The Clean Heat Standard

Richard Cowart, Regulatory Assistance Project

Chris Neme, Energy Futures Group

With advice, input, data, and support from the
EAN Clean Heat Working Group

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Contents

I. Introduction 3
A. Focus of this Paper: Clean Heat in Vermont 3
B. Vermont and the Global Climate Imperative 4
II. The Case For a Clean Heat Standard 9
III. Clean Heat Standard Proposal 17
A. Nature of the Obligation: Delivering Clean Heat Credits 17
B. Who Are the Obligated Parties? 19
C. Size of Annual Obligation 20
D. Design for Equity 23
E. Eligible Measures – What Actions Earn Clean Heat Credits? 26
F. Credit Values for Eligible Measures 28
G. Multiple Ways to Acquire Credits 30
H. Interaction with Electric Utilities' Tier 3 Requirements 33
I. Ensuring Compliance: Default Delivery Agent, Non-Compliance Payments 34
J. Banking of Credits 36
K. Fuel Dealer and Workforce Assistance 36
IV. Summary of Design Recommendations 37
Appendix 1 40
Appendix 2 44

I. Introduction

A. Focus of this Paper: Clean Heat in Vermont

Vermonters spend approximately $750 million per year[1] to purchase fossil heating fuels that we know we can no longer responsibly burn. Importing those fuels imposes a huge drain on the Vermont economy and exposes Vermont families and businesses to substantial fuel price volatility in global markets. Fuel oil, propane, and gas bills also impose substantial and disproportionately high energy cost burdens, especially on lower-income households. Fossil-fuels used for thermal purposes (what this paper calls "fossil heat" for simplicity) account for 34% of Vermont's total greenhouse gas (GHG) emissions.[2] Those emissions must be reduced by at least 15% below 2018 levels by 2025 and then by 40% by 2030 and 80% by 2050 to meet our carbon reduction requirements.[3] In this report we aim to tackle these problems through a performance-based program, the **Clean Heat Standard**, that would ensure that Vermont's heat suppliers and local enterprises transform their businesses greenhouse gas (GHG) emissions and fossil heating costs in Vermont buildings.

Why focus on heat?

We focus on heat for numerous reasons. First, as noted above, fossil heat accounts for 34% of Vermont's climate pollution, and is the second largest source of those GHG emissions, after transportation. Unless we rapidly revamp the heating sector we can't come close to meeting Vermont's climate goals. In Vermont's climate, heat is also an essential service -- for health, comfort, and a viable economy. Warm homes and businesses are healthier, and cleaner heating systems are key to lowering local air pollution levels as well as global warming gasses. Ensuring that warm homes and clean heat are affordable remains critical, and is a central goal of the Clean Heat Standard. Furthermore, fossil heating has historically been high-cost and particularly price volatile, putting a major strain on Vermonter's budgets.

[1] Note: In 2018, per the Vermont Agency of Commerce and Community Development (ACCD) (using EIA SEDS data) VT spent $769.4 million on thermal fossil fuels across the residential, commercial, and industrial sectors. Specifically, $343.6 million on fuel oil, $309.5 million on propane, and $116 million on natural gas. Averaged over the past decade, fossil thermal spending has been $758 million per year. Source: Ken Jones, Economic Research Analyst, ACCD.

[2] https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2017_Final.pdf

[3] Vermont's Global Warming Solutions Act – i.e., reductions of 26% relative to 2005 levels by 2025, 40% relative to 1990 levels by 2030 and 40% relative to 1990 levels by 2050. Reductions from statutory reference dates were converted to common 2018 emissions level based on the Vermont Energy Action Network's Annual Progress Report for Vermont for 2020/2021 (https://www.eanvt.org/wp-content/uploads/2021/06/EAN-APR2020-21_finalJune2.pdf).

What's included in fossil heat?

This paper and the Clean Heat Standard address the problem we call "fossil heat." As previously noted, while heating buildings (space heating) is the largest use of fossil heating fuels, it is not the only end use in this sector. Fossil fuels are also burned for water heating, clothes drying, cooking, and some industrial processes. These and other on-site combustion uses would be included in the total sales figures covered by the Clean Heat Standard. Figure 1 provides a breakdown of greenhouse gas emissions in Vermont's thermal sector.

We recognize that for some of these uses it will be more difficult to substitute low-emitting heat sources. Therefore, the design of the CHS would not require reductions in all end uses to the same degree or at the same pace.

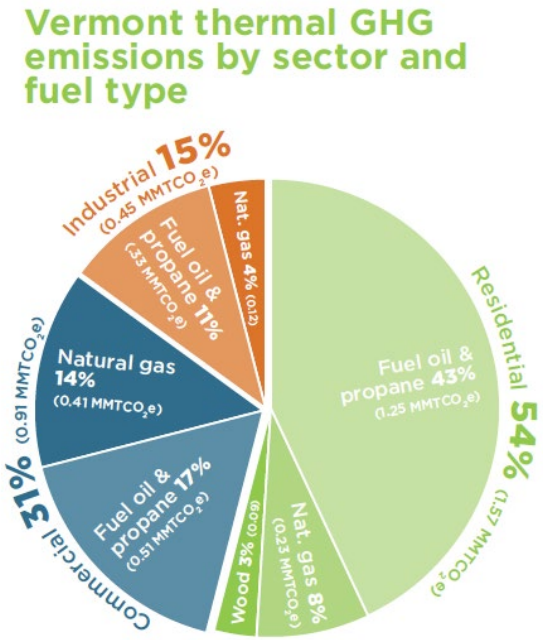


Figure 1. Vermont thermal GHG emissions by sector and fuel type

B. Vermont and the Global Climate Imperative

Over the past decade public awareness of global climate change has evolved from thinking of it as a long-term problem, to recognizing it as a looming crisis requiring urgent, immediate action – from thinking of climate change as a problem about slowly melting glaciers to recognizing it as a cascade of wildfires, floods, and droughts. In 2020, the Vermont Legislature, acting on the evidence and accepting that we too have a responsibility to act, passed the Global Warming Solutions Act (GWSA).[4]

In the GWSA the Legislature found that there is indeed a "climate emergency," and adopted legally-enforceable emission reduction requirements for the Vermont economy. The Act also created the Vermont Climate Council and directed the Council to create a Climate Action Plan to achieve meet greenhouse gas emission reduction targets[5], not less than:

- 26% below 2005 emission levels by 2025;
- 40% below 1990 emission levels by 2030; and
- 80% below 1990 emission levels by 2050.

The Plan must also "achieve net zero emissions by 2050 across all sectors" of the Vermont economy.[6]

[4] "A climate emergency threatens our communities, State, and region and poses a significant threat to human health and safety, infrastructure, biodiversity, our common environment, and our economy." H.688 (2020) Sec. 2 (1)
[5] 10 VSA Sec. 578 (a).
[6] 10 VSA Sec. 592 (b)(4).

In addition to meeting these overall requirements, the Climate Action Plan must "include specific initiatives, programs and strategies that will reduce greenhouse gas emissions from the transportation, *building, regulated utility, industrial, commercial*, and agricultural sectors" of the economy.[7] Moreover, the Plan must provide for GHG emission reductions "that reflect *the relative contribution of each source* or category of sources of emissions."[8]

Clearly, this legislation requires Vermonters to develop realistic strategies that will reduce GHG emissions from fossil heat sources – not just in buildings but also, where feasible, in transportation, industry, electricity consumption, and agriculture. Those reductions must be proportionate (e.g., roughly 34% of all reductions should come from the thermal sector) and must be ambitious and timely, meeting the requirements for 2025, 2030, and 2050 noted above.

Vermont's Climate Action Plan calls for creation of the Clean Heat Standard

On December 1, 2021 the Vermont Climate Council adopted its first comprehensive Climate Action Plan (CAP), as required by the GWSA. The Plan's section on Buildings and Thermal Pathways presents a set of coordinated policies to reduce emissions in line with the GWSA requirements, including enhanced weatherization, building codes for rental housing and new construction, and a call for adoption of the Clean Heat Standard. A key provision of the Climate Plan is the Council's recommendation that the General Assembly should:

"Adopt legislation authorizing the Public Utilities Commission to administer a Clean Heat Standard consistent with the recommendations of the Clean Heat Standard Working Group."

The Plan further recommends that the Legislature act on this recommendation *"by the end of the current session (May 2022) followed by no longer than 18-24 months for administrative process, including program design, orders, or rulemaking."*

-- Vermont Climate Council, Initial Climate Action Plan at p. 99 (Dec. 2021)

Recognizing both the importance of this Council conclusion and the need to move quickly on it, this paper sets out a package of recommendations for stakeholders and decision-makers to consider in coming months.

It's time to focus on thermal pollution

In Vermont, as in the US generally, most climate pollution has come from three sources: electricity, transportation, and the thermal sector, which includes heat for buildings, hot water, and some industrial processes.

Of these three sectors, to date Vermont has only made significant progress on electricity. The electricity sector has been paying for and delivering the overwhelming majority of the GHG reductions we have seen in Vermont to date, in significant part by purchasing an ever-increasing portion of our electricity from hydro, wind, solar, and other renewable sources. Our electric utilities have also funded the delivery – primarily through Efficiency Vermont – of substantial energy efficiency savings on a firm schedule. Though Vermont Gas and the state's low income weatherization program have delivered some emission

[7] 10 VSA Sec.592(b)(1) (emphasis added).
[8] 10 VSA Sec 592 (d) (2) (emphasis added).

reductions through efficiency programs, as a whole the fossil fuel sector has delivered only a small share of the savings we need to lower customer bills and climate pollution.

These gains did not happen on their own – they resulted from government policies, including the Renewable Energy Standard and energy efficiency savings obligations, that required improved performance across energy providers, ramping up over time. We aim to take the same approach to clean heat.

What do we propose?

As the best way to meet the challenges noted above, we propose creating the **Vermont Clean Heat Standard (CHS).** The CHS is a performance standard, applied to the providers of fossil heating fuels in Vermont, requiring them to deliver a gradually-increasing percentage of low-emission heating services to Vermont customers.

Fossil heating fuels reach customers in Vermont in a variety of ways. To ensure complete and even-handed coverage, and to reduce administrative complexity, the CHS would be applied upstream, at the wholesale level – that is, on the state's only regulated natural gas supplier, VGS[9], and on the transfer points where wholesale storage facilities deliver fuels to Vermont retail delivery vehicles.[10] The standard would apply to all substantial fossil fuel sales, including fuel oil, propane, natural gas, and kerosene.

How the Clean Heat Standard would work: **(**see Figure 2, next page)

(1) The CHS is akin to the Renewable Electricity Standard (RES) and the efficiency performance standards in effect in Vermont, and in many other states and nations. The overall standard and major milestones are set by the legislature, and a regulatory agency is authorized to supervise implementation.

(2) Fossil heat wholesalers ("obligated parties") are required to deliver clean heat solutions to Vermont customers on a percentage basis that rises over time. While each year's clean heat additions could be modest (perhaps 4% per year), clean heat additions would add up over time to help meet Vermont's emissions reduction requirements.

(3) Those fossil heat providers could meet the standard through a wide range of actions. Most directly, they could displace fossil fuels with qualified biofuels or renewable natural gas. Or, working with Vermont families and businesses, they could help customers to install low-

[9] Formerly "Vermont Gas Systems"

[10] While imposing a clean heat performance obligation on wholesale fossil heat providers is a new approach to managing climate pollution, obligations on fossil fuel providers at the wholesale level are not unusual. Fuel quality standards, blending requirements, and the federal Renewable Fuel Standard are customarily applied at the producer or wholesale level. Under the California Low Carbon Fuel Standard (for transportation fuels), the obligation to supply low-carbon fuel applies to fuel producers and importers, not to the operators of retail gas stations. The Transportation Climate Initiative (TCI) as designed would apply to fuels as they are removed from a storage facility (a "terminal rack") or delivered into a TCI jurisdiction. The Vermont CHS should, similarly, apply at the wholesale level where permitted, or to "jurisdictional wholesalers and importers" if Vermont's jurisdiction is found to be more limited. This legal question will be examined in a companion document. Whether the CHS obligation would apply exclusively to fuel wholesalers and VGS, or to those importing fuel for final consumption in Vermont as well, does not alter the other program design elements and recommendations in this white paper.

emission heating systems such as cold-climate heat pumps and/or advanced wood heating equipment[11], and/or to better insulate their buildings.

(4) We expect most of the customer-level work to be done in coordination with local enterprises -- Vermont fuel dealers, heating contractors, Efficiency Vermont, our weatherization programs, and others. Anyone delivering qualified clean heat solutions to Vermont homes and businesses could earn Clean Heat Credits, which could then be sold to the upstream fossil providers who will need them to meet their annual performance obligations.

(5) A critical feature of the CHS is **customer choice.** The CHS does not require a homeowner or business customer to change their heating system or to choose any particular clean heat option. The program allows customers to choose among a range of options, or to take no action until the time is right for them. But it will provide incentives, information, and support for clean heat options, and we know from experience that these measures can accelerate the transition to cleaner and more efficient buildings across the state, providing lower cost and more price stable clean heating options and helping reduce dependence on fossil fuels.

[11] Vermont has a long history of relying on wood for heat, and, more recently, significant experience in more efficient, lower-emitting Advanced Wood Heat systems (AWH). Options today include efficient pellet stoves, automated pellet or chip boilers or furnaces, and efficient cord wood stoves. See page 24 of the 2020/2021 EAN Annual Progress Report (https://www.eanvt.org/tracking-progress/annual-progress-report/2021-annual-progress-report/)

This paper describes such a standard and explores how it could be designed and implemented.

The paper first examines the reasons for selecting a CHS for Vermont, in relation to other program options that decision-makers might consider to tackle thermal climate pollution. It then sets out the key design principles driving the structure of the program, before describing the major program elements. The CHS Working Group --which includes individuals with deep experience in energy supply, energy efficiency, customer service, heating systems, finance and regulation -- has examined the key elements of the CHS in depth. In this paper we describe the major design issues, and some related pros and cons, and answer the fundamental question, "how would it work?"

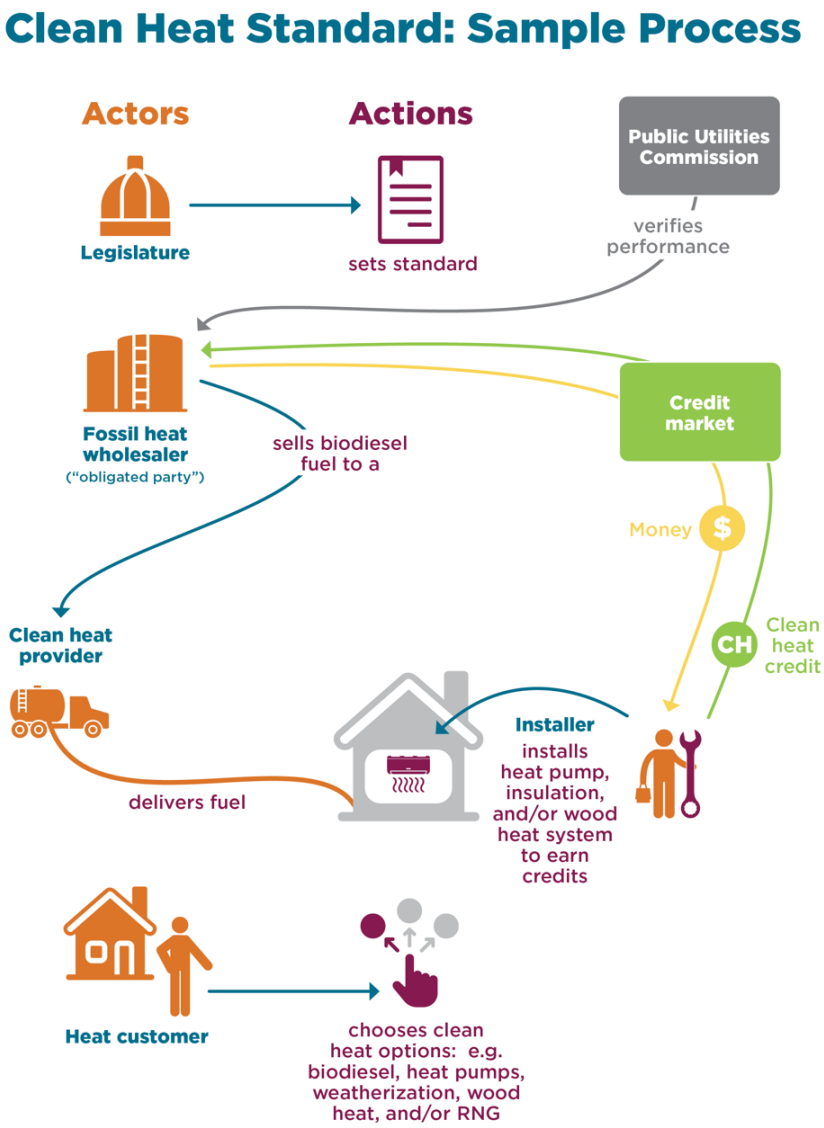


Figure 2. How the Clean Heat Standard would work

The sections below explore design and implementation issues in some depth, which might lead a reader to conclude that the CHS is a complex endeavor, and perhaps hope that "there must be a simpler way." However, there is no single "magic bullet" solution to climate change, nor to the thermal sector's contribution to the problem. If there were, the problem might have been solved already. It is the design details that allow the program to maximize customer choice and equitable solutions, minimize costs, and assure real reductions in GHG emissions. Vermont and many other states have succeeded with similar well-established programs in energy efficiency and renewable power, and they all have implementation details that don't rise to the level of legislative decision-making and can instead be delegated to administrative agencies. By studying the implementation details ourselves ("kicking the tires," so to speak) the CHS Working Group has tested this concept well enough to conclude that it can work effectively.

Note that though this paper focuses on Vermont's thermal and industrial sectors, the concept of the Clean Heat Standard could also be applied to or expanded to include the transportation sector, as California, Oregon, and Washington have done with their Low Carbon Fuel Standards for transportation fuels, and as has been proposed for Vermont via a "Clean Transportation Standard".[12]

The Clean Heat Working Group and the CHS Design Process

This whitepaper and CHS recommendations have been guided by the Clean Heat Working Group, a group of industry experts and stakeholders focused on reducing GHG emissions from the thermal sector in Vermont. The group was formed in response to a proposal by Richard Cowart and Don Rendell at the Energy Action Network's 2020 Summit, and has been supported by a broad cross-section of EAN members from the outset. The Working Group has met regularly over the past year to consider all of the elements of a Clean Heat Standard, to hear from experts and stakeholders, and to review and refine the proposal described in this paper.

The Working Group has included experts from the fuel delivery sector, Vermont legislators, Vermont's pipeline gas utility (VGS), electric utilities (GMP and BED), independent energy experts (especially RAP, EAN, and EFG), Efficiency Vermont, the Department of Public Service, and the Public Utility Commission. We also received expert advice and counsel from the Vermont Fuel Dealers Association, the National Biodiesel Board, the National Oil Heat Resource Alliance, among others.

