

Massachusetts Clean Heat

Standard:

Policy and Regulatory Analysis

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What is a Clean Heat Standard (CHS)?

- CHS is a credit-based performance standard for suppliers of heating energy
- Suppliers would be required to acquire an increasing number of tradable credits reflecting “clean heat” resources, corresponding to providing cleaner heating energy to their customers over time
- Clean heat obligations would be scaled to meet sector-level greenhouse gas (GHG) requirements
- Clean heat resources could include “weatherization improvements, heat pumps, clean district energy and other verified low-carbon options, potentially including renewable methane, clean hydrogen, biodiesel, renewable diesel and advanced wood heat” (Coward et al.)
- Policy described in detail in: Coward, Seidman, and LeBel, July 2022, “A Clean Heat Standard for Massachusetts” prepared for Massachusetts Executive Office of Energy and Environmental Affairs (EEA) by the Regulatory Assistance Project

Objectives of a Clean Heat Standard

- Reduce emissions in the building and industrial sectors
- Track and account for increasing clean heat resources
- Provide a potential funding source for clean heat actions through the sale of credits to obligated entities
- Work well alongside other policies and programs to reduce emissions

Contents

- Clean Heat Credit (CHC) costs: How much will credits cost when acquired through different actions? (with details in Appendix)
- CHS compliance portfolios, 2025-2030: What do the Clean Energy and Climate Plan (CECP) pathways look like in terms of assumed CHS portfolios?
- Policy analysis: What are the important policy decisions and associated context to design a CHS policy that works well and meets state goals?
- Regulatory analysis: What are the implications of a CHS for regulated utilities, and what role will the regulatory system play in a well functioning CHS?

Clean Heat Credit Cost Comparisons

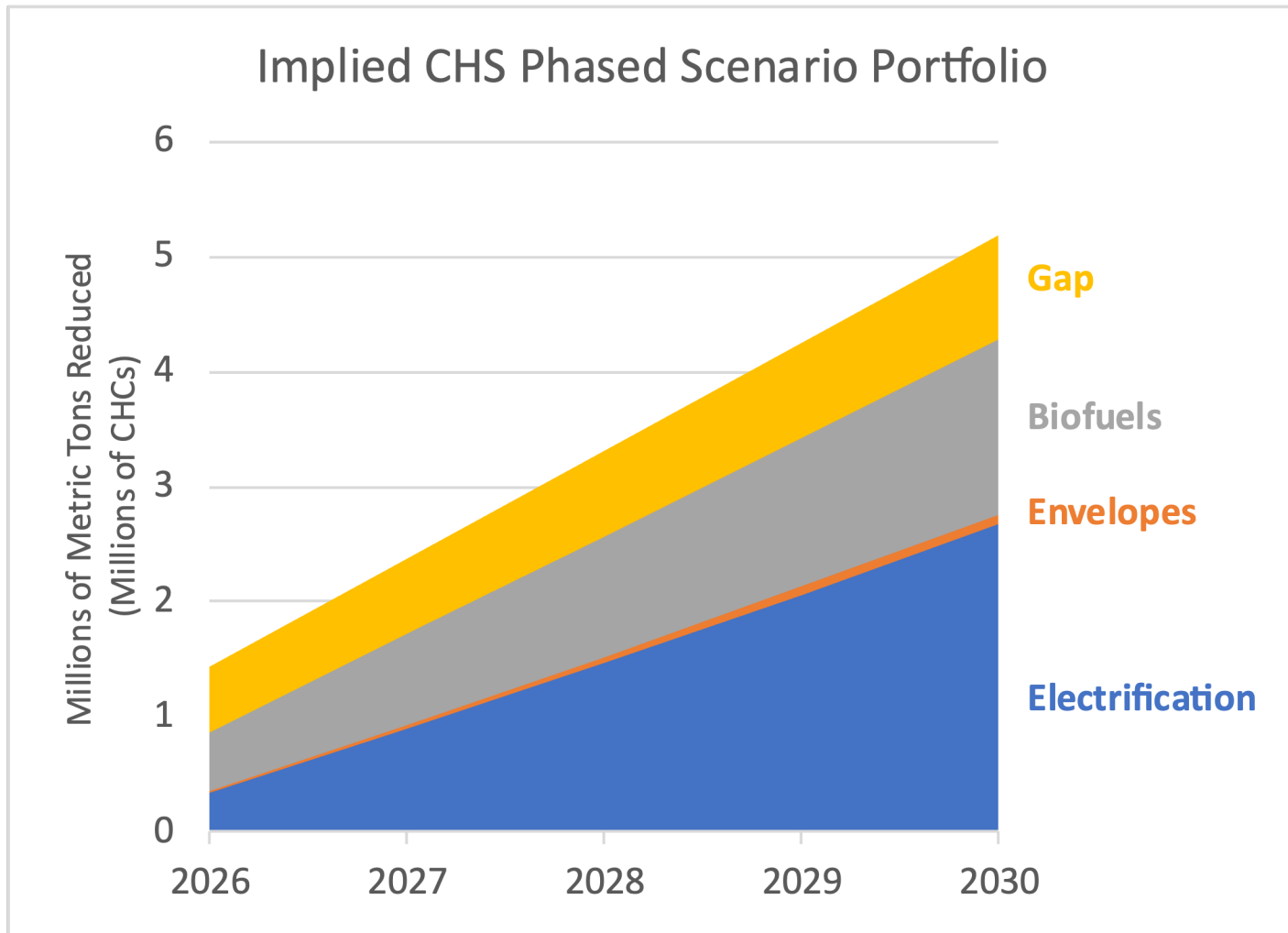
- Biodiesel and renewable diesel are the least-cost options for CHS compliance, up to the level of their potential penetration based on heating oil market share and blending limits
- Hot water electrification and building envelope efficiency are reliably low-cost CHC sources, followed by dairy biomethane and electrification of homes heated with delivered fuels
- The full incremental cost of HVAC electrification for gas-heated buildings is comparable in cost (per ton) to the low end of the cost range of biomethane from landfills and waste
 - These are also the two largest sources of potential credits
 - How competitive these two sources are with each other depends on:
 - Whether biomethane can hit the low end of its cost range, after accounting for updated emissions factors
 - Whether electrification at the required scale requires incentives from the CHS policy covering the full incremental cost
- *See Appendix for method and cost details*

