Study assumptions

System modeling manipulates three main parameters during a study: generation, the electrical network, and the electrical demand or load. The analysis models demand consistent with the results of a load forecast. Planning studies for this long range plan assume peak load conditions that occur during extreme weather using what is called a "90-10"forecast, meaning there is a 10 percent chance that the actual load will exceed the forecast.

The analysis models the electrical network in its expected configuration during the study horizon. New facilities and system changes are modeled if they have received ISO-NE approval, which provides a level of certainty that the facility will be in service as planned.

All generators are modeled in service unless a basis exists to model them out of service. The capacity of intermittent generators is discounted based on historically validated expected performance during the summer peak hour. For instance, wind generation is discounted to 5 percent of its capacity, and hydro generation is discounted to 10 percent of its capacity. Peaking generators that participate in the 10-minute reserve market were modeled at 80 percent of their combined total capacity based on historical performance in New England.

Lastly, the analysis begins by assuming two significant generation resources are out of service. This assumption is based on the sufficiently high and historically demonstrated expectation that any two resources can be unavailable due to planned outages as well as unforeseen events. For the sub-system analysis, the effect of local generation is more relevant. Therefore, instead of the two-significant-resource assumption, more attention was paid to local generator outages.

These study assumptions serve as the foundation for all long range plan studies in New England.

Assumptions regarding Plattsburgh-Sand Bar imports.

The system analysis for the 2012 Plan incorporates a major change in ISO-NE's assumption about the flow of power from New York to Vermont over the Plattsburgh-Sand Bar transmission tie. Where past studies have always counted on those imports, the current analysis assumes that New York will no longer be able to provide support to Vermont when needed. System constraints in New York have led New York to request that studies assume zero megawatts will flow over the tie, and that, under certain conditions, Vermont will export to New York.

With this new assumption, the analysis shows weaker system performance, some transmission concerns emerge earlier, and the scale of transmission reinforcements needed to maintain reliability increases. The assumption of zero power from New York over this tie also increases the size of any non-transmission solutions needed to postpone the reliability problems.

VELCO, together with ISO-NE and other stakeholders, are urgently pursuing steps to ensure sufficient flow on the tie to postpone the need for a transmission solution in Vermont, but it is not yet clear whether these steps will yield a positive outcome. Some combination of transmission reinforcements and contractual or operating agreements between Vermont and New York entities will be required. First, transmission reinforcements in New York could physically allow imports from New York to be restored. In addition to the physical flow, a purchased power contract between New York and Vermont parties, or an operating agreement between New York Independent System Operator (NYISO) and ISO-NE may be needed. One concern is that NYISO may not agree to provide support to Vermont under emergency conditions. Due to these complexities and uncertainties with Vermont's ability to rely on power flow from New York, the transmission analysis was performed with the tie

NEED to BE RE-FLECTED AS A Solution.

flow at 0 megawatts (MW), and power flow levels consistent with the historical performance were evaluated as a non-transmission solution.

As a component of actions needed to restore the ability to rely on flows between New York and Vermont over this tie, VELCO is also considering installing a piece of equipment at Vermont's Sand Bar Substation, at an estimated cost of $4 million. →WHAT IS THIS COMPONENT? DESCRIBE?

ISO-NE Vermont/New Hampshire Needs Assessment the basis for the 2012 Plan update

As the Regional Transmission Organization for New England, ISO-NE manages the New England region's bulk electric power system, administers and operates the wholesale electricity market, administers the region's Open Access Transmission Tariff (OATT), and conducts regional transmission planning. This Plan is largely based on the regional 10-year analysis performed by the ISO-NE, supplemented to meet the requirements of the planning process approved by the PSB in Docket 7081. The adjustments include analysis of the transmission system beyond the 10-yr horizon, analysis of the sub-transmission system, inclusion of energy efficiency beyond ISO-NE's last currently scheduled auction for future power capacity, and a more extensive evaluation of non-transmission alternatives. The scope of the 10-year transmission analysis was prepared under the guidance of ISO-NE and in collaboration with the neighboring transmission owners, such as National Grid (NGRID) New York, NGRID New England and Public Service of New Hampshire (PSNH), and was reviewed by the ISO-NE Planning Advisory Committee (PAC). Through participation in the PAC, the public stakeholders and other interested parties can influence the ISO-NE regional study, have advance knowledge of deficiencies, and are able to propose alternative solutions that may include demand reduction and supply measures, all of which influence the overall Regional System Plan.

