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Clean heat standards handbook

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Executive summary

Legislators around the world are developing innovative policy tools called clean heat standards. This handbook provides insights on the role these tools can play in national or regional climate policies, and contains detailed recommendations on how to design such instruments.

In most countries, fossil fuels are still used to provide space and water heating in buildings, and for industrial process heat. Solutions exist to reduce the use of these fuels and their climate impacts. These include energy efficiency measures, such as improving building insulation, and fuel switching, including the electrification of space and water heating through heat pumps.

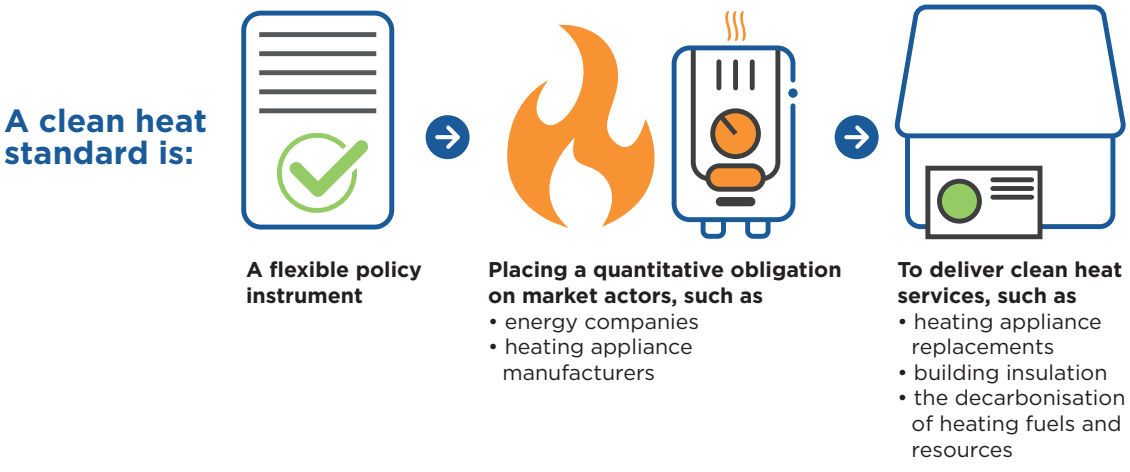
There are barriers to the mass deployment of clean heating solutions, however. For example, building owners might face high upfront costs and challenges in accessing financing. Many households already struggle to pay their energy bills, making any further investments even more complicated.

Decision-makers around the world are, therefore, developing policy frameworks to decarbonise the heating sector. Designing effective and equitable policies requires the use of a suite of different instruments, making heat decarbonisation an area ripe for policy innovation.

In many jurisdictions, the policies in place do not set a clear trajectory for the deployment of clean heat solutions, preventing the market from supporting the timely achievement of climate goals.

One emerging policy solution is the clean heat standard. As shown in Figure 1, this tool places a performance requirement on heating market actors to increase the uptake of clean heat products and services, offering flexibility within a range of eligible actions. Obligated parties can, for example, decide to conduct the activities themselves or hire a third party. A policy mechanism of this kind can provide a smoother and swifter pathway to decarbonisation than equipment standards alone, and can complement wider policy and market reforms that support clean heating.

Figure 1. Elements of a clean heat standard



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This handbook guides decision-makers and stakeholders through the main aspects of clean heat standard design, namely:

Characteristics of a clean heat standard | **Step 1. Assess the potential role** | **Step 2. Design the obligation** | **Step 3. Create flexibilities** | **Step 4. Ensure compliance**

Characteristics of a clean heat standard

Clean heat standards are flexible instruments that policymakers can tailor to meet different needs. Depending on its design, a clean heat standard can secure a minimum trajectory for the deployment of clean heat technologies. Several jurisdictions have developed or are in the process of developing a clean heat standard.

- In the United States, the state of Colorado has imposed a clean heat planning and performance obligation on the largest pipeline gas utilities. Other states, including Vermont, Massachusetts and Maryland, are developing clean heat requirements for both gas and other energy companies. In all these states, the clean heat standard would require energy companies to achieve greenhouse gas (GHG) reductions in the heating sector. These U.S. standards reward both actions promoting renewable heat consumption, such as heat pump installations, and actions reducing heat demand, such as building renovations.

- The United Kingdom is developing a different approach. Inspired by CO2 targets for new vehicles that apply to car manufacturers, the UK will obligate heating system manufacturers to deliver a rising proportion of heat pumps in their annual sales, or to purchase credits from other fossil fuel manufacturers or heat pump manufacturers.

Understanding who pays for and who benefits from a clean heat standard is important to make provision for and prioritise those groups which face the greatest barriers to accessing affordable, clean heat, and to minimise the cost passed on to them. With a clean heat standard, obligated parties will pass compliance costs on to their customers. The way these costs are distributed is important, because low-income households are more likely to be disproportionately affected and might not be able to switch to clean heat solutions. In the same way, only a small group of heat users will benefit from the clean heat standard each year, and it is important to ensure that obligated parties prioritise low-income households.

Assessing the potential role of a clean heat standard

Once a jurisdiction confirms its interest in implementing a clean heat standard, the next step is to assess the role that the standard could play. To do that, an understanding of the heat decarbonisation challenge and related policy gaps is required, including an assessment of the difficulties faced by some groups seeking to access affordable heat.

The use of heat in each sector can vary from one jurisdiction to another, potentially influencing the scope that the clean heat standard would cover. The appropriateness of different heat decarbonisation solutions and the barriers to their mass deployment also vary across jurisdictions. Bearing this in mind, decision-makers can design decarbonisation pathways that best suit their local circumstances.

If implementing a clean heat standard can add value to other heat decarbonisation policies, it is necessary to review possible interactions between the clean heat standard and these policies. Depending on its design, a clean heat standard can complement these policies and secure an increased level of activities in the clean heat sector. Clean heat standards on their own will not, however, solve all issues related to heat decarbonisation. They are most effective in a comprehensive policy mix. Heat planning tools are particularly important to ensure coherent and geographically-sensitive heat decarbonisation.

Designing the obligation

The next step for decision-makers interested in implementing a clean heat standard is to design the obligation. This requires identifying obligated parties and setting targets.

Within the clean heat standards already operating, under development or under consideration around the world, there are two types of obligated parties: energy companies and heating appliance manufacturers. These two models of clean heat standards have varying market leverage and distributional impacts, although both can play a role as part of a comprehensive policy framework for heat decarbonisation.

Depending on the objective of the clean heat standard, its target can be set in terms of CO2 reductions, or by using another metric such as the number of clean heat installations. Sub-targets can help achieve additional policy objectives, for example to prioritise groups of beneficiaries or to foster innovation.

Creating flexibilities

Decision-makers can introduce further flexibilities to ensure a cost-effective achievement of the target without compromising the goals of the tool. These include the possibility for obligated parties to 'bank' and 'borrow' credits from one obligation period to another, trade compliance credits with other obligated parties or third parties, and buy out part or all of their obligation.

It is important to carefully design these flexibilities so that they do not compromise achievement of the objectives. For example, the scheme's rules could allocate the fees paid by obligated parties buying out some of their obligation to another entity tasked with achieving clean heat actions.

Ensuring compliance

Finally, a number of design options relate to the compliance framework of the clean heat standard. These involve the assignment of administrative tasks, the rules to credit clean heat actions, and the penalties and incentive regime.

These decisions have a major impact on the functioning of the tool and the achievement of its objectives. It is, for example, crucial to set penalties in case obligated parties do not achieve their targets. The level and credibility of these penalties is important to secure progress towards the objectives of the clean heat standard.

Recommendations

This handbook asserts that, while each jurisdiction might face different priorities when it comes to heat decarbonisation, clean heat standards are flexible instruments that can be tailored to meet different needs. There is no one-size-fits-all design of a clean heat standard, and the authors of this handbook invite decision-makers to launch a dialogue with stakeholders to design an effective and equitable heat decarbonisation framework.

We recommend that decision-makers assessing the potential role for a clean heat standard in their jurisdiction:

1. **Consider the specificities of the heating sector,** and where barriers to investments prevent the mass deployment of clean heat solutions.

2. **Place equity issues at the core of the policy design process,** including by putting in place inclusive consultation processes involving all communities that will be impacted directly or indirectly.

3. **Favour pathways that bring long-term benefits to people and the environment.** Some solutions might bring GHG savings but create a lock-in to fossil fuel-based systems or cause other environmental damages.

4. **Reflect on the different design options for the clean heat standard,** noting that these will influence the outcome of the policy, and that there is no one-size-fits-all solution.

5. **Explore whether sub-targets can help** achieve additional policy objectives, such as the prioritisation of target groups of beneficiaries. This can improve the contribution of the tool to an equitable energy transition.

6. **Look into complementary policies** that would further advance heat decarbonisation, considering that a comprehensive policy mix is needed to address all the barriers.

Contents

Be on the lookout for:

Zooms offer context for topics mentioned in the main text. A zoom might delve deeper into a subject, present information about a case study or contain examples from other sectors.

Checklists consist of a series of questions for policymakers to consider when developing a clean heat standard.

Examples pages list clean heat standard policies, or aspects thereof, which directly relate to the discussion in the preceding chapter.

Introduction

The challenge

Heat decarbonisation is a central element of climate policies in many countries. At the same time, heating is an essential service. Access to affordable heating services is a challenge for a lot of households, and therefore many governments, around the world.

Heat supply was responsible for almost 40% of global energy-related CO2 emissions in 2021.[1]

The need for clean heat policies

Cost-effective technical solutions to decarbonise the heat sector exist, but the barriers to investment by millions of building owners are high, and the impacts on the energy network infrastructure significant. Coordinated policy action is required to chart a path through this complex transition.

Many countries provide financial incentives, employ fiscal measures or use regulation to tilt the market towards cleaner heat. The pace of change needs to accelerate, however, if climate goals are to be met. Policymakers around the world are currently grappling with this problem.

Clean heat standards

One policy solution is a clean heat standard, which is a low-emission performance standard applied to the provision of heating services and equipment.

This policy places an obligation to deliver clean heating solutions on market actors in the heating sector, and provides some flexibility in how to achieve this target.

[1] International Energy Agency (IEA). (2023). *Renewable Heat*. https://www.iea.org/reports/renewables-2022/renewable-heat

Why this handbook?

As more jurisdictions turn their attention towards accelerating heat decarbonisation, there is a growing interest in clean heat standards, alongside the recognition that they can complement other policies.

This handbook collects initial recommendations for decision-makers and stakeholders interested in the design of clean heat standards. As experience with clean heat standards around the world is quite limited, the recommendations reflect the authors' extensive knowledge of similar policy tools in energy efficiency, renewable energy and transport policy.[2]

These recommendations consider that the equitable decarbonisation of heat requires policies that make provision for and prioritise those who face the greatest barriers to accessing affordable, clean heat, and minimise the cost passed on to these groups.

RAP created this handbook to share expertise gleaned from our work supporting decision-makers in developing clean heat standards.[3]

How to use this handbook

Decision-makers and stakeholders can read this handbook in the order it has been prepared, or skip directly to the section they have an interest in.

- **The preliminary chapter** describes the characteristics of clean heat standards.
- **Step 1** explores the role a clean heat standard can play in addressing clean heat challenges.
- **Step 2** provides information on designing the obligation.
- **Step 3** describes possible flexibility mechanisms under a clean heat standard.
- **Step 4** examines the design of the compliance mechanisms of a clean heat standard.

