesses. We will make strategic investments in beneficial electrification to reduce carbon, leverage our infrastructure and provide a counterbalance to the revenue and load impacts of increased efficiency and distributed generation. In addition, we will continue to invest in our system to improve reliability reducing the risk of future outages due to aging infrastructure or severe weather.

Change is happening, and as a utility leader, we are focused on action and results. We continue to explore new avenues – encouraging behind-the-meter interaction with VEC and providing consumer choices and incentives that encourage clean and affordable energy. This plan provides some of the options that can accelerate our leadership across a wide-range of possible future scenarios. Additionally, the plan provides insight into our current knowledge, data and assumptions we use to develop forecasts. Finally, VEC strives to balance remaining rooted in the present, committed to serving our members with safe, reliable, affordable energy services while branching out to meet evolving needs and expectations.

We look forward to continuing our collaborative relationship with the PUC, the Department of Public Service, and other energy stakeholders in Vermont while we work together to build a sustainable energy future in Vermont.



Rebecca Towne

Chief Executive Officer

1.2 Summary

1.2.1 Power Supply

Vermont's aggressive policies behind investment in renewable generation and the increasing electrification of consumers' lifestyles offers several unique challenges and opportunities for the electric utility industry to help lead the way in combatting climate change and maintaining reliable and affordable energy costs for Vermont business' and residents. With the advancement of smarter, flexible load technologies and appliances and the increased penetration of intermittent resources, electric utilities are experiencing a seismic shift in how power is delivered to consumers and how consumers are using that power. Where decades ago system operation was focused on managing generation to match the load needs on the grid, today we are also tasked with managing load to match the ever increasing intermittency of cleaner renewable generation resources. VEC's Power Supply strategies, decisions, and investments will be focused on several critical areas.

- **Vermont's Renewable Energy Standard** - 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 taking into account load growth from Tier III programs. 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.
- **Beneficial Electrification** - Tier III of Vermont's RES encourages the adoption of technologies such as electric vehicles, heat pumps, and energy storage. Adoption of these technologies, collectively referred to as beneficial electrification, provides an opportunity for VEC members to directly reduce carbon emissions and increase penetration of renewable resources by adding load to the electric grid during times when renewable energy is able to be generated. VEC's work will continue to include a focus on the identification and incentivizing of beneficial electrification technologies that provide the maximum benefit to VEC members and the state as a whole.
- **Load Management** - With the adoption of smarter load and energy storage across the region, VEC's biggest challenge will be managing these flexible resources in a way that provides value to our entire membership. Accurately predicting load, specifically monthly peak loads for Vermont and annual peak loads for ISO-New England are critical in keeping VEC's transmission and capacity costs as low as possible. As energy storage prices continue to drop and other utilities invest in flexible load technologies, predicting these peak load periods will become increasingly difficult. VEC will need to continue investing in load management resources such as energy storage, behind-the-meter load management programs, and load forecasting software in order to keep pace with other industry leaders and avoid significant increases in transmission and capacity costs.

1.2.2 Transmission and Distribution

With regulatory policy and incentives driving significant changes to the electrical grid, aging infrastructure approaching or past useful life, it has becoming increasingly difficult to ensure least cost of service while maintaining a high level of reliability and member service. Prioritizing limited capital investment and utilization of resources is as challenging as ever. VEC's T&D philosophies, programs, and corresponding capital plan are shaped by four challenges, each of which has distinct solutions.

