

# Financing zero carbon heat: turning up the dial on investment

A report by the Green Finance Institute's  
Coalition for the Energy Efficiency of Buildings



# Foreword

**The 2020s were dubbed the ‘decade of action’ for tackling the global climate crisis and delivering on the United Nation’s Sustainable Development Goals. This time last year, few were predicting that an imminent global crisis – the COVID-19 pandemic – would demonstrate so profoundly the need for resilience in protecting our communities and economies from environmental risks and would catalyse unprecedented levels of action by governments, businesses and individuals.**

The ensuing recovery needs to incorporate resilience, climate action and social inclusivity. The world’s major economies are already signalling their ambition; from the EU’s pledge that 30% of the COVID-19 stimulus package will fight climate change and President-elect Biden’s \$2 trillion climate action plan, to the UK Prime Minister’s Ten Point Plan for a Green Industrial Revolution. These ambitions must be matched with robust, granular and practical action plans that can deliver tangible outcomes.

A pragmatic and outcomes-focused approach is critical to decarbonise the built environment, where an estimated £65 billion of investment is needed to improve the UK’s housing stock to EPC C by 2035. Achieving this goal will require innovative financial mechanisms as well as an enabling policy environment. For this reason, the Green Finance Institute established the Coalition for the Energy Efficiency of Buildings – to bring together the public and private sectors to co-create the solutions needed.

As part of the Coalition’s work, more than 50 industry experts were brought together in the Zero Carbon Heating Taskforce to identify and unlock the investment barriers to heat decarbonisation. This report outlines the market insights, financial solutions and enabling policies that were designed by the Taskforce to mobilise capital towards a greener built environment.

As 2020 draws to a close, we look forward with optimism to a new year of continued collaboration and thank all our Coalition and Taskforce members for their enthusiastic, commitment despite the many challenges of the past year, in pursuing practical climate action.

**Dr Rhian-Mari Thomas OBE**

Chief Executive, Green Finance Institute  
Chair, Coalition for the Energy Efficiency of Buildings

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# 60-second summary

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-  This report presents the market insights and intended next steps of the Zero Carbon Heating Taskforce, an extension of the Green Finance Institute's Coalition for the Energy Efficiency of Buildings (CEEB).
-  The Taskforce convened over 50 industry experts throughout autumn 2020, applying the CEEB's outcomes-focused methodology to assess the barriers and opportunities to accelerate investment into zero carbon heating solutions.
-  The Taskforce leveraged its members' expertise, existing literature and international best practices to identify the key financial and non-financial barriers to decarbonising the UK's heating systems.
-  The Taskforce co-designed a portfolio of 12 demonstration projects to unlock these investment barriers, which will be brought to market and scaled by the wider CEEB membership.
-  The report outlines the opportunities for investment into heat decarbonisation to support a green economic recovery, alongside the enabling policies, regulations and datasets to accelerate the UK's net-zero transition.

# 1. Executive Summary

In the run-up to COP26, the UK has an opportunity to show global leadership and deliver a

green economic recovery with rapid, coordinated action on zero carbon heating.

## Zero carbon heating – turning the challenge into an opportunity

In the UK, heating the built environment is one of the largest contributors to emissions and accounts for 21% of the national total.<sup>1</sup> Housing alone is responsible for almost two thirds of these,<sup>2</sup> and the current pace of decarbonisation falls short of the estimated 20,000 households per week that need to switch to zero carbon heat between 2025 and 2050. A near complete decarbonisation of heat is essential to achieve the government's net-zero target by 2050.

While the challenge is great, so too is the opportunity. The electrification of heat is a climate priority among many major economies, and therefore early adopters can develop a competitive advantage in technological, regulatory and financial innovation. In the run-up to COP26, the UK has an opportunity to show global leadership and deliver a green economic recovery with rapid, coordinated action on zero carbon heating.

## Introducing the Zero Carbon Heating Taskforce

The Coalition for the Energy Efficiency of Buildings (CEEB) was convened by the Green Finance Institute, with support from the climate think tank E3G, to develop the market for financing net-zero carbon and climate-resilient buildings. Bringing together over 200 global experts, the CEEB aims to design and deliver innovative financial solutions, datasets, policies and regulations that can mobilise capital towards a sustainable built environment.

The initial phase of the CEEB focused on catalysing investment towards energy efficiency improvements in the UK's residential buildings.<sup>3</sup> In Autumn 2020, the CEEB convened over 50 industry experts into the Zero Carbon Heating Taskforce (the Taskforce) to assess the barriers and opportunities to accelerate investment into zero carbon heating solutions.

<sup>1</sup> BEIS (2018a) Clean Growth – Transforming Heating, overview of Current Evidence.

<sup>2</sup> CCC (2016a) Next steps for UK heat policy.

<sup>3</sup> Green Finance Institute (2020a) Financing energy efficient buildings: the path to retrofit at scale.

## Market context

The Taskforce launched with the global pandemic taking centre stage, and with virtually every country dealing with the economic and social fallout from the global health crisis. Meanwhile, another global emergency – the climate crisis – paints the backdrop, underscoring the urgent need to get on the fast track to net-zero emissions.

Heat decarbonisation presents an opportunity to spur near-term economic growth and support the Government's bold ambition to create 2 million green jobs by 2030<sup>4</sup>, with a high jobs multiplier effect.<sup>5</sup> Recent studies have estimated that nearly half of all green jobs by 2030 will be in clean electricity and low-carbon heat.<sup>6</sup> The UK has already implemented several green building stimulus measures – such as

the Green Homes Grant – and the Prime Minister's Ten Point Plan announced a new target to install 600,000 heat pumps per year by 2028.<sup>7</sup> These are important signals that provide longer term confidence for the market.

Further UK policy announcements related to the heat transition are expected shortly, including the Heat and Buildings Strategy, Energy White Paper and Net Zero Review. A long term policy framework, underpinned by targets, regulation and standards, and properly capitalised by Treasury, can create the enabling environment for instilling the confidence and certainty needed to support financial innovation and trigger investment in skills, technologies and supply chains.

## Profiling the market for zero carbon heating solutions

To identify the financial and non-financial barriers to accelerating the pace of heat decarbonisation, this work segments the domestic property market into four key categories, each with their own characteristics, challenges and opportunities:

- existing homes that are currently connected to the gas grid (on-grid);
- existing homes off-grid;
- new builds; and
- homes connected to district heating networks.

There are different technological options for decarbonising heat for each of the four segments. Recent academic research suggests that a combination of energy efficiency, heat pumps and district heating is the most effective investment pathway for heat decarbonisation over the next 10 years.<sup>8</sup>

Barriers to investor and consumer confidence were in evidence across all four segments: the lack of long-term demand certainty that is critical for investor and business appetite; difficulty in accessing information about finance options and low awareness of technical solutions; high up-front costs, and the perceived 'hassle factor' of low carbon heat installations.

In addition, levelling the playing field between electric heat and gas prices, and consequently improving the economics of low carbon heating solutions, is a necessary step to further increase confidence and achieve greater scale.

<sup>4</sup> BEIS, Department for Education. (2020, November 12). UK government launches taskforce to support drive for 2 million green jobs by 2030.

<sup>5</sup> Hepburn et al. (2020) Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?

<sup>6</sup> Local Government Association (2020) LGA: Over a million new green jobs could be created by 2050.

<sup>7</sup> BEIS (2020a) The Ten Point Plan for a Green Industrial Revolution.

<sup>8</sup> Rosenow et al. (2020) The pathway to net zero heating in the UK: A UKERC policy brief.

# Mobilising capital: the portfolio of demonstration projects

The portfolio of demonstration projects that are designed to help overcome the barriers to heat decarbonisation is shown in Table 1.

Beyond their individual impact, the projects have significant potential to interact positively with other industry initiatives and inform government policy.

Type	Name	Demonstration project overview	Property type			
			On-G	Off-G	NH	DH
Lending Products	<b>Demand Aggregation Financing</b>	A service that establishes a ‘critical mass’ in demand in an area to bring down the price of zero carbon heating solutions, enabling customers to access cheaper solutions, while scaling supply chains through guaranteeing a minimum number of purchases. A financial institution supports customers making purchases through low-interest loans.	✓	✓		✓
	<b>Green Home Salary Sacrifice Scheme</b>	A tax-efficient mechanism for employees to pay for a heat pump via a hire purchase agreement with their employer or a third-party, similar to the ‘Cycle to Work’ scheme. Aggregating demand from multiple employers through salary sacrifice platforms provides confidence for heat pump manufacturers to scale rapidly.	✓	✓		
	<b>Mobilising Secured and Unsecured Finance</b>	Using existing secured (i.e. mortgage) and unsecured (i.e. personal loans, credit cards) finance to support the installation of zero carbon heat technologies.	✓	✓	✓	

**Key:** On-G: On the gas grid Off-G: Off the gas grid NH: New Homes DH: District Heating

**Table 1:** Overview of demonstration projects

Type	Name	Demonstration project overview	Property type			
			On-G	Off-G	NH	DH
Institutional Investments	<b>Third Party Asset Infrastructure</b>	Creates a role for investors by bringing them into the investment in an asset, such as heating infrastructure, which can then be paid back over time via a running charge to homeowners.	✓	✓	✓	
	<b>Green Real Estate Investment Trust (REIT)</b>	Green REITs embed environmental criteria into a popular asset class and provide a scalable mechanism to attract significant volumes of institutional investment into energy efficiency buildings with zero carbon heating systems.	✓	✓	✓	✓
	<b>Community Improvement District Financing</b>	Designates specific zones as Community Improvement Districts and supports the building of new district heating networks in the designated area. Financing is provided upfront by institutional investors, repaid via an increased levy charged to buildings in the area that choose to connect to the network.				✓
	<b>National District Heating Fund</b>	A specialist investment fund focussed on investing in district heating networks across the country. The fund could sit independently or as part of the new National Infrastructure Bank.				✓
Skills, Incentives & Enabling Mechanisms	<b>Zero Carbon Heat Investment Guides</b>	Two practical guides: the first informing lenders about zero carbon heating technologies and wider energy efficiency measures; the second identifying gaps in the knowledge of manufacturers, suppliers and delivery organisations about finance options, and developing answers in consultation with lenders.	✓	✓	✓	✓
	<b>Tax Credits and Incentives for the Private Rented Sector</b>	Research to better understand the roles tax credits and incentives could play in supporting landlords to get on track for zero emissions, enabling government to make well-informed decisions.	✓	✓	✓	✓
	<b>National Heat Delivery Body</b>	Analysing the required design for a centrally-run, locally-led body that would provide oversight and central coordination for national heat decarbonisation. Such a body would help govern financing and scale uptake through standardisation. The body could also coordinate specific financial schemes set out by the Taskforce and wider CEEB.	✓	✓	✓	✓

**Key:** On-G: On the gas grid Off-G: Off the gas grid NH: New Homes DH: District Heating

Type	Name	Demonstration project overview	Property type			
			On-G	Off-G	NH	DH
Tenancy Agreements	All-in Rental Agreements	Tenants pay a set rent each month which is inclusive of heat (and often other items including internet). This creates a revenue stream for the landlord to recoup on an investment or service debt for investing in low carbon heating.	✓	✓	✓	✓
Energy Service Products	Heat as a Service	A resident's home is upgraded to high energy performance standards with energy controls integrated into an app. This manages the heating preferences for the property and takes advantage of opportunities to procure cheaper energy. The resident pays for the service through a monthly bill, or as part of inclusive rents.	✓	✓	✓	

Key: On-G: On the gas grid Off-G: Off the gas grid NH: New Homes DH: District Heating

## 2. Introduction and context

The drive to electrify heat is a climate priority among many major economies, presenting the

UK with an opportunity to develop a competitive advantage in smart energy systems and green finance innovation.

## 2.1 Zero carbon heating – turning the challenge into an opportunity

Keeping our homes warm without warming the planet is among the greatest challenges the UK faces in achieving net-zero greenhouse gas emissions by 2050.

In the UK, heating the built environment is one of the largest contributors to emissions and accounts for 21% of the national total<sup>9</sup>. Housing alone is responsible for almost two thirds of these. Around 85% of homes are currently connected to the gas grid.<sup>10</sup> At the current rate of installation, it will take 700 years to install the 19 million heat pumps the Climate Change Committee estimates are needed by 2050.<sup>11</sup>

While the challenge is great, so too are the rewards. The drive to electrify heat is a climate priority among many major economies, presenting the UK with an opportunity to develop a competitive advantage in smart energy systems and green finance innovation. At the same time, green home retrofits can improve the lives of millions through warm, healthy, zero carbon housing and deliver health benefits such as preventing avoidable illnesses, which currently costs the NHS up to £2 billion a year in England alone.<sup>12</sup> A focus on heat decarbonisation will also support a green recovery. Reliable estimates indicate there will be almost 700,000 green jobs by 2030, and nearly half will be in clean electricity and low-carbon heat.<sup>13</sup>

Importantly, there is past precedent for the UK redesigning its heating system – with the shift from coal to gas and widespread introduction of central heating from the 1970s. Now is the moment to build on this legacy and design a heating system fit for the 21st century.

A significant volume of private and public investment is required in the zero carbon heat transition, supported by a raft of regulatory tools, incentives and engagement mechanisms to scale-up adoption. The UK can demonstrate international leadership ahead of COP26 by prioritising heat decarbonisation, simultaneously supporting the Government's net-zero ambitions and helping to deliver a green, inclusive economic recovery.

