How to accelerate the heat transition:
a guide for local government and actors

Module 2

Financial policy
instruments for sustainable heating

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SHIFFT

SUSTAINABLE HEATING: IMPLEMENTATION OF FOSSIL-FREE TECHNOLOGIES

CONTENTS

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INTRODUCTION

This is the second part of a series exploring how municipal efforts can accelerate the decarbonisation of heating at the community level.

This is an output of the EU Interreg 2 Seas funded project SHIFFT – Sustainable Heating: Implementation of Fossil Free Technologies. This module outlines financial policy instruments, describes good practice for their application and addresses a range of common challenges. Examples from cities taking part in the SHIFFT project and others are provided.

SHIFFT targets the barriers and levers to growth of zero carbon heat in households and communities and this document aims to provide guidance as to how financial support can be effectively provided by cities to key stakeholders who may be influenced to install or promote zero carbon heating systems heat to households, neighbourhoods and other community buildings.

This document is the second in a four-part guide on how to accelerate the heat transition in cities. Module one in this guide is concerned with the role of communities and the need for a co-creation process which can ensure that community views are a central part of any municipal planning for the shift to zero carbon heating. Module three focuses on city heat strategies, regulation, and other non-financial policy instruments. Module four addresses the technologies and technical choices for the heat transition in cities.
All of the other modules are also available from the SHIFFT website:
https://shifftproject.eu

AN OVERVIEW:

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Across European states, policy instruments to provide financial support for zero carbon heat are much less common and less well-developed than policy instruments for the support of renewable sources of electricity.

In general, these instruments aim to use public money or finance to mitigate cost barriers to adoption of zero carbon heating technology; these may be the capital cost of purchase and installation or the running costs of renewable heat technologies. Most of the literature on financial policy for heat takes a national or international perspective, this document presents the different options for financial support that have been developed which have or could be applied at local levels of government. It will consider subsidy schemes, tax-based schemes including tax relief and credits, and anything else where a financial stimulus is applied. Where they exist, they have tended to have been adopted at the national level rather than the local level. There is always the theoretical potential for direct financial support below this level but often this is limited by the availability of sufficient financial resource at lower levels of governance. Adoption at regional level will tend to depend on the particular governance structure. There is also a need to consider how national and local level financial instruments might interact or over subsidise, which may limit the potential for future application.

One clear role for local government, which cuts across both financial and non-financial policy instruments for heat decarbonisation, centres on getting the right information to different types of consumers. This can include information on the kinds of technology that might be applied, the supply companies needed to adopt them, the balance of energy efficiency and zero carbon generation and, relevant to this module, raising awareness of the availability of different financial support, regardless of the level of governance from which it emerges. Helping to target those who qualify, who can afford to access capital, or who might most benefit from different mechanisms is a task best suited to local government. A 2022 UK poll around renewable heat put concerns about the cost of new zero carbon system as the biggest deterrent to their adoption, and targeted information which addresses this is essential (BEIS Public Attitudes Tracker 2022). Our expectation is that this concern will also apply across other countries.

3 KEY FINANCIAL INSTRUMENTS FOR SUPPORTING EFFICIENT, ZERO CARBON HEAT

A range of financial policy instruments have been deployed to encourage investment in local carbon heat technologies and upgrades to building energy efficiency across Europe. These instruments are diverse, and each has merits and limitations; a broad set will be required as policy must target different audiences (households, businesses, industry, and subdivisions of these) to encourage the adoption of a wide range of measures (such as zero carbon heat generation, heat distribution, energy efficiency, and energy monitoring technologies) in both new and existing buildings in different contexts and localities. Further, different mechanisms will have a better fit with existing regulatory regimes, different national approaches to providing support and options will be shaped by different starting points and available resources. A rich literature has documented these; and more detail on the nuances of different instruments along with comparison between some European countries can be found (Connor et al., 2013; Collier, 2018; Tognetti, 2020; Economidou et al., 2019; Bertoldi et al., 2021; Kerr & Winskel, 2021). Different actors will have different characteristics; for example, householders are likely to be more debt averse than businesses or have different expectations for the financial returns on their investment.

Figure 1: Overview of current financial instruments supporting energy renovations in the EU. Source: Bertoldi et al. 2021

	TRADITIONAL & WELL ESTABLISHED	TESTED & GROWING	NEW & INNOVATIVE
Non Repayable Rewards	Grants & Subsidies	Energy Efficiency Obligations	Energy Efficiency Feed-in Tariffs
	Tax Incentives		
Debt Financing	Soft Loans	Energy Performance Contracts	Energy Efficiency Mortgages
	Leasing	Energy Service Agreements	Crowdfunding
		Revolving Funds	Property Assessment Clean Energy
		Commercial Loans	On-bill Finance
Equity Financing		Energy Performance Contracts	Crowdfunding
		Energy Service Agreements	

3.1
A SELECTION OF FINANCIAL INSTRUMENTS FOR LOCAL GOVERNMENTS

3.1.1 Capital grants

Cash grants offer a discount against purchase of a technology or service, this might take the form of a straightforward cash payment toward the overall cost or a percentage of the total cost, typically with a limit on total cost. This can stimulate the market by partially or fully mitigating the capital costs of zero carbon heat technologies or energy efficiency measures for householders and businesses. Grants are either paid to the property owner or the contracted installer on verification of an eligible installation. Grants can be designed to vary based on a range of criteria including energy performance, household income, property or tenancy type, intervention measure, and technological maturity. Free-ridership can occur when the subsidy is used by consumers who intended to install a measure regardless of subsidy; this is very difficult to avoid but it can be mitigated to reduce the risk of richer households gaining more from grants than poorer households – known as the 'Matthew effect'. Effectiveness depends on the size of the grant and the relative cost of the technology options.

Table 1 Capital Grants

Core benefits	**Easy to understand.** **Able to stimulate uptake of novel technologies at an early stage.** **Able to direct support towards vulnerable or low-income groups.**
Cost and effectiveness uptake.	**High capital cost but generally high Relatively low administration costs.** **However, uptake is often lowest households, since access to capital may still be an issue.** **Can be cost limited to suit available budget.**
Challenges	**Short-term and relatively small-scale impact.** **Budget restrictions and uncertainty can negatively impact the market.** **May experience free riders.** **Can involve complicated application processes.** **May not address 'landlord problem' or 'split incentive': those in private rented properties gain from improved energy efficiency but lack the ability to make changes, whilst landlords do not see direct benefit from upgrades.**
Practicalities at local level	**Grants can be targeted at specific local demographics.** **Local grants may use national frameworks for requirements such as quality assurance or connect to existing building regulation enforcement.**

3.1.2 Tariffs

Tariffs pay property owners for generating zero carbon heat or, more innovatively, for energy saved. Typically, a tariff is paid per unit of energy generated, incentivising development and installation of efficient generation equipment. Tariffs may be applied on a 'deemed' basis for smaller systems, whereby the output is estimated rather than measured, in order to avoid relatively high costs of metering small systems, and with an additional benefit of minimising administrative costs. Tariffs reduce total cost of ownership of the new heating system (or measure) by paying the property owner over time (typically over 5-20 years) for implementing zero carbon energy measures, but they only indirectly alleviate problems of access to capital. Examples of these include the UK Renewable Heat Incentive (a form of government subsidy). Energy efficiency 'feed-in tariffs', as they are sometimes called, have not yet been implemented at scale.

Table 2 Tariffs

Core benefits	**Reasonably easy to understand.** **Doesn't require up-front financial support.** **Can be effective in stimulating the supply chain and normalising new technology.**
Cost and effectiveness	**With good management, admin costs should be relatively low.**
Challenges	**It can be more difficult to limit costs and this can be unappealing to government at any level.** **It is possible to over-subsidise technology, where the 'real' price is not clear.** **Care must be taken to ensure tariffs do not reward intentional wasting of heat to maximise subsidy, as occurred with the Northern Ireland Renewable Heat incentive (Muinzer, 2017).** **Doesn't address issue of capital access and thus may direct public funds to the advantage of 'middle classes'.**
Practicalities at local level	**Previously deployed regionally in Germany. No known examples at the local level.**

BOX 1: MECHELEN – GRANT FOR BOILER AUDIT

Mechelen offers householders a range of grants for retrofit and renewable heat technologies, these are also means-tested with more support provided to those on the lowest incomes.

More information (in Flemish): https://klimaatneutraal.mechelen.be/premies

3.1.3 Low interest loans

Low interest loans are a longstanding and useful method of stimulating the market for zero carbon heat and other retrofit measures by providing direct access to (affordable) capital for householders and businesses. More innovatively, loan schemes are being established as 'revolving funds' in which the loan repayments are recycled to fund further loans. As private loans are still not widely available or affordable, government provision of low interest loans can accelerate decarbonisation.

BOX 2: LENDOLOGY CIC, UK

In the UK, the non-profit enterprise Lendology has partnered with a number of local governments in the southwest of England to offer households low-interest loans to fund home energy performance upgrades. The local government funds the reduced interest rates; Lendology provides capital and runs the loan scheme.

https://www.lendology.org.uk/loans/

Table 3 Low interest loans

Core benefits	**Continuity of funding (especially revolving funds).** **Easily implemented by banking institutions – avoiding more tedious processes associated with grant schemes.**
Cost and effectiveness	**Assessment of opportunity must be transparent and accurate. A key potential problem is recommendation of loans for adoption of ineffective technology which does not deliver on savings.**
Challenges	**Householders exhibit a degree of debt aversion.** **Others may be unable to meet existing financial capability requirements (e.g. due to low income or previous debt) – these may need revising.**
Practicalities at local level	**Local government may not have the capital themselves and often partner with a third party provider.** **Municipal loan schemes can be designed to be repaid via property tax and the debt attached to the property (rather than the individual) so it can be transferred and paid off by the next owner, reducing personal debt.** **A high degree of default on debt may push up costs and may influence lending decisions and thus loan access.**

3.1.4 Tax instruments

Government can subsidise the costs of installing zero carbon heat or energy efficiency measures though tax reductions, rebates, exemptions or benefits – such as VAT exemption or reductions in income or property tax (some property taxes are controlled municipally or regionally depending on the country, VAT is usually a national, sometimes regional, competence, and income tax is usually controlled nationally). The reductions can be conferred via a range of taxes (on income, property or VAT) and to support all or some types of zero carbon heat or energy efficiency measure (for more detail see Economidou et al., 2021). Different types of taxation are suited to different objectives: VAT and income tax reductions are typically used to target particular measures or technologies (though the latter can be used for whole building upgrades, e.g. Italy's 'Eco superbonus' scheme), whereas linking property tax to building energy performance may encourage more holistic, building-level approach to zero carbon heat.

Table 4 Tax instruments

Core benefits	**Can target moments of change (e.g. property taxes when moving house)** **Can directly reduce upfront costs (VAT particularly), though with an upper limit equal to the tax rate.**
Cost and effectiveness	**Variable overall costs as stimulating uptake can increase government revenues.** **Administration costs vary depending on the specific tax and incentive (see e.g., Jahn & Rosenow, 2017 on property taxes).**
Challenges	**Reliant on high tax collection rate.** **Can attract free riders.** **Typically reduces tax revenues, though a case can be made to shift tax burden elsewhere.**
Practicalities at local level	**Of the taxes considered, those on property are most commonly controlled locally.**

3.1.5 Auctions and tenders

It is possible to procure heat supply or distribution through a competitive auction or tender process. Auctions operate by offering support to the best value (i.e. lowest cost per MWh) projects for a given technology or service and they tend to be used to support large-scale projects. Rather than offering a specified price, auctions are a price discovery tool in which suppliers bid for a portion of a total capacity (Daszkiewicz, 2020; Blömer et al., 2022). Auctions are relatively new to the renewable heat sector and it is possible to acquire different forms of heat technology, heat supply , or capacity in this way (see Blömer et al.'s 2022 policy brief on auctions for heat for more detail and examples). These include the auctioning of heat dispatch to a network, the installation of heat generation capacity and the planning and construction of new or expanding district heat networks. Tender processes are similar to auctions, but bidders compete to supply the full capacity required rather than a portion of it. Tendering and auction mechanisms are unlikely to be appropriate for individual household applications due to high admin costs at scale and relative complexity, but may be useful in supporting larger infrastructure projects, such as district heating, where zero carbon technology might usefully contribute to high demand applications such as in industry.

Table 5 Auction mechanisms

Core benefits	**Evidence of application to renewable electricity suggests auctions are effective for support of technologies close to market readiness.** **Reveals real price of technology.**
Cost and effectiveness	**Downward pressure on price may be an effective way to allocate resources against carbon saving.**
Challenges	**Experience with small-scale application to renewable electricity suggests high admin costs at scale. Together with the relatively complexity, means this is unlikely to be useful for individual household systems.**
Practicalities at local level	**Tenders are familiar to most, if not all, municipal governments, auctions perhaps less so, but are increasingly useful to cities for, e.g., heat networks.**

3.1.6 Inclusion in financial obligations

Mechanisms may oblige energy companies or other entities to act to achieve particular goals through obligations. The UK's Energy Company Obligation (ECO) is entering its fourth iteration and while it primarily favours energy efficiency it has provided some support for zero carbon heating systems to replace ageing fossil fuel systems. Energy companies are set targets for either carbon or energy reduction and earn credits against these targets based on installation of energy efficiency or other zero carbon energy technology. Each action has an associated carbon saving against a target for the company. This saving can be amended over time and technologies can be added or removed from the list of actions as they mature or become ubiquitous. The obligated companies can then choose which to roll out to consumers (not necessarily their own consumers) and develop strategies to achieve the goals at minimum costs.

Other forms of obligation are considered in module three of this series, which deals with non-financial mechanisms.

Table 6 Spending obligations

Core benefits	**Heavily discounts upfront costs (possibly even meeting 100% costs).** **Allows for targeting of more vulnerable consumers and consumers most likely to be in fuel poverty.**
Cost and effectiveness	**Energy companies can be incentivised to find the lowest cost route to delivery as with the UK ECO mechanism.** **Administration costs are typically very low.**
Challenges	**Political issues, all consumers pay more in order to reduce energy costs for some, though overall costs may drop.** **Where this exists as a national mechanism, control of its application at local level may be entirely in the power of the energy companies. There may be some possibility of attracting companies to operate in a particular city.**
Practicalities at local level	**Enforcement and administration might be an issue for a locally led version of the financial obligation, especially in relation to a company which operates more widely than the municipality.**

3.1.7 Direct Public Investment

Local government can invest directly in new heat technology or infrastructure. The largest examples of this are municipal heat networks which may be built and owned by the municipality (or a subsidiary), but smaller examples include heat networks connecting public buildings or heat pumps for single buildings. The capital for this can be financed from the government's income, through borrowing or bond issuance, from grants, or a combination of these. Major projects may be structured as public-private partnerships combining government investment and private capital, but the contracts must be well-negotiated to ensure that the risks are shared and any guaranteed returns fair.

The potential for municipally owned and/or operated systems will be shaped by national regulatory architecture as well as ongoing practice and attitudes to municipal energy companies. This will impact the role that the municipality takes, or the functions that can be provided by either the municipality or a third party. None of the four states represented in the 2 Seas region has a formalised regulatory architecture for district heat networks (unlike Germany where municipalities own heat infrastructure), though the UK has announced a new approach, to be led by the current gas and electricity regulator. Details have not been published as yet.

Table 7 Direct public investment

Core benefits	**The municipality can cover the upfront capital costs of infrastructure where funds are available.** **May allow for some targeting of more vulnerable consumers and consumers most likely to be in fuel poverty.**
Cost and effectiveness	**High capital cost but with a return on investment. Leveraging governmental access to low-cost capital can enable services to be provided cost-efficiently, with surpluses supporting the public accounts.** **Local and public ownership of heat infrastructure.** **Also attention to civic and public values instead of mere financial-economic private sector values.**
Challenges	**Political issues, all consumers pay more in order to reduce energy costs for some, though there is also a carbon saving.** **Risk attached for the municipality.** **Cultural attitudes to municipal energy companies may shape the likelihood of this option being culturally acceptable.** **Consumer protection is necessary to limit exposure to rising costs.**
Practicalities at local level	**Access to capital can be a barrier for local government, and therefore joint public-private investment is often adopted. This is not problem-free.** **Public ownership may be politically challenging as it conflicts with the dominant doctrine of a 'small state' state' (e.g. UK, the Netherlands).**

BOX 3: FOURMIES – INVESTING IN LOCAL HEAT NETWORKS

The city of Fourmies is investing (with support from European and national funding bodies) in the construction of a heat network in the city centre, connecting nine municipal buildings to a biomass boiler running on local hedge-trimmings.

www.shifftproject.eu/news-and-events/cultural-heat-network-ville-de-fourmies-fr/

BOX 4: BRISTOL – INVESTMENT IN A HEAT NETWORK

Bristol City Council has invested directly (assisted by national funding) in the construction of the city's heat network infrastructure through a fully municipal government-owned company which now owns the network.

The city has also launched its City Leap initiative which aims to mobilise public and private investment in sustainable energy infrastructure over 20 years. Initially focusing on publicly owned buildings to build supply chains and expertise, the ambition is to support the whole locality in decarbonising.

More information: www.energyservicebristol.co.uk/cityleap/

3.1.8 A Public 'Energy Services Company' (ESCo)

A company can be established by the local government (possibly in partnership with private investment) to support improvements to building fabric or developing local heat systems. Specifically, these companies are often proposed as a vehicle to provide finance for residential renovation works (as well as offer technical assistance and oversee works), or to invest in developing district energy services such as heat networks. These companies can take a variety of structures and business models according to their purpose (e.g. Tingey et al., 2021). Given the relatively high financial and resource set-up costs, these financing models are most relevant in the context of structured programmes in which demand can be coordinated, such as whole-area or multi-occupancy building projects.

See also: 'Retrofit one-stop-shops' below and in Module 3 in this series.

Table 8 A Public ESCo

Core benefits	**Applies existing government expertise in planning and building standards, as well as experience in retrofitting social housing and public estate.** **Retrofit approach may incorporate wider value streams, such as social welfare, local jobs, and social justice.** **Ability to provide funding for large, coordinated whole-building (e.g. condominiums) or whole-area projects.** **A familiar, trusted, and accountable retrofit provider.**
Cost and effectiveness	**Relatively high capital requirement to set up and deliver but can provide good value for money both for the municipality and householders.**
Challenges	**Access to capital.** **May meet ideological opposition to public ownership.** **Companies can experience financial losses and may not be suited to all markets.** **Awareness and popularity of ESCOs varies between countries.**
Practicalities at local level	**Municipal in-house models can avoid costs and time of setting up a separate enterprise and provide direct control. They can also experience disruption at moments of political handover.** **Third sector organisations can provide greater resilience and continuity.**

3.1.9 Other tools

We have listed a selection of common and useful financial policy instruments which are suitable to be implemented by municipal governments. Other instruments exist, Figure 1 shows a range of some of the other options for financial instruments suitable for encouraging energy efficiency renovations – see Bertoldi et al. (2021) for full description and exploration. Many of those which are most likely to be delivered by private companies (e.g. energy efficiency mortgages) may need support from government.

BOX 5: AN ESCo TO TARGET CONDOMINIUMS IN FLANDERS

A 2022 report by BBL (Foundation for an improved living environment) proposed a public ESCo as a solution particularly to provide finance and support to 'condominiums' – multi-occupancy buildings – which present particular challenges, including the joint ownership of these large buildings and the consequent need for agreement and coordination. An ESCo can act as a third-party investor for these works and recoup the money through on-bill payments, providing an integrated service.

Examples of retrofit ESCos remain limited, but the development of an ESCo along these lines is being explored in the city of Mechelen as a key part of their heat strategy.

3.2 GOOD PRACTICE

The nature of the heat transition makes it a unique challenge. The need to develop and apply a wide range of technological upgrades (in particular, heat pumps, heat networks, biomass boilers and myriad energy efficiency measures) distributed across tens of millions of buildings presents a far more complex problem than decarbonising electricity. Financial (and other) policy must be targeted at a diverse set of solutions in diverse socio-economic and spatial, as well as political, contexts. We have identified some key areas of 'good practice' relevant to financial policy tools based on research and experience which can guide local government in policy development. We summarise some basic tenets of effective policy, below.

3.2.1 Keep it simple

Financial subsidies often suffer from complicated or tedious application processes which dissuade consumers from applying. Since zero carbon heat systems will be much more dependent on active buy-in from communities, it is essential to develop policies which are easy to understand and to access. More complex policies can mean higher administrative and transaction costs, and act as a barrier to adoption and to maximising spend on new systems. A balance must be struck between ensuring verification to minimise fraud or freeriding, whilst designing an easy-to-use process to aid organisational and public understanding.

3.2.2 Target moments of change or disruption

Changes to building fabric or the heat system are necessarily disruptive to the lives, work or activities of those using the building. Therefore, policy is best targeted at moments when there is already flux or disruption, such as building sale or purchase, renovations or extensions, and replacement of old heating systems, encouraging heating and fabric upgrades at the same time. In this context, it is especially important that the process for accessing support, finding contractors, and carrying out the installation is as straightforward as possible. An estimated 30% of new heating systems bought in the UK are emergency purchases when old systems fail in adverse conditions. A policy which slows replacement seems likely to deter the consumer from selecting the zero carbon option (Ipsos Mori & The Energy Saving Trust, 2013).

BOX 6: LISTENING AND RESPONDING TO CITIZENS – HELPING SELF-STARTING CONDOMINIUMS

In Middelburg, the association of owners of a condominium of 36 units investigated the possibilities for making the building natural gas-free and approached the municipality to ask for funding. The process involved research and external expertise, as well as considerable effort to get all apartment owners on board. The municipality was asked if they could contribute to the cost of getting this co-creation process started, which they agreed to do.

This request led to the city to allocate budget for similar initiatives. Five condominium associations can get a contribution of 50% of their initial research costs (e.g. for external advice and organising meetings) up to a maximum of €1500. In return, the initiatives share their experiences to make sure the lessons learned are shared with associations in similar buildings or situations.

3.2.3 Policy mixes

Research shows that combinations of policies, both financial and non-financial, can be more effective than individual policy instruments when, together, they target different but complementary challenges, even with the same technology (See Figure 2). Typically, subsidy schemes often go along with campaigns or other types of communicative policy instruments for the reason that target groups (like households) first need to be made aware and consider the benefits of the subsidy before deciding to actually apply for it. Another example is purchase incentives for heat pumps that can be combined effectively with quality standards for technology manufacture and installation (Rosenow et al. 2017). Or energy home audits (paid for by national government) combined with a subsidy to lower upfront investment in thermal insulation and heat equipment. Grants for different stages can also be combined – one study found that the highest conversion rate for retrofit projects came from a relatively low assessment subsidy but a relatively high installation subsidy (Gillich et al., 2018).

Furthermore, to drive the transition to zero carbon heat as fast as possible and to include both one-off and multi-stage deep retrofit improvements, policy mixes must address the full range of energy efficiency technologies (Rosenow et al. 2017). Specific to heat, ensuring a high degree of household energy efficiency should always be a precursor to introduction of a zero carbon heating system (e.g. IEA Net Zero Report, 2021). This allows for minimisation of the size and cost of the new system and avoids future waste of fuel and associated costs, where applicable. However, while essential to the goal of minimising emissions and ensuring householder comfort, this adds the complication of deploying policy instruments to drive both energy efficiency and introduction of zero carbon heating. At the local level, policy mixes might involve designing policy to complement existing national instruments.

Main Effects	Reducing installation cost from £10,500 to £5,500	+ 10 %**
	Interest-free loan instead of an upfront payment	+ 9 %**
	Making heat pump running costs cheaper than gas boiler	+ 7 %**
	Reducing installation time from ten to three days	+ 0 %
Combined Effects (Interaction effects)	Low installation cost + low running cost	+ 30 % (+13 %**)
	Interest-free loan + low running cost	+ 24 % (+8 %**)
	Low installation cost + Interest-free loan	+ 16 % (-3 %**)

Figure 2 The results of a UK study in 2022 examining single interventions (orange) and combined policy interventions (green). The study found that 12% of the population would choose a heat pump in current conditions; the right-hand column shows the additional percentage of participants who would choose a heat pump following each intervention (or combination). The numbers in brackets indicate the 'interaction effects', i.e. the effect of combining two interventions on uptake. The study found that combining policy to reduce installation costs (i.e. a grant) and running costs could make up to 30% of the population select a heat pump – this combined effect is 13 percentage points greater than either of the two measures individually. In contrast, combining a grant with an interest-free loan had an effect 3 percentage points smaller than the sum of the measures individually, suggesting that they mutually reduced their effectiveness. N = 8,016; Choices = 24,048. ** = p<0.01. Source: Nesta and the Behavioural Insights Team, 2022: https://www.nesta.org.uk/report/how-to-increase-the-demand-for-heat-pumps/

3.2.4 Policy stability

The decarbonisation of the heat system at the local level needs to be carried out rapidly to meet climate targets (and alleviate the post-Coronavirus energy price crisis), nonetheless the whole process will take decades rather than years. A stable and predictable policy environment providing sustained support over decades can give both consumers and suppliers confidence to plan and take decisions about developing resilient supply chains, training and other essential stages, and thus bring about substantial lasting change in the heat system (Hanna, Parrish & Gross, 2016). Whilst a degree of flexibility or adaptability can be beneficial, (the possibility of) abrupt policy change creates uncertainty and heightens perceived risks.

3.2.5 Staging of policy deployment

The transition from fossil fuel heating to efficient renewable heating systems in buildings is often conceived as following a series of phases of new technology adoption. At the same time, it is necessary to support the deployment of both building fabric energy efficiency measures and zero carbon heat technologies at the same time.

The various barriers to adoption vary over time, meaning that the optimal policy instruments also change, as shown in Figure 3. Financial policy instruments are likely to be more important at earlier phases of market development, and structural and regulatory instruments will become increasingly important and effective as the market grows and becomes established. For example, whilst capital grant subsidies can be effective at an early stage when the capital costs and perceived risks of innovative products are highest, these might usefully be replaced over time with low-interest loans (Webb, 2016). It should be noted that the majority of zero carbon heat technologies are technologically mature, and in use in high volume in some parts of the world, including some European countries. What is needed is to develop their wider adoption in Europe, by supporting their increased commercial maturity as well as awareness and uptake in order to increase deployment and reduce costs through both learning and scaling up.

One implication of this is that two technologies may need different support instruments at the same time, if both are to thrive. Along the same lines, some instruments may be more appropriate for supporting growth in the household or in the commercial or industrial sectors, for example households tend to require more simple-to-understand mechanisms or need more help to access capital to self-fund.

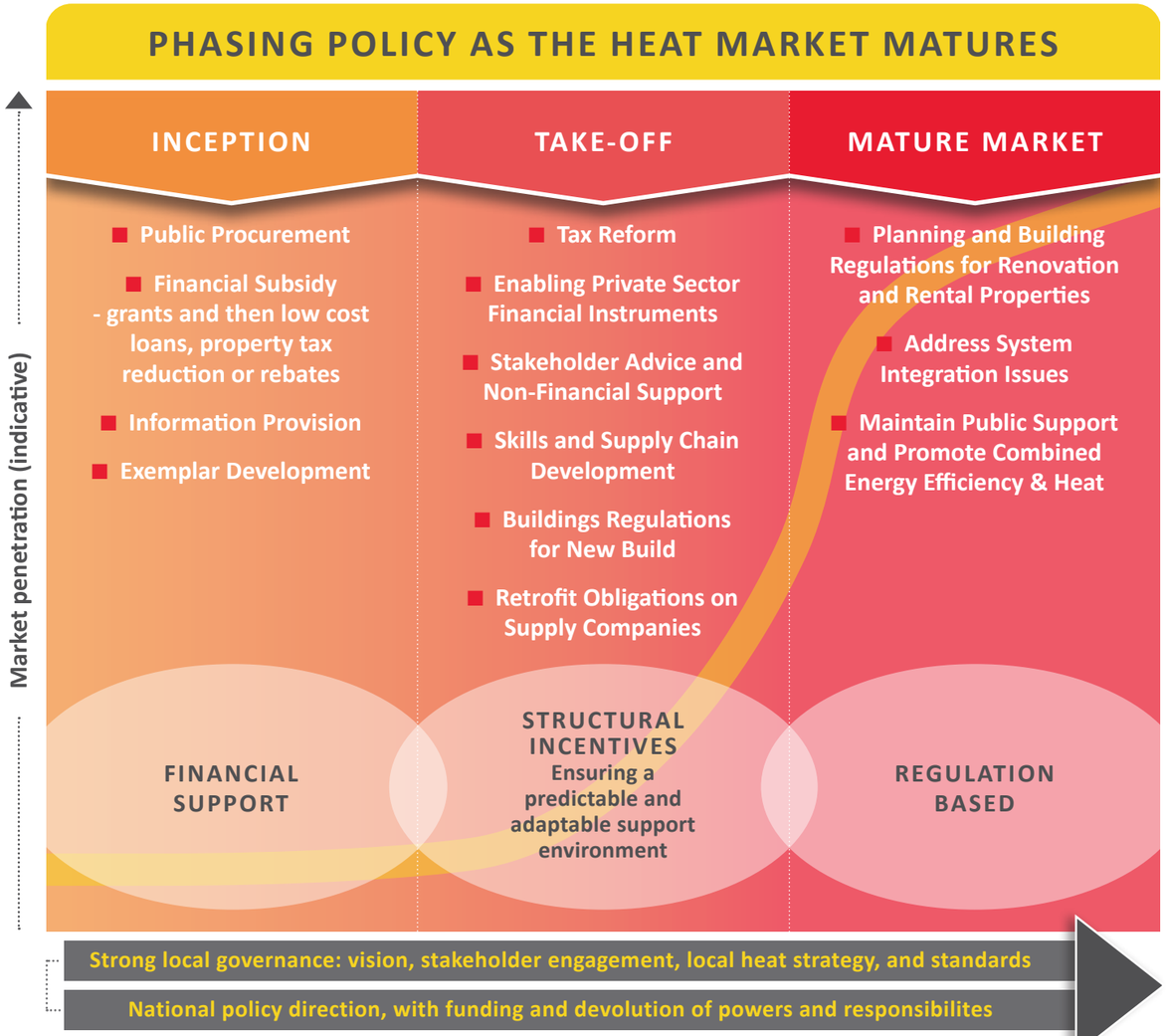

Figure 3 S-curve of the development of heat technology market and policy instruments. Source: Adapted from Foxon et al. (2005); Lowes et al.(2020); and IEA (2012).

3.2.6 Greater support for comprehensive retrofit measures drives uptake

Evidence indicates that a stable and comprehensive policy environment can enable those constrained by capital availability to retrofit in a staged manner, installing a series of single measures (Rosenow et al., 2017). It is also possible to offer preferential interest rates or larger grants to householders who take a holistic approach to installing retrofit measures (i.e. installing multiple measures). A holistic approach to retrofit is essential to long term goals and minimising the cost of this is a considerable societal benefit; enabling and encouraging householders and businesses to think and plan holistically should therefore feature in the design of local support programmes or even of targeted support for particular measures, for example, benefits may be offered for those who install an extra measure as part of a wider programme of works.

3.2.7 One-stop-shops: a citizen hub for financial support

Retrofit one-stop-shops provide services including advice, assistance and project management for those upgrading the energy performance of their house. In addition to providing non-financial assistance, one-stop-shops can assist residents or businesses with identifying and accessing suitable available funding. There is more information on one-stop-shops in our guidance module on ‘non-financial policies’.

3.2.8 Local Energy Economies and Community Enterprise

The fossil fuel heat system relies on fuel traded nationally and internationally and the transition to renewable heat sources offers an opportunity to enhance the local economic benefits from the heat system. Local government can work with local businesses to build the supply chain capacity to install and maintain renewable heat systems; focusing on supporting local business capabilities will help to maximise the economic benefit to the local area, creating jobs and retaining profits locally.

Local government can also help community enterprise to establish and flourish, in many cases public support such as tax benefits, tariffs, grants or use of municipal infrastructure may be required for local energy communities to establish and succeed. Community energy enterprises and energy non-profit organisations are diversifying by developing and testing new business models to install and operate heat generation and distribution (e.g. as in Denmark), and to install energy efficiency and renewable heat technologies (e.g. Carbon Co-op, Manchester, UK). These organisations’ local embeddedness and trustworthy nature can mitigate some householders’ concerns about the legitimacy and honesty of contractors, and their citizen ownership can keep prices low (Gorroño-Albizu & Djørup, 2019), whilst economic benefits are retained locally.

4 COMMON CHALLENGES AND SOLUTIONS

4.1 HOUSEHOLDER AND CONSUMER CHALLENGES

Householders and other building occupants face a range of economic, informational and decision-making barriers to adopting or investing in low/zero carbon retrofit (Bertoldi et al., 2021).

Financially, high upfront costs, the need to incur debt, and split incentives (such as between tenant and landlord, where one person must pay the costs and another feels the benefits) are frequent barriers to adoption of zero carbon heat systems. Zero carbon heating technologies (e.g. heat pumps, insulation and ventilation) tend to have a high upfront capital cost which can make them unappealing or, for many households, an impossibility due to limited access to capital. Depending on the maturity of the technologies and the supply chain proficiency and capacity, policy can be selected to directly alleviate limited access to capital (e.g. through loans or grants) or indirectly enhance access to capital by reducing other barriers in order to encourage third parties to provide capital. Other options could include providing 'heat-as-a-service' to customers (Energy Systems Catapult, 2019) – this may be offered by the municipality or an independent company. It may be possible for municipalities to encourage service providers to establish themselves in the locality, otherwise access this may be 'luck of the draw' for the moment. Application of this model is growing in Europe, Denmark for example has used subsidies to encourage energy service companies to offer heat-as-a-service wherein customers effectively get a heat pump by subscription (Jensen and Svendsen, 2021).

Loans can mitigate limited access to capital to meet high upfront costs, but debt aversion can reduce uptake and debt finance relies on the credit worthiness of the householder or business. Grants avoid this aversion but are more expensive from the government perspective.

These challenges are compounded and exacerbated by split incentives in cases where the building occupants are tenants (Petrov & Ryan, 2021). Tenants benefit directly from improvements but are not incentivised or are often unable to invest in changes in a building they do not own. Landlords, meanwhile, are discouraged from investing in the building's energy performance due to the lack of direct return on their investment, though they may benefit from increased property value. Multi-dwelling buildings can also struggle to reach agreement to invest. Different tenancy types are an important parameter in policy development. Solutions to this tend to attempt to incentivise landlords to act, whilst providing tenants with savings and information about energy performance (Ástmarsson et al. 2013; Bird and Hernández, 2012). Ástmarsson et al. (2013) propose a range of policy instruments including mandating energy performance, allowing landlords to raise rents to cover costs, and energy labelling. Bird and Hernandez (2012) describe a single solution using finance repaid through utility bills with a small portion paid to the landlord for a short period; it is designed so that tenants experience (small) savings from day one which increase as the costs are paid off. To our knowledge, this has not yet been implemented anywhere.

BOX 7: UPFRONT COSTS AND RUNNING COSTS FOR HEATING TECHNOLOGIES

Householders must consider both the upfront costs and the longer-term running costs of their heating system. The IEA has a residential heat economics calculator (with data for some countries) which provides an estimated comparison of the costs of buying and running different heat technologies over their lifetime, see below.

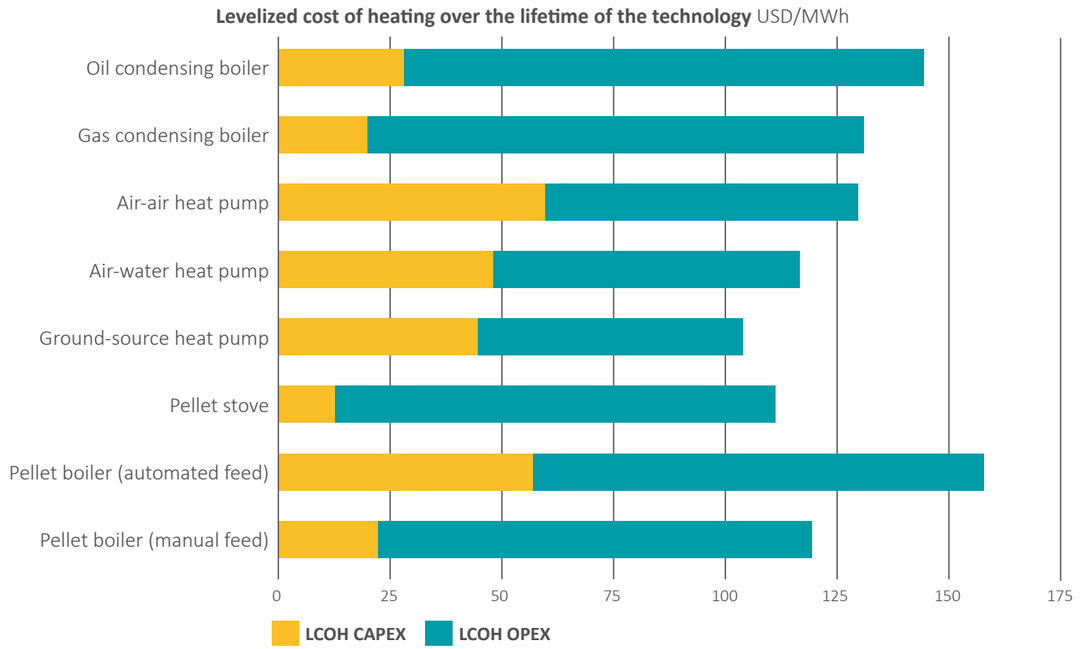

Figure 4 - Levelised costs for heat technologies in France. Source: IEA www.iea.org/articles/residential-heat-economics-calculator

The running costs of fuel consuming technologies are more prone to short-term change than capital costs, as they are dependent on the prices of their fuel, such as electricity, gas and heating oil, and are affected by market volatility and policy change. This can have a strong effect on the economics of different technologies. As gas prices in Europe rose faster than electricity prices in 2021-22, the relative running costs of a heat pump improved compared to a gas boiler – making them more economic in some countries. For more information see Rosenow (2022). Heat pump running costs are also influenced by the efficiency of the device. If this trend continues, heat pumps may become increasingly competitive with gas boilers.

4.2 FUNDING

Financial resources are, in general, limited for local government given the relative scope of their powers to raise taxes. Many prominent incentive schemes for heat pumps or insulation programmes are run nationally but there are ways that local government can develop and provide financial tools to incentivise decisions and change.

- **Connecting residents with national funding schemes:** Local government can inform local residents of available funding and provide assistance in accessing the support. Residents may also benefit from meeting those who have already accessed national funds and deployed new heating systems. There is good evidence that consumers are influenced by those they meet with experience of different systems.
- **EU funds may be available** for the development of some projects, such as the EU City Facility - See Box 8
- **Limited funding can be targeted to support those most in need,** such as those in poverty, enabling carbon emissions reduction as well as contributing to other social goals.
- Local government can use national funding schemes to fund services locally – local government can **offer services to householders which are funded by available national schemes** – see "Middelburg – A conduit for national financial support" on page 28.
- Local government can establish **a partnership with a third-party loan provider** – Low-interest loan programmes can be run in partnership with a third-party providing the capital.
- Local government can **leverage its public trust to reduce prices by coordinating a collective buying scheme** – this can reduce capital costs for householders without public capital investment. Examples include Middelburg, NE; Mechelen, BE; Frome Council, UK.
- Local government can use its tax powers to the maximum extent to encourage particular behaviours – it may be possible to **modify property taxes to reflect building energy performance,** incentivising owners to install efficiency measures.

BOX 8: EU CITY FACILITY & ELENA

The EU City Facility offers grants to help local governments to develop investment concepts for sustainable energy projects (but not directly fund investment) – the funds can support feasibility studies or financial, market or risk analyses. Building an investment case can support local governments in raising private investment or in accessing other funds such as ELENA (European Local ENergy Assistance) from the European Investment Bank.

Mechelen uses an EU city facility fund to target the condominium sector with financial incentives. It will develop an investment concept for the energy renovation of co-owned condominiums in the city. This will include (technical) feasibility studies, market analyses, stakeholder analyses, legal, economic and financial analyses, risk analyses and further supporting tasks.

More info: www.eucityfacility.eu/

BOX 9: MIDDELBURG – A CONDUIT FOR NATIONAL FINANCIAL SUPPORT

The Southwest Netherlands municipality of Middelburg is an early mover to decarbonise its heat system, however, the city has limited finances to provide direct financial support to residents or businesses. It has nonetheless initiated a programme to encourage and facilitate change.

The Netherlands national government is offering a grant to households to have a retrofit assessment carried out for their property. Middelburg's municipal government is collaborating with a local energy assessment company to provide government-sponsored assessments for local households.

Middelburg is also developing a collective buying scheme for a range of energy efficiency measures – residents will indicate the measures they want to install and will pay lower prices due to the volume of households buying. The scheme runs in partnership with a private organisation and will be communicated from the council as their initiative – this is intended to make the most of the council's public trust whilst using the other organisation's experience and tools for delivering the scheme.

4.3 COORDINATION

Heat system transformation over the coming years and decades will require coordinated policy action between levels of government in order to help stimulate an organised shift in activity from businesses, organisations and citizens. High-cost policies, such as grants for heat pumps or major home renovation, tend to run nationally rather than locally due to resource availability. Problems can arise from the design and implementation of these policies, such as delayed announcement or uncertainty about forthcoming subsidies, as well as boom and bust cycles from short-lived subsidy programmes. These can be locally impactful by, for instance, causing hesitancy among householders and businesses making investment decisions but are beyond the control of local government.

Research and experience show that reliance on financial stimulation alone is insufficient to enable change at the speed and scale required; in addition, government must address non-financial barriers through a broad set of support measures. These non-financial measures are described in module 3 in this series.

There is a need for coordinated action to enable effective zero carbon heat policy, arising from all levels of government within a country. Failure to act at any level will result in inefficiency and a failure to achieve the levels of deployment required to meet net zero goals. This action must include clear feedback between levels of government and a willingness to act in concert. Clear policy goals at all levels will be important to this and will require city governments to work with citizens to identify preferences for technology and support its deployment. Outcomes will need to be fed back to higher levels of government. Module one in this series sets out how cities can begin the process of working with their citizens, based on the experience of four cities in the SHIFFT project.

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