5 Action Plan

5.1 Introduction

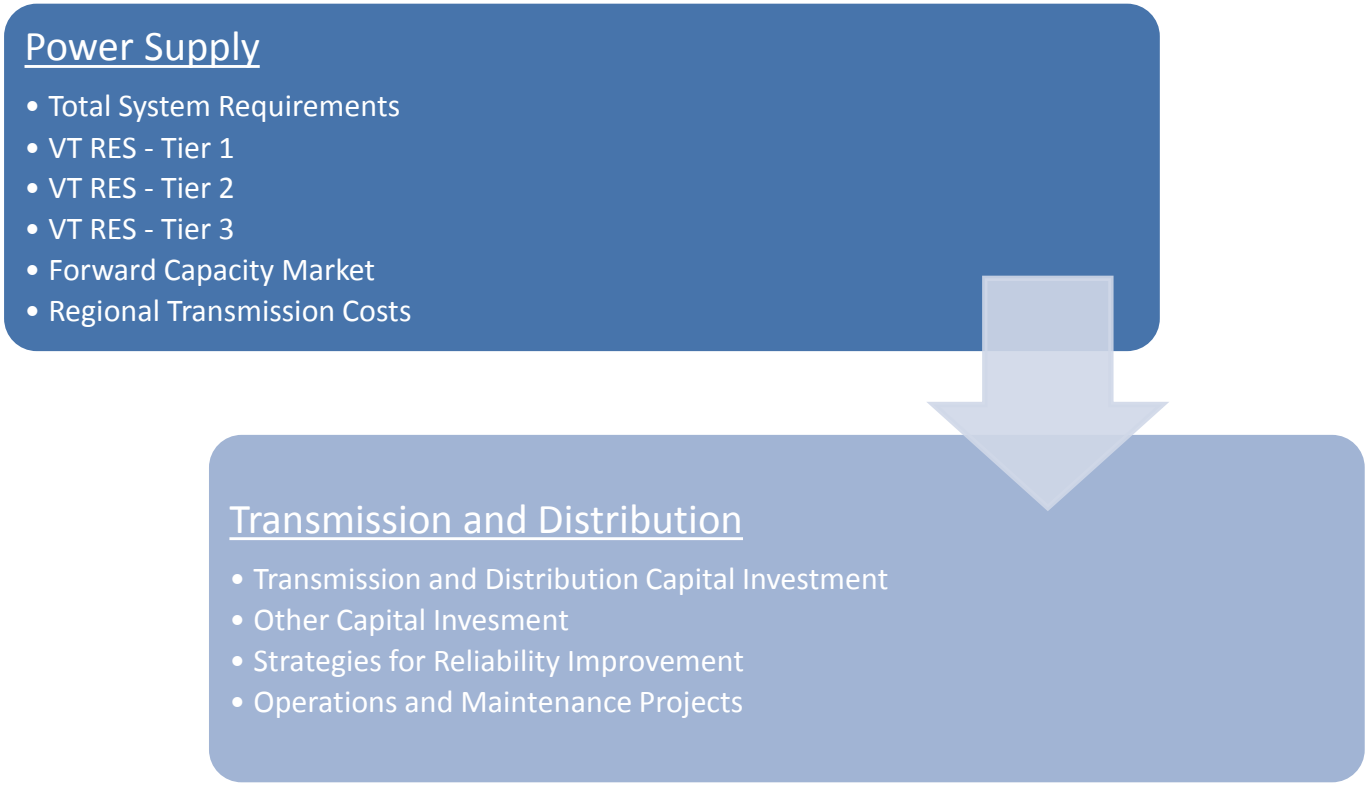
This section of the IRP contains VEC's future actions and decision-making framework for its power supply portfolio, T&D improvements, and capital investments. VEC's action plan looks out five years into the future since it is likely subject to change as we can only base on what we know and forecast today. Our evolving world will need us to stay nimble, proactive and reactive. We plan to the best of our ability, then respond and shift appropriately.

A high-level summary of the action plan is provided below:

Section	Description
Power Supply	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 meeting state renewable energy goals through the increased penetration of renewable resources and the implementation of beneficial energy transformation projects. • 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	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. • Shift capital investment 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.

Table 5.2.1.A Summary of VEC action plan

Section 5 is broken up into two primary sections, Power Supply and Transmission and Distribution, each which are described in further detail below



An overview of VEC's projects and action items that were completed since the prior IRP are located in Appendix-T. In addition, VEC has provided a guide as to where items stipulated in a Memorandum of Understanding (MOU) issued July 16, 2016 in Docket No. 8672 are located in VEC's 2019 IRP filing. This guide is located in Appendix-S.

5.2 Power Supply Action Items

5.2.1 Power Supply Total System Needs Strategy and Action Plan

VEC intends to meet its energy needs in the least expensive way possible while meeting the minimum required renewable portfolio standards. Therefore, as long as it will minimize costs, VEC will target using the maximum amount of non-renewable energy on an annual basis as the RES allows. Any allowable non-renewable energy added to the portfolio will be procured by balancing short-term and long-term costs net the sale of any excess RECs.

There is no industry standard formula hedging strategy; in fact the mere presence of different risk tolerances and market perspectives is the basis for liquid markets. VEC's current informal strategy in the energy market is to be at least 90% hedged going into any given year and at least 80% hedged from 13-24 months prior to the beginning of a year; however, we allow flexibility in the timing in order to avoid having to enter transactions at a point when market prices are unfavorable.

It is important to remember that the main purpose of hedging is not to obtain the lowest cost. Because of the volatile nature of spot market prices, hedges can either be below market or above market. The main purpose of hedging is to lock in prices the utility is willing to live with in order limit exposure to the spot market while avoiding being too short at the time of excessive price spikes. It is quite likely that over time not hedging would be less expensive than hedging; however, one must be willing, and have enough money in reserves (or be able to change rates instantly), to survive periods of high spot market prices.

5.2.2 Total System Action Plan

1. Participate in Public Service Board Docket #8550 to be aware of any rules or implementation issues for Vermont's RES that may affect VEC's non-renewable portfolio.

2. Monitor VEC's Total System requirements and resources. This will require monitoring and updating:
   a. Load forecasts as more recent information becomes available;
   b. The pace of net-metering installations including size and technology, and the associated impacts on load;
   c. Load reduction impacts of efficiency measures actually installed, and projected to be installed, on the VEC system by Efficiency Vermont; and
   d. Load growth impacts of Tier 3 technologies implemented on the VEC system.

3. Monitor output of Tier 1 and Tier 2 resources compared to current projections, especially with respect to how needs may change as a result of Tier 3 implementation, and adjust future projections accordingly.

4. Analyze needs, on a monthly basis, taking into account VEC system-wide load shapes and the output and rate of implementation of Tier 2 resources, many of which may produce more energy in the summer than in the winter and the impact of Tier 3 implementation.

5. Analyze needs, on an hourly basis in each month of the year, taking into account VEC system-wide load shapes the output and rate of implementation of Tier 2 resources, many of which may generate more energy in the summer than in the winter and the impact of Tier 3 implementation.

6. Monitor the cost-effectiveness of including additional non-renewable resources into VEC's mix on a long-term basis compared to:
   a. Additional Tier 1 resources
   b. Additional Tier 2 resources net the sale of the associated RECs
   c. Purchasing on the spot market.

7. Maintain a tool that will model the emissions impact of VEC's non-renewable portfolio based on the same assumptions in this IRP, but at the same time consider other data sources that may provide a more accurate assessment of the impact of the non-renewable portion of VEC's portfolio.

8. Negotiate short-term purchase power contracts with suppliers that take into account VEC's system-wide load shape, the output and rate of implementation of Tier 2 resources, and the impact of Tier 3 implementation. Various structures will need to be analyzed on a contract-specific basis including:
   a. Load following
   b. Fixed shape
   c. Daily options

d. Blocks of on-peak and off-peak energy

Total System Decision Criteria

VEC's preference is to enter short-term power purchase agreements; however, it is open to considering longer-term agreements or ownership in projects.

The exact portfolio in any given year will be dependent upon a number of variables analyzed or discussed in the IRP, plus variables that were not specifically analyzed. Decisions will be made taking into account the following criteria, as applicable to a given decision:

- VEC's credit rating
- Impact on VEC bond covenants including Times Interest Earned Ratio (TIER), Debt Service Coverage (DSC) and equity requirements
- Impact on VEC rate path
- Capital requirements
- VEC's access to capital
- Inputed debt
- Balance of short-term costs vs long-term savings and vice-versa
- Externalities
- Local economic impact
- Supplier credit risk
- Credit assurance required of VEC
- Access to letters of credit
- Cash flow

5.2.3 Renewable Energy Standard: Tier I Strategy and Action Plan

Act 56 requires that Vermont utilities retain RECs from resources that qualify to meet the total renewable energy requirement at a level that begins at 55% of total retail sales in 2017 increasing by 4% every 3 years. Distributed Renewable Generation, or Tier II resources, must make up 1% of the total retail sales in 2017 increasing by 0.6% every year for 15 years to reach a total of 10% of total retail sales in 2032. VEC refers to the difference between the Total Renewable Energy requirement and the Tier II requirement as the Tier I requirement.

VEC's initial Tier I strategy is to meet its requirement in the least cost manner, but not exceed the requirement unless exceeding it can help minimize costs to members. Because our analysis shows the purchase price of Tier I qualifying RECs to be less than or equal to the revenue that we receive by selling Tier I qualifying REC that are also Massachusetts Class-I- and Connecticut Class-I-qualifying RECs, our primary strategy will be to sell as many Massachusetts Class-I- and Connecticut Class-I-qualifying RECs as possible and meet any resulting shortfall in our Tier I requirement by purchasing lower-priced VT Tier I REC.

Tier I Action Plan

1. Participate in PUC proceedings regarding rules for Tier I resource qualification and other aspects addressing implementation of Vermont's RES.

2. Monitor VEC's Tier I requirements, especially with respect to how needs may change as a result of deviations from the assumed net load forecast. This will require us to monitor and update the following variables:
    a. The pace of net-metering installations, including size and technology, and the associated impacts on load;
    b. Load reduction impacts of efficiency measures actually installed and projected to be installed on the VEC system by Efficiency Vermont; and
    c. Load growth impacts of Tier III technologies implemented on the VEC system.
3. Monitor and update the annual projected output of all Tier I resources and REC purchase contracts in VEC's portfolio.
4. Maintain tools to track VEC's projected requirements and resources to provide a simple, easy to update view of VEC's Tier I REC position.
5. Monitor current prices and projections for purchase and sale of all Tier-I-qualifying RECs and the Tier I Alternative Compliance Rate and monitor volumes of Tier I Resources in New England with respect to requirements in the various states.
6. Sell more valuable Tier-I-qualifying RECs and replace by purchasing less-valuable Tier-I-qualifying RECs as needed to fulfill Tier I REC requirements. Decisions regarding when to transact, how much to sell/buy and whether to pay the Alternative Compliance Rate will be based on:
    a. Short-term prices with respect to history;
    b. Long-term projections;
    c. The relationship of prices with respect to those assumed in financial plans; and
    d. The relationship of prices with respect to those already in VEC rates.

5.2.4 Renewable Energy Standard: Tier II Strategy and Action Plan

Tier II Strategy

Tier II resources are in-state distributed generation resources that have a nameplate capacity of 5 MW or less (AC), and that came online July 1, 2015 or later. VEC's Tier II strategy has been to enter long-term power purchase agreements with developers as opposed to developing generation projects on our own for the following reasons:

1. As a not-for-profit utility, VEC's core strengths are delivering electricity to its customers, negotiating favorable power supply contracts, and managing the financial risk associated with the resources in its energy and capacity portfolios.
2. As a not-for-profit utility, VEC does not have the ability to take advantage of potential tax credits that a for-profit entity does. This allows VEC to realize lower project costs when partnering with a 3rd party than it would be able to obtain if it were to own a project itself.
3. VEC does not have expertise in the design, development and maintenance of renewable projects. To develop this expertise would take time and money, and will come at a cost, as mistakes would likely be made along the way. VEC believes its members' best interests are served, at this point in time, by focusing our labor resources on our core competencies and allowing other entities to develop and own the projects.
4. Developing any generation project can require the expenditure of several hundreds of thousands of dollars in site selection, design and permitting. There are many hurdles along the way which can force the potential project to be abandoned before it becomes commercial. As a result a developer (whether VEC or a third party) can spend a significant amount of money with no project to show for it.

As the prior analyses show, VEC is not projected to need additional Tier II resources before 2029 at the earliest. However, if and when VEC decides to acquire more Tier II resources other than net-metering, it expects to continue the strategy of using purchase power agreements rather than owning generation resources as long as the above reasons still hold true.

Some of these power purchase agreements will likely be at levelized prices (meaning the same price for each year of the term) in order to provide cost stability. Others may start at lower prices and escalate each year in order to provide lower rates in the earlier years of the contract.

Tier II Action Plan

1. Participate in PUC proceedings regarding rules for Tier II resource qualification and other aspects addressing implementation of Vermont's RES.
2. Monitor VEC's Tier II requirements, especially with respect to how needs may change as a result of deviations from the assumed net load forecast. This will require monitoring and updating:
    a. The pace of net-metering installations, including size and technology, the rate paid for the output, and the associated impacts on load;
    b. Load reduction impacts of efficiency measures actually installed and projected to be installed on the VEC system by Efficiency Vermont; and
    c. Load growth impacts of Tier III technologies implemented on the VEC system.
3. Monitor the cost of new Tier II resources compared to the distributed generation benefits they provide.
4. Continue to track VEC's projected requirements and resources to in a simple, easy to update view of VEC's Tier II REC position.
5. Continue to be an active participant in the National Rural Electric Cooperative Association Renewable and Distributed Energy Membership Advisory Group. This will allow VEC to learn from the experiences of other cooperatives regarding issues associated with implementation of distributed renewable resources. It will also allow VEC to share its knowledge with other cooperatives.
6. Continue to monitor the REC market and VEC's Tier II REC position. To the extent necessary, balance the purchase of RECs from the new Tier II facilities with VEC's projected needs.

5.2.5 Renewable Energy Standard: Tier III Strategy and Action Plan

Tier III Energy Transformation Strategy

Tier III of Vermont's Renewable Energy Standard sets goals for utilities to reduce carbon dioxide emissions by transitioning members from fossil fuel usage to cleaner electricity. VEC's Tier III energy transformation strategy has been to offer bill credits to members that purchase prescriptive Tier III technologies such as CCHPs, HPWHs, pellet stoves, and electric vehicles. This allows our diverse membership to choose the Tier III technologies that make sense for them to invest in depending on their specific situations. Concurrently, VEC has focused significant effort on identifying previously off-grid, energy intensive, operations and transitioning them to electric service through our Clean Air Program (CAP). VEC's CAP has proven to be very successful, largely due to a growing maple sugaring industry in VEC's service territory.

VEC also provides all Tier III program participants with the option to utilize our pilot Time-of-Use rates. This rate has been critical in the completion of several CAP projects, allowing businesses to remain competitive within their industry and even expand their operations.

As the prior analyses show, VEC is projected to meet its Tier III requirements if forecasted adoption rates and CAP project success holds true. However, Tier III requirements get increasingly more difficult to reach as simple, straightforward CAP projects dwindle and early adopters of various technologies have already invested. VEC anticipates continuing its current strategy of offering a diverse portfolio of energy transformation projects while remaining nimble to market changes and the desires of our membership.

Tier III Action Plan

1. Participate in PUC proceedings regarding rules for Tier III energy transformation projects requirements and other aspects addressing implementation of Vermont's RES.
2. Monitor VEC's Tier III requirements, especially with respect to how needs may change as a result of deviations from the assumed net load forecast. This will require monitoring and updating:
    a. The pace of net metering installations, including size and technology, and the associated impacts on load;
    b. Load reduction impacts of efficiency measures actually installed and projected to be installed on the VEC system by Efficiency Vermont; and
    c. Load growth impacts of Tier III technologies implemented on the VEC system.
3. Monitor the effectiveness of different incentive levels and structures for all Tier III technologies and programs.
4. Quantify and claim the Tier III value of peak shaving initiatives.
5. Identify new industries for potential CAP projects and aggressively pursue CAP leads in all sectors.
6. Identify and monitor new technologies as they come to market and demand grows for the products.
7. Work with neighboring utilities and organizations to share ideas and learn what strategies are working well for nearby utilities and utilities across the globe.
8. Continue to monitor VEC's Tier II REC position and the cost effectiveness of potentially using excess Tier II REC to meet Tier III requirements.

5.2.6 Forward Capacity Market Strategy and Action Plan

Forward Capacity Market Strategy

For reasons similar to those discussed in the Tier II section, VEC will acquire capacity resources, at least for now, through purchase power agreements as opposed to direct ownership in newly developed resources.

VEC intends to add resources to the portfolio through negotiated purchase agreements with suppliers of existing capacity resources. Most contracts will be short-term in nature (less than 5-years) because of the continually changing market rules and the potential volatility in the market. To hedge against the possibility of Vermont becoming its own capacity zone, VEC will investigate costs associated with procuring capacity delivered to the capacity zone Vermont resides in and a contract with a developer for a long-term purchase of up to 20 MW from a facility located in Vermont.