To contribute towards these outcomes, the Green Finance Institute's Coalition for the Energy Efficiency of Buildings widened its remit to include heat decarbonisation. The Zero Carbon Heating Taskforce convened more than 50 organisations over a series of workshops, and assessed the zero carbon heating market across four key categories:

- existing homes connected to the gas grid (on-grid);
- existing homes off-grid;
- new builds; and
- homes connected to district heating networks.

This report presents the Taskforce's findings, including the barriers and opportunities to decarbonise heating in each segment and a portfolio of financial and finance-enabling demonstration projects.

In the next phase, the CEEB members will take forward the demonstration projects with the aim to catalyse further innovation and product development across the finance sector. In addition, the coalition will exploit the synergies with existing CEEB demonstration projects and pursue non-financial solutions that create the enabling environment for increased capital flows.

<sup>9</sup> BEIS (2018a) Clean Growth – Transforming Heating: Overview of Current Evidence.

<sup>10</sup> BEIS (2020b) Transforming Heat – Public Attitudes Research: A survey of the GB public on the transition to a low-carbon heating future.

<sup>11</sup> Rosenow et al. (2020) The pathway to net zero heating in the UK: A UKERC policy brief.

<sup>12</sup> CCC (2019a) Net Zero Technical Report.

<sup>13</sup> Local Government Association. (2020). LGA: Over a million new green jobs could be created by 2050.

## 2.2 Context for the Taskforce – green recovery measures and policy

The Taskforce launched with the global pandemic taking centre stage, and with virtually every country dealing with the economic and social fallout from the global health crisis. Meanwhile, another global emergency – the climate crisis – paints the backdrop, underscoring the urgent need to get on the fast track to zero emissions.

Across most, if not all, economic recovery packages there is a major focus on building back better and creating new economies which are greener, healthier and more resilient. The contribution of zero carbon heating to this agenda is clear, and a number of governments have already included low carbon heat in their stimulus and recovery packages. In Italy, citizens are being offered a 110% refund on the purchase price of a heat pump via five annual tax

credits,<sup>14</sup> and in Luxembourg, household subsidies for sustainable heating have been increased by 25%, with the state also covering 81% of the costs for replacing a heat pump.<sup>15</sup> Lithuania,<sup>16</sup> Finland,<sup>17</sup> New Zealand<sup>18</sup> and Canada<sup>19</sup> are among the list of major economies that have included low carbon heating in recovery measures.

The UK has also included green home upgrades within its stimulus and recovery plans, as shown in Table 2. Crucially, for the heat pump market, measures include an ambitious target to install 600,000 heat pumps per year by 2028, announced as part of the Prime Minister's Ten Point Plan for a Green Industrial Revolution.<sup>20</sup> The scale of ambition sends a strong market signal to the private sector, however a significant step-change from the current installation rate is required to hit this target.

<sup>14</sup> Whitlock, R. (2020, August 18) Italian 'Superbonus' is one of the most ambitious heat pump installation schemes to date. Renewable Energy Magazine.

<sup>15</sup> Erang, G. (2020, June 29) Climate action: "It's now!" – green affordable housing in Luxembourg. RTL Today.

<sup>16</sup> Foxwell, D. (2020, June 12) Lithuanian stimulus package commits funds for grid connection. rivieramm.com

<sup>17</sup> Government Communications Department, Ministry of Finance (2020, June 2) Government reaches agreement on fourth supplementary budget proposal for 2020.

<sup>18</sup> Dreaver, C. (2020, May 20) Budget 2020: What you need to know. Rnz.co.nz

<sup>19</sup> Infrastructure Canada (2020, September 1) Canada and British Columbia invest in green energy solutions. Newswire.

<sup>20</sup> BEIS (2020a) The Ten Point Plan for a Green Industrial Revolution.

Scheme	Description
Green Homes Grant scheme for England	Provides grants worth up to two thirds of the installed cost of measures including heat pumps, solar thermal, biomass boilers and hybrid heat pumps, capped at £5,000. Low income households can receive vouchers covering 100% of the cost up to £10,000.  £500 million will be administered locally: £200 million via the Green Homes Grant's Local Authority Delivery (LAD) scheme – where local authorities can bid for funding to support low-income households – and £300 million via Local Energy Hubs at a later date.
Public Sector Decarbonisation Scheme	Announced in the Conservative manifesto, this scheme aims to improve insulation and energy efficiency of public buildings and investment in green heating over 2021.
£50 million from the Social Housing Decarbonisation Fund	Pledged in the Conservative manifesto, initially to pilot new approaches to retrofitting social housing at scale.
In Scotland, £1.6 billion in Programme of Government	For energy efficiency and heat in homes and buildings, pledged by the Scottish Government over the next Parliament to support long-term plans.
In Wales, £9.5 million Optimised Retrofit Programme	To fund energy efficiency measures in up to 1,000 existing homes owned by registered social landlords and councils. Launched in September 2020.
Ten Point Plan for a Green Industrial Revolution	Through the Ten Point Plan, and confirmed in the Spending Review, the Government announced a one-year extension to the Green Homes Grant scheme, with a further £1 billion for the Grant and Public Sector Decarbonisation scheme. The Futures Homes Standard was also referenced.

**Table 2:** UK green home stimulus measures

The benefits flowing from green employment, innovation and manufacturing make labour-intensive home retrofits an ideal recovery measure. However, economists have shown these cannot be achieved through short-lived stimulus measures alone.<sup>21</sup> Stimulus must translate into longer-term recovery measures and a clear policy framework to reap the lasting benefits. This can deliver the certainty that markets and financial institutions need to scale up supply chains and develop innovative products.

A green recovery will require mobilisation of significant levels of public and private finance, working together to maximise the impact on the wider economy, and leading to green job creation, warmer homes and emissions reductions. Financial institutions are committed to the green agenda, as has been illustrated through new climate pledges,<sup>22</sup> recent commitments to launch new green mortgage products,<sup>23</sup> and the launch of the Partnership for Carbon Accounting Financials.<sup>24</sup> The CEEB and its members aim to harness this momentum, stimulate the market for financing zero carbon heat and contribute towards a green economic recovery.

<sup>21</sup> Turner et al. (2020) A Net Zero Principles Framework: Fundamental Questions for Public Policy Analysis.

<sup>22</sup> For example, see Clarke, P. (2020, October 9) HSBC commits up to \$1trn for climate change shift. Financial News.

<sup>23</sup> Carter, J. (2020, October 28) NatWest launches its first Green Mortgage range. Mortgage Introducer.

<sup>24</sup> PCAF (2020, September 17) Partnership for Carbon Accounting Financials (PCAF) launches UK coalition.

### 3. Profiling the market for heat decarbonisation

A combination of energy efficiency, heat pumps and district heating comprises

the most effective

investment pathway for heat

decarbonisation over the

next 10 years.

This section considers the existing technology options available for decarbonising heat in the UK, and profiles the distinct challenges and opportunities for accelerating zero carbon heating across the four key market segments.

## 3.1 Technology pathways

There are various technological options for decarbonising heat, all of which have a role to play at different times and in different geographies. Recent studies show that a combination of energy efficiency, heat pumps and district heating comprises the most effective investment pathway for heat decarbonisation over the next 10 years.<sup>25</sup>

Energy efficiency improvements will play a central role in reducing heat loss and the cost of keeping warm.<sup>26</sup> Without appropriate efficiency improvements, the cost of heat decarbonisation could be £6.2 billion higher per year to 2050.<sup>27</sup> The CEEB recommends a fabric-first approach, which maximises the performance of the components and materials that make up the building fabric itself, before considering the use of mechanical or electrical building services systems.

Currently in the UK, heat network connections are being developed in dense urban areas, mainly in new developments, and supported by the Heat Networks Investment Project (HNIP). The Renewable Heat Incentive (RHI) has driven deployment of heat pumps, biomass boilers and solar thermal systems, mostly in commercial buildings and rural, off-grid homes, but has not yet achieved scale.

The RHI recorded approximately 11,000 installations in 2019,<sup>28</sup> whereas 1.7 million gas boilers were installed in the same period.<sup>29</sup> As the RHI does not offer help towards the up-front system costs, domestic uptake has been low. As of January 2020, around 76,000 domestic systems had been approved under the RHI scheme, significantly lower than the targeted 513,000 total system registrations by the end of 2020.<sup>30</sup>

The scenario for hydrogen at scale – so-called ‘blue hydrogen’ produced using natural gas with steam methane reforming plus carbon capture and storage (CCS) – will take longer to get off the ground.<sup>31</sup> And while ‘green hydrogen’ is compatible with a zero-carbon trajectory, it is projected to be a scarce resource to be prioritised for hard-to-abate sectors such as heavy industry and freight. There are currently pilot schemes underway for these technologies that will likely have a role to play in the heating sector in the future.

<sup>25</sup> Rosenow et al. (2020) The pathway to net zero heating in the UK: A UKERC policy brief.

<sup>26</sup> Without energy efficiency, the costs of decarbonising heat have been estimated to be £6.2 billion higher per year to 2050. See Imperial College London (2018) Analysis of Alternative UK Heat Decarbonisation Pathway; Climate Change Committee.

<sup>27</sup> Imperial College London (2018) Analysis of Alternative UK Heat Decarbonisation Pathway; Climate Change Committee.

<sup>28</sup> BEIS (2015) Renewable Heat Incentive statistics.

<sup>29</sup> Rosenow et al. (2020, June 12) UK heating plan still means 120 gas boilers installed for every low-carbon system. [energypost.eu](http://energypost.eu).

<sup>30</sup> BNEF (2020) 2020 U.K. Energy Transition Outlook: Policy drivers of decarbonization.

<sup>31</sup> ‘Green’ hydrogen is produced using electrolysis with renewable power, an energy carrier needed to fully decarbonise the economy and may have a role to play in decarbonising heat for buildings. However, it is not considered viable at this scale, primarily owing to the better value applications the additional renewable power

Technology and current deployment	Suitability and scalability
<p><b>District heating:</b> Currently there are around 17,000 heat networks in the UK which supply nearly 500,000 consumers,<sup>32</sup> accounting for 2% of domestic heat.</p>	<p>District heating schemes require a high density of heat demand to be economic, therefore are suitable for urban areas, new build developments and some rural areas. The Government estimates that 14-20% of UK heat demand could be cost-effectively met by heat networks by 2030 and 43% by 2050.<sup>33</sup></p>
<p><b>Heat pumps:</b> The UK has approximately 210,000 heat pumps, of which, roughly 175,000 are air-source.</p>	<p>Air source heat pumps (ASHPs) absorb heat from the outside air to heat homes and hot water. Ground source heat pumps (GSHPs) use pipes buried to extract heat from the ground. A property will require outside space and an adequate level of insulation to be fitted. GSHPs are better suited to houses with access to gardens or outside space and shared ground loop arrays can connect multiple dwellings to a GSHP system. The CCC estimates that there are 10 million on-grid homes suitable for heat pumps and potential for a further 10m+ with additional insulation, and 1.6 million owner-occupied homes off-grid technically suitable for a heat pump.<sup>34</sup></p>
<p><b>Biogas:</b> The Green Gas Certification Scheme noted that 1 million homes were using biogas in 2019.<sup>35</sup></p>	<p>Biogas is produced through the process of anaerobic digestion of organic materials, such as agricultural and food waste. Its environmental credentials can depend on methane leakage and source of biomass – for instance, certain commodity crops can be associated with sustainability concerns. Nonetheless, for a number of off-grid rural homes, particularly those with access to consistent biomass waste streams, this technology could be an option.</p>
<p><b>Hydrogen:</b> Early stage development, with some pilot projects.</p>	<p>Use of hydrogen in homes is still at an early stage, with further feasibility studies required to prove safety and determine the required technology and infrastructure upgrade. Green hydrogen – derived from non-fossil sources – is currently a scarce resource, representing around 1% of the total production.<sup>36</sup> Green hydrogen may be a less efficient heating source than electrification: estimates suggest that powering the UK road freight would require 3,500 wind turbines, whereas green hydrogen production would require 12,000 wind turbines.<sup>37</sup> The feasibility of converting the natural gas distribution networks, and the costs involved, is currently unknown.</p>

**Table 3:** Overview of main technologies for zero carbon heating

<sup>32</sup> ADE (2018) Market Report: Heat Networks in the UK.

<sup>33</sup> ADE (2018) Market Report: Heat Networks in the UK.

<sup>34</sup> Imperial College London (2018) Analysis of Alternative UK Heat Decarbonisation Pathway; Climate Change Committee.

<sup>35</sup> GGS (2019, April 25) 1 million homes now on green gas tariffs.

<sup>36</sup> See: <https://www.fchobservatory.eu>

<sup>37</sup> Wright, O. (2020, September 24) Fossil fuel companies 'misleading' Boris Johnson on green hydrogen. The Times.

The table below shows the carbon savings associated with different types of zero carbon home retrofit measures.<sup>38</sup>

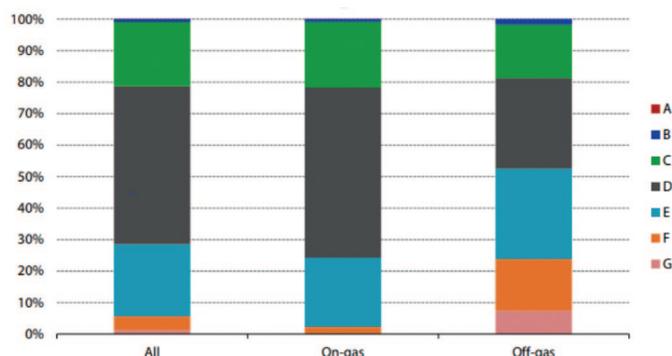
Abatement option	Emission savings in 2030	
	MtCO <sub>2</sub> e	Of which cost-effective
Energy efficiency improvements	6	4
Heat pumps and biomass boilers in off-gas homes and heat pumps in new-build homes	4	3-4
Low-carbon heat networks in on-gas homes, including new-build homes	2	2
Total emission reduction in residential buildings	13	9-10

**Table 4:** Emission reduction potential to 2030 to meet the fifth carbon budget – analysis from the Climate Change Committee

## 3.2 Existing homes on-grid

On-grid homes represent the largest proportion of the UK's building stock – around 85% currently connected to the gas grid<sup>39</sup> – and are among the oldest in Europe, with the average on-grid home built around 1950.<sup>40</sup> Representing 77% of the UK's heat-related greenhouse gas emissions, decarbonising on-grid homes is one of the biggest opportunities to get on track for net-zero.

