REA & WHA response to BEIS Call for Evidence: Future Framework for Heat in Buildings

The Renewable Energy Association (REA) and Wood Heat Association (WHA) are pleased to submit this response to the above consultation. The REA represents a wide variety of organisations, including generators, project developers, fuel and power suppliers, investors, equipment producers and service providers. Members range in size from major multinationals to sole traders. There are over 550 corporate members of the REA, making it the largest renewable energy trade association in the UK. The WHA is the UK trade association for the modern wood heating and related biomass heating industry including wood fuel suppliers, biomass boiler and stove installers and distributors, and anyone involved in the supply chain.

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General points

We welcome this call for evidence and the recognition of the importance of decarbonising heating in the UK. If the UK is to reduce its emissions by 80% by 2050, then heating needs to be almost completely decarbonised. It is, therefore, paramount that the Government is willing to enact ambitious policies that will aid this transition as quickly as possible. The Government has chosen to decarbonise the off-gas-grid area first, and it is vital that there is a clear and visible long-term strategy and framework to decarbonise heat when the Renewable Heat Incentive ends in 2021. There is currently uncertainty over what will replace the scheme, which prohibits the industry from planning and adapting to new market conditions.

Gas grid

We support the government ambition to phase out the installation of high carbon fossil fuel heating off the gas grid during the 2020s. However, action on decarbonising the gas grid must not be delayed. In particular, as highlighted by the Committee on Climate Change[1], at present there is no commitment to biomethane production post-2021.

From our initial discussions with BEIS, we understand that it is not until the mid-2020s that BEIS officials anticipate making policy decisions for how the Government intends to decarbonise the gas grid. However, technology developers and investors require clarity and visibility much sooner on the long-term framework for funding projects that will inject green gas into the gas grid. Decisions on how this sector will be supported after the current RHI comes to an end (March 2021) must be taken urgently. It is furthermore fundamental that the Government increased the

[1] An independent assessment of the UK's Clean Growth Strategy From ambition to action Committee on Climate Change January 2018

availability of feedstock for the AD sector by implementing mandatory food waste collection.

Within the biomethane sector, the RHI has stimulated business investment in the range of £400 – £800m (on average £10 million per project), supporting the development of competitive supply chains, with a number of AD and biomethane equipment providers currently active in the UK and companies involved in the design, construction, operation of AD plants as well as grid connections and gas trading. Since the recent uplift of biomethane tariffs will attract further investment (in the range of £200 – £400m), by the end of March 2021 the RHI will have stimulated business investment in the biomethane sector in the range of £600m to £1.2bn. According to the REA, the AD sector currently employs around 3,000 people across the UK supply chain and this sector turnover is around £356m.

If the RHI simply comes to an end at the end of March 2021, and support in either its existing form or a different one is no longer provided to new projects, development and investment will be stifled. With no long-term plan for funding projects, investors will lose confidence in this market. In addition, this will have adverse consequences for companies across the supply chain, especially those involved in manufacturing, construction and installation, grid connections and grid-entry units. With no prospect of new development and growth, these companies will either go out of business or will have to move away from this sector, with considerable losses of British based jobs and skills. Taxpayers' money that has been spent so far to support the development of these supply chains and British based skills will have been wasted.

A similar cliff edge applies to deep geothermal, which most often makes economic sense in urban dense areas, where there are larger heat demands and a bigger concentration of larger customers, rather than off the gas grid. Deep geothermal plants need a heat demand of +30GWh per annum with low-temperature hot water, which is not common in off-gas-grid areas. There is currently no policy support for geothermal after 2021.

Therefore, decisions on how this sector will be supported after the current RHI comes to an end (March 2021) must be taken urgently.

Answers to Consultation Questions

A pathway to regulation?

1. **Do you agree that the policy framework should focus initially on enabling the market to drive the transition away from high carbon fossil fuels, and in the longer term on helping consumers and industry to comply with regulations?**

We believe there is a need to do both at the same time, i.e. both enable the market to move away from high carbon fossil fuels, and ensure that consumers are protected (price and service levels) and their energy systems comply with industry standards and regulation.

We agree that the market is unlikely to be able to drive the transition towards low-carbon technologies by itself, as with the switch from town gas and the switch to condensing boilers. In every European country with significant low-carbon heating & cooling, there are some forms of support schemes, taxation, or regulation. In Austria, there are investment incentives ranging €200-€5000; in Denmark, there are tax exemptions for renewable technologies; in Finland, there are a combination of subsidy schemes and tax exemptions; France provides zero-percent-interest loans, direct subsidy, investment grants, and lower VAT for renewables; Germany provides

zero-percent-interest loan and investment grants; Italy has both grant-based subsidy and tradable certificates; and Sweden has tax carbon since 1991.
It is therefore vital that there is a combination of regulation, taxation, and support schemes to advance the deployment of low-carbon heat. The transition away from high-carbon fossil fuels is highly unlikely to occur without market-enabling policies.

2. **How should government best engage with existing and emerging heating markets, consumers and other stakeholders, to ensure regulations are designed in a way that works for everyone?**

We would encourage the Government to engage with both incumbent and non-incumbent industry stakeholders through direct consultations, meetings, and open regional workshops. It is also important to engage directly with the finance sector. We would also recommend setting up an industry advisory panel to help guide policy. The REA would be happy to facilitate the regional workshops and can host many of the events. We would also be happy to be part of an advisory panel.

3. **How could a firm end date for high carbon fossil fuel installations be delivered through regulations? How much time do manufacturers, suppliers and installers trading in high carbon fossil fuels need to prepare for a firm end to new installations?**

We strongly support a firm end date for high-carbon fossil fuel installations, and this will help direct consumers and drive the industry towards low-carbon technologies. We believe it should be delivered in similar terms to the switch to condensing gas boilers, where it has been a legal requirement that all gas boilers installed in England and Wales had to be condensing boilers since 1st April 2007. After the agreed phase-out date, it will no longer be legal to install high-carbon fossil fuel installations, and any new heat installations will be low-carbon.
This policy is being considered in the Netherlands for gas boilers[2], and Denmark has already enacted a phase-out of oil boilers since 2013 for new buildings and since 2016 for existing buildings[3]. This allows consumers to think ahead and plan the switch to low-carbon heating if the phase-out is announced some years ahead of its implementation.

It would be reasonable to give the industry some years to prepare, train staff members, and organise supply chains before enabling a phase-out. We, therefore, suggest that a phase-out of high-carbon fossil fuel installations should happen in 2025, which will give the industry 5 years to prepare and consumers several years to consider which alternative is best for their property. Considering the lifetime of high-carbon fossil fuel installations, if the phase-out is any later than 2025 off-gas-grid properties will still be heated with high-carbon fossil fuel in 2040 when the emissions from heating will need to be significantly reduced to meet the Government's carbon budgets. High-carbon fossil fuels installations could be banned in domestic and non-domestic new building much earlier, such as from 2021, to provide the industry with the opportunity to develop skills and become experienced with low-carbon technologies.

[2] deVolkskrant (2018), Het doodsvonnis van de cv-ketel is geveld: over drie jaar praktisch verboden https://www.volkskrant.nl/economie/nederland-moet-van-het-gas-af-en-dus-gaat-de-standaard-cv-ketel-in-de-ban-mogelijk-al-over-drie-jaar~a4584848/amp
[3] Renewable Energy World (2013), Denmark puts the brakes on heating costs with new legislation, https://www.renewableenergyworld.com/ugc/articles/2013/02/denmark-puts-the-brakes-on-heating-costs-with-new-legislation.html

Non-domestic buildings

4. **What is the potential for non-domestic buildings to transition away from the use of high carbon fossil fuel heating? Is the use of high carbon forms of fossil fuel driven by process heating requirements, with space and water heating requirements secondary to this? Are different solutions required for different heat uses and are there cleaner alternatives?**

The potential for non-domestic heating off the gas grid to transition away from high carbon fuels is great. As seen with the Non-domestic RHI, over 10,000 systems were installed in various non-domestic buildings with different heating requirements. Most often the driver for the use of fossil fuels has been a lack of alternatives or the cost of alternative technologies prior to the RHI.

With process heating, there is a need for high-quality heating, which fossil fuels have been able to meet; however, many low-carbon technologies are able to deliver the same quality heating, with costs and lack of familiarity being the key barriers. For space and water heating of non-domestic buildings, most renewable heating technologies supported under the RHI are able to deliver the required heating in principle. Although the right technology depends on the specific building fabric, heat demand, required heat quality, grid connection, storage facilities, road access, existing heating system, and heat medium, amongst other factors. We, therefore, very much agree with the notion that different solutions are required for different heat uses.

It is important to recognise the limitations of the property, as some non-domestic properties require space/water heating at a temperature higher than can be efficiently produced by heat pumps. The costs of refitting these buildings to work with the lower temperature heat available from heat pumps can make the process impractical. Similarly, some locations do not have the space required for biomass fuel storage or the access needed for fuel delivery.

Alternatives to oil and coal systems in domestic and non-domestic buildings

5. **What do you think are the main technology choices for reducing heating emissions from off gas grid households, businesses and public sector organisations (eg transitional technologies)?**

The main technologies for off-gas-grid heating will be heat pumps, biomass, geothermal, biogas, and solar thermal, as these are all currently low-carbon with the potential of becoming near carbon neutral. They are proven and available now. However, they are not transitional technologies.

One of the main transitional technologies would be hybrid heating systems, such as heat pumps combined with oil or gas boilers, or biomass boilers with an oil boiler as backup. These hybrid systems may prove useful in inspiring confidence among consumers in the new technologies and will prove a useful bridging technology.

However, beyond 2025, the carbon budgets do not allow new installations of hybrid systems, if heating is to be completely decarbonised by 2050.

6. **What do you think are the main technology choices for achieving near zero emissions from off gas grid heating (technologies which are consistent with our 2050 targets)?**

The main technologies for off-gas-grid heating will be heat pumps, biomass, geothermal, biogas, and solar thermal, as these are all currently low-carbon with the potential of becoming near carbon neutral. It is important to recognise that all technologies have advantages and disadvantages and must be tailored to the heat use, building fabric, and consumer preference, as per question 4.

Heat pumps
Heat pumps have proved very effective in new build properties where the heat demand is lower and the cost is lower to install larger radiators and/or underfloor heating as needed. It does require some space, but less than biomass fuel storage. It is very convenient for consumers that do not want to deal with fuel delivery and want a lower maintenance. As the power grid is decarbonised, the GHG emissions of heat pumps will decline and align with the Government's 2050 targets.

Biomass
Biomass boilers have been shown to be very effective in replacing oil boilers in existing buildings. Of the domestic RHI installations, 56% of biomass systems replaced oil, with 22% Air Source Heat Pumps (ASHP) and 27% of Ground Source Heat Pumps (GSHP) replacing oil. Biomass boilers will still be needed in order to reach the 2050 targets, as many of our existing buildings with higher heat demand will exist in 2050, which other technologies may struggle to sufficiently heat. In addition, the use of biomass fuels supports the forest and woodland growth in the UK and abroad, and as the wider economy decarbonises, the GHG emissions of biomass will decline (e.g. emissions from transportation of biomass declining) and align with the Government's 2050 targets.

The thinnings used for biomass are essential to forest management, which ensures the growths of higher quality timber that can be used for furniture and buildings. The use of biomass leads to more productive forests, with higher carbon stock and higher tree stock. The use of biomass thereby supports the ongoing growth of forests and woodlands in the UK. Please see our response to question 9 for further details.

Geothermal

Geothermal has a great potential within the UK, however, deep geothermal typically makes less economic sense in the off-gas-grid area, as there is usually not a sufficiently big concentration of larger customers. Typically deep geothermal plants need customers of +30GWh per annum with low-temperature hot water demand heat, which is not common in off-gas-grid areas. It is still an emerging technology with no plants in operating to date, but after the first 50 plants in operation, the costs and risks will reduce significantly, which have been seen in many other European countries as the industry matures.

Deep geothermal energy can provide heat for commercial, industrial and residential buildings. It is ideal for providing heat to district heating schemes, universities and hospitals. It can also be used in industrial processes, such as cooling, or in aquaculture and horticulture. Boreholes are drilled to access natural reservoirs of hot water and transferred to heat exchangers for use as direct heat. In the case of 'hot rocks' or 'EGS' schemes, water is pumped from the surface into rock formations where it is heated and returned to the surface. After the heat has been exploited the water is recycled back down into the ground via a second borehole.

Deep geothermal energy is available 24 hours per day, 7 days a week, and produces large quantities of heat to be used in industrial processes, farming and district heating. It has a very small surface footprint and is a reliable, cost-effective form of energy. Once built, a deep geothermal plant can be expected to continue in production for fifty years or more.

Independent analysis[4] shows that the UK's deep geothermal potential equates to 100 GW of heat production. The technology could thus make a substantial low carbon contribution to the UK's energy mix.

Sustained efforts have been made by the sector to break ground on new geothermal energy project to follow the trail-breaking Southampton borehole (which feeds into that city's heat network) dating from the 80s. The RHI has boosted the business case for deep geothermal in the UK, but regulatory changes are still needed to address non-financial barriers.

Several deep geothermal projects are now close to realisation, with Stoke, Bishop Auckland and the Cornish EGS projects moving towards financial closure and the drilling stage. Meanwhile, and partly in response to the difficult domestic conditions, UK deep geothermal companies have been exporting their expertise to other countries.

Solar thermal

Solar thermal is a useful technology for reducing the amount of fuel consumed by off-gas-grid properties, whether that be fuel (oil, LPG, biomass) or electricity.

Anaerobic digestion

Agricultural sector

Within the agricultural sector specifically, most farms are off the gas grid in the UK, particularly small ones. In these situations, on-farm anaerobic digestion would enable

[4] Geothermal Energy Potential in Great Britain and Northern Ireland published by SKM May 2012.

replacing fossil fuel heat required for the farm buildings and the farmer's own household with renewable heat from biogas (as both, heating and hot water supply), whilst delivering numerous additional benefits. In addition to decarbonising off-gas-grid heat, significant and cost-effective greenhouse gas mitigation could be achieved by the controlled/managed processing of slurry and fertiliser replacement through the use of renewable biofertiliser. As AD plants operate at a 'steady state', the heat supply would be relatively stable. It would, therefore, need to be combined with other low-carbon technologies to meet the higher heat demand in winters, or else it would produce waste heat in the summer when heat demand is lower.

Food and beverage sector

Similarly, on-site anaerobic digestion deployed on factories, especially in the food and beverage sector, could provide part of the heat requirement for the beverage or food manufacturing process, which would replace some of the fossil fuel heat, especially within processes that have a significant heat requirement (distilleries, breweries etc.). Nestlé, Diageo, and First Milk are examples of companies using on-site AD to process biodegradable production residues to generate heat and power that could be used on the site to some extent. It would need to be combined with other low-carbon technologies that are dispatchable and can generate high-grade heating, such as biomass.

Heat networks

Heat from biogas plants, large-scale heat pumps, biomass boilers/CHP, geothermal, and large-scale solar thermal arrays can be used to supply both small (a few households) and large-scale district heating systems (entire towns). For example, typical consumers of waste heat from biogas plants would be industrial and commercial buildings, public bodies, and private consumers. Consumers with a usually high and continuous heat demand throughout the year include, for example, large meat producers, aquacultures, laundries, recreation centres, hospitals, swimming pools, and spas.

However, given the variable nature of heat demand in buildings (as opposed to process heat), it is rare to find an effective match between waste heat produced (e.g. by biogas or CHP plants), which tends to be constant, and heat demand from a district heating network. Waste heat can provide the base load heat demand, but responsive heat generating systems, such as biomass boilers or heat pumps, are also needed.

The installation of a district heating system for waste heat from biogas plants is associated with considerable installation costs. The larger the distances between the biogas plant and the heat consumer, the higher are the costs.

<u>Biopropane / Bio-LPG</u>

For existing LPG customers, bio-LPG can provide a drop-in fuel alternative with no additional action required from the consumer. This renewable fuel can deliver over 80% reduction in emissions against conventional LPG and 85% against kerosene – though carbon factors are dependent on feedstock and production process[5].

However, investment is needed in developing biogas production routes. Currently, there is no incentive to supply low-carbon fuels into the domestic heating sector off

[5] DECC 2014, RHI Evidence Report: Biopropane for Grid Injection, 29th October 2014, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/376487/RHI_Evidence_Report_-_Biopropane_for_Grid_Injection__2__2_.pdf

the gas grid, whereas the transport sector places a value on renewable fuels, driven by the price of an RTFO certificate.

Hybrid heating systems

There are merits in a hybrid heating solution that combines heat pumps with methane, where the customer has the ability to fuel switch. These normally combine heat pumps with a gas boiler to deal with peaks in demand. For off-gas-grid properties, the source of gas could be compressed or liquefied green gas (e.g. biomethane or biopropane) that could be delivered to properties by road. These systems enable consumers to save on the upfront costs of the heat pumps and associated connection charges (by choosing a heat pump with a lower capacity) and switch to gas when electricity prices are high. However, it is important that any hybrid systems actually use compressed or liquefied green gas, rather than high-carbon fossil fuel-based gas. Otherwise, an incentive is created to merely install the cheapest, least efficient heat pump, and then run most of the heat demand on the fossil oil or LPG.

Biomass, bioliquids and biopropane

7. **What evidence is there that bioliquids can provide an affordable and sustainable alternative to fossil fuel heating? What are the technical barriers and what might the impacts on domestic and business consumers be? How scalable are sustainable supply chains and is there a maximum amount of bioliquids which can be supplied?**
8. **What evidence is there that biopropane can provide an affordable and sustainable alternative to fossil fuel heating? What are the technical barriers and what might impacts on domestic and business consumers be? How scalable are sustainable supply chains and is there a maximum amount of biopropane which can be supplied?**

We believe that some bioliquids can play a smaller part in helping decarbonise off-gas-grid properties. For example, according to the NFU, vegetable oil or biodiesel have potential as drop-in replacement fuels for oil-fired boilers. Ten years ago, Riello Burners and OFTEC were involved in trials that showed only modest changes to burner heads and infrastructure were required. Again, according to the NFU, at current oilseed rape crop yields, a niche market of 88,000 tonnes/year (110 million litres, or about 55,000 households) could be supplied from around 100,000 ha of land.

Off-gas-grid properties that are not in urban areas tend to be older, larger, less energy efficient and situated in remote areas which may have limited electricity grid capacity. This can make electrification more difficult and expensive for some properties off the gas grid, and heat networks are only feasible in more dense area. For these properties, decarbonisation with biomass boilers, Bio-LPG boilers, and hybrid systems is more suitable. Biopropane can deliver over 80% reduction in emissions against conventional LPG and 85% against kerosene – though carbon factors are dependent on feedstock and production process[6]. Biopropane is a choice that should be made available to consumers, particularly for existing LPG consumers. This fuel can provide a drop-in fuel alternative with no additional action required from the consumer.

However, it should be restricted to the properties where heat pumps, biomass boilers, and heat networks are not feasible. The condensing boiler regulations included a points system and the more points a dwelling scores, the more likely it is that a condensing boiler can't be fitted. A similar system could be developed here to ensure that only properties where heating with heat pumps, biomass boilers, and heat networks unfeasible can use bioliquids or biopropane.

9. **Do you have any evidence on the air quality impacts of the use of solid biomass, bioliquids and/or biopropane?**

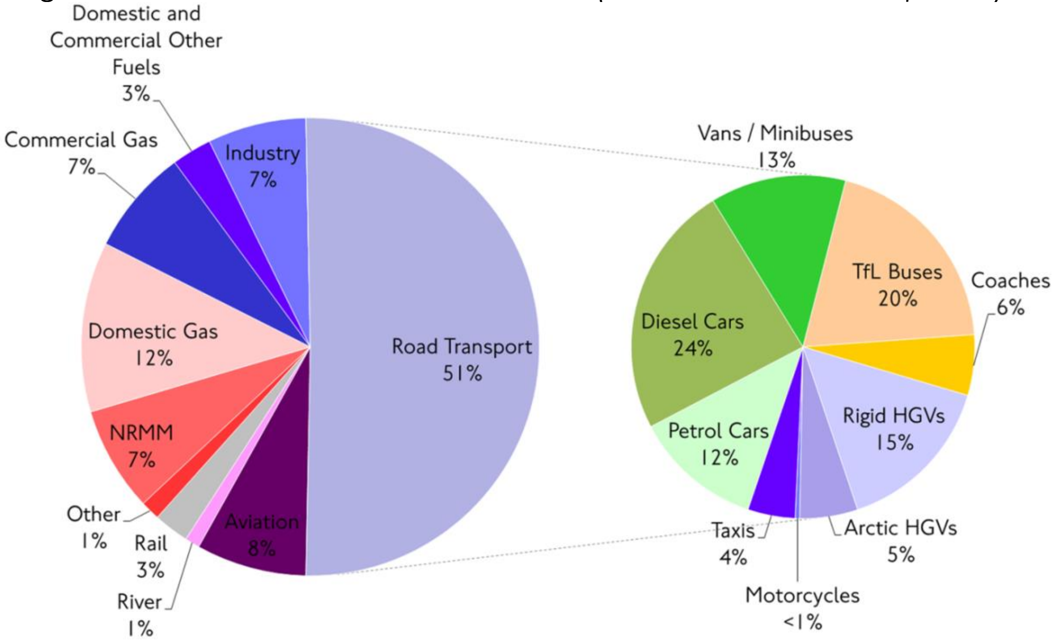
<u>Air quality</u>
We strongly support the Government's efforts to improve the air quality in Britain. It is essential to the well-being and health of the British population.
When assessing the impact of biomass heating, it is important to distinguish between the air quality issues in the UK's urban centres and the rural, off-gas-grid areas, where the air quality is much better. It is in these areas, where biomass heat installations

[6] DECC 2014, RHI Evidence Report: Biopropane for Grid Injection, 29th October 2014, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/376487/RHI_Evidence_Report_-_Biopropane_for_Grid_Injection__2__2_.pdf

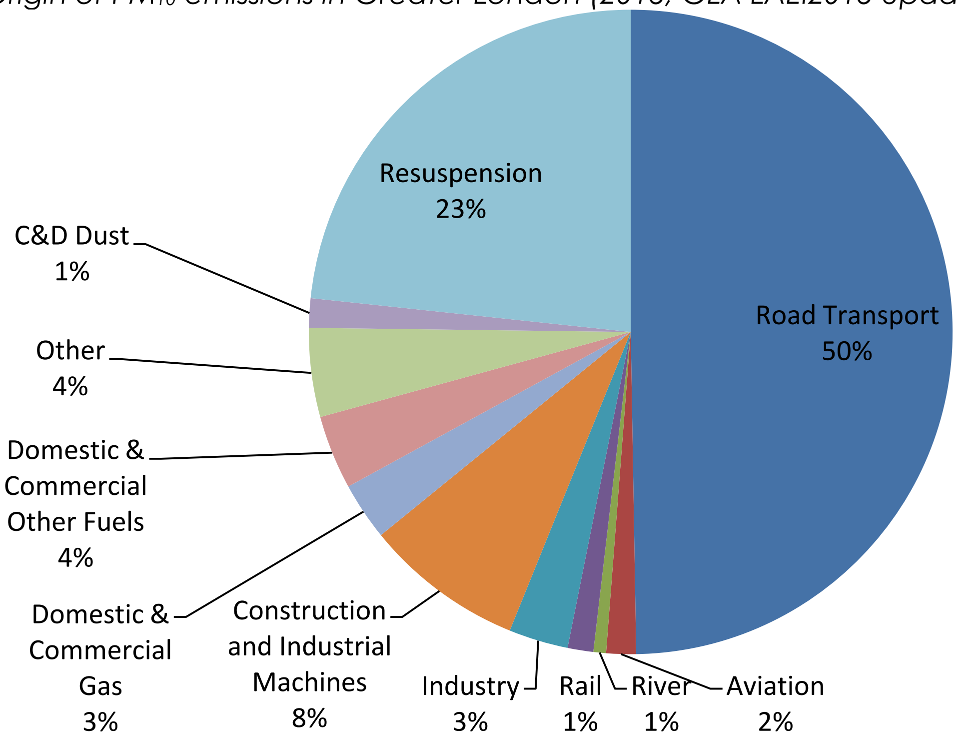
would replace coal and oil installations, which would not significantly affect the local air quality.

Overall, the majority of air quality emissions originate from road transport, however, some have also been identified as originating from wood burning in urban areas. As the figures below from the Greater London Authority show, around 4% of PM_{10} emissions and 3% of NO_x emissions originate from commercial and domestic other fuels, which include emissions from wood burning. However, the GLA data does not go further into details of the "other fuel" category, and it is unclear how much wood burning makes up.

Origin of NO_x emissions in Greater London (2013, GLA LAEI2013 update)



Origin of PM_{10} emissions in Greater London (2013, GLA LAEI2013 update)



For urban areas, Fuller et al. (2014)[7] suggest that emissions related to wood burning mainly arise from "a decorative or secondary heating source", garden waste burning, and patio wood burners. This would indicate that the relatively minor emissions from urban wood burning are not from biomass boilers, as supported under the RHI, but instead from open fires and old stoves. Furthermore, the Government's Domestic Wood Survey[8] shows that 68% (2014) of wood burning appliances in London were open fires. Font & Fuller (2017) from King's College London makes several note-worthy points in their report for Defra "Airborne particles from wood burning in UK cities"[9]:

- "In most cities wood burning PM concentrations were greater in evenings, indicating residential combustion, and greater at weekends. Coupled with the poor correlation with daily temperature (R^2=0.12-0.57) this suggested that current urban wood burning was in large part decorative and was not being used primary heating."
- Emissions from wood burning have actually decreased between 2009 and 2015, as high emission fireplaces have been replaced with newer and lower emission wood stoves.
- Particle emissions from open fireplaces have been shown to be ~3 times higher than from traditional woodstove, ~12 times higher than eco-labelled stoves, and ~15 times higher than those from pellet stoves[10].

Mitchell (2017)[11] from the University of Leeds compared the emissions from various types of stoves in their PhD thesis, as illustrated below:

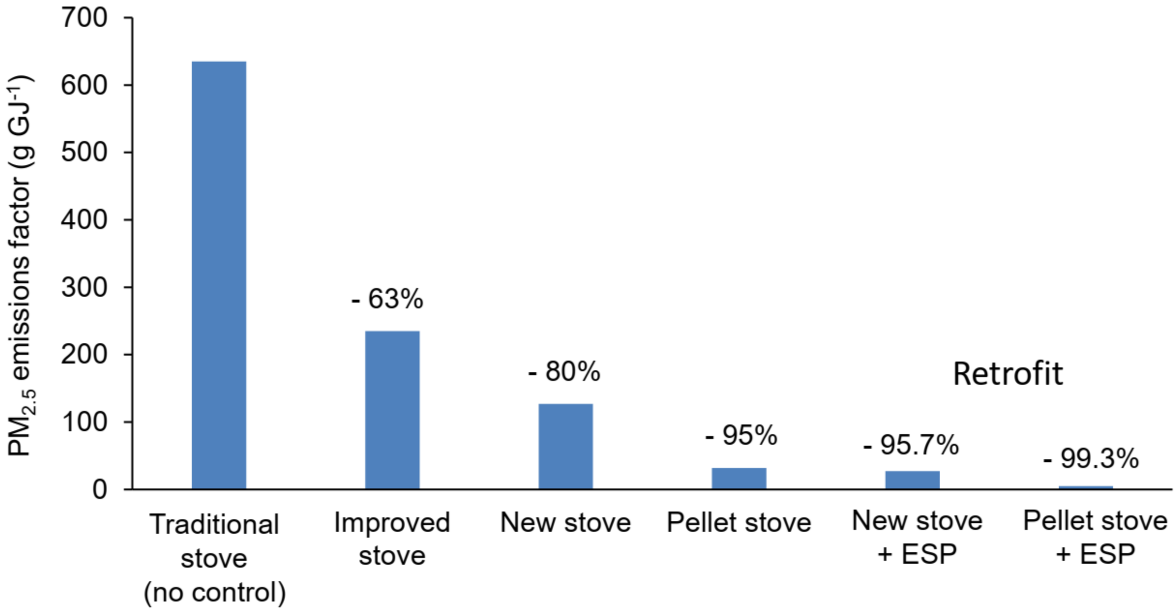
[7] Fuller, Gary W. (2014), Anja H. Tremper, Timothy D. Baker, Karl Espen Yttri, David Butterfield, Contribution of wood burning to PM10 in London, *Atmospheric Environment 87 (2014) 87-94*, Retrieved from https://doi.org/10.1016/j.atmosenv.2013.12.037

[8] DECC (2016), Summary results of the domestic wood use survey, *Renewables statistics*, 31 March 2016, Retrieved from https://www.gov.uk/government/publications/summary-results-of-the-domestic-wood-use-survey

[9] Font, Anna (2017), Gary Fuller, Airborne particles from wood burning in UK cities, Prepared for Defra, Retrieved from https://uk-air.defra.gov.uk/assets/documents/reports/cat05/1801301017_KCL_WoodBurningReport_2017_FINAL.pdf

[10] AIRUSE, Action B4, 2015: Emission factors for biomass burning, AIRUS-LIFE11 ENV/ES/584, Retrieved from http://airuse.eu/wp-content/uploads/2013/11/R09_AIRUSE-Emission-factors-for-biomass-burning.pdf

