GMP is beginning its first Level 3 ASO Cluster Study at the time of filing this IRP and will be working closely with VELCO to define the way these new studies are performed. We anticipate finding efficiencies during this first iteration that will streamline future cluster studies and reduce costs. The zones in which the 20 MW aggregation limit is applied are still being determined by VELCO and ISO as their definitions of these zones are refined. We expect to learn more about the criteria that trigger cluster studies and how they are scoped in the coming months.

The Long View on Changing Load Shapes, Systemwide

The loads that GMP expects, and hopes, to see in the next 10 years will change in ways not seen for decades. We are planning for unprecedented load growth, but the largest contributor to this load growth, EV charging, is also one of the most flexible. Likewise, Vermont will need solar amounts in addition to what we have interconnected today to meet State requirements for renewable generation. However, we are increasingly able to shift generation to different hours of the day through distributed storage. Understanding what we face without conventional management is necessary as we continue to design programs to manage load and generation.

Hosting Capacity Analysis

GMP analyzed hosting capacity across several rounds, with each subsequent round introducing a new constraint to the system. We began by looking only at substation power transformer capacity, then redistributing solar to determine each region's export limit, and finally by considering all N-1 contingencies on the bulk and subtransmission to find a systemwide hosting capacity. This study was performed using the same planning criteria as VELCO's hosting capacity analysis in the 2024 LRP and includes all of the same bulk transmission limitations identified in the 2024 LRP. Our hosting capacity study left us with an optimized, total hosting capacity for solar on the GMP system without requiring subtransmission or bulk transmission upgrades.

During the process of optimizing hosting capacity, the reliability dispatch algorithm initially closed the Burlington and Middlebury zones to further solar development beyond our net-meter forecasts. The total hosting capacity with this most-optimized approach was 962 MW. However, we do not think that this is an accurate representation of how solar will be developed in the future due to historical development of larger projects in these areas, so we reserved some capacity in these zones and reran the dispatch algorithm to

hold the Burlington and Middlebury zones constant with additional headroom. We found a new optimized total hosting capacity of 957.3 MW, or 4.4 MW below the truly optimized capacity. The results are shown in **Table 3-5.**

Zone	Total existing solar	Total forecasted solar (net-metered and utility-scale)	Additional hosting capacity	Total optimized solar hosting capacity (interconnected + forecasted + optimized)
Ascutney	25.1	6.0	55.2	**86.2**
Burlington	82.7	25.7	8.8	**117.2**
Central	51.7	20.2	21.2	**93.1**
Florence	0.4	0.2	0	**0.6**
Johnson	0.6	0.4	0	**0.9**
Middlebury	41.5	5.9	11	**58.5**
Montpelier	35.2	24.3	4.2	**63.6**
Morrisville	5.0	2.9	0	**7.9**
Rutland	64.6	28.5	80.5	**173.7**
Southern	55.2	25.8	192.8	**273.7**
St. Albans	38.4	24.9	0	**63.3**
St. Johnsbury	15.2	3.4	0	**18.7**
Total	**415.5**	**168.1**	**373.7**	**957.3**

Table 3-5. GMP results of its optimized solar hosting capacity analysis, in MW, by zone.

This table show the following:

- We can support approximately 950 MW of interconnected solar without requiring transmission or substation power transformer upgrades if care is taken to site solar in optimized locations, while taking T&D constraints into account. Based on our power supply planning, we need a total of about 835 MW to achieve our Tier II requirements. This is roughly an additional 350 MW of DG above where we are as of the end of 2024.

- Based on sensitivity analysis of the impact of other resources, such as SHEI and the flows on the Granite Phase-Angle-Regulators (PARs), we note that reducing flow on SHEI and adjusting the Granite PARs to reduce west to east transfer will restore some additional capacity in these four zones.
- There are sub-areas supplied by 34.5 kV or 46 kV lines. The loss of one end of these lines forces all of the generation to export from the other end of the loop, which can limit the amount of generation added in these sub-areas.