From the outset, our Working Group has worked in tandem with a similar group focused on Weatherization at Scale, recognizing that reducing Vermont's emissions affordably requires building shell improvements as well as changing heat energy supply sources.

The authors are grateful for the expertise, good ideas, and support given by EAN staff, Working Group participants and other experts who have helped us to develop the whitepaper. We achieved a high level of consensus on the architecture of the CHS and on nearly all of the CHS design elements. However, in the final analysis, the details of the proposal and any errors or omissions are ours alone.

– Richard Cowart and Chris Neme, December 2021

II. The Case For a Clean Heat Standard

Among policy paths to reduce fossil heat, why do we propose the Clean Heat Standard?

In a recent article in Scientific American,[13] Professor Naomi Oreskes points out that some problems we may think of as "hard" (manufacturing a Covid vaccine, for example) are in some senses "easy" (mass-production techniques can scale up rapidly). Meanwhile, other problems we might think are easy can actually be quite hard. Delivering vaccines to millions of people in thousands of locations is actually quite difficult, even though most people have a strong interest in their own health, and the vaccine has been free. Professor Oreskes concludes with this observation: "When it comes to solving real-life problems, it is the supposedly straightforward ones that seem to be tripping us up. The vaccine-vaccination paradox suggests that the truly hard sciences are those that involve human behavior."

[12] See: https://www.eanvt.org/events-and-initiatives/2021-ean-summit/pitches/clean-transportation-standard-pitch-2021/

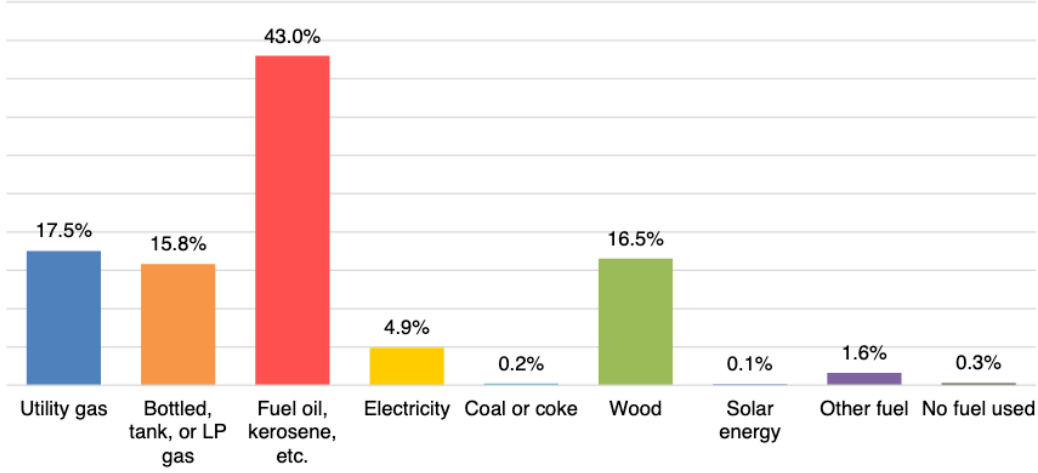
[13] Naomi Oreskes, "What Makes a Problem 'Hard'?" Scientific American May 2021 at 77.

The problem of thermal pollution is one that very deeply involves human behavior. It is no small thing to create a public policy that can reach out to just about every home and building owner in our state to help them transition heating systems to address a global problem. Technology is not the limiting issue. We have the technology to "vaccinate" most buildings in Vermont with weatherization, cold-climate heat pumps, biofuels, and advanced wood heat systems. But we currently lack the programs to deliver enough units to enough buildings fast enough to meet our climate goals.

There are approximately 332,000 housing units in Vermont[14]. As shown in Figure 3 below, over 77% (over 255,000) of those homes are heated primarily by fossil fuels.

Home fuels

Figure 3-17: Vermont homes by primary heating fuel



Source: U.S. Census Bureau: American Community Survey 5-year estimates, 2013-2017 (Table B25040) from housingdata.org.

Changing out hundreds of thousands of heating systems, weatherizing hundreds of thousands of buildings and developing many large new sources of renewable biofuels every year for the next two decades is technically possible. But getting it done requires a delivery system that works with customers on an individual basis to install and service non-fossil appliances, water heaters, and new heating systems and to retrofit individual homes and businesses with more insulation and sealing of unwanted leaks. On the supply side, we will need to work with farms, foresters, and other businesses to develop and install biofuel processing equipment and the delivery infrastructure needed to move sustainable biofuels that deliver GHG reductions as measured on a lifecycle basis to market. This requires a diverse workforce that is skilled in customer service, analysis of a range of technical products, and equipment installation.

Heating systems are not a mail-order item. We need Vermont-focused businesses with customer relationships and, literally, "boots on the ground." The Vermont economy already contains an array of fuel dealers, renewable energy companies, and heating contractors who could, if refocused and incentivized, do much of the needed work. Out of state suppliers would likely see a growing market in

[14] VHFA Vermont Housing Needs Assessment, February 2020. The report shows a total of 331,106 as for 2017, adjusted up slightly to account for growth (which is very slow in recent years).

Vermont as well. We need a Clean Heat Standard that will support businesses and ensure that they deliver heating solutions at the scale needed to meet Vermont's climate, equity, and economic goals.

A Clean Heat Standard is by no means the only policy option available to reduce thermal consumption and GHG emissions. We have considered several other options including, among others: carbon pricing, thermal energy efficiency programs, building codes, heating equipment appliance standards, and reliance on electric utility mandates. All of these approaches have some merit, and any or all of them could be adopted to work in tandem with a Clean Heat Standard. To the degree that any of these parallel strategies lower demand for fossil heat, or lower the cost of delivering clean heat solutions, they only make it easier to deliver cleaner fuels and heating conversions, speeding up the transition to clean heat in Vermont.

However, we conclude that none of these other options is likely to succeed on its own, and none would be as singularly effective as a Clean Heat Standard in delivering tangible progress. In brief, here's why:

- **Carbon pricing**, by itself, is a weak and potentially expensive means to drive change in the buildings sector, where actions must be taken by individual building owners facing significant barriers to change. Cap-and-invest programs can help, but changes in fuel prices alone have not historically driven much change in heating systems.[15]

- **Thermal energy efficiency programs** are essential to delivering equitable and effective heating solutions in Vermont, and we judge that a program like the "Weatherization at Scale" proposal is needed as a companion to the CHS. But even ambitious weatherization efforts can deliver only about 25% reductions in the heat demands of a typical Vermont home, so up to 75% of the needed fossil reduction has to come from switching to cleaner energy sources.

- **Building codes and appliance standards** can improve the performance of new construction in Vermont, and of replacement water heaters and furnaces. But the pace of new construction, less than 1% per year,[16] and the expected percentage improvement in appliance efficiencies are too low and too slow to deliver the reductions we need in fossil heat consumption in coming decades.

- **Electric utilities -** Vermont has succeeded in delivering electric energy efficiency, renewable power, and some fossil fuel avoidance through performance standards imposed on electric utilities, including Tier 3 of the RES. However, it makes little sense to impose additional performance obligations on our cleanest major source of energy (electricity) while imposing

[15] In economic terms, the price-elasticity of demand for heating fuels is quite low. It would likely require an unacceptably high carbon price to drive building owners to install new heating systems, unless the carbon program also provided customer assistance and financial incentives to accelerate change.

[16] Building energy codes also govern additions and changes to existing buildings. However, such savings are still likely to provide only a modest contribution to the substantial levels of GHG emission reductions required to meet the state's requirements. That is because (A) only a small fraction of existing building energy use is affected by codes each year; (B) building energy codes typically establish a "floor" for efficiency, not efficiency levels that are optimal in the context of aggressive climate policy; and (C) even optimal levels of efficiency improvements in buildings – though essential to enabling *affordable* decarbonization – will not be enough to achieve even close to a 40% emission reduction by 2040, let alone 80% by 2050.

almost no obligations on the fossil fuel providers that are delivering the most carbon-intensive fuels we consume (fuel oil, propane, natural gas). To deliver the depth of change required, we need to engage the existing fossil industry in its own transition to a clean thermal sector.

Additional discussion and support for these conclusions is set out in Appendix 1 of this paper.

Building on Experience:
Renewable Portfolio Standards, Energy Efficiency Obligations, and Vermont's Tier 3

The Clean Heat Standard would not be the first time that performance obligations are placed on energy providers. In Vermont, across the United States, and in many other countries there are decades of experience with clean energy performance standards, applied to the electric power sector and, in some cases, to regulated pipeline gas companies. What's unique about the Vermont Clean Heat Standard is that it would apply a performance standard to energy providers across both regulated and non-utility energy companies.

The most widely-known examples of clean energy performance standards are the electric Renewable Portfolio Standards in place in many jurisdictions to mandate continuing increases in renewable energy generation as part of utilities' portfolio of electric power provided to end-use customers. At least 30 US states have electric RPS's in place and 5 states have "clean energy standards" that include some non-renewable power in the obligation pool.

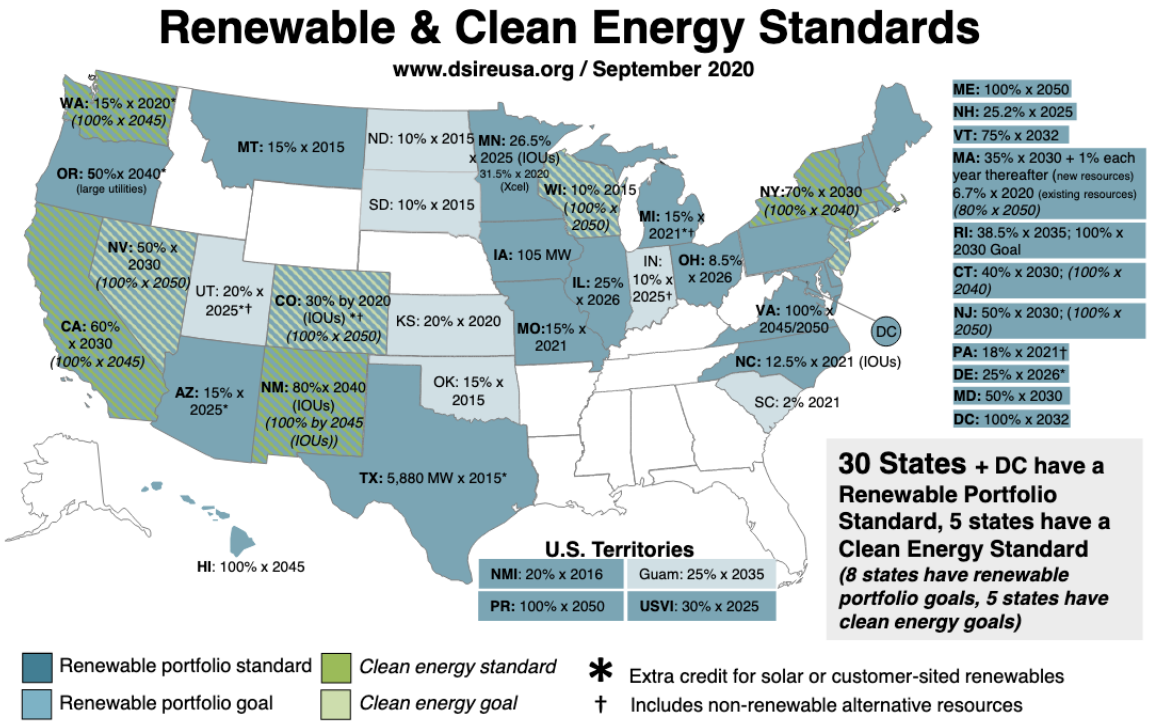


Figure 5: Renewable and Clean Energy Standards in the US

In a similar vein, at least 31 states have an Energy Efficiency Resource Standard (EERS) or similar obligation in place, requiring regulated utilities or retail electricity suppliers to deliver energy efficiency savings to and with their end-use customers.

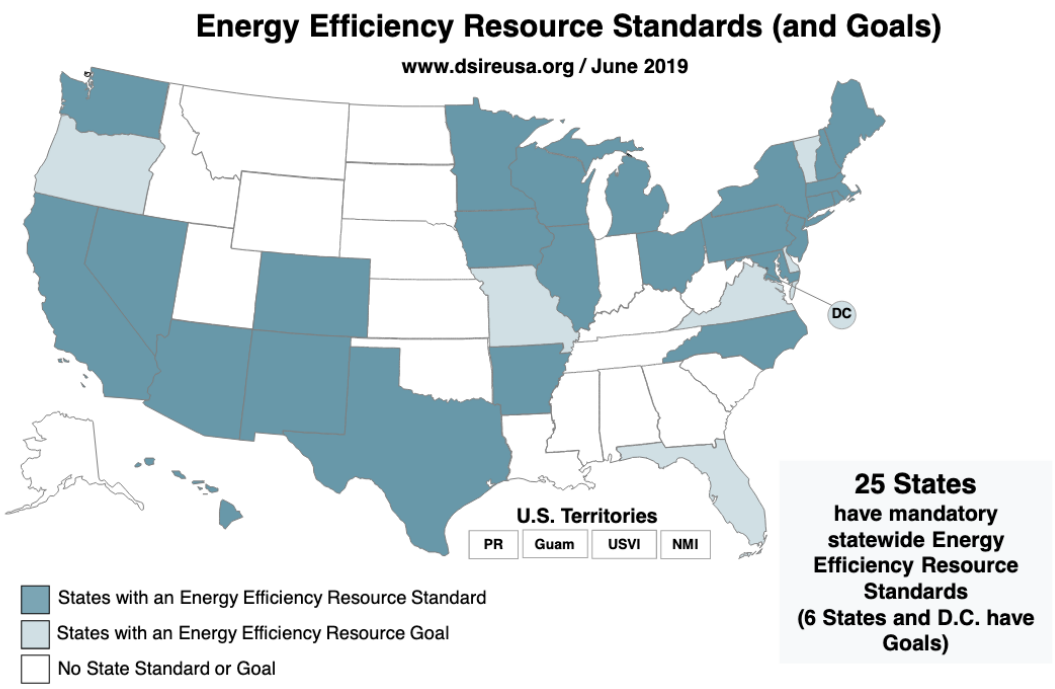


Figure 6. Energy Efficiency Standards in the US

Renewable energy standards (RESs) and energy efficiency obligations have worked well to drive change in the electricity sector. In some jurisdictions, as in Vermont, efficiency obligations also apply to the regulated pipeline gas utilities, also with notable success. As previously discussed, Vermont is also now in its fifth year of remarkably smooth and successful implementation of its RES Tier 3 requirement for electric utilities to reduce their customers' direct consumption of fossil fuels.

Our national and local experience with these performance standards reveals five broad observations:

1. **Change at scale.** Renewable Portfolio Standards and Efficiency Resource Standards have delivered a large fraction of the renewable energy and energy efficiency services received by end-use customers in the states that have enacted them.

2. **High prices not required**. They have delivered these clean energy improvements largely in the absence of carbon taxes or cap-and-trade regimes. They can deliver systemic changes without relying on higher prices to change consumer behavior. Carbon revenues can be quite helpful, but carbon taxes are not required to deliver renewable power or energy efficiency as power system resources.

3. **Focus on adding "good" resources, not on limiting "bad" resources.** Both the RPS and EERS have been designed to require the addition of desirable resources to energy systems, rather than imposing a cap or a penalty on the production or consumption of less desirable resources. Even so, by adding low-emission resources to energy systems, they have displaced worse energy sources and substantially reduced environmental harms, including greenhouse gases.

4. **We know how to administer them**. Performance standards require ways to measure and count performance, and across the country we now have decades of experience in how to do this. The

details can seem complicated, but across all of these programs, utilities, administrators, and stakeholders have developed the procedures and verification methods to make implementation a relatively routine matter.

5. **Competition lowers costs and drives innovation.** To the degree that performance standards permit flexibility in resources and delivery methods, they can promote new ideas and uncover cost-savings opportunities. For example, spurred by RES obligations, many utilities have conducted competitive solicitations for renewable supplies from independent producers, leading to rapid reductions in the cost of solar and wind power.

All of these observations could apply in the administration of a Clean Heat Standard:

- Like the RES and the EERS, the Clean Heat Standard is not a fee-based system or a tax. Its continued success does not depend on annual governmental appropriations.

- Designing the CHS to focus on the delivery of resources that are perceived as "good" avoids arguments over how to/why to limit the use of fossil resources that most people and businesses view as normal. The CHS will provide opportunities and incentives for consumers to switch away from fossil heat systems, but it does not require any individual end-consumer to make that choice.

- As with numerous energy efficiency programs, CHS success requires finding ways to work with both upstream vendors[17] and end-use customers to deliver solutions in thousands of distributed locations.

- The CHS would be a performance-based obligation, without detailed prescriptions, imposed on fossil fuel sellers on a competitively-neutral basis. This creates the environment to deliver clean heat solutions and incentivizes innovation and lower costs over time.

- Finally, the electricity RPS has guided numerous electricity providers to new business models that work sustainably in the emerging low-carbon economy. In like manner, the Vermont Clean Heat Standard is designed to help Vermont's heating enterprises, including traditional fuel companies, to transition and thrive while helping their customers to switch to cleaner, sustainable heating choices.

It's time to do for heating what we have done for electricity– to serve Vermonters better by reducing carbon pollution and fossil energy bills. This has not happened, and won't happen, just through wishful thinking or the actions of a few well-meaning early adopters – *it requires a clean heat performance standard, applied on a competitively neutral basis to all major suppliers of heating fuels in Vermont.*

[17] The CHS will need and support agricultural and other businesses that can develop biofuels, as well as heating equipment vendors and installers, the advanced wood heat value chain, insulation contractors, and others.

Clean Heat and Fuels Standards in Other Jurisdictions

Vermont is not, of course, the only jurisdiction seeking to lower the GHG impacts of fuels.

In the heating sector, four recent examples include actions in Colorado, Oregon, New York and California.

- In 2021 the **Colorado** legislature adopted a **Clean Heat Standard,** requiring distribution gas utilities to reduce emissions by 4% by 2025 and 22% by 2030, using a variety of "clean heat resources," including RNG, electrification, efficiency, and green hydrogen. This program will be overseen by the Colorado PUC.
- The **New York** legislature just passed legislation (A7290) requiring **all fuel oil sold for heating in New York** to contain at least 5% biodiesel by 2022, and 10% by 2025. That legislation currently (December 2021) awaits the Governor's signature. This statewide legislation builds on a law in effect in recent years requiring minimum biofuel blends in New York City, which was then extended to surrounding counties.
- **Oregon,** in 2019, was the first state to create a goal for **Renewable Natural Gas** (RNG) for its pipeline gas system. The law requires Oregon PUC to encourage delivery of RNG, with a goal of delivering 30% RNG by 2050.
- The **California** Energy Commission (CEC) is required by state law (AB 3232, in 2018) to assess the potential to reduce emissions from buildings by at least 40% below 1990 levels by 2030. The CEC's report concludes that efficiency and RNG alone are unlikely to meet that goal, and that heat switching, especially to electric heat pumps, will be required.

Some well-developed performance standards for cleaner fuels also exist in the transportation sector.