- **Prioritization of Investment to Improve Condition of Infrastructure** - VEC's largest challenge is prioritizing investment to maintain and improve an extensive and aging infrastructure while balancing cost to the membership. This infrastructure is approaching its end of usual life many sections of VEC's territory, and in some cases has passed its' expected life. The biggest area of concern is VEC's distribution system, which encompasses 71 percent of VEC's total assets. In particular, undersized and high loss conductor, line locations and difficult access, aging wood poles, direct buried and unjacketed underground cables, and aging electrical equipment.
- **Reliability** - VEC has met its SQRP reliability targets for the past 9 years. However, VEC has seen a recent trend resulting in an increase in both outage frequency and duration. Tree outages represent the largest portion of both duration and frequency of outages.
- **Beneficial Electrification** - Beneficial electrification includes technologies such as electric vehicles, heat pumps, and energy storage. VEC has forecasted a load increase of approximately 11MW by 2023, which is approximately 13% of VEC's system peak (approximately 85MW). As with any type of load growth, quantity and location of these technologies can have significant impacts on the electrical grid. Given the limited penetration of these technologies on VEC's distribution system today these impacts are relatively minimal, however as incentives and growth continue the likelihood of VEC infrastructure upgrades and member owned upgrades related to these technologies increases. The implementation of load control and rate structures to manage demand during peak times will greatly determine the impact of this load growth. In addition, VEC receives limited notification for these types of loads making it critical to perform annual system planning and identify alternatives for lack of notification.
- **Distributed Generation** - VEC continues to see a rapid rise in distributed generation on its system. VEC currently has 33.5 MW of distributed generation installed on its system (13.7 MW of which is net metering solar). In addition, approximately 8.2 MW of pending, primarily group-net metered projects also sits in VEC's interconnection queue. Furthermore, using the baseline power supply forecast, another 20 MW of distributed generation (17 MW of which will come from net metering solar) is expected to come online by 2023. This growth requires VEC to re-prioritize limited resources to reviewing interconnection applications (around 380 annually) to ensure grid stability. While some of these applications are completed quickly, many can take years to proceed through a study and CPG process. VEC is able to complete many of these applications relatively quickly; some can take a year or more to proceed through to completion.

1.3 Action Plan

Section	Description
Power Supply	<p>Invest in a portfolio of load management tools to minimize energy, transmission, and capacity costs for VEC’s membership while reducing regional carbon emission and meet state renewable energy goals through the increased penetration of renewable resources and the implementation of beneficial energy transformation projects.</p> <ul style="list-style-type: none"> • Anticipate and react to the total power supply requirements of VEC’s membership, accounting for the pace of net metering installations and adoption of new beneficial electrification technologies. • Continue to monitor Energy, Capacity, and REC market prices and hedge against future price volatility when appropriate. • Enhance VEC’s magnitude and diversity of load management tools including residential, commercial and utility scale storage and dynamic behind-the-meter load control. • Cost effectively balance REC arbitrage opportunities with VEC’s ability to meet annual Renewable Energy Standard requirements.
Transmission and Distribution	<p>Prioritize and invest in the system to improve reliability, reduce risk of future outages due to aging infrastructure, and ensure system stability with the increased penetration of distributed generation and beneficial electrification.</p> <ul style="list-style-type: none"> • Shift capital spending from substation improvements and automation to distribution reliability improvements and asset enhancements. • Enhance vegetation maintenance cycle from 12 years to 6-7 years by 2023 to improve reliability and reduce long-term costs. • Implement and execute a comprehensive maintenance plan to proactively reduce preventable outages and gather accurate asset information. • Continue to use technology platforms such as AMI, SCADA, and GIS with a focus on enhancing data integrity.

1.4 Table of Contents

VEC's 2019 Integrated Resource Plan is broken up into six sections:

1. Executive Summary

- 1.1. Introduction
- 1.2. Summary
- 1.3. Action Plan
- 1.4. Table of Contents
- 1.5. Thank You

2. Introduction and Member Programs

- 2.1. About Vermont Electric Cooperative
- 2.2. Service Quality and Reliability Performance
- 2.3. Communicating with our Members
- 2.4. Member Programs

3. Power Supply

- 3.1. Introduction
- 3.2. Key Internal Factors
- 3.3. Energy Requirements and Needs Assessment
- 3.4. Tier I Analysis
- 3.5. Tier II Analysis
- 3.6. Tier III Analysis
- 3.7. Forward Capacity Market
- 3.8. ISO New England and New England Power Poole Regional Transmission Costs

4. Transmission and Distribution

- 4.1. Introduction
- 4.2. Transmission and Distribution Challenges
- 4.3. Statistics
- 4.4. Assets
- 4.5. Design and Planning Philosophies
- 4.6. Grid Transformation and Philosophies
- 4.7. Operational Excellence
- 4.8. Reliability

5. Action Plan

- 5.1. Introduction
- 5.2. Power Supply Action Items
- 5.3. Transmission and Distribution
 - 5.3.1. – 5.3.12 Capital Investment
 - 5.3.13. Strategies for Reliability Improvement
 - 5.3.14. Operations and Maintenance Projects

6. Appendix

1.5 Thank You

We wanted to take an opportunity to thank those who spent significant time researching and preparing for this document. The 2019 VEC Integrated Resource Plan was prepared by:

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