Additional distributed or utility scale storage can be used to reduce exports that distribution substation transformers and the transmission system see, increasing hosting capacity on the GMP system. All storage on the GMP system has multiple use cases, and depending on location and amount of installed storage, GMP could use customer sited distributed storage to reduce exports or partner with utility scale "solar soaking" energy storage whose operational philosophy would be to charge during solar hours and discharge in the evenings.

Figures 3-8 and 3-9 visualize how solar in Vermont could be distributed, to minimize upgrade costs.

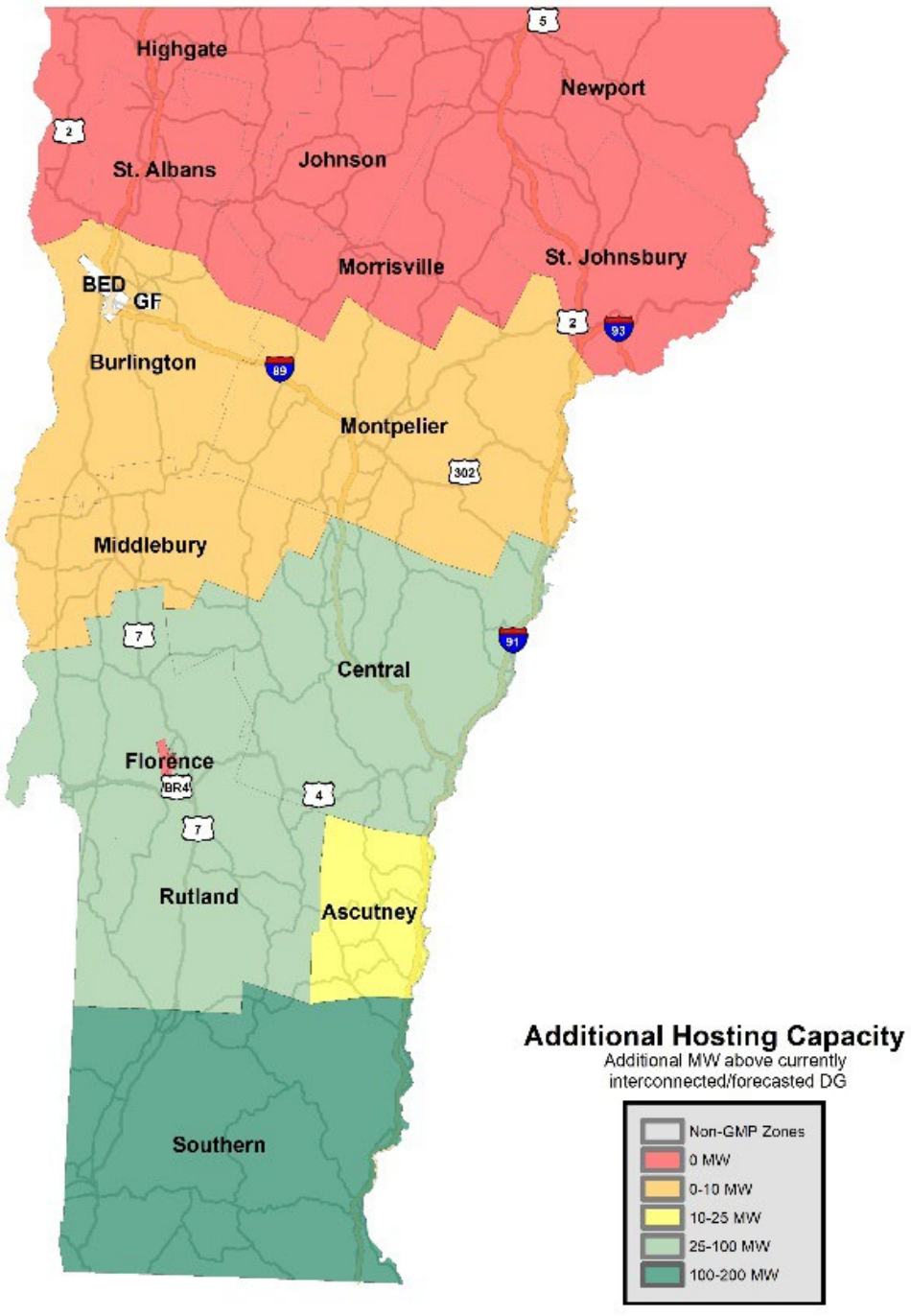

Figure 3-8. Additional hosting capacity beyond forecasted and projected solar growth, according to GMP's hosting capacity analyses.

