11 DRAFT Electricity Sector Mitigation Pathways

The electric sector has made great strides in both reducing emissions from electricity purchases and use, and in reducing overall demand through efficiency programs. Therefore, in the near term, between now and 2030, the focus should be to maintain the progress made in the electric sector to ensure a cost-effective backbone for the very significant transition necessary to decarbonize the transportation and buildings/heating sectors.

Pathways, strategies and actions related to adaptation and resiliency regarding the electric sector and electric infrastructure – many of which are in further support of mitigation – are laid out thoroughly in other sections, particularly Section 12 and the other pathways in this Section 11, and are not repeated here. Recommendations regarding further research and actions on GHG emissions accounting from the electricity sector and in all other sectors is discussed in Section 9.

Keeping Vermont's electric supply affordable and increasingly carbon free and renewable will enable Vermonters to transition to low carbon electricity as fuel source in transportation and heating, the two largest sources of GHG emissions. The electricity sector needs to support that transition with a cost-effective, fully carbon-free or renewable electricity portfolio over time. Vermonters also need technical and financial help to upgrade their homes and businesses to support this transition. Finally, in carrying out this work, Vermont must ensure a strong, reliable, flexible grid at both the distribution and bulk transmission levels because Vermonters will be relying upon the grid even more so in the future to support decarbonization with many interconnected, distributed load and generation resources.

On a statewide basis, the electric sector is already relatively low carbon and will be nearly carbon free and largely renewable by 2030 under current utility long-term power supply contracts. The state's Renewable Energy Standard (RES) is already based upon a percentage of total retail sales/load and therefore is designed to keep pace with electrification.

State distribution utilities and the bulk transmission system operator, VELCO, already support coordination and long-range statewide transmission planning across service territories, through the Vermont System Planning Committee and Public Utility Commission (PUC) processes.

Vermont also already has in place certain programs to help support fossil fuel transition, through Tier 3 of the RES; already-deployed EV charging rates in certain utility territories; deployment of EV fast chargers (Level 3 and Level 2); and other strategies.

Going forward, Vermont will require significant increased efforts to decarbonize transportation and heating, including through electrification. This in turn will require both investments in infrastructure to support customer electrification (panel upgrades, home chargers, storage, and distributed energy resources (DERs) including small-scale renewable generation), and well-coordinated load management to minimize infrastructure costs associated with peak demand. The overall electricity portfolio also must account for the type of increased demand that will come from these measures; energy requirements are expected to be significantly higher in winter compared to summer. Finally, as noted in many public comments and those of Climate Council members, there are tradeoffs involved in any energy choice – different environmental impacts and burdens will occur with each, including the catastrophic environmental harm that has come from the use of fossil fuels. Transparently recognizing that these harms are not all equivalent, and that the burdens of each fall differently, will be key to creating greater trust and accountability as we create a just transition.

Pathway: Further decrease GHG emissions from electric sector purchases

A primary mechanism for reducing GHG emissions will be electrification of the transportation (electric vehicles) and buildings (heat pumps) sectors. Electric vehicles and heat pumps are inherently more efficient than combustion technologies and therefore reduce energy usage and carbon emissions. However, emission reductions associated with electrification are closely linked with the power supply portfolio of the electric utility providing power to the device.

The GHG Inventory maintained by the Department of Environmental Conservation (DEC) bases emissions in the electric sector on the annual power supply portfolio of Vermont's utilities. This largely reflects the fact that Vermont is part of a regional electric grid where load and generation are balanced in real time; as more carbon-free energy is put onto the system there is less overall generation from fossil-fuel-fired plants. Every kilowatt hour of a clean energy resource that counts in Vermont's RES and other state's equivalent policies must actually be delivered and used into our New England region, as tracked annually through a registry and accounting system

of Renewable Energy Credits maintained by the NEPOOL GIS. While in future years it may be possible to move to more seasonal or even daily/hourly tracking of the use of carbon-free resources, in the meantime it is critical that utilities continue and deepen their progress to utilize cleaner resources and help displace fossil fuel resources on our regional grid.

Strategy – 100% Carbon-free or Renewable Electricity

Vermont should develop 100% carbon free or renewable electric portfolio standard to ensure progress continues into the 2030s and beyond while being mindful of the economic impact on cost-burdened Vermonters and maintaining the cost-effectiveness of fuel-switching to electric measures.