Forward Capacity Market Action Plan

1. Monitor Forward Capacity Market rules and potential changes through participation in NEPOOL Participant Committee meetings and reviewing notes from NEPOOL Markets Committee and Reliability Committee meetings.
2. Attempt to understand how rule changes may impact capacity prices in Vermont.

3. Maintain model projecting VEC Capacity Load Obligations and Capacity Supply Obligations on a long-term forward-looking basis.
4. Target Tier II resources for development in locations in VEC's territory that will have the most beneficial impact on VEC's Capacity Load Obligation with ISO-NE.
5. Maintain capacity resources sufficient to cover at least 50% of VEC's projected Capacity Supply Obligation going into the Forward Capacity Auction for any given commitment period.
6. Investigate developing additional interruptible load programs and rate options for customers on the VEC system that will allow VEC to reduce the customers' load at times of annual New England peaks in order to minimize VEC's capacity costs.
7. Investigate the acquisition of a long-term capacity resource in Vermont through a long-term capacity purchase agreement.

5.2.7 Regional Transmission Costs Strategy and Action Plan

Regional Transmission Costs Strategy

VEC believes peak shaving can be a valuable tool in managing its costs. The timing of the Vermont and New England peak loads may be more difficult to predict as more batteries are installed and load shape flattens out, making it more difficult for peak shaving resources to be cost effective. However, VEC could see its costs increase significantly by not pursuing peak shaving either through its share of the New England peak increasing or transmission rates increasing because of fewer MW to allocate costs over.

Except for the possible exception of a residential battery program, VEC expects to acquire peak shaving and other demand response resources, at least for now, through purchase power agreements or incentive rates as opposed to direct ownership in newly developed resources. This is due mainly to the capital intensiveness of batteries as well as the flexibility it provides against the risk of technology invested in today becoming obsolete quickly.

Regional Transmission Costs Action Plan

1. Monitor transmission cost allocation rules and potential changes through participation in NEPOOL Participant Committee meetings and reviewing notes from NEPOOL Transmission Committee and Reliability Committee meetings.
2. Target Tier II resources for development in locations in VEC's territory that will have the most beneficial impact on VEC's monthly peak load as measured by ISO-NE.
3. Investigate developing additional interruptible load programs and rate options for customers on the VEC system that will allow VEC to reduce the customers' load at times of Vermont peaks in order to minimize VEC's transmission costs.
4. Continue to identify locations for additional utility-scale battery projects.
5. Continue to work the NRTC and other utilities to develop a residential battery program through which VEC can provide members with improved reliability and dispatch the batteries to reduce VEC transmission costs.
6. Continue to test batteries at large commercial customer sites to manage member load in a way to both reduce member demand charges and VEC load at the time of Vermont monthly and annual peaks.

7. Continue to evaluate the cost-effectiveness of, and possibly expand, behind-the-meter load management projects.
8. Continue investing in load management resources such as energy storage, behind-the-meter load management programs, and consider load forecasting software to improve peak load management effectiveness.

5.3 Transmission and Distribution

The Transmission and Distribution section of the document is broken up into three sections: (1) Capital Investment, (2) Strategies for Reliability Improvement, (3) Operations & Maintenance projects.

5.3.1 Capital Investment Overview

Prioritizing capital investment is critical to ensuring VEC's membership receives the most reliable least-cost service. VEC's capital investment strategy primarily focuses on reliability and asset improvements. VEC places its capital projects into specific categories listed below:

- **Distribution** – This category includes both specific distribution projects (greater than $10,000) and annual blankets.
    - **Reconductoring** – Replacement or upgrade of wire size for both overhead and underground conductor.
    - **Line changes** – Movement of a line from off-road ROW to the road or from overhead to underground.
    - **Pole replacements –** Conditional or end of useful life replacements of pole assets.
    - **Transformers** – Includes distribution transformer exchanges due to outages or replacements due to condition
    - **Ordinary replacements** – Anchor, recloser, pole top construction, or regulator replacements due to condition.
    - **Tier 3 CAP** – Customized opportunities to members with off-grid or underserved homes or businesses to replace fossil fuel usage with electricity.
    - **New service** – Line extensions for new service, temporary services, and retirements of lines.
    - **New construction** – New sectionalizing (reclosers, fused cutouts, sectionalizers), regulators, tie lines, or additional phases.
    - **Increase capacity** – Increasing distribution transformer capacity or voltage conversions
    - **Other** – Security lights or LED upgrades.
- **Substation** – Substation equipment replacements and upgrades.
- **Transmission** – Transmission ordinary replacements and new construction where applicable.
- **SCADA**– Telecommunications, SCADA, Operations Technology (OT) cybersecurity.
- **Facilities** – New buildings, building enhancements, and security.
- **Fleet** – New vehicles or replacement of existing vehicles
- **IT** – New software, software upgrades, hardware upgrades
- **Metering** – New meter installations, meter replacements, industrial metering
- **ET&I** – Energy Transformation and Innovation. This includes items such as battery storage, heat pumps, new technology projects, etc.

Each VEC project estimated to be greater than $10,000 receives a specific line item within that fiscal year's budget (January to December). VEC also utilizes annual blankets that contain miscellaneous replacements and construction. These blankets are too cumbersome to identify with a specific line item budget as they encompass hundreds of similar work orders.

VEC increased its capital budget to $9.65 million in 2008, $10 million in 2019, and will increase from $10 million by $300,000 annually until 2023. The following graph displays VEC's projections until 2023.

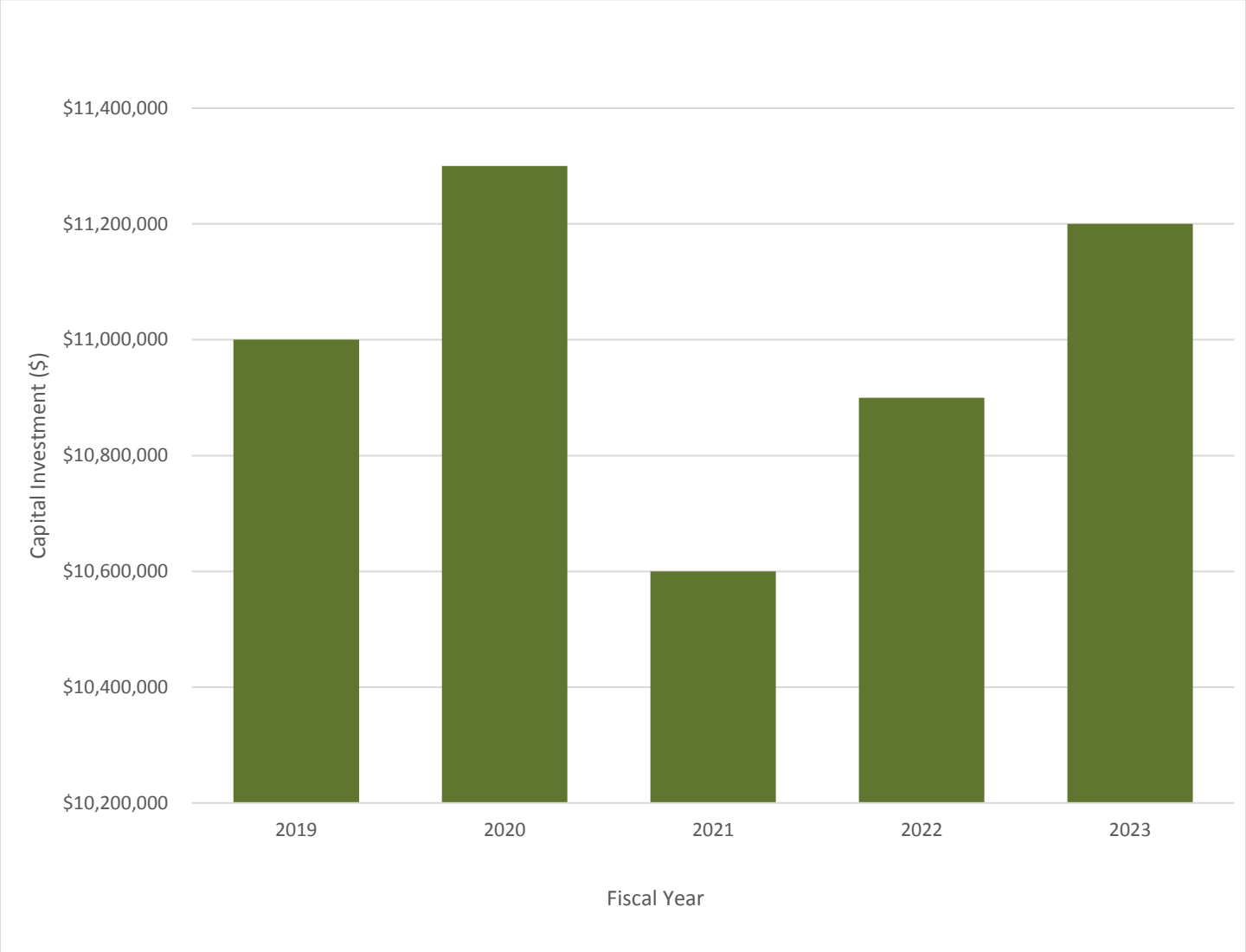


Figure 5.3.1.A VEC Capital investment 2019-2023

VEC expects to begin and complete construction of a new $2.4 million Newport district facility that will increase the capital budget to $11 million in both 2019 and 2020.

5.3.2 T&D Capital Investment

VEC's Transmission and Distribution investment includes the Distribution, Substation, Transmission, and SCADA sections. Our capital investment strategy is shifting from a significant investment in substation plant to investments in distribution plant. The 2008 system assessment primarily identified substation improvements that formed the basis for VEC's 2008-2018 capital investment plan. Since 2009, VEC has rebuilt 11 substations and invested approximately $29 million (42% of capital available) into substation plant to address safety and reliability concerns.

Further details on all four of the components shown in the chart below (Distribution, Substation, Transmission, and SCADA) can be found in the following sections.

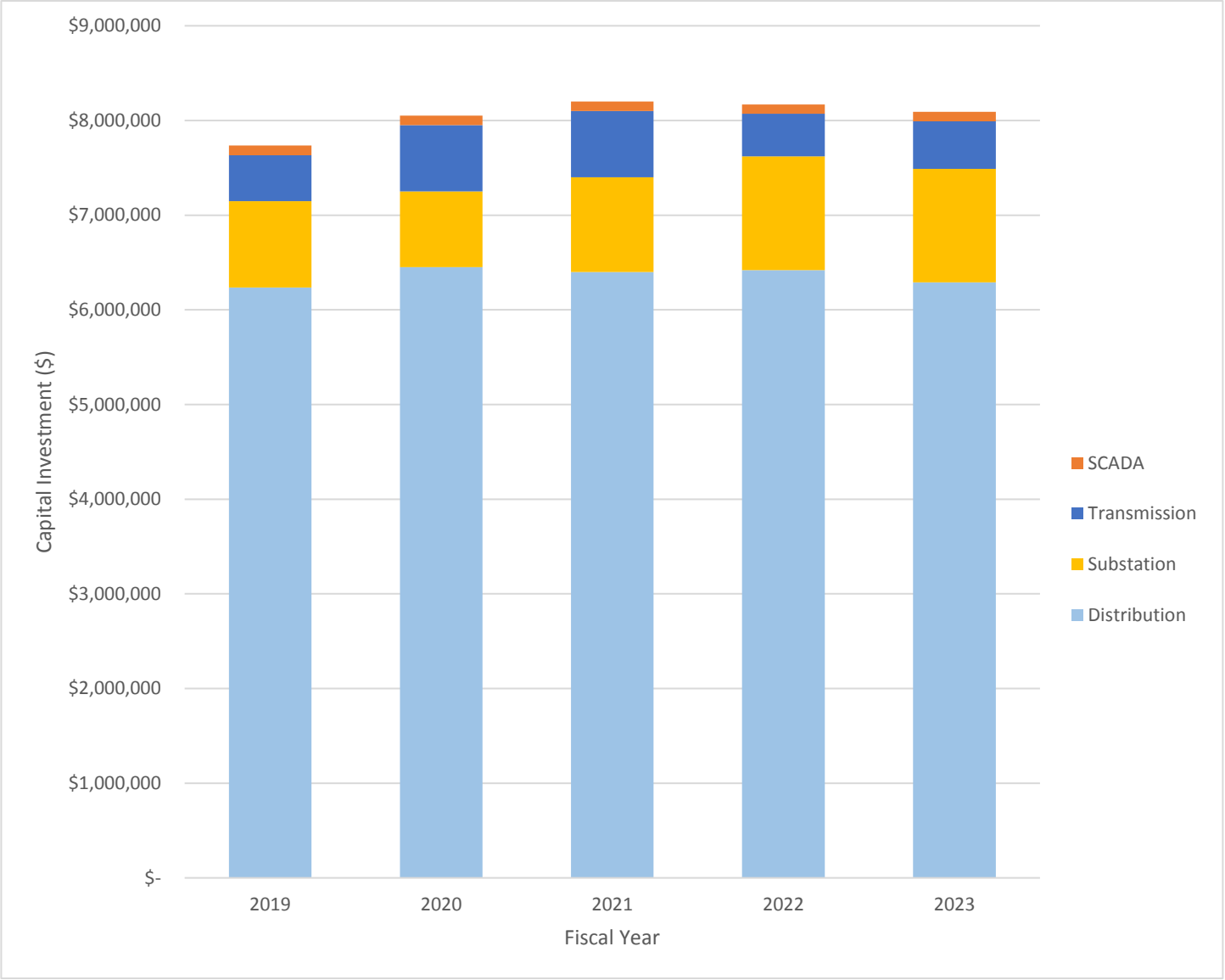


Figure 5.3.2.A Transmission & Distribution capital investment 2019-2023

Distribution Capital Investment (2019-2023)

Looking forward, VEC's Distribution capital investment emphasizes reconductoring, line relocations, and asset replacement. The chart below shows VEC's expected distribution capital investment from 2019-2023. Each of the categories is described in further detail in the sections below.

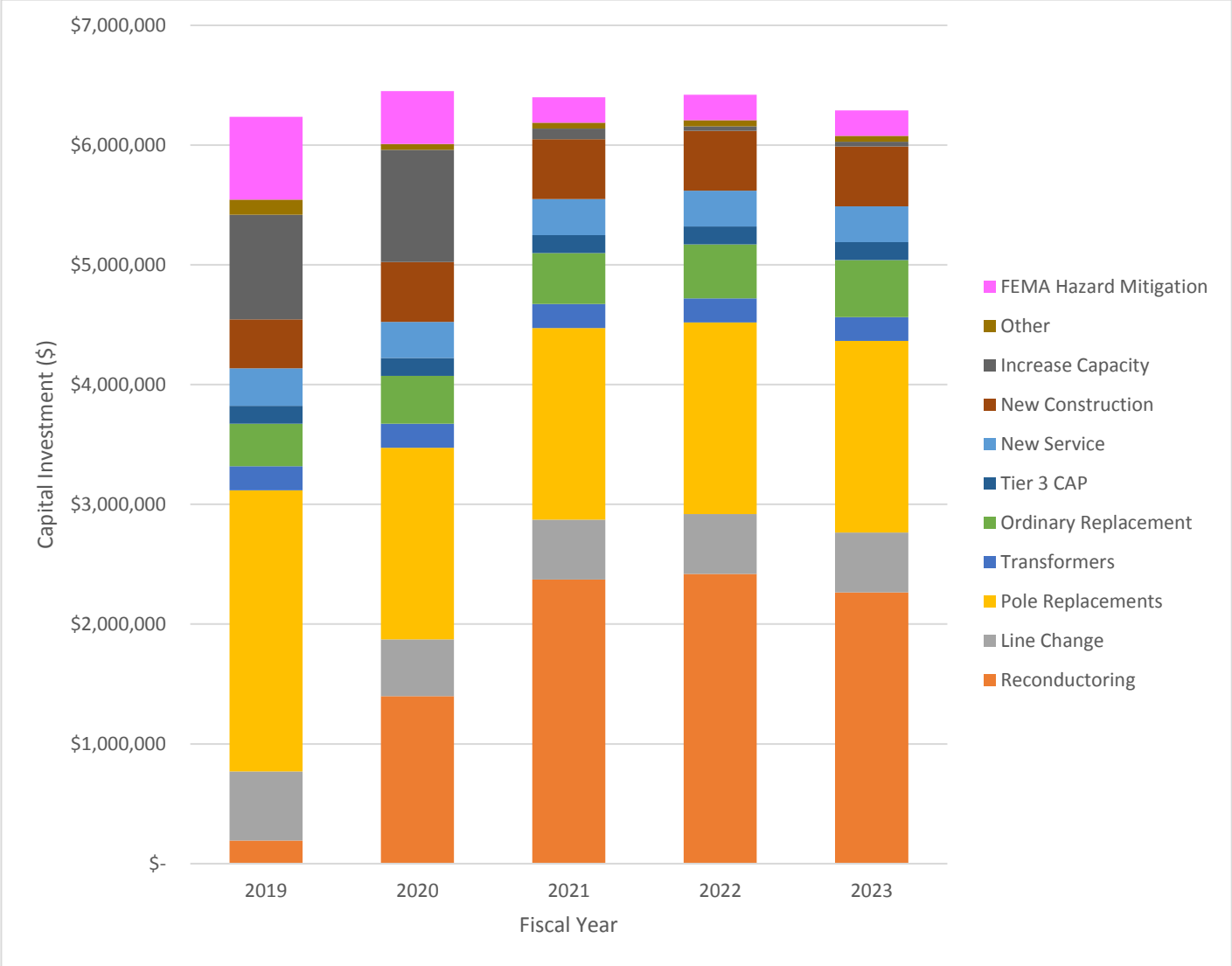


Figure 5.3.2.B Distribution capital investment 2019-2023

The distribution capital budget includes several non-discretionary components (on average 46 percent or approximately $2.9 million) such as new services and line extensions, pole replacements due to end of useful life or pole inspections rejects, and increases in capacity due to voltage or load constraints. The remainder of the budget (54 percent or $3.4 million) includes discretionary funds focused on reconductoring, line changes, and new construction projects.