CHS Compliance Portfolios 2025-2030

CECP Pathways

- Each CECP compliance pathway modeled in the CECP for 2025 and 2030 meets the emissions limit using a different combination of actions
- We backed out what the CHS compliance portfolio would look like in each of several scenarios (the Phased, Clean Fuels, and Full Electrification scenarios)
- The energy trajectories in the CECP data received from EEA do not align well with the emission trajectories
- Specifically, if the state uses the amount of energy for each end use and fuel detailed by the EEA's materials, emissions will not fall enough to meet the required levels for 2030
- We refer to this difference as the “gap” because the scenarios do not describe how these emissions would be reduced

Phased Scenario

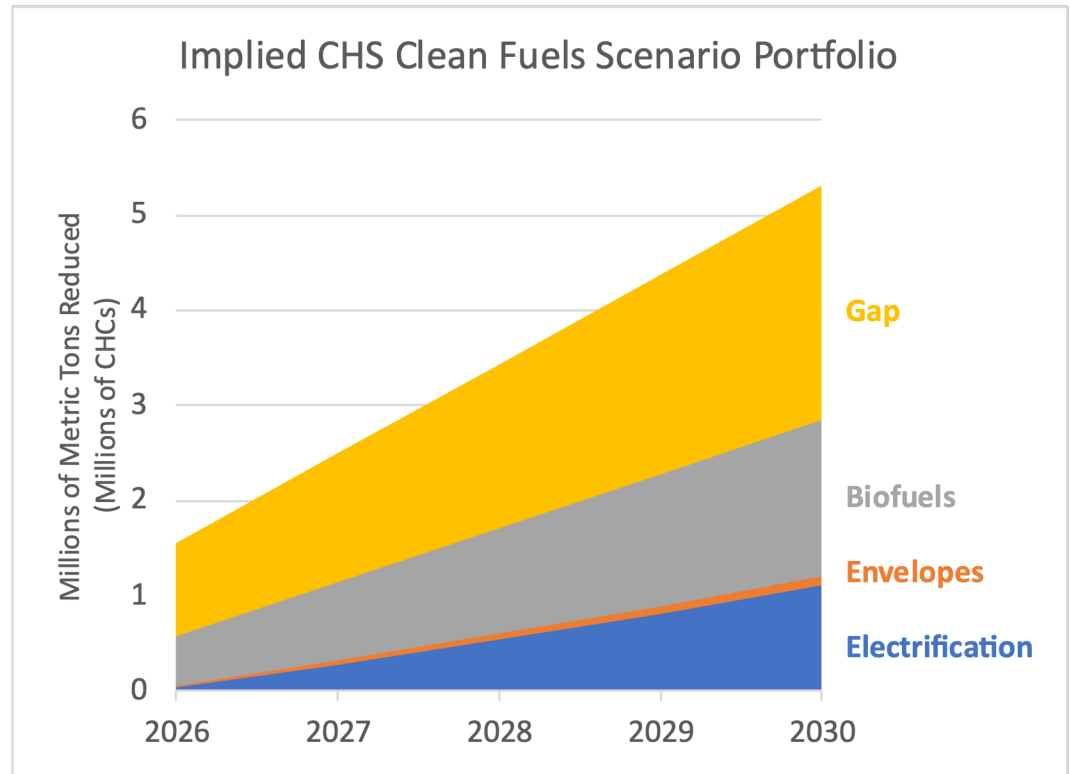


Other Scenarios

- The CECP data from EEA does not include end-use-specific information for scenarios other than the Phase scenario
- Results on the following slides reflect estimates to make emissions totals line up, but may not reflect the underlying CECP data