Vermonters pay approximately $900 million in electricity costs per year, with over half that that amount associated with procuring energy. These costs are recovered from Vermont electric customers through cost- and usage-based electric bills and as such electric bills are an inherently regressive payment structure, something to keep in mind when looking at ways to utilize electric bills to achieve our state policy goals.

Vermont policymakers and stakeholders in the Climate Plan process have also been clear that they want to see Vermont move more aggressively toward clean electricity to support overall mitigation of emissions and decarbonization. Vermont's current RES aims to achieve 75% renewable resources annually by 2032; the accompanying analysis by Cadmus indicates that the current RES is adequate to meet the GWSA goals for 2025 and 2030. While Vermont's goal was forward-thinking when passed, other states in New England are increasing their required amounts of new renewable electricity and are also focusing on supporting existing carbon-free generation sources. For example, energy from HydroQuebec, which is defined as "renewable" in Vermont,[1] is supported in Massachusetts under its Clean Energy Standard – Existing[2] requirement for carbon-free resources procured to meet that state's carbon reduction mandates from 2020-2050. Similarly, both Massachusetts and Connecticut have policies that support nuclear energy to further carbon reduction policies.

[1] 30 V.S.A. § 8002(2)(C)
[2] 310 CMR 7.75

Vermont must move toward a fully clean electric portfolio that strongly support new resources designed to displace fossil-fuel-fired generation in the region, not just existing. In doing so, it will be important to consider a number of questions, as outlined below, that embrace equity and also tackle whether our current structure that supports renewable electricity should be modified to support carbon-free resources. Regardless of the eventual design, a legislative requirement that Vermont's utilities have power supply portfolios that are 100% carbon free by 2030[3] will reduce electric sector emissions and enable deeper carbon reductions associated with electrification in the transportation and thermal sectors. The strategy recommends that new requirements are designed to fit already-procured resources, including long-term committed contracts for carbon-free resources that run through the mid-2030s.

Specifically, the General Assembly adopt a carbon reduction policy that directs the Public Utility Commission, utilizing expertise as appropriate, to identify, review, and research as needed design parameters for a 100% carbon-free or renewable electric portfolio standard that equitably promotes electrification.

Such a study would be used to inform subsequent legislative discussion and would take into account the additional studies being recommended by the Science and Data Subcommittee, including on GHG accounting. Given the numerous design options of such a mandate, the significant costs and potential impacts on low-income and cost-burdened Vermonters, and the fact that such a mandate would lock-in resource selection over a period of decades, the study will need to be designed in a manner that that structures a clean or renewable power supply requirement in a way to maximize GHG emissions reductions while protecting the interests of Vermonters in equity, economic development associated with local renewable generation, affordability, and other issues.

Questions that warrant further research in such a study include:

- Using existing renewables and new resources – the right mix for equity and additionality
    - Date of qualification for 'new' resources – considering both regional and instate generation

[3] Moving to 100% clean electricity portfolio by 2030 would align with the GWSA 2030 timeframe; however, under Vermont's current GHG inventory a later date, such as the 2032 compliance date currently in the Vermont RES, also would allow Vermont to meet its overall emissions reduction goals.

- In-state and out-of-state generation – the right mix for economic development, equity, affordability, land use, and other considerations
- Supporting generation of all sizes and types (small/large/hydro/wind/solar/storage etc.)
- Pace of increased requirements by type of resource/RES Tier
- Incentivizing resources to deliver when needed (e.g. during peak hours, noting that these are likely to shift over time; seasonal needs such as winter loads; how storage may fit in), taking into account the time scale on which renewability is measured now (annually) and in the future (e.g., quarterly, monthly, hourly)
- Siting, including environmental, community, and transmission system considerations
- Carbon impact of resources; what source/criteria are utilized; whether the framework changes to a carbon standard rather than a renewable standard
    - Informed by any additional GHG inventory recommendations

Action

<table>
<tr><td colspan="3">Lead Implementer: Legislature; Other Implementers: PUC, DPS, Utilities</td></tr>
<tr><td rowspan="2">a.</td><td rowspan="2">Action details: Move from 75% Renewable Energy Standard to 100% Carbon Free or Renewable Electricity</td><td>Impact: High/enabling</td></tr>
<tr><td>Equity: Depends on program design</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">Timeline to implement: No later than 2030</td><td>Cost-Effectiveness: Depends on program design</td></tr>
<tr><td>Co-Benefits: Depends on program design</td></tr>
<tr><td>Technical Feasibility: Y</td></tr>
</table>