Just over 20% of on-grid homes are in EPC bands A to C for energy efficiency performance, and 25% are in the lowest E-G groups, as shown in Figure 1. This is partly due to EPC ratings being influenced by the cost of heating; the relatively low cost of gas results in favourable EPC results.<sup>41</sup> However, if reported on an energy efficiency basis (i.e. kWh of heating per m<sup>2</sup>), off-grid homes perform better for each SAP band. Of the 2.4 million homes in fuel poverty in England, 2.0 million are on-grid (circa 10% of on-grid households).



**Figure 1:** SAP rating for Great Britain housing in 2021 (Source: National Household Model)<sup>42</sup>

<sup>38</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>39</sup> BEIS (2020b) Transforming Heat – Public Attitudes Research: A survey of the GB public on the transition to a low-carbon heating future.

<sup>40</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>41</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>42</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

## Current technologies and low carbon alternatives

Currently, the majority of on-grid homes use gas-fired boilers as their main heating system, of which 60% use more efficient condensing boilers.<sup>43</sup> The UK CCC

estimates a large proportion of these homes could be fitted with heat pumps, and a further 3 million might be viable for economically efficient heat networks.

## Existing public and private finance offers

There is public funding available for heat decarbonisation in on-grid homes, which received a significant boost through the inclusion of heat pumps within the **Green Homes Grant scheme**.<sup>44</sup> The scheme provides qualifying households with up to £5,000 towards measures to decarbonise their homes, with up to £10,000 available for lower income households. Other sources of public finance include the **Energy Company Obligation (ECO)**, **Renewable Heat Incentive (RHI)**, and the **Clean Heat Grant** (currently awaiting a final decision). A range of publicly funded schemes exist in the devolved nations.

As for private finance, **green mortgages** often include zero carbon heat technologies as an eligible use of proceeds. A growing number of financial institutions offer **retrofit lending products**, covering measures including zero carbon heating solutions (see Table 9 on green mortgage offers in Section 4). For example, Nationwide Building Society offers Green Additional Borrowing mortgages which can fund the purchase of heat pumps,<sup>45</sup> as do Ecology Building Society's Energy Improvements Mortgages.<sup>46</sup>

The legitimacy of the market for green retrofit finance is strengthened by the Green Finance Institute's **Green Home Retrofit Finance Principles**, which provide lenders with a framework for the consistent application of funds towards verifiable retrofit activities.<sup>47</sup> Specialist service providers – such as Sero Homes and Energiesprong – offer innovative business and financing models that can also support on-grid households to reduce emissions.

<sup>43</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>44</sup> See: <https://www.gov.uk/guidance/apply-for-the-green-homes-grant-scheme>

<sup>45</sup> See: <https://www.nationwide.co.uk/products/mortgages/borrowing-more/green-additional-borrowing>

<sup>46</sup> See: <https://www.ecology.co.uk/mortgages/residential-mortgages/energy-improvements/>

<sup>47</sup> See: <https://www.greenfinanceinstitute.co.uk/ghrfp/>

## Barriers to zero carbon heat technologies

The table below identifies financial and non-financial barriers to zero carbon heating experienced by decision makers in relation to on-grid properties.

Financial barriers	Non-financial barriers
<ul style="list-style-type: none"> <li>- <b>High cost of heat pump installation</b> (£6k - £20k+)</li> <li>- <b>Access to capital</b> – very dependent on homeowner life stage</li> <li>- <b>Limited point-of-sale options</b> and lack of connections between finance and original equipment manufacturers of heat pumps</li> <li>- Inability to <b>unlock revenue streams by linking homeowners to grid flexibility</b></li> <li>- <b>Limited tax incentive</b> for low carbon options; VAT at 20% on heat pumps and boilers</li> <li>- <b>Unknown impact on property values</b> and subsequent resale</li> <li>- Disparate local councils and registered social landlords currently <b>unable to aggregate demand</b> for zero carbon heating and thereby access cheaper capital</li> <li>- <b>Finance providers have limited knowledge or experience</b> of offering these products and see little demand</li> <li>- <b>Lack of long term and consistent incentives</b> for ‘able to pay’ market</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Low awareness</b> of zero carbon heat technologies and no central advice site</li> <li>- Disconnect between <b>increasing public concern about the climate emergency and homeowners’ understanding of heating</b> and impact on climate</li> <li>- Zero carbon heating systems perceived as a <b>hassle, disruptive and more expensive than gas</b></li> <li>- <b>Planning and permission challenges</b> with heat pumps</li> <li>- <b>Lack of technical solutions for individual flats</b> and related issues between leaseholders and freeholders</li> <li>- <b>Lack of trusted supply chain</b></li> <li>- <b>No obligation to switch to low-carbon option</b> and gas boiler lifecycles of 10–15 years</li> <li>- <b>Lack of technical solutions for individual flats</b> and related issues between leaseholders and freeholders</li> <li>- Challenges for <b>listed and historic buildings</b></li> </ul>

**Table 5:** Barriers to investment for existing homes on-grid

### 3.3 Existing homes off-grid

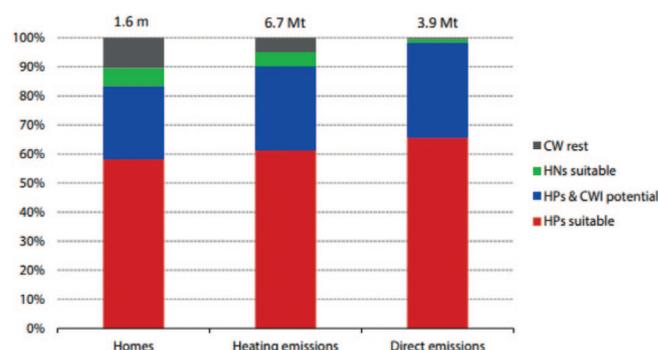
There were just under 4 million UK homes off the gas grid in 2018, representing 15% of the total.<sup>48</sup> Typically these properties use either oil or liquid petroleum gas (LPG) as their main fuel, and make up a large share of total emissions (23%), due to the higher carbon intensity of these fuels.<sup>49</sup> Most existing electric heating is used in off-grid homes (77%).

As for energy efficiency and EPC ratings, 48% of off-grid homes are in EPC bands A-D. 24% are in the lowest two bands (E-F).<sup>50</sup>

However, off-grid homes use, on average, less heating than on-grid homes and therefore tend to perform better for each SAP band.<sup>51</sup> Due to higher fuel costs it is more expensive to heat off-grid homes, creating hardship for the 12.5% of rural households that are in fuel poverty.<sup>52</sup> Of the 2.4 million English homes in fuel poverty, 0.4 million are off-grid.

## Current technologies and low-carbon alternatives

As we have seen, off-grid homes tend to be heated by the highest carbon fuels, including oil and LPG, and even coal and wet wood, although these are being phased out in the UK.<sup>53</sup> With appropriate fabric efficiency and thermal storage, almost 3 million off-grid homes could be suitable for heat pumps and 0.5 million may be suitable for heat networks.<sup>54</sup> Improved energy efficiency performance will be needed to ensure heat pumps run optimally; there are around 1.6 million owner-occupied off-grid homes with cavity-walls suitable for heat pumps. The remaining 0.7 million owner-occupied off-grid homes are solid wall properties and will need enhanced insulation for heat pump readiness.



**Figure 2:** Off-grid owner-occupied homes with cavity walls (Source: Climate Change Committee)<sup>55</sup>

<sup>48</sup> BEIS (2019) LSOA estimates of properties not connected to the gas network.

<sup>49</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>50</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>51</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>52</sup> Energy Saving Trust (2019, March 19) Why outside the grid does not mean outside of help.

<sup>53</sup> Frangoul, A. (2020, February 21) In a bid to tackle air pollution, the UK will ban coal and certain types of wood for domestic burning. CNBC.

<sup>54</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>55</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

## Existing public and private finance offers

Public and private finance offers available to off-grid homes are similar to those for on-grid homes, with relevant government grants including the

**Green Homes Grant** and **Renewable Heat Incentive** (see section 3.2). Likewise, private finance offers include **green mortgages** and **retrofit loans**.

## Barriers to zero carbon heat technologies

The financial and non-financial barriers facing decision makers living in off-grid properties when moving towards zero carbon heating solutions are similar to those experienced in on-grid homes.

Financial barriers	Non-financial barriers
<ul style="list-style-type: none"> <li>- <b>High cost of heat pump installation</b> (£6k - £20k+) with additional costs to enhance energy efficiency of off-grid homes, particularly in remote and rural areas</li> <li>- Costs of making <b>detached houses energy efficient is higher</b>, increasing overall costs. More prevalent among the most rural properties off the gas grid</li> <li>- <b>Access to capital</b> – dependent on homeowner life stage</li> <li>- Limited <b>point-of-sale options</b> and lack of connectivity between finance and original equipment manufacturers</li> <li>- Inability to <b>unlock revenue streams</b> by linking homeowners to grid flexibility</li> <li>- <b>Unknown impact on property values</b></li> <li>- Disparate local councils and social landlords currently <b>unable to aggregate demand</b> for zero carbon heating and thereby access cheaper capital</li> <li>- <b>Finance providers have limited knowledge or experience offering</b> products and see little demand</li> <li>- <b>Asset finance security</b> – securing an asset for &lt;£10k means less ability to recover asset, with higher costs</li> <li>- <b>Lack of long term and consistent incentives</b> for 'able to pay' market</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Low awareness of low carbon heat</b> technologies and no central advice site</li> <li>- <b>Disconnect between increasing public concern about the climate emergency</b> and homeowners' understanding of heating and impact on climate</li> <li>- <b>'Hassle factor'</b> of replacing heating system and energy efficiency measures</li> <li>- <b>Planning and permission challenges</b> with some zero carbon heating solutions</li> <li>- Lack of <b>trusted, local supply chains</b></li> <li>- <b>No obligation</b> to switch to low-carbon options</li> <li>- Challenges for <b>listed and historic buildings</b></li> <li>- <b>Renewable and flexible electricity supply needed</b> to coincide with increased demand from heat pumps</li> </ul>

**Table 6:** Barriers to investment for existing homes off-grid

## 3.4 New homes

New builds offer a straightforward opportunity to integrate zero carbon heating systems in home design. Today, new homes are still being built to low energy efficiency standards and continue to be connected to the gas grid. The Future Homes Standard was referenced in the Prime Minister’s Ten Point Plan and will introduce more stringent climate standards for new homes. Until then, developers can and will continue to build homes according to the standards in place when planning permission is granted.

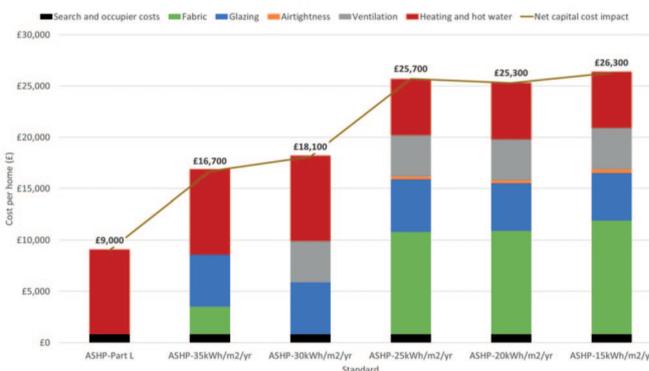
A review of the homes built since the UK legislated for net zero emissions found that for England, of the 217,311 new homes built between June 2019 and June 2020, 82% are EPC rated A or B.<sup>56</sup> There were 13,000 homes built with an EPC rating of D or below, all of

which will need to be retrofitted with insulation and zero carbon heating technology at significantly greater cost than if they were built that way at the outset. The Climate Change Committee estimated savings of £5,500 per home from upfront installation of low carbon heating compared to a later retrofit.<sup>57</sup> This represents an extra £71.5 million in cost for those homes built since June 2019.

The UK Green Building Council undertook a feasibility study into the design, delivery and cost of new net zero carbon buildings. While the development costs were forecast to increase by 3.5% by 2025, these will likely be offset by increased rental premiums, lower tenancy void periods, lower offsetting costs and lower lifecycle costs.<sup>58</sup>

## Current technologies and low carbon alternatives

Options for low carbon heating in new homes tend to be air or ground source heat pumps and district heating, made suitable through high standards of energy efficiency. Installing zero carbon heating from the outset avoids connection costs to the gas grid, and the system can be optimally designed for the property, making heat pumps cheaper to install and run than in on-grid homes, which first need to be retrofitted with energy efficiency measures.



**Figure 3:** Capital cost of retrofitting to higher space heating standards with an air-source heat pump (nominal undiscounted cost in 2030) (Source: Currie & Brown and AECOM<sup>59</sup>)

<sup>56</sup> MHCLG (2020) Live Tables on Energy Performance of Buildings Certificates. Table NBI: domestic Energy Performance Certificates for new dwellings by energy efficiency rating.