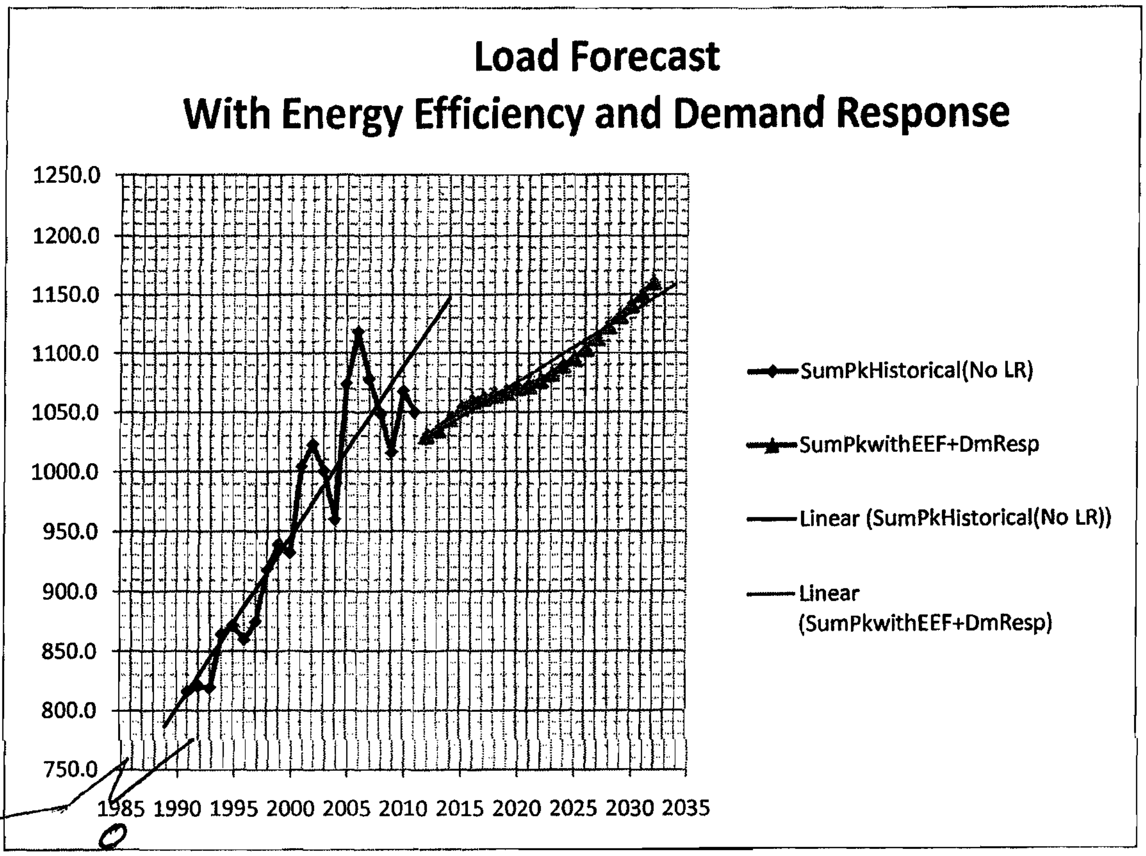
A note about the planning horizon: 10 years vs 20 years

The Docket 7081 planning process requires VELCO to plan using a 20-year horizon. Federal NERC standards and long-term studies performed in New England use a 10-year horizon. The longer the horizon of a planning analysis, the more uncertain are its conclusions due to uncertainties regarding predictions of load level, generation, system topology, changes to planning standards, and changes to public policy that impact how the transmission system will be utilized. This report reflects VELCO's 20-year analysis, however, the bulk of the analysis focuses on the 10-year period through 2021. Results beyond 10 years were used to examine system performance trends, evolving system needs, the effects of increased demand, and longer-term solution options. This approach is consistent with the Docket 7081/Vermont System Planning Committee (VSPC) process.