New Services

This category includes all line extensions, line retirements, as well as temporary services. VEC's members are responsible for costs associated with new services and associated line extensions via VEC's tariff and line extension policy. However, there are often credits in one fiscal year that do not carry over into the following fiscal year. For instance, a member who may pay for an underground line extension in December but does not see construction until

the ground thaws in April/May. Historically, VEC has seen investment of approximately $300,000 annually to this blanket, and we expect that pattern to continue. VEC installs around 270 new services each year, the vast majority of which are small 100 or 200 A services. The chart below displays the capital investment on new services before and after member contribution via tariff and line extension charges.

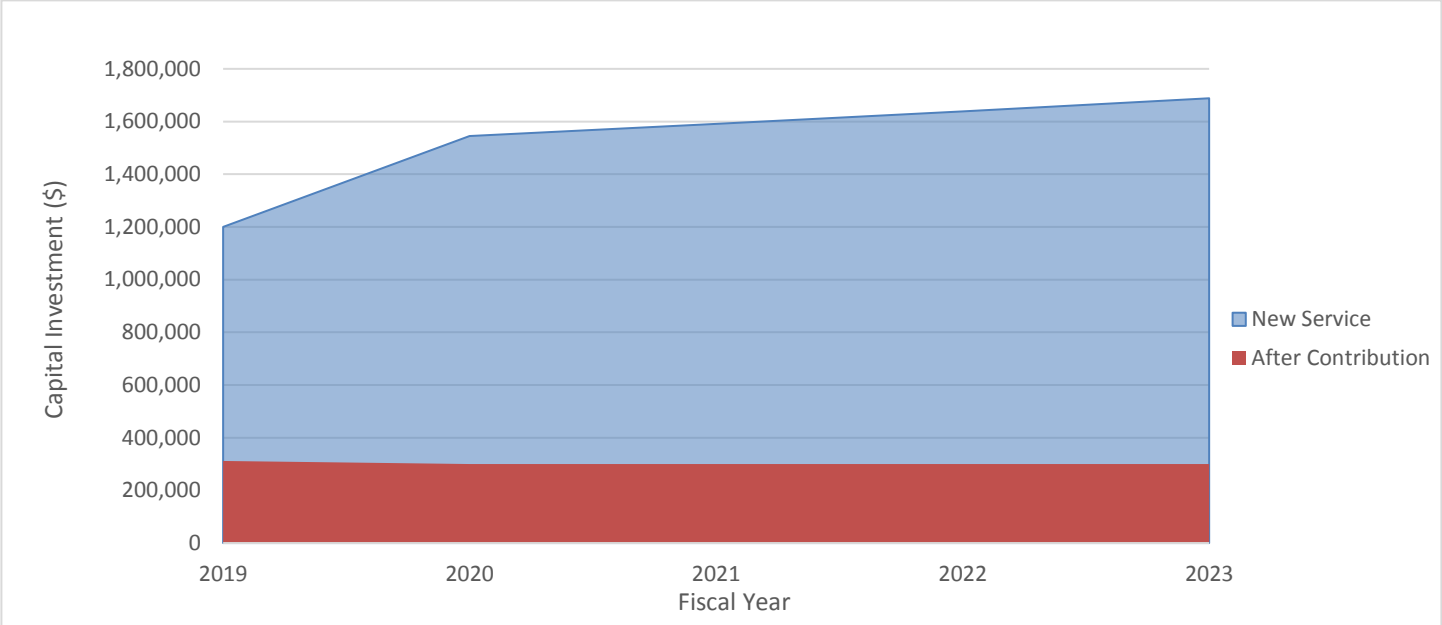


Figure 5.3.2.C New service investment 2019-2023

New Construction

This category includes any new construction such as new equipment (regulators, reclosers), new tie lines (feeder backup), or additional phases to address design criteria violations.

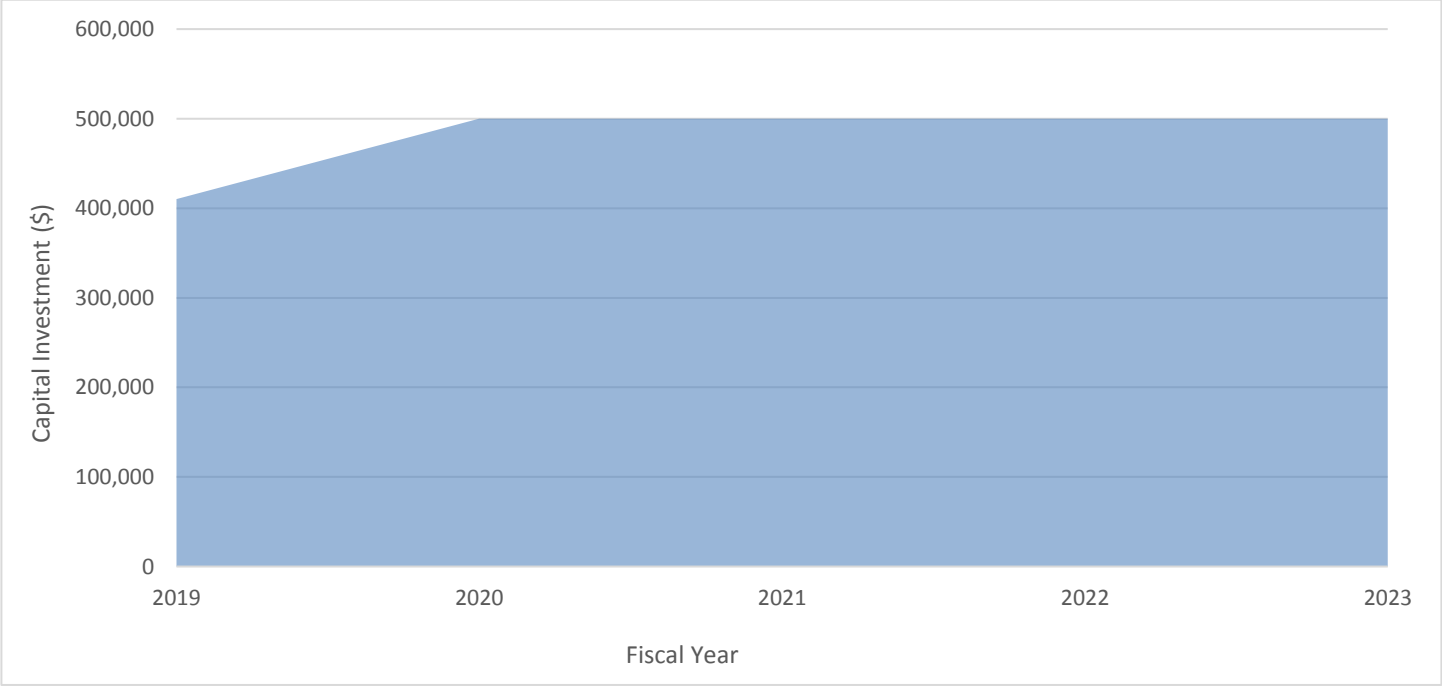


Figure 5.3.2.D New construction investment 2019-2023

The System Load and Voltage Study, completed in 2018 identified several sections of line that exceed VEC's design criteria for loading and voltage today, even without additional load growth. These line sections are scattered throughout the system and the solutions are generally tap changes, additional phases or voltage regulation. VEC analyzes each project using a capital prioritization process and budgets according to priority.

In addition, VEC has several opportunities to build new lines to allow for additional feeder backup and will construct such backup if the criteria in Section 4 are met. As part of this effort, and in order to provide the most reliability benefit to the VEC membership, VEC will add SCADA automation to the switches that will enable these ties where applicable.

Increase Capacity

This category includes all system voltage upgrades such as voltage conversions as well as increases in service. In the Voltage Upgrades section of Section 4 – Transmission and Distribution, VEC noted that it still operates about 90 miles of 2.4 kV lines. VEC converts all of its lower voltage circuits to standard 7.2 kV as assets deteriorate and capacity or voltage constraints arise. A study completed in late 2018 identified several locations where voltage was out of tolerance and identified the following voltage conversions:

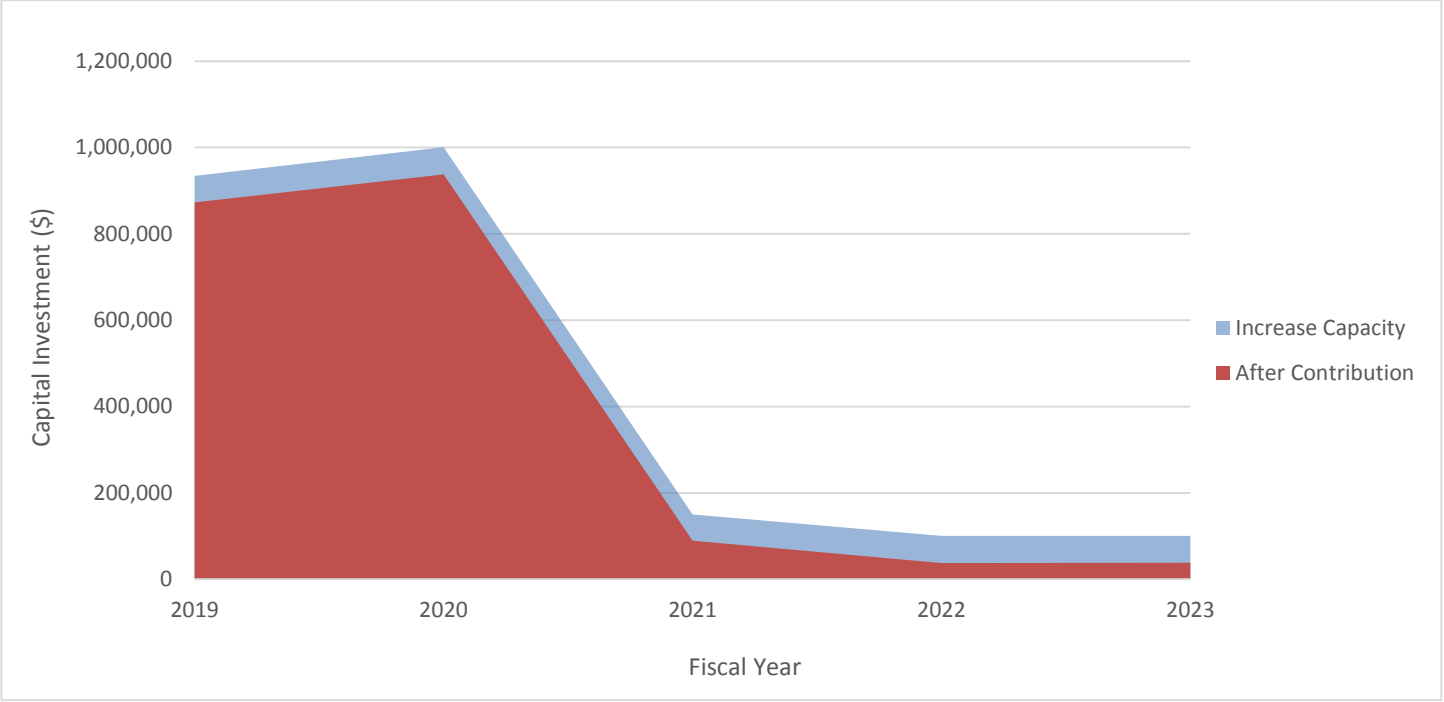


Figure 5.3.2.E Increase capacity investment 2019-2023

- Newport 44-4D - North Derby Rd (2018-2019)
- Derby 45-1G9B Beebee Road (2019)
- Irasburg 42-5E15 Lake Road (2019-2020)
- Island Pond 47-4D3 Head of the Pond Road (2019-2020)
- West Charleston 48-3D Church Hill/West Echo Lake Road (2020)

Member-driven service upgrades such as increases to service size represent around ~$150,000 (before contribution) or around 40 projects annually. 75 percent of these upgrades are a service increase of 100 Amps or less.

Reconductoring

VEC is reallocating a significant portion of its available discretionary funds to reconductor #6A, #8D, and #6 steel with a goal of replacing 25 miles annually by 2021. Underground replacements make up the remaining mileage (approximately 1 mile). The chart below shows this increase in investment and includes both overhead and underground reconductoring projects.

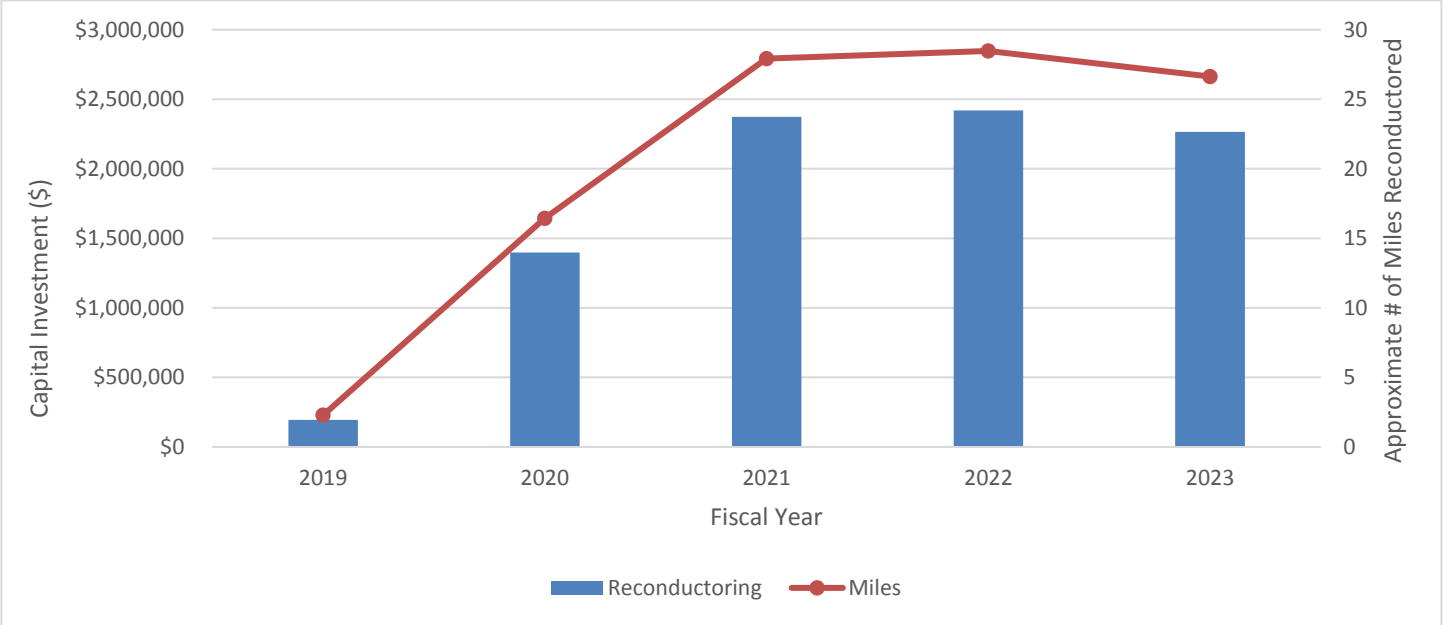


Figure 5.3.2.F Reconductoring investment 2019-2023

Underground Reconductoring

VEC has seen an increase in outages because of direct buried and unjacketed concentric neutral underground cable failures. The chart below details VEC's planned efforts to replace this older type of underground installation which averages around 1 mile per year:

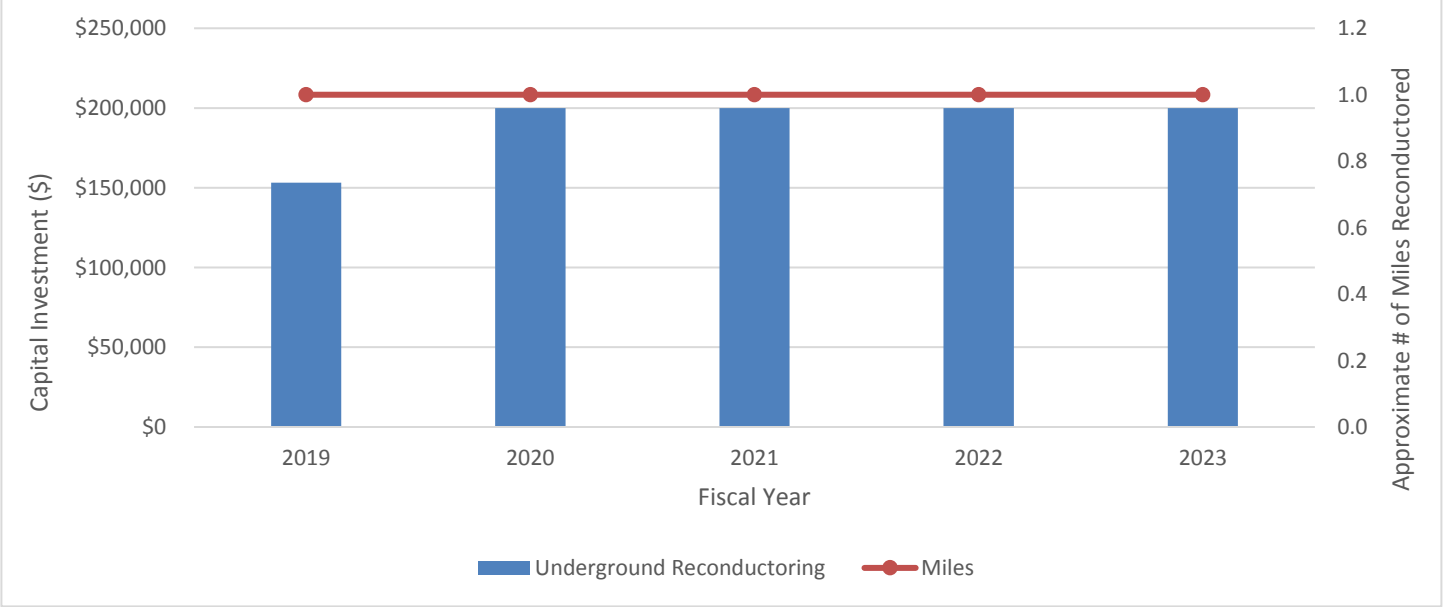


Figure 5.3.2.G Underground reconductoring investment 2019-2023

VEC has an unknown quantity of buried, unjacketed conductor on its system and it does not intend to replace such conductor as long as it is functional. However, as outages occur, we will prioritize such replacements based on cost, quantity of members, and reliability impacts. These projects are typically very costly and generally affect few members.

Pole, Ordinary, and Transformer Replacements

This category includes pole, transformer, recloser, and other equipment replacements. VEC invests the majority of its transmission and distribution capital budget on structure and equipment replacements. The increase in investment on identified distribution projects has moved capital investment from replacements to more focused reconductoring, line changes, and new construction.

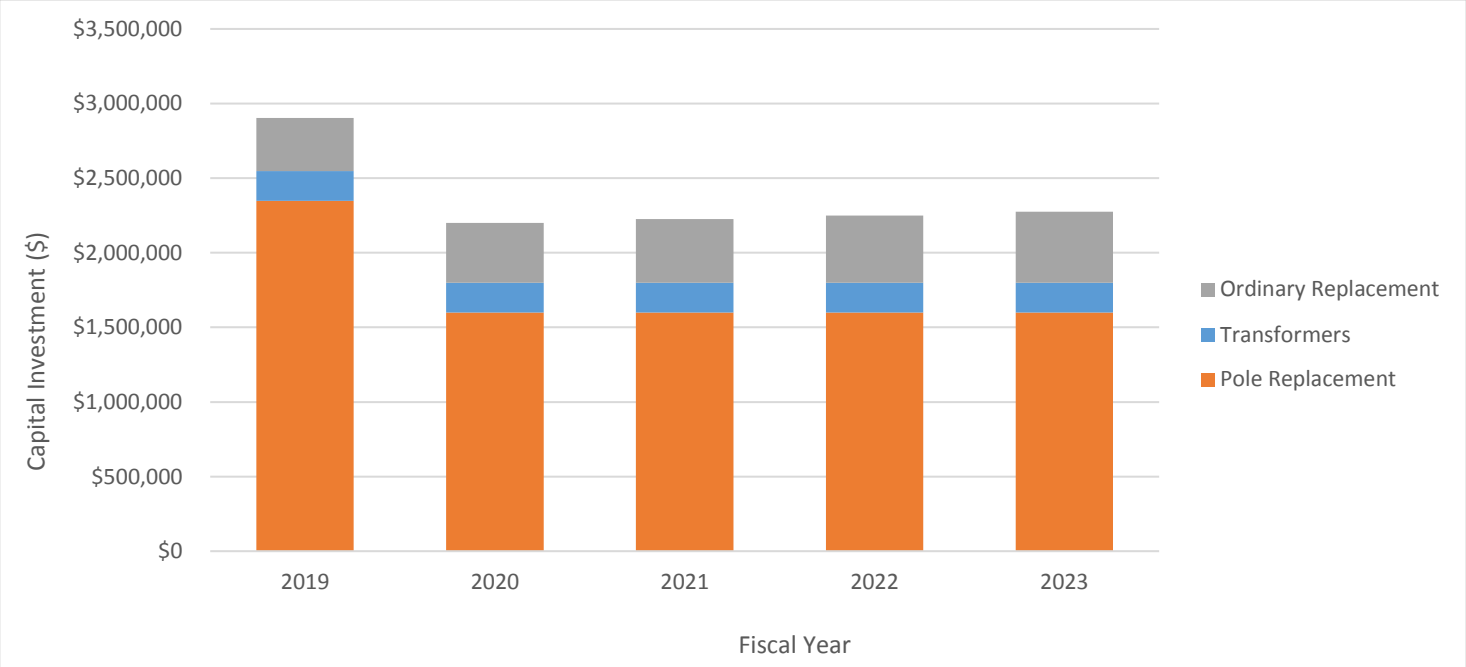


Figure 5.3.2.H Structure and equipment investment 2019-2023

Recent analysis reviewed the approximately 600 open transmission and distribution work orders to determine budgeting requirements, duration of project, and project status. Through that analysis, VEC identified that many of these work orders (around 250), primarily pole replacements, remained open for more than a year.

This large quantity of older jobs creates a budgeting challenge but also requires significantly more oversight and administration on behalf of VEC's engineering and operations staff. VEC intends to address many of these lingering projects in 2019 to decrease the overall quantity of work it is managing and ensure the closure of future projects in a reasonable amount of time. The 2019 increase in pole replacement investment is reflective of these changes.

Pole Replacements

In general, VEC expects to see an increase in the ~440 poles replaced annually due to change in use or from results of the annual pole inspection program. This is primarily due to an increase in investment on reconductoring projects, feeder backup, and adding additional conductor phases.

As smaller, lighter conductor such as 6A or 6 Steel is replaced with larger, heavier conductor such as 1/0 or covered conductor ("tree wire") the additional weight will often require larger and often taller poles to meet engineering requirements and ground clearance.

Telephone Pole Replacements

Telephone pole replacements are any pole within Franklin Telephone and Consolidated Communication's joint owned set area or at the request of Consolidated or Franklin Telephone. VEC replaces around 200 of these poles annually and expects this number to decrease in coming years due to VEC's 2019 acquisition of 7,700 joint owned poles from Consolidated. However, given this acquisition VEC's pole replacement budget has increased (around $130,000) because of VEC now setting and removing those poles.

Transformer Replacements

VEC has seen an increase in overhead and transformer replacements from around 220 annually in 2016 to 550 annually in 2018 primarily due to voltage conversions and underground reconductoring projects. VEC does expect this increase to slow over the coming years, as it does not anticipate any additional voltage conversions past 2021. VEC typically replaces transformers due to condition, load growth, or capital projects.

Ordinary Replacements

VEC categorizes everything from anchors, recloser changes, cutout replacements, or new meter loops for members as part of its ordinary replacements blanket. As part of VEC's maintenance plan initiative, VEC plans to maintain or replace all hydraulic reclosers on the VEC's system within the next five years. VEC has limited asset information (age, counters, etc.) available for its distribution reclosers and as such, VEC expects that significant replacement and maintenance will need to occur and has budgeted capital investment accordingly.

In an effort to continue improving member safety VEC's field technicians have recently began identifying NESC and NEC code violations on VEC and member owned meters and equipment. The District Operation Supervisor and Field Engineer review each violation. VEC sends letters to members that have violations on non-VEC-owned assets asking them to fix the violation. VEC averages approximately $60,000 annual to fix these NESC violations. The following is an example of one of those locations.

Figure 5.3.2.I NESC violation identified in Newport district

Line Change

This category includes any project that relocates a distribution line from its existing location to another location or going from overhead to underground. Most commonly, this is moving a line from difficult to access right of way to the roadside.

VEC expects to relocate approximately 3-4 miles of line annually pending easement acquisition and permitting schedules. VEC gives higher priority to lines that are currently inaccessible or present environmental challenges (wetlands or washout).

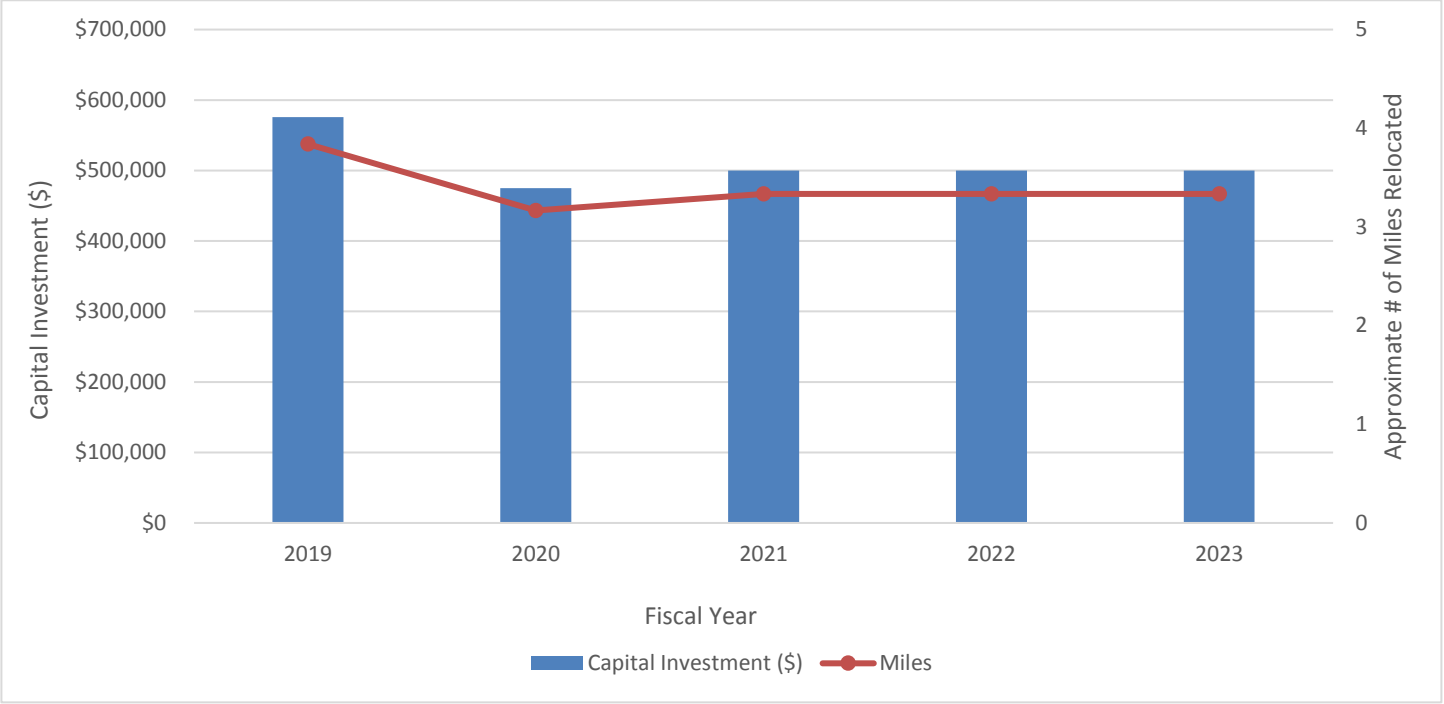


Figure 5.3.2.J Line change expenditure 2019-2023

FEMA Hazard Mitigation Funding

In 2018, VEC submitted five proposed projects for Section 404 funding ($635,000 contribution from FEMA) to relocate and reconductor sections of line that were affected by Wind Storm Phillipe in 2017. VEC completed some of these projects in 2018 and will complete the remainder in 2019. VEC also received another $1.1 million across five additional projects for damage from the wind event of May 2018. VEC plans to complete these projects in 2020, as VEC did not receive the award until first quarter 2019.

In addition, VEC plans to apply for Section 406 – Public Assistance funding in 2019.

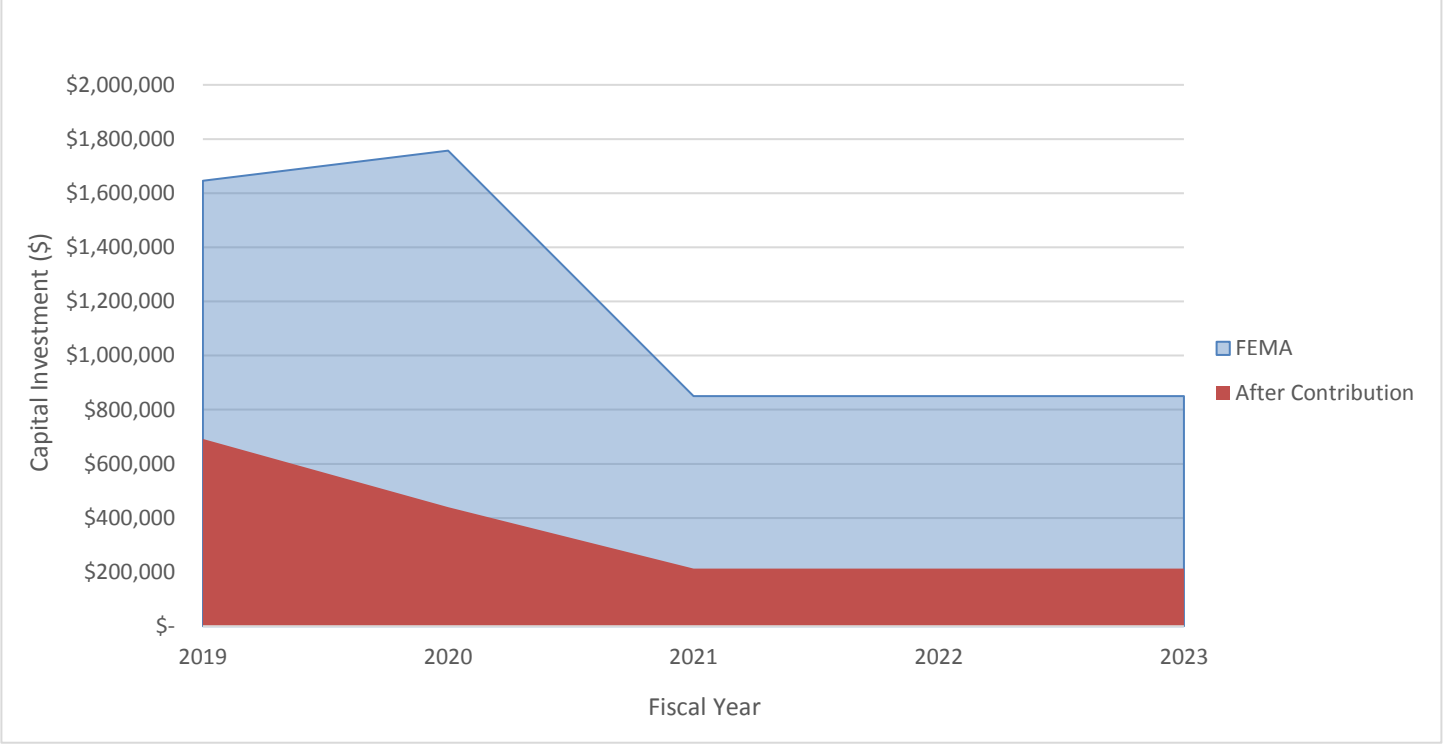


Figure 5.3.2.K FEMA hazard mitigation investment 2019-2023

Tier 3 CAP

VEC's Clean Air Program (CAP) offers customized opportunities to members with off-grid or underserved homes or businesses to replace fossil fuel usage with electricity. VEC is expecting to see an annual increase of three small CAP projects (typically sugarmakers), and one large CAP project (typically gravel pits or sawmills).