<sup>57</sup> CCC (2019b) UK housing: Fit for the future? and Currie et al. (2019) The costs and benefits of tighter standards for new buildings – Final Report. Climate Change Committee., stated: “To improve fabric standards and install low-carbon heat via retrofit, costs range from over £16,000 to more than £25,000 per home – up to five times the costs of achieving the same standards in when first constructing the home.”

<sup>58</sup> UKGBC (2020) Building the Case for Net Zero: A feasibility study into the design, delivery and cost of new net zero carbon buildings.

<sup>59</sup> Currie & Brown and AECOM (2019) The costs and benefits of tighter standards for new buildings – Final Report.

## Existing public and private finance offers

There are few government grants that support housebuilders in building net zero properties. The **Home Building Fund** has experienced limited uptake and does not specifically set out carbon emissions targets. And the **Heat Networks Investment Project (HNIP)** focuses on supporting the delivery of more local heat networks, which provides only indirect support for housebuilders.

Homebuyers are typically the target for private finance offers, although some property developers have used **Sustainability Linked Loans** with KPIs linked to embodied carbon and energy efficiency. With **green mortgages** now available from several UK lenders there is some encouragement for homebuyers to seek better performing properties, typically measured through above-average EPC ratings. The Government's **Help to Buy scheme** is targeted at new-build properties; however, energy performance is not currently a criteria of finance products.

## Barriers to zero carbon heat technologies

The table below identifies financial and non-financial barriers that decision makers experience when building and purchasing new homes with zero carbon heating solutions.

Financial barriers	Non-financial barriers
<ul style="list-style-type: none"> <li>- <b>Lack of incentives or support</b> for housebuilders to spend money on low carbon heating ahead of regulatory timetable</li> <li>- <b>Capital expenditure is higher</b> for energy efficient and low/zero carbon homes compared to gas boilers and connection to the gas grid, and <b>builders do not recoup benefits</b> of low carbon measures</li> <li>- The retrofit cost to reach 2050 targets will have to be paid by the homeowner, who will face similar financial barriers as identified in the on-grid and off-grid sections</li> <li>- There are <b>no financial products</b> which enable home buyers to upgrade their homes ahead of the purchase</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Building regulations do not stipulate requirements</b> for low carbon heating, until the Future Homes Standard enters into force in a few years' time</li> <li>- <b>Most builders will not incur additional construction costs</b> without a regulatory requirement or planning condition, except for social housing providers</li> <li>- <b>Planning permission</b> laws lock in building standards from the time permission is granted</li> <li>- <b>A knowledge gap</b> undermines confidence in new types of low carbon heating technology</li> <li>- <b>Skills gap</b> in the market with not enough workers trained to deliver low carbon heating at scale</li> <li>- <b>Demand for low carbon heating is weak</b> from home buyers</li> <li>- <b>Future proofing technology</b> is a challenge</li> </ul>

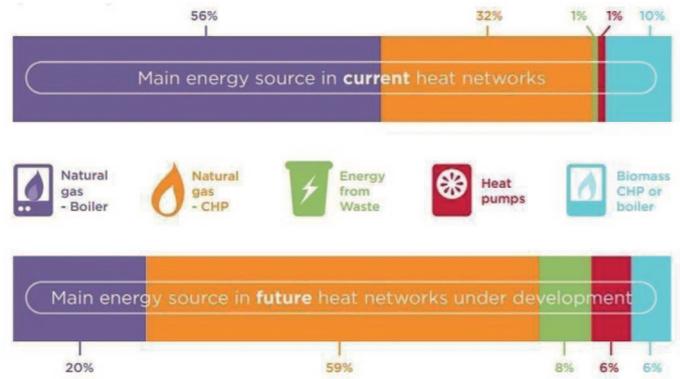
**Table 7:** Barriers to investment for new homes

<sup>59</sup> Currie & Brown and AECOM (2019) The costs and benefits of tighter standards for new buildings – Final Report.

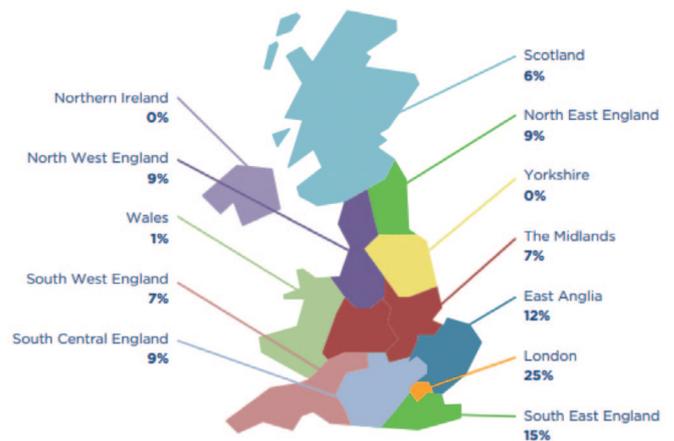
### 3.5 District heating networks

Currently heat networks account for around 2% of the UK’s heat demand. The UK CCC has suggested that up to 5 million homes could be connected to low-carbon heat networks by 2050, to achieve the national climate targets.<sup>60</sup> The implication is that substantial capital investment is required, with studies estimating up to £22 billion of private investment could be required to meet these targets.<sup>61</sup> However, district heating networks are only as clean as their heat source, and many existing networks are not currently low carbon, as shown in Figure 4. A transition to lower carbon heat sources is needed to meet the heat decarbonisation challenge.

District heating networks are best suited to densely built urban areas where heat demand drives positive network economics. There are around 0.5 million customers connected to heat networks in the UK, with the geographic distribution shown in Figure 5.<sup>62</sup> The majority of domestic connections are to small flats and maisonettes, while connections in the commercial sector and universities cover more users and a higher heat load. Between 3 million and 8 million dwellings, as well as many commercial and public buildings, can be connected to heat networks at reasonable cost.<sup>63</sup>



**Figure 4:** Main energy source for current heat networks and heat networks under development, respectively, in the UK (Source: The Association for Decentralised Energy)



**Figure 5:** Location of UK Heat Networks (Source: The Association for Decentralised Energy)

<sup>60</sup> CCC (2019a) Net Zero Technical Report.

<sup>61</sup> Aldridge et al. (2017) Piping hot: The opportunity for heat networks in a new industrial strategy. IPPR.

<sup>62</sup> ADE (2018) Market Report: Heat Networks in the UK.

<sup>63</sup> ADE (2018) Market Report: Heat Networks in the UK.

## Current fuels and zero carbon alternatives

At present, heat networks reduce carbon emissions in buildings by 0.7–1.0 million tonnes of CO<sub>2</sub> each year.<sup>64</sup> The CCC's central scenario analysis suggests that heat networks can reduce carbon emissions by approximately 2.2 million tonnes of carbon emissions (mtCO<sub>2</sub>) in residential buildings and 3.5 mtCO<sub>2</sub> in non-residential buildings by 2030.<sup>65</sup> Analysis by the Association for Decentralised Energy (ADE) suggests a six-fold increase in the rate of deployment of heat networks is required to achieve these reductions, combined with connections to more renewable heat sources.<sup>66</sup>

The heat source for heat networks is important. The majority of existing heat networks use natural gas as the main energy source, but this is improving for heat networks under development, as shown in Figure 4. Improvements in the share of low carbon heat sources will turn district heating networks into zero carbon heating solutions.

## Existing public and private finance offers

Public sources of funding to support the scaling of district heating networks include the **Heat Networks Investment Project** (HNIP), which with £320 million capital gap funding is open to public, private and third sectors for projects in England and Wales.<sup>67</sup> The **Heat Networks Delivery Unit** (HNDU) provides support and guidance for Local Authorities developing heat networks.<sup>68</sup> Since its inception, HNDU has run nine funding rounds that have awarded £23 million in total, and is currently running its tenth round. Over 250 projects have been supported across 150 local authorities. In addition, BEIS is currently consulting on a proposed Green Heat Network Fund (GHNF) scheme, a capital grant funding programme that will help new and existing heat networks move to low and zero-carbon technologies, expected to open for applications in 2022.<sup>69</sup>

Investment structures and private finance offers do exist for heat networks. The most common structures include: a project that sits on the project owner's balance sheet and is financed through **corporate finance loans** or existing reserves; or a project that is off-balance sheet in a separate special purpose vehicle (SPV) in a **project finance structure**, with the owner investing alongside other private equity investors and long-term project finance debt to fund the project.

Project owners and operators include public or private sector companies, for instance Energy Service Companies (ESCOs). Project sponsors initiate the development of a heat network and usually provide a portion of the funding; this includes property developers, local authorities, universities, business park owners, leisure centres, schools, commercial and social landlords, community organisations and charities.

<sup>64</sup> ADE (2018) Market Report: Heat Networks in the UK.

<sup>65</sup> CCC (2016b) Annex 2. Heat in UK buildings today.

<sup>66</sup> ADE (2018) Market Report: Heat Networks in the UK.

<sup>67</sup> See: <https://www.gov.uk/government/collections/heat-networks-investment-project-hnip-overview-and-how-to-apply>

<sup>68</sup> See: <https://www.gov.uk/guidance/heat-networks-delivery-unit>

<sup>69</sup> BEIS (2020d) Green Heat Network Fund: Consultation on proposals for scheme design.

## Barriers to zero carbon heat technologies

The table below identifies financial and non-financial barriers to the scaling up of zero carbon district heating networks.

Financial barriers	Non-financial barriers
<ul style="list-style-type: none"> <li>- <b>High upfront capital costs</b> of infrastructure</li> <li>- <b>Lack of clarity of deal flow</b> or visibility of future projects for financial institutions</li> <li>- <b>Demand risk</b> for constructor and finance provider               <ul style="list-style-type: none"> <li>- questions surrounding how to guarantee cashflow without guaranteed offtake, causing revenue risk</li> </ul> </li> <li>- <b>Lack of conformity between projects and related contracts</b> makes it challenging to assess risks and opportunities at portfolio level, with scale inadequate for certain financial institutions who are willing to inject capital</li> <li>- <b>Economics of lower carbon options</b> not currently reflected in price to consumer</li> <li>- <b>Connection costs</b> for household to join network</li> <li>- <b>Accurate cost saving forecasts unclear</b> for consumers</li> <li>- <b>Unclear relationship to property valuation</b> for homeowners</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Lack of long-term policy framework</b>, with the long-term nature of infrastructure further increasing the need for clarity, and policy changes presenting risks for investors</li> <li>- <b>Statutory framework</b> underpinning heat network regulation needed to provide consumer protection</li> <li>- <b>No obligation for consumers to connect to a network</b> once built. If a zone is identified as suitable for a network, mandatory connections could be considered</li> <li>- <b>No requirement or existing support for networks to move to low-carbon heat sources</b></li> <li>- <b>Consumer education</b> on requirements to reach net zero and lack of understanding of heat networks by the general public</li> </ul>