Limitations in the scope of the Plan

This Plan may not include all transmission issues that must be addressed in the coming period. VELCO reached out to utilities during its analysis to identify all concerns that may require system upgrades, however, some concerns may not have been identified due to insufficient information, unforeseen events, new requirements or the emergence of new information. From time to time, VELCO must make improvements to its system to replace obsolete equipment, make repairs, relocate a piece of equipment, or otherwise carry out its obligations to maintain a reliable grid. Sometimes these activities require significant projects, such as the current work to replace obsolete equipment at the Highgate converter discussed on page 12 and line rebuilds to replace aging equipment or maintain acceptable ground clearances. The Plan does not include such projects that are needed to maintain the existing system. Similarly, economic transmission—projects paid for by developers for the purpose of bringing power to markets—is generally beyond the scope of this reliability-focused plan except as discussed on pages 11-12.

The break in the scale exaggerates the apparent volatility and growth rate



Peak Demand Trends

Transmission planning is based on peak electric demand, since infrastructure must be adequate to deliver power at the moment when usage is highest. For some time, Vermont usage, like that of the rest of New England, has peaked during the summer.

The all-time Vermont summer peak of 1118 MW occurred in 2006. Following that milestone, the peak declined to as low as 1016 MW in 2009 due to the deep recession and unusually cool summers, but subsequently rebounded to 1068 MW in 2010 and 1050 MW in 2011 as the economy somewhat recovered. In 2010 and early 2011, economic projections assumed a fairly robust recovery. Later in 2011, the economic projections were revised downward based on the expectation of a much slower recovery. The latest forecast projects slower load growth based on this slower economic recovery.

Accounting for Energy Efficiency and Demand Response in the Forecast

The current forecast reflects the impact of increased public investment in energy efficiency. In August, 2011, the PSB approved 20-year budgets and savings targets for energy efficiency services funded through Vermont's energy efficiency charge on electric bills. For the Vermont forecast, ITRON's challenge was to determine how much new energy efficiency to incorporate without double-counting energy efficiency that was already embedded in the forecast model. Through an analysis of historical loads and associated DSM expenditures, ITRON determined that the load forecast should include the effects of energy efficiency at a rate of $20 million per year, based on the conclusion that the base forecast already included approximately half the demand-side other Vermont location. Such projects would provide reliability benefits to Vermont, and require reinforcement of the Vermont transmission system to accommodate the additional imports. Since no specific project is proposed, the Plan did not analyze potential HQ project impacts.

Renewable energy development

Renewable energy is in a period of significant expansion due to federal and state incentives and the decline of development costs. FERC order 1000, issued in July 2011, establishes federal policy to increase renewable development by facilitating transmission reinforcements needed for significant renewable resources to connect to the grid. Transmission reinforcements affected by the new policies may range in scale from a large, inter-regional connection of Midwestern renewables to Northeast load centers, to a local project in Vermont to eliminate a constraint preventing renewable generation projects from moving forward. West of Vermont, developers are planning extensive wind generation in northern New York that will likely require transmission upgrades. Wind power is similarly trapped in northwest Maine. Routes through Vermont may be proposed to interconnect renewable generation, with potential reliability benefits to Vermont and needs for transmission reinforcement to provide adequate capacity. Since no specific project is proposed, the Plan does not analyze potential impacts of economic projects to deliver renewable energy to market.

Local resources

The following section discusses in-state generation and other resources that have an impact on the Vermont analysis.

Vermont Yankee

The license for the Vermont Yankee (VY) nuclear plant is scheduled to expire in 2012. In light of litigation pending at the time of the analysis, system performance was evaluated in two ways, assuming both retirement and continued operation.

The 2012 Plan restates the conclusion of the 2009 analysis, which also examined system performance with and without Vermont Yankee. Both Plans assume that, with Vermont Yankee decommissioned, the plant's output could be replaced by out-of-state resources without requiring new transmission facilities in Vermont, though the 2009 analysis identified the potential need for additional transmission facilities in adjacent states absent Vermont Yankee.