- The federal **Renewable Fuel Standard (RFS)** requires a substantial volume of biofuels to be blended into gasoline and diesel fuels for transportation. This policy demonstrates the viability of fuel performance standards and the value of tradeable credits, but suffers from its focus on a limited range of solutions—some with significant side-effects. Vehicle fleet mileage standards permit more diversity, with credits earned for a wide range of efficiency improvements,
- A more successful example is the **California Low Carbon Fuel Standard (LCFS),** which has been implemented since 2011 and was revised in 2018. The LCFS is intended to reduce the carbon intensity of transportation fuels by 20% by 2030. Fuels that are cleaner than the declining standard earn credits that can be sold to fuel suppliers whose fuels are higher-emitting. An important part of the LCFS program is its use of life-cycle analysis of alternative fuels; the values established for different biofuels and other pathways is recognized as credible and relied upon in other jurisdictions. These values provide an important resource that the Vermont Clean Heat program can rely upon. The LCFS now gives credits also to clean fuels capital investments that will reduce transportation emissions, such as DC fast-electric vehicle charging stations, and some hydrogen infrastructure.
- **Oregon** followed California's lead and now requires a 10% decline in the carbon intensity of transportation fuels by 2025, compared to levels in 2015. **British Columbia** has also followed the California model, with slightly lower goals in the short term, but also with a 20% reduction in carbon intensity by 2030.

  From these examples, and others globally (e.g., Brazil, Canada, European Union), we draw three conclusions: (a) clean energy performance standards, whether for heat or for transportation, are a viable policy choice to reduce emissions in fuels sectors, (b) these standards are already driving large markets for biofuels and alternatives, so there is likely to be ample supply of clean fuels to serve Vermont's comparatively small requirements; and (c) the crediting tools used to track federal RFS credits and California LCFS credits could be used in Vermont to measure and credit a wide range of clean heat resources.

The central idea of a Clean Heat Standard is a performance standard applied to all suppliers of fossil-fuel heat in Vermont, requiring them to serve Vermont customers with gradually-increasing percentages of low-emission heat, while phasing down their sales of fossil fuels over time. Just as the electricity RPS's are replacing coal and gas-fired generation with hydro, wind, and solar power, the CHS would replace fuel oil, propane, fossil gas, and kerosene heat with renewable biofuels, cold-climate heat pumps, advanced wood heat, district heating, energy efficiency improvements, and other low-carbon options.

There are of course many ways to approach this design challenge, so it has been helpful to keep in mind a few guiding principles to test our decision-making on various aspects of the CHS. A successful Clean Heat Standard will:

1. **Meet Vermont's climate goals**. The CHS program must reduce both local air pollution and global greenhouse gasses and be expected to meet the thermal sector's share of emission reductions called for in the Global Warming Solutions Act.
2. **Provide customer flexibility** -- give individual homeowners, building owners, and other consumers a wide range of low-emission heating options to choose from, as well as the ability to decide if and when to make changes in response to market offerings.
3. **Promote supplier flexibility** -- offer numerous pathways for obligated entities to meet their Clean Heat obligations.
4. **Minimize cost** -- maximize flexibility to enable emission reductions to be achieved at the lowest possible cost.
5. **Maintain resource diversity** -- minimize negative side-effects, avoiding over-reliance on single technologies, and minimize exported environmental harms from cleaner heating choices in Vermont.
6. **Enhance social equity** – build social equity into the architecture of the program, and particularly minimize adverse impacts on low-income households and those most burdened by high energy bills.
7. **Scale over time** -- grow gradually in scale over time to provide opportunities to benefit from new technology, capture economies of scale, and provide reasonable certainty to market participants that the market for clean heat solutions will continue and grow.
8. **Be as simple as possible --** minimize complexity of administration while maintaining enough regulatory rigor to ensure that emission reductions are real and consistent with state requirements. Vermont's CHS should be capable of meshing with programs in other states, if they are created, but we should not delay our own progress waiting for other states to act.
9. **Mesh well with other policies** -- The Clean Heat program should work well with, and be mutually-reinforcing with Vermont's weatherization, Tier 3, and other GHG reduction initiatives.
10. **Enhance local economic development** – replace expensive and volatile fossil fuels with efficiency investments and cleaner and more affordable fuels to support growth in the Vermont economy, including new jobs and job training opportunities, and fuel dealers' ability to transition to new and economically sustainable business models.
11. **Leverage existing institutions** – work with existing Vermont policies and institutions to boost progress, ensure consistency across policies, and avoid recreating the wheel.

III. Clean Heat Standard Proposal

As with any policy concept, the key elements of a Clean Heat Standard could be structured in a variety of ways. The CHS Working Group has considered many of these program options in depth. In this section we provide our recommendations on a number of the key elements of a CHS for Vermont. The section concludes with a table that summarizes all of the recommendations and can serve as a quick reference.

More detail on some of these elements and the rationale for our recommendations is included in Appendix 2.

A. Nature of the Obligation: Delivering Clean Heat Credits

Recommendations

1. **Credit system**. Obligated parties will be required to produce or acquire a specific number of clean heat credits each year. The annual requirement will grow over time to enable achievement of Vermont's climate policy goals (see subsection C on the Size of the Obligation).
2. **Clean heat credits expressed in CO2e**. Clean heat credits will be expressed in units of carbon dioxide equivalents (CO2e).
3. **Credits are based on the magnitude of emissions reductions at Vermont homes and business sites**. Credits will not account for the historic upstream emissions associated with the production and delivery of fossil fuels to those sites. However, the net impacts of biofuel replacements will be assessed on a lifecycle basis to avoid exporting emissions that would remain unaccounted for.
4. **Attribution not required**. The obligated party must simply demonstrate than an emission reduction has been achieved and that it owns the rights to that reduction. Double-counting is forbidden, but the claiming entity does not need to demonstrate that it alone was directly responsible for producing the reduction.

Discussion[18]

Clean Heat Credits. Designing a market-based program to ensure specific levels of reductions in fossil emissions in Vermont begins with a choice between two systems: (a) a system that requires fossil providers to earn *credits for positive actions* (e.g., selling renewable fuels or installing heat pumps) or (b) one that *reduces emissions under a declining cap* and distributes those emission allowances among fuel sellers by auction or some other means. The cap-and-allowance system is more akin to the method used in the Regional Greenhouse Gas Initiative. The credit-based system is more akin to the systems Vermont has used for Renewable Energy Standards and Efficiency Obligations.

Each of these approaches has pros and cons. The main advantage of a cap-and-allowance system is that it provides a fair degree of certainty on the absolute level of emissions over time. A cap-and-invest system (e.g., RGGI) can also raise financial resources to support energy transitions.

[18] More discussion about each of the recommendations for delivering clean heat credits is available in Appendix 2.

We propose a Clean Heat Standard based on an earned-credit system, akin to the electric RES. Like the RES, the CHS would provide a clear picture of the rate of change required. It would create a commercial value for each heat pump, wood pellet stove, home weatherization job, gallon of biofuel and other measures. That, in turn, could help fuel dealers, contractors, farmers and others to transition their businesses to selling such products and services.

The main advantage of a credit system over an allowance system is that it focuses on the delivery of concrete, delivered clean solutions rather than on allowance limitations and pricing as a tool to drive down consumption of fossil fuels. A key goal of the CHS is to stimulate suppliers, whether based in Vermont or elsewhere, to deliver clean heat solutions to Vermont customers. This connection is stronger in a credit-based system.

The common denominator to measure credits should be CO2e. In the Renewable Energy Standard, performance is counted in delivered kWh. Since the CHS is designed to match the emission reductions required by the Global Warming Solutions Act, CHS credits should be measured in terms of CO2 equivalents, which would give credit for the CO2 emissions avoided by the addition of clean heat solutions. Using CO2e also allows a variety of clean heat options, from weatherization to biofuels, to be compared on an apples-to-apples basis.

Credits Expressed in Terms of On-Site Emission Reductions. The current Vermont Greenhouse Gas Emissions Inventory measures emissions at the point of combustion of fossil fuels. That is the simplest way to measure both baseline emissions and future emission reductions. It is also consistent with the structure of the Global Warming Solutions Act and other states and countries. However, to avoid the problem of "exporting" emissions or overlooking new impacts from biofuels, biofuel additions can only earn credits on a net basis, after accounting for the lifecycle emissions associated with their creation and consumption.

Attribution is Not Required. One of the most attractive features of the CHS is that it can recognize credits for the delivery of clean heat solutions without needing to consider which program or entity (or combination thereof) "caused" the solution to be delivered. The Vermont GWSA requires specific levels of emission reduction by 2025, 2030 and 2050. A Clean Heat Standard is simply a policy tool for ensuring that those reductions are achieved in Vermont's thermal sector. Thus, what matters is whether emissions actually go down and the correct number of clean heat credits have been generated. It does not matter who generates those credits or why they were generated.

This is akin to how Vermont's current electric RES works. Electric utilities must simply show that a certain percent of their electric portfolio each year is from wind, solar, and other renewable energy sources. It does not matter whether a customer would have put photovoltaic panels on their roof without a utility program or whether a wind turbine would have been built without any utility support. As long as the utility acquires the renewable attributes of such resources, they can use them to demonstrate compliance with their RES obligation.

B. Who Are the Obligated Parties?

Recommendation

1. **The obligation for reducing emissions would be imposed on Vermont Gas Systems (VGS) and wholesale suppliers of fuel oil, propane, and other fossil fuels sold to Vermont homes and businesses.**

Discussion

As Vermont does not produce fossil fuels, we are entirely dependent on imports. We spend about $750 million each year to import fuels to heat buildings and hot water, to cook, boil maple sap, and to run industrial processes. These fuels are sold into the state via truck and rail by a small number of major energy suppliers operating in a few locations, including Boston, Montreal, Albany, Burlington, Essex, Rutland, Hartford, and North Walpole, NH. There are, in contrast, a larger number of retail providers (currently 96) of oil, propane, kerosene, and natural gas, ranging in size from very large corporations to local, family-owned fuel dealers. Vermont retailers also operate about 75 bulk storage facilities for distillate products, and about 50 bulk propane storage facilities in state.

Should the CHS obligation be imposed "upstream," on wholesale providers, or "downstream," on retail delivery companies? There are pros and cons for either choice.

At a very practical level, delivering on a CHS requires thousands of building owners to make major changes to their heating systems. We do not envision enacting a mandate directly requiring those owners to replace their heating systems, so how can we best support them to make those changes? The principal reason to place a clean heat obligation on retail fuel providers is that they have a direct relationship with end-use customers, and thus have the opportunity to work with them on heat-switching choices. In addition, in the long run, clean heat services will be a big business opportunity in Vermont, and it serves the state's economic goals to develop that expertise in-house and in-state, as we have for energy efficiency and solar power. Placing an obligation on existing fuel providers on a competitively-neutral basis might well provide a needed boost in that direction.

However, "upstream" wholesalers have much greater financial and management capacity, and they have the opportunity to acquire and blend renewable fuels into the system, which could quickly deliver at least some carbon savings without requiring actions by end-users.[19] Wholesalers could also meet their clean heat obligations by purchasing credits from others, or contracting with a range of delivery entities, including fuel dealers, heat pump contractors, or organizations such as the Vermont Fuel Dealers Association or Efficiency Vermont. Finally, obligated parties might wish to use this opportunity to build up a clean heat line of business, akin to the work that many traditional energy companies have been doing in transitioning to renewable electricity. An upstream obligation would still give retail fuel dealers the opportunity, but not the direct obligation, to deliver fuel-switching services to their customers.

All things considered, our working group recommends placing the CHS performance obligation on wholesale providers of fossil heating fuels, and allowing multiple pathways to earn credits. However, since either upstream or retailer obligations could work, the ultimate choice might well come down to

[19] Fossil fuel wholesalers include both in-state and out-of-state entities, and out-of-state entities with in-state facilities and operations. Intermediate shipment points are also commonly used, as in the numerous bulk storage tanks that store fuel for later loading onto local delivery trucks. We recommend that the CHS obligation be imposed on the first jurisdictional provider of fossil heating fuels destined for consumption in Vermont. This is akin to the approach used in other clean fuel standards, such as the California Low Carbon Fuel Standard.

the practical preferences of Vermont's fuel dealers and other energy service providers. Whichever way the CHS is designed, it should provide ample opportunity for both regional and Vermont-based fuel dealers and energy companies to develop new lines of business and to thrive in a low-carbon energy environment.

C. Size of Annual Obligation

Recommendation

1. **The PUC would be authorized and required to set annual Clean Heat obligations of sufficient magnitude to achieve the thermal sector's portion of Vermont's GHG emission reduction goals.** The obligation would rise over time in line with the GWSA's requirements.
2. **Technology carve-outs are not needed.** The CHS can be met in many different ways, allowing customer choices, provider choices, and competition to deliver solutions.
3. **The PUC would be enabled to make adjustments to the Standard requirements.** The PUC would be authorized, on evidence and after public hearings, to adjust the level of obligation on a forward-going basis: (a) upward if credits are meaningfully oversupplied; and (b) downward, subject to strict conditions, in response to serious, unavoidable technical problems, supply constraints, and adverse market conditions.

Discussion

The Clean Heat obligation rises over time in sync with climate requirements. The essential idea of the Clean Heat Standard is to add clean heat resources to Vermont homes and businesses over time. Heating, like electricity, is an essential service. Just as the Renewable Energy Standard seeks to add clean resources to the power mix, without imposing a cap on consumption, the Clean Heat Standard seeks to add clean heat services to the thermal sector without putting a limit on how much heat is delivered or consumed. Adding clean heat solutions in Vermont serves multiple purposes: they lower heating costs to Vermonters, add resilience to the heating sector[20], promote jobs in advanced heating technologies, improve indoor and outdoor air quality – and lower GHG emissions. Lowering climate pollution is not the only reason to create a Clean Heat Standard.

That said, as the fraction of clean heat in Vermont will grow over time, GHG emissions from the thermal sector will naturally decline. The Standard should be designed to sync with the State's overall climate requirements, recognizing as well that the CHS is not the only tool called upon to reduce emissions from the thermal sector.

The chart below shows how emissions from the thermal sector should decline in keeping with the GWSA requirements. In very general terms, the rate of improvement set out in the law is roughly 2% per year until 2025, rising to just under 7% per year between 2025 and 2030, and then settling to a reduction in emissions of about 3.3% per year from 2030 to 2050.[21]

[20] Adopting a Clean Heat Standard now protects Vermont against the risk of supply disruptions and abrupt policy shifts that are likely to come later, as the climate crisis worsens and future governments impose policies to rapidly shift away from fossil heating fuels.

[21] Note that these percentages are all measured from the starting year in each time period, not from each year's immediately preceding year.

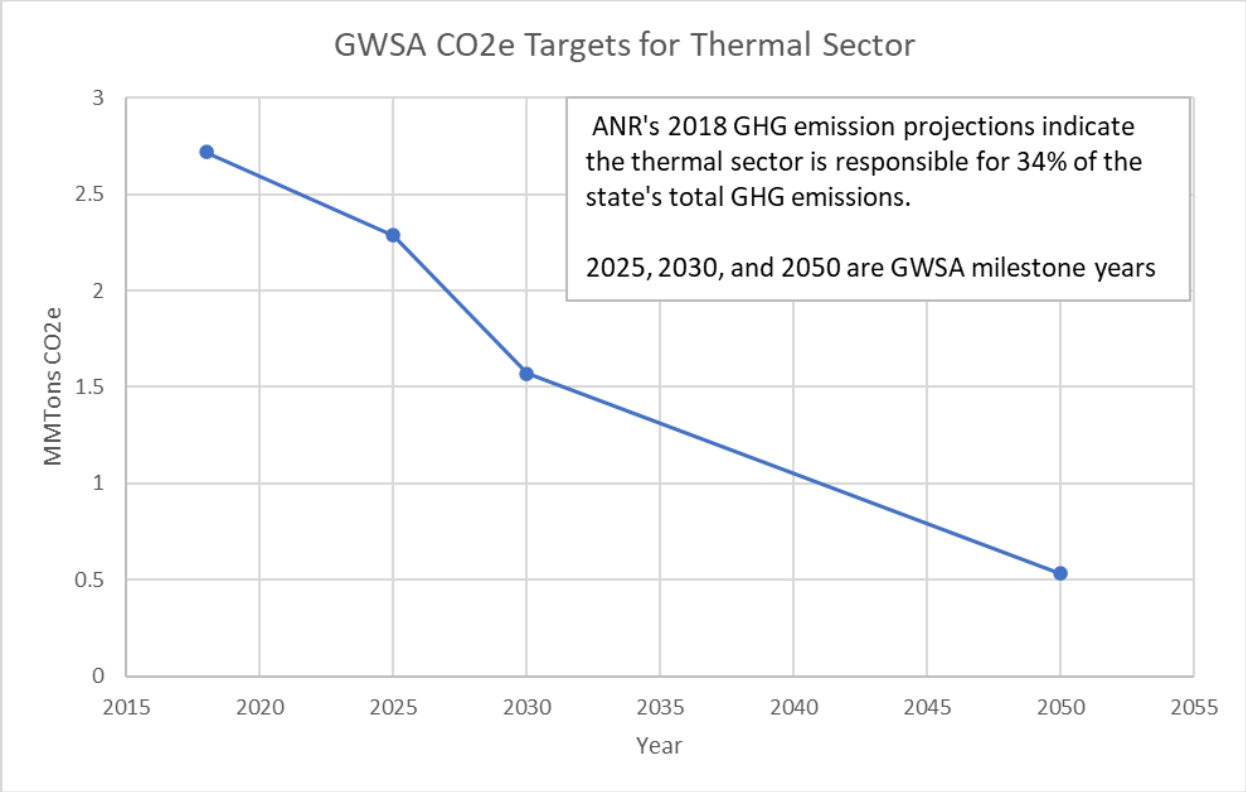


Figure 7. Global Warming Solutions Act: emission reductions required for the thermal sector

The CHS would enable a variety of clean heat choices. With these climate objectives in mind, what heating solutions should the Standard require? We conclude that the CHS should permit a range of technologies and fuels to compete for the ability to earn clean heat credits. A series of analyses by the Energy Action Network[22] reveals that the CHS standard could be met in many different ways, combining different numbers of weatherization jobs, heat pumps, advanced wood heat systems, and/or different blends of renewable pipeline gas and biofuels. One such "pathway" is shown in the chart below. As the chart illustrates, to meet Vermont's climate requirements, we will need very substantial increases through a variety of means. Heat pumps both for water and space heating, building weatherization, and advanced wood heat make up the majority of the measures likely to be used, but many other options are available as well.