Pathway – Enable All Vermonters to Choose Electrification

Having a zero-carbon electricity supply along with electric transportation and heating options will not get Vermont the deep emissions reductions required by the GWSA unless Vermonters can choose these technologies easily and affordably. Vermont's largely older housing and building stock, rural infrastructure, and the complexities of navigating new technology create real hurdles to going electric. If we are not careful, we could repeat inequities seen in the

deployment of other programs and infrastructure, like broadband and solar, where too few Vermonters have easy, affordable access to new technology. It will take sustained, committed work to enable all Vermonters to choose to go electric.

Strategy

Programs need to be focused on providing financial and technical assistance for Vermonters to upgrade electric service and to purchase and install equipment. Available federal funding, including through the recently-passed infrastructure legislation and through potential additional legislation targeted at GHG mitigation and resiliency, should be leveraged to make these often one-time or long-term investments. The basics are not flashy – the level of electric service to buildings and homes; the age of internal wiring; service panel upgrades – but they are absolutely key to giving Vermonters access to decarbonization through electrification. We also need to provide education and support for installing equipment such as EV chargers and new heating systems, so that the complexities of change do not create a barrier. And in doing this work, we have to think about how all types of buildings – old farmhouses on rural roads, those in our compact downtowns, multifamily homes and buildings, and mobile homes – can make the switch. Coordinating this work with weatherization and efficiency efforts is a must. We need to finally crack the code for offering Vermonters easy access to home and building upgrades. In doing so, we should neither insist that all must be done at once – since that is unaffordable and unrealistic for many – nor that one solution has to be elevated over another. Rather, when Vermonters are able to start an upgrade, the foundational work that would allow other measures to be done then or later should also be deployed. For example, installing 200-amp service upgrades to homes if insulation and other work affecting the shell of a building is being done. If a heat pump is being installed, consider an upgrade to the service panel with future expansion to EVs, solar, and storage in mind.

This work will have benefits not just in GHG reductions, but in long term affordability for Vermonter, greater resiliency, and economic activity. It will spur the need for more Vermonters to work to install equipment, meaning that we also must help plan for an adequate workforce for technical assistance and installation. This work also has the opportunity to create a more just transition, if we are successful in focusing programs and support for not only those who are

income qualified but also those who have historically been left behind as new technologies roll out, particularly those in rural towns and marginalized communities.

Actions

<table>
<tr><td colspan="3">Lead Implementers: Legislature for funding initiatives; Utilities, Private Sector & Nonprofits</td></tr>
<tr><td rowspan="2">a.</td><td rowspan="2">Action details: Develop programs for implementation regarding 200-amp service and related building upgrades, coordinated with weatherization, efficiency, and equipment incentive programs (EV chargers, HP, storage, etc.), and ensure that any potentially related statewide program (such as Clean Heat Standard, if adopted, or enhanced weatherization efforts) includes building electrical upgrades in their design and funding models in order to enable decarbonization.</td><td>Impact: High/Enabling</td></tr>
<tr><td>Equity: Target lower income Vermonters, multifamily, and rural areas of Vermont without strong infrastructure.

Ensure direct financial support through equitable source for income qualified, plus easy financing access for all utilizing same tools as for weatherization and equipment financing, including possible on-bill payment through electric utility bills after pilot project for weatherization improvements currently underway.</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">Timeline to implement: Initial enabling funding 1-2 years</td><td>Cost-Effectiveness: Depending upon tools funded and level of funding – see DPS Cost of Carbon Measures report</td></tr>
<tr><td>Co-Benefits - High
Jobs/workforce dev
Economic activity from sales of equipment and services
Healthier buildings, healthier people
Lower maintenance/ownership costs (e.g., EVs)</td></tr>
<tr><td>Technical Feasibility: Yes</td></tr>
</table>

Pathway – Load Management and Grid Optimization

As Vermont increasingly turns to electricity as a low- or no-carbon resource for transportation, heating, and related distributed energy purposes, our electric grid will become more complex, with more points of local connection and coordination, and we will rely on it even more so than today. This is true even for those Vermonters who increase their own resiliency with solar and storage because key to community and statewide resiliency is for us to act collectively – to pool distributed energy resources and coordinate their deployment through the greater electric grid. And we have to make this transition at a time when, due to climate change, we are facing more frequent, severe storms that damage infrastructure, including our electric system.