[2] Crossley, D., Gerhard, J., Lees , E., Kadoch, C., Pike-Biegunska, E., Xuan, W., Watson, E., Wasserman, N., & Sommer, A. (2012). *Best practices in designing and implementing energy efficiency obligation schemes*. Task XXII of the International Energy Agency Demand Side Management Programme. https://www.raponline.org/knowledge-center/best-practices-in-designing-and-implementing-energy-efficiency-obligation-schemes; Lees, E. & Bayer, E. (2016). *Toolkit for Energy Efficiency Obligations*. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/toolkit-for-energy-efficiency-obligations; International Energy Agency (IEA). (2017). *Market-Based Instruments for Energy Efficiency. Policy Choice and Design*. https://www.iea.org/reports/market-based-instruments-for-energy-efficiency

[3] Santini, M., Cowart, R., Thomas, S., Gibb, D., Lowes, R. & Rosenow, J. (2023). *Clean heat standards: New tools for the fossil fuel phaseout in Europe*. RAP. https://www.raponline.org/knowledge-center/clean-heat-standards-new-tools-for-fossil-fuel-phaseout-in-europe; Cowart, R., & Neme, C. (2021). *The Clean Heat Standard*. Energy Action Network. https://www.raponline.org/knowledge-center/the-clean-heat-standard; Cowart, R., Seidman, N. & LeBel, M. (2022). *A Clean Heat Standard for Massachusetts*. Prepared for the Massachusetts Executive Office of Energy and Environmental Affairs. RAP. https://www.raponline.org/knowledge-center/clean-heat-standard-massachusetts; Cowart, R., Seidman, N., LeBel, M. & Weston, F. (2023). *Meeting the Thermal Challenge: A Clean Heat Standard for Maryland*. Prepared for the Maryland Department of the Environment. RAP. https://www.raponline.org/knowledge-center/meeting-thermal-challenge-clean-heat-standard-maryland

Characteristics of a clean heat standard

A review of the different models of clean heat standards currently implemented or considered around the world will aid understanding of their main design features, and the distributional impact of introducing such a tool.

Defining a clean heat standard

Clean heat standards place a performance requirement on heating sector market actors to increase the uptake of clean heat products and services, while giving these actors some flexibility in how they comply.

Examples

Clean heat standards can take different forms, depending on the obligated parties and their desired clean heat actions.

More information about these examples can be found in Further resources.

- In several U.S. states, legislators are opting for an obligation on heating fuel suppliers to provide rising levels of clean heat services. These energy companies can reach their obligation through multiple pathways including, for example, electrification through heat pumps, biogas blending, biomass boilers, and demand reduction through fabric efficiency improvements.

- In the United Kingdom, the 'Clean Heat Market Mechanism' is due to come into force in 2025. It will require fossil fuel heating appliance manufacturers to surrender credits establishing that a certain number of heat pumps have been installed in the UK. These targets are proportionate to their fossil fuel boiler sales. Manufacturers may meet their obligations by shifting their production, or by purchasing credits from other fossil fuel heating manufacturers or heat pump manufacturers. This is the only currently available example of a clean heat standard on space heating appliance manufacturers.[4]

Similar policies in other sectors

The U.S. examples rely on long experience of setting obligations related to energy efficiency and renewable energy on energy companies, while the UK model builds on the design of a zero-emission vehicle mandate for manufacturers of cars and vans.[5] Both models require obligated parties to engage with heat users and support their transition to clean heat, either directly or through third parties.

[4] The Japanese government is developing a requirement for water heater manufacturers to achieve target indexes, based on their fossil energy consumption and sales volumes, and taking into account factors such as climate and the size of tanks. Tosaka, N. (2023, 13 December). *Demand-side energy policies and strategic approaches in each country* [Workshop remarks]. EMAK12: Evolution of Energy Efficiency Policies into Demand-Side Energy Policies, Paris, France. Workshop with Japan Ministry of Energy, Technology and Industry (METI)). https://energyefficiencyhub.org/resources/emak-12-evolution-of-energy-efficiency-policies-into-demand-side-energy-policies/

[5] Department for Transport. (2023). *A zero emission vehicle (ZEV) mandate and CO2 emissions regulation for new cars and vans in the UK*. https://www.gov.uk/government/consultations/a-zero-emission-vehicle-zev-mandate-and-co2-emissions-regulation-for-new-cars-and-vans-in-the-uk

A broad definition

Across the globe there is a great deal of experience with performance standards applied to energy suppliers, especially energy efficiency and renewable energy delivery requirements. These mechanisms vary considerably across jurisdictions.

Our definition of clean heat standards is similarly wide-ranging. It applies to commercial suppliers of fossil heating fuels or equipment, but not to their customers or end users. The scope of a clean heat standard can range from quite narrow to very broad.

- On the narrow end, there are standards that simply require suppliers to deliver a minimum fraction of renewable heating solutions, such as the liquid biofuels blend in New York,[6] the renewable energy requirements adopted or under consideration in France and Ireland,[7] or the forthcoming heat pump manufacturing requirement in the UK.

- On the broader and more flexible end is the version set out in Vermont's legislation, which applies to all fossil heat providers and permits a wide range of clean heat resources to earn credits.

While any of these performance standards could qualify as a clean heat standard, we are particularly interested in solutions that give obligated parties the flexibility that is often required to address the needs of different heat users and real-world market barriers.

Our definition excludes conventional equipment standards and building codes, because these tools regulate the performance of individual equipment or buildings, while clean heat standards apply to fleets of equipment.

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[6] Oil and Energy Online. (2023). *New York State Enacts Low-Carbon Heating Fuel Law*. https://oilandenergyonline.com/articles/all/new-york-state-enacts-low-carbon-heating-fuel-law

[7] France puts an obligation on gas suppliers to file green certificates that they can obtain by directly injecting biogas into a gas network or by purchasing them from biogas producers. République Française. (2022). *Décret no 2022-640 du 25 avril 2022 relatif au dispositif de certificats de production de biogaz*. [Decree no. 2022-640 of 25 April 2022 related to the system of biogas production certificates]. https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000045653118. Ireland is considering an obligation on all heat fuel suppliers to achieve a heat obligation rate. Government of Ireland. (2021). *Consultation on the Introduction of a Renewable Heat Obligation*. https://www.gov.ie/en/consultation/7bc5b-consultation-on-the-introduction-of-a-renewable-heat-obligation

Main design features

Clean heat standards can secure an increased level of activities in the clean heat sector and a minimum trajectory for the deployment of clean technologies. The nature of the trajectory depends on the design of the obligation.

Obligation

Clean heat standard targets can be expressed in many ways. These include the number of installations or sales of certain products, the amount of GHG reductions achieved or local air pollutants removed, the amount of renewable heat supplied, and so on.

Obligated parties

Clean heat standards apply to market actors such as energy network companies, energy suppliers, and manufacturers of heating equipment.

Creditable actions

The provision of clean heat services under a clean heat standard can derive from upstream interventions, such as replacing fossil fuels with renewable fuels, or downstream interventions, including the replacement of heating appliances and actions to lower heat demand – or from a combination of the two.

Clean heat standards use market forces, as they encourage the search for cost-effective solutions. Obligated parties have some flexibility in how they fulfil their obligations. In some schemes they can buy credits from other obligated parties who exceed their target, or from an open market for compliance credits. This makes it possible to reward overachievers and provide a solution for companies struggling to meet their target.

Distributional impacts

Access to clean and affordable heat is a challenge in many jurisdictions. It is vital that the policy framework for heat decarbonisation contributes to solving the issue and does not make this situation worse.

Almost 10% of the EU population were unable to keep their homes adequately warm in 2022.[8]

Understanding who pays for and who benefits from the clean heat standard should inform its design, ensuring it does not negatively impact those who are already struggling to access clean and affordable heat. Indeed, without further incentives or requirements to prioritise vulnerable groups, a clean heat standard would not naturally improve access to clean and affordable heating solutions for those who need it most. It is also crucial to consider the impact of other decarbonisation policies on these populations.

Who pays?

Obligated parties under a clean heat standard pass compliance costs on to their customers; it is expected that obligated parties will seek to keep these costs to a minimum. Low-income households are more likely to be disproportionately affected by these costs, however, and might not be able to limit them by switching to clean heat solutions.

The design features of a clean heat standard will affect the level of these costs, the groups that will ultimately bear them, and how they will be distributed.

Who benefits?

While the financial impact of the clean heat standard will be spread across many customers, only a relatively small number of energy users will benefit from the clean heat actions deployed by obligated parties each year. Without specific requirements, obligated parties are likely to prioritise actions among wealthier groups, as these groups will need less financial support to switch to clean heat solutions.

Sub-targets or supporting policies can ensure that the clean heat standard prioritises low-income households and other vulnerable groups.

[8] European Commission. (2023). Commission Recommendation (EU) 2023/2407 of 20 October 2023 on energy poverty. https://eur-lex.europa.eu/eli/reco/2023/2407/oj

Step 1. Assess the potential role

The first step for decision-makers interested in implementing a clean heat standard is to assess the role that the standard could play in their jurisdiction.

Context: Heat decarbonisation, access and affordability

A good understanding of the heat decarbonisation challenge requires looking at the status quo and identifying the barriers in place. Designing decarbonisation pathways that best suit local circumstances involves paying specific attention to equity issues, considering that access to affordable heating is a challenge in many localities around the world.

The dominant role of fossil fuels

The heating sector remains heavily dependent on burning fossil fuels, with renewables representing only a modest share, as described below. While the situation varies significantly between jurisdictions,[9] in many countries limited progress to date and the widespread use of high-carbon fossil fuels like oil and gas mean that substantial effort, alongside major policy and market reform, will be required to shift to renewable heat.

Around 33% of global energy use is in industry, the vast majority of which is for process heat.[11] Space and water heating is by far the largest energy end-use in buildings.[12]

The industrial and building sectors are the main consumers of heat with, respectively, 53% and 44% of heat final energy consumption globally.[10] The use of heat in each sector can vary from one jurisdiction to the other, potentially influencing the scope that new policy tools such as clean heat standards would cover.

In many countries, there are growing demands for cooling, associated with growing carbon emissions. While our report does not focus on this important decarbonisation challenge, the same equipment might be used for heating and cooling. It should be noted that the growth of cooling demand could support the deployment of reversible heat pump systems, which may be a valuable consumer offering.

Clean heat solutions

Solutions to decarbonise heat include the reduction of heat demand and the deployment of renewable heat. Reaching global climate goals requires a combination of these solutions,[13] the potentials of which vary across jurisdictions.

- It is possible to reduce heat demand in buildings by improving the envelope, switching to more efficient heating appliances, and cutting wasteful heat consumption through behaviour changes. Industry can increase the energy efficiency of its processes and reduce heat demand by, for example, insulating pipes carrying heat or ensuring heat recovery.

- Renewable heating can stem from the use of ambient heat, solar radiation, and renewably sourced electricity or fuels. The beneficial electrification of space and water heating is a key element of heat decarbonisation strategies.[14] Installing electric heat pumps can achieve both energy use reduction and the decarbonisation of energy sources.[15] Increasing a building's ability to operate flexibly can help ensure that it consumes electricity at times when it is supplied by decarbonised sources.[16] Electrification of heat is also possible in a number of industrial sectors.

[9] Gross, R. & Hanna, R. (2019). Path dependency in provision of domestic heating. *Nat Energy* 4, 358–364 (2019). https://doi.org/10.1038/s41560-019-0383-5
[10] IEA. (2023). *Renewable Heat*. https://www.iea.org/reports/renewables-2022/renewable-heat
[11] REN21. (2023). *Renewables 2023 Global Status Report Collection, Renewables in Energy Demand*. https://www.ren21.net/gsr-2023/modules/energy_demand/02_industry_in_focus
[12] IEA. (n.d.). *Heating*. https://www.iea.org/energy-system/buildings/heating
[13] IEA. (2023). *Renewables 2022*. https://www.iea.org/reports/renewables-2022/renewable-heat
[14] RAP. (n.d.). *Beneficial electrification*. https://www.raponline.org/toolkit/beneficial-electrification/
[15] Lowes, R., Gibb, D., Rosenow, J., Thomas, S., Malinowski, M., Ross, A. & Graham, P. (2022). *A Policy Toolkit for Global Mass Heat Pump Deployment*. RAP, CLASP and the Global Buildings Performance Network. https://www.raponline.org/knowledge-center/policy-toolkit-global-mass-heat-pump-deployment

The barriers to clean heat deployment

Most of the solutions to decarbonise heat are technologically mature, but the speed of their deployment is not in line with climate goals. Indeed, there are barriers to investments in clean heating, which impact the costs and benefits associated with different decarbonisation pathways. Some of these barriers are explored **below**.

Difficulty in accessing clean and affordable heat

In many jurisdictions around the world, there are barriers which reduce access to affordable and clean heating for specific groups. Lower-income households and other vulnerable groups already experience higher energy burdens than other households and therefore may ration heat, leading to serious health and other wellbeing impacts.