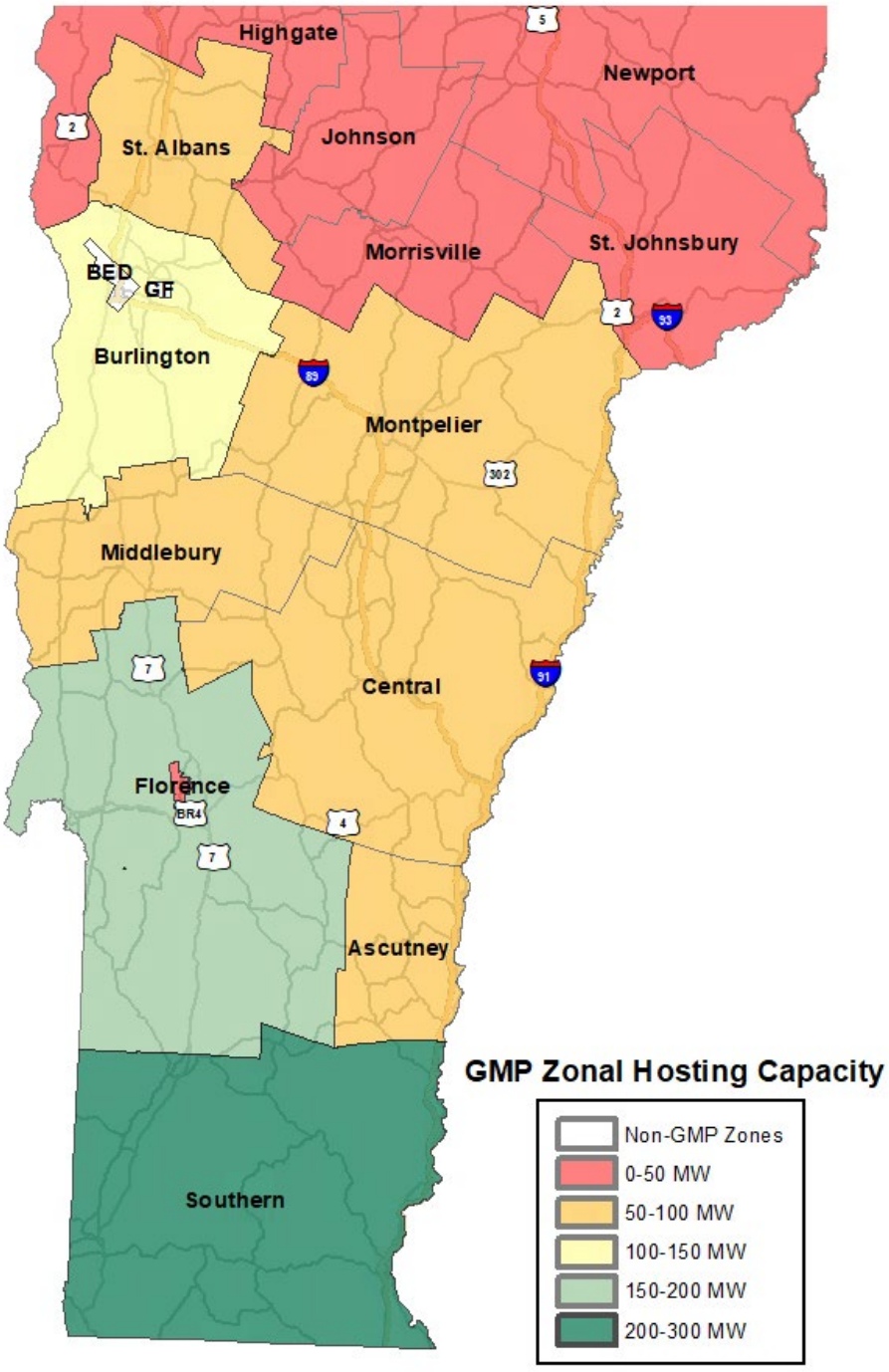

Figure 3-9. Zonal distribution results for solar, from GMP's hosting capacity analyses.