[22] The EAN analyses have been built on the work of Leigh Seddon, Mei Butler and Jared Duval. (citations needed)

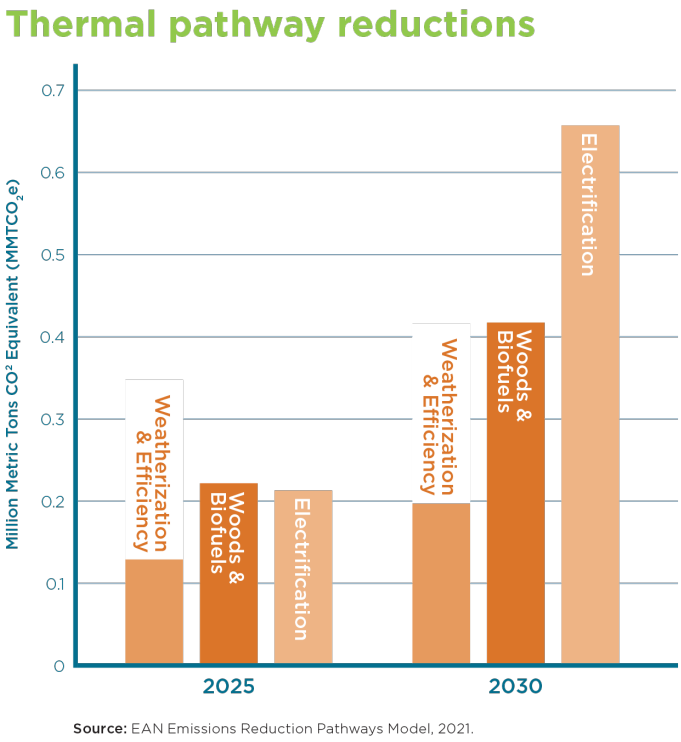


Figure 8: One possible heating mix scenario meeting GWSA requirements

The chart above shows just one possible pathway among many. What is our "crystal ball" prediction for the future mix of heat pumps, advanced wood heat, biofuels, district heat, green hydrogen, and renewable natural gas in Vermont in 2050? We don't know, and we don't need to know. A crucial aspect of the Clean Heat Standard is that it is not necessary for the state to specify the exact pathway to meet our climate goals. Those decisions will be made by individual consumers and their heating suppliers.

Adjustments to the Standard should be permitted in response to the performance of other thermal policies, and to supply constraints and unanticipated market conditions. Decades of experience with energy policies, including utility integrated resource plans, renewable portfolio standards, and efficiency programs have taught providers and regulators that the costs of environmental improvement often come down more quickly than first projected. When renewable portfolio mandates created a growing market for wind and solar power, initial costs were relatively high. However, economies of scale, experience, and competitive bidding for renewables drove down costs much more quickly than analysts expected. With a certain and growing market in Vermont for installed heat pumps, pellet stoves, and biofuels, we should expect to see reductions in the cost of customer contacts and installation over time.[23]

[23] The cost of delivering and installing clean heat solutions should drop with increased scale and experience in Vermont. If other states adopt similar policies, the manufactured cost of clean heating equipment might be reduced, while equipment performance is likely to continue to improve. The cost of biofuels might rise due to potential supply limitations, or might drop with technological improvements. Increased penetration of heat pumps could deliver positive benefits to power systems, but could be costly if usage is not managed over time through advanced rate designs, storage and demand management techniques.

In addition, as equipment vendors, contractors, and supply houses gain experience with these cleaner technologies, heating markets may gradually be transformed, as has happened over time with a number of lighting technologies. This evolution could lead to two positive results. Most directly, lower costs for clean heat systems would yield a greater supply of clean heat credits, moderating the cost of the CHS program for providers and consumers. Beyond that, with higher uptake and lower costs for the CHS, decisionmakers might have the opportunity to increase the pace or ambition of the CHS itself, which would deliver deeper GHG savings earlier in the program. This might be needed if climate progress in other sectors moves more slowly than desired and/or if the Global Warming Solutions Act is revised to require faster or deeper emissions reductions than currently outlined, in line with evolving scientific guidance.

On the other hand, economic conditions might change dramatically enough to cause a real shortage of clean heat opportunities, or supply chain disruptions could interfere with delivery of new equipment.[24] For all of these reasons, we recommend building into the CHS legislation an opportunity for state regulators to revise the obligation level on a forward-going basis. Any adjustments to slow down progress should be subject to strict limits to protect the essential purposes of the CHS.

D. Design for Equity

Recommendations

1. **From the outset, the CHS should be designed to mitigate the disproportionate energy burdens and negative distributional effects of existing fuel costs in Vermont.**
2. **CHS program planners should call attention to essential complementary programs, such as low-income weatherization and fuel assistance programs, to assist in the transition to cleaner heating solutions.**
3. **Details of CHS program design and ongoing program implementation should be guided by the principles of procedural inclusion, learning from lived experience, and equity.**

Discussion

The Global Warming Solutions Act identifies quite clearly the equity imperative that attends the transition to a low-carbon future: the transition must be effective, and it must be a "just transition." It would be difficult to find a sector in which these twin imperatives operate more obviously than the thermal sector.

As the American Community Survey documents, lower income Vermonters spend a high and disproportionate fraction of their income on household energy, compared with higher income households. This is despite their consuming substantially less energy for home heating and electricity. See chart below.

[24] As we launch a CHS program that could run for 25 years, it's obviously impossible to anticipate events like the housing crisis of 2008, the Covid-19 pandemic or the shortage of computer chips that is slowing down production of automobiles in 2021.

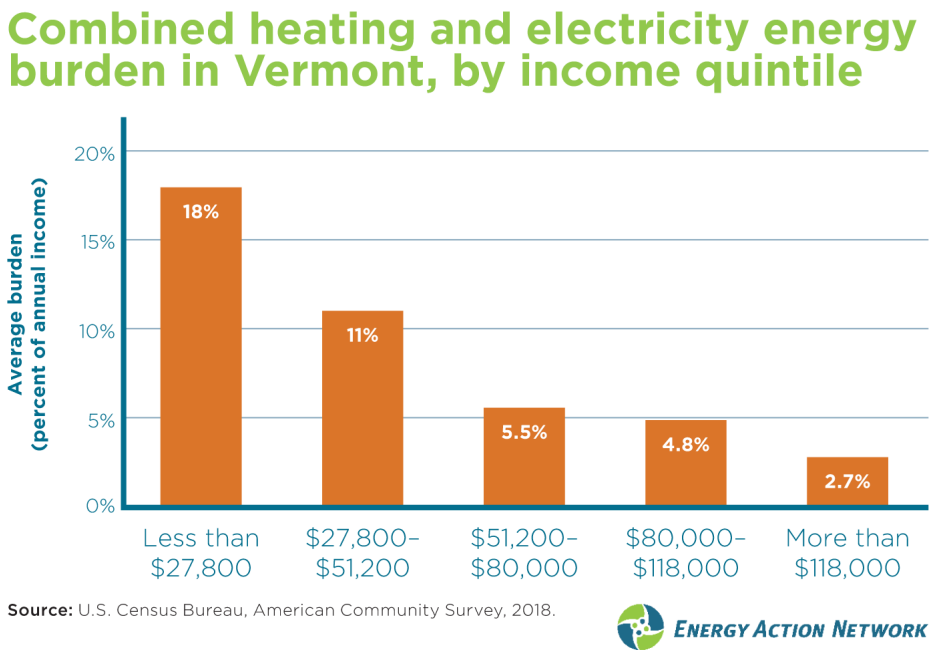


Figure 9. Energy burden by income quintile in Vermont

Meeting Vermont's climate goals requires a comprehensive reduction in emissions from across all segments of the building stock, including (and probably most importantly from) the worst-performing building stock—often the homes of the lowest-income households. Decarbonizing this fraction of the housing stock will make the greatest proportional contribution to reduced energy burdens, improved health outcomes, and transitional equity. Both building shell improvements and heating conversions will be necessary to improve this fraction of the housing stock, and since the private resources of occupants are by definition limited, public policies will be needed to make it happen. Those strategies should be built into the CHS program design from the beginning.[25]

A number of options have been considered by the Working Group to deliver an equitable clean heat transition, but we have not yet settled on final recommendations. Those design features would greatly benefit from input from a broader public engagement process. Some preferred ideas include:

- **Early action to benefit those most burdened by high energy costs**. From the outset, the CHS program should focus on energy-burdened households by requiring a high fraction of all credits earned to be sourced from services provided to low-income households. The program rules could mandate, for example, that at least one-third of heating upgrades must be delivered in the housing units occupied by those in the lowest income quintile, and that at

[25] There is, on the surface, tension in program design between dedicating efficiency and heat-switching resources to consumers with the highest energy-burdens, versus maximizing early pollution reductions by focusing on the "quickest reductions from anywhere." We recognize that a just transition requires both "justice" and an effective "transition," so multiple objectives must be served. At this point we judge that the balance should favor early action to improve heating systems for those who bear the greatest energy burdens. Ultimately, clean heat solutions will have to be delivered to most homes and businesses across Vermont, so almost everyone will ultimately be served. We think it is both equitable and ultimately cost-effective, to provide clean heat solutions to the most energy-burdened households disproportionately earlier in the process than would be the case if the distribution of benefits were left to market forces alone.

least for the first five years, two-thirds of the upgrades must be delivered to households in the lower half of the income distribution. Ultimately, of course, households in every income category must be transitioned to low-carbon thermal uses, and this is what the CHS program envisions. But a policy to address the "most burdened, first" would be consistent with the goals of the just transition.

- **Close coordination with weatherization programs.** While thermal efficiency actions are creditable under the CHS, we do not expect the CHS to be able to carry the very large financial weight of thermal modernization of the entire building stock of the state. That will require a suite of complementary financial instruments, mandates, public funding and tax credits, landlord incentives and more. However, with a focus on the most burdened households and most vulnerable communities, it will be important to pair up clean fuels options and weatherization programs to deliver comprehensive low-carbon solutions in the most burdened households and neighborhoods.

- **Minimum efficiency standards for multi-family rental properties.** Low-income households are disproportionately renters. Regulations that require multi-family building owners to meet minimum standards for insulation levels, air leakage, heating system efficiency, and the efficiency of other appliances is one way to address the challenging "split incentive" barrier to efficiency investments.[26] The City of Burlington, Vermont currently has such a regulation, but the rest of the state does not.

- **Targeted subsidies at point of sale, and early appliance retirements.** Lower income households are those most at risk of running unsafe and inefficient heating and hot water appliances, and they are at high risk of having to replace failed appliances in an emergency situation. Those implementing the CHS program could design an outreach effort in concert with community action agencies specifically designed to reach lower-income/energy-burdened households with financial assistance and trusted advice, for the purpose of proactively replacing those inefficient and unsafe units before they fail.

- **Dedicate alternative compliance payments to low-income solutions.** While the overall CHS program should be focused disproportionately on the lowest income households, the default service provider (and recipient of any noncompliance payments) could focus its efforts 100% on the toughest housing stock and the most-burdened households.

- **Equity strategies for pipeline gas.** As a regulated network, VGS has heightened responsibilities and opportunities to serve the needs of low-income households. And as the uses of the VGS network change, and possibly contract, equity concerns will be elevated. VGS should consider ratemaking techniques to avoid a situation in which low-income customers are left paying for a high fraction of the system's fixed costs. Options include accelerated depreciation in the near term, phasing in low-income rates, and targeted assistance (including weatherization and

[26] "Split incentives" refers to the fact that building owners who make decisions about capital investments often have little incentive to improve efficiency because they do not pay the higher energy bills resulting from inefficient structures and appliances. Conversely, tenants who pay the energy bills do not have the authority to make major efficiency investments; even if they had the authority, given uncertainty over whether they will even reside in a building long enough for a major efficiency investment to pay for itself, they also have little incentive to make such investments.

clean heat options) to energy-burdened households. The option to create a district heating system serving especially dense neighborhoods is also a possibility. An equitable transition should be built into the approved regulatory plans for VGS in the coming decade.

- **Other solutions, including leveraging public funds, should also be studied.**

In addition, as a matter of **procedural equity** and openness to new ideas in program design, we conclude that a process of outreach to impacted communities and low-income representatives should be undertaken. Input from housing agencies, weatherization and efficiency practitioners, and finance experts should support this engagement. It is important to open the design process to ideas that can emerge from energy-burdened communities, housing providers, and others with lived experience and professional expertise delivering weatherization and heating solutions.

E. Eligible Measures – What Actions Earn Clean Heat Credits?

Recommendation

1. **Only measures that directly reduce combustion of fossil fuels in Vermont homes and businesses would be eligible for clean heat credits.** Categories of measures that would be eligible include:

    a. Liquid biofuels and renewably-sourced pipeline gas;
    b. Electrification measures, particularly heat pumps for space heating and heat pump water heaters;
    c. Advanced wood heat options, particularly pellet stoves and pellet and wood chip boilers;
    d. Thermal energy efficiency measures;
    e. District heating systems; and
    f. Hydrogen fuel and on-site carbon capture and storage.

    Emissions offsets (e.g., tree planting or reductions in fossil fuel combustion outside of the Vermont thermal sector) would not be eligible. Reductions in fugitive emissions upstream from homes and businesses, from fossil fuel storage systems, the VGS distribution system, and shared propane facilities would not be eligible.

2. **Only biofuels "delivered" to Vermont are eligible**. Biofuels with lower lifecycle GHG emissions than the fossil fuel they are replacing would be eligible measures, provided they are delivered and used to fuel heating systems and other appliances in Vermont homes and businesses.[27]

[27] VGS and some fuel dealers already offer voluntary renewable fuels options to their customers. Continued sales of this type should be eligible to earn Clean Heat credits. However, to avoid a form of double-counting, the quantity of such sales should be reflected in the baseline numbers used to set the Standard at the outset.

Discussion

Direct Reductions in Fossil Fuel Combustion in Vermont Homes and Businesses. Vermont's GWSA clearly articulates a preference for direct reductions in Vermont's gross emissions. In addition, reducing Vermont's reliance on expensive and price-volatile fossil fuels requires us to focus on the direct delivery of building upgrades and clean heat solutions in Vermont homes and businesses. Direct reductions from Vermont homes and businesses are also much easier to document as being real (i.e., actually occurring), legitimate (e.g., relative to an appropriate baseline), and not being double-counted (e.g., relative to emission reduction requirements in other sectors and/or in other jurisdictions).[28] For example, it would be very challenging to verify whether investment in forest preservation, especially in another country, effectively achieved the level of GHG emission reduction assumed. Similarly, it would be challenging to determine whether GHG emission reductions at an industrial facility in another state were both (A) attributable to the actions or payment of an obligated party in Vermont;[29] and (B) not also being counted towards other emission reduction requirements in the host state or even a third state.

"Deliverability" Requirement for Biofuels. The requirement that any biofuels substituted for fossil fuels be "delivered" to Vermont homes and businesses is consistent with the principle of focusing on curbing emissions from Vermont facilities. For biodiesel and/or other biofuels displacing fuel oil, propane, or kerosene, this requirement means that Clean Heat credits can be earned only for biofuel physically delivered to Vermont homes and businesses. Biogas (biomethane) that is trucked to a Vermont home or business would also be an eligible measure. Giving credits simply for the *creation* of biofuels anywhere in the world – or even anywhere in the North America or the U.S. – would overwhelm the Vermont CHS and undermine its fundamental goal to change the nature of heating in our state. Put simply, the CHS should be a Clean Heat program for Vermonters, not an offsets support system.

The concept of deliverability is a little more complicated in the context of the pipeline delivery system for methane gas because it is not possible to trace which molecules of methane are burned in which homes and businesses. Thus, for pipeline biogas, deliverability could be satisfied by purchase and sale of what Vermont Gas Systems (VGS) calls a "bundled" product. Specifically, VGS must both purchase the biogas itself (including its GHG emission reduction attributes) and have a contractual pathway for physical delivery of the biogas from the point at which it is injected into a pipeline all the way to the VGS distribution system. This is analogous to how VGS currently acquires both fossil and renewable gas.

This concept is also consistent with the way RECs are credited in Vermont's electric RES, where renewable electric generation in Quebec, New York, and other New England states is eligible to count when the power is delivered to the power grids and markets that directly serve Vermont. Renewable generation cannot earn RES credits in Vermont, on the other hand, when the generator is located on a

[28] As discussed in the next sub-section on Credit Values for Eligible Measures, some of the concerns about offsets, such as ensuring that reductions actually occurred, ensuring proper baselines from which reductions are measured, and ensuring reductions are not credited for multiple purposes (or in multiple jurisdictions), are potentially applicable to biofuels as well – especially if they are produced out-of-state. However, biofuels are different in that they can be measured when directly displacing fossil fuels burned in Vermont homes and businesses.

[29] While it is not necessary to document attribution for direct reductions in Vermont emissions, it would make no sense to allow counting of any emissions offsets, especially outside of Vermont's borders, without requiring a demonstration of attribution.

remote power grid and sold in a remote power market (e.g., in California or Georgia) that do not deliver electricity in our region.

F. Credit Values for Eligible Measures

Recommendation

1. **A technical advisory group (TAG) should be charged with developing deemed assumptions regarding the credits that common clean heat measures produce.** That would include the number of credits a measure is worth each year, the life of the measure (i.e., the number of years for which it would earn credits), any degradation in credit values over time, and other relevant assumptions.
2. **Credits for biofuels will be based on the "but for" principle – i.e., what emissions would have occurred absent use of the biofuel to displace a fossil fuel in Vermont.** This will require consideration of deliverability (see above) and all regulations, including GHG regulations, applicable to agriculture, forestry, and other relevant sectors in the jurisdiction in which the biofuel is produced.
3. **Credits will be "time-stamped"**. Measures that produce emissions reductions over multiple years – e.g., heat pumps, other electrification measures, advanced wood heat, and weatherization measures – would earn an appropriate number of credits for the year they are installed as well as each subsequent year during which they would be expected to produce emission reductions. Only the credits with the current year "time-stamp" would apply to the current year obligation; credits with future year time-stamps would apply against credit requirements in those future years.
4. **TAG assumptions will be updated annually**. The update process will include formal approval by the PUC and will be concluded in the Fall of each year so that obligated parties can have sufficient notice of changes in assumptions to adjust their plans for meeting their obligations the following year.
5. **Once approved, TAG assumptions will be "locked" for the year in question, and will not be changed with retroactive effect.** Credits earned by any measure installed during that year – including credits for future years associated with long-lived measures – will not be changed.
6. **Credits for uncommon measures not addressed by the TAG process, as well as for measures installed in large businesses for which the cost of site-specific estimates of impacts can be justified, will be estimated by obligated parties on a custom basis**. Such estimates will be subject to review and regulatory approval.

Discussion[30]

1. **Technical Advisory Group (TAG)**

A Clean Heat Standard (CHS) Technical Advisory Group (TAG) would be akin to existing Technical Advisory Groups that were created years ago to (a) develop of energy savings assumptions for Vermont's efficiency utilities and (b) develop assumptions for fossil fuel reduction measures that Vermont's electric utilities employ to meet their RPS Tier 3 requirements. Indeed, the CHS TAG would be able to leverage the substantial work already done in Vermont to characterize efficiency measures and other fossil fuel reduction measures. In fact, it would be important that any underlying assumptions used for efficiency programs, electric RPS Tier 3 initiatives, and the Clean Heat Standard be the same.

[30] Additional discussion on recommendations 1-3 are available in Appendix 2.