**Table 8:** Barriers to investment for district heating networks

Housing Tenure Split					
		Drivers	Trigger Points	Barriers – Financial	Barriers – Non-Financial
Owner Occupied	First-time buyer	<ul style="list-style-type: none"> <li>To buy an energy efficient home</li> <li>Concerned about cost of living</li> <li>Demographic can influence priority of environmental consciousness vs. financial incentives</li> </ul>	<ul style="list-style-type: none"> <li>Recently moved</li> <li>About to move</li> <li>Introduction of new incentives/grants (e.g. Green Homes Grant including heat pumps)</li> </ul>	<ul style="list-style-type: none"> <li>Higher up-front costs of low-carbon residential heating systems vs traditional gas boilers</li> <li>Cheaper relative cost of gas</li> <li>Lack of products and incentives to shift to zero carbon heating</li> <li>Lack of certainty on long-term RHI payments</li> <li>Improvements not reflected in home value</li> <li>First-time buyers only: seeking to minimise outgoings, highly leveraged, limited options for further borrowing</li> </ul>	<ul style="list-style-type: none"> <li>Continued support from industry and government for gas installations and network improvements</li> <li>Phase-out of gas boilers will not be required until the Future Homes Standard enters into force</li> <li>Education and hassle, including misperception that 'gas is green'</li> <li>Lack of access to good information</li> <li>Fragmented market and access to trained installers</li> <li>Switch to a new heating system needs to be straightforward and user needs to be able to transact with confidence</li> <li>Timing: installation should suit user, especially when existing system is not at end-of-life</li> </ul>
	Mortgaged homeowner	<ul style="list-style-type: none"> <li>Minimising costs</li> <li>Increase in asset value from measures</li> </ul>	<ul style="list-style-type: none"> <li>Expanding family</li> <li>Children leave home</li> <li>Other renovations to the property</li> <li>Introduction of new incentives/grants</li> </ul>		
	Own outright	<ul style="list-style-type: none"> <li>Aesthetics, health, comfort</li> <li>Consider dwelling as an investment/asset value increase</li> </ul>	<ul style="list-style-type: none"> <li>Adapting home for future</li> <li>Recently acquired investment</li> <li>Introduction of new incentives/grants</li> <li>About to sell</li> </ul>		
Private Rented	Small Landlord	<ul style="list-style-type: none"> <li>Ability to recoup investment</li> <li>Meeting regulatory standards</li> <li>Increase in asset value from measures</li> <li>Positive relationship with long-term tenant</li> </ul>	<ul style="list-style-type: none"> <li>Void periods</li> <li>Change of tenancy</li> <li>Replacing faulty item/ upgrading property</li> <li>Planning new acquisitions</li> <li>Impending regulatory deadlines</li> </ul>	<ul style="list-style-type: none"> <li>Higher up-front costs of low-carbon heating vs traditional gas boilers</li> <li>No financial incentive</li> <li>Leaseholders cannot recoup their investment by increasing service charge</li> <li>No perceived increase in value</li> <li>Limited capacity to leverage credit</li> <li>Landlord-tenant split incentive</li> <li>Lack of certainty on RHI payments</li> </ul>	<ul style="list-style-type: none"> <li>Education and hassle</li> <li>Lack of good quality information</li> <li>Limited awareness for acquiring finance</li> </ul>
	Large Landlord / Asset Manager	<ul style="list-style-type: none"> <li>Ability to recoup investment</li> <li>Meeting regulatory standards</li> <li>Increase in asset value from measures</li> <li>Green building certification for reputational benefits</li> </ul>	<ul style="list-style-type: none"> <li>Void periods</li> <li>Change of tenancy</li> <li>Replacing faulty item/upgrading property</li> <li>Planning new acquisitions</li> <li>Impending regulatory deadlines</li> </ul>	<ul style="list-style-type: none"> <li>High upfront costs, particularly for landlords with multi-property portfolios; currently unable to aggregate demand</li> <li>Uncaptured value: no certainty on increase to rent or property value</li> <li>Landlord-tenant split incentive</li> <li>Lack of certainty on long-term RHI payments</li> </ul>	<ul style="list-style-type: none"> <li>Regulatory uncertainty about future requirements</li> <li>Ambiguity surrounding new housing standards</li> <li>Limited awareness for acquiring finance</li> <li>Supply chain maturity</li> <li>District Heating: size of market and lack of regulatory environment</li> </ul>
Social Rented	Housing Association	<ul style="list-style-type: none"> <li>Interest in placing health and wellbeing in decision making</li> <li>Tackling fuel poverty and delivering social benefits</li> <li>Meeting regulatory and duty-of-care standards</li> </ul>	<ul style="list-style-type: none"> <li>Priorities in Association</li> <li>Maintenance cycles</li> <li>Void periods in tenancy</li> <li>Impending regulatory deadlines</li> </ul>	<ul style="list-style-type: none"> <li>Typically higher cost of borrowing than Local Authorities</li> <li>High upfront costs to decarbonise large portfolios</li> <li>Lack of certainty on long-term RHI payments</li> </ul>	<ul style="list-style-type: none"> <li>Stock is often widely dispersed</li> <li>Decision making is sometimes with cooperatives</li> <li>Supply chain maturity</li> <li>District Heating: size of market and lack of regulatory environment</li> </ul>
	Local Council	<ul style="list-style-type: none"> <li>Interest in placing health and wellbeing in decision making</li> <li>UK net-zero 2050 target and local council climate emergency declarations</li> <li>Drive green recovery and jobs</li> <li>Different regulatory systems depending on location (e.g. England, Scotland or Wales)</li> <li>Tackling fuel poverty</li> </ul>	<ul style="list-style-type: none"> <li>Priorities within Councils, including climate emergency</li> <li>Maintenance cycles</li> <li>Void periods in tenancy</li> <li>Impending regulatory deadlines</li> </ul>	<ul style="list-style-type: none"> <li>New build and existing stock compete for budgets</li> <li>High upfront costs to decarbonise large portfolios</li> <li>Establishing new financial models difficult due to approval required and timelines</li> <li>Short-term grant profile difficult to reconcile with long-term objectives</li> <li>Bureaucracy of new finance models getting clearance</li> <li>Lack of long-term policy certainty and capital investment from central government</li> </ul>	<ul style="list-style-type: none"> <li>Priorities within Councils</li> <li>Supply chain maturity</li> <li>Legislative requirements to enable certain solutions</li> <li>Lack of data on measurable benefits and impacts</li> <li>District Heating: size of market and lack of regulatory environment</li> </ul>

Figure 6: Overview of drivers, trigger points and barriers for different tenures

## 4. Mobilising capital:

the portfolio of demonstration projects

The portfolio of demonstration projects will collectively align with and amplify existing energy efficiency initiatives, as well as inform government policy.

The following section sets out a portfolio of demonstration projects to overcome investment barriers and channel investment into low-carbon heating, with different solutions appealing to each market segment. As a portfolio, the demonstration projects will collectively align with and amplify existing energy efficiency initiatives, as well as inform government policy.

## 4.1 Lending products

Demonstration Project 1: <b>Demand Aggregation Financing</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> This demonstration project would develop an online service that establishes a ‘critical mass’ in demand for a specific technology in a local area, in order to bring down the price of zero carbon heating solutions. It would be supported by delivery partners and manufacturers who benefit from a guaranteed minimum number of purchases, and financial institutions that offer attractive funding options.</p>				
<p>Customers in a specific region can register their interest with a coordinating body, which will then approach manufacturers for bids once a minimum threshold in demand has been met. The best offer is then communicated to those who registered interest. One or more financial institutions would offer funding to help customers to purchase these systems; the guaranteed demand could incentivise the financial institutions to offer attractive products. Exclusivity agreements could provide certainty of demand and ensure a guaranteed reduction in equipment costs, which could be communicated to customers at the point of registration. Alternatively, a ‘reverse auction’ approach could be adopted.</p>				
<p><b>Real-economy outcome:</b> Demand Aggregation Financing can provide households with lower cost zero carbon heating solutions, thereby making them more desirable and increasing installations across the country. This demonstration project could support all housing tenures, enabling access to cheaper technology and finance by establishing the ‘critical mass’ in demand required to achieve economies of scale. Similar approaches are underway for community solar buying schemes (see case study on iChoosr). This will in turn help scale up local supply chains through guaranteeing a minimum level of demand in a specific region, giving manufacturers the confidence to invest in skills and technologies.</p>				
<p>To establish a pilot scheme for Demand Aggregation Financing, the initial steps include developing a framework and template plan for those seeking to aggregate demand for zero carbon solutions, and considering the financial products and services that can underpin aggregation.</p>				
<p><b>Delivery partners:</b></p> <ul style="list-style-type: none"> <li>• Buying scheme operators</li> <li>• Law firms</li> <li>• Lenders</li> <li>• Local authorities</li> <li>• Manufacturers and installers</li> <li>• Social-rented landlords</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Building Renovation Passports to inform residents about which measures are most suitable for their homes</li> <li>• Long-term policy certainty about incentives, including an exit strategy following the Green Homes Grant and Renewable Heat Incentive/Clean Heat Grant</li> <li>• Further measures to scale supply chains and bring down costs, such as a Heat Pump Sector Deal</li> </ul>			

**Key:** On-G: On the gas grid Off-G: Off the gas grid NH: New Homes DH: District Heating

### Case study 1: Demand aggregation financing for solar through iChoosr

In 2008, iChoosr started operations in Belgium, delivering a group-buying scheme to help bring registrants that needed a service into contact with a supplier that could provide high-quality products at a reasonable cost. In the UK, it focuses schemes around Collective Energy Switching and group-buying for solar panels and battery storage, including through Solar Together. Solar Together allows local councils to support group-buying in their area to enable homeowners to install solar panels and storage for a competitive price with a pre-vetted installer.

Residents and SMEs living in a participating council area can register for the Solar Together group-buying scheme. Once a minimum demand threshold has been met, a 'reverse auction' is held among manufacturers, where the lowest bid wins. After the auction, registered participants receive a personal recommendation which will include information about the winning supplier and complete package, costs and savings.

Demonstration Project 2: <b>Green Home Salary Sacrifice Scheme</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> Salary sacrifice schemes allow employees to exchange part of their pre-tax salary for a non-cash benefit, such as childcare vouchers and cycle equipment. A Green Home Salary Sacrifice Scheme offers a tax-efficient mechanism for employees to pay for a domestic heat pump, via a hire purchase agreement with their employer or a third-party.<sup>70</sup> At the end of the hire period, employees would be eligible to purchase the equipment outright and could utilise complementary funding options to support this investment. Salary sacrifice schemes must be made available to all employees above the National Minimum Wage in participating organisations; therefore, schemes offered by the large employers could access a significant number of households.</p>				
<p><b>Real-economy outcome:</b> Leveraging the trusted relationship between employees and employers, a Green Home Salary Sacrifice Scheme can offer a simple, attractive and tax-efficient solution to finance the uptake of heat pumps among owner-occupiers in the able-to-pay market. Salary sacrifice could help to drive adoption of other public and private finance options, if employees are eligible to combine funding sources. Meanwhile, aggregating demand from multiple employers through salary sacrifice platforms could provide the confidence for heat pump manufacturers to scale rapidly.</p> <p>To establish an effective scheme, a feasibility study should explore the following: whether existing legislation permits heat pumps as eligible equipment; the impact of heat pump costs (that are significantly higher than e.g. bicycles); how the finance can be secured and the financial regulatory implications. The results can inform a pilot scheme with a salary sacrifice platform, alongside major employers in the finance and energy sectors who increasingly engage their employees on environmental issues.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Employers of scale (e.g. finance and energy sectors, public sector, academia, retail)</li> <li>• Financial regulators (i.e. FCA)</li> <li>• Government (i.e. HMT, HMRC)</li> <li>• Law firms</li> <li>• Manufacturers</li> <li>• Salary sacrifice platforms</li> <li>• Trade unions</li> </ul>		<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Legislative amendments to allow heat pumps as an eligible category of non-cash benefit, if required</li> <li>• Mandating that Green Home Salary Sacrifice Schemes are conducted by TrustMark or MCS registered tradespeople</li> <li>• Introducing a carbon price to 'level the playing field' (see Section 6)</li> </ul>		

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<sup>70</sup> Department for Transport (2019) Cycle to Work Scheme – Guidance for Employers.

Demonstration Project 3: <b>Mobilising secured and unsecured finance</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> Approximately 78% of UK adults hold at least one credit or loan product.<sup>71</sup> These are supported by highly regulated financial institutions that maintain a robust and scalable banking infrastructure. The familiarity of consumers with secured (i.e. mortgage) and unsecured (i.e. personal loans, credit cards) finance creates an opportunity to utilise existing products to fund the installation of zero carbon heat technologies.</p>				
<p>In addition to Green Mortgages and Retrofit Loans (see Table 9) that offer favourable terms for energy efficient investments, financial institutions can develop their relationships with the 97% of UK adults who are ‘banked’ with advice and support on their net-zero transition.<sup>72</sup> They can leverage the rich data collected on customers, which could enable banks to engage at key trigger points (e.g. moving house, growing family). Meanwhile, public capital could be efficiently channelled to homeowners via government-backed guarantee schemes on mortgages that unlock lower borrowing rates.</p>				
<p><b>Real-economy outcome:</b> Deeper customer engagement at appropriate trigger points can increase awareness and catalyse action among homeowners, while familiar lending products that incorporate attractive features can stimulate capital flows towards retrofitting projects. These outcomes can also help financial institutions to meet increasingly stringent disclosure and reporting requirements, including the Bank of England Climate Stress Tests.<sup>73</sup></p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Financial institutions (e.g. banks, building societies, other specialist lenders)</li> <li>• Financial regulator (i.e. FCA)</li> <li>• Government (i.e. BEIS, HMT)</li> <li>• Retrofit coordinators, contractors and installers</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Fiscal incentives to pump prime the market, including EPC-linked incentives or a green Stamp Duty<sup>74</sup></li> <li>• Implementation of the LENDERS project recommendations and enhanced disclosure of the EPC distribution of mortgage books, as currently being consulted upon by BEIS,<sup>75</sup> requiring disclosure of EPCs and Environmental Impact Ratings</li> <li>• Increased access to the FCA’s Regulatory Sandbox to create a positive environment for financial innovation</li> <li>• Public funding support for fuel poor and vulnerable households to avoid creating a two-tier mortgage market</li> </ul>			

**Key:** On-G: On the gas grid Off-G: Off the gas grid NH: New Homes DH: District Heating

<sup>71</sup> FCA (2018) The financial lives of consumers across the UK: Key findings from the FCA’s Financial Lives Survey 2017.

<sup>72</sup> FCA (2018) The financial lives of consumers across the UK: Key findings from the FCA’s Financial Lives Survey 2017.

<sup>73</sup> See: <https://www.bankofengland.co.uk/climate-change>

<sup>74</sup> UKGBC (2013) Retrofit Incentives: Boosting take-up of energy efficiency measures in domestic properties.

<sup>75</sup> BEIS (2020c) Improving home energy performance through lenders: Consultation on setting requirements for lenders to help householders improve the energy performance of their homes.

Company Name	Product Name	Launch Year	Requirements of Product				Comments
			Discount to Existing Mortgage or New Low-Interest Rate Mortgage	Additional Borrowing for Existing Customers	Energy Efficiency of Property must be Improved	Property Bought must be Energy Efficient	
Ecology Building Society	C-Change Discount	2006	✓		✓		95% of customers already eligible.
	Energy Improvements Mortgage	2018	✓		✓		Often accept projects that standard lenders may not.
Barclays	Green Home Mortgage	2018	✓			✓	Must be a new-build property from a select group of housebuilders.
Nationwide Building Society	Green Additional Borrowing Mortgage	March 2020		✓	✓		At least 50% of borrowing must be spent on energy efficiency improvements.
Newbury Building Society	GoGreen Further Advance	July 2020		✓	✓		
Saffron Building Society	Retro-Fit Mortgage	September 2020	✓		✓		Proof of energy efficiency upgrades needed.
NatWest Group	Green Mortgages	October 2020	✓			✓	£250 cashback paid to solicitor. Valid EPC rating of A/B required.
EeMAP Initiative	Aim to Develop an "Energy Efficient Mortgage"	On-going	✓	✓	✓	✓	An EU-wide market-led initiative intended to channel private capital into energy efficiency investments.
BNP Paribas	Green Mortgage	Since 2018	Collaborating with E.ON to develop and pilot such a product, under the EeMAP Initiative umbrella.				
Monmouthshire Building Society	Green Mortgage – Under the VALUER Project	Pilot to launch soon	✓			✓	To pilot product in low-carbon housing development Parc Eirin, in South Wales.