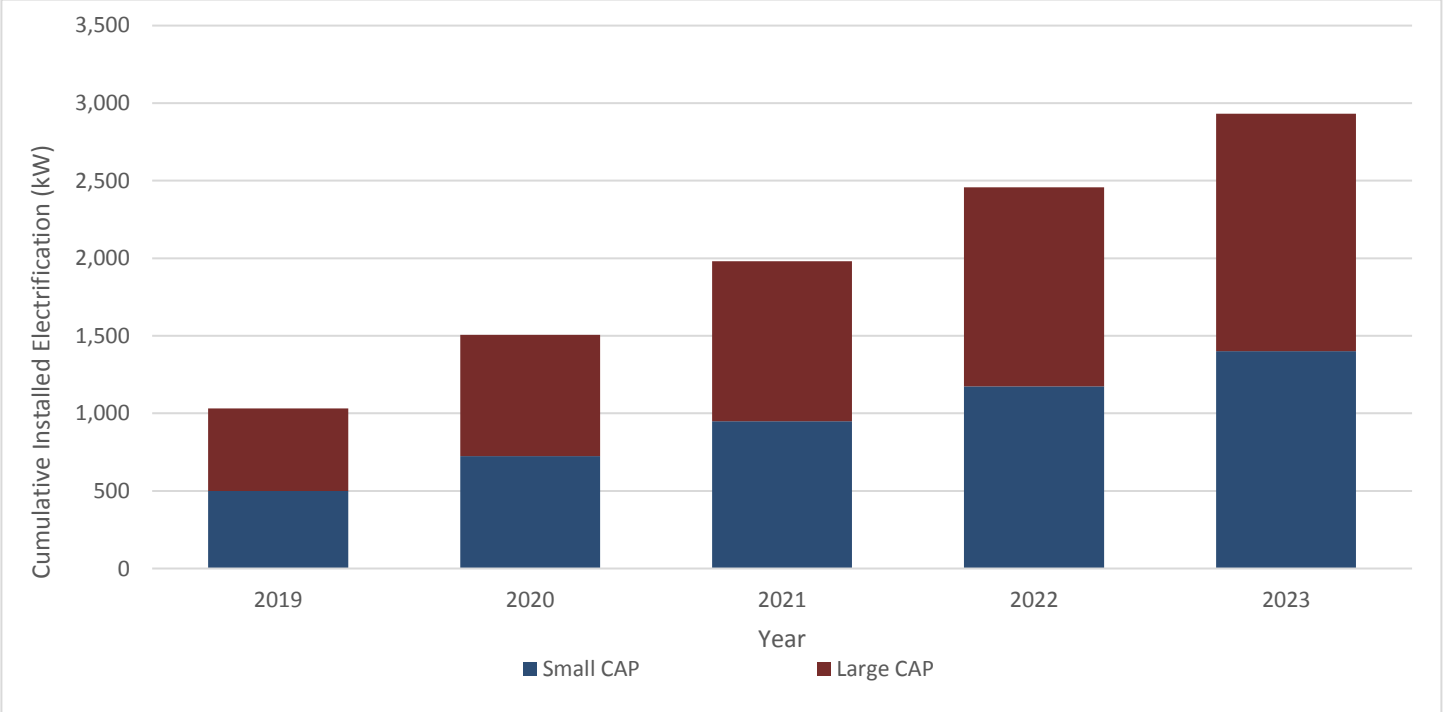


Figure 5.3.2.L Cumulative installed electrification after diversification (kW) by year CAP

Each project has a special contract outlining a cost share agreement. The forecast details this investment in the chart below:

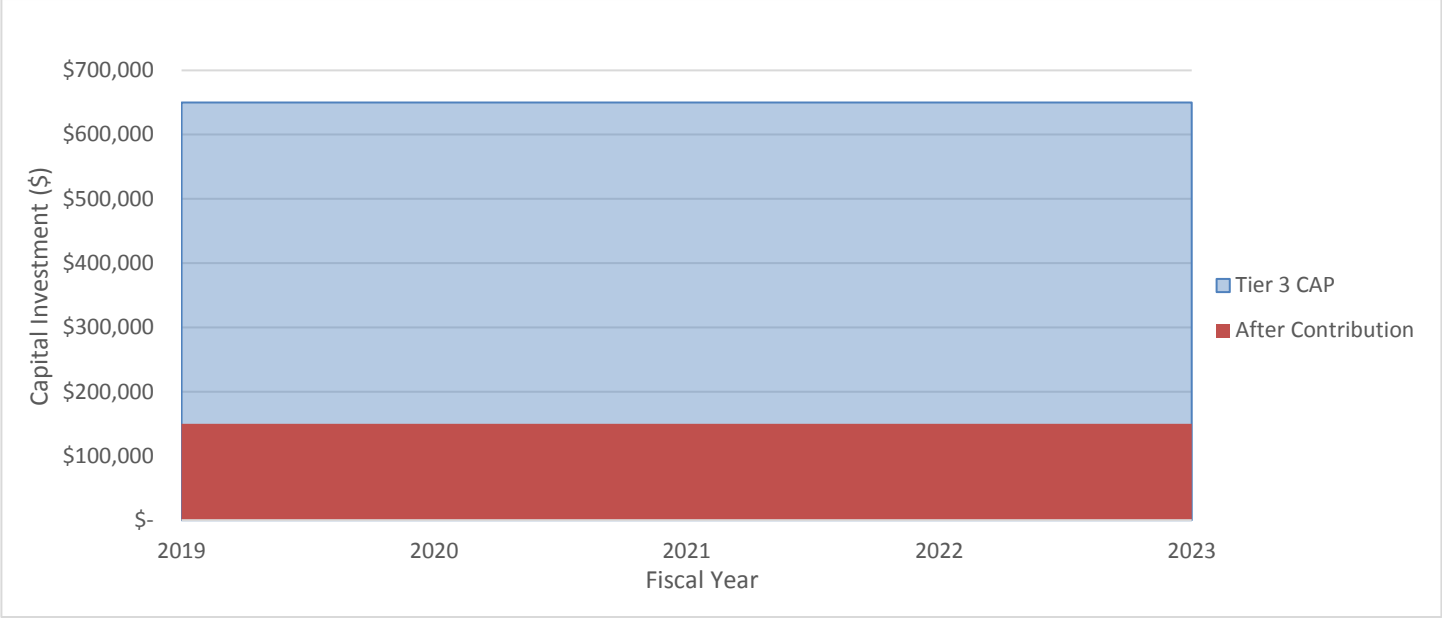


Figure 5.3.2.M Tier 3 CAP investment 2019-2023

Transmission Capital Investment (2019-2023)

VEC uses 173 miles of transmission lines to deliver power from our transmission service providers to our distribution substations or wholesale transmission members. VEC's 46 kV transmission lines are connected to VELCO's 115 kV substations at Highgate, Jay, Newport and Irasburg. VEC's 34.5 kV transmission lines are operated as radial connections to 34.5 kV transmission lines operated by GMP. The chart below shows VEC's future expected transmission investment, which VEC expects to increase over prior years. The vast majority of capital dollars will be devoted to replacement of assets due to poor condition.

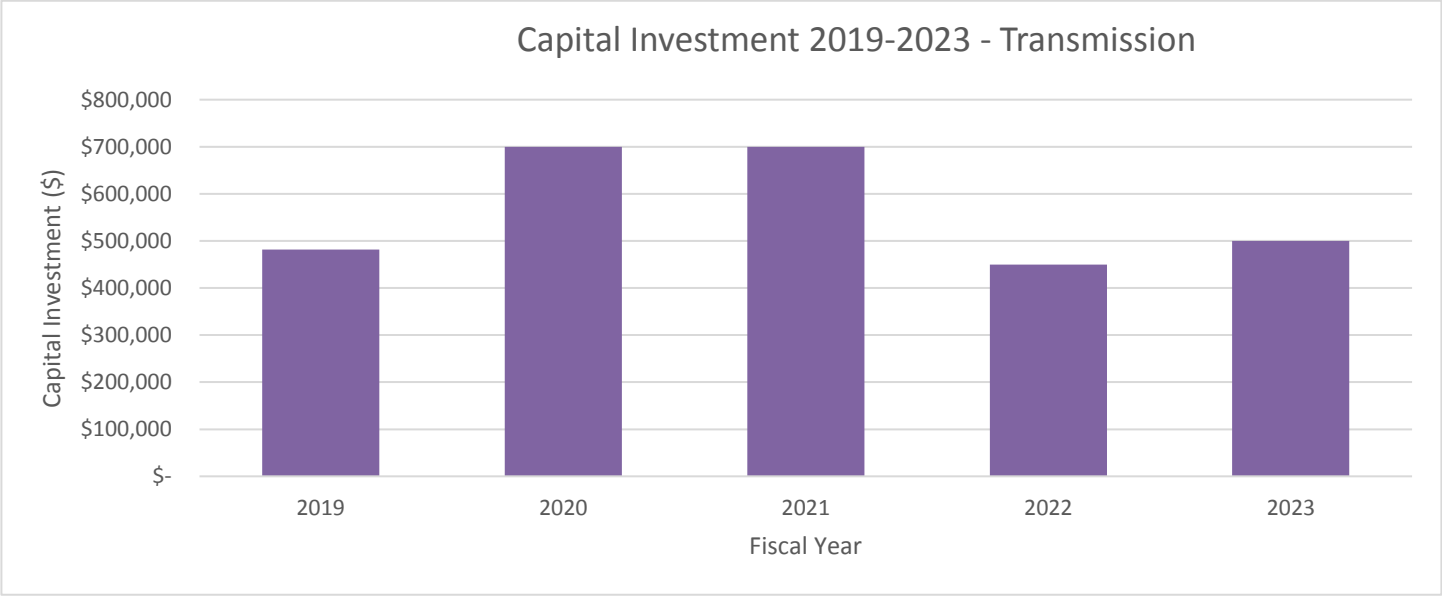


Figure 5.3.2.N Transmission capital investment 2019-2023

The sections below provide specifics on VEC's planned transmission investment.

H16 Condition Assessment/Replacement and 43-1A Distribution Underbuild Reconductoring (Expected 2019-2021)

The VEC H16 line is an 18.6-mile 46 kV sub-transmission line that feeds VEC's Burton Hill substation, the towns of Barton and Orleans as well as Portland Pipe. Portland Pipe is a pipeline pumping station that had been a high-use member but has been off-line for several years. This project consists of a condition assessment and replacement of VEC's poorest condition transmission poles; they also happen to be some of VEC's oldest transmission poles.

In 2009, VEC inspected and treated all of its transmission poles at ground line. However, VEC has been working on the condition assessment to review pole top conditions. Because of this condition assessment, VEC replaced 74 poles of 168 poles/structures on this line since 2012, which were deemed conditionally inadequate. VEC expects to complete the H16 Condition Assessment and Replacement in 2020.

In addition to the assessment and replacement, VEC is planning to reconductor 4.56 miles of distribution underbuild from #2 ACSR to 336 ACSR that will allow full feeder back of VEC's Burton Hill substation from VEC's Irasburg Substation. VEC expects to complete the 43-1A Reconductoring and Transmission Pole Replacement in 2020-2021.

Vermont Route 78 AOT Relocation (Expected 2020)

The Vermont Agency of Transportation (VAOT) continues to work through the planning stages of a project to widen Route 78 from Swanton Village to the West Swanton Bridge. VEC has approximately 5,000 feet of 46 kV transmission line with single-phase distribution underbuild impacted by the project. As a result, VEC will need to move approximately 15 transmission poles so that the project can move forward. VAOT will reimburse 100 percent of the cost of the rebuild except for VEC overheads. VEC expects to permit in 2019 with construction beginning in 2020/2021.

Miscellaneous Replacements

VEC is expecting to perform a second round of pole inspection and treatment on all of its transmission poles in 2020. As a result, expect that approximately 1.46 percent or 38 (VEC's average pole reject percentage) of the 2,575 transmission poles on VEC's system will need to be replaced. The cost of replacing a transmission pole is generally two to three times the cost of a distribution pole due to additional material and safety requirements. In addition, these poles are generally not located roadside.

VELCO K41 and K46

VEC is working with VELCO on a joint project to replace structures and insulators on the K41 and K46 lines that run from Richford to Mosher's Tap in Newport. Much of this line is double-circuit and contains a single structure with both 115 kV and 46 kV lines. VELCO owns, operates and maintains the 115 kV and 46 kV assets. VEC leases and operates the 46 kV facilities and is responsible for 50 percent of the costs associated with any structure or equipment replacements.

Substation Capital Investment (2019-2023)

As was stated above, VEC invested heavily in substation assets from 2008 to 2016. We are expecting to slow down this investment in the coming years. The chart below shows VEC's past and future expected substation investment.

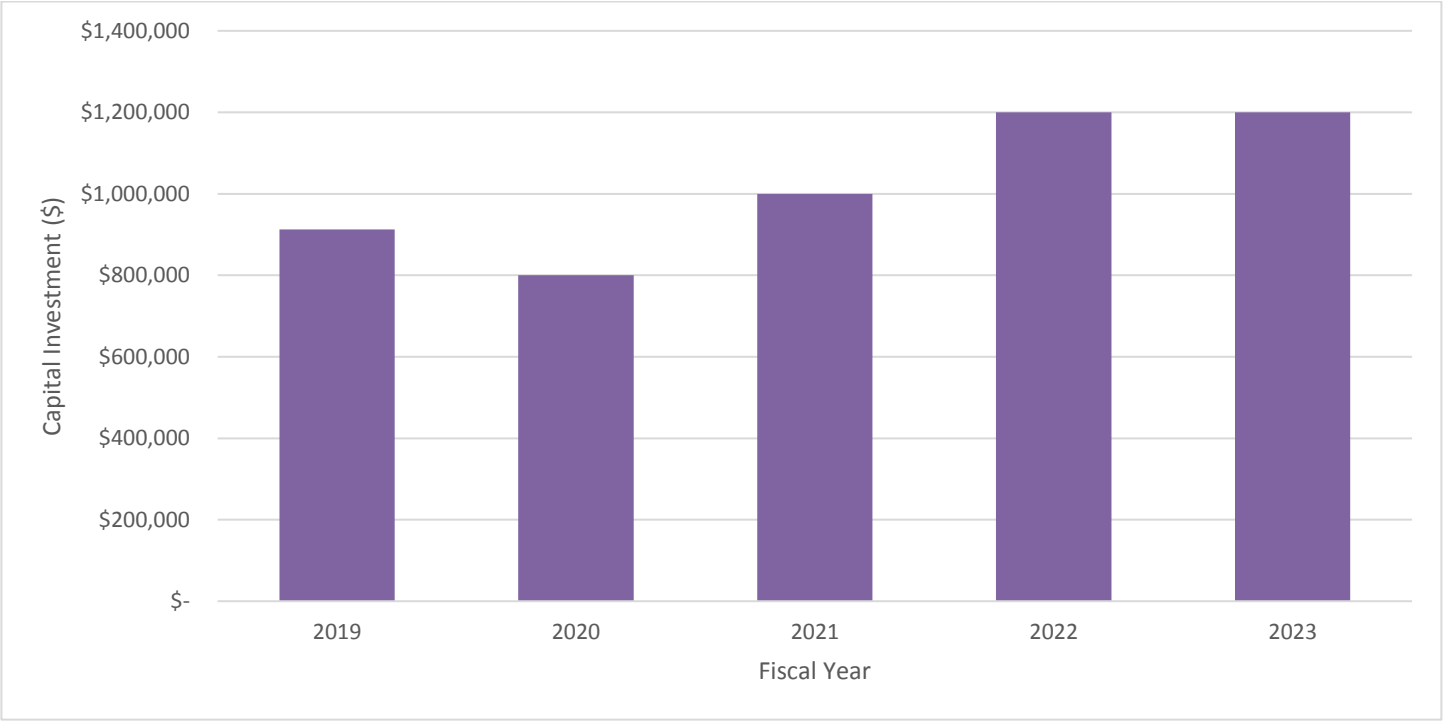


Figure 5.3.2.O Substation capital investment 2019-2023

A high-level overview of VEC's proposed substation projects is provided below:

Sheldon Substation (Expected 2020-2021)

In late 2017, VEC received an application for a 20 MW solar project that was located approximately one-half mile from VEC's existing Sheldon #32 substation. Given the proximity to the existing Sheldon substation that feeds VEC's largest member (West Rock Paper Mill) and the condition and working clearances of the existing substation, it is not feasible to interconnect this generator into the existing substation.

VEC plans to work with the developer to relocate and rebuild its Sheldon Substation at the proposed generation site. The proposed design would include two 46 kV radial buses with a normally opened bus tie breaker, five incoming and outgoing line breakers and two power transformers to step down voltage to 34.5 kV and 12.47 kV similar to the existing Sheldon substation. The developer would be responsible for costs equal to the Highgate three-breaker ring bus substation (second 20 MW solar project application) and VEC would be responsible for the remainder.