Other sections of the Climate Plan, particularly Sections 12 and 13, discuss actions needed to harden electricity infrastructure and create community-level resiliency. The goals of this Pathway will be to lower barriers and increase customer participation in load control programs and devices, to unlock the value Distributed Energy Resources can bring collectively, through coordination and management, to the greater grid, so that in the future our electric system is not only cleaner but also more reliable and cost-effective. To help support electricity sector emissions reductions cost-effectively, the way forward will include enhanced use of load control, through direct utility measures, dynamic rate design, and programs offered by energy services companies directly to customers, to flexibly manage and coordinate the electric grid. This will create not only greater equity statewide, particularly for our rural communities, but also greater overall benefits through more efficient, cost-effective electricity services and through supportive programs for load management that in turn create jobs and economic activity.

Strategy

We should support and expand on existing programs and policies that encourage load management and grid optimization, in order to enable the deep decarbonization we need through use of the electric sector.

For this strategy, tools already exist. We should continue to prioritize programs delivered by our efficiency utilities, electric utilities, and energy services companies to encourage load management and grid optimization, through utility Integrated Resources Plan (IRP) proceedings, regulation proceedings, rate designs, innovation pilots, and other existing PUC oversight. Rapid technological changes mean that we should encourage quick program evolution – we need to be

willing to adapt and try new things to keep Vermont toward the front of the curve when it comes to optimizing our grid to support electrification. In the future, this will include many different individual functions, products, and technologies, from sensors and meters used today to new product-level features capable of dynamic load control, pricing signals and even billing, along with new distributed energy resource management platforms and intelligence to help coordinate it all. PUC review can help create equity by incorporating screening to ensure utilities pursue programs achieve overall least cost, taking into account carbon and societal benefits and other criteria.[4] Programs should be designed to deliver shared customer savings for load control, and to encourage customers to match where possible their own load to generation to optimize the system for the benefit of all, with a vigilant eye on equitable access that has often eluded us.

Actions

<table>
<tr><td colspan="3">Lead Implementers: Utilities; Other Implementers: PUC, DPS, Private Sector</td></tr>
<tr><td rowspan="2">a.</td><td rowspan="2">Action details: Support direct utility load control programs, including implementation of management platform</td><td>Impact: Medium/enabling</td></tr>
<tr><td>Equity: High, if implemented with shared savings in mind so that all customers benefit</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">Timeline to implement: Ongoing</td><td>Cost-Effectiveness: Depends upon specific design and cost recovery, but purpose of these programs should be to more cost-effectively manage DERs across the grid than in the absence of such control.</td></tr>
<tr><td>Co-Benefits: High.
Jobs (individual project deployment and infrastructure)
Enabling individual and community-level resiliency
Safety
Lower overall costs than in absence of</td></tr>
</table>

[4] The common need across state regulatory processes and government programs to train decisionmakers on equity and the principles of a just transition, as well as considerations regarding statutory criteria that would ensure those issues are included in decisions and programs, is treated in the [Crosscutting Themes] section of the Climate Plan.

		programs, yielding economic benefits
		Technical Feasibility: Yes
Lead Implementers: Utilities; Other Implementers: PUC, DPS, Private Sector		
a.	Action details: Encourage dynamic rate offerings, including those designed to encourage direct load/generation matching, and rate design to support electrification through shared customer savings	Impact: Medium/enabling
		Equity: While rates must be offered to all similarly situated customers care must be taken to consider who will have the opportunity to benefit, such as Time of Use rates providing variable benefit to shift workers and avoiding "electrification" rates that do not share increased load benefits with all customers.
	Timeline to implement: Ongoing	Cost-Effectiveness: High, so long as shared savings are the goal. To the extent subsidies between customer groups are utilized, historically marginalized individuals and those who have not accessed energy programs successfully in the past should be prioritized.
		Co-Benefits: Medium, same as list above
		Technical Feasibility: Yes

204