2. **"But for" Principle for Biofuels**

As previously discussed, combustion of biofuels typically produces the same amount of CO2 emissions at point of combustion as combustion of the fossil fuels they are displacing. The difference is that the biofuels can provide other GHG emission reduction benefits – either eliminating emissions of other GHGs and/or removing CO2 from the atmosphere before they are burned. Thus, CHS credits for biofuels need to be based on their net effect on GHG emissions. To estimate that net effect one must understand what GHG emissions would have occurred absent the substitution of the biofuel for fossil gas, fuel oil, propane or any other fossil fuel. That is the "but for" test.

3. **Time-Stamping Credits**

Some clean heat measures have a one-year life. For example, a gallon of biodiesel reduces GHG emissions only in the year in which it is burned. Other clean heat measures – such as heat pumps, wood pellet stoves, and home weatherization projects – provide GHG emission reductions for 15 years, 20 years or even longer. The CHS needs to assign emission reduction credit values for these long-lived measures. Credit values for future years should decline, as appropriate for each type of measure, to account for expected interactions between measures over time.[31]

4. **Annual Assumption Updates**

In order to ensure that the credit system results in actual GHG emission reductions that are consistent with the state's climate policy requirements, assumptions regarding the number of CHS credits attributable to different clean heat measures will need to be regularly re-evaluated and, when appropriate given new information, updated. As discussed further in the Verification and Evaluation section in Appendix 2, an important source of input for updates will be evaluation studies managed by the Department of Public Service.

To provide clarity and reduce uncertainty for obligated parties, that update process should be prescribed and institutionalized rather than occurring on an ad hoc basis. The most logical approach would be to update assumptions annually. Ideally, such updates would be approved through a regulatory process managed by the PUC, with final regulatory decisions available in the Fall of each year. That would give obligated parties sufficient notice of changes in assumptions to adjust their plans for meeting their obligations the following year.

[31] For example, if 100 homes are weatherized to the point where they achieve 20% heating energy savings, they will initially provide GHG reductions equal to 20% of their previous emission levels. However, over time, a growing number of those weatherized homes will likely also convert to heat pumps, install advanced wood heating systems, and/or burn biofuels. As a result, the average GHG savings from weatherization jobs completed this year will decline over time. Customers will still receive benefits from the weatherization work in the form of lower heating costs – e.g., lower electricity consumption by heat pumps and/or lower consumption of biofuels than would have been the case without weatherization. However, credits assigned to the weatherization measures will need to decline over time to ensure no double-counting of emission reductions.

5. **Assumptions "Locked" for Lifetime of Approved Measures, Until Next Update**

Once an annual update to assumptions has been approved by the PUC, those assumptions should be considered "locked" for any measures installed until the next updates are approved. For example, if in the Fall of 2025 the PUC approves an updated assumption that a 3-ton centrally-ducted heat pump provides a defined stream of clean heat credits across the fifteen years of its assumed life, any heat pump installed in 2026 would earn those credits in 2026 and each year thereafter through 2040 (its fifteenth year). Those credits would remain as assigned in 2026, even if a future evaluation suggests that such heat pumps produce more or less GHG emissions reduction than 5 credits per year would imply. In other words, the number of credits a common measure provides is determined by the PUC approved assumptions for the year the measure is installed. New evaluation data used to update measure assumptions would only apply prospectively – i.e., only to measures installed in years after measure assumptions are updated.

This approach provides certainty for obligated parties regarding the number of credits they can earn for different measures – at least within a given year. While the tradeoff for that certainty is potentially understating or overstating the actual amount of GHG emission reductions achieved, such deviations are likely to be small if there is a commitment to on-going evaluation and annual updates to assumptions based on the results of such evaluations. It should be noted that this approach to "locking" assumptions a year in advance for the purpose of determining whether goals or obligations have been met is very common across the United States – including in Vermont – for energy efficiency programs. It is also implicit in the way Vermont's electric utilities' compliance with RPS Tier 3 requirements is determined.

6. **Credits for Custom Measures**

The process of establishing deemed average assumptions for clean heat measures only works for common measures that are deployed across many different customers and for which the transaction costs of site-specific calculations would not be worth it. It is impossible to identify in advance every type of clean heat measure that may be deployed. Moreover, for larger projects for commercial and industrial customers it may make more sense to develop customized, site-specific estimates of clean heat credits. In such cases, the obligated entities would be responsible for developing custom estimates with regulators responsible for reviewing and adjusting such estimates as appropriate. This is common practice in Vermont today for custom efficiency measures/projects, as well as for custom RPS Tier 3 projects (an example of the latter would be the reduction in diesel fuel consumed by a generator at a quarry that results from extension of an electric line to the quarry).

G. Multiple Ways to Acquire Credits

Recommendations

1. **Obligated parties should have flexibility on the types of actions and transactions used to acquire credits.** That flexibility should include the following options:
    a. Generating credits themselves;
    b. Contracting with other parties to produce credits;
    c. Buying credits on the open market; and/or
    d. Assigning their obligation to a "default delivery agent".

2. Obligated parties should have flexibility to acquire credits from any customer in the state.

Discussion[32]

Many Ways to Acquire Credits. Flexibility will be essential to minimizing the costs of compliance with the Clean Heat Standard. It may also be essential to enabling the standard to be met, as different obligated parties will have different levels of capacity and interest in the way credits are developed or acquired. The system should be open to at least five options, as seen in Figure 10 below:

1. Obligated parties should have the option to **generate credits directly,** by helping customers to install different emission reduction measures (e.g., heat pumps, wood pellet stoves, and weatherization of buildings) and/or by purchasing and selling biofuels to customers, as this is the simplest way for them to comply with the Clean Heat Standard. This is analogous to how efficiency and renewable energy credits are acquired in Vermont today.

2. If an obligated party does not want to work with customers directly, it could **hire contractors to install** clean heat measures on their behalf. This is also analogous to how many utility efficiency programs operate in Vermont and across the country.

3. Third, an obligated party could hire a more broad-based **third-party program administrator**, who might earn credits through a range of services, and might deliver them on behalf of multiple obligated parties. This is analogous to the way that Efficiency Vermont works today on behalf of multiple electric utilities.

4. As a fourth option, the obligated party could **buy credits on the open market**, which allows a variety of private sector businesses to use the Clean Heat Standard as a vehicle to advance existing or new business models. For example, a current fuel oil dealer or an HVAC contractor could decide to diversify its business by selling heat pumps or wood pellet stoves, generating credits that could then be sold to any obligated party. When an obliged party buys those credits, it would defray the cost of making heat pump and/or pellet stove sales, ultimately lowering costs to customers and/or increasing the profitability of the business selling the clean heat products.[33]

5. The final option would be assigning emission reduction obligations to a **"default delivery agent"** designated by the PUC. This could be an "option of last resort", providing an "out" for any obligated party that does not want to have to deal with the planning and management of efforts to acquire credits in some other way.

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[32] Additional discussion on the ways to acquire credits is available in Appendix 2.

[33] If other states were to create a Clean Heat Standard equivalent to Vermont's, it's possible to envision a multi-state market for Clean Heat credits. Vermont has experience in some of these markets, including the Regional Greenhouse Gas Initiative, the regional market for renewable credits, and credit trading under the Clean Air Act. However, we conclude that it is unnecessary and would be unwise for Vermont to wait for other states to act before launching our own Clean Heat program. Many of the benefits of clean heat, including air quality, health, lower fossil fuel bills, and economic development benefits, are local, and the program is aimed at improving the Vermont building stock. There is no reason to wait for other states to act before delivering these benefits in Vermont.

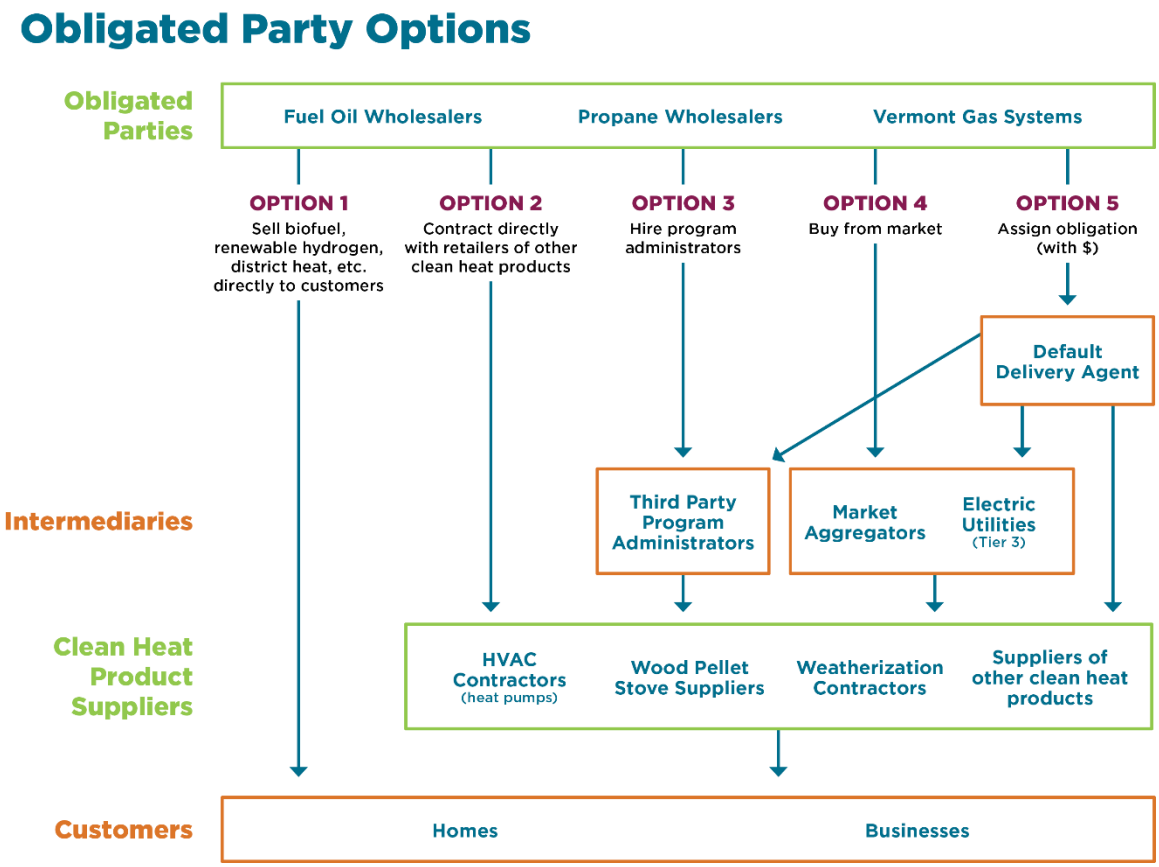


Figure 10. Obligated parties can choose among multiple options to acquire CHS credits

Regardless of which of these options or combinations of options are utilized, a mechanism would be needed to establish "ownership" of credits, both to create a strong credits market and to avoid double-counting (or double-selling of credits). This is not a new or onerous challenge. For example, it currently exists with regard to bidding of efficiency resources into the New England ISO's capacity market, and the attribution of renewable energy credits (RECs) to obligated parties throughout the New England states.

Any Vermont customer can create clean heat credits by reducing their use of fossil heat. Another potentially important aspect of flexibility is the ability of an obligated party to acquire clean heat credits, not just from their own customers, but for measures installed in *any* Vermont home or business. That would include customers who buy fossil fuels from other obligated parties. For example, wholesale fuel oil company A could acquire credits resulting from the installation of a heat pump in a home that buys fuel oil from provider B. Or a fuel oil company could acquire credits resulting from the installation of a pellet stove in a propane or natural gas heated home.

This customer flexibility will serve several purposes. It will broaden the range of options for obligated parties and create greater competition in the market, lowering the cost of compliance with the Clean Heat Standard. It should also make it easier for businesses selling clean heat products and services – e.g., HVAC contractors selling heat pumps, vendors of pellet stoves, and weatherization contractors – to find markets and the best prices for the credits they could generate.

H. Interaction with Electric Utilities' Tier 3 Requirements

Recommendation

Vermont electric utilities' RPS Tier 3 requirements should remain in place, and the CHS and Tier 3 programs should be administered to be mutually supportive.

Discussion

Electric Utility RPS Tier 3 Requirements Would Remain.
Vermont's Electric Utility RPS Tier 3 requirements to reduce customers' consumption of fossil fuels is an innovative, landmark policy. It has clearly launched the state down a path to reducing GHG emissions from the thermal sector (most Tier 3 emission reductions are coming from the thermal sector, primarily from heat pumps displacing fossil fuel heat). Now in its fifth year, implementation of the policy is running smoothly, with even faster progress in reducing emissions than initially planned.[34] Based on both results to date and the annual goals set in statute, we estimate that Tier 3 requirements will ultimately achieve about 7% of the needed annual thermal sector emission reductions by 2030. That represents a significant "down payment" on the 40% reductions by 2030 required by the 2020 Vermont Global Warming Solutions Act.

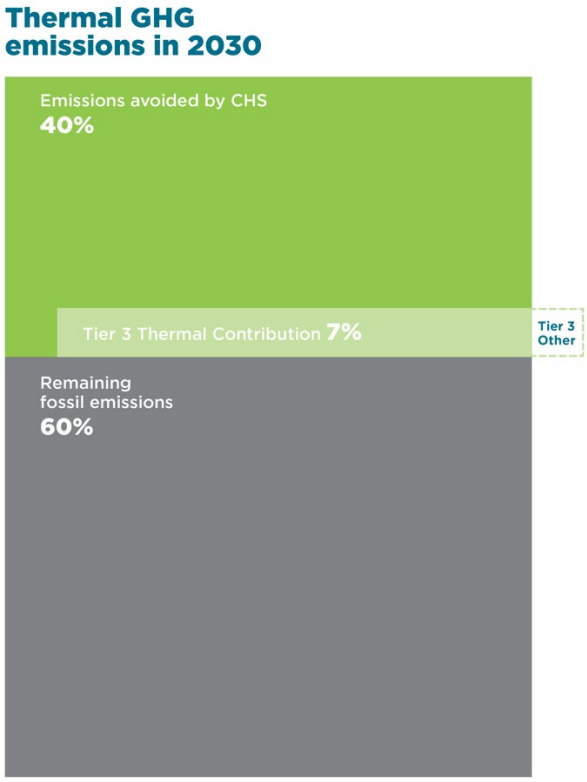
While the state could conceivably meet the thermal sector portion of the GWSA's 2030 emissions reduction goal by increasing the magnitude of the Tier 3 requirements by a factor of five or six, we believe a Clean Heat Standard that imposes an emission reduction obligation on suppliers of fossil fuels makes more sense than an expanded obligation on electric utilities, especially to avoid putting any further upward price pressure on our cleanest "fuel": electricity. On the other end of the spectrum, the *Clean Heat Standard* could be designed to achieve the ***total*** emissions reduction required to meet the thermal and industrial sector contributions to State GHG emission reduction goals, without any contribution from Tier 3 projects. However, we believe that there are significant advantages to keeping the electric RPS Tier 3 requirements in place – in concert with the Clean Heat Standard. The policy appears to be working very well, with the state's electric utilities having developed an effective program infrastructure for delivering and documenting reductions in fossil fuel consumption. It would be better to build on that infrastructure than to tear it down and start the CHS from "ground zero". In addition, requiring both electricity providers and fossil providers to deliver fossil fuel emission reductions adds diversity to the mix of clean heat providers.

The existing Tier 3 program and the new CHS could work together quite well. As shown in Figure 11 below, Tier 3 savings could count towards a utility's Tier 3 obligations, and also be credited as a part of the overall CHS reduction requirements. In this case, electric utilities could sell credits earned through thermal projects to fossil fuel providers who need them to meet their CHS obligations. Other arrangements are possible, and are discussed in Appendix 2. In general, we find that Vermont's existing

[34] Green Mountain Power, which accounts for about three-quarters of the state's electricity sales, achieved about twice as much fossil fuel reduction as required by statute in 2020 (Green Mountain Power, *Cutting Carbon: RES Tier III Savings Report, 2020 Plan Year*, March 15, 2021.

Tier 3 requirements and a broader Clean Heat Standard could work together quite well, and would lower costs and increase diversity in the delivery of clean heat solutions.[35]

Figure 11: Tier 3 & CHS Interaction



I. Ensuring Compliance: Default Delivery Agent, Non-Compliance Payments

Recommendations

1. **The PUC should appoint a statewide default delivery agent hired through a competitive solicitation for a multi-year period.**
2. **Obligated parties that fail to acquire the number of credits required in a given year should have to make a non-compliance payment, set to exceed the estimated cost of delivering clean heat credits.**
3. **Non-compliance payments should be given to the default delivery agent to acquire emission reductions that make up for the shortfalls that precipitated the payments.** Special consideration should be given to disproportionately applying such payments to delivering clean heat solutions to low-income customers.

[35] We recommend that the same principle apply to other existing programs that are reducing emissions. For example, efficiency investments made by the state's low income weatherization assistance program, by Efficiency Vermont, and by Vermont Gas would all be creditable.

4. **The Vermont Department of Public Service (PSD) should be responsible for both leading annual efforts to verify compliance and sponsoring studies/evaluations of actual field performance of clean heat measures.**

Discussion[36]

Default Delivery Agent. To ensure attainment of clean heat goals, the PUC should appoint a Default Delivery Agent, which would be directed and funded to deliver creditable clean heat solutions to Vermont homes and businesses if either (A) an obligated party chooses to assign its obligation to the default provider; and/or (B) any obligated entities that chose to retain their obligation fail to produce or acquire the number of clean heat credits they were obligated to produce or acquire in any given year. The default delivery agent should be hired through a competitive procurement process run by the PUC (as was done in the past for the Efficiency Vermont contract).

Non-compliance payments. As with any regulation, in order to ensure that emission reductions are actually achieved there would need to be a penalty for obligated parties that fail to meet their obligation. We call that a non-compliance payment. To provide a sufficient inducement for obligated parties to meet their emission reduction obligations on time, the magnitude of the non-compliance payment should be significantly greater than the cost of acquiring clean heat credits would have been.

Non-compliance payments should be provided to the default delivery agent and used to acquire additional emission reduction credits within two years of when the payments are received. The generation of such additional credits will offset the previous year's credit shortfall that precipitated the non-compliance payment.

Consideration should be given to requiring additional credits acquired with non-compliance payments solely or disproportionately from low income customers. This is one potential mechanism for addressing equity concerns.

PSD Role in Annual Verification Process. The PSD should be charged with annually assessing compliance with CHS requirements for each obligated party. The PSD should publish a draft annual report on its compliance assessment, with opportunities for obligated parties and others to provide comment. There should also be an informal opportunity for the parties to attempt to reach consensus on issues raised. Ultimately, whether or not consensus is achieved, the PSD should file its final report with the PUC. If there is still disagreement on the final report, the PUC can adjudicate such disagreements. The PSD should also be charged with responsibility for sponsoring studies or evaluations of actual performance of clean heat measures in the field. Such studies would be used to inform TAG updates to deemed credit values for different CHS measures. The PSD currently plays both of these roles – annual compliance assessments and sponsoring of evaluation studies – for both Vermont's efficiency utilities and its electric utility Tier 3 programs.