The project is contingent on the solar developer receiving its Vermont CPG and VEC is expecting permitting to begin in late 2019. A phased construction approach would allow the developer to come online in 2020 and then allow VEC the flexibility of moving over its two distribution and transmission circuits during 2021-2022 fiscal years. If this new 20 MW of generation could feed directly into the R65 34.5 kV line to St. Albans and bypass VELCO Highgate, there may be added benefit to the SHEI if during times of curtailments. In this case, VEC would need to rebuild its transmission line to the existing substation at the same time as the new substation is constructed. A larger transformer would be required on the R65 line and paid for by the developer.

Belvidere Substation Rebuild and Montgomery Substation Retirement (Expected 2021)

VEC's Belvidere load is currently served via the Montgomery #7 3A circuit due to peak loads that exceed the rating of the Belvidere substation transformer. The peak load is driven primarily by maple sugar makers located in Belvidere. The distribution line from Montgomery to Belvidere is single phase, making it difficult to balance the phase loading at the Montgomery substation. This also presents a challenge for any future load growth in the area.

The transmission line to Montgomery substation is a radial line that feeds through Belvidere ending in Montgomery. Rebuilding Belvidere substation, retiring Montgomery substation, and converting this portion of 34.5 kV transmission into 12.47 kV distribution would have several benefits. First, it places the source closer to the load allowing for better load management and voltage support. Second, it would allow VEC to retire some of its substation assets, reducing operating and maintenance costs. Third, it would allow VEC to reduce its transmission line length, reducing maintenance costs, and improving reliability to the region. The 34.5 kV transmission has 4/0 aluminum conductor that would make an excellent three phase distribution line to Montgomery. The circuit would not need any additional upgrades or voltage support in order to feed the load in Montgomery. This project is shown in the graphic below:

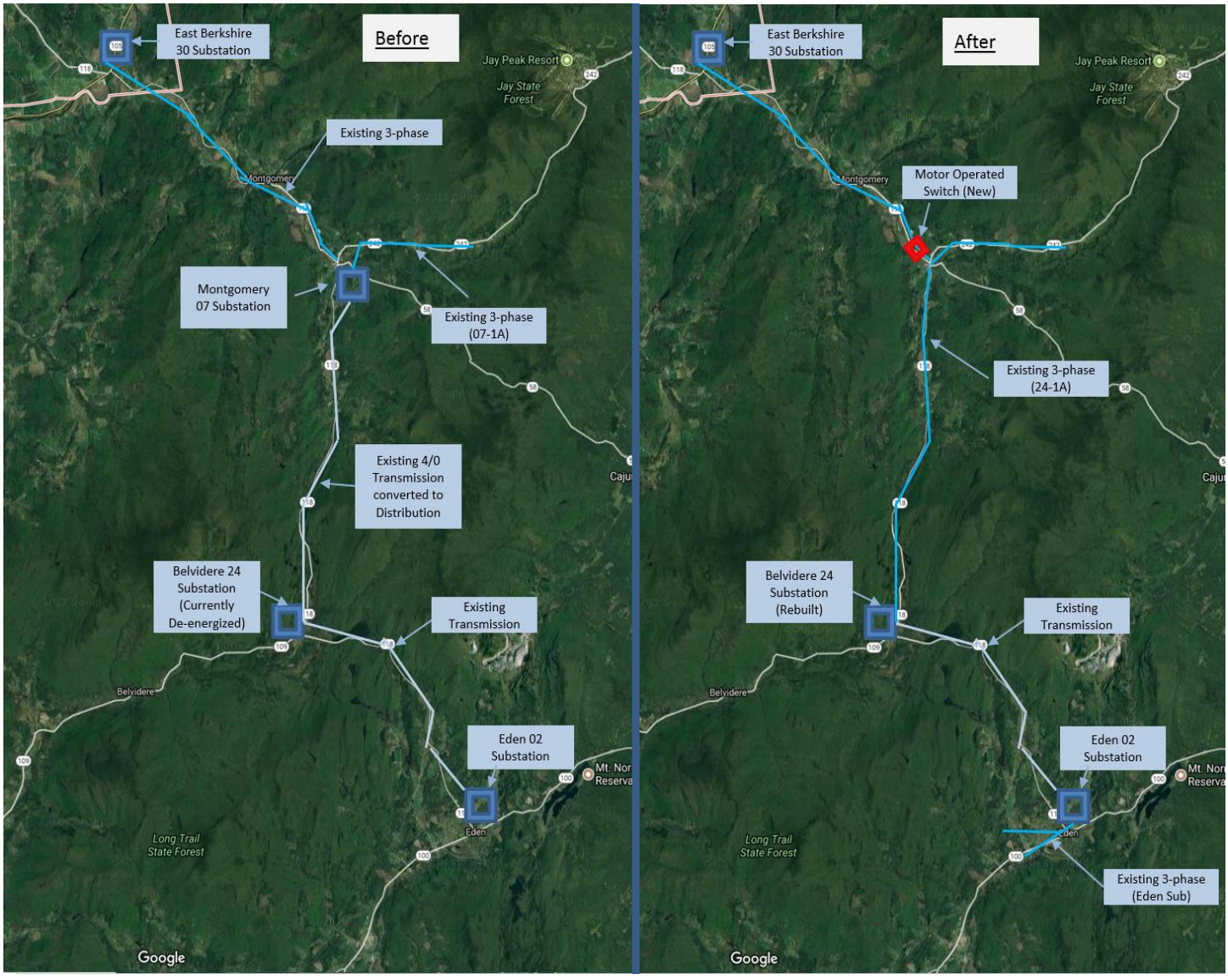


Figure 5.3.2.P Belvidere and Montgomery consolidation plan

A future project would allow for feeder backup of the existing Montgomery #7 1A. VEC would need to construct a new tie line along with sections of reconductoring on the existing 3-phase between Berkshire and the town of Montgomery.

This project screened out of Docket 6290 as the upgrade is proposed for reliability and to balance load between phases and circuits.

Hinesburg #19 Transformer Upgrade (Expected 2021)

In 2019, VEC will install a 2 MVA battery energy storage project located adjacent to the VEC Hinesburg #19 substation and interconnected to the VEC 19-3A 12.47 kV distribution circuit. The battery storage project creates additional load on the Hinesburg substation and causes the peak load to exceed 80% of the substation transformer nameplate rating, exceeding VEC's design criteria.

VEC is evaluating the need to increase capacity at this substation because of the battery project and will be monitoring actual loading and performance of the project through the first year of operation. This will give VEC a clearer idea of if and when a substation capacity increase may be necessary. A capacity increase would upgrade the three existing 2,500-kVA transformers to a minimum 10/12 MVA transformer to allow for future load growth. In addition, VEC will add oil containment.

VEC is reviewing this project via Docket 6290.

VELCO SCAP Projects (2020-2023)

VELCO developed an evaluation protocol (Substation Condition Assessment Project or SCAP) used to conduct a condition assessment of its substations. The objective of the SCAP is to address stations within VELCO's system believed to require refurbishment. Typically, these stations are older, have not recently undergone significant capital upgrades and consist of facilities with planned replacements. VELCO first performs a comprehensive condition assessment of the facility, with the recognition that age alone does not warrant replacement, to develop the scope of work with the objective of refurbishing the station, extend the life of the assets, and improve reliability.

At several of these locations, VEC owns exclusive facilities (facilities that are as necessary for the operation and control of our system only and not required by VELCO). VEC will bear 100 percent of the cost of any exclusive facilities replacements.

The SCAP identified three substations with associated projects that are located within VEC's service territory. VELCO has not yet created a work scope for the projects, and estimates are based on total costs of other SCAP station projects. Once the project scopes are developed, a condition assessment report will be completed along with a scoping exercise. Presently, the locations and rough timelines for these projects are listed below:

- VELCO Irasburg SCAP (Expected 2020-2021 and $1.6 million)
- VELCO Highgate SCAP (Expected 2020-2022)
- VELCO South Hero SCAP (Expected 2021-2023)

SCADA Capital Investment (2019-2023)

This section of VEC's capital budget includes any investment in telecommunications, SCADA, and Operations Technology (OT) cybersecurity. SCADA investment has since slowed with the largest recent investment being an upgrade to VEC's SCADA system.

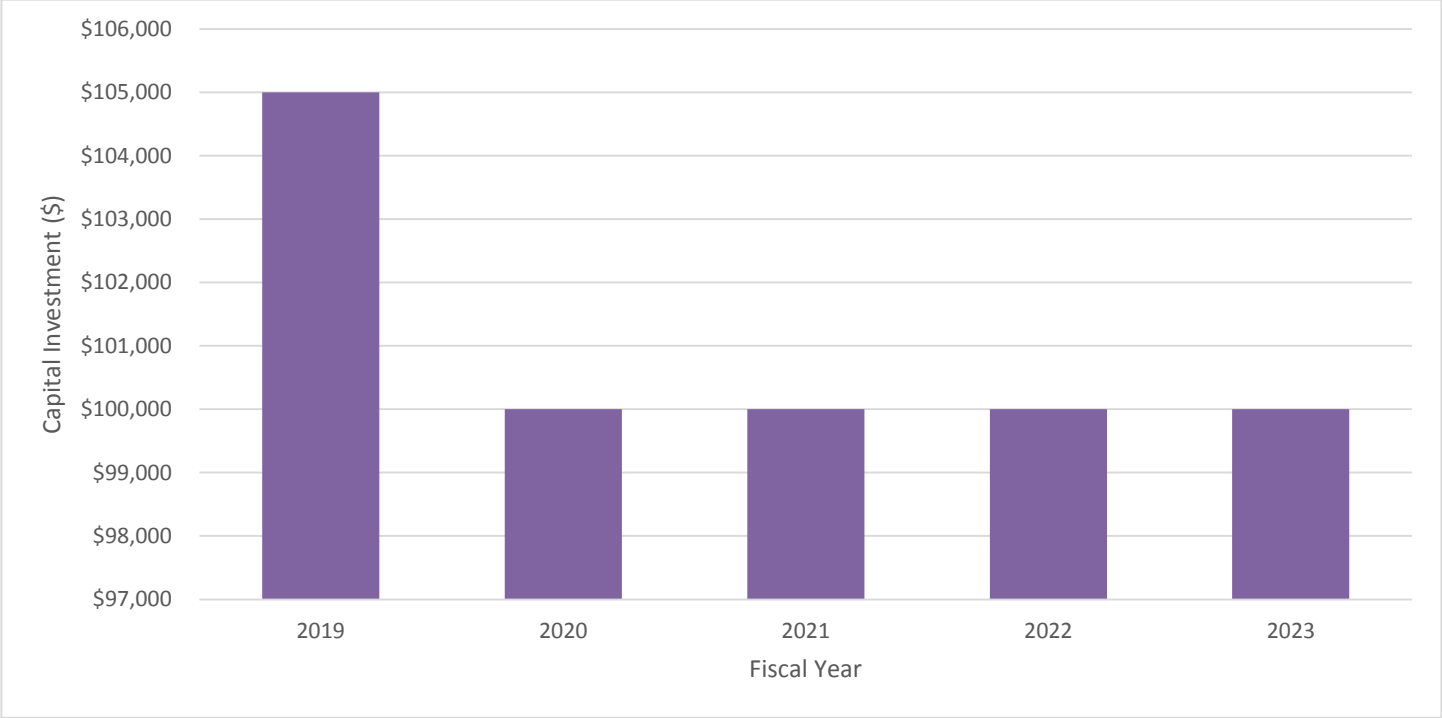


Figure 5.3.2.Q SCADA capital investment 2019-2023

A high-level overview of VEC's proposed SCADA projects is provided below:

- **Operations Technology Cybersecurity Improvements (2019-2023) -** The VEC internal private and SCADA networks are isolated from each other for cybersecurity. VEC categorizes any cybersecurity upgrades associated with the SCADA system in this section. Upgrades to VEC's cybersecurity posture are expected to occur on at minimum a semi-annual basis to ensure VEC's operational systems remain secure.
- **SCADA System Upgrade (2020) -** We will be replacing our SCADA system in 2020 This replacement is primarily due to Windows 7 going out of support and to renew hardware.
- **Additional Real Time Metering (Ongoing) -** VEC also expects to continue deploying real time capable, high accuracy meters across its system to benefit both engineering and operations.

5.3.3 Other Capital Investment

The T&D section of VEC's capital budget represents around 80 percent of total capital investment. Further details on the remaining components (Metering, Information Technology, Facilities, Fleet, ET&I) can be found in the following sections.

Metering Capital Investment (2019-2023)

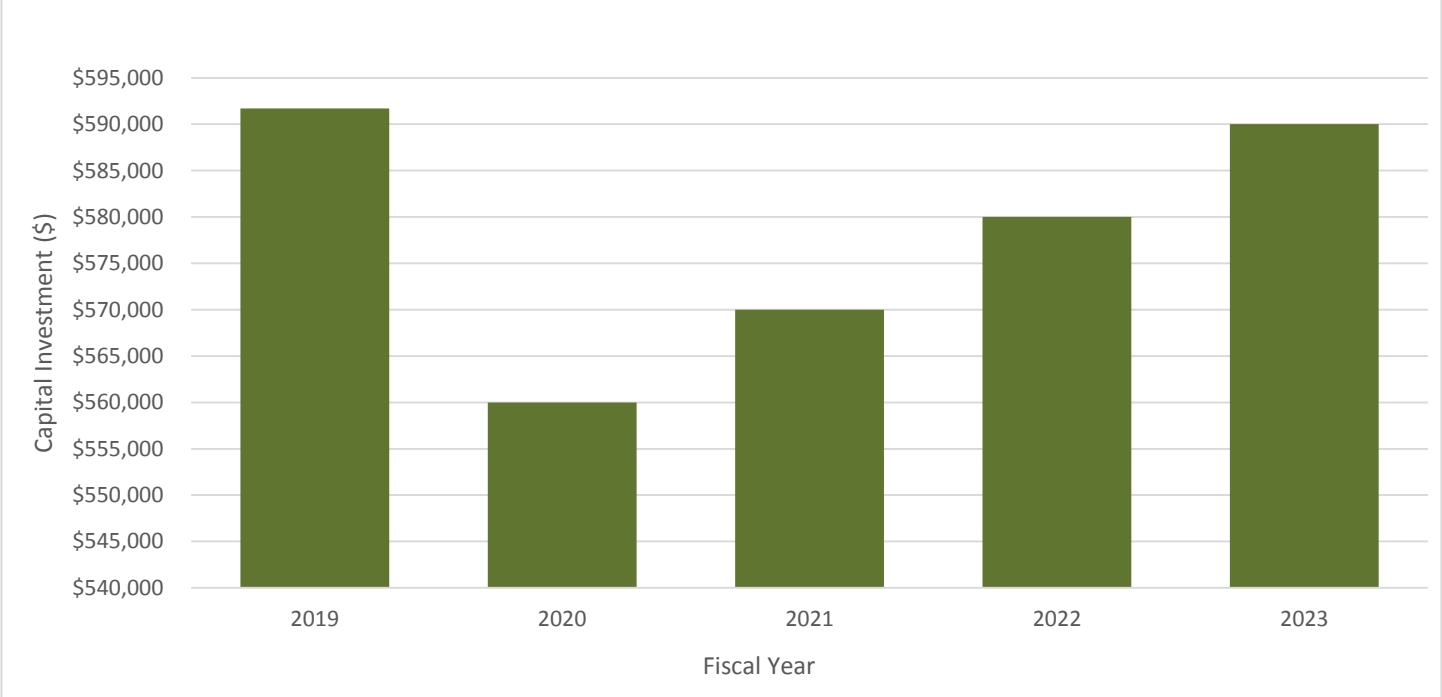


Figure 5.3.3.A Metering capital investment 2019-2023

AMI Substation Upgrades (2019)

In preparation of VEC's AMI Upgrade, upgrades to substation hardware were required to utilize features of the new system. In addition, VEC plans to install AMI at its Guildhall #53, Jericho #10, and Montgomery #07 substations in 2019. These substations did not have AMI packages, and the meters were read from other substations. As a result of these upgrades, member will experience shorter outage response times. The only location on VEC's system currently without AMI is French Hill #20 due to a high cost to invest for a low number of meters.

AMI Upgrade (2018-2022)

VEC is in the process of upgrading from its existing Aclara TWACS power line carrier system to a newer version called eTWACS (enhanced TWACS).

In order to make use of these enhanced features, VEC needs to have 80 percent penetration of newer meter modules per substation, as well as new substation hardware. While some substations are already 80 percent penetration, many do not. VEC has developed a multi-year plan to replace roughly 20,000 of VEC's meters and perform hardware upgrades at half of the substations to support the performance and feature enhancements.

VEC is considering accelerating annual meter replacements to meet this plan and expects minimal capital impact. VEC upgraded the other half of VEC's existing meter assets at the end of their normal life expectancy of ten years.

Information Technology Capital Investment (2019-2023)

The Information Technology (IT) section of the capital budget includes any new software, software upgrades, and hardware upgrades associated with the corporate business network. All operations technology associated upgrades are kept separate in the SCADA section. VEC's IT achieves three major overarching and intertwined goals.