The 2012 analysis reveals several reliability issues on the Vermont system with and without continued operation of the plant. With Vermont Yankee in service, upgrades will be needed near the plant sooner than with the plant retired, although the scale of those upgrades is the same whether or not the plant is in service. The scale of non-transmission alternatives needed to avoid transmission upgrades would need to be larger with VY in service than with the plant retired. [IS IT LINEAR? e.g., IF VY reduces output by 50% IS THE NTA NEED reduced by 50%?

Some of the reliability concerns aggravated by VY retirement were identified in the 2009 plan and are being addressed. VELCO installed 115 kV capacitor banks at West Rutland in December 2011, and 345 kV shunt reactors are expected to be installed at Coolidge and Vernon before the end of 2012.

The Highgate Converter

The Highgate Converter is the point at which energy flows from HQ to Vermont's electric grid. HQ and the Vermont utilities recently renewed the contract for this power, effectively establishing that power deliveries will continue over the tie for the foreseeable future. The converter can carry the full contracted amount during all

Transmission Results

The following section presents the findings of the ISO-NE VT/NH Needs Assessment, supplemented with additional analysis and the updated load forecast by VELCO.

Bulk System Issues

This section describes reliability issues on the bulk transmission system, which includes "Pool Transmission Facilities" or "PTF" for which costs are shared across the New England region through ISO-NE, as well as non-PTF facilities at voltages of 115 kV and above. The VT/NH Needs Assessment identified four regional groupings of bulk system reliability issues that are presented beginning on page 18. The following table summarizes the bulk transmission system issues identified in the study for quick reference.

Summary of Bulk System Regional Grouping & Transmission Solutions	**Proposed Lead & Affected Distribution Utilities**	**Estimated Transmission Cost[7]**	**Screened In or Out of Full NTA Analysis**
Southeast Vermont • Rebuilding the Vermont portion of the Vernon to Northfield 345 kV line.	*Lead*: CVPS *Affected*: All VT	$6M	Out
Connecticut River Valley • Construction of a second 115 kV line between Coolidge and Ascutney, rebuilding the Ascutney to Ascutney Tap section.	*Lead*: ~~GMP~~ CVPS Affected: All VT	$105M	Out
Central Vermont • Construction of a second 345 kV line between Coolidge and West Rutland.	*Lead*: ~~CVPS~~ GMP *Affected*: All VT	$157M	In
Northwest Vermont • Rebuilding the West Rutland to Middlebury 115 kV line • Rebuilding the New Haven to Williston 115 kV line • Rebuilding the Williston to Tafts Corner 115 kV line	*Lead*: GMP *Affected*: All VT	$221M	In

[7] All cost estimates include a 50 percent contingency (cost adder) to account for unknown factors that can affect project costs. Costs associated with line additions also include substation expansion costs.