[36] Additional discussion of default delivery agent and non-compliance payments can be found in Appendix 2.

J. Banking of Credits

Recommendation

1. **Obligated parties that acquire more CHS credits than required for any given year can "bank" the excess credits for application to future year obligations.**

Rationale and Discussion

Obligated parties may acquire more clean heat credits than they need to meet their obligation for a given year. Indeed, some amount of "over-shooting" is highly likely to occur in many years if obligated parties see the cost of modest over-compliance to be lower than the cost of falling short of their obligations and having to make a non-compliance payment (see discussion of non-compliance payments). Allowing any such excess credits to be applied to a future year's obligation will lower the cost of meeting the state's emission reduction goals. It will also likely enhance the likelihood of meeting annual goals by lowering the cost of over-compliance (since, from the perspective of the obligated parties, the credits from over-compliance are still useful and not "wasted"). Regulators will need to establish a system for tracking banked credits, but that should be relatively easy to implement.

K. Fuel Dealer and Workforce Assistance

Recommendations

1. **The CHS should be designed and implemented to provide new business development opportunities for those seeking to develop clean heat businesses, including current Vermont fuel dealers**. Technical assistance, start-up loans and open solicitations, together with customer incentives, can open the door to a range of clean heat enterprises. These programs should include supporting Vermont fuel dealers who want to expand their businesses to install clean heat measures.
2. **The CHS should be designed and implemented to provide** transition assistance, where needed, to employees of fossil energy companies, and to provide job training, job enhancement, and high-quality certification opportunities to workers in clean energy enterprises.

Discussion

Business development opportunities. As noted above, one of the reasons to choose the Clean Heat Standard (and a Clean Heat credit system) as a principal climate policy in the thermal sector is that it provides a very direct opportunity for Vermont's existing fuel dealers to transform their businesses from ones that focus largely on fossil fuel sales to ones with a forward focus on installing and servicing clean heating technologies. Such businesses and their trained employees will potentially be needed to deliver and service over 250,000 clean heating installations in Vermont. Of course, those opportunities will extend to any enterprise, whether inside or outside of Vermont, who can deliver clean heat solutions on a competitive basis.

A substantial portion of fuel dealers' business transition costs and employee training costs will likely be recoverable through the new services they will provide, and through payments from

obligated wholesalers for the Clean Heat Credits that Vermont heating providers will earn. But additional public funding should also be provided for both purposes.

Training the Clean Energy Workforce. Vermont's clean energy transition – which will include building retrofits, distributed renewable energy, implementing the Clean Heat Standard, and more – will create a large number of job opportunities. One goal of the Clean Heat Standard is to add jobs in Vermont in place of the funds we export to purchase fossil fuels. One advantage of the CHS, compared to government-budgeted programs, is that the CHS can deliver a steadily increasing demand for clean energy services, which allows employers and employees alike to expect the new jobs to be career jobs, not short-term project jobs. But the transition will not be done well unless the work force is well trained and properly qualified. We propose a concerted effort across agencies and training programs to launch such programs and recruit the clean energy workforce.

We can envision a number of sources of funding for these purposes, but our Working Group is not the best forum for figuring this out. The legislature has commissioned work on the workforce challenge, and others are working on it as well. We recognize that delivering on the promise of the Clean Heat Standard will support a significant number of clean energy jobs and will require a package of financial supports and training programs.

IV. Summary of Design Recommendations

The following table summarizes the key CHS design parameters discussed above and in more detail in Appendix 2.

Design Element	Proposal Summary
Obligated Party	• VGS and wholesale distributors of fuel oil, propane, kerosene, and other fossil fuels delivered to buildings and/or industry in Vermont
Nature of Obligation	• "Credit system" in which obligated entities are required to have produced or acquired a certain number of CHS credits each year. • Credits to be expressed in CO_2e. • Credits based on magnitude of emission reductions at Vermont homes and businesses. At this time, they will not account for related upstream emissions associated with the production or delivery of fossil fuels to those sites, per current VT GHG Inventory protocol. However, biofuel measures will be assessed on a lifecycle GHG emissions basis. • Attribution is not required. Obligated parties must simply demonstrate that an emission reduction has been achieved and that it owns the rights to that reduction. It does not need to demonstrate that it caused the reduction to occur. This is analogous to the electric RPS (attribution for causing a PV panel to be installed is not required).
Size of Annual Obligation	• PUC to establish growing annual obligations of sufficient magnitude to achieve the thermal and industrial sectors' portion of Vermont's GHG emission reduction goals (i.e., 15% reductions by 2025 and 40% reductions by 2030 – relative to 2018 levels) • PUC to periodically adjust future obligation levels as necessary to ensure achievement with state emission reduction goals and/or to address unanticipated market challenges.

Eligible Measures	• Only measures that directly reduce combustion of fossil fuels in Vermont homes and businesses are eligible for CHS credits. This includes:
	  ○ Electrification (e.g., heat pumps, heat pump water heaters)
	  ○ Advanced wood heat (e.g., wood pellet stoves)

	○ Biofuels (e.g., renewable gas, biodiesel) ○ District heating with low-carbon fuels ○ Energy efficiency ○ Hydrogen (if production process is less CO2e-intensive than displaced fossil fuels, on a lifecycle basis) • No credits provided for "offsets" (e.g., tree planting) or for reductions in VGS distribution system losses. • For biofuels to count, they must be "delivered" to Vermont homes and/or businesses. For fuels displacing fuel oil and propane, this means delivery directly to a Vermont customer. For biogas, it means a "bundled" product where Vermont Gas both owns the biogas and its attributes, and has secured a contractual pathway for physical delivery to the VGS system. This is analogous to the Vermont electric RPS.
Credit Values for Eligible Measures	• Deemed annual values and number of years earned to be established by formal Technical Advisory Group, analogous to current TAG for Efficiency Vermont and current electric utility Tier 3. • Magnitude of credits for biofuels based on "but for" principle – what emissions would have occurred absent use of biofuel to displace fossil fuel combustion. That would require consideration of regulations (including regulations of GHG emissions) applicable to agricultural, forestry and other relevant sectors. • Credits to be "time stamped" – i.e., assigned to specific years. ○ For renewable fuels, they are assigned to the year they are sold/consumed by end use customers. ○ For fuel-switch and efficiency measures, credits assigned to each year of expected measure life, with gradual adjustments as appropriate to account for likely future interactions with other clean heat measures (as determined by TAG) • TAG assumptions to be annually updated, with such updates formally approved – or approved with modifications – by the PUC. • Once approved, TAG assumptions will be "locked" for the duration of the following year. Any credits earned that year will not be changed based on new information that may surface in the future. • Values for custom projects not addressed by TAG process to be estimated by obligated entities on a custom basis.
Banking of Credits	• Obligated parties that acquire more credits than they need to meet their obligation in a given year may bank credits and apply them to future year obligations.
Options for Acquiring Credits	• Obligated parties have flexibility on a range of transactions for acquiring credits: ○ Generating credits themselves (selling renewable fuel, installing heat pumps, etc.); ○ Contracting with other parties to produce credits; ○ Buying credits on the open market; or ○ Assign their obligation to a "default delivery agent" along with payments – set by the PUC – necessary for the "default delivery agent" to acquire the credits necessary to meet the obligation. • Obligated parties have flexibility to acquire credits from any customer in the state – not just those customers to whom they currently sell fuel.
Default CHS Delivery Agent	• There should be a single statewide default delivery agent hired for a multi-year period. • The default delivery agent should be hired through a competitive solicitation run by the PUC.
Non-Compliance Payment (NCP)	• Obligated parties who fall short of credit requirements in any year must pay an NCP. • Magnitude of NCP to be established by PUC, and should be substantially higher than the cost of assigning an obligation to the default delivery agent. • NCP is given to Default Delivery Agent to acquire credits to make up for the shortfalls that precipitated the NCP. Consideration should be given to disproportionately applying such payments to the acquisition of credits from low income customers.

Interaction with Electric Tier 3 requirements	• Electric Tier 3 requirements would remain in place. • Emission reductions achieved by electric Tier 3 efforts could also count towards CHS goals – and vice versa. • Electric utilities would be able to sell such credits to CHS obligated parties – and vice versa.
Verification & Evaluation	• Verification of compliance would be performed annually by the Department of Public Service (PSD). • The PUC should annually certify compliance or non-compliance, leveraging the PSD review but also considering other evidence and perspectives put forward by other parties. • The PSD should also sponsor evaluation studies of actual field performance of CHS measures to support regular updating of assumptions through TAG process. • A small surcharge applied to all gas and delivered fuels should be established to pay for PSD verification/evaluation costs.
Fuel Dealer and Employee Transition Assistance	• Training and other business development support to be offered for fuel dealers interested in broadening businesses – e.g., selling & servicing heat pumps, selling wood/pellet stoves/boilers, weatherization, etc. • Positive policies to support new Clean Heat entrants and their employees

Social Equity	• Need to include policies to minimize adverse effects on low income customers and potentially other customer segments for which there may be equity concerns.
	• Option within CHS design:
	  ○ Fuel-switching "carve outs" – e.g., must support at least one low-income heat pump, pellet stove for every 2 non-low income installations/jobs. Maybe even a higher ratio in the early years – to serve low income customers disproportionately early.
	  ○ Substantial low-income weatherization requirements (or carve out), especially in early years
	• Other complementary state policies
	  ○ VGS rate designs for low-income customers
	  ○ Enhanced/increased state low-income fuel cost assistance
	  ○ Statewide minimum efficiency requirements for rental properties
	  ○ Fee-bate for heating equipment (lowering incremental cost of low GHG options)
	  ○ Broadening the range of measures the state low-income Wx program promotes (not just Wx, but also renewables, heat pumps, etc.)

Clean Heat Standard -- Appendices

Appendix 1. Policy Choices for Clean Heat – Why We Recommend a Clean Heat Performance Standard

A Clean Heat Standard is by no means the only policy option available to reduce thermal consumption and GHG emissions. We have considered several other options including, among others: carbon pricing, thermal energy efficiency programs, building codes, and heating equipment appliance standards. All of these approaches have some merit, and any or all of them could be adopted to work in tandem with a Clean Heat Standard. To the degree that any of these parallel strategies lowers demand for fossil heat, or lowers the cost of delivering clean heat solutions, they only make it easier to deliver cleaner fuels and heating conversions, speeding up the transition to clean heat in Vermont.

However, we conclude that none of these other options is likely to succeed on its own, and none would be as singularly effective as a Clean Heat Standard in delivering tangible progress. Reasons for this conclusion are set out below.

Why carbon pricing alone will not do enough

While many analysts have suggested that putting a price on carbon could be the driver for clean heat, there is strong evidence that pricing carbon, by itself, would not drive down fossil heat emissions meaningfully unless it were set at unrealistically high rates. Looking at consumption data over many decades, economists conclude that demand for heating fuels is strongly inelastic – that is, consumption changes very little in relation to the price of fuel. In a study for the legislature in 2019, following extensive economic modeling, *Resources for the Future found that even if carbon prices were set as high as $100 per ton, the achieved reduction in carbon emissions statewide would be only about 10% below the expected business as usual case.* RFF concluded:

> "Our results indicate that both the environmental and economic impacts of carbon pricing policies alone are likely to be relatively small….Due to the concentration of Vermont's emissions in transportation and heating, moderate pricing alone is unlikely to produce the large reductions in GHG emissions that would be needed to meet Vermont's emissions targets. Historically, transportation and heating fuel uses are relatively insensitive to changes in fuel prices and therefore we project relatively small emissions reductions in these sectors."[37]

Vermonters know the truth of this conclusion from our own experience, having lived through very large swings in the prices of fossil fuels in recent years, with very little impact on overall fossil fuel demand.

Why thermal efficiency programs can't do enough

Vermont has long been a leader in promoting energy efficiency, including building weatherization. These programs are essential, and should be dramatically expanded. Specifically, "Weatherization at Scale", an initiative being developed in concert with the Clean Heat Standard, should be implemented alongside

[37] Resources for the Future, "Analysis of Decarbonization Methods in Vermont" (2019) Executive Summary at p.2. While carbon prices alone are a weak tool to drive emission reductions in the thermal sector, carbon pricing (either via a carbon tax or a cap-and-trade program) can accelerate emission reductions if carbon revenues are devoted strategically in ways that help end users to save energy and convert to cleaner fuels. See section IV(1)(A) below.

this Clean Heat proposal. Thermal efficiency and clean heat work together like two blades of a pair of scissors to cut fossil heat pollution.

However, as a very practical matter, thermal efficiency does not eliminate the need for a clean heat program. Weatherization experts agree that thermal retrofits – even so-called "deep retrofits" – can be counted on to reduce the heat load of Vermont buildings often in the range of just 20 to 30%. The large majority of the heat load in most buildings will still need to be met through thermal inputs of some kind. To meet our climate goals, those inputs will need to come from low-emission sources—those that would be promoted by a Clean Heat Standard.

Why building codes will not do enough

Every building built today is likely to be in operation for 75 to 100 years. It is possible to build new structures to a very high standards delivering near-zero or net-zero emissions. There are important reasons to improve building codes in Vermont so that new buildings are much more efficient, healthier, and less polluting that historic buildings have been. But building codes could not come close to addressing the climate challenge posed by the existing building stock. Vermont has among the oldest building stock in the nation, and the replacement rate in that stock is less than one percent per year. The rate of new additions is also low, in recent years less than 2/10ths of 1% per year. The vast majority of the buildings that will be in service in 2050 are already built and not likely to be replaced any time soon.[38]

Why equipment standards are not enough

In contrast to the building stock, the heating equipment in buildings tends to have much shorter life-spans. The life of an average oil furnace in Vermont is 20-25 years, for example. Unfortunately, most heating appliances, including hot water heaters, are replaced on an emergency basis when they fail. As a result, owners rarely have the time or inclination to switch to an entirely new system, even one that would be less polluting and less expensive to run in the long term. For these reasons, many experts have advocated for raising the minimum performance standards for heating appliances so that the choices available at the time of sale are altogether more efficient.

However efficient new heating appliance standards might be, it is not likely in the near term (i.e. before 2025) that Vermont would enact an equipment standard that would ban the sale of new fossil heating equipment altogether – for example, to forbid a building owner from replacing a failed oil furnace with a like-kind unit. Partly, this is because fuel oil equipment can be run on B100 biodiesel and natural gas equipment can be run on increasing shares of renewable natural gas.[39] In addition, in order to accommodate some electric heat pumps, changes to distribution systems (pipes or ducts) to which they would need to be connected[40] can create challenges to addressing immediate needs for heat under emergency replacement conditions. Some homes may also require modifications to existing electrical

[38] VHFA, Vermont Housing Needs Assessment (February 2020). For this reason, reducing heat from buildings is even more difficult than reducing emissions from vehicles. The vehicle fleet turns over much more quickly than the housing stock, and vehicle emissions can be addressed by a few manufacturers, not hundreds of thousands of individual homeowners.

[39] The same is not true for propane, for which there is not currently available a no- or low-carbon fuel alternative (which means propane equipment may need to be a particular focus of equipment standards).

[40] Most furnaces and gas boilers are connected to networks of pipes or ducts that last much longer and are more complicated and more expensive to re-engineer when a heating system is changed. Depending on both existing heating system designs and which new clean heat technology is being considered, such changes may or may not be needed.

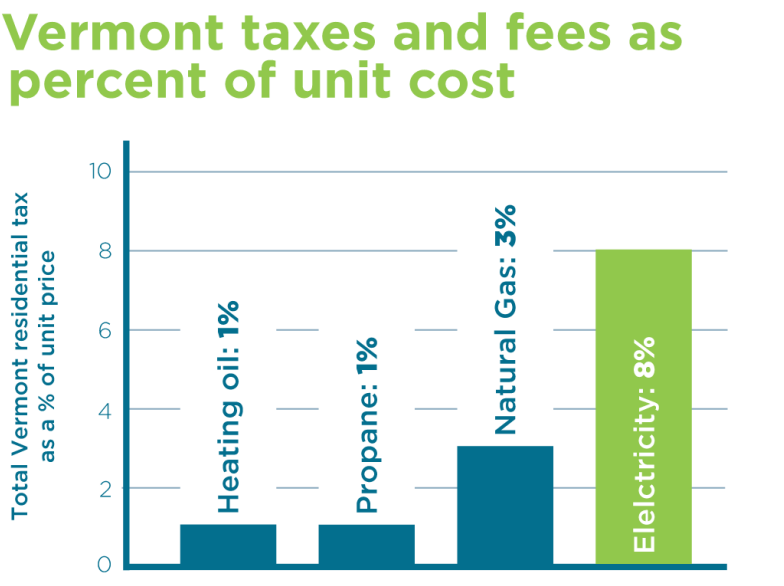
systems in order to use heat pumps, which can also create timing challenges in the context of emergency replacements. Even if equipment standards could forbid sales of new fossil fuel dependent heating equipment going forward, it would be better to avoid the small crises that occur when units fail. It would be preferable to enlist the expertise of furnace technicians to warn customers that their unit will soon be at the end of its life and to offer advice on how to install a clean heat alternative proactively, rather than just waiting until the unit fails. A Clean Heat Standard would create and support this proactive approach.

Why simply expanding Tier 3 is not the best answer

Vermont is among a handful of states that have gotten a start on thermal efficiency and clean heat installations by extending utility energy efficiency or renewable energy programs. Vermont electric utilities are obliged to deliver fossil energy reductions through an added requirement, called Tier 3, to the Renewable Energy Standard. Under the Tier 3 program, electric utilities have delivered thermal efficiency, heat pumps, and advanced wood heat installations, and a variety of other fossil avoidance solutions including electric vehicle measures and less carbon-intensive industrial equipment. Creative solutions have included line extensions to deliver power to displace fossil fuels in such facilities as sawmills, gravel pits, and sugar houses.

Based on the statutory schedule of increasing targets and the mix of strategies and measures recently deployed by Green Mountain Power to meet its 2020 obligation, we estimate that Tier 3 will result in approximately a 7% reduction in Vermont's thermal sector emissions by 2030. While much more will obviously be needed, that represents an important and good start towards achieving the 40% reduction that the state needs by 2030. Based on the electric utility experience to date, one possible approach to clean heat in Vermont might be "just make the electric utilities do it." Put simply, the state could just increase the magnitude of the Tier 3 requirements by a factor of five or six. We do not believe this is the best answer, for three reasons.

First, electric utilities and electric rates are already bearing most of the cost of addressing climate change in energy in Vermont. Electric rates have supported renewables additions, grid upgrades, and electric efficiency programs. Carbon costs are also reflected to some degree in power costs through the Regional Greenhouse Gas Initiative. In contrast, aside from VGS, fossil heat companies pay very little for energy efficiency; they face no renewables mandates; and have no carbon reduction requirements. As a result, progress has been very slow in the thermal sector, and we have created a situation in which the cleanest energy source (electricity) is paying extra costs to



Source: Vermont Department of Public Service, 2019; Vermont Fuel

ENERGY ACTION NETWORK

Appendix Figure 1. Vermont taxes and fees as a percent of heating fuels costs

address climate change, while the higher-emitting fossil fuels are paying very little. (See Appendix Figure 1)

The resulting price distortion is sending the wrong price signals to consumers and making it that much harder to clean up our energy mix. Putting a clean heat obligation on fossil providers is appropriate on the merits and it also helps to rebalance the scales with respect to sharing the costs of the energy transition.