The recent energy price volatility and the high cost of gas improve the economics of switching to clean heating solutions. For lower-income households, however, higher prices make all forms of heating – and most other household expenses – less affordable.[17] The fossil fuel price volatility intensifies existing budget pressures, added to which evidence is mounting that fossil-fuelled heating will likely become more expensive over time.[18]

In 2020, more than a quarter of all households in the United States reported difficulty paying energy bills or having kept their home at an unsafe temperature because of energy cost concerns.[19]

This understanding requires a swift refocussing of both decarbonisation and affordability policies. A good grasp of the economic and structural inequities at the root of this problem, as well as a proper identification of the impacted communities and their needs, can help decision-makers design equitable heat decarbonisation policies.

[16] Yule-Bennett, S. & Sunderland, L. (2022). *The joy of flex: Embracing household demand-side flexibility as a power system resource for Europe*. RAP. https://www.raponline.org/knowledge-center/joy-flex-embracing-household-demand-side-flexibility-power-system-resource-europe

[17] Sunderland, L. & Gibb, D. (2022). *Taking the burn out of heating for low-income households*. RAP. https://www.raponline.org/knowledge-center/taking-burn-out-of-heating-low-income-households

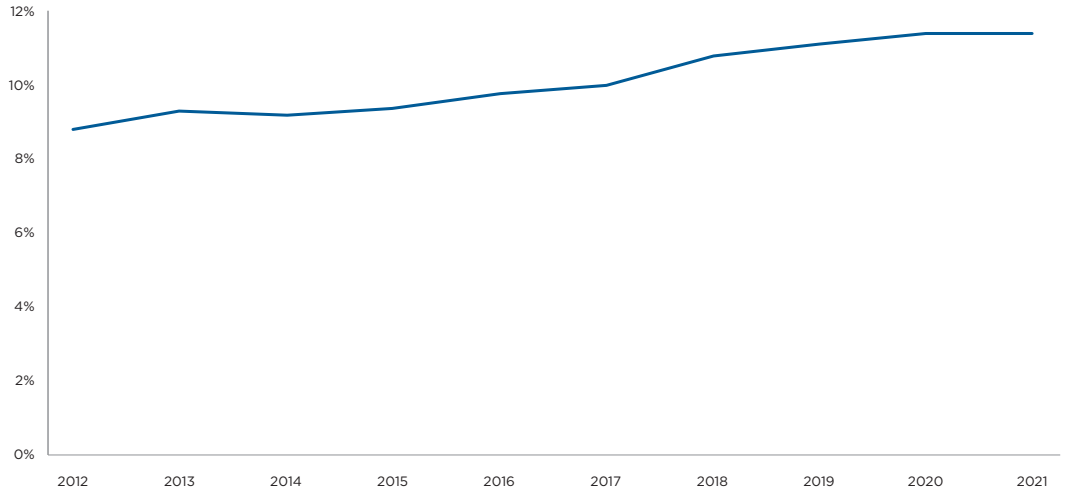
[18] Lowes, R. (2023). *Decompression: Policy and regulatory options to manage the gas grid in a decarbonising UK*. RAP. https://www.raponline.org/knowledge-center/decompression-policy-regulatory-options-manage-gas-grid-decarbonising-uk

[19] U.S. Energy Information Administration. (2022). Residential Energy Consumption Survey (RECS). https://www.eia.gov/todayinenergy/detail.php?id=51979

Zoom: Progress and barriers to clean heat deployment

The heating sector remains heavily dependent on burning fossil fuels, including coal, oil and gas. Renewable heat represents only a modest share of total heat consumption, as Figure 2 shows.[20]

Figure 2. Share of modern renewable heat in total heat consumption (world, 2012-2021)



Source: International Energy Agency. (2022). World Energy Outlook 2022.

In this figure, 'modern renewable energy' excludes traditional uses of biomass and covers the direct and indirect (e.g. through district heating) final consumption of bioenergy, solar thermal and geothermal energy, as well as renewable electricity for heat. Ambient heat harnessed by heat pumps is not considered due to data insufficiency, especially in industry.

Solutions to decarbonise heat include the reduction of heat demand and the deployment of renewable heat, as Figure 3 illustrates.

Figure 3. Solutions to decarbonise heat uses

Reduction of heat demand
Solutions include:

- Improvement of building envelopes
- Improvement of energy efficiency of heat industrial processes
- Installation of efficient heating appliances
- Behaviour changes

Deployment of renewable heat, including electrification
Solutions include:

- Installation of heating appliances using renewable energy sources (individual or central heating systems, district heating)
- Use of electricity or other carriers based on renewable energy

[20] IEA. (2022). World Energy Outlook 2022. IEA, Paris. https://www.iea.org/reports/world-energy-outlook-2022

There are barriers to making investments like these in clean heating, however. For example:

- Households face economic obstacles such as high upfront costs for first-time heat pump installations,[21] and non-economic hurdles such as a lack of consumer information, constraints on supply chains and installers, and, where homes are rented, split incentives between landlord and tenant.[22] Many of these barriers are higher for low-income households.[23]

- In the industrial sector, clean heat projects might face internal competition for capital, especially if their payback period is longer than for other projects. In some jurisdictions, a lack of regulatory requirements prevents a focus on heat decarbonisation.

- In many localities, the price ratio of electricity to fossil gas is unfavourable, deterring the adoption of heat pumps.[24]

- Most heating equipment has a relatively long lifetime. This means that the opportunities to replace the equipment at the end of its natural life are rare. Even if fossil fuel equipment is phased out of the market, it would take a long time to fully decarbonise the fleet.

- A lack of planning and coordination between public and private actors can prevent the enactment of solutions such as district heating.

- Uncertainty regarding the future status of incumbent infrastructure, including the gas network, can alter the investment climate for clean heat solutions.[25]

[21] Lowes et al., 2022.
[22] Landlords who do not pay energy bills are not motivated to save money through energy efficiency investments, and tenants, who may not permanently occupy a home, are not motivated to make the investment in more efficient appliances.
[23] Sunderland & Gibb, 2022.
[24] Rosenow, J., Thomas, S., Gibb, D., Baetens, R., De Brouwer, A. & Cornillie, J. (2022). *Levelling the playing field: Aligning heating energy taxes and levies in Europe with climate goals*. RAP and 3E. https://www.raponline.org/knowledge-center/aligning-heating-energy-taxes-levies-europe-climate-goals
[25] Anderson, M., Rosenow, J. & Cowart, R. (2022). *The clash with gas: Should it stay or should it go?* RAP. https://www.raponline.org/knowledge-center/clash-with-gas-should-it-stay-or-should-it-go

Policy gaps

A good understanding of the existing clean heat policies is needed to determine the value a clean heat standard would add in a given jurisdiction. It is important to understand which groups bear the costs of clean heat policies and which groups benefit from them.

Assessing the contribution of subsidy schemes

Subsidies, including grants, tax rebates and loans, provide financial means to access clean heat. Their effectiveness depends on the policy design and whether beneficiaries also face non-economic barriers to accessing clean heat solutions. For instance, a subsidy programme may be undersubscribed because financial incentives are inadequate, scheme rules are too complex, or people are unaware of its existence. It may also lack resources to achieve the desired level of clean heat action.

Resources for subsidies financed from general budgets come from general taxation. These revenues are mostly drawn from a mixture of taxes on consumption, income and other sources, which spreads the costs of subsidies over a large number of contributors.

In some jurisdictions, subsidy policies are designed to benefit specific priority groups like low-income households.[26]

Carbon taxes affect low-income households most, while having a relatively modest impact on fossil energy consumption across the economy. They work best alongside other policies that tackle barriers to action and address impacts on bills.[28]

Assessing the contribution of carbon taxes

Carbon taxes increase the cost of fossil fuels, providing an incentive to reduce consumption and invest in clean heating technologies. Their effectiveness in driving change depends on their levels, on the costs and availability of substitute energy sources and heating technologies, and the willingness and ability of building owners to invest in clean heat. Evidence suggests that, on their own, carbon taxes are unlikely to effect the changes needed to transform the way in which buildings are heated. Other policies must simultaneously address the many other market failures and barriers that hold back heat decarbonisation.

Carbon taxes disproportionately impact low-income households.[27] They can affect people's ability to afford to heat their homes to adequate levels; these same households might also be less able to invest in clean heat. Ensuring that the impact of carbon taxation on low-income households is mitigated is therefore an issue that needs careful consideration.

Carbon taxation revenue is a potential source of public funding for subsidy programmes specifically designed to benefit low-income households.

[26] Sunderland and Gibb, 2022.
[27] Thomas, S., Sunderland, L. & Santini, M. (2021). *Pricing is just the icing: The role of carbon pricing in a comprehensive policy framework to decarbonise the EU buildings sector.* RAP. https://www.raponline.org/knowledge-center/pricing-just-icing-role-carbon-pricing-comprehensive-policy-framework-decarbonise-eu-buildings-sector
[28] Thomas et al., 2021.

Assessing the contribution of carbon emissions trading systems

Carbon emissions trading systems (ETSs), also called cap and trade schemes, place a limit on GHG emissions and issue a fixed number of allowances equal to that threshold. Allowances can be traded, creating a market price for carbon emissions; this price might vary but the emissions outcome is assured. Depending on the sectors that they cover, ETSs can encourage energy savings and investment in clean heat technologies.

ETSs have distributional impacts, comparable to carbon taxes. The carbon price that ETSs add to fossil energy products is passed on through energy rates, and leads to reductions in the consumption of essential energy services among those who cannot afford higher energy prices.

Authorities can use ETS revenues to subsidise investment in clean energy solutions by low-income households.[29]

Assessing the contribution of phaseout policies

Phaseout policies are regulatory instruments that set a date for restricting the sale, and potentially the use, of fossil fuel-based appliances. Building codes can act like phaseout policies, in that they can prevent the installation of some technologies in new or existing buildings. If announced sufficiently far in advance, phaseout policies for fossil fuel heating appliances can provide the market with long-term certainty and enough time to adapt in a way that minimises transition costs.

Phaseout policies can be based on the fuels used or the efficiency of the heating appliances, as boilers have a lower efficiency than heat pumps.

The distributional impact of these policies depends partly on the upfront and operational costs of the different heating solutions. If upfront costs for cleaner solutions are higher, which is often the case, it's important to bear in mind that low-income households may struggle to access subsidies or suitable finance.

Phaseout policies require solid companion policies to avoid unintended consequences for these households.[30]

Assessing the contribution of energy efficiency obligation schemes

Energy efficiency obligation schemes (EEOSs), also called energy efficiency resource standards (EERSs), require obligated energy companies to deliver a defined level of energy savings. EEOSs leave it up to each company to find the best delivery routes for achieving the energy efficiency goal, within a set of options. In many cases, EEOSs can support the deployment of clean heat actions, if these actions reduce the overall energy consumption of a building or site.

Like a clean heat standard on energy companies, an EEOS is funded by energy bills and disproportionately impacts low-income households.

In the absence of a dedicated sub-target for delivery among those households, obligated parties under an EEOS are likely to prefer to focus on other household groups or end uses when deploying an energy efficiency project.

[29] Cowart, R., Bayer, E., Keay-Bright, S. & Lees, E. (2015). *Carbon Caps and Efficiency Resources: Launching a "Virtuous Circle" for Europe*. RAP. https://www.raponline.org/knowledge-center/carbon-caps-and-efficiency-resources-launching-a-virtuous-circle-for-europe

[30] Sunderland & Gibb, 2022.

Added value of clean heat standards

The policy mix in place is often not effective enough to drive decarbonisation at the pace needed to reach climate goals. Clean heat standards can complement it by providing a specific trajectory for clean heat developments. A careful assessment of policy interactions is needed, considering that only a comprehensive policy mix can address all the barriers to heat decarbonisation.

Providing a trajectory for clean heat

Clean heat standards include a feature that subsidies and carbon taxes lack: depending on how they have been designed, they secure a route for heat decarbonisation or clean heat development. Some designs allow for a broader set of decarbonisation options and a larger potential for GHG cuts.

This trajectory can complement the carbon budget set under an ETS. Indeed:

- Emissions reductions required under an ETS can be achieved through a reduction in heating services, while a clean heat standard would be able to focus on the take-up of clean heat solutions among low-income households, if designed with a ringfence for such a group.