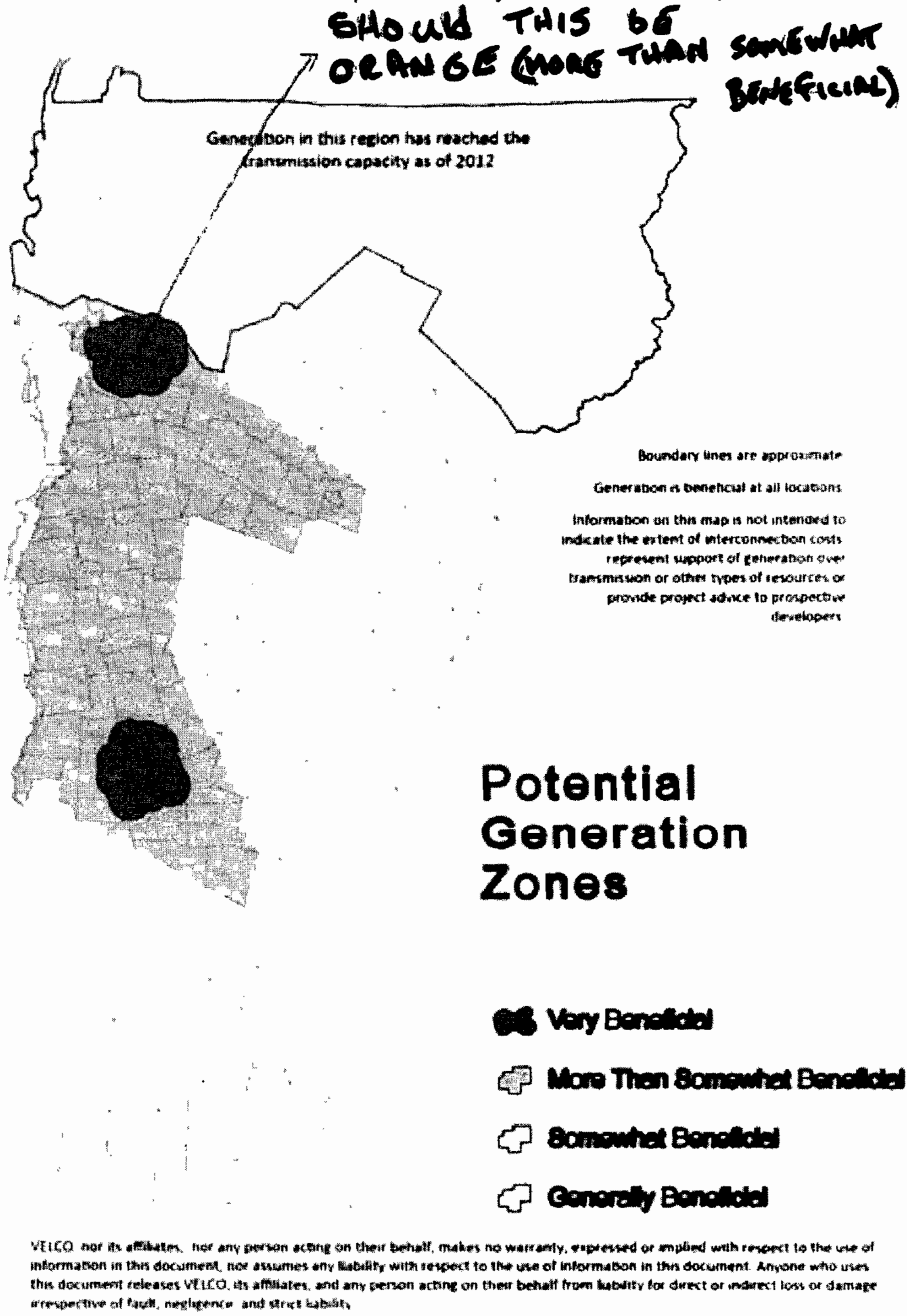
<table>
<tr><td rowspan="2">Critical load level & need timing</td><td colspan="3">Vermont
With VY: 880 MW</td><td colspan="3">New England
With VY: 23600 MW</td><td colspan="2">Est. timing of need
Past</td></tr>
<tr><td colspan="3">Without VY: 970 MW</td><td colspan="3">Without VY: 26000 MW</td><td colspan="2">Past</td></tr>
<tr><td rowspan="3">Reliability gap in MW[9]</td><td></td><td>Location</td><td>PV20@0 VT@1060</td><td>PV20@0 VT@1100</td><td>PV20@0 VT@1160</td><td>PV20@70 VT@1060</td><td>PV20@70 VT@1100</td><td>PV20@70 VT@1160</td></tr>
<tr><td>VY in service</td><td>Ascutney Tap</td><td>213</td><td>263</td><td>310</td><td>209</td><td>258</td><td>306</td></tr>
<tr><td>VY out of service</td><td>Ascutney Tap</td><td>115</td><td>166</td><td>212</td><td>110</td><td>161</td><td>208</td></tr>
<tr><td>Proposed lead & affected utilities</td><td colspan="8">Lead utility: ~~GMP~~ CVPS
Affected utilities: All Vermont distribution utilities
Regional: National Grid and Northeast Utilities</td></tr>
<tr><td>NTA screening</td><td colspan="8">Q 1: Is the proposed project's cost expected to exceed $2 million?
A 1: Yes
Q 2: Could elimination or deferral of all or part of the upgrade be accomplished through the use of non-transmission alternatives?
A 2: No. This overload is primarily affected by load in New Hampshire and regional power transfers and cannot effectively be influenced by reductions in Vermont load. Analysis showed it would require more than 200 MW of generation located at the Ascutney tap to postpone the transmission solution. Generation of this size cannot be supported by the current fuel infrastructure in Vermont and would exceed the cost of the transmission solution.
Q 3: Is the likely reduction in costs from the potential elimination or deferral of all or part of the upgrade greater than $1,000,000?
A 3: Not applicable—screened out by Q2.</td></tr>
<tr><td>Equivalency</td><td colspan="8">The reliability deficiencies in the Connecticut River region occur under normal conditions, with all transmission facilities in service, or as a result of a single outage event. A non-transmission solution would need to be in service during all hours where the load level exceeds the critical load level. In this case, the non-transmission solution would need to be on line when the Vermont load is at or above 880 MW, a proxy for the relevant New Hampshire load level that creates this reliability concern. A non-transmission solution would need to be located east of the Ascutney substation (Weathersfield, VT, or New Hampshire).</td></tr>
</table>