Second, a diversity of approaches is important to success in the needed transition. We can expect that fuel dealers, electric companies, and a pipeline gas company will take different approaches to the solutions offered to customers and how they will be marketed. We don't know in advance, but it's likely that electric utilities will favor heat pumps, while fuel dealers may favor biofuels and delivery of wood pellets, and VGS might focus its efforts on renewable methane and district heating. In the short run, Vermont may need all of these solutions to meet our climate goals and in the long run we may need them to navigate and manage power peaks and outages, renewable gas price hikes, or other supply disruptions. Choice is also important to consumers due to personal preferences and the nature of the building stock.

Third, as noted above, the thermal transition requires a workforce of customer-facing installers and experts who can help customers to change over heating systems to low-emitting equipment. Vermont's fuel dealers have those relationships and have the opportunity to build on them to evolve new business models for their companies. Simply mandating a huge expansion of the electric utility Tier 3 program would not give these companies the incentive to retarget their businesses for the future.

Appendix 2. Additional Discussion of Key Design Recommendations

Section A: Nature of the Obligation

1. Clean Heat Credits

As noted in the body of this paper, designing a market-based program to ensure specific levels of reductions in fossil emissions in Vermont begins with a choice between two systems: (a) a system that requires fossil providers to earn *credits for positive actions* (e.g., selling renewable fuels or installing heat pumps) or (b) one that *reduces emissions under a declining cap* and distributes those emission allowances among fuel sellers by auction or some other means. The credit-based system is more akin to the systems Vermont has used for Renewable Portfolio Standards and Efficiency Obligations. The cap-and-allowance system is more akin to the method used in the Regional Greenhouse Gas Initiative and in the proposed Transportation Climate Initiative. The characteristics of these choices are set out in the chart below. Note that modifications are possible and hybrid solutions can be also designed.

Program Elements and Functions	Credit System – requires addition of clean heat	Cap and Allowance System – requires reductions in fossil heat
Standard	Specified level of GHG emissions avoided by qualified actions	Specified level of remaining GHG emissions (i.e., a cap)
Mechanism	• Relies on performance obligation to drive change • Credits are earned representing GHG emissions avoided.	• Relies on allowance prices to drive change • Permits (allowances) to emit GHGs (the right to pollute) • Allowances can be either auctioned off or allocated/assigned for free
Governance	• Targets set by the legislature • Obligated parties responsible for acquiring sufficient emission reduction credits. • Oversight of compliance by PUC/PSD and ANR	• Cap set by the legislature • Obligated parties must have allowances to cover their emissions or sales. • PUC/PSD/ANR to manage any auction of allowances and use of revenue from auction. • Oversight of compliance by PUC/PSD and ANR
Emission reduction measures	The range of emission reduction measures for which credits are assigned can be established at a high level through statute and refined through a technical process overseen by regulators.	Because achievement of the obligation is determined by actual remaining emission levels, there is no need to specify which measures can be used.
Credit values of different clean heat measures	• A technical process, involving relevant stakeholders, establishes the number of annual emission reduction "credits" assigned to types of measures, the number of years for which they are assigned, and any degradation of credit values over time. • Credit values for common measures are deemed averages that are regularly	• For most measures there is no need to assign emission reduction values because compliance with obligation is based on the actual amount of remaining emissions. • One exception is for biofuels and/or any other emissions offsets that are allowed. For such measures a technical process and regulatory approval is still required to assign

	updated based on technical data and on-going evaluation. • Process and methods for determining savings from larger, unique projects would be established. • The PUC approves (and resolves any disputes) over measure values.	emission reduction values (e.g., combustion of renewable methane produces as much direct CO2 emissions as combustion of fossil methane – the difference is that emissions from renewable methane are assumed to be at least partly offset by other reductions in greenhouse gas emissions).
Delivery of Emission Reductions	• Obligated parties can either run programs to acquire credits themselves, contract such programs to other entities, or buy credits from other entities. System can also include option to assign obligation to a "default provider" (along with funds necessary for that provider to acquire reductions).	• Obligated parties can simply reduce sales, or could pay to purchase emission allowances. • Obligated parties could diversify and run programs to reduce emissions, but are not obliged to do so. • If allowances are auctioned, revenues from auction can be invested by the state in programs to reduce emissions. Some measures could have value beyond GHG reductions (e.g., weatherization of homes).
Role of the Market	• Vendors, contractors or other entities that produce or install any measure for which credits can be assigned can sell the GHG reduction attributes of their products or services.	• Market price of allowances is the main driver of change • Obligated entities have some incentive to support markets for products and services that reduce emissions and allowance prices. However, such products and services do not have any saleable market value.
Determination of Compliance	• Obligated entities must demonstrate they have acquired enough credits. • As long as obligated entities have legitimately acquired credits that are properly valued, they are in compliance. • Regulatory oversight to ensure credits are legitimate and properly valued.	• Obligated parties must demonstrate that their actual emissions were no greater than the number of emission allowances they own. • Obligated parties bear risk of non-compliance if they deliver more fuel than their owned allowances permit. • Regulatory process to confirm compliance.
Addressing Equity Concerns	• Can create "carve out" for low income customers – e.g., minimum percent of weatherization or fuel-switching measures required to be for low income households. • Other complementary policies – gas rate design, rental efficiency requirements, bill payment support, etc. – could also be used.	• Relying on higher fuel prices to drive change will raise heat costs for everyone. • Requires complementary policies – gas rate design, low income weatherization increases, rental efficiency requirements, bill payment support, etc.

Each of these approaches has pros and cons. One advantage of the credit system is that it creates a commercial value for each heat pump, wood pellet stove, home weatherization job, gallon of biofuel and other measures. That, in turn, could help fuel dealers, contractors, farmers and others to transition their businesses to selling such products and services. Another advantage of the credit system is that it reduces uncertainty for the obligated parties (Vermont Gas and the suppliers of delivered fuels) regarding what they need to do each year to meet their obligations. Each entity knows at the beginning of each year how many total credits they need to acquire and how much each type of common emission reduction measure is worth. In contrast, under the allowance system, where fossil heat suppliers commit to provide their customers with uninterrupted supplies through the heating season, they may not know what their total sales will be until the end of the year. If demand is greater than expected because of colder weather, increased economic activity or other reasons, their plans for acquiring allowances or reducing emissions may be inadequate.

On the other hand, the cap-and-allowance system provides greater certainty that the state's desired emission reductions will be achieved. Because of on-going evaluation and recalibration of emission reduction values assigned to different measures via the pre-existing technical resource manuals produced for efficiency measures and Tier 3 fossil fuel reduction measures, the difference between state goals and emission reductions achieved under a credit system is likely to be small. However, there may still be some difference. Another related advantage of the allowance system is that it may be administratively simpler to implement – primarily because it eliminates the need for a process to assign values to some emission reduction measures. However, that may be only a small advantage. There will still be a need for a value determination process for biofuels. Also, while there is no need to assign a value to heat pumps, wood pellet stoves, weatherization of homes, and other measures, there will still likely be a need to analyze the magnitude of emission reductions such measures provide so that obligated parties can effectively plan to for how they will reduce emissions enough to stay within their allowance limits.

The main advantage of a credit system over an allowance system is that it focuses on the delivery of concrete, delivered clean solutions rather than on allowance limitations and pricing as a tool to drive down consumption of fossil fuels. A carbon cap on heating fuels is intended to incentivize change through higher prices on fossil heat, which is an ineffective way to drive change in the buildings sector. The credit system, on the other hand, aims to assist customers to improve buildings and heating systems by measuring clean heat additions. In addition, a key goal of the CHS is to stimulate Vermont-based suppliers to deliver clean heat solutions to Vermont customers. This connection is stronger in a credit-based system.

On the whole, we conclude that advantages of the credit system – direct consumer benefits, greater support to Vermont businesses to sell clean heat products and services, and the greater planning certainty for obligated parties – outweigh the greater emissions certainty offered by the cap-and-allowance system. While a legitimate argument could be made for either approach, we conclude that the credit-based Clean Heat approach is preferable.

2. Credits Expressed in CO2e

The direct GHG emissions from Vermont's thermal sector are primarily in the form of carbon dioxide (CO2). However, if biofuels are to be an allowable measure for reducing emissions, one needs to account for the entire lifecycle impacts of all greenhouse gas emissions associated with their production, distribution, and combustion. For example, the direct CO2 emissions from burning a million BTUs of methane are the same regardless of whether the methane is a fossil fuel or was captured from a dairy farm. The latter is better for the global climate because the CO2 emissions from its combustion are offset by a reduction in methane emissions that would otherwise result from just letting cow manure biodegrade. Accounting for such biofuel tradeoffs requires expressing credits in terms of carbon dioxide equivalents (CO2e).

3. Credits Expressed in Terms of On-Site Emission Reductions

The current Vermont Greenhouse Gas Emissions Inventory measures emissions at the point of combustion of fossil fuels. That is the simplest way to measure both baseline emissions and future emission reductions and is consistent with the practice of other states and countries.

But what about upstream emissions associated with existing consumption? Note that a ton of CO2 emission reduction from a gas furnace or boiler can be presumed to come with some "upstream" emission reductions (e.g., a reduction in emission leaks in the Vermont Gas distribution system and fugitive methane emissions from fracking and/or other methods used to produce natural gas). This is the case even if we are not "counting" such upstream GHG reductions. Put another way, a requirement to reduce CO2 emissions from combustion of fossil methane by 40% will also produce a 40% reduction in lifecycle CO2e emissions associated with fossil methane combustion. The same is true for all other fossil fuels for which there are also GHG emissions associated with production and delivery to homes and businesses. Thus, as long as both the *baseline emissions* from which reduction goals are measured and the *credits for reductions* are measured the same way, the total GHG reductions for any single type of fossil fuel will be the same whether goals and credits are expressed solely in terms of on-site emission reductions or lifecycle emission reductions.

The only potentially adverse effect of basing emission reduction goals and clean heat credits solely on on-site emissions is that differences between different types of fossil fuels in ratios of lifecycle to on-site emissions are not addressed. For example, if the CO2e emissions from a million BTUs from fossil fuel "X" were 10% less than for fossil fuel "Y" at the point of combustion but 20% more when considering full lifecycle emissions, a market based system for clean heat credits that is based on on-site emissions will place greater value on reductions of fossil fuel Y when the reductions from fossil fuel X would be more valuable from a lifecycle basis. However, we would expect most obligated parties to focus primarily on emission reductions associated with their own fuels, so the potential adverse effect of not accounting for differences in the ratio of lifecycle to on-site emissions for fossil fuels is likely to be small and offset by the benefit of simplicity.

4. Attribution Not Required

The Vermont GWSA requires specific levels of emission reduction by 2025, 2030 and 2050. A Clean Heat Standard is simply a policy tool for ensuring that those reductions are achieved in Vermont's thermal sector. Thus, what matters is whether emissions actually go down and the correct number of clean heat credits have been generated. It does not matter who generates those credits or why they were generated. If many of the credits would have been generated through natural evolution of the market (e.g., customers buying heat pumps or weatherizing homes on their own, without any programmatic inducement), that would simply mean that the level of effort required by obligated parties to acquire the right number of credits – and cost they would need to incur to do so – will be lower than if natural market forces would not produce much change on their own.

This is akin to how Vermont's current electric RES works. Electric utilities must simply show that a certain percent of their electric portfolio each year is from wind, solar, and other renewable energy sources. It does not matter whether a customer would have put photovoltaic panels on their roof without a utility program or whether a wind turbine would have been built without any utility support. As long as the utility acquires the renewable attributes of such resources, they can use them to demonstrate compliance with their RES obligation.

In contrast, some programs do require obligated parties to prove that *their actions caused* the savings to occur. Vermont's energy efficiency goals and Tier 3 fossil fuel reduction goals require "attribution" – that is, only investments in efficiency or fossil fuel reductions *that were caused by programs run by the obligated parties* count towards the obligation. That is because the state's efficiency and Tier 3 goals were created to deliver savings beyond the levels that would have occurred naturally, rather than with

statewide, bottom-line end points in mind. For example, Efficiency Vermont has been expected to improve the efficiency of electricity use in the state by about 2% per year relative to what it otherwise would have been. Conceptually, the state could have established an objective end it was trying to achieve – e.g., as a 20% absolute reduction in total electricity consumption by a date certain. If energy savings goals had been set that way, attribution would not be required because we would be assessing performance relative to that ultimate outcome. However, energy savings goals have not been set that way, largely because of uncertainty over how factors outside the control of Efficiency Vermont (e.g., economic growth, emergence of new energy consuming technology) could affect its ability to manage to such a goal. Instead, incremental annual goals are periodically established based on estimates of progress that can be cost-effectively achieved in the near term.[41]

The situation with GHG emission reductions – and the role of the Clean Heat Standard in driving reductions in the thermal sector – is fundamentally different. We know that the state – indeed, the world – needs to eliminate or largely eliminate GHG emissions by 2050 to stabilize the global climate. And Vermont's policy-makers have specified levels of progress towards that ultimate goal that need to be achieved by 2025 and 2030. That needs to happen regardless of levels of economic growth, demand for new energy consuming equipment, or any other factors that could affect energy consumption and emissions. In this context – where there are clearly defined ultimate outcomes that need to be achieved – attribution is not necessary. This approach ensures compliance with state policy goals and eliminates any need for complex studies (with results that are always at least somewhat uncertain) of who was responsible for a certain investment.

Section E: Eligible Measures – Additional Note on Biofuels

The requirement for VGS to acquire transmission capacity for physical delivery will provide an incremental incentive for biogas production that is in or relatively close to Vermont – as long as it is near to a gas pipeline that is connected to Vermont. Unbundled biogas – i.e., biogas produced and used in another state but for which VGS does not own transmission capacity necessary to bring it to Vermont – would not count as an eligible measure, even if VGS were to purchase its environmental attributes. That should change only if and when Vermont establishes a bilateral or multi-lateral relationship with another state or states with regards to trading of emissions credits.

Note that all biofuel purchases must be exclusively declared and retired in Vermont to avoid double-counting of their emission reduction attributes. Obligated parties retiring biofuel credits in Vermont should be required to register them in a broader registry if/when there is an appropriate mechanism for doing so. In the interim, they should at least attest that they are the sole and exclusive owner of all attributes of the fuel and that all such attributes are being retired.

Section F: Notes on Credit Values for Eligible Measures

7. **Technical Advisory Group (TAG)**

[41] In the case of Tier 3, the state was also just trying to make progress in reducing fossil fuel consumption rather than using Tier 3 to achieve the total reduction required to meet long-term climate goals. In that context, it also made sense to require attribution when determining whether Tier 3 reduction goals were met.

A Clean Heat Standard (CHS) Technical Advisory Group (TAG) would be akin to existing Technical Advisory Groups that have been created to (a) develop of energy savings assumptions for Vermont's efficiency utilities and (b) develop assumptions for fossil fuel reduction measures that Vermont's electric utilities employ to meet their RPS Tier 3 requirements. Indeed, the CHS TAG would be able to leverage the substantial work already done in Vermont to characterize efficiency measures and other fossil fuel reduction measures. In fact, it would be important that any underlying assumptions used for efficiency programs, electric RPS Tier 3 initiatives and the Clean Heat Standard be the same.

A modest addition to the state's technical staff (1 or 2 FTE at the DPS and PUC) would likely be required to administer the CHS, including the TAG process. Additional work would be required for the Clean Heat Standard, particularly converting existing assumptions on fossil fuel savings into emission reduction credits and developing assumptions for new measures, including biofuels, that have not yet been addressed by existing processes. However, Vermont is fortunate to have a substantial foundation on which to build. We already know how to do the technical work of counting and crediting savings in clean energy programs.

At a minimum, the CHS TAG should be comprised of representatives from the obligated parties, Efficiency Vermont, the Vermont Department of Public Service, and representatives of non-financially interested stakeholders. There may be value in formalizing the process by having the PUC appoint members to the TAG. There may also be value in the CHS TAG hiring an expert consultant to develop assumptions and lead the annual updating process. That consultant would take input from the members of the TAG and endeavor to reach consensus among TAG members on assumptions. However, the consultant would ultimately be responsible for putting forward proposed assumptions for regulatory approval. This kind of process is current used in some other jurisdictions, including the state of Illinois for efficiency measure assumptions.[42]

8. "But for" Principle for Biofuels

As previously discussed, combustion of biofuels typically produces the same amount of CO2 emissions at point of combustion as combustion of the fossil fuels they are displacing. The difference is that the biofuels can provide other GHG emission reduction benefits – either eliminating emissions of other GHGs and/or removing CO2 from the atmosphere before they are burned. Thus, CHS credits for biofuels need to be based on their net effect on GHG emissions. To estimate that net effect one must understand what GHG emissions would have occurred absent the substitution of the biofuel for fossil gas, fuel oil, propane or any other fossil fuel. That is the "but for" test.

For example, if a landfill is currently capturing and flaring (burning) methane, the GHG emission reductions associated with injecting the methane into a gas pipeline (rather than flaring it at the landfill) would be equal to the avoided CO2 emissions from the flaring. If a different landfill were simply venting methane rather than flaring it, the GHG emission reductions associated with injecting the methane into a gas pipeline would be the CO2e associated with eliminating the landfill methane emissions. If a third landfill was capturing its methane and burning it to produce electricity, the GHG emission reductions associated with instead injecting the methane into a gas pipeline would be the avoided CO2 emissions

[42] Interestingly, the Vermont Energy Investment Corporation, the organization that runs Efficiency Vermont, is the technical consultant to the Illinois stakeholder process on annual updates to its efficiency Technical Reference Manual.

from the methane combustion at the landfill minus the increase in CO2 emissions on the electric grid from whatever alternative generation would likely be employed to replace the kWh it was producing.

One related aspect of the "but for" test is a determination of how existing or future government regulations would affect GHG emissions. For example, if a government regulation would require landfills of a certain size that are currently not capturing and flaring methane to begin to do so in three years, the GHG emission reductions that would be credited for capturing methane for injection into a gas pipeline will be different prior to the date the regulation goes into effect than after it goes into effect. The same would be true of regulations governing emissions from the agricultural, forestry and other sectors from which biofuels may be produced. This may be particularly important as Vermont and other states adopt climate policies for reducing GHG emissions from such sectors. If such policies are not considered in establishing the CHS credit values for biofuels, there will essentially be double-counting of emission reductions relative to state goals.