- Enhance business performance by adding products and tools for VEC's membership and employees. We will work on methods to enhance data collection and leverage data from advanced technologies.
- Modernize 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.
- Maintain and enhance security of the enterprise, as a means to protect member and employee data. VEC continues to focus on our cybersecurity posture with a combination of training and new technology.

VEC expects to increase IT capital investment over the next several years

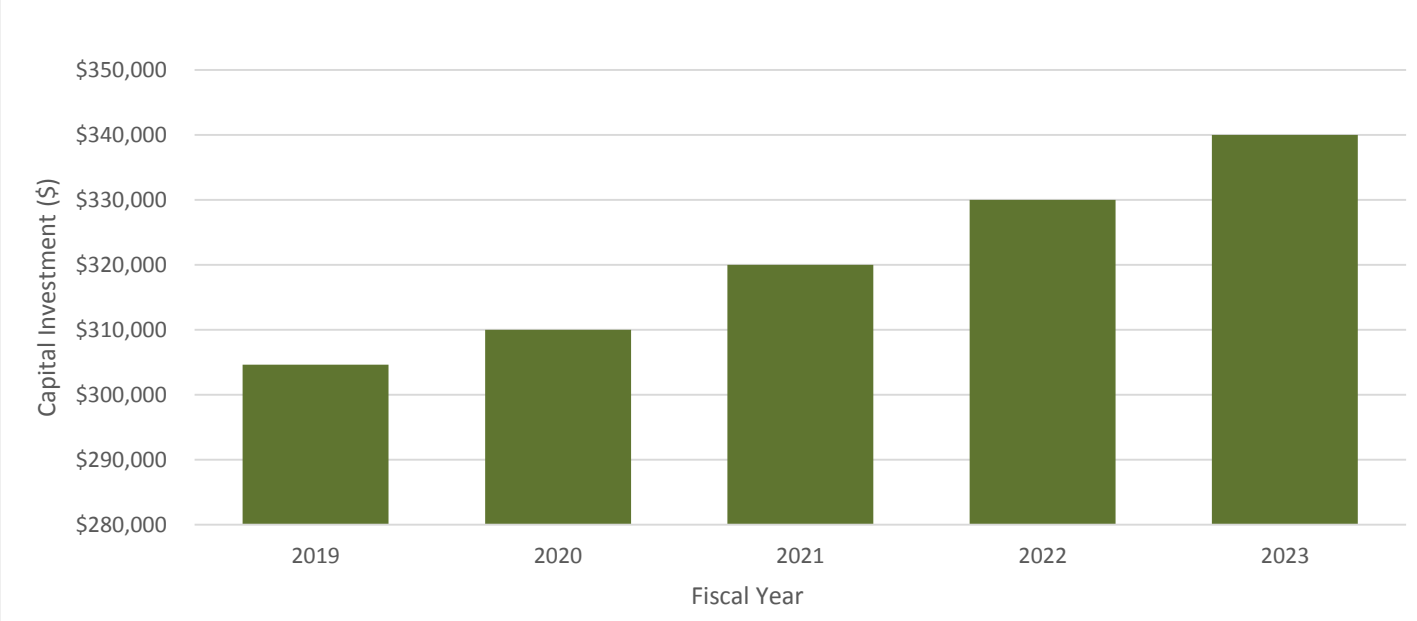


Figure 5.3.3.B IT capital investment 2019-2023

Major areas of Information Technology investment include:

Cybersecurity

VEC utilizes the Cybersecurity Capability Maturity Model (C2M2) to measure and guide our cybersecurity posture and identify areas for improvements. 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.

Email security also continues to be a focus through ongoing training, awareness, and bi-annual testing to help protect VEC resources from one of most common malware attack vectors. The single weakest links in the information

security chain are people who may be uneducated or negligent, vulnerable to attacks both inside and outside an organization.

We will also focus on password security and increased use of two-factor authentication, specifically related to the accounts used to administer network resources. VEC plan to implement a new password server in conjunction with YubiKey two-factor authentication. This will allow flexibility and will end reliance on shared credentials.

Modernizing Tools

Continuing to leverage technology to gain efficiencies, VEC will refresh the iPads used by field workers. In addition, a number of servers will require upgrades, such as print servers, which will entail numerous changes affecting end users. Expanding the standard server based solutions to mobile technology allows VEC to streamline processes and provide real-time data to those that need the information, especially during a storm event. Additionally, VEC is actively moving paper to an electronic document management system. This not only reduces paper and makes VEC more environmentally conscience, but having such documents available through mobile devices means we can be more efficient and responsive to members.

To prepare for the end of Windows 7 support in January 2020, VEC will begin to introduce its employees to the Windows 10 platform throughout 2019. We will upgrade PCs in public rooms such as conference rooms and district offices. VEC is planning on further upgrades via the acquisition of new hardware and others by upgrades in place. A complete adoption of Windows 10 in late 2019 and early 2020 will enable native disk encryption, adding to data security.

In order to accommodate different and more efficient ways of doing work, VEC is evaluating more robust and convenient remote working solutions to be implemented starting in 2020.

Storm and Outage Response

VEC is planning to implement new features within AclaraOne (software front-end for the AMI TWACS system) to allow us to identify outages by pinging our system without waiting for a member to call.

Finally, FirstNet, a government backed, AT&T implemented, cellular network for first responders, offers numerous benefits for VEC in storm response, including priority calling and enhanced data plans. VEC anticipates planning for this rollout in first quarter 2019 with implementation by the end of the second quarter.

Backup Operations Center

VEC has a backup operations center that includes a control room and a server room, shared between IT and OT. This backup control center will be upgraded 2020.

VEC is also installing new hardware to support backup core business activities such as email, intranet and file servers. In addition, there will be new software to enhance the migration of resources to the backup operations center in the event of a disaster in Johnson. The ultimate goal is to create a seamless transition between these two facilities in case there is a loss of one, ensuring no interruption of service to VEC's membership.

Distributed Energy Management

As the more distributed resources (hot water heaters, batteries, etc.) are adopted on VEC's system, we will need a new software/hardware platform to integrate and make the best use of those technologies. This type of system is often called a Distributed Energy Management Platform or DERMS. One of the challenges VEC has faced in its preliminary research into this type of a product is finding a fiscal and value balance. There are many products

available but very few provide flexibility to allow meter devices to be integrated at a cost that is sustainable for the cooperative. Being technology agnostic and interfacing with a number of solutions will help drive adoption of these systems.

Facilities Capital Investment

The facilities section of the capital budget includes any new buildings, building enhancements, and physical security. The chart below, and the explanations that follow, show the planned facilities projects and investment.

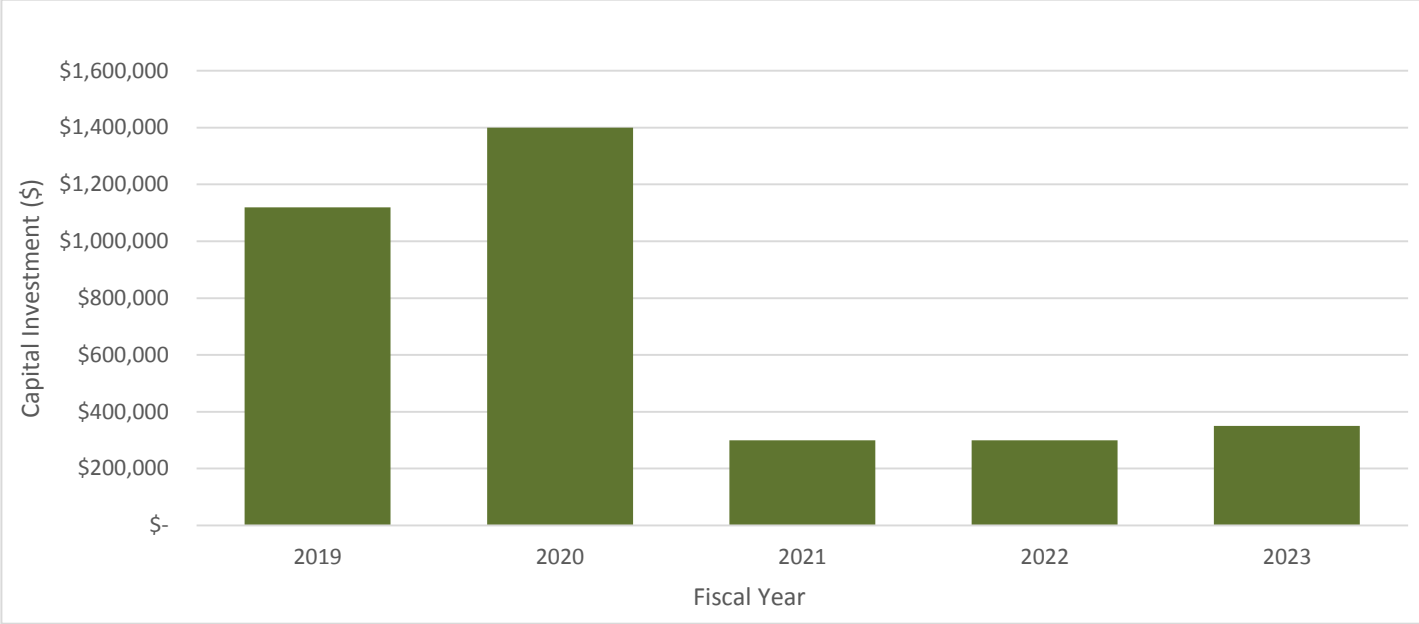


Figure 5.3.3.C Facilities capital investment 2019-2023

Newport Facility (2018-2020)

VEC acquire land for a new Newport service facility in 2018 and began the permitting process in 2019. The existing facility has inadequate space for storage, personnel and fleet. The first phase of construction will occur in late 2019 and the total project cost is approximately $2.4 million. The goal is to be moved into the new facility by December of 2020 when our lease for the current service facility expires, and we hope to begin the transition much earlier. The first photo below shows the existing facility and the second shows a rendering of the new facility.

Figure 5.3.3.D Existing Newport facility

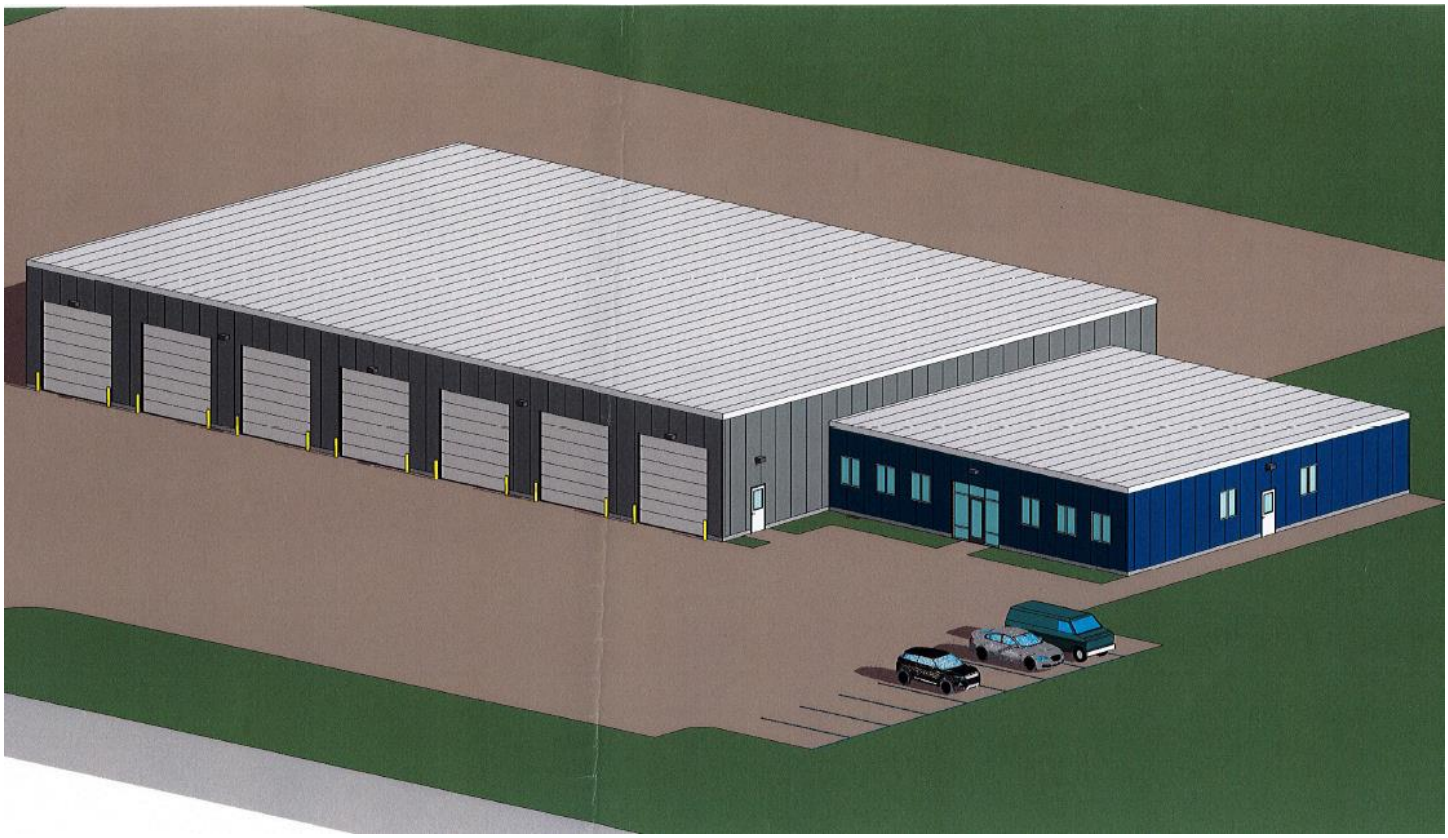


Figure 5.3.3.E Future Newport facility

Physical Security Improvements (Ongoing)

Physical security is a top priority for VEC and not only protects our employees but also enhances cybersecurity. VEC expects to add several new improvements including auto-closing doors in the Johnson office, swipe access, and cameras and shaker wire to several substations

In addition a fence for the new Newport service facility is scheduled for construction in 2020.

Fleet Capital Investment (2019-2023)

VEC's Fleet Department maintains safe and reliable vehicles in recognition that high performing fleet helps VEC with safety, efficiency and reliability. Our fleet consists of bucket trucks, digger trucks, smaller vehicles (e.g., light-duty pickup trucks and street only vehicles), off road equipment, and trailers. Our goal is to ensure that each vehicle or piece of equipment is in workable condition to fulfill its mission, whether for daily work or for storm restoration. VEC outfits all fleet vehicles with Global Positing System (GPS) that allows System Operations personnel to locate each vehicle for enhanced safety and outage response time.

In developing a replacement schedule, the Fleet Department assesses each vehicle for overall safety, reliability, age, and anticipated use with a goal of smoothing vehicle replacements over time. To that end, we generally target the replacement of one large bucket truck, one small bucket truck, and six smaller vehicles or pieces of equipment annually. VEC currently has four digger derrick trucks and these types of vehicles tend to have a longer life span. VEC plans to schedule a rotation of one of these trucks for rotation in the 2020 or 2021 Capital Fleet budget.

VEC is considering adding electric vehicles to the VEC fleet. In early 2019, VEC purchased a Ford Fusion Hybrid to replace one of its "pool vehicles" shared by all employees. VEC forecasts that by the end of 2019 that there will be over one hundred new hybrid/electric vehicles types available, expanding the options available.

Because of new accounting rules (FASB's Accounting Standards Update, ASU 2013-02) related to operating leases, VEC transitioned from leasing vehicles to buying them through the capital budget beginning in 2017. The new rule requires VEC to list all outstanding lease payments as debts.