[9] Reliability gap associated with reliability concerns at various load levels and PV20 NY to VT import assumptions. The reliability gap is the effective amount of demand or generation resource that would be required to resolve the reliability concern. The amount of the gap will vary depending on the location of the resource.

Proposed affected & lead utilities	**Lead utility:** ~~CVPS~~ GMP **Affected utilities:** All Vermont distribution utilities **Interregional:** New York utilities
NTA screening	*Q 1: Is the proposed project's cost expected to exceed $2 million?* A 1: Yes *Q 2: Could elimination or deferral of all or part of the upgrade be accomplished through the use of non-transmission alternatives?* A 2: Yes *Q 3: Is the likely reduction in costs from the potential elimination or deferral of all or part of the upgrade greater than $1,000,000?* A 3: Yes. *Discussion*: Although non-transmission alternatives are a viable means to address this group of deficiencies, obstacles may preclude their implementation. The amount of load reduction needed is too large for energy efficiency to be implemented in time. Generation additions may be viable options, particularly as part of a hybrid solution that includes transmission reinforcement and/or additional power delivery commitments from New York. Depending on the amount of generation needed, the current fuel infrastructure in Vermont may not be able to support the needed generation. A more detailed analysis is being conducted to determine whether the cost of generation would exceed the cost of transmission and whether non-transmission alternatives are feasible.
Equivalency	The reliability deficiencies in the Central Vermont region occur as a result of an outage event after one transmission facility is already out of service. A non-transmission solution would not need to be in service under normal conditions, but would need to be on line at or above a Vermont load level of 1010 MW after a transmission facility is out of service. A non-transmission solution would need to be located west and north of the North Rutland substation to be effective.

Relative benefits of non-transmission alternatives based on location

A number of the reliability concerns identified in this plan may be addressed, in whole or in part, by new generation or significant new demand-side programs that reduce peak load, based on VELCO's analysis and the results of ISO-NE's assessment of non-transmission alternatives completed in conjunction with the VT/NH Needs Assessment. The following discussion focuses on generation, but the locational benefits are also applicable to load reduction through energy efficiency or demand response.



As discussed in the section on equivalency (page 15), the effectiveness of generation as an NTA depends on its location. For example, a 50 MW generator installed in one location may provide the same reliability benefit as a generator twice its size, if the 50 MW generator is more optimally located. New generation can also aggravate a reliability concern if installed at the wrong location. The map below shows where generation can be more or less effective at improving system reliability and, thus, potentially deferring one or more transmission solutions.

Generation located near Burlington should have a positive effect for most of the state. Similarly, generation located near Rutland should have a positive effect for the Central Vermont area. Generation that is located in the general vicinity of these towns and alongside the transmission corridors in Chittenden, Washington, Addison and Rutland counties provide similar benefits, but at a reduced effectiveness.