- If the ETS covers several sectors, a clean heat standard could drive action in the building sector, where a carbon price on its own cannot overcome the numerous market failures and barriers.[31]

- With more than one policy objective, two or more regulatory approaches may be justified. The co-existence of renewable portfolio standards and ETSs in the power sector in the U.S. and, in the EU, new vehicle CO2 standards and the forthcoming 'ETS 2' on buildings and road transport are analogous approaches.

The heat decarbonisation route set by a clean heat standard can also complement the trajectory set by an EEOS, which usually focuses on energy efficiency goals. Because clean heat solutions often contribute to both energy efficiency and heat decarbonisation objectives, the rules governing a clean heat standard should define whether actions are creditable under both schemes. This is further explored in **Step 4**.

Existing EEOSs could be adapted to secure clean heat outcomes through a dedicated EEOS sub-target focused on, for example, the buildings sector, space heating energy savings or heating system replacement.

If energy companies are the obligated parties under a clean heat standard, compliance costs will be reflected in energy bills; the end effect of cost pass-through is similar to a carbon tax, an ETS or an EEOS. Combining these instruments would therefore require careful examination.

On the one hand, the impacts of fossil fuel heating — on the environment as well as on the climate and human health — may justify the use of several instruments at the same time.

On the other hand, the combined impact of these tools on fossil fuel prices would need to be assessed. It might be necessary to buffer some end users from the impacts of the price increases, if they are not able to respond to the price signal and switch to clean heat.

[31] Thomas et al., 2021.

Supporting phaseout policies

Clean heat standards could complement a phaseout policy, both before and after it comes into force. Such a relationship is illustrated **below**.

To prepare for the phaseout policy, a clean heat standard could restrict the use of fossil heating technologies as a means of compliance by obligated parties, shifting the market before they are removed from sale. Manufacturers and installers can increase their capacity in an orderly manner, avoiding additional transition costs and reducing the risk that policymakers postpone the point at which the end of sales is scheduled to come into force.

Once fossil fuel appliances are no longer on the market, clean heat standards can trigger actions to remove existing fossil fuel equipment from buildings.

Creating synergies with subsidy schemes and heat planning

Subsidies can counteract the risk that a clean heat standard will add substantial costs onto energy bills by socialising some of the costs of meeting the clean heat trajectory across taxpayers.

Subsidies can also relieve specific cost pressures faced by obligated parties under a clean heat standard. For example, if a clean heat standard includes a sub-target for delivery among low-income households, it is likely that obligated parties, and ultimately their customers, will face higher costs to support clean heat investments among these households. A subsidy specifically designed to benefit low-income households could relieve this pressure.

If a clean heat standard cannot be specifically designed to benefit low-income households, a well-designed subsidy scheme would be an excellent complement which would enable more benefits to go to these households.

It is particularly important to place regulatory approaches like clean heat standards within the context of heating (and cooling) planning, given the related implications for infrastructure across the electricity, gas and heat networks.

Indeed, the choice of a particular heating solution will be influenced by the decarbonisation plans for the geographical area where it will be installed. For example, if there are plans to put in place a district heating system, it does not necessarily make sense for a household to install a new, individual heating system. It would be logical to prioritise such installations in areas earmarked for gas grid decommissioning.

A clean heat standard can restrict eligible actions to those that are compatible with the heat plan, as explained in **Step 2**.

Zoom: Introducing a clean heat standard alongside phaseout policies for fossil fuel heating appliances

Heating equipment standards can support a phaseout of fossil fuel boilers and water heaters. Several jurisdictions have adopted or are discussing the use of such tools with a view to limiting the use of fossil fuels to heat buildings. For example:

- In 2023, New York passed the United States' first state-wide law that bans fossil gas in new buildings.[32]
- In September 2023, Germany adopted legislation requiring that all new heating systems run on at least 65% renewable energy.[33] The requirement will come into force once local municipalities have submitted binding heat planning strategies.[34]
- The European Commission is considering a de facto ban on heating appliances running on fossil fuel through the revision of heating appliance ecodesign requirements from 2029 onwards.[35]

Phaseout policies can be an effective tool for reducing sales of fossil fuel heating systems by shrinking their market size and allowing clean heating systems to take their place through new installations. These policies may struggle to achieve a rapid, full replacement of fossil heating systems, however. This is because heating systems have a long lifetime and fossil fuel systems will continue to be installed until the phaseout policy is put in place.

Figure 4 illustrates the potential synergies between phaseout policies and clean heat standards by sketching the trajectories of clean heating system sales under three scenarios: business as usual; end of fossil fuel heating appliances sales, effective in 2030 (phaseout policy); and combined use of a phaseout policy and a clean heat standard (with the clean heat standard effective in 2024).

- In the first case, the market for clean heat systems gradually increases until 2040. At these rates of growth, however, clean heat appliance sales are not quick enough to capture the entire heating market, much less achieve full replacement of fossil heating systems.
- In the second case, a phaseout policy comes into force in 2030. It is effective in stopping the sale of fossil fuel boilers at that date. The market for clean heating systems remains effectively capped at the current total market size, however, as manufacturers and installers adjust to installing, for example, heat pumps instead of boilers. In addition, there may be an unwanted uptick in fossil heating device sales prior to the phaseout date, as consumers remain sceptical of the performance and cost of the clean heating alternatives.
- In the third case, the phaseout policy is introduced as planned, along with a 2024 clean heat standard. The clean heat standard is effective in completely replacing the fossil fuel heating system market, as well as doubling the total market size by 2040, ensuring that most fossil heating devices are replaced by 2040.

[32] Phillips, A. (2023, 23 April). New York set to pass first statewide law banning gas in new construction. *Washington Post*. https://www.washingtonpost.com/climate-environment/2023/04/27/new-york-natural-gas-ban

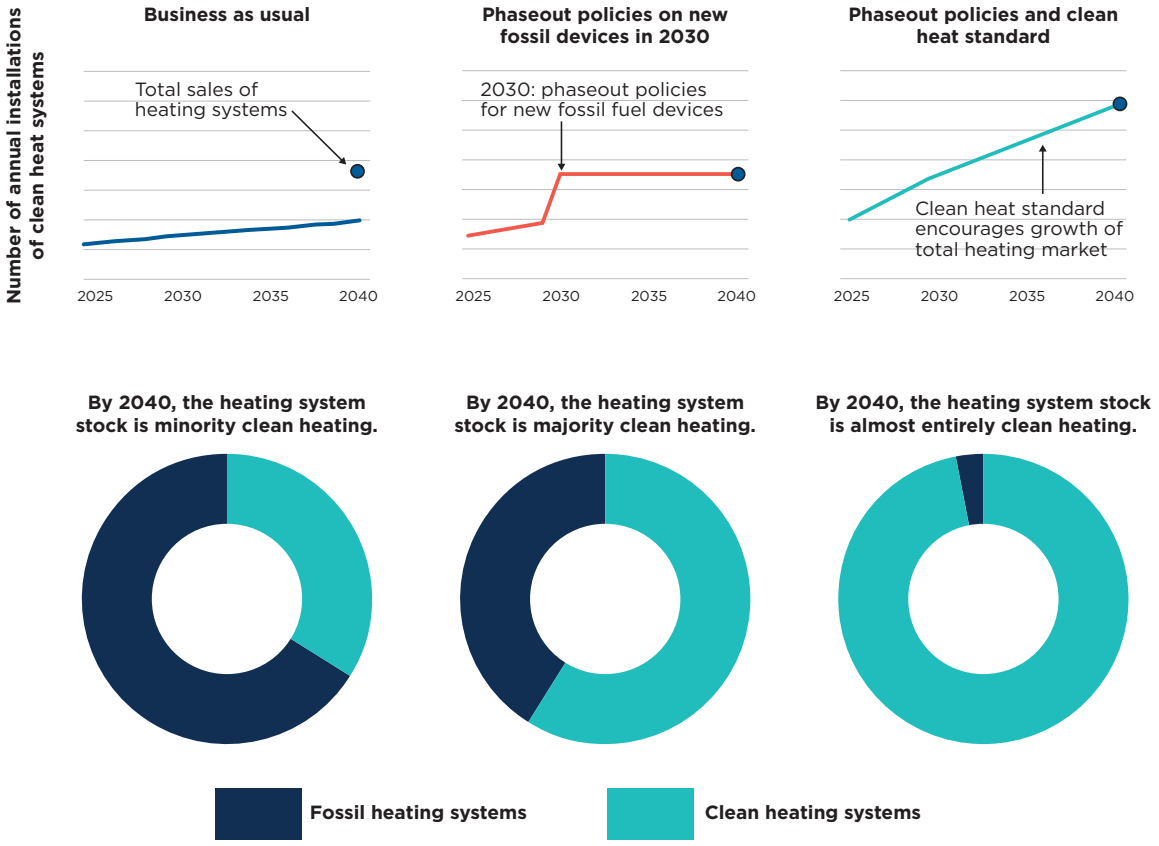
[33] Deutsche Bundesregierung. (2023). Für mehr klimafreundliche Heizungen [For more climate-friendly heating]. https://www.bundesregierung.de/breg-de/aktuelles/neues-gebaeudeenergiegesetz-2184942

[34] This legislation was significantly weakened from previous versions, criticised for not being strong enough to meet the country's greenhouse gas reduction targets in buildings. Deutsche Umwelt Hilfe. (2023). Deutsche Umwelthilfe warnt vor Rechtsbruch durch neues Heizungsgesetz: Bundesregierung torpediert Pariser Klimaziele und treibt Menschen in die Kostenfalle [German environmental aid warns of a breach of the law through the new heating law: the federal government is torpedoing Paris climate targets and driving people into a cost trap]. https://www.duh.de/presse/pressemitteilungen/pressemitteilung/deutsche-umwelthilfe-warnt-vor-rechtsbruch-durch-neues-heizungsgesetz-bundesregierung-torpediert-pa)

[35] European Commission. (2022). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EU 'Save Energy'*. COM/2022/240 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0240&qid=1712830996051

This example illustrates that clean heat standards can ramp up supply chains ahead of the phaseout date for fossil fuel equipment, and accelerate the modernisation of the heating equipment fleet.

Figure 4. Clean heat standards with phaseout policies for fossil fuel heating appliances – an illustration of potential impacts



Assumptions: (1) More than 90% of heating appliances installed in buildings at the beginning of the period are fossil fuel-based, and the sales of clean heat appliances grow at an average of 5% annually (business as usual), 8% (phaseout only) or 11% (phaseout and clean heat standard). (2) In the phaseout scenario, higher levels of maintenance extend the lifetime of fossil fuel appliances, and sales of fossil fuel heating appliances increase by 20% during the year before the phaseout date, as some users seek to pre-empt the restriction. These conservative assumptions are not well documented, given the limited experience with phaseout policies worldwide. (3) The clean heat standard is effective at achieving heating system replacements in line with heating decarbonisation goals. This also means that other policy measures are in place to address bottlenecks such as costs, workforce and energy pricing.

Checklist:
Assessing the potential role of a clean heat standard

Heat decarbonisation, access and affordability

- ❑ What are the main economic sectors using heat and what are the characteristics of these sectors (type of investments, consumer behaviour, etc.)? What is the share of renewable heat in these sectors? How has it evolved over time and what developments are expected?
- ❑ Which communities are impacted by difficulties in accessing affordable heating, and why? What are their specific needs and barriers?
- ❑ What are the most appropriate decarbonisation pathways for the heating sector in your jurisdiction (cost-effectiveness, affordability, consumer benefits, environmental impacts, etc.)?
- ❑ What are the barriers to the deployment of clean heat solutions?

Policy gaps

- ❑ What policies contribute to heat decarbonisation in your jurisdiction?
- ❑ Which barriers are these policies addressing? How successful are they in doing that? Are these policies ambitious enough to decarbonise the heating sector at the speed needed to meet climate goals?
- ❑ Who pays for and who benefits from these policies?

Added value of clean heat standards

- ❑ What could clean heat standards add to the current policy mix? What would it mean for the design of the standard (targeted actions, obligated parties, mobilisation of market forces, etc.)?
- ❑ What other policy tools would be needed to secure an equitable decarbonisation of the heating sector?
- ❑ How would interactions with other policy tools influence the design of the clean heat standard?
- ❑ How would the introduction of a clean heat standard influence the design of other policy tools?

Step 2. Design the obligation

Having identified specific policy gaps and objectives, the next step for decision-makers interested in implementing a clean heat standard is to design the obligation.

Obligated parties

The clean heat standards already operating or under development around the world involve two types of obligated parties: energy companies and heating appliance manufacturers.

Leveraging the market influence of obligated parties

Decision-makers will have an interest in opting for a clean heat standard design which can best help them overcome the barriers to clean heat deployment.

With a clean heat standard on energy companies, the obligation to deliver clean heat services could be coupled with requirements to concentrate efforts in areas that have been prioritised for fossil fuel phaseouts.

A clean heat standard on energy companies can build on the relationship that some energy companies have with end-users, for example, as providers of energy services and advice.

A clean heat standard on heating appliance manufacturers can encourage investment decisions to transform heating appliance supply chains and may have particular value in places with major appliance manufacturing industries. Manufacturers have privileged access to installers and well-established marketing skills; placing an obligation on heating appliance manufacturers could have an impact on this significant supply chain constraint. It would limit the range of decarbonisation options to those available to manufacturers, however, and other policy tools would need to be employed alongside it to set a decarbonisation trajectory for the whole heating sector.

Considering distributional impacts of both models

The design of the clean heat standard impacts the ability of low-income households and other vulnerable groups to access affordable heat.

Clean heat standards on energy companies:

Under clean heat standards on energy companies, fossil energy consumers would ultimately bear the compliance costs incurred by the energy companies, which would be passed on through energy bills. Left unchecked, low-income households with an inefficient home and fossil fuel heating would be disproportionately affected.

Nevertheless, there are ways to control the financial impacts. If the obligated energy companies are regulated, cost recovery can be managed through the regulated rates. If the obligated party is a competitive energy supplier, putting in place flexibilities such as trading or buyout prices can help, as further explained in **Step 3**.

It is important to consider how the costs are reflected in energy bills, and to assess whether the surcharge related to the scheme's implementation should be paid by all consumers or by a segment thereof (for example, all customers except low-income households).

With fixed fees, low-use consumers pay more proportionally than high-use consumers.[36]

Energy companies have an incentive to pursue customers with more access to capital or a greater ability to invest. A sub-target for low-income households and vulnerable groups can ensure that obligated parties implement actions in these households or mandate third parties to do so.

[36] Sunderland, L., Jahn, A., Hogan, M., Rosenow, J. & Cowart, R. (2020). *Equity in the energy transition: Who pays and who benefits?* RAP. https://www.raponline.org/knowledge-center/equity-in-energy-transition-who-pays-who-benefits

Clean heat standards on heating appliance manufacturers:

In clean heat standards on heating appliance manufacturers, those who purchase heating technologies that the standard does not support are likely to pay an indirect cost for the obligation, as appliance manufacturers will be looking to promote sales of clean options. The price of cleaner technologies will likely decrease, while the price of other appliances will likely rise.

It would be challenging to introduce a sub-target for installations in low-income households because heating appliance manufacturers may have little leverage on where their products are sold. This possibility would depend on whether the scheme allows manufacturers to purchase credits from third parties with better access to end-users. To our knowledge, such a design feature has not been tested in manufacturer obligations in other sectors, such as vehicle manufacturing.

Sufficient grant funding and technical support would be needed for low-income households to switch to clean heat. Introducing a sub-target for these households through either a clean heat standard on energy companies or an EEOS could ensure a trajectory for the decarbonisation of heat amongst these households.

Obligating energy companies vs. heating appliance manufacturers: an overview

Clean heat standards, whether on energy companies or heating appliance manufacturers, can play an important role in a comprehensive policy framework for heat decarbonisation. They could even be combined, as is often the case in the transport sector (as explored **below**). Table 1 summarises the differences between the two clean heat standard models.

Table 1. Comparison of clean heat standard models

	Clean heat standard on energy companies	Clean heat standard on heating appliance manufacturers
Eligible actions	Possibility to include a broad set of actions	Limited to heating appliance sales
Role in heat decarbonisation framework	Possibility to set a trajectory for clean heat and to cover a broad range of sectors	Limited to setting a trajectory for new heating appliances
Market leverage	Can build on energy companies' access to consumers	Can build on relationship between manufacturers and installers
Costs	Costs reflected in energy bills	Costs borne by consumers who purchase fossil fuel technologies
Distributional impact	Disproportionately affects low-income households	Disproportionately affects low-income households

Looking at market structure

Options among energy companies

The following energy company entities could be the obligated parties under a clean heat standard:

- Pipeline gas distribution utilities, whether they are investor-owned, publicly operated, or both.

- Providers of delivered fossil fuels such as distillate heating oil and propane. It is possible to regulate these fuels at the point of importation or earlier in the wholesale chain of commerce. Another option is to place the obligation on retailers. Wherever the obligation is attached, existing tax and energy policies usually identify the fuels that are sold for heating; those tracking methods could be used for the clean heat standard as well.

- Solid and liquid bioenergy companies.

- Electricity retailers or distribution companies. This point is subject to discussion, as described in 'The case of electricity companies' (**see below**).

The objective of the clean heat standard will influence the choice of obligated parties. For example, if the overall objective is to reduce carbon emissions from space and water heating, decision-makers could choose to obligate all wholesalers, distributers or retailers of fossil heating fuels. If the objective is to reduce environmental impacts more broadly, including on local air quality, solid and liquid bioenergy companies could be included.

If policy instruments targeted at specific fuels are already in place, the sales of those fuels could be removed from the calculation of companies' obligations. For example, if an existing policy aims at systematically decarbonising district heating systems, it might make sense to exempt district heat from the obligation.

Upstream or downstream energy companies

There is no definitive answer to the question of whether to obligate energy companies upstream or downstream. The two approaches have both been successful in analogous EEOSs in operation around the world.

- Downstream energy retailers have direct relationships with end-use customers, whereas upstream companies do not. Depending on the design of the standard, upstream companies could, however, rely on third parties to implement clean heat actions on their behalf.

- Upstream wholesalers and distributors are likely to have sizeable financial and management capacity, whereas downstream companies may be very small. In addition, distributers of gas and electricity are often regulated monopolies that can be rewarded for meeting targets through their public service agreements, whereas downstream retailers tend to operate in a competitive market, with less regulatory oversight regarding the costs that obligated parties pass through to end-users. The number of obligated parties will impact administrative expenses.

- There are also jurisdictional considerations. In the U.S., for example, individual states have limited jurisdiction over interstate commerce and can regulate fuels and sales only within their own borders. This limits the reach of possible upstream and wholesale obligations, but it does permit a state's obligation to attach to fuels at the point of importation, in-state distribution or sale.

The case of electricity companies

Several considerations point towards excluding electricity companies from the list of obligated parties under a clean heat standard. First, in many jurisdictions, electricity is becoming less carbon-intense as other policy measures drive down emissions. Secondly, electrification, through the take-up of heat pumps, is often the most cost-effective way of decarbonising heat; a clean heat standard including electricity companies would lead to compliance costs being passed through on electricity prices, reducing the energy cost savings for households and businesses considering switching to heat pumps. As electricity systems decarbonise, this would be the opposite of the 'polluter pays' principle.

Some considerations can, however, point towards including electricity companies. Moving from electric resistive heating to heat pumps, along with building fabric efficiency measures, can reduce emissions significantly in carbon-intense electricity systems.

Electricity companies could be obligated separately to make efficiency improvements to the power system, including the replacement of electric resistive heating by heat pumps. Alternatively, electricity companies could be allowed to sell credits from clean heat actions to obligated parties, even if they are not obligated themselves. Downstream electricity retailers could be well placed to act as accredited third parties given their existing relationships with end-users. Electricity companies would also benefit from additional sales if they switch heating customers from fossil fuels to electricity.

Options among heating appliance manufacturers

For simplicity, obligations could apply to all heating appliance manufacturers, including those who only produce non-fossil fuel appliances. With fossil fuels making up the largest share of heating in most countries, however, there may be little sense in obligating an actor to do something they are already doing, such as a heat pump manufacturer that does not sell fossil fuel boilers. If policymakers wish to create a direct revenue stream for clean heat appliance manufacturers, they could allow them to sell credits to obligated parties without being an obligated party themselves.

An obligation on manufacturers will need to cover appliances sold, rather than only manufactured, in a particular market. Indeed, it is likely that some fossil fuel appliances within a given heating market will be made elsewhere – and, if these are not captured by the clean heat mechanism, their importation would undermine the target. Such an approach could therefore impact manufacturers of fossil fuel heating appliances outside of the country that the clean heat standard operates in. Although this aim could be achieved through customs policy, it may be difficult to enforce within countries in liberalised international markets like the EU. In the U.S., while states have some authority to regulate the installation of heating equipment, they are quite limited in their ability to regulate international or interstate trade in that equipment.

Assessing the appropriateness of size exemptions

Small companies may not have the ability to carry out clean heat actions in-house. Contracting with third-party clean heating technology suppliers could disproportionately increase their costs, if they do not have existing contract management facilities. Any regulatory requirement makes it more difficult for smaller companies to compete. It is possible to exempt small companies from the obligation, however, for example by employing a minimum sales threshold to qualify.

Size exemptions could however reduce the standard's contribution to the thermal transition, and provide a competitive advantage to some polluters. An alternative would be to provide flexibilities that enable smaller companies to meet their clean heat obligations with a lower administrative burden. This includes the ability to pool obligations, for example through an umbrella sector association, and the possibility to purchase compliance from certified third parties through a dedicated trading platform. Flexibilities are explored in Step 3.

Analysis of market size and structure is a vital precursor to decision making.

Zoom: Combining obligations in the transport sector

Clean heat standards on energy companies and on heating appliance manufacturers could be combined, as is often the case in the transport sector, where GHG standards applying to car manufacturers coexist with fuel standards applying to transport fuel suppliers.

Here are two examples.

European Union

- Obligation on transport fuels suppliers

Each EU member state has to set an obligation on transport fuel suppliers to ensure that the amount of renewable fuels and renewable electricity supplied to the transport sector leads to a GHG intensity reduction of at least 14.5% by 2030, compared to a baseline.[37]

- Obligation on vehicle manufacturers

The EU has set CO2 emissions performance standards for new passenger cars and vans. This regulation sets fleet-wide CO2 emissions targets for each manufacturer applying from 2020, 2025, 2030 and 2035.[38]

California, United States

- Obligation on transport fuel suppliers

Every transport fuel provider must demonstrate that its fuel mix meets the carbon fuel standard for each annual compliance period, or that it has purchased credits from other fuel providers. The standard provides a declining carbon intensity benchmark for each year and assigns a score to each fuel based on its lifecycle GHG emissions.[39]

- Obligation on vehicle manufacturers

The sales of new zero-emission vehicles and plug-in hybrid electric vehicles must equal at least 35% in 2026, 68% in 2030, and 100% in 2035.[40]

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[37] Transport & Environment. (2023). *What the EU's new Renewable Energy Directive means for clean fuels in Europe*. https://www.transportenvironment.org/discover/what-the-eus-new-renewable-energy-directive-mean-for-clean-fuels-in-europe

[38] European Commission. (n.d.). *CO_2 emission performance standards for cars and vans*. https://climate.ec.europa.eu/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_en

[39] U.S. State of California Air Resources Board. (n.d.). *Low Carbon Fuel Standard*. https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard

[40] U.S. State of California Air Resources Board. (2022). *California moves to accelerate to 100% new zero-emission vehicle sales by 2035*. [Press release]. https://ww2.arb.ca.gov/news/california-moves-accelerate-100-new-zero-emission-vehicle-sales-2035

Target setting

The metric in which the target is defined, its trajectory and the length of compliance periods are key interlinked aspects of target setting.

Reflecting policy objectives

If the objective of a clean heat standard on energy companies is to decarbonise heat, denominating the target in terms of GHG emissions reductions would make sense. If the clean heat standard aims to achieve GHG reductions in the building sector only, it would be possible to exclude the fuels sold to the industrial sector from the baseline. If the objective is more limited, for example to increase the share of heat pumps in the thermal mix or the share of biogas in all heating gas sales, the metric could focus on those specific outcomes.

The target of a clean heat standard on heating appliance manufacturers could relate to:

- The fleet of products put on the market – for example, GHG emissions reductions, average appliance efficiency, or renewable heat generated. Fleet targets allow some flexibility in delivery and potential market innovation. They could theoretically allow for the delivery of more cost-effective action by giving manufacturers freedom in how to support clean heating. This is similar to the approach the EU takes with its CO2 standard for vehicles, which is expressed as an average fleet GHG emission requirement.[41]

- The technology, as is the case in the UK scheme which focuses on heat pump deployment numbers. When the role for certain technologies is known to be important, specificity in terms of outcomes may increase the simplicity of schemes and deliver clearer and more pre-determinable outcomes. This approach is similar to the new vehicle policies in California and other U.S. states, which put an obligation on vehicle manufacturers to sell a growing percentage of eligible technologies, or purchase credits from other manufacturers.[42]

[41] European Commission, n.d.
[42] U.S. State of California Air Resources Board, 2022.

Balancing short-term and longer-term considerations

It is crucial that the long-term goal of a clean heat standard is in line with politically agreed climate objectives. Shorter-term targets for obligated parties would usually provide balance between progress towards the long-term goal and what is practically possible.

The first phase of a clean heat standard might have a relatively unambitious target to ease obligated parties and regulators into the scheme. Somewhat modest targets in initial scheme phases could be balanced by providing certainty over the long-term policy goal, the clean heat standard's role in achieving it, and the ability for obligated parties to bank overachievement for future use.

The obligation can be set for any period. A longer obligation period provides more certainty for market actors, but also increases the need for intermediate targets to ensure that long-term goals are reflected in short-term actions. Even within a short-term obligation period of three years, annual targets could secure delivery actions throughout the period.

The shorter the target period, the greater the need for flexibility in banking and borrowing of compliance between periods, to acknowledge practical realities such as supply chain disruptions and labour force constraints, and to avoid unfairly penalising obligated parties. These considerations are further explained in **Step 3**.

Clean heat standard legislation might set a long-term target, for example of heat decarbonisation by 2040, and instruct policymakers to fix interim targets every few years in line with a cost-effective trajectory towards the 2040 goal, taking account of market conditions.

Constraints: Sub-targets, caps and eligibility

Sub-targets can help achieve additional policy objectives, such as prioritisation of target groups of beneficiaries or fostering innovation. It is also possible to place a cap on resources that might be needed during the thermal transition but which decision-makers wish to limit over the longer term (for example, certain types of biofuels), and to define a list of eligible or ineligible actions.

Setting sub-targets to secure delivery among priority groups

Jurisdictions considering a clean heat standard have been quite well attuned to the need to ensure economic and social equity as part of programme design. Sub-targets among priority end-users are likely to be relevant in many locations. Indeed, unless there are complementary funding programmes, delivery among low-income households is likely to cost obligated parties more than it will among other end-users, as they are less likely to be able to provide their own funds towards investing in clean heat technologies.

Delivery among a particular end-user group – e.g., households eligible for welfare payments – is likely to incur additional costs, in order to find qualified recipients and check their eligibility. In addition, the houses may need upgrades before heat pumps or other high electricity use elements can be accommodated (e.g., electric panel upgrades, asbestos removal, etc.).

Geography may also be a consideration, both in lower-income and marginalised urban settings and many rural regions. Obligated parties are likely to face additional costs when delivering in hard-to-serve urban neighbourhoods and remote rural areas.

Experience with EEOSs has shown that providing additional incentives for obligated parties to deliver among low-income households and other vulnerable groups has not led to significant increases in delivery of services among these populations. Performance requirements, on the other hand, have proven useful in delivering energy efficiency measures to priority households on both income and geographic bases.[43]

Distinguishing between different technologies

Sub-targets can help build the supply chain for clean heat technologies that are underrepresented in the market, but expected to be central to long-term heat decarbonisation. Caps can constrain the use of actions that have a limited role in the heating transition. Potential longer-term cost reductions need to be balanced with increased costs in the short term, as obligated parties will have fewer options to meet their obligations.

Defining eligible or ineligible actions is also an option. The list of eligible actions could evolve over time, with the possibility for decision-makers to include a process by which third parties can suggest additions.

[43] ENSMOV & SocialWatt. (2021). *Policy Guide: The Energy Efficiency Directive energy savings obligation and energy poverty alleviation.* https://ensmov.eu/policy-guide-the-eed-energy-savings-obligation-and-energy-poverty-alleviation

Reflecting the scheme's objective

The scheme's objective drives the eligible or desired actions.

A scheme focused narrowly on switching end-users from fossil heat combustion technologies to low-carbon heat technologies might limit the actions to electrification measures, such as heat pumps, and wood heat options.

A scheme focused more broadly on reducing carbon emissions from heat through end-use actions might also include thermal energy efficiency measures.

A scheme focused on decarbonising heat, either at end-use or upstream level, might add biogas and zero-carbon hydrogen which could be blended with fossil gas, liquid biofuels and district heating decarbonisation options.

The inclusion of hybrid boiler-heat pump systems as an eligible action could lead to market innovations, although some consideration of their value in terms of long-term suitability and actual emissions savings would be recommended.

Promoting early actions

If a principal objective of the clean heat standard is to reduce GHG emissions, early action is desirable, both to meet urgent climate goals and to accelerate market transformation in the thermal sector. For these reasons, it will likely be useful for the initial programme rules to provide 'early action' credits for verifiable clean heat actions taken even before the initial compliance period.

Zoom: The treatment of bioenergy options

The eligibility of all bioenergy options, whether biogas, bioliquid or biomass, is a very important decision in the design of a clean heat standard.

It is crucial to comply with sustainability requirements and consider the extent to which the use of bioenergy in the heating sector aligns with broader land-use and bioenergy strategies.

Experience with Europe's biofuel obligations and the U.S. automobile ethanol mandate has led many advocates and decision-makers to be wary of programmes that advance bioenergy resources or other innovative alternatives without careful oversight. These fuels can have a range of impacts, including local emissions from combustion and indirect land-use changes in remote source regions. Topics of concern have included renewable methane, liquid and woody biofuels, and various alternative gasses, including hydrogen, which many analysts judge as useful in high-temperature industrial processes but inappropriate as a broad-based low-temperature heating fuel.[44]

Jurisdictions will differ as to how these topics are addressed. Clean heat standards can be tailored to reflect each locality's policy determinations, including by putting in place a cap or by restricting eligibility. One option could be to limit wood heat options to rural areas, where sustainable fuel sources are more abundant and local air quality issues are less problematic.

The U.S. state of Vermont, for example, does not place a percentage cap on the use of these solutions but requires a sustainability review, and applies lifecycle analysis and an increasingly stringent set of carbon intensity thresholds before alternative fuels can participate in the clean heat standard. In 2025, a liquid or gaseous clean heat measure will have to emit at least 20% less than conventional fuel oil on a lifecycle basis to earn any credits at all in Vermont. That qualifying threshold will rise gradually to 80% in 2050. The regulator may relax the most stringent standard, if needed, to address practical implementation limitations.

[44] Rosenow, J. (2022). Is heating homes with hydrogen all but a pipe dream? An evidence review. *Joule 6*. https://doi.org/10.1016/j.joule.2022.08.015

Examples from clean heat standards in operation or under development

Obligated parties

Colorado, United States

- Obligated parties are gas distribution utilities with more than 90,000 customers. This exempts municipal utilities and smaller investor-owned pipeline companies.

- Competition is unlikely to be distorted since the service territories of the utilities are regulated, but it does limit the overall reach of the programme.

United Kingdom

- Obligated parties will be fossil fuel appliance manufacturers who sell at least 20,000 gas boilers or 1,000 oil boilers into the UK market each year.

- Manufacturers who make boilers outside of the UK which are sold into the UK market will also be covered if their sales exceed the threshold levels.

- The scheme will allow heat pump manufacturers to sell credits to, but will not count them as, obligated parties.

Vermont, United States

- Obligated parties are the regulated pipeline gas utility and importers of fossil heating fuels at the point of importation, regardless of whether those importers are wholesalers or retailer providers, and regardless of their size.

- This places the obligation as far upstream as possible while covering all competing fuels equally, noting that Vermont is unusual among U.S. states due to having a high fraction of fossil heat delivered via fuel oil and propane.

- Vermont does not include electricity companies because fossil heat providers have contributed very little to meeting the state's climate goals, while the electricity sector is already paying for the broad-based energy efficiency programmes and a high percentage of renewable electricity. 'Tier 3' of Vermont's Renewable Portfolio Standard requires utilities to deliver beneficial electrification services that will displace fossil fuel use among end users in the state.[45]

Target setting

Colorado, United States

- Obligated parties must file clean heat plans showing how they will achieve a 4% reduction in GHG emissions in 2025 and a 22% reduction in 2030 compared with a 2015 baseline.

- The regulator can amend those plans to protect reliable service and to moderate possible rate impacts.

[45] That programme is expected to deliver about one-sixth of the fossil use reduction required by the Affordable Heat Act by 2030. Cowart & Neme, 2021, p33.

Examples from clean heat standards in operation or under development

United Kingdom

- Each year, obligated parties will need to submit a certain number of certificates establishing that heat pumps have been installed in the UK.

- This target will be linked to the number of fossil fuel heating appliances sold by each obligated party and will increase each year in line with heat pump installation targets.

Vermont, United States

- Obligated parties should acquire and retire a number of clean heat credits each year matching the GHG reductions for the thermal sector set out in the state's Climate Action Plan.

- The metric for credits from diverse kinds of actions is tons of CO2e avoided. Vermont opted for lifecycle GHG emissions as a metric to avoid the problem of 'exporting' emissions or overlooking impacts from biofuels.

- The regulator is required to define the obligation in numerical terms on a ten-year basis, and this forward-looking obligation will be revised every three years to reflect progress against GHG reduction requirements.

- The legislation permits the regulator to adjust the annual reduction requirements for a period of up to three years "for good cause," which could be due to a shortage of clean heat credits, market conditions, or undue financial impacts on consumers. Such a relaxation must have the "minimum impact possible" on meeting GHG reduction goals.

Sub-targets, caps and eligibility

Colorado, United States

- GHG cuts should come from clean heat resources, which include a broad range of actions including demand-side management, beneficial electrification, and green hydrogen developments.

- The standard limits the amount of recovered methane that could qualify under the programme. The regulator can, however, permit a higher percentage if needed to ensure cost-effectiveness.

Massachusetts, United States[46]

- Clean heating solutions would include cleaner heating technologies, the electrification of building stock, increases in building efficiency, and a move away from fossil fuels.

- The clean heat standard "must be designed to include and protect" low and moderate income and environmental justice populations "from the outset."

[46] The Commission on Clean Heat, which advises the government, recommended the establishment of a clean heat standard and provided suggestions on its design. Following up on the Commission's recommendation, a detailed assessment of the clean heat standard was also included in the "Massachusetts Clean Energy and Climate Plan for 2025 and 2030," released by the Executive Office of Energy and Environmental Affairs in June 2022.

Examples from clean heat standards in operation or under development

United Kingdom

- The scheme will allow one eligible action: the fitting of a hydronic heat pump.

- Such a focus automatically excludes heating technologies which may have value elsewhere or for other reasons, such as biomass systems, solar thermal, or heat pumps using air-blown distribution.

- There have historically been concerns that the inclusion of air-to-air systems in renewable heat support in Europe may lead to the growth of air-conditioning and the maintenance of existing fossil-fuelled heating systems alongside them. There are countries or regions where air-blown systems are the norm, however, and it may be the case that allowing air-to-air heat pumps in areas with primarily hydronic heating could stimulate growth in the heat pump market. The UK's specific focus on hydronic heat pumps is based on its high proportion of buildings with wet central heating systems and the known importance of heat pumps.

Vermont, United States

- Clean heat credits will stem from actions such as the delivery of low-emission heating fuels, energy efficiency and weatherisation measures, and the installation of electric or renewable heating systems.

- At least 16% of total thermal reductions must come from low-income customers and at least 16% from moderate-income customers. These amounts exceed the fraction of sales to these segments today. Over half of the services delivered to these households should be long-term installed measures such as weatherisation and heat pumps, as these are expected to lower household heating bills over many years.

- Switching from one fossil fuel use to another fossil fuel use is not a creditable clean heat measure. This is intended to avoid giving clean heat credits for replacing oil heat with pipeline gas heat. Even though that switch could reduce emissions in the short term, incentivising oil-to-gas switches would have the longer-term effect of locking in reliance on pipeline gas infrastructure and gas supplies, which is not in line with the goal to gradually eliminate the use of fossil fuel heat.

- Any creditable action taken after 1 January 2023 can earn credits against later compliance obligations. This provision aims to ensure that obligated parties and other market participants have no reason to delay action while waiting for the programme's final rules to be written and approved by the legislature. This is intended to create an on-ramp to the initial compliance period and to help develop the market for clean heat services.

Checklist:
Designing the obligation under a clean heat standard

Obligated parties

❑ Which market actor would have more leverage to achieve the objective of the scheme as an obligated party? How does the market structure influence the choice of obligated parties?

❑ How will the costs of the scheme be reflected in the price of the products sold by the obligated parties? How can the design of the tool mitigate the impact on low-income households and vulnerable groups? Is there a need for additional policy tools to deal with these additional expenses for consumers?

Target setting

❑ How does the objective of the scheme influence the target metric? How does it influence its scope, including for example the sectors covered?

❑ What would be a realistic target in the short term? What is needed to reach climate goals? How can the target trajectory evolve over time to bridge short- and long-term concerns?

❑ What would be a good timeframe for the obligation period, providing both regulatory certainty and an opportunity to adapt to new circumstances?

Sub-targets, caps and eligibility

❑ Would it make sense to introduce a sub-target to guarantee the delivery of benefits among low-income households or vulnerable households?

❑ Is there a reason to promote certain technologies over others? Can sub-targets and caps help deal with these issues? Does it make sense to restrict the eligibility of certain actions?

Step 3. Create flexibilities

This chapter explores the different flexibilities that a clean heat standard design can include to ensure cost-effective achievement of the target without compromising the goals of the tool.

Banking and borrowing

Clean heat standards can include banking and borrowing flexibilities. With banking, obligated parties which overachieve their targets can carry forward, or bank, all or some of this excess to support compliance with the obligation in a future period. Borrowing means that obligated parties which underachieve their targets during an obligation period can postpone some of this achievement to, or borrow from, the next obligation period.

Securing stability

Banking and borrowing can smooth over changes in compliance periods. For example, at the end of an obligation period, activities might slow down if obligated parties have already reached their targets, unless some banking is allowed. If obligated parties know that they will be able to overachieve their targets and use those actions to comply with future phases, they will be more likely to structure their efforts in a way that aligns both with the long-term policy goals and their cost-effective compliance trajectory.

Banking and borrowing can also help obligated parties contend with changes in market conditions or unanticipated events. For example, limited borrowing could help contain costs of the scheme at the end of a period in case obligated parties have difficulties in meeting their target.

Avoiding delayed action

Banking involves early action and is therefore an acceptable practice in view of reaching climate goals. Consideration should, however, be given to setting a cap to secure regular market growth for clean heat.

Decision-makers should treat borrowing carefully to avoid delaying climate action. If they allow borrowing, it is useful to cap it and to discourage it, for example by requiring obligated parties to pay a penalty or to deliver additional actions — beyond what has been borrowed — in the next compliance period.

Trading of compliance credits

It is common to allow obligated parties under a clean heat standard to trade compliance credits.

Assessing different options

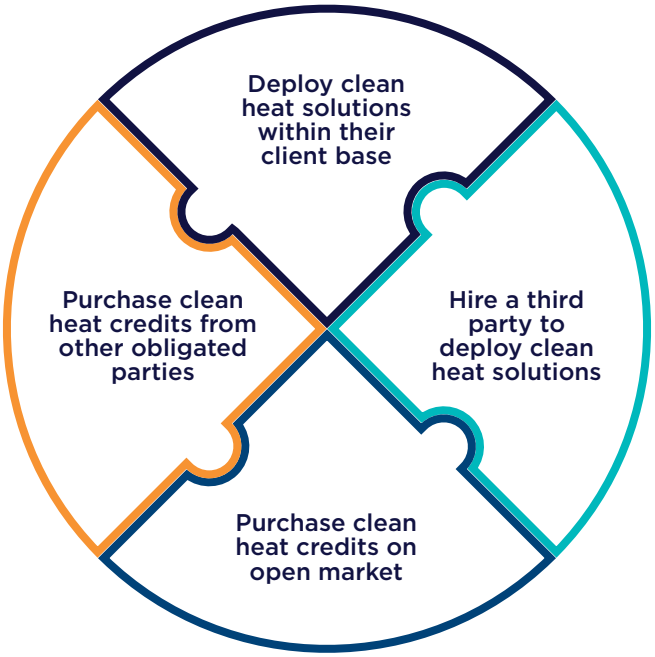
Clean heat standards provide some flexibility to obligated parties on how to achieve their target, as illustrated by Figure 5.

Obligated parties can be expected to deploy clean heat solutions within their client base or hire a third party to help them do so.

In some cases, obligated parties can trade compliance credits with other obligated parties. This is called horizontal trading. A similar feature is called pooling, where several obligated parties team up to meet their goals.

Vertical trading describes situations where accredited non-obligated parties can obtain credits which obligated parties could buy to comply with their obligation.

Figure 5. Possible delivery mechanisms for obligated parties under a clean heat standard



Balancing market access and simplicity

The trading of compliance credits can further increase opportunities for market players to source clean heat projects and identify the most cost-effective options to reach targets and sub-targets. The inclusion of non-obligated parties into trading can encourage the emergence of third-party providers of clean heat.

Trading can involve the creation of 'clean heat credits,' a legal instrument issued by an authorising body guaranteeing that a specified amount of clean heat has been delivered. It is possible to set up a market for trading such credits. Arrangements such as trading platforms and price disclosure obligations can increase the liquidity of the market for compliance credits. They also add a layer of complexity to the scheme.

Buyouts and alternative compliance mechanisms

Depending on the design of the clean heat standard, obligated parties could be allowed to buy out a share or all of their obligation through the payment of a compensation fee to the public authority. In addition, it could make sense to appoint a default delivery agent to deliver clean heat actions on behalf of obligated parties, against the payment of the compensation, as an alternative compliance mechanism.

Encouraging action

Setting a buyout option can help obligated parties limit compliance costs, but it can also reduce the outcome of the clean heat standard. That is why it is good practice for decision-makers to cap this option to encourage action.

There are other ways to address the burden of compliance costs, including trading. In the first years of a scheme, the target is usually smaller, providing the market time to grow and lowering the need for buyout.

It is important to allocate buyout funding to the achievement of the overall heat decarbonisation target, including by assigning a default delivery agent that the scheme administrator could contract to implement clean heat actions.

Setting a buyout price

The scheme's rules would typically include a buyout price informing obligated parties of the cost to them per compliance unit. Setting the buyout price at the right level will encourage action from obligated parties. Indeed, if this price is lower than the cost of delivering actions, it is likely that obligated parties will opt to buy out, and more alternative policies will be required to reach clean heat goals.

Examples from clean heat standards in operation or under development

Banking and borrowing

United Kingdom

- The clean heat market mechanism allows both banking (up to 10%) and borrowing (up to 35% for the first two years).

Vermont, United States

- The clean heat standard foresees that an obligated party which has met its annual requirement would be able to retain excess clean heat credits for future sale or application to its obligations in future compliance periods. More detail will be outlined in the rules that the Public Utility Commission will develop.

Trading of compliance credits

Colorado, United States

- The clean heat targets scheme in Colorado foresees the trading of recovered methane credits, a tradeable instrument that represents a GHG emission reduction or GHG removal enhancement of one tonne of CO2e from actions involving recovered methane.

United Kingdom

- The UK clean heat mechanism would allow trading of compliance credits between obligated parties and the sale of credits from heat pump manufacturers to obligated parties.

- The UK suggests that only heat pump manufacturers and obligated parties will be able to own credits, not third parties, and that only obligated parties will be able to purchase credits.

Vermont, United States

- The Public Utility Commission will put in place a system of tradeable clean heat credits earned from the delivery of clean heat measures.

- Many actors – including heating, ventilation and air conditioning contractors, fuel dealers, electric utilities, housing authorities and building renovation providers, as well as obligated parties – will be able to earn and trade credits with obligated parties.

Buyouts and alternative compliance mechanisms

Vermont, United States

- By default, obligated parties under the clean heat standard will make payments to a delivery agent to fulfil their obligation. Prices for low-income households, moderate-income households and other credits will be available in advance, and obligated parties will be able to meet their obligations by paying a pro rata share of the default service provider's annual budget.

- Obligated parties will be able to request a full or partial exemption from using the default delivery agent, and seek to implement clean heat actions themselves or purchase credits from other entities.

- This approach is based on the state-wide energy efficiency model, Efficiency Vermont, which has delivered efficiency services on behalf of obligated electricity and gas utilities for many years.

Checklist:
Creating flexibilities under a clean heat standard

Banking and borrowing

- ❑ Is there a need for banking and borrowing to smooth the transition between two compliance periods?
- ❑ If decision-makers opt for banking and borrowing, how can the rules encourage early action and steady market growth for clean heat projects?

Trading of compliance credits

- ❑ Is trading expected to encourage the search for cost-effective actions to meet the target and sub-targets, and is this needed?
- ❑ Would the benefits of trading justify the increased complexity of the scheme, and is it manageable in the first years of the scheme?

Buyouts and alternative compliance mechanisms

- ❑ Can buyouts help reduce uncertainties about the costs of the scheme, and are they needed?
- ❑ If buyout is selected as an option, how could funding from buyouts be reinvested in securing clean heat increases? Does it make sense to appoint a default delivery agent?

Step 4. Ensure compliance

This chapter provides a review of the design features of a clean heat standard which can help secure compliance.

Administration

Decision-makers need to appoint a scheme administrator for the clean heat standard and define its role.

Role of the administrator

Legislation will usually establish some basic rules for the scheme and appoint an administrator to manage it.

It is good practice for primary legislation to contain enough details to set the scope of the scheme, while providing sufficient flexibility to move into the different implementation phases and adjust for changed circumstances through secondary legislation or decisions by the scheme administrator.

Choice of administrator

The administrator can be, for example, a ministry, a government agency or a regulator. Depending on the obligated parties and the design of the scheme and its objectives, different public bodies will be in the best position to provide administration. This depends on their expertise and experience.

Role of third parties

The clean heat standard can allow the administrator to allocate one or several of the management tasks to a third party, as long as the administrator remains in control of the policy's strategic elements.

Rules to credit actions

To check progress towards meeting the targets, the impact of clean heat actions must be assessed.

Assessing the impact of actions

In some cases, the impact of the clean heat actions is directly measurable. This is the case, for example, if the target is sales of clean heating appliances.

In other cases, the impact is not directly measurable. This is for example the case if the target is GHG emissions reductions. The impact in this example would be the difference between actual emissions and the emissions that would have occurred without the actions credited under the clean heat standard.

If the impact is not directly measurable, alternative assessment methods are required.

- One option is to establish deemed scores, whereby actions are allocated predefined impacts such as emissions reductions.
- Another possibility is to use energy meter data to assess the impact of each clean heat action.

Providing deemed scores

Providing deemed scores for standardised clean heat actions helps to limit the administrative burden, as does the provision of support tools to aid score calculation and simple online reporting processes.

In many cases, basic data on the characteristics of a building might be needed to generate a deemed score.

The simplicity of deemed scores – obligated parties must report actions, not *ex post* estimates of impacts – creates an incentive for unscrupulous market actors to prioritise speed of installation over quality. Sufficiently rigorous monitoring, verification and penalty regimes are needed to dissuade poor-quality installation.

Using metered methods

With metered methods, metered energy consumption is compared with an agreed model of what energy consumption would have been without the actions.

This approach can be more complex, but it can also be more accurate. It might be required for complex installations, for example in large commercial or mixed-use buildings.

Historical energy consumption and other information, such as weather data, would be needed to populate metered measurement models.

Considering lifetimes

Accounting rules should define how to treat actions that have impacts over many years, by attributing lifetimes to actions and deciding whether to discount impacts over time.

Making adjustments

Accounting rules should establish whether to adjust impacts to account for second-round effects, in particular the rebound effect, and additionality.

Rebound effect

Fabric efficiency measures and heat pump installations reduce the costs of heating buildings to a particular level of thermal comfort, which may lead some building occupiers to increase internal temperature levels compared to what they were prepared to accept before the clean heat actions were undertaken. This potential increase in the use of energy as a result of actions that reduce the costs of energy services is known as the direct rebound effect.

The use of *ex post* meter data automatically takes into account some second-round effects such as this one. To level the playing field between actions with different measurement regimes (metered and deemed), it would be sensible to apply a 'comfort taking' factor to deemed scores based solely on technical information. Evaluation evidence could be used to do this.

Other second-round effects (indirect rebound effects, spillovers) are difficult to estimate in the context of crediting actions.[47] In any case, a clean heat standard with a trajectory towards an end goal can have automatic stabilisers built into its design. These might be targets expressed as percentages of how much energy sales will increase or decrease in absolute terms if second-round effects lead to changes in energy consumption.

Complementary policies and additionality

Considering the complexity and scope of the heat decarbonisation challenge, jurisdictions have created a variety of programmes and policies to foster energy savings and emissions reductions in the building sector. Here we discuss how to account for interactions between those initiatives and the clean heat standard.

The term 'additionality' within a clean heat standard refers to the extent to which the impacts declared by obligated parties are due to the clean heat standard, as opposed to other policy measures or the autonomous actions of end-users. In many cases, eligible actions under a clean heat standard could also be supported by complementary policies such as EEOSs. Other policies such as equipment standards could help advance the objective of a clean heat standard. In addition, some heat users would have switched to clean heat solutions even in the absence of the clean heat standard.

There are two opposing ways to deal with additionality:

- A clean heat standard can disregard the question of additionality and award clean heat credits in all cases where eligible measures were rolled out and emissions reductions achieved. In this case, credits could be earned by any actor, including autonomous actors and those who use multiple funding sources and authorities to deliver eligible measures.

- Alternatively, a clean heat standard can require obligated parties to demonstrate that their actions led to emissions reductions that are additional to what would have happened in the absence of the standard.

[47] The indirect rebound effect happens when some of the financial savings resulting from the actions being installed are spent on other things that have an energy consumption associated with them; see Lees & Bayer, 2016. Spillover refers to additional impacts beyond those directly related to the actions that participants undertake – for example, through the uptake of actions by nonparticipants exposed to the policy measure, or through additional actions by participants themselves. Thomas, S. & Santini, M. (2021). *Measuring and increasing impact: The next challenge for EU energy efficiency policy measures.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/measuring-increasing-impact-next-challenge-eu-energy-efficiency-policy-measures).

If the target under a clean heat standard is set to the levels of emissions reduction or sales that the jurisdiction wants to achieve, the first option would be appropriate. For example, if the goal is to reduce emissions in the sector by 40%, any eligible action that contributes to that 40% can earn clean heat credits, regardless of what 'caused' the action to occur. Obligated parties will have the opportunity to contribute to delivering those actions, or they might simply offer to purchase the credits from others, which provides financial support for complementary policies and initiatives.

If the target under a clean heat standard is set to less than the levels of emissions reductions or sales that the jurisdiction wants to achieve, the second option would be appropriate. In this case, additionality should be addressed to reach overall decarbonisation objectives. Using the above example, if decision-makers project that complementary heat decarbonisation programmes will reduce emissions by 15%, the clean heat standard could be set at 25%. The estimated contribution expected from the other clean heat programmes would be subtracted from the overall target. This would lower the size of the obligation (in this case, to an additional 10%) while shrinking the pool of possible creditable actions.

The decarbonisation goal can be met in either case, but it is administratively simpler to avoid debates about additionality for individual measures and base the scope of the clean heat standard on the total goal.

Energy efficiency policies offer a good example. As energy efficiency has multiple public benefits beyond its contribution to decarbonisation, there is a case for allowing energy-efficient clean heating actions, including weatherisation and heat pumps, to earn credits both toward a clean heat obligation (for reducing emissions) and toward an EEOS (for improving energy efficiency). This can also simplify the scheme's rules and administration. At the same time, if actions can earn credits under different schemes, decision-makers will need to consider that activities under the two schemes might be concentrated in the same households. This has distributional consequences and could justify an increase in the sub-targets for low-income and vulnerable groups.

Promoting certain actions

It is possible to boost the credits given to actions (bonuses) or to reduce them (maluses) to reflect policy priorities. Bonuses (or maluses) provide an artificial boost to (or diminution of) the impacts credited to particular actions.

If certainty in delivery is needed, a sub-target would be preferable to bonuses. If policymakers do not require certainty, for example for innovative actions whose costs might come down with more short-term uptake, bonuses might be preferred.

Bonuses reduce the number of credits needed to deliver the overarching policy objective. One way of limiting the extent to which obligated parties use bonuses and ensure that the targets are aligned with the overarching policy goal would be to cap their use and adjust the target upward.

Zoom: Monitoring, verification and evaluation in clean heat standards

Decision-makers setting up a clean heat standard will lay down requirements related to monitoring, verification and evaluation to ensure that the progress on paper reflects what is happening on the ground.

Monitoring

The clean heat standard will include a procedure for obligated parties to document progress by feeding data into a monitoring system.

In some jurisdictions, it might be possible to make use of existing systems or databases. For example, existing schemes may already track the installation of all or some heating systems for reasons of safety and compliance.

Verification

Decision-makers can put in place two types of verification: first, to ensure that there is no fraud, i.e. the clean heat action has actually been delivered; second, to check that the equipment has been properly installed and delivers clean heat.

For small and numerous individual actions this may require sampling, meaning that only a subset of actions is verified.

Evaluation

Decision-makers will also lay down requirements related to evaluation. At a minimum, evaluators will look at whether the scheme has met its target. Depending on their mandate, they can look at other impacts, including on environmental, social and economic objectives. An evaluation can feed back ways to improve the next phase of the clean heat standard, in line with the continuous improvement principle.

Independence and transparency

It is good practice to ensure a high degree of independence for the agent responsible for monitoring and verification, and to ensure that independent third parties are in charge of conducting evaluations. A strong process involves mandating transparency in reporting by the administrator, and an open review of the monitoring and evaluation findings.

Penalties and incentives

A clean heat standard will involve a penalty for obligated parties that miss their target. Another option is to include performance incentives for obligated parties that overachieve their targets.

Encouraging action

Setting the penalty price at the right level will encourage action from obligated parties. Indeed, if this price is lower than the cost of delivering actions, it is likely that obligated parties will opt to receive a penalty, and more alternative policies will be required to reach clean heat goals.

In schemes with a buyout price, the penalty can be a multiple of the buyout price.

It is good practice to set the penalties in advance, to enforce them transparently and without undue delay, and to include an obligation to make up for the missed actions on top of the penalty.

Decision-makers could also increase the chances of compliance by setting incentives that would further encourage obligated parties to take action. Financial incentives have not yet been considered in clean heat standards, but they exist in other policies.[48]

Penalty funding allocation

It is important to dedicate financial resources coming from the penalties to the achievement of the overall heat decarbonisation target.

One option is to assign these resources to a default delivery agent that the scheme administrator would contract to implement clean heat actions.

[48] Crossley, et al, 2012.

Examples from clean heat standards in operation or under development

Administrator

Colorado, United States

- The Colorado Public Utilities Commission administers the state's clean heat targets. This includes the approval of the clean heat plans that utilities file.

United Kingdom

- The UK has appointed the Environment Agency as an administrator for the Clean Heat Mechanism.

Vermont, United States

- The Public Utility Commission will have the authority to administer the clean heat standard. Before that, it will submit detailed rules to implement the standard to the legislature.

- The Public Utility Commission will appoint a Technical Advisory Group, an Equity Advisory Group, and one or more default delivery agents to assist in administration of the programme.

Rules to credit actions

Colorado, United States

- The scheme provides instructions on which methods to use to calculate GHG emissions reductions.

- Methane credits should follow an accounting protocol established by the Air Quality Control Commission.

United Kingdom

- Obligated parties will need to submit boiler sales figures to the scheme administrator on a quarterly basis. This data will be audited and verified.

- Credits for heat pump installations will be notified via an appropriate certification scheme such as the Microgeneration Certification Scheme, which currently tracks heat pump installations for the purposes of grants, or an equivalent scheme.

- The UK government is proposing that the scheme will support hybrid systems comprising a heat pump with a fossil fuel backup, but such systems will only receive half a credit.

Vermont, United States

- Obligated parties do not need to establish that the measure was implemented solely as a result of the clean heat standard, but they must demonstrate that the emissions reductions are real.

- The Public Utility Commission will create an administrative system to register, sell, transfer and trade clean heat credits.

- The Department of Public Service will perform the verification of clean heat credit claims and submit results of the verification and evaluation to the Public Utility Commission annually.

Examples from clean heat standards in operation or under development

Penalties and incentives

United Kingdom

- Where obligated parties fail to meet their obligation, they will be required to make a payment in lieu of £3,000 per missing heat pump credit.

Vermont, United States

- Obligated parties that fail to retire the number of clean heat credits required each year will make a noncompliance payment to the default delivery agent of twice the amount established by the Commission for timely per-credit payments.

- The Public Utility Commission can also set penalties.

Checklist:
Ensuring compliance under a clean heat standard

Administrator

- ❑ What should primary and secondary legislation include to provide both certainty and adaptability regarding the administration of the scheme?
- ❑ Who should be the administrator of the scheme, and what should their responsibilities be?
- ❑ Does it make sense to hire a third party to manage some aspects of the scheme? If yes, how will the administrator keep control over the scheme's direction?

Rules to credit actions

- ❑ How could the rules to credit clean actions secure both simplicity and accuracy?
- ❑ Does it make sense to adjust the credits associated with each action to take into account secondary effects such as additionality?
- ❑ Should the clean heat standard become the umbrella policy, with other complementary policy-driven investments counting as creditable clean heat measures?
- ❑ Is there a need to associate a bonus or a malus with any actions?

Penalties and incentives

- ❑ What would be the right level of penalties to encourage action by obligated parties? Is there a need to provide incentives for obligated parties to comply?
- ❑ How could funding from penalties be reinvested in securing clean heat progress? Does it make sense to appoint a default delivery agent?

Conclusions

Designing a clean heat standard requires a good understanding of the role that this standard will play in a comprehensive framework for heat decarbonisation. Decision-makers can build on longstanding experience with similar market-based tools, including energy efficiency and renewable mandates.

This handbook provides a starting point for launching a discussion about designing a clean heat standard. There is no one-size-fits-all solution, and designing the standard will require a dialogue with all relevant stakeholders, including potential obligated parties, the clean heat industry, possible beneficiaries, consumers who will carry the costs of the standard, and, most importantly, vulnerable groups that the standard might affect without necessarily improving their ability to benefit from clean heat solutions.

We recommend that decision-makers assessing the potential role for a clean heat standard in their jurisdiction:

1. Consider the specificities of the heating sector, where barriers to investments prevent the mass deployment of clean heat solutions such as energy efficiency and renewable heat. Very often existing policies encourage the deployment of clean heat, but not at the speed required to meet climate goals.

2. Place equity issues at the core of the policy design process, including by putting in place inclusive consultation processes involving all communities that will be impacted directly or indirectly. Access to affordable heat is already a concern in many jurisdictions, and it makes sense for heat decarbonisation policies to contribute to solving this issue.

3. Favour pathways that bring long-term benefits to people and the environment. Some solutions might bring GHG savings but create a lock-in to fossil fuel-based systems or cause other environmental damages. Jurisdictions will differ in how they address these topics, and clean heat standards can be tailored to reflect each jurisdiction's policy determinations.

4. Reflect on the different design options for the clean heat standard, noting that these will influence the outcome of the policy. Decision-makers will have an interest in opting for the model of clean heat standard which can best help them overcome the barriers to clean heat deployment. Flexibilities can be designed to ensure a cost-effective achievement of the target without compromising the goals of the tool, while the compliance framework will be crucial to secure progress.

5. Explore whether sub-targets can help achieve additional policy objectives, such as prioritisation of target groups of beneficiaries, ensuring an equitable clean heat transition, or fostering innovation. Where they can be implemented, sub-targets for the delivery of clean heat actions among low-income households and vulnerable groups can improve the contribution of the tool to an equitable energy transition.

6. Look into complementary policies that would further advance heat decarbonisation. While clean heat standards add to the toolbox that policymakers can use to decarbonise heat, they cannot on their own solve all issues related to heat decarbonisation: that requires a diverse policy mix, including for example heat planning policies.

Further resources

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