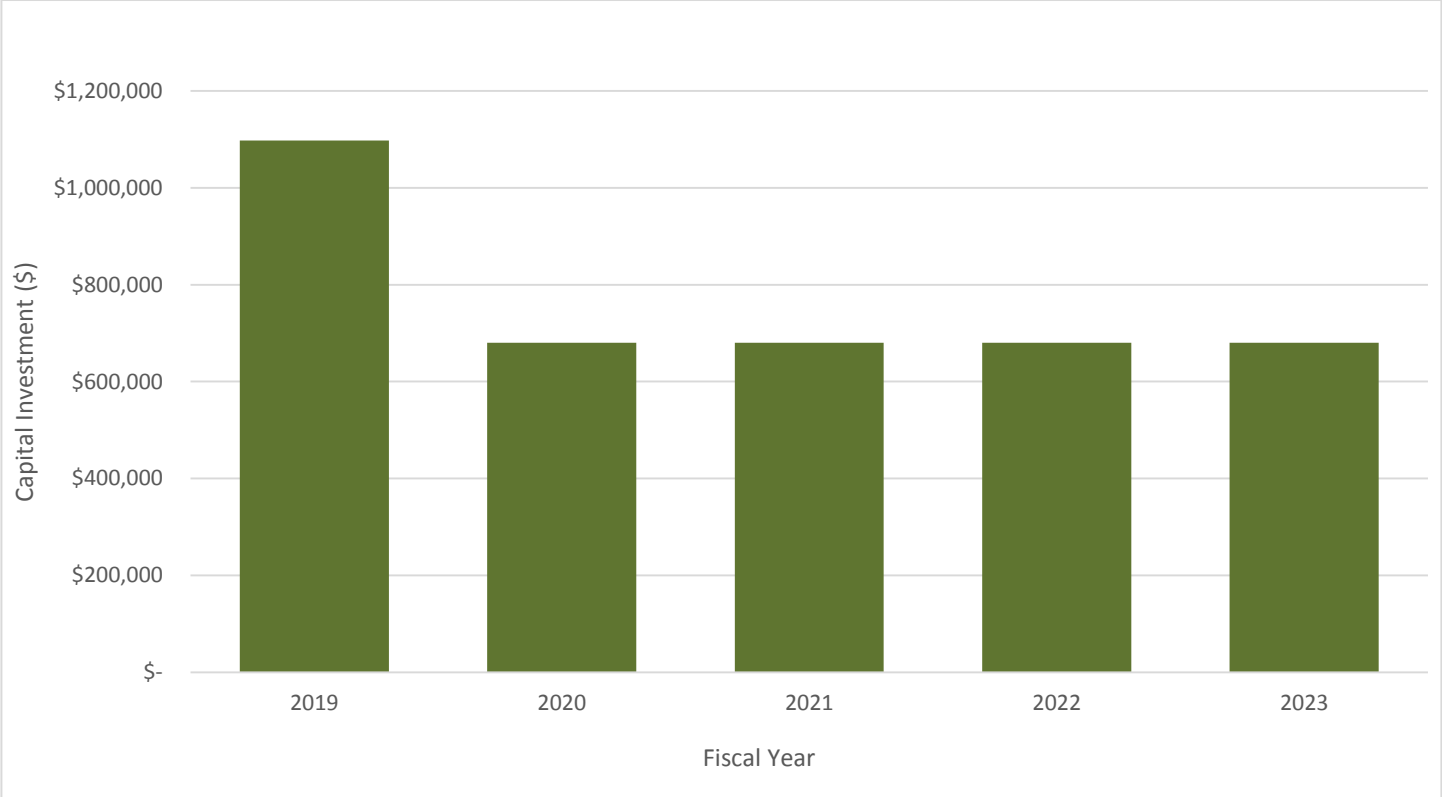


Figure 5.3.3.F Fleet capital investment

ET&I (Energy Transformation and Innovation) Capital Investment (2019-2023)

The Energy Transformation and Innovation (ET&I) section of VEC's capital budget is new starting in 2019. The expected investment is shown in the chart below.

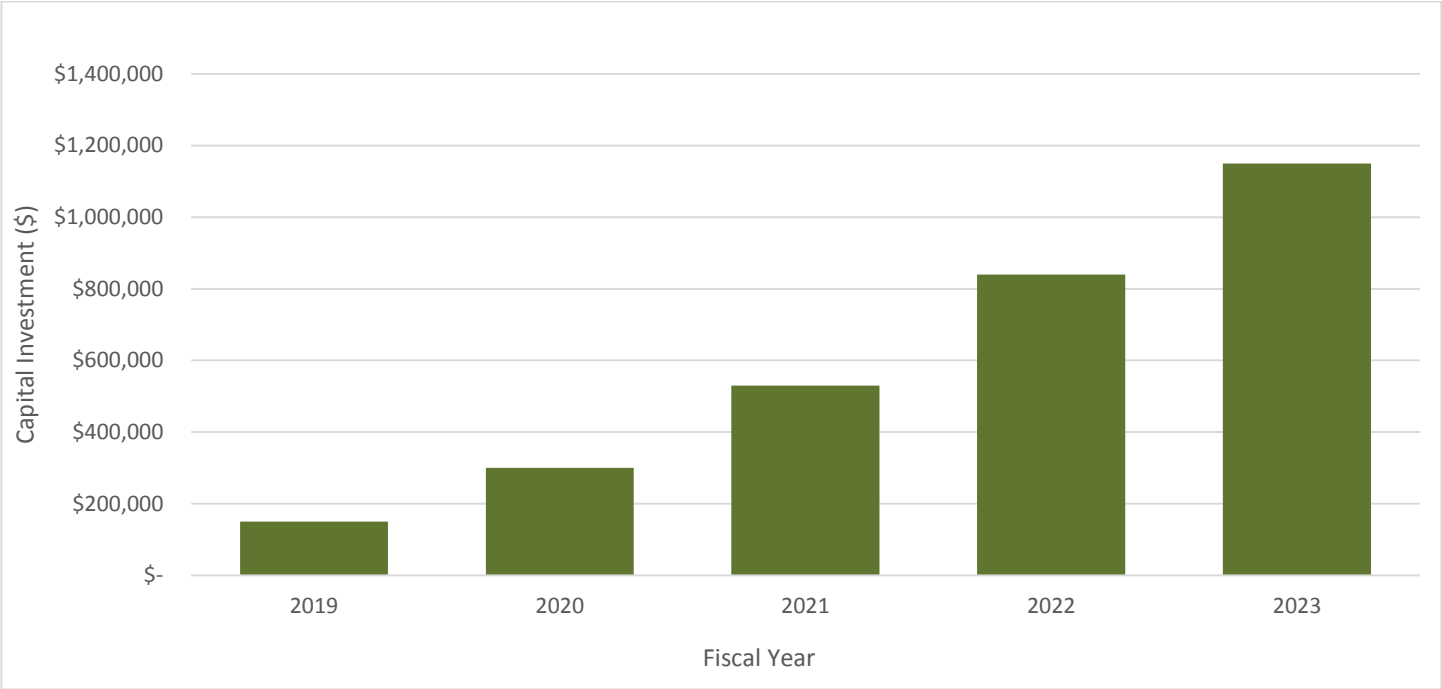


Figure 5.3.3.G ET&I capital investment 2019-2023

The ET&I budget was put together as a place-holder for VEC to be able to support energy transformation and innovative, beneficial electrification initiatives that are in early stages of development/adoption or in a prototype/concept phase. The reason for a separate budget area is to not impact the budget for "business as usual" such as T&D, Fleet, IT, and Facilities enhancements. We arrived at the 2019 base level of $150,000 based on our plan to install 15 residential batteries at approximately $10,000 each. Assuming that interest in residential storage would increase, VEC took a conservative approach to double that amount to $300,000 (30 installations) in 2020 and then adding $300,000 to the budget each year thereafter through 2023. However, VEC recognizes there are many opportunities across the residential and commercial/industrial sectors, and this budget allows us to be nimble enough to pursue pilots and new technologies.

Storage is another area where utilities can capitalize on leveraging new technologies but is capital intensive from an initial investment perspective. Storage solutions range in size from residential to utility scale. Storage solutions, whether residentially aggregated or leveraging economies of scale at a utility level, bring the benefit of using renewable, clear electricity, grid stability/resiliency (e.g., power back-up), and lowering the cost of purchased power for all members when dispatched at high electricity demand. VEC plans to use the ET&I budget as these various solutions are developed and implemented, accounting for the proper ROI.

Since 2017, VEC has made electrification of transportation a top education and outreach priority. It is also a significant component of our annual member engagement plan. While some of programs center on direct incentives for the purchase of all electric and hybrid vehicles, VEC focuses the capital investment from the ET&I budget on the development of the infrastructure (e.g., line extensions, transformers, etc.) and charging stations. With a fast changing technological environment, VEC focuses on bringing the most cost effective infrastructure to bear while still

adhering to a robust ROI to ensure benefit for all members. Smart investments ensure ratepayers do not incur any unnecessary costs that would make electricity less competitive with fossil fuels.

Finally, VEC is considering several areas requiring capital investment to promote economic development and load growth within its territory. Not only do these initiatives address the renewable generation "curtailment" issues of the SHEI, but leverage VEC's infrastructure and business partnerships to directly address the transformation to cleaner sources of energy. VEC established the ET&I budget to ensure it can leverage these types of innovative solutions and partnerships when they arise.

5.3.4 Strategies for Reliability Improvement

Recognizing there is room for improvement based on the reliability assessment section, VEC intends to continue existing strategies and initiate several new strategies to decrease both outage duration and quantity

1. Vegetation Management

   The chart below shows the plan through 2021. The ultimate goal is to be at a six-seven year trimming cycle by 2023.

	Total Miles		**Miles Needing Trimming**		**Trimming Cycle (Years)**	
Sub-transmission	~136		~121		5	
Distribution	~2,438		~1,707		12 to 10 to 9	
	2016 (Y-2)	**2017 (Y-1)**	**2018 (Y)**	**2019 (Y+1)**	**2020 (Y+2)**	**2021 (Y+3)**
Amount Budgeted	$2,417,314	$2,912,244	$3,073,819	$3,532,331[2]	$3,880,239	$4,337,361
Amount Spent	$2,588,854[1]	$3,149,711[1]	$3,474,842[1]			
Miles Trimmed	230	270	275	223[3]	250[4]	275[4]

Table 5.3.4.A Amount budgeted, spent, miles trimmed as part of vegetation management cycle

[1] "Amount Spent" in 2016 through 2018 reflect additional funding approved by the Board of Directors to clear certain circuits of low reliability. 2016 through 2018 are years were VEC's overall Operational Revenue exceeded the Operational Budget allowing additional vegetation maintenance above the planned 200 miles to be completed.

[2] Anticipated budgets for 2019 through 2021 have accounted for planned increases in contractor costs per mile based on the average cost per mile from 2017 through 2018.

[3] In general, the 2019 plan was to clear 200 miles of line. However, based on how circuits were determined, VEC added an additional 23 miles of planned vegetation maintenance.

[4] "Miles Trimmed" for 2020 and 2021 are planned and provide the basis for the amount budgeted.

2. Worst Performing Circuits
   a. Determine worst performing circuits in annual 4.900 filing and develop reliability improvement projects.
3. "Three or More" Reports
   a. Complete quarterly "Three or More" Reports to determine reliability improvement projects.
4. Review of SAIDI > 1 Minute
   a. Continue to complete reviews of all outages with a SAIDI (System Average Interruption Duration Index) value of greater than 1 minute.

5. System Protection
    a. Utilize worst performing circuit, “Three or More”, and SAIDI > 1 minute reports to identify opportunities for system protection improvements such as unfused side taps.
    b. Continue to review existing protection on all new projects (generation and load)
6. Wildlife Protection –
    a. Over the next five years, VEC aims to reduce animal-related outages to 10 percent or less via the installation of wildlife protection.
    b. VEC recently established an avian protection plan that involves patrolling three phase main lines and removing nests identified on these. If the osprey comes back to same location, VEC sets a pole away from our distribution line to allow the osprey to build their nest while not affecting the power system.
7. Fault Indicators
    a. Continue deployment of fault indicators where applicable.
    b. Ensure proper operation by periodic checks.
8. Damage Prevention Plan
    a. Continue to follow OP-26 to guarantee the reliability of service to our members, avoid damage to VEC underground facilities and ensure the safety of our employees and the public.
9. Opportunities for Feeder Backup
    a. Complete a System Contingency Analysis to identify capital improvements to make better use of feeder backups to improve system reliability.
10. SCADA and Motor-Operated Tie Switches
    a. Continue to evaluate opportunities for SCADA automation and motor operated tie switches
11. Maintenance Plan
    a. Complete ongoing, scheduled, system-wide maintenance
    b. Complete 5-year “System Assessment” on all circuits

5.3.5 Operations & Maintenance Projects

The following section details VEC’s Operations and Maintenance related projects (O&M) moving forward.

Engineering Studies

VEC engages in several system wide reviews or studies of its power system. The following chart identifies VEC’s existing and future engineering studies:

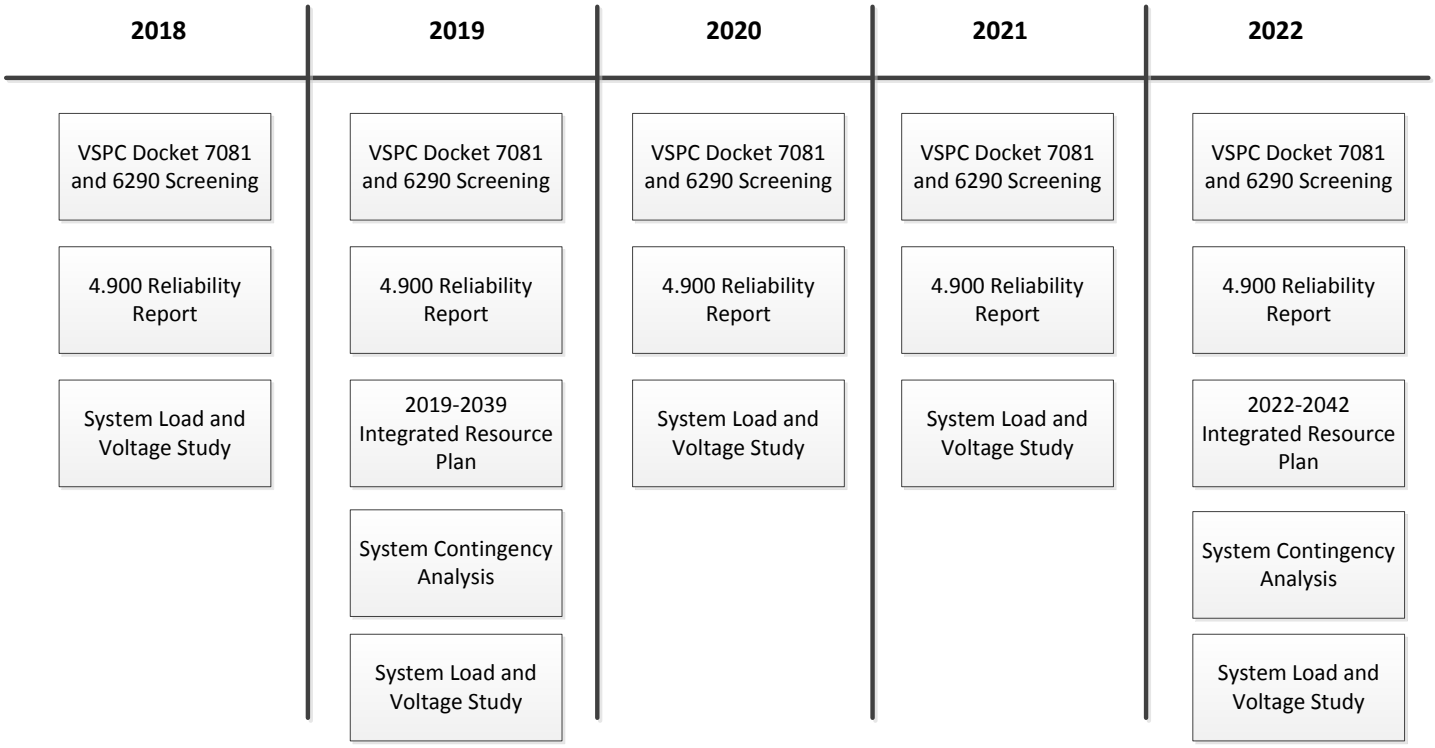


Figure 5.3.5.A 2018-2022 VEC engineering studies

Each of these studies were identified in the system planning section of Section 4 – Transmission and Distribution

Work Management

VEC has an ongoing initiative to focus and enhance internal business processes to identify methods of delivering low cost, reliable power to its members. VEC utilizes NISC's iVUE CIS Work Management system to ensure performance, accountability, and transparency on each of these processes.

The members of the VEC team focusing on this initiative are considered part of the ongoing commitment of ensuring that the system continues to build upon past successes, is properly refined, developed and improved to meet VEC future business needs.

VEC utilizes NISC's AppSuite, which is a mobile application that allows field personnel access to VEC's Work Management system, member information, as well as a link to all outage data. VEC currently utilizes a significant amount of paper communications, which can result in lost information, project delays, and general inefficiency. VEC's current goal is to further implement AppSuite to all of our field personnel, which will eliminate paper, enhance member communications, increase reliability, decrease project completion time, and ultimately make our employees more efficient.

T&D Standards

In 2004, VEC acquired Citizens Communications Company's Vermont Electric Division. At the time, VEC was no longer an RUS borrower but still followed RUS construction standards in its existing two service districts. With the acquisition of Citizens, VEC added two additional districts that followed different equipment and construction standards.

Since then a review and consolidation of construction standards has not occurred and inconsistency remains throughout VEC's territory. Ad hoc standardization of equipment and construction practices has occurred when new technologies arise. In late 2019 VEC is kicking off a more holistic initiative to continue this effort and VEC expects to be able to reduce inventory costs by around 20% (current inventory is ~$4.7 million) if further standardization of construction practices and equipment occur.

OMS and SCADA Integration

In addition to the meter and software upgrades associated with VEC's AMI upgrade, VEC intends to integrate its OMS and SCADA systems. A instantaneous outage is created in VEC's OMS system when VEC feeder breakers or other SCADA enabled devices operate due to a fault or outage, an. Currently VEC operators need to manually enter this outage and in high outage times, particularly major events, the system can get "bogged down" by unnecessarily pinging meters on a substation.