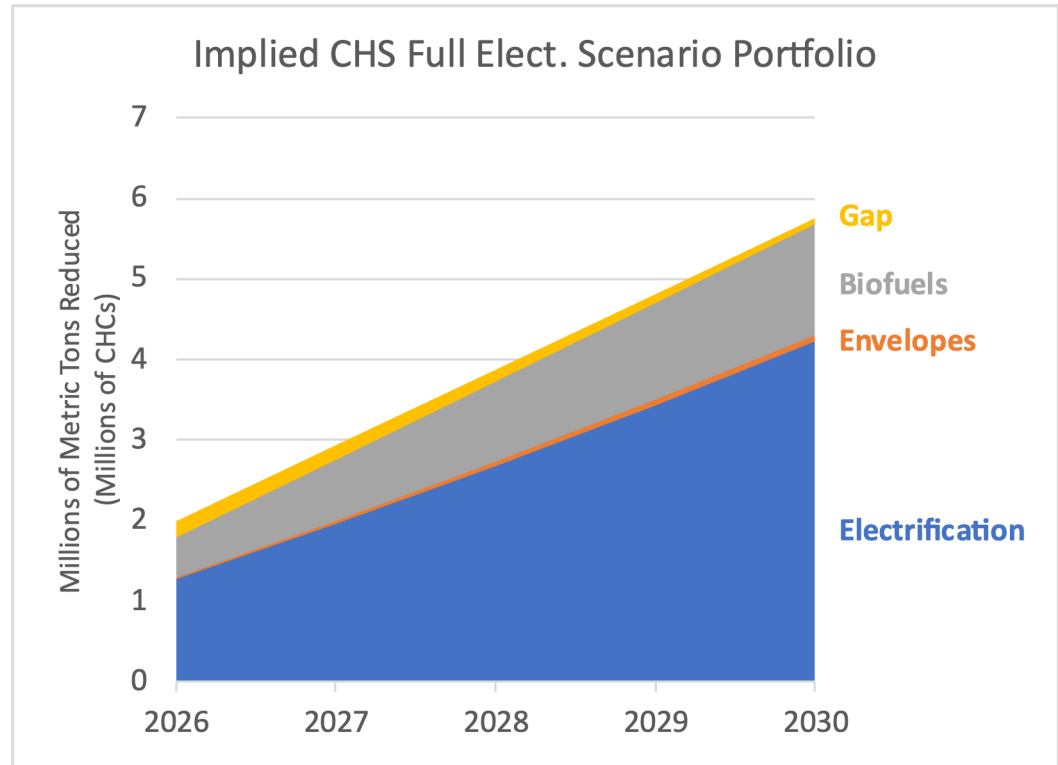
Clean Fuels Scenario

- Buildings emissions in this scenario have a much larger gap because it appears to count on achieving greater reductions in this sector later using more alternative fuels (especially for pipeline gas)
- The alternative fuel use before 2030 appears to be almost the same between Clean Fuels and the Phased scenarios
- Very little net electrification occurs in this time period



Full Electrification Scenario

- Emissions fall faster in this scenario than in the Phased scenario
- As a result, the gap between the sublimit and the energy use estimates nearly disappears



Take-Aways from Portfolio Analysis

- All portfolios use both electrification and biofuels
- High Electrification pathway reduces emissions most quickly
- Clean Fuels pathway appears to under-procure electrification relative to least-cost CHS compliance
 - Recall that electrification is likely lower cost than most biomethane, so the small amount of electrification in this approach is unlikely to be the least-cost path
- Later periods (after 2030) in the all three cases increasingly depend on electrification. This should impact policy design in the near term because success later depends on foundations laid in the near term.

Policy Analysis

Policy Analysis

- The goal of this portion of our analysis is to identify promising (or essential) policy structures to enable the CHS to function well and in alignment with the state's Roadmap and CECP.
- Topics addressed include:
 - Existing programs
 - Clean heat standard impacts on obligated entities
 - Clean heat standard program design considerations

Background: Commission on Clean Heat Report

- The Commission on Clean Heat made several recommendations that either reflect choices in the issues raised in this section or have implications for the design choices presented here
- In general, we agree with the Commission's recommendations regarding the CHS policy design and framework
 - E.g., the Commission says strong things about lifecycle emissions accounting and not getting sidetracked from the long-term objective of a mostly-electrified thermal sector (while maybe using low-carbon fuels as part of the way to reduce emissions faster in the near term)
- There remain some potential conflicts in approach between the conception of the CHS as using market forces to drive cost-effectiveness and innovation, and the Commission's concept of a Building Decarbonization Clearinghouse that brings every program under one umbrella
 - Would the Clearinghouse offer customers info about competing programs?
 - Would all obligated entities work through the Clearinghouse?

Existing Programs

Mass Save Overlap Management

References to future Mass Save programs and funding throughout this report are meant to encompass the existing program as well as any reformed efficiency program under the Clean Heat Commission-recommended Building Decarbonization Clearinghouse approach

- Mass Save programs will generate CHCs, but Mass Save programs at their current scale are not enough to meet the CHS requirements, so additional funds would be required
 - Mass Save electricity-savings programs would not generate CHCs because they would not impact emissions in the covered fuels/sector
- Obligated entities could provide additional funds to Mass Save programs, or fund their own separate programs, to move markets enough to meet the emission limits/CHS obligations
- CHCs belong to the property owner, but would most likely transfer from building owner to program in exchange for incentive payment (as happens with SMART payments and SRECs, for example)
- Programs end up with a collection of the CHCs they have purchased from participants, and would transfer those CHCs to their funders in some proportion
 - Proportion to be worked out among the funders; if some are regulated entities, then regulators could watch/oversee this process
 - For example, CHCs could be distributed according to proportion of funds provided for each program (so-called “mutual fund” approach)
- Default gas suppliers associated with the regulated Mass Save Program Administrators (PAs) would presumably dominate the market for Mass Save-generated CHCs
 - Should there be an auction or other mechanism to distribute these credits instead of bilateral agreements?
- Weatherization before electrification would generate CHCs, but weatherization after electrification would not. This could result in different value and claims regarding weatherization depending on its context, and Mass Save may need to fill in the gaps.

Mass Save Funding Level Is Important

- For a fixed total amount of funding required for clean heat programs, some would come from Mass Save and some from the sale of CHCs to obligated entities
- Given the fixed number of CHCs obtained through these programs:
 - If Mass Save contributes more, the cost/ton of CHCs obtained this way will be lower
 - If Mass Save contributes less, the cost/ton of CHCs will be higher
- Since electrification and efficiency CHCs will be the majority of the CHCs (as envisioned in the CECP), high Mass Save funding could keep the overall market price for CHCs low, making this pathway more attractive
- IRA tax credits and rebates for electrification equipment could play a role comparable to Mass Save in terms of lowering the additional funds required to meet GHG limits, and thus the CHC prices
- For 2025 to 2030, the CECP's assumed rate of heat pump deployment in the "phased" case corresponds to about the same rate of deployment as Mass Save planned to achieve during 2022-24. This implies little need for additional support from CHS funds, although as the market shifts from electrification of delivered fuels homes to gas homes, roughly double the funds may be required. That is, CHS funding may need to roughly match what Mass Save is otherwise funding. Mass Save funding would also shift from electric PAs to gas PAs.