That said, it is important to recognize that biofuel projects may require multi-year commitments to make them economically viable. Thus, the uncertainty inherent in a system that initially gives full credit for reduced methane emissions from a farm that is currently unregulated, and then five years later de-rated the number of CHS credits earned from use of biofuels produced by that farm because of new regulations put in place after the project was developed, would create barriers to development of such projects. Thus, it may be appropriate to base biofuel credit values for specific biofuel projects with multi-year contracts – at least for an appropriately long duration (e.g., 10 years or 15 years) – solely on regulations in place or known to have been enacted but not yet in effect at the time a project begins production. Alternatively, the TAG could assign a degradation factor to certain types of biofuel projects to account for expected but unknown future regulations. Either approach would provide certainty regarding the future value of biofuels projects that may be necessary to support investment in such projects.

9. Time-Stamping Credits

Some clean heat measures have a one-year life. For example, a gallon of biodiesel reduces GHG emissions only in the year in which it is burned. Other clean heat measures – such as heat pumps, wood pellet stoves and home weatherization projects – provide GHG emission reductions for 15 years, 20 years or even longer. The CHS needs to assign emission reduction credit values for these long-lived measures.

There are potentially two ways to do this. One is to credit a multi-year year measure its full lifetime emission reductions in the year it is installed. For example, if a heat pump had a 15-year life and produced 10 clean heat credits per year, one could assign 150 credits to that heat pump in year 1. In other words, a heat pump installed in 2024 would provide 150 credits towards an obligated party's 2024 credit obligation (but no credits in subsequent years). This is the approach currently used for determining compliance with Vermont's electric RPS Tier 3 requirements. The second option is to time-stamp a "multi-year strip" of credits that a multi-year measure earns. In this case, a heat pump installed in 2024 would earn 10 credits with a 2024 time stamp, another 10 credits with a 2025 time stamp, another 10 credits with a 2026 time stamp and so on through 2038 (the 15th year of its life).

The first option of capturing the lifetime emission reductions in the year a measure is installed is simpler and works well in the context of the electric utilities' electric RPS Tier 3 requirements. However, it is

inconsistent with the GWSA's statutory requirements to achieve defined levels of GHG emission reductions in specific years. It would result in substantially lower levels of emission reductions in any given target year than required by Vermont's GWSA.

For example, consider a hypothetical situation in which obligated parties currently have 300 units of GHG emissions, and face the statutory objective of a 40% reduction in current emissions by 2030 (300 x 40% = 120 units of GHG reductions by 2030). Assume each heat pump produces 1 unit of GHG reduction per year, and each heat pump lasts 15 years.[43] As Table 1 below shows, if a heat pump's lifetime emissions reductions can all be claimed in the year heat pumps are installed, the obligated party would need to install only 36 heat pumps by 2030. The 36 heat pumps are expected to deliver 120 units of reduction *eventually*, but will deliver only 36 units of GHG reduction *in 2030*, or only a 12% reduction from current emissions – far short of the 40% required by statute. As Table 2 shows, to physically deliver 120 units of savings **in 2030,** 120 new heat pumps would have to be **in operation in 2030.** Thus, giving lifetime savings credits at the time of installation for savings that will only happen in the future is not consistent with the statutory goal of meeting emission reduction targets on time in the physical world. And continuing this form of accounting past 2030 would only kick the can further down the road.

Table 1: GHG Emission Reductions if Lifetime Reductions Are Credited in the Year of Measure Installation

	2023	2024	2025	2026	2027	2028	2029	2030
2023 Program	15							
2024 Program		30						
2025 Program			45					
2026 Program				60				
2027 Program					75			
2028 Program						90		
2029 Program							105	
2030 Program								120
New HPs Installed In Year	1	2	3	4	5	6	7	8
Cumulative HPs Installed Since 2022	1	3	6	10	15	21	28	36
Credits Earned in Year	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**
Actual Emission Reductions in Year	**1**	**3**	**6**	**10**	**15**	**21**	**28**	**36**
Actual GHG % Reduction	0.3%	1.0%	2.0%	3.3%	5.0%	7.0%	9.3%	12.0%

In these Tables credits given for new heat pumps are shown in yellow and time-stamped credits from heat pumps installed in previous years are shown in green. In Table 1, lifetime savings are pulled forward to the year of installation, and savings in 2030 are only 12% of the savings required. In Table 2, emission reductions from multi-year measures are credited only when they are delivered, and the statutory reduction target is met. In short, while time-stamping of credits for multi-year measures is a little more complicated, it is necessary to ensure that emission reduction targets will be met.

Table 2: GHG Emission Reductions if Annual Reductions are Credited in the Year They Are Delivered

[43] These are simplifying assumptions used for illustrative purposes only.

	2023	2024	2025	2026	2027	2028	2029	2030
2023 Program	15	15	15	15	15	15	15	15
2024 Program		15	15	15	15	15	15	15
2025 Program			15	15	15	15	15	15
2026 Program				15	15	15	15	15
2027 Program					15	15	15	15
2028 Program						15	15	15
2029 Program							15	15
2030 Program								15
New HPs Installed In Year	15	15	15	15	15	15	15	15
Cumulative HPs Installed Since 2022	15	30	45	60	75	90	105	120
Credits Earned in Year	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**
Actual Emission Reductions in Year	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**
Actual GHG % Reduction	5%	10%	15%	20%	25%	30%	35%	40%

A final note on long-lived measures: when developing credit values for measures that last longer than one year – e.g., heat pumps, wood pellet stoves, and home weatherization – it will be also important to account for likely future interactive effects with other measures, which may well reduce the actual savings delivered by the earlier measures installed. [44] These interactive effects should not be seen as a reason to avoid long-lived measures. These are the kinds of adjustments often made by TAG-like technical groups.

Notes on Section G - Flexibility to Acquiring Credits from Any Customer

1. Flexibility on Customers from Whom Credits Can be Acquired

An important aspect of flexibility is the ability of any obligated party to acquire clean heat credits for measures installed in *any* Vermont home or business. That would include customers who buy fossil fuels from other obligated parties – including customers who use different fuels than those sold by the obligated party. For example, a wholesale fuel oil company could acquire credits resulting from the installation of a heat pump in a home that buys fuel oil from a different wholesaler (or through a fuel dealer who buys its fuel oil from a different wholesaler). A fuel oil company could acquire credits resulting from the installation of a heat pump in a propane or fossil gas heated home.

This customer flexibility will serve several purposes. First, by broadening the range of options for obligated parties, it will create greater competition in the market and therefore lower the cost of compliance with the Clean Heat Standard. Second, it would create the potential for obligated parties to bundle sales of their fuel with other products and services as a way of more holistically meeting their

[44] Consider, for example, a heat pump that is installed in home in 2023, has a 15-year life, and reduces fuel oil consumption in the home from 600 gallons to 300 gallons in the first full year after it is installed. Because of increasing emission reduction requirements over time, by 2030 or even 2025 that home may be getting a portion of its heating fuel in the form of biodiesel instead of just fuel oil. Or the home may invest in upgrades to its attic insulation at some point over the 15-year life of the heat pump. In either case, in the heat pump will end up reducing fuel oil consumption in future years by less than 300 gallons. It would obviously be very challenging to address such interactions for each unique installation so the TAG will likely need to assign average expected degradation factors to long-lived clean heat measures.

customers' energy needs. Third, it will simplify tracking and verification of compliance by eliminating the need to determine whether a customer from whom credits were derived was a customer (directly or indirectly through a fuel dealer) of the obligated party. Fourth, it will make it easier for businesses selling clean heat products and services – e.g., HVAC contractors selling heat pumps, vendors of pellet stoves, and weatherization contractors – to find markets and the best prices for the credits they could generate. Fifth, it would allow for the potential for lower cost reductions in emissions from one fossil fuel to lower the total cost of compliance for the state. Finally, it avoids an underlying problem as to who "owns" a customer relationship. The fact that customers can easily change the dealer from which they buy fuel oil, propane and kerosene would make a requirement to acquire credits only from an obligated party's own customers challenging.

Section H: Notes on Interaction with Electric Utilities' Tier 3 Requirements

1. Electric Utility RPS Tier 3 Requirements Would Remain

Vermont's Electric Utility RPS Tier 3 requirements to reduce customers' consumption of fossil fuels is an innovative, landmark policy. It has clearly launched the state down a path to reducing GHG emissions from the thermal sector (most Tier 3 emission reductions are coming from the thermal sector, primarily from heat pumps displacing fossil fuel heat). Now in its fifth year, implementation of the policy is running smoothly with even faster progress in reducing emissions than initially planned.[45] Based on both results to date and the annual goals set in statute, we estimate that Tier 3 requirements will ultimately achieve annual thermal sector emission reductions of about 7% by 2030. That represents a significant "down payment" on the 40% reductions by 2030 required by the 2020 Vermont Global Warming Solutions Act. As we discuss in Section II of this paper, the state could conceivably meet the thermal sector portion of the state's new 2030 emissions reduction goal by simply increasing the magnitude of the Tier 3 requirements by a factor of five or six. However, for reasons also articulated in Section II, we believe a Clean Heat Standard that imposes an emission reduction obligation on suppliers of fossil fuels makes more sense as a policy vehicle to fill the gap between the emission reductions that Tier 3 will provide and the state's new emissions reduction goals.

On the other end of the spectrum, the *Clean Heat Standard* could be designed to achieve the ***total*** emissions reduction required to meet the thermal and industrial sector contributions to State GHG emission reduction goals. If that were the case, the current electric RPS Tier 3 requirement would no longer be necessary. However, we believe that there are significant advantages to keeping the electric RPS Tier 3 requirements in place – in concert with the Clean Heat Standard. First, the policy appears to be working very well, with the state's electric utilities having developed an effective program infrastructure for delivering and documenting reductions in fossil fuel consumption. It may be better to build on that infrastructure than to tear it down and start the CHS from "ground zero". Second, with the Clean Heat Standard obligations being imposed on fossil fuel wholesalers, there may be an incentive for the CHS obligated parties to favor biofuels over electrification and other potential measures. Maintaining the electric RPS Tier 3 as a mechanism that would generate a modest portion of CHS emission reduction requirements, with the electric utilities' own likely bias towards electrification measures, could provide some balance to the range of solutions pursued across Vermont.

[45] Green Mountain Power, which accounts for about three-quarters of the state's electricity sales, achieved about twice as much fossil fuel reduction as required by statute in 2020 (Green Mountain Power, *Cutting Carbon: RES Tier III Savings Report, 2020 Plan Year*, March 15, 2021.

Put simply, we conclude that the advantages to maintaining the electric utilities' RPS Tier 3 requirements outweigh any advantages of ending them. It should be noted that this decision could be revisited in future years. Note that it would likely be both much less disruptive to keep Tier 3 now and terminate it later than to terminate it now and need to restart it later.

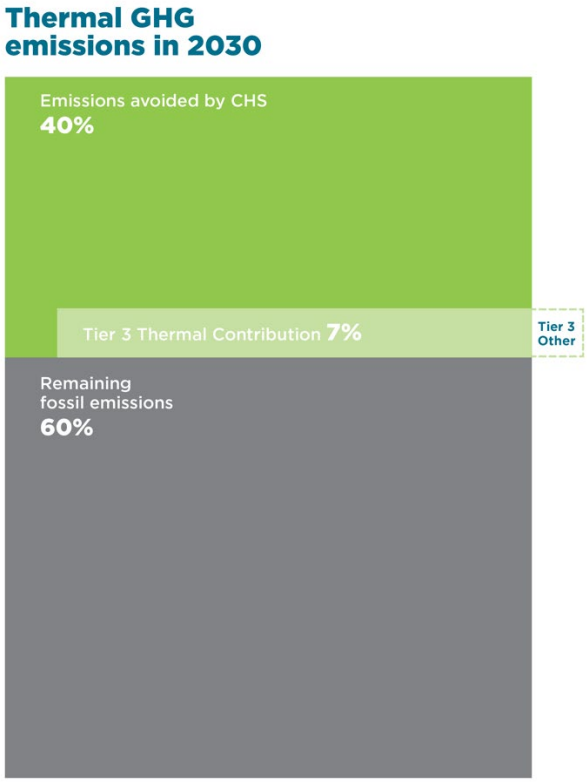
2. Emission Reductions Achieved Under Electric RPS Tier 3 Can Count toward CHS Requirements

Tier 3 could conceptually interact with a Clean Heat Standard in one of two ways. The first option would be to make Tier 3 and CHS requirements completely separate from each other. Under this approach emission reductions generated by the electric utilities through Tier 3 programs would count only towards Tier 3 requirements and emission reductions generated by fossil fuel wholesalers would count only towards CHS requirements. The CHS emission reduction targets would be based on the total emission reductions from buildings and industry that are required by the state, minus the portion expected from Tier 3 initiatives.

The second option would be to make Tier 3 and CHS requirements overlapping. Under this approach emission reductions from buildings and industry[46] that are generated by electric utilities through Tier 3 programs could count towards both Tier 3 and CHS requirements and emission reductions generated by fossil fuel wholesalers would count towards CHS requirements, and if sponsored by an electric utility could count towards Tier 3 requirements as well.[47] Because the thermal sector emission reductions expected from Tier 3 are a just a subset of the total reductions required to meet the state's climate goals, this approach would be like making Tier 3 a "carve out" of the CHS. It would be analogous to Vermont's current electric RPS which requires 75% of electricity purchases to be renewable by 2032 (Tier 1) and 10% from distributed renewables (Tier 2), with distributed renewables counting towards both Tier 1 and Tier 2 requirements.

[46] Most of the Tier 3 reductions being generated today are from buildings and industry. However, some are from the transportation sector and increased renewables. Only the reductions from buildings and industry would be overlapping with a CHS as the concept is envisioned in this paper.

[47] Note that about 10% of Tier 3 emission reductions are currently from non-thermal sectors, primarily transportation. In both models those reductions would count only towards Tier 3 requirements.



Appendix Figure 2. Most utility Tier 3 actions also contribute to meeting CHS requirements

There are a number of advantages to this second option. Most importantly, it will align the objectives of electric utilities and fossil fuel wholesalers obligated under a CHS. That will facilitate pursuit of least cost solutions to both sets of regulatory requirements. It will also reduce confusion in the market that could be created by electric utilities and fossil fuel suppliers completing for the emission reductions from the same customers with the same measures.

3. Selling of CHS and Tier 3 Attributes

The mechanism through which emission reductions of Tier 3 and CHS credits could count towards each regulatory requirement would be the assignment of both a CHS attribute and a Tier 3 attribute to each unit of emission reduction. Electric utilities who generate emission reductions could sell CHS attributes to wholesale fossil fuel suppliers and the fossil fuel suppliers could sell Tier 3 attributes to electric utilities.

Note that CHS and Tier 3 attributes are overlapping, but different. CHS would be measured in CO2e reductions in a time-stamped year. Tier 3 compliance is measures in units of lifetime fossil fuel reductions (expressed in MWh equivalents). However, as long as the underlying assumptions for computation of each value are the same (see discussion in Subsection E above), these differences would not be of any concern.

Section I – Notes on Default Delivery Agent

1. Single Entity Hired for Multi-Year Period

The default delivery agent should be a single statewide entity hired for a multi-year period. Making the default provider a statewide entity would allow for economies of scale to lower the costs of compliance. Also, because there can be significant effort required to ramp up programs to acquire credits, both the default provider's contract and any obligation assignments should ideally be for multi-year periods. To that end, it would be appropriate to require decisions to assign obligations to be made every three years – or some other interval, ideally aligned with the duration of the contract for the default delivery agent. Also, to enable the default delivery agent to effectively plan to acquire credits, it would need sufficient notice – at least six months – of the obligation being assigned.

2. Competitive Solicitation

The default delivery agent should be hired through a competitive procurement process run by the PUC (as was done in the past for the Efficiency Vermont contract). This would minimize the costs of compliance.

Section I – Notes on Non-Compliance Payments

1. Penalty for Failure to Meet Obligation

As with any regulation, in order to ensure that emission reductions are actually achieved there would need to be a penalty for obligated parties that fail to meet their obligation. We call that a non-compliance payment.

2. Magnitude of Non-Compliance Payments

To provide a sufficient inducement for obligated parties to meet their emission reduction obligations on time, the magnitude of the non-compliance payment will need to be significantly greater than the cost of acquiring clean heat credits would have been.

Because the cost of compliance may change over time – both as a result of emission reduction requirements growing in scale and potentially as a result of costs for some compliance measures changing as market demand grows – the PUC should be charged with establishing and periodically updating the magnitude of non-compliance payments. Because the PUC is also charged with establishing payments for pre-assigning obligations to the default delivery agent (for obligated parties who choose that path to compliance), both values (non-compliance and pre-assignment payments to default delivery agent) should ideally be established and updated by the PUC at the same time.

3. Use of Proceeds from Non-Compliance Payments

Non-compliance payments should be provided to default delivery agent and used to acquire additional emission reduction credits within two years of when the payments are received. The generation of such

additional credits will offset the previous year's credit shortfall which precipitated the non-compliance payment.

Consideration should be given to requiring additional credits acquired with non-compliance payments solely or disproportionately from low-income customers. This is one potential mechanism for addressing equity concerns. Of course, the price of non-compliance payments would need to reflect the cost of any such requirements to focus on low-income customers.

Section I – Notes on PSD Role in Verification and Evaluation

1. PSD Annual Compliance Review

Just as it currently does for both efficiency utility savings claims and electric utility Tier 3 claims, the Vermont Department of Public Service (PSD) would be charged with annually reviewing each obligated party's compliance with its emission reduction requirements. That review would ensure that any deemed assumptions regarding CHS credit levels for common measures were properly applied. It would also require judgment on the reasonableness of assumptions for custom measures. Just as with its current review of efficiency utility and electric utility Tier 3 claims, the DPS should have a modest budget to hire consultants to support its reviews.

2. PUC certification of Compliance or Non-Compliance

The PSD review will be a critically important independent perspective on compliance. However, obligated parties and other organizations should have the ability to challenge the DPS conclusions and present alternative perspectives. Thus, there should be a process in which all such perspectives can be considered and adjudicated. The PUC is the logical venue for such a process – just as it is for energy savings claims by the state's efficiency utilities and Tier 3 compliance claims by the state's electric utilities.

3. PSD Evaluation Studies

As discussed in Subsection E above, there will be an on-going Technical Advisory Group (TAG) process through which assumptions regarding the CHS credit values for different kinds of emission reduction measures would be established. The TAG will make such decisions based on best available information. To ensure that the best available information is robust and current, the state will need to support modest investments in field studies on the actual effects of different CHS measures. As it does for the state's efficiency utilities and electric utilities implementing Tier 3 programs, the PSD should be responsible for identifying evaluation priorities, sponsoring field studies to assess actual impacts of different CHS measures in Vermont homes and businesses, and bringing those study results to the TAG process to inform updates to key assumptions. Of course, obligated parties and others can be expected to provide input to the DPS on evaluation priorities, scopes of work for field studies, and draft results. However, to ensure independence, the PSD should have final say on all such decisions.

4. Small Fossil Fuel Surcharge to Fund PSD Review and Evaluation Studies

Both the annual review and evaluation studies will require some technical resources. For example, the current PSD budget for evaluating the state's efficiency utility savings claims is a little under $2 million

per year. A small surcharge on fossil fuel sales could be levied to provide funding necessary to support the PSD role in verification of compliance and evaluation.