The results of our subtransmission hosting capacity analysis show that if solar development were guided toward the Rutland, Southern, and Central regions of Vermont shown in the maps above, it would minimize subtransmission and transmission upgrade costs. GMP is considering several tools such as RFPs, the GMP solar map, PPAs, the 5.500 interconnection process, locational pricing adjustors and associated studies to help guide solar into unconstrained areas while also meeting Tier II obligations.

The revised ISO PP5-6, which complies with FERC Order 2023, will also require additional studies in areas that are saturated with one megawatt or larger solar projects. As of September 2024, one ASO cluster study has been triggered in the Essex area, including some proposed projects in the Bristol area. Although GMP has not facilitated Level 3 transmission studies in the past, we understand these in-depth stability studies required by FERC will have added cost paid for by the generation developers. It is possible that the requirement of costly transmission studies will naturally guide developers toward regions where they are not close to the regional threshold—such as in the southern parts of the state.

When GMP provides a forward curve on the anticipated PPA pricing for larger scale solar projects, this includes the cost of interconnection. If an increase in interconnection costs beyond those assumptions occurs through the study process, it does not necessarily translate one for one to an increased PPA price, and in fact solar developers may need to absorb some or all the increased costs depending on the negotiated terms of the PPA price. Storage can also help alleviate these costs, as storage paired with solar could both reduce the total cost of interconnection and increase the hosting capacity of a circuit while still providing a host of other values discussed throughout this chapter. This could be looked at as an alternative to a portion of the cost to interconnect the project, and could provide many more benefits to the local system.

Other regional developments, such as decreases in Hydro-Québec (HQ) imports and changes to our interfaces with New York ISO and the rest of ISO New England, could affect how much and where solar can be developed. A scenario in which HQ reduces imports through Highgate could increase hosting capacity in northern Vermont, although this could provide some challenges for our broader power supply portfolio. Through the VSPC and relationships with neighboring entities, GMP is closely monitoring any changes in grid topology and imports that could change the landscape of solar hosting capacity.

For instance, the VELCO and Grid United *Alliance Transmission Exchange*, presented at the July 2024 VSPC meeting, could create new opportunities for larger renewable projects to come online in the northern Vermont region and address some of the SHEI. Changes in the output of large generators like McNeil could also increase hosting capacity in the northern region of Vermont.

Our takeaway from the solar hosting capacity study is that GMP can reach its Tier II goals without large transmission upgrades if we are strategic about where new generators interconnect on our system and also focus on storage. We will continue to monitor where solar gets interconnected as well as regional developments that could unlock hosting capacity or further constrain renewable development.

Peak Load Studies

GMP performed a full N-1 contingency analysis on its subtransmission using standard contingencies on both the bulk and subtransmission to assess the subtransmission system's ability to operate reliably at peak loads in the next 10 years. When looking at solutions for issues on our subtransmission, we applied a probability and reliability equal slope criterion. This criterion aims to gain most of the benefits of full N-1 reliability while reducing the costs by considering the probability of an event at a critical load level. We evaluated a 2024 operating case as our base case, and 2030 and 2035 summer/winter peaks and light-load/high-DG cases.

Our 2024 base case is a conservative case, placing the total Vermont summer peak load at roughly 1,028 MW. The last time that Vermont saw this level of loading was in the summer of 2013. The load growth that Vermont is expecting in the future due to electrification needs to be considered in the context of our actual loads lagging behind conservative forecasts for growth.

Figure 3-10 shows **actual** winter and summer peak loads in Vermont, from 1980 to 2024.

N-1 Results

GMP found thermal and low/high-voltage violations in peak import/export scenarios. Many of the worst overloads were existing constraints on our subtransmission system and were impacted by electrification or high amounts of DG on the system. GMP did not find any thermal violations for all-lines-in conditions in the next 10 years. **Table 3-6** lists contingency violations that could be potential reliability issues in the next 10 years without load management. With EV charging management we can eliminate a couple of these violations and reduce the depth of others.