Electric PA Mass Save Programs

- Electric utility PAs currently run fuel-switching electrification programs within Mass Save for oil and propane customers
- Under a Clean Heat Standard, these programs would generate CHCs, which presumably belong to the electric PAs as the funders of those programs
- They could sell these credits to obligated entities and offset some of the cost of running the programs
- Alternatively, electric PAs could stop these programs and let another entity (under the Building Decarbonization Clearinghouse umbrella) run oil and propane electrification programs in exchange for the credit value
- Both of these approaches lower the cost of Mass Save on electric bills, but the impact depends on the value of the CHCs and its relation to the amount of incentives required to encourage electrification
- If CHCs are low cost, CHC value alone may not be enough to move this segment of the market if it were a standalone program. This implies a need for Mass Save funding to continue.
 - Low-cost CHCs likely implies a large Mass Save contribution on the gas side, so electric and gas PA support for electrification in Mass Save are linked and likely need to move in parallel
- If CHCs are high cost, CHC value may be enough to cover all of the incentives required, and electric PAs could either get out of this business or use the CHC revenue to cover the entire cost of running these programs

Equity Across Fuels and Utilities

- Mass Save is funded by IOU electric and gas ratepayers, and not delivered fuel customers (except through their electric bills as electric ratepayers) or municipal utility ratepayers.
- If Mass Save has high funding for clean heat programs, CHC prices will be lower, which will lower costs for residents/businesses who are not Mass Save contributors (who could buy lower-cost CHCs from the programs).
- Open question: Could Mass Save sell CHCs to these entities at a price that reflected its full cost per ton reduced, not just the CHC portion?
- Fuel oil suppliers with excess CHCs from making an easy switch to B20 in the early years of the CHS could see a windfall by selling their credits for more than they cost (which is close to zero). This windfall will be larger if Mass Save funding is low, so CHC prices are high.
 - We do not assume an easy switch to B100 (due to customer hardware costs) or renewable diesel (due to limited supply)

Alternative Energy Portfolio Standard

- The Commission on Clean Heat suggested the repeal of the Alternative Energy Portfolio Standard (APS)
- There is no longer a policy desire to support combined heat and power (CHP)
- Everything else that qualifies for the APS would be covered by the CHS, leading to potential triple-counting between Mass Save, APS, and CHS
- Repealing the APS would transfer the obligation to support these measures from electric utilities (and electric rates) and to fossil fuel providers (and thereby increase their prices). This would shift prices marginally in favor of electrification.

Impacts on Obligated Entities

What Does CHS Look Like for Different Market Actors?

- CHS as described would apply to fuel suppliers. This includes the default service supply arrangement provided by regulated LDCs, but also municipal gas utilities and competitive suppliers of natural gas, fuel oil, and propane.
- Obligations would be proportional to the amount of covered fuel sold (and associated emissions)
- CECP indicates an open question as to whether electricity suppliers or electric utilities might have a CHS obligation
- While the vast majority of gas is sold via default service, the policy also must work for competitive gas suppliers
- The following slides describe impacts of a CHS on all potential obligated entities

What Does CHS Look Like for Different Market Actors?

Gas distribution utilities

- Obligation falls on their default service procurements
- Close coupling with Mass Save provides ready source of credits; net cost to acquire credits depends on Mass Save funding levels
 - Municipal gas utilities do not have this close coupling, but are otherwise similar
- Can also procure RNG; relative attractiveness of this for CHS compliance depends on Mass Save funding level

Competitive gas suppliers

- Could procure RNG or buy credits originating from Mass Save-aligned programs or fuel oil dealers
- Short-term supply contracts mean they look for short-term compliance solutions (not long-term contracts)
- In theory could run their own electrification program, but very unlikely because it would end/reduce their ability to sell fuel to these customers (and customers might not stay with them as supplier in any case)

Propane dealers

- No easily available drop-in fuel to sell and earn credits directly
- Likely to buy credits originating from Mass Save-aligned programs or fuel oil dealers
- Customer competition means they generally look for short-term compliance solutions (not long-term contracts)
 - Could partner with customers to partially electrify outside of other programs and accumulate the credits; would seek long-term contract with customer to retain service contracts, etc. If CHC prices are low, this is less likely than if they are high.

What Does CHS Look Like for Different Market Actors?

Fuel oil dealers

- Straightforward low-cost compliance pathway to switch customer default to B20 and sell B100 where they can. For residential sector CHS compliance, this approach could be enough to meet obligation as late as 2030 (depending on GHG reductions assigned to B20, and how much B100 they can sell).
- Customer competition means they generally look for short-term compliance solutions (not long-term contracts)
 - Could partner with customers to partially electrify outside of other programs and accumulate the credits; would seek long-term contract with customer to retain service contracts, etc. If CHC prices are low, this is less likely than if they are high.

Electric distribution utilities

- If electric Mass Save continues to support electrification of oil and propane heat, then EDCs would be a source of CHCs

Electrification & weatherization workforce/contractors

- Additional funding for their projects would increase demand
- Managing complexity of different funding sources could cause friction

Implications for Competitive Suppliers

- All suppliers except the LDCs are unregulated or barely regulated by the DPU. This means the DPU will have less control or visibility into how they meet their CHS obligations (similar to RECs today).
- Competitive suppliers could develop and offer their own programs instead of programs run through Mass Save or the Clearinghouse
 - This would increase both innovation and complexity
 - Uncertain what suppliers' interest would be to develop and run programs
 - It would complicate the Clearinghouse to have to track and help customers with offers from their competitive suppliers that are not part of a centralized offering
 - But if the Clearinghouse didn't track and assist with such things then its effectiveness would be reduced

Should Electric Utilities Have CHS Obligations?