Table 9: Green mortgage offers in the UK

## 4.2 Institutional investments

Demonstration Project 4: <b>Third Party Asset Infrastructure</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> To reduce the financial burden on individual property owners, there is a role for third party financiers to bridge the gap in capital required for zero carbon heating. In the instance of some off-grid homes and new-build developments, a third party could provide either all or some of the additional capital required to build an asset – such as a ground source heat pump array – which could provide heat to multiple homes. The residents connected to the asset then pay a charge to a third party investor on a regular basis, with the expectation of eventually buying out the investment made by the third party.</p> <p>The possibility also exists for a similar scheme to Demand Aggregation Financing to be implemented to pool demand, with all consumers that register paying a service charge to the third party owner, rather than receiving a loan to cover the upfront costs.</p>				
<p><b>Real-economy outcome:</b> This model for financing new assets can fill the gap where it is prohibitively expensive to source the capital or deemed too expensive. By bringing in a third party, the upfront capital to build the project can be supplied and paid back over the long term. In the instance of new homes, bringing in a third party investor enables the design of the property to meet the requirements for the asset, such as a GSHP or several ASHPs, reducing the overheads of the developer and enabling the new home owner to hold the agreement directly with the provider.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Ambitious organisations seeking to deploy zero carbon heat ahead of 2025</li> <li>• Housing developers</li> <li>• Local authorities</li> <li>• Manufacturers</li> <li>• Retrofit coordinators, contractors and installers</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Review the Standard Assessment Procedure to fairly reflect the benefits of new technologies in homes</li> <li>• Changes to planning arrangements which permit developers to build housing based on outdated building regulations in place at the time of granting permission</li> <li>• Revoking levies on electricity for heat, and introducing a carbon price to ‘level the playing field’ (see Section 6)</li> </ul>			

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Demonstration Project 5: <b>Green Real Estate Investment Trust (REIT)</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> Real Estate Investment Trusts (REITs) are companies that own and operate income-producing real estate, often pooling the capital of multiple investors, and can be publicly traded on securities exchanges. Growing demand for ESG investments creates the environment for a new class of REITs in the UK that invest into energy efficient buildings with zero carbon heating systems. Green REITs can also set environmental targets on portfolio properties, alongside financial returns targets.</p> <p>Green REITs can pursue a breadth of strategies: the acquisition of inefficient properties with subsequent investment to improve the energy efficiency, thereby enhancing rental rates<sup>76</sup> and investor returns; the acquisition of newly constructed, energy efficient properties; the provision of development finance to support the construction of net zero properties, including Build-to-Rent portfolios; the conversion of a development company into a REIT for tax purposes.</p>				
<p><b>Real-economy outcome:</b> Green REITs embed environmental criteria into a popular asset class and provide a scalable mechanism to attract significant volumes of institutional investment into net zero properties. Meanwhile, REIT managers can encourage property developers to deliver sustainable building stock through ambitious investment criteria that target net zero standards. More broadly, Green REITs will appeal to a wider range of investors (e.g. fund managers with ESG mandates) and further accelerate a rapidly growing market in the UK.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Financial institutions</li> <li>• Institutional investors (i.e. REIT managers, pension funds)</li> <li>• Law firms</li> <li>• Property developers</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Clear, robust, common benchmarks to facilitate accurate reporting to showcase relative performance of Green REIT portfolio assets</li> </ul>			

**Key:** On-G: On the gas grid Off-G: Off the gas grid NH: New Homes DH: District Heating

<sup>76</sup> RICS (2019) Energy efficiency and residential values: a changing European landscape.

Demonstration Project 6: <b>Community Improvement District Financing</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> Community Improvement District Financing aims to build heat networks in specific areas, designated as Community Improvement Districts, with financing provided by institutional investors, repaid via an additional levy charged to all buildings in the area that choose to connect to the heat network. The increased levy would be charged via business rates, council tax, or other tax mechanisms.</p>				
<p><b>Real-economy outcome:</b> Building on community-led approaches and existing schemes, the Community Improvement District Financing would bring a new heat network to a designated area, reducing energy bills and improving community engagement. Property owners and tenants in the Community Improvement District should not only see lower bills, but also increases in property values. The project would encompass buildings of all types. Projects applying for Community Improvement District Financing would be required to have a zero-carbon heat source or a clear roadmap to attain this in a set time frame, with potential financial penalties if this is not achieved, similar to those embedded in sustainability-linked loans.</p> <p>A study of similar schemes, such as Business Improvement Districts<sup>77</sup> and Tax Increment Financing, would identify successful features that could be leveraged for this demonstration project. A feasibility study could then explore the technicalities of the scheme, including: economic analysis of benefits to the area and building valuations; calculation of the additional levy; the differences for new-build and existing buildings; and the most efficient financial structuring.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Business owners</li> <li>• ESCOs</li> <li>• Financial regulators (i.e. FCA)</li> <li>• Government (i.e. BEIS, HMT)</li> <li>• Local authorities</li> <li>• Law firms</li> <li>• Private-rented and social-rented landlords</li> </ul>		<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• A framework for heat network zoning, as BEIS will be consulting on in spring 2021,<sup>78</sup> and the potential for mandatory heat network connections</li> <li>• Potential financial subsidies provided by government to building owners in the Community Improvement District, to incentivise connections to early schemes</li> <li>• Building Renovation Passports to inform residents of the Community Improvement District of how they can connect, and clearly explain the financial benefits and implications</li> </ul>		

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<sup>77</sup> See: <https://www.gov.uk/guidance/business-improvement-districts>

<sup>78</sup> ADE (2020) Right place, right stuff: Gov to put local areas in charge with zoning consultation on heat networks.

Demonstration Project 7: <b>National District Heating Fund</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> A specialist investment fund focussed on investing in district heating networks across the country, with the flexibility to fund through both debt and equity. The fund could sit independently or as part of the new National Infrastructure Bank, as announced in the 2020 National Infrastructure Strategy.<sup>79</sup> Seed funding from the Government could be provided for the initial rounds, helping leverage in private capital, similar to the success achieved by the Green Investment Bank, which leveraged £2.50 of private capital for every £1 of public money spent.<sup>80</sup> Alternatively, the fund could be seeded with private capital. Further financing routes could be explored to finance projects at different stages in their life in the future.</p>				
<p><b>Real-economy outcome:</b> The fund would help de-risk investments and leverage private capital that may otherwise see such investments as too risky. Funding could support heat networks being built across the country, and standardisation would allow portfolios to be established in the longer-term, paving the way for a sustainable long-term district heating market in the UK.</p> <p>Initial steps to develop this concept include engagement with financial institutions to ascertain market demand, determining the optimal structure for the fund, and exploring options to launch the fund with public seed funding or proceeding with private capital.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• ESCOs</li> <li>• Financial institutions</li> <li>• Government (i.e. BEIS, HMT)</li> <li>• Local authorities</li> <li>• Pension funds</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• If initially seeded through public money, then government support for the seed funding and establishment of the fund would be crucial</li> <li>• This demonstration project could be included as part of the newly announced National Infrastructure Bank, in a similar manner to the Green Investment Bank Offshore Wind Fund<sup>81</sup></li> <li>• A framework for heat network zoning, as BEIS will be consulting on in Spring 2021, would further de-risk potential investments, with the fund focusing on investing in areas that have been identified as heat networks zones</li> </ul>			

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<sup>79</sup> HM Treasury (2020) National Infrastructure Strategy.

<sup>80</sup> NAO (2017) Department for Business, Energy & Industrial Strategy, UK Government Investments, The Green Investment Bank.

<sup>81</sup> Green Investment Group. (2017, January 13). World's first offshore wind fund manager powers through £1bn target.

## 4.3 Skills, incentives and enabling mechanisms

Demonstration Project 8: <b>Zero Carbon Heat Investment Guides</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> Currently, there is a knowledge gap between lenders and the zero-carbon heating supply chain and delivery partners. This demonstration project will enhance lenders’ understanding about how they can support different zero carbon heating technologies and systems, and will also enhance the knowledge of heating supply chain actors and delivery partners (i.e. manufacturers, local authorities) about the ways that finance can be mobilised to scale up solutions.</p>				
<p><b>Real-economy outcome:</b> Increased knowledge and engagement on both sides can help scale investments into low carbon heating technologies and systems; lender awareness of risks and opportunities can help to bring down the costs of lending, while greater familiarity of financial opportunities in the supply chain can create opportunities and inspire new business models to leverage funding options.</p> <p>Two practical toolkits can unlock these opportunities. The first will inform lenders about zero carbon heating technologies and energy efficiency measures, developed by engaging lenders to identify knowledge gaps. The second toolkit will do the same in reverse – identifying gaps in the knowledge of manufacturers, suppliers and delivery organisations about finance options, and developing answers in consultation with lenders.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Development Banks (i.e. European Bank for Reconstruction and Development, other European finance experts with experience of similar projects)</li> <li>• Financial institutions (i.e. banks, building societies, other specialist lenders)</li> <li>• Government (i.e. BEIS, HMT)</li> <li>• Local authorities</li> <li>• Manufacturers</li> <li>• Retrofit coordinators, contractors and installers</li> <li>• Social-rented landlords</li> <li>• Trade associations</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• The forthcoming National Infrastructure Bank and a new National Heat Delivery Body could disseminate the toolkit and associated trainings</li> <li>• Use toolkit to engage with the Bank of England about the scale of borrowing needed to get the UK on track to decarbonise heat, considering options to lend at rates that make this possible</li> </ul>			

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Demonstration Project 9: <b>Tax Credits and Incentives for the Private Rented Sector</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> The private-rented sector is required to comply with Minimum Energy Efficiency Standards (MEES), with proposals underway increase this to EPC C standard by 2025 (new tenancies) and 2028 (for all tenancies). Tax credits and incentives have been proposed to help landlords decarbonising their homes, including capital allowances, income tax and stamp duty rebates.</p> <p>This demonstration project would undertake market research and scenario analysis to better understand the roles for incentives in supporting landlords to decarbonise their portfolio, research into existing schemes, and interviews with private landlords.</p>				
<p><b>Real-economy outcome:</b> Government will have additional information to help inform decisions about introducing tax credits and incentives to support private landlords to meet, and move beyond, the MEES standards. This can unlock benefits for tenants who would gain access to warmer, healthier, low carbon homes. Increased demand for zero carbon homes can boost supply chains and create green jobs across the country. In addition, fiscal incentives can interact with private finance as illustrated by the tax rebate scheme for heat in Italy.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Academia and data specialists</li> <li>• Government (i.e. HMT, BEIS)</li> <li>• Private-rented landlords</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Building Renovation Passports to inform Landlords of the best measures to undertake</li> <li>• Further measures to scale supply chains and bring down costs, such as a Heat Pump Sector Deal</li> <li>• MEES extended to include zero carbon heating, factoring the Environmental Impact Rating as well as the Energy Efficiency Rating</li> <li>• Changes to EPCs to reflect carbon savings and move away from cost-based calculations</li> </ul>			

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### Case study 2: Italian tax rebates for heat – the Decreto Rilancio

In Italy, a tax incentive 'super bonus' was introduced in July 2020 as a stimulus measure to encourage green home retrofits, including the installation of heat pumps. Resident taxpayers can receive up to 110% of the cost of certain renovations, paid in the form of tax credits. This will be divided into five equal annual tax reductions. There are two other options: a credit transfer or invoice discount. In these cases, the credit for the eco-bonus is "sold" and transferred to a financial intermediary (e.g. a bank) or to the contractor who is undertaking the work. If the tax credit is transferred to a financial institution, they then lend the money to do the work. When transferring the tax credit directly to the contractor, they will discount the amount on the invoice, and recover the money from their tax declaration.

Demonstration Project 10: <b>National Heat Delivery Body (NHDB)</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> National coordination is required to provide clear direction on the district heating market; a National Heat Delivery Body would provide this central coordination and oversight, while implementation would be led by Local Authorities, Local Economic Partnerships and regional delivery bodies. This demonstration project could coordinate several financial and non-financial schemes outlined in this report, including Demand Aggregation Financing, Community Improvement District Financing and the National District Heating Fund, amongst wider CEEB demonstration projects.</p>				
<p><b>Real-economy outcome:</b> The NHDB can deliver project delivery, scientific, financial and technological advice to local actors, as well as coordinating the national plan and ensuring environmental and social return metrics are achieved. A focus on standardised contracts and due diligence, coupled with technical assistance, would enable consistency in heat networks across the country and allow easier aggregation of investible portfolios. The remit could be extended to coordinating other schemes related to decarbonising heat, including those set out in this report.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• ESCOs</li> <li>• Financial institutions</li> <li>• Government (i.e. BEIS)</li> <li>• Heat Networks Delivery Unit (HNDU)</li> <li>• Law firms</li> <li>• Local authorities</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Government mandate to establish the proposed body to spearhead heat decarbonisation efforts</li> <li>• If privately established, a clear government policy pathway is needed to support and facilitate successful planning and delivery</li> <li>• A framework for heat network zoning, as BEIS will be consulting on in spring 2021, to support Local Authorities to design and deliver locally-appropriate heat decarbonisation strategies</li> </ul>			

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## 4.4 Tenancy agreements

Demonstration Projects II: <b>All-in Rental Agreements</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> Aimed at the private and social rented markets, All-in Rental Agreements can create a stable flow of income for landlords to invest in low carbon heating measures for a property. This is already a proven model with many rental agreements incorporating heating, internet and water costs into the rental rate – for example, in student accommodation – and could unlock a funding stream to repay investments in the heating system of a property.</p> <p>The CEEB is in the advanced stages of developing a Green Rental Agreement, due in early 2021, which will help landlords to improve the energy efficiency of their property. The experience of this demonstration project is directly transferable to the proposition.</p>				
<p><b>Real-economy outcome:</b> All-in Rental Agreements present an opportunity to increase investment in the private-rented sector by creating a consistent funding stream, via the rental payment, which can be used to repay the upfront investment in zero carbon heat technologies. Additional funding from public sources may be required for hard-to-improve properties, or where the necessary technologies are prohibitively expensive.</p> <p>All-in Rental Agreements should improve security of costs for the tenant, while providing the landlord with security of repayment. With increasing public interest in the climate emergency, a zero carbon green rent may be attractive to prospective tenants.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Data specialists</li> <li>• Energy companies</li> <li>• Law firms</li> <li>• Lenders</li> <li>• Letting and managing agents</li> <li>• Local government</li> <li>• Private-rented landlords</li> <li>• Social-rented landlords</li> <li>• Trade associations</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Minimum Energy Efficiency Standards (MEES) for landlords should be set to an EPC C or above and Environmental Impact Rating C</li> <li>• Better enforcement of the MEES regulation</li> <li>• Grants for social and private rented properties issued by local government</li> </ul>			

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## 4.5 Energy service products

Demonstration Project 12: <b>Heat as a Service</b>	On-G	Off-G	NH	DH
<p><b>Overview:</b> Heat as a Service is a model whereby a provider offers customers the technology to upgrade their home, with the ability to control the comfort they receive for a monthly cost. By upgrading homes to high energy performance standards with zero carbon heating, and letting the resident choose the level of comfort they desire, the provider can remotely optimise the building performance and deliver significant energy savings that outweigh the cost of home energy optimisation. Maintenance is covered by the provider, reducing costs to the resident.</p>				
<p><b>Real-economy outcome:</b> As a cost-effective model for the customer to retrofit their home, this service has potential to reduce costs for homeowners and housing developers, who can outsource the heating system to a third-party provider. The application of this model stretches across tenures and market segments, providing customers access to affordable zero carbon heating services.</p>				
<p><b>Delivery partners</b> include:</p> <ul style="list-style-type: none"> <li>• Business innovation specialists</li> <li>• Data specialists</li> <li>• Energy companies</li> <li>• Financial institutions</li> <li>• Financial regulators (i.e. FCA)</li> <li>• Housebuilders</li> <li>• Retrofit coordinators, contractors and installers</li> </ul>	<p><b>Policy levers</b> to support demand and scale-up:</p> <ul style="list-style-type: none"> <li>• Increased access to the FCA’s Regulatory Sandbox to create a positive environment for business model and financial innovation</li> <li>• Amendment to qualifying criteria for the Renewable Heat Incentive (RHI) and successor scheme rules to include leased heating equipment</li> </ul>			

**Key:** On-G: On the gas grid Off-G: Off the gas grid NH: New Homes DH: District Heating

## 4.6 Existing demonstration projects – the potential to decarbonise heat

The Taskforce also identified the potential for existing demonstration projects – to support the decarbonisation of heating, as outlined in Table 10.

Existing demonstration project	Overview and links to heat decarbonisation
<b>Energy Efficiency and Valuation</b>	Research the relationship between energy efficiency performance, low carbon heating solutions and property valuation to unlock investment in zero carbon homes. Homeowners can see the financial benefits; estate agents and mortgage providers better understand the benefits and opportunities and are better able to evaluate risks.
<b>Building Renovation Passports</b>	Building Renovation Passports provide information to homeowners about options to get their home on track for a zero-carbon heating system – outlining the best option for their property, and any place-based considerations (i.e. if there are district heating networks in the area the property could be connected to). They can provide links to public and private financing options, including Demand Aggregation Financing platforms operating in the area.
<b>Green Home Retrofit Finance Principles</b>	The Principles, launched by the CEEB in September 2020, <sup>82</sup> are a framework of guidelines that promote integrity in the market by providing financial institutions with a consistent and transparent methodology for the allocation of finance towards retrofitting works in the UK’s domestic buildings. Projects that are identified for lending include zero carbon heating solutions.
<b>Property Assessed Clean Energy ‘style’ financing</b>	Financial institutions provide long-term capital for retrofit projects – which could include zero carbon heating solutions – while local authorities or associated independent third parties collect repayments via an additional property charge that is passed through to the lender.
<b>Guarantees for Social Housing</b>	An insurance-backed guarantee mechanism for deep retrofit projects with ‘Comfort Plans’, to increase confidence amongst early adopters (e.g. social landlords) and improve the financing available for such projects, which can also include zero carbon heating solutions.
<b>Community Municipal Bonds</b>	Utilises a crowdfunding approach to create an efficient, scalable and cost-effective source of funding for local authorities to finance projects that address the climate emergency, which could include zero carbon heating solutions.

**Table 10:** Addressing heat decarbonisation with the existing CEEB demonstration projects

<sup>82</sup> See: <https://www.greenfinanceinstitute.co.uk/ghrfp/>

## 5. Driving systemic change

A move beyond individual solutions and policies to a near-term future where

finance, government, industry, households and good governance work together on a shared ambition for net-zero emissions and climate-safety.

Decarbonising heat in the UK requires systemic change and a move beyond individual solutions and policies to a near-term future where finance, government, industry, households and good governance work together on a shared ambition for net-zero emissions and climate-safety. And it must also encompass the wider sustainability agenda, circularity in design and climate resiliency measures. This section presents the potential system-wide impacts achievable by the demonstration projects, and the policy recommendations proposed by Taskforce members that will stimulate zero carbon heating demand across and beyond the scope of the portfolio.

## 5.1 Driving synergies between demonstration projects

Demonstration projects must align and interconnect to become collectively greater than the sum of the individual parts. The diagram below shows how a supportive policy framework and non-financial

enabler demonstration projects can scale up demand for the financial solutions devised by the Taskforce and accelerate the decarbonisation of homes while supporting a green recovery.



**Figure 7:** Interaction of financial solutions with full demonstration project portfolio and a supportive policy framework

## 5.2 Policy recommendations

The UK policy landscape has yet to provide the market signals required to scale supply chains, jobs and investment in zero carbon heating solutions. The UK's recently-announced target to install 600,000 heat pumps per year by 2028 is an important and

positive step. To bolster and build on this, policy levers that can drive the success of the demonstration projects are highlighted throughout this report. A series of overarching, system-level legislative and regulatory changes are identified below.

### 5.2.1 Long-term frameworks and targets to provide business and investor confidence

A **long-term policy outlook, accompanied by regulation, targets and milestones**, is essential to instil the confidence and certainty that industry and investors need to invest in the skills and technologies for a mass-market in smart, efficient zero carbon heat. The forthcoming Heat and Buildings Strategy presents an opportunity to provide those positive signals and decisions, especially if supported by the Net Zero Review and Energy White Paper.

Recommendations should include a **fabric-first approach** that promotes energy efficiency measures, as well as **climate resiliency** and **circular, sustainable design**. And the framework must be **properly capitalised** and supported by Treasury.

By establishing confidence in short and long-term demand for zero carbon heating, manufacturers and service providers can invest and flex their capacity to match.<sup>83</sup> Government targets should provide a clear direction of travel. The Energy Efficiency Infrastructure Group (EEIG) recommends **bringing forward the EPC C target for homes from 2035 to 2030** and introducing a new goal to **halve heating emissions from existing homes by 2030**.<sup>84</sup> This would be commensurate with the pace of decarbonisation

needed,<sup>85</sup> aligned with Scotland's ambition for heat,<sup>86</sup> and can be technically delivered in ten years – principally through heat pumps and heat networks deployment.<sup>87</sup> Furthermore, a timeline to **phase out all fossil fuel boilers** would signal the direction away from high-carbon heating systems. This should be supported by the **Future Homes Standard** that was referenced in the Prime Minister's Ten Point Plan.

This overarching policy outlook, with accompanying targets, should form the basis of a **coherent national policy framework that spurs local leadership**. While policy decisions and regulations such as tax incentives or a potential carbon price are best implemented at a national level, there is also a need for local governance mechanisms that scale-up innovations and supply chains for zero carbon heating.

<sup>83</sup> Hansford, P. (2015) Solid Wall Insulation: Unlocking Demand and Driving Up Standards.

<sup>84</sup> EEIG (2020) Turning stimulus into recovery: From the Green Homes Grant towards a resilient Net Zero economy.

<sup>85</sup> By eliminating 45% of today's emissions by 2030 to limit global warming to 1.5°C. See: IPCC (2018) SR15: Global Warming of 1.5°C.

<sup>86</sup> Scotland is seeking to fully eliminate emissions from heat buildings by 2040. See: The Scottish Government (2020) Protecting Scotland, Renewing Scotland.

<sup>87</sup> Modelling for the National Infrastructure Commission finds that the combination of energy efficiency and heat pump deployment can reduce emissions from heating buildings by 44% by 2030. See: Element Energy & E4tech (2018) Cost analysis of future heat infrastructure options.

For example, **zoning** considers the most appropriate heat decarbonisation and energy efficiency solutions for a given area. Local Authorities can use a zoning framework to identify specific areas with high potential for heat networks, or other solutions. This in turn could encourage the development of innovative business models and financing approaches – including **Demand Aggregation Financing** and **Third-party Asset Infrastructure** – which could increase access to lower cost finance. In a welcome move, BEIS announced a consultation on a framework for heat network zoning in spring 2021.<sup>88</sup>

At present, a major barrier to scaling up zero carbon heating solutions at a local level is a lack of capacity among Local Authorities. **A National Heat Delivery Body** could be established to help advise Local Authorities and other actors, such as Local Economic Partnerships, providing scientific, governance, financial and technological guidance and scaling up the financial solutions being developed by the CEEB. This would complement the new **National Infrastructure Bank**.

### Carbon Pricing – Levelling the playing field for zero carbon heating

The Zero Carbon Commission report, published in September 2020, calls for the government to announce a clear carbon price trajectory reaching a minimum of £75/tCO<sub>2</sub>e by 2030, charged upstream on the producers of greenhouse gases. A carbon price would be beneficial, as it ensures that companies account for their emissions in business cases and financial models when making future investment and strategy decisions.

The Commission's recommendations outline a differentiated approach by sector, with the domestic heating measures recommended for introduction in 2021. A clear trajectory can provide clarity on future costs, improving investor confidence to scale zero carbon heating solutions, as well as making gas boilers less economic compared to zero carbon heating solutions, and providing lead time for consumers to convert. The recommendations of the Commission should be considered for all sectors, including heating-specific financial support for poorer households.

The Taskforce members recommended that implicit fossil fuel subsidies should be removed, both through policy support and changing the way decarbonisation support is recouped from energy bills. For example, the cost of conversion from fossil fuel-based systems to zero carbon heating infrastructure could be incorporated into infrastructure costs and bill plans.

## 5.2.2 Delivery regulations: stimulating project pipeline

Currently, zero carbon heating systems compete on an uneven playing field due to a regulatory framework and incumbent market that favours gas, with sunk costs in fossil fuel infrastructure. A carefully considered **carbon price** could change the equation to reflect the carbon savings that can be achieved (see case study on Carbon Pricing).<sup>89</sup>

Zero carbon heating considerations need embedding into regulations and standards, ensuring that frameworks support the heat transition. To achieve this a **comprehensive review of current standards and regulation** should be undertaken. For instance, Energy Performance Certificates (EPCs) currently discourage the shift towards heat pumps and instead

favour low cost gas.<sup>90</sup> BEIS has signalled revisions will be made through the EPC Action Plan, and these should incorporate the adjustments needed for heat decarbonisation. BEIS is also looking at tightening MEES for the Private Rented Sector to include an Environmental Impact Rating of C, in addition to an Energy Efficiency Rating of C.

The **Future Homes Standard** should mandate that all new homes are zero carbon, built to high standards of energy efficiency and installed with zero carbon heating solutions. There is widespread industry support for this to be bought forward to 2023.

<sup>88</sup> ADE (2020) Right place, right stuff: Gov to put local areas in charge with zoning consultation on heat networks.

<sup>89</sup> Zero Carbon Commission (2020) How carbon pricing can help Britain achieve net zero by 2050.

<sup>90</sup> Foresight Climate & Energy (2019, October 21) Energy performance certificates hold back heat decarbonisation.

A **programme of structural incentives** is needed to stimulate the able-to-pay market and leverage private finance, backed by a reliable regulatory framework to drive buildings' carbon and energy performance. In spring 2020, the CEEB convened a meeting of expert stakeholders who proposed a range of options that would support this, including a zero-carbon heating technology rebate system, VAT reform to stimulate energy efficient and zero carbon heating renovation, landlord and business energy saving allowance, and **Stamp Duty Incentives and rebates**.<sup>91</sup>

### National Infrastructure Bank – using public capital to de-risk and scale private finance

Blended finance refers to the combination of public and private finance, maximising the impact of public spending while helping to de-risk private finance. It can also identify, develop and standardise investment propositions, drive investment flows to regions that need it most, and play a critical role in the governance of long-term decarbonisation strategies.