- CECP indicates an open question as to whether electricity suppliers or electric utilities might have a CHS obligation
- Arguments for:
 - Electricity is used for heating in both resistance and heat pump equipment, resulting in emissions in the electric sector
 - Resistance -> heat pump conversion reduces electric load and (maybe) emissions (see below) and could be incentivized by CHCs
- Arguments against:
 - Electric sector emissions are already capped by RGGI and the Clean Energy Standard
 - Electric emissions are not part of the sectoral sublimit calculation in the CECP for residential or commercial heating
 - It would be difficult to identify which electric use is for “heat” applications and should therefore be counted as part of the CHS
- Implications: We think the arguments *against* are stronger, at least for now

Policy Design Considerations

Equity Implications

- Market-based policy designs do not have a long history of successfully reflecting the needs of low-income and underserved communities
 - The value of a tradable credit would need to reflect the additional value of working with these customers, e.g., through some kind of multiplier, which makes policy implementation more complex and outcomes more uncertain
- A more centralized program-based approach has more historical successes with embedding equity
 - E.g., low-income weatherization programs and income-eligible Mass Save programs
- Centralized program-based approaches can also have more predictable costs and benefits, insulating customers from volatility

Lessons from SRECs and SMART

- Small solar generators in Massachusetts produce SRECs to meet the solar carve-out in the RPS
- Initially, system owners would generate SRECs and sell them individually via brokers. This was a hassle. As a result, the policy was less cost-effective because customers saw this as an extra cost in time/hassle so SRECs had to be quite expensive.
- SMART centralized the purchase of SRECs by providing a way to sell all SRECs in a single transaction with a known cost (even though they are generated over time). The SMART program takes care of the hassle. SMART compensation for SRECs is lower than it was, but the program is still successful on this front.
- Implication: Customers should face the hassle of dealing with exactly how many CHCs their project creates and should not be exposed to price volatility. This can be addressed via upfront payments or a continuing stream of payments as long as the equipment is in operation.

Carve-Outs

Carve-outs help ensure at least a certain amount of a given activity happens to comply with the CHS

- Valuable for actions that advance goals not easily expressed in dollars, like equity
- Also valuable for actions that may be expensive but are required to lay the groundwork for known future pathways
- Promising areas for carve-outs:
 - Building shell improvements (contribution may be small but expected to pay off in the long term)
 - Only 2% of 2030 CHS compliance expected to come from weatherization in CECP Phased Case
 - Relatively low-cost credits, and well-established programs, so may not require much incentive to include in portfolio
 - Low-income programs (where greater incentives/100% cost coverage may be necessary, so CHCs could be more expensive)

Caps

Caps limit the amount of a given activity used for CHS compliance to keep it from dominating the portfolio

- Valuable for actions that risk diverting compliance into a dead end (e.g., actions that are low cost but cannot be used to reach net zero)
- Promising areas for caps:
 - Biogas/RNG, where capping could allow RNG to contribute to near-term (e.g., 2030) CECP emission levels while limiting risk of a dead end resulting from limited RNG supply and slowed electrification that could result from greater RNG use
 - Higher cost of credits, relative to other options, may also encourage limits to use in a least-cost portfolio
 - Liquid biofuels may be naturally capped by the market share of heating oil, but capping could provide additional push toward electrification and avoid dead end to the extent that B100 and renewable diesel are not zero emission
- CECP emphasizes long term electrification and notes the lost opportunity costs when electrification is delayed. Given this policy objective and the outcome of the “clean fuels” pathway, decision makers in MA should consider using caps for the use of alternative fuels for compliance

Multipliers

Multipliers give more (or less) than one ton of emissions credit for a given action, in order to encourage or discourage its place in the overall portfolio

- For example, low-income programs could get a 2x multiplier so that work in that sector would be especially rewarding
- Main concern with multipliers is that they can make achieving the final emission reduction more uncertain.
 - For example, if everyone just did low-income programs at 2x credit, then actual emissions would only fall by half as much as needed
 - Multipliers under 1 as a way of discouraging but allowing use of a given action/resource could result in overcompliance with emission limits (which is less of a problem)
- Not clear that multipliers are worth using if caps and carve-outs are available instead, especially given statutorily binding emission targets

Measure Allowance and Characterization

- Emission reductions from increased efficiency in combustion equipment could count unless explicitly disallowed
 - Seems likely that CHS would follow Mass Save in not allowing credit for more efficient gas equipment
 - If it were disallowed, then emissions could fall faster than the cap because some reductions (nonprogrammatic replacement of inefficient equipment) would not be awarded CHCs
 - This issue goes away if/when combustion equipment installation is disallowed
- Expect that measures would share a characterization and assumptions with Mass Save programs
- Evaluation, measurement, and verification protocols and studies would inform how much credit could be claimed for a given action
- Likely important to fix the CHS characterization of a measure at the time of installation/payment, so that CHC awarded per action doesn't change after the fact
 - May need to build in slack to emission limits to allow for differences between expected and actual emission changes
 - May need to account for the rebound effect

Free-Ridership and Spillover

- In Mass Save, the question for measuring Program Administrator performance is “what change did you cause in the world?”
 - In this context, efficiency increases that were going to happen anyway shouldn’t be credited to the program, so *free-ridership* adjustments are made to the results
 - Similarly, if someone takes an efficiency action because of a program but doesn’t participate in the program, then the program should get some credit—this is *spillover*
- In the CHS, free-ridership and spillover don’t matter: it’s an umbrella policy that doesn’t care how the emission reductions happened, just that they did
- Implications:
 - Measure and program characterization for CHS will be different than for Mass Save
 - Obligated entities may try to track down places with lots of free riders and arrange to buy their CHCs inexpensively (if you’re going to do something anyway, and someone offers you money to do it, you likely don’t need to be paid as much money)
 - Spillover could result in emission reductions without tradable credits being created via a centralized program. Whether the resulting CHC owners sell the credits is uncertain.
 - If they don’t sell them, then there would be greater emission reductions than counted in the program, which is not really a problem

New Construction Baselines

- CHS requires reductions below a baseline level of emissions, in order to hit a sectoral sublimit in physical tons
- If the new construction baseline allows on-site combustion emissions, then the baseline would need to increase; the CHS obligations would also increase by the same amount to keep on track for the sublimit
 - If a new building replaces an existing building, then the baseline needs to account for that as well (e.g., subtract the estimated emissions associated with that building and then add the new building emissions)
- CHCs would be earned for building a new building that is lower emission than the amount added to the baseline
- How much this matters depends on the rigor of the new building energy code
 - A zero-on-site-emission code would eliminate this issue

Alternative Compliance Payment (ACP)

- ACP would be owed by any obligated entity that fails to meet its obligation, paid on a per-ton basis.
- Collected funds could support policy-driven emissions reduction, especially in areas that market programs might not reach as strongly (e.g., low-income weatherization + electrification)
- ACP should be set substantially higher than the expected marginal cost of CHCs so that providers will actually produce the emission reductions on schedule to meet the CECP emission levels
 - If entities fall short, then pay the penalty, the funds won't get out into the field until at least a year later than needed, and more likely 2-3 years later. This could delay meeting emission levels.
- Interplay with level of requirement
 - If the required level exceeds what the market can realistically deliver (like with MA RPS Class II) then the CHC price will stay pegged to the ACP and the program would raise lots of funds, but emission reductions would lag behind the required level
 - We don't recommend this because it would create excess costs and could delay emission reductions. We do not see evidence that respending ACP funds would be more effective at achieving policy goals than just having obligated entities fund emission reductions
- If ACP payments are expected but will take time to collect/process, programs could consider getting loans (e.g., from a green-bank-like entity) to cover immediate program implementation

Price Volatility and Banking

- Portfolio standard policies tend to exhibit a credit price behavior in which credits trade either at very high prices (near the ACP) if supply is short of demand, or very close to zero value if supply exceeds demand.
- This leads to price volatility, which market actors need to account for in their decisions about expected return from investments
- This kind of volatility is especially damaging to programs if it passes through to individual participants (e.g., families), since they may make an investment in a clean heat action and then get less for their CHCs than expected
 - Credits would be created each year, but likely sold up front by building owners through the incentive process
 - We assume that MA policy would aim to insulate individual building owners from price volatility, akin to how SMART pays an average price for SRECs and participants don't have to deal with selling their own credits
- If there are a few larger market players with a public interest mission or regulatory oversight (e.g., EE PAs) they can moderate this effect while buying CHCs from program participants at predictable prices (incentive levels), which vary slowly depending on what is needed to drive participation
- Banking and borrowing would allow an entity to avoid being forced to buy when prices are high or sell when they are low, thereby moderating market prices to more of a long-term average
- Too much banking and borrowing could endanger meeting legal emission limits in specific years (e.g., 2030, 2035, etc.), so limits should be set at a reasonable level to bound this risk (e.g., to a level comparable to weather risk)

CHC Storage

- There is also a separate need for a different kind of banking:
 - Because CHCs are only released when they are generated each year by avoiding fossil fuel use, but may be sold upfront in exchange for an incentive, someone is holding onto the future stream of CHCs from any given installation and releasing them into the market when they are allowed
 - This role could be played by a governmental “bank” or by the large regulated entities
 - Future value of CHCs will be uncertain, so anyone holding and reselling CHCs is taking noticeable risk, comparable to risk in long-term REC contracts
 - Regulated entities may need DPU oversight/approval for handling these long-term risks on behalf of the market (similar to approvals for long-term contracts for other resources)

Summary of Key Open Policy Questions

- There remain some potential conflicts in approach between the conception of the CHS as using market forces to drive cost-effectiveness and innovation, and the Commission's concept of a Building Decarbonization Clearinghouse that brings every program under one umbrella
 - Would the Clearinghouse offer customers information about competing programs?
 - Would all obligated entities work through the Clearinghouse?
- How aggressively Mass Save building decarbonization programs be funded outside of the CHS?
- Should electric utilities have a CHS obligation?
- Default gas suppliers associated with the regulated Mass Save PAs would presumably dominate the market for Mass Save-generated CHCs
 - Should there be an auction or other mechanism to distribute these credits instead of bilateral agreements?
 - Could Mass Save sell CHCs to obligated entities that don't contribute to Mass Save (delivered fuels and municipal gas utilities) at a price that reflects its full cost per ton reduced, not just the CHC portion?
- What is an appropriate ACP level?
- What caps and carve-outs should the state establish?

Regulatory Analysis

Regulatory Analysis

- The goal of this analysis is to identify and analyze the high-level regulatory implications of the CHS for gas utilities
- Topics addressed include:
 - Examples of issues that regulators might need to address
 - Pros and cons of distribution utilities vs energy suppliers as the obligated entities
 - Transparency of CHC portfolios and plans
 - Implications of potential compliance cost pass-through, rider, and amortization
 - Interactions with new utility business models
 - Interaction of alternative compliance payments with utility performance incentives
 - Prudence and cost disallowance

What Could Go Wrong that Requires Regulatory Intervention?

Examples:

- A utility could focus more on bioenergy and less on electrification than would be optimal, in order to support its pipeline-based cost-of-service business model
- A utility could bias support toward its own rate-based non-pipeline alternatives (e.g., networked geothermal) instead of lower-cost credits that could be available from other programs
- A utility could develop and then select to favor “heat as a service” or financing programs/products using its own capital instead of market competitors offering lower-cost credits

Energy Suppliers vs. Distribution Utilities

- A key policy design question for the CHS as applied to natural gas is whether to have the distribution company or the energy supplier be responsible for compliance
- The Commission on Clean Heat and CECP indicate it would be suppliers, but at a recent forum in Connecticut a state presenter said that answer wasn't set yet
- The chart on the next page indicates some advantages and disadvantages of each approach

Gas LDCs vs. Energy Suppliers

Obligation on...	Advantages	Disadvantages
Gas distribution companies	<ul style="list-style-type: none"> • Mass Save coordination and overlap may be easier to manage • DPU can use performance incentives and distribute program risk between ratepayers and shareholders • Fewer obligated entities 	<ul style="list-style-type: none"> • Business model tied to long-term infrastructure use
Energy suppliers	<ul style="list-style-type: none"> • Parallel w/ delivered fuels and w/ RPS • Could spur innovative programs because more entities would have obligations (and they may not all love Mass Save) 	<ul style="list-style-type: none"> • Reluctance for long-term contracting/long-term planning (aside from regulated suppliers w/ DPU approval) • Disadvantages for LDCs carry over here in their energy supplier role

Transparency

- Regulated entities with compliance obligations (including default suppliers associated with the LDCs) should file detailed information about their CHC portfolios and their plans to meet future years' CHS obligations
- This information should include the cost, technology, location, and date of the action that created the CHCs
- A system akin to the NEPOOL GIS (which tracks REC ownership for RPS compliance) may be required to track ownership and eligibility of CHCs
- There is some risk that making their portfolio details public could disadvantage the suppliers in the market for CHCs (e.g., a seller could know what the utility paid for CHCs last year and adjust prices to match)
- However, since most LDC-associated CHCs can come from centralized programs, the transparency benefits likely outweigh any market impacts

Cost Pass-Through

- We assume that LDCs would pass through the cost of CHCs as they do the cost of Mass Save and the cost of fuel, and as electric suppliers pass through the cost of the RPS
 - This makes the utilities insensitive to the cost of CHCs: there's no *direct* incentive to select the least-cost portfolio
- May need to establish incentives to contain costs passed through (see later slides on performance-based ratemaking, ACPs, and prudence)
- Regulators should think carefully about whether to itemize the cost of the CHS on bills, like Mass Save; separate charges can help ensure funds are used for their intended purpose but can also be politically sensitive
- Because credits required would increase each year at a relatively rapid rate (reflecting the need for rapid action to meet GHG limits) and electrification and EE require upfront incentives, there could be a call for program cost amortization or for financing-based approaches to limit near-term rate and bill impacts
- Regulators should evaluate these carefully and be wary of the added lifetime costs associated with paying for capital, as well as interaction effects with declining utility sales and future rate increases

New Business Models

- A CHS interacts with discussions of new business models for LDCs, such as networked geothermal or “heat as a service” offerings
 - Networked geothermal systems are shared heating and cooling resources that could use the gas main right of way
 - “Heat as a service” is an approach in which customers pay for heat delivered, and the utility owns (and earns a return on) the hardware. This model could overcome split incentives in landlord/tenant situations and allow an interested expert entity to manage/optimize energy use and equipment.
 - It’s not clear that gas utilities should be the entities empowered to develop such programs. If they did, they could cross-subsidize with the traditional business to limit the risk of “death spiral” rate effects. Other players may also be interested in playing this role, and there is no need for a franchised natural monopoly.
- Regulators should regulate how utilities select to purchase CHCs from these new affiliated businesses, and whether the CHC prices paid are reflective of the market price and are a good deal for ratepayers, looking across all options

Performance-Based Ratemaking and ACPs

- If the LDCs are involved (but more easily if their regulated role is obligated), the DPU could establish performance incentives for achieving CHS compliance or otherwise supporting the policy
- Alternatively, could simply make utility shareholders responsible for paying any ACP
- Positive performance payments (akin to Mass Save shared savings approach) are more expensive for ratepayers, but also have a regulatory history

Prudence and disallowance

- Is an ACP sufficient deterrence for bad behavior with respect to CHS portfolio construction?
 - If utilities know their shareholders will be on the hook for falling short in the future, they may be sufficiently motivated not to choose dead-end pathways
 - Caps and carve-outs can still shape their plans and lower risk of dead ends
- If ACP costs are not passed to shareholders, then caps and carve-outs are even more necessary to shape utility behavior regarding electrification and biogas
- Prudence review of Clean Heat portfolios—covering cost and performance—could feature in rate cases
- If Clean Heat is highly planned and coordinated with Mass Save, then pre-approval and review as part of the Mass Save 3-year planning cycle (or its successor) could reduce the use of subsequent prudence review

Summary of Key Open Regulatory Questions

- Is the CHS obligation on the gas distribution utility or the gas supplier?
- How much information should be made public about CHS compliance, and through what mechanism/process?
- What incentives or disincentives should be established to support CHS cost containment?
- Who is responsible for paying ACPs—shareholders or ratepayers?

Appendix: Clean Heat Credit Costs

Method

- Clean Heat Credits (CHCs) are the expected compliance instruments for a CHS
- Each CHC represents one ton of emissions reduction in a given year
- By economic theory, CHCs should have a cost equal to the amount required to pay decision-makers to choose the low-carbon option
- For commodities like biofuels, this cost should equal the difference between the cost of production (plus profit) for the biofuel and the cost of the fossil fuel option
- For programs like electrification and efficiency, the cost depends on market uptake and may vary from the actual cost difference
 - Mass Save offers incentives that cover a portion of the difference and obtains some rate of uptake; a larger incentive could achieve a larger uptake
- These values do not reflect any federal \$ support, such as from the Inflation Reduction Act
 - The IRA includes support for all major options: biomethane, electrification, and efficiency

Electrification and Efficiency

- CHC cost depends on whether Mass Save funding is also available and funding the same measures. In that case, CHC cost would only need to cover the difference between Mass Save and the incentive level required to meet the emissions goal.
- We present three costs for each end use and sector:

TRC	Mass Save incentive level	Customer incremental cost
<ul style="list-style-type: none">• Entire upfront cost difference between the baseline and the low-carbon option	<ul style="list-style-type: none">• Cost required to achieve emissions reductions at the same rate as Mass Save, if Mass Save were to exit these measures	<ul style="list-style-type: none">• Difference between Mass Save level and the TRC• Represents cost a CHC would reflect if it bridged the difference between present Mass Save incentive levels and the TRC

- *The values presented here are for 2025, in \$2022. The costs per ton fall slightly for later years for electrification measures due to the fall in grid emissions.*
- *These values reflect the weighted average across the specific measures within each group, weighted by the Mass Save program administrators' plan for 2022-24*
- *The specific measures vary between residential and income-eligible, so these values should be used as indicative CHC costs within a given end use and sector*

Electrification and Efficiency

Sector	Base fuel	End use	TRC-based CHC cost (\$/metric ton)	Mass Save-based CHC cost (\$/metric ton)	Customer cost-based CHC cost (\$/metric ton)
Residential	Oil	HVAC	\$205	\$83	\$122
Residential	Oil	Envelope	\$206	\$154	\$52
Residential	Oil	Hot Water	\$4	\$56	-\$52
Residential	Propane	HVAC	\$243	\$109	\$134
Residential	Propane	Envelope	\$236	\$163	\$72
Residential	Propane	Hot Water	\$70	\$16	\$54
Income Eligible	Oil	HVAC	\$281	\$281	\$0
Income Eligible	Oil	Envelope	\$106	\$106	\$0
Income Eligible	Oil	Hot Water	\$235	\$235	\$0
Income Eligible	Propane	HVAC	\$331	\$331	\$0
Income Eligible	Propane	Envelope	\$57	\$57	\$0
Income Eligible	Propane	Hot Water	\$450	\$450	\$0
Commercial	Oil	HVAC	\$87	\$61	\$26
Commercial	Propane	HVAC	\$44	\$31	\$13
Residential	Gas	HVAC	\$409	\$156	\$253
Residential	Gas	Envelope	\$194	\$159	\$35
Residential	Gas	Hot Water	\$52	\$23	\$29
Income Eligible	Gas	Envelope	\$151	\$151	\$0
Commercial	Gas	HVAC	\$446	\$312	\$134
Commercial	Gas	Envelope	\$482	\$241	\$241

Electrification and Efficiency Take-Aways

- Hot water electrification measures tend to cost less, across all fuel types
- Building envelope efficiency is an attractive measure—almost always lower cost per ton (TRC) than HVAC electrification (especially for residential gas customers).
 - Costs generally in the \$200/ton range for TRC
 - The pace of envelope work may be harder to accelerate from Mass Save baseline than HVAC electrification would be; Mass Save already covers ~3/4 of incremental cost of envelope work
- Delivered fuel HVAC electrification is lower TRC cost per ton than gas, esp. for commercial
 - Gas HVAC electrification ~\$400-\$450/ton vs. oil and propane \$40-\$250/ton
 - Current Mass Save incentives (per CHC or ton) also reflect this difference

Biofuels

- CHC prices reflect the incremental cost of the biofuel option relative to the fossil fuel baseline, divided by the reduction in lifecycle emissions.
- For these results, we have used the California Low Carbon fuel Standard (LCFS) values for biofuel emissions. These are placeholders pending determinations from Mass DEP regarding emission rates to assume for biofuels of different types and from different sources.
 - Based on the CECs for 2025/2030 and 2050, we expect Mass DEP to update accounting methods for methane and biofuels. Mass DEP may find lower GHG benefits for fuels used in Massachusetts, which would increase the cost per ton for these credits.

Heating Oil Alternatives

- Biodiesel B20 and Renewable Diesel both sell for less than fossil diesel, thanks to federal subsidies.
- Therefore, we assume that B20 and Renewable Diesel have a \$0 CHC cost.
- In the event of a CHS, we expect these fuels to rapidly grow and take over the heating oil market.
- B20 offers a 7% emission reduction relative to B5, which we believe to be today's baseline level of biodiesel blending.
 - Biodiesel blends above B20 (e.g., B100) require hardware changes in consumer boilers, and we expect this to be a substantial barrier to those blends.
- Renewable diesel offers a 63% reduction relative to B5, so this fuel could see a rapidly rising market share under a CHS. Renewable diesel does not face blend limits but is also less available than biodiesel.
 - Renewable diesel production is smaller than biodiesel production and growing rapidly (DOE reports a more than tripling of domestic production capacity in the pipeline). It is primarily targeted at the California market.
- There are no biofuel alternatives to propane available in the market today

Biomethane

Fuel Source	Emissions (gCO ₂ e/MJ)	Avoided Emissions (kgCO ₂ e/MMBtu)	Incremental Fuel Cost Range (\$/MMBtu)	CHC Cost Range (\$/metric ton)	Low Potential* (MA, TBTU/year)	High Potential* (MA, TBTU/year)
Landfill Gas	56	9.7	\$3.60-\$15.50	\$370-\$1,595	5.67	9.34
Animal Manure			\$14.90-\$29.10		0.10	0.21
Dairy	-164	241.8		\$62-\$120	0.10	0.21
Swine	-164	241.8		\$62-\$120	0.00	0.00
Poultry	31	35.9		\$415-\$811	0.00	0.00
Waste Recovery Facility	56	9.7	\$3.90-\$22.60	\$401-\$2,325	0.62	0.86
Food Waste	31	36.1	\$15.90-\$24.80	\$440-\$687	0.81	1.42
Agri. Residue	31	36.1	\$14.80-\$23.90	\$410-\$662	0.01	0.03
Forest Residue	31	36.1	\$13.80-\$25.70	\$382-\$712	0.61	1.22
Energy Crops	31	36.1	\$14.80-\$27.70	\$410-\$767	0.04	0.08
Muni Solid Waste	31	36.1	\$13.80-\$40.70	\$382-\$1,128	6.55	14.78

*: Potential for Massachusetts based on *Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment*, American Gas Foundation

Biomethane

- The large majority of Massachusetts-sourced biomethane would be available from landfills and municipal solid waste, followed by waste recovery, food waste, and forest waste.
- All of these sources have credit costs starting around \$370/ton and up
- A small amount of dairy biomethane may be available at a lower cost per ton avoided
 - Regionally, dairy has a larger potential (e.g., Vermont dairy cows) although lack of pipeline access and the number of small farms have historically been significant barriers to accessing this resource