The newly announced National Infrastructure Bank could underpin this approach, helping finance projects and infrastructure that are currently viewed as unattractive to the private sector, and crowd-in additional finance to maturing markets. The leverage effect experienced by the original Green Investment Bank demonstrates the impact of green banks: for every £1 invested by the Green Investment Bank, a corresponding £2.50 of private capital was invested.<sup>92</sup> Investments in energy efficiency measures by KfW – Germany's national infrastructure bank – can motivate building owners to borrow and spend €6<sup>93</sup> for every €1 invested. The federal government has nearly recouped its outlay through increased VAT revenue alone.<sup>94</sup>

The recent State of Green Banks 2020 report showed that green banks in 36 countries have invested over \$24 billion in low-carbon technologies to date.<sup>95</sup> The new National Infrastructure Bank can help the UK lead in new clean infrastructure markets. The Green Finance Institute published an Insights Paper providing initial guidance on the potential sectors for investment for the National Infrastructure Bank in order to facilitate a green long-term economic recovery.<sup>96</sup>

<sup>91</sup> Green Finance Institute (2020b) Stimulus actions for a greener and more resilient property sector.

<sup>92</sup> NAO (2017) Department for Business, Energy & Industrial Strategy, UK Government Investments, The Green Investment Bank.

<sup>93</sup> EEIG (2020) Turning stimulus into recovery: From the Green Homes Grant towards a resilient Net Zero economy.

<sup>94</sup> Added to this are less directly accountable increases in income and corporation tax revenues, and employer and employee social security contributions which should easily make the investment revenue-positive. See: Cambridge Econometrics & Verco (2014) Building the Future: the economic and fiscal impacts of making homes energy efficient.

<sup>95</sup> Whitney, et al. (2020) The State of Green Banks 2020, Rocky Mountain Institute.

<sup>96</sup> See: Green Finance Institute (2020c) The Role of a UK National Infrastructure Bank in a Green Recovery: Insights Paper.

## Supporting measures: to ensure rate of delivery can be maintained

There are a range of measures that can support the scaling of supply chains, such as a **Heat Pumps Sector Deal**, analogous to that for the offshore wind industry. Approaches that support **blended finance** should also be advanced – including through the newly announced **National Infrastructure Bank** – to enable the creation and delivery of new investable asset classes that channel public and private capital towards defined net-zero outcomes (see case study on National Infrastructure Bank).

Low public awareness on the contribution of UK homes to greenhouse gas emissions, and of the existence of zero carbon heating solutions, can stymie the rapid decarbonisation of heat. Recent studies have shown that, despite growing public concern about the climate emergency, awareness of alternatives to gas boilers such as heat pumps remains low.<sup>102</sup> **Improved education and public engagement campaigns** could help raise awareness and stimulate demand for zero carbon technologies, thereby creating an environment for financial institutions to innovate new green finance products. There will also be a role for increasing skills and awareness across the zero-carbon heating value chain – from boiler installers, through to financial institutions, which could be addressed by the **Zero Carbon Heat Investment Guides** demonstration project.

**Building Renovation Passports (BRPs)** can also play an important enabling role in increasing education and engagement on zero carbon heating options. BRPs have been recommended by the Climate Change Committee<sup>103</sup> and Green Finance Taskforce<sup>104</sup>, among others. A consistent, government-backed framework will build confidence in BRPs and allow them to achieve rapid, widespread adoption. A government-led **voucher scheme** could support training opportunities to upskill the heat supply chain, and a **government-backed public engagement campaign** could help raise awareness.

### Green Gilts – using innovative public green finance products to fund key policy recommendations

The UK Government recently announced a green gilt issuance set for 2021.<sup>97</sup> Although details are not yet known, this issuance could contribute towards funding the policies in this report, including seed funding for the **National Infrastructure Bank**. A recent 'Green+ Gilt' proposal by the Green Finance Institute, Impact Investing Institute and Grantham Institute identified that this could be done without hypothecation.<sup>98</sup> The €7 billion French green OAT (Obligations Assimilables du Trésor) set a precedent for this, which stipulated that "proceeds are managed in compliance with the general budget rules and finance an equivalent amount of eligible green expenditure".

Previous sovereign green bond issuances have been mapped to eligible expenditure for green home retrofits. The first impact report on environmental expenditure matched to the French green OAT showed that approximately one-third of the issuance funded its successful 'CITE' programme in 2017, a tax credit that can be claimed by households the year after carrying out energy efficiency retrofit measures in their homes.<sup>99</sup> The 2020 impact report showed that 930,000 households had benefitted from the CITE tax credit in 2019 alone.<sup>100</sup>

Similarly, the €5.98 billion Netherlands sovereign green bond, issued in May 2019, included "Energy Efficiency" as one of the four expenditure categories for which the green bond proceeds could be used. Funding was made available through the Energy Performance incentive scheme for the rental sector (STEP), providing housing corporations and property owners with subsidies for improving the energy efficiency of existing homes. The Dutch government had entered into commitments that will enable around 110,000 homes to implement energy efficiency improvements and, as of May 2020, had paid out €239.8 million using capital allocated from the green bond raise.<sup>101</sup> A similar approach could be adopted for a green gilt.

<sup>97</sup> HM Treasury (2020, November 9) Chancellor statement to the House – Financial Services. GOV.UK.

<sup>98</sup> LSE Grantham Institute (2020) The Green+ Gilt: How the UK could issue sovereign bonds that deliver climate action.

<sup>99</sup> Agence France Trésor (2019) Green OAT: Allocation and Performance Report for 2019.

<sup>100</sup> Domergue, S., Vermont, B., CGDD (2018) Impact assessment of the « crédit d'impôt pour la transition énergétique (CITE) »

<sup>101</sup> Dutch State Treasury Agency, Ministry of Finance (2020) State of the Netherlands: Green bond report.

<sup>102</sup> BEIS (2020b) Transforming Heat – Public Attitudes Research: A survey of the GB public on the transition to a low-carbon heating future.

<sup>103</sup> CCC (2019, February 21) UK homes unfit for the challenges of climate change, CCC says.

<sup>104</sup> Green Finance Taskforce (2018) Accelerating Green Finance.

## 6. Conclusion

The financial demonstration projects and policy recommendations detailed in

this paper, alongside an ambitious national approach, have the potential to catalyse cross-sectoral action on heat decarbonisation.

## 6. Conclusion

Decarbonising the UK's heating system creates an opportunity to demonstrate global leadership and develop a competitive advantage in zero carbon heating technologies and innovative financial solutions. An ambitious national approach can boost manufacturing and technological innovation, create green jobs, and ensure that everyone has access to warm, healthy, zero carbon homes. It should be one of the central pillars of the green economic recovery.

This report has presented the findings of the Zero Carbon Heating Taskforce, including a detailed analysis of the UK's heat market and the financial, policy and regulatory innovations to bridge the investment gaps and drive systemic change. In the next phase, the Coalition for the Energy Efficiency of Buildings will work collaboratively to test, demonstrate and scale the solutions.

As the UK looks to build momentum for a green and inclusive recovery, a focus on zero carbon heating offers significant economic, social and environmental benefits. The financial demonstration projects and policy recommendations detailed in this paper have the potential to catalyse cross-sectoral action on heat decarbonisation, which will be vital in driving momentum on climate action in the run up to COP26, and for many more years to come.

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# Appendices

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## Appendix 1 – Acknowledgements

The Green Finance Institute would like to thank the numerous individuals from each of these organisations who have contributed their time, insights and feedback, in their personal capacities, to strengthen the quality of this report.

### Members of the Zero Carbon Heating Taskforce

Abundance Investment	Ground Source Heat Pump Association
The Association for Decentralised Energy (ADE)	Heat Pump Federation
Association for Renewable Energy & Clean Technology (REA)	Homes England
Arup	ilke Homes
Baringa Partners	Islington Council
BEAMA	The Kensa Group
BEIS Heat Networks Delivery Unit	Leeds City Council
BNP Paribas	Legal & General
Bristol City Council	Liverpool City Council
British Property Federation (BPF)	Lloyds Banking Group
Building Societies Association (BSA)	Lux Nova Partners
Centrica	Metropolitan
Centre for Research into Energy Demand Solutions (CREDS)	National Centre for Decarbonisation of Heat (NCDH)
Cheshire East Council	Octopus Energy
Clarion Housing	Orkney Islands Council
Confederation of British Industry (CBI)	OVO Energy
Department for Business, Energy & Industrial Strategy	ReFLEX Orkney
E3G	Resourceful Futures
Ecuity	Santander
Energyharmonics	Scottish Government
EnergyPro	Sero
Energy Saving Trust	Solo Energy
Energy Systems Catapult	SSE
Enfield Council	Travers Smith
Engie	UK Finance
E.On	Vattenfall
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## Appendix 2 – Acronyms and abbreviations

<b>ADE</b>	Association for Decentralised Energy
<b>ASHP</b>	Air Source Heat Pump
<b>BEIS</b>	Department for Business, Energy and Industrial Strategy
<b>BRP</b>	Building Renovation Passport
<b>CCC</b>	Climate Change Committee
<b>CCS</b>	Carbon Capture and Storage
<b>CEEB</b>	Coalition for the Energy Efficiency of Buildings
<b>CITE</b>	French Energy Transition Tax Credit
<b>CO<sub>2e</sub></b>	Carbon Dioxide Equivalent
<b>COP</b>	Conference of the Parties
<b>DfE</b>	Department for Education
<b>ECO</b>	Energy Company Obligation
<b>EEIG</b>	Energy Efficiency Infrastructure Group
<b>EeMAP Initiative</b>	Energy Efficient Mortgages Action Plan Initiative
<b>EPC</b>	Energy Performance Certificate
<b>ESCOs</b>	Energy Services Companies
<b>ESG</b>	Environmental, Social and Governance
<b>FCA</b>	Financial Conduct Authority
<b>FCDO</b>	Foreign, Commonwealth and Development Office
<b>GSHP</b>	Ground Source Heat Pump
<b>HMRC</b>	Her Majesty's Revenue and Customs
<b>HMT</b>	Her Majesty's Treasury
<b>HNDU</b>	Heat Networks Delivery Unit
<b>HNIP</b>	Heat Networks Investment Project
<b>kWh</b>	Kilowatt Hour
<b>LAD</b>	Local Authority Delivery
<b>LPG</b>	Liquid Petroleum Gas
<b>mtCO<sub>2</sub></b>	Million tonnes of carbon emissions
<b>MCS</b>	Microgeneration Certification Scheme
<b>MEES</b>	Minimum Energy Efficiency Standards
<b>MHCLG</b>	Ministry of Housing, Communities and Local Government
<b>NH</b>	New Homes
<b>Off-G</b>	Off-Grid
<b>On-G</b>	On-Grid
<b>OO</b>	Owner-Occupied
<b>PRS</b>	Private Rented Sector
<b>REIT</b>	Real Estate Investment Trust
<b>RHI</b>	Renewable Heat Incentive
<b>RSL</b>	Registered Social Landlord
<b>SAP</b>	Standard Assessment Procedure
<b>SME</b>	Small and Medium Enterprise
<b>Solar PV</b>	Solar Photovoltaic
<b>SPV</b>	Special Purpose Vehicle
<b>UCL</b>	University College London
<b>VAT</b>	Value-Added Tax
<b>ZCHT</b>	Zero Carbon Heating Taskforce

## Appendix 3 – About the Coalition for the Energy Efficiency of Buildings

The Green Finance Institute (the Institute) was established in July 2019 as the UK's principal forum for public and private sector collaboration in green finance. As an independent organisation supported by HM Treasury (HMT), the Department for Business, Energy and Industrial Strategy (BEIS), the Foreign, Commonwealth and Development Office (FCDO) and the City of London Corporation, the Institute is uniquely placed to mobilise capital through accelerating the domestic and global transition to a sustainable, net-zero carbon and climate-resilient economy. Through convening mission-led coalitions, the Institute aims to identify and unlock barriers to deploying capital at pace and scale towards impactful, real-economy outcomes.

In December 2019, the Green Finance Institute convened the Coalition for the Energy Efficiency of Buildings (CEEb or the Coalition) to develop the market for financing net-zero carbon and climate-resilient buildings in the UK. The Coalition's goal is to design, develop and launch a portfolio of new financial solutions that unlock investment into the sector and stimulate further innovation. Formed of global experts from financial services, energy and construction industries, local and national government, academia and civil society, the Coalition represents a unique and powerful collaboration. The Coalition is supported by leading independent climate think tank, E3G, which acts as secretariat, and now comprises over 200 individual members.

The initial focus of the Coalition for its first year has been developing and delivering a suite of demonstration projects aimed at catalysing increased flows of finance towards energy efficiency improvements within UK homes. The Coalition recognises that the full decarbonisation of UK homes also requires a focus on heat; with synergies and opportunities associated with considering the two issues in parallel, both through retrofit projects and finance solutions. In light of this, the Zero Carbon Heating Taskforce (the Taskforce) was assembled in Summer 2020 to review the UK heating market, identify the investment barriers and design, launch and scale the financing mechanisms needed to overcome these barriers.

This report presents the finding and recommendations from the Taskforce's over 50 member organisations, who convened in a series of workshops to assess the market for zero carbon heating in UK homes across existing homes on-grid, existing homes off-grid, new homes and district heating. Members identified the barriers and opportunities for each property type, and developed a list of solutions that can be taken forward to help scale up finance into the heat transition.

In the next phase, the Coalition and its members will bring to market selected 'demonstration projects': financial solutions and non-financial enablers that are commercial, scalable and will help mobilise capital flows. The Institute will unlock synergies between individual demonstration projects and facilitate cross-sector collaboration to address specific challenges that limit the uptake of energy efficiency, low-carbon heating and resilience upgrades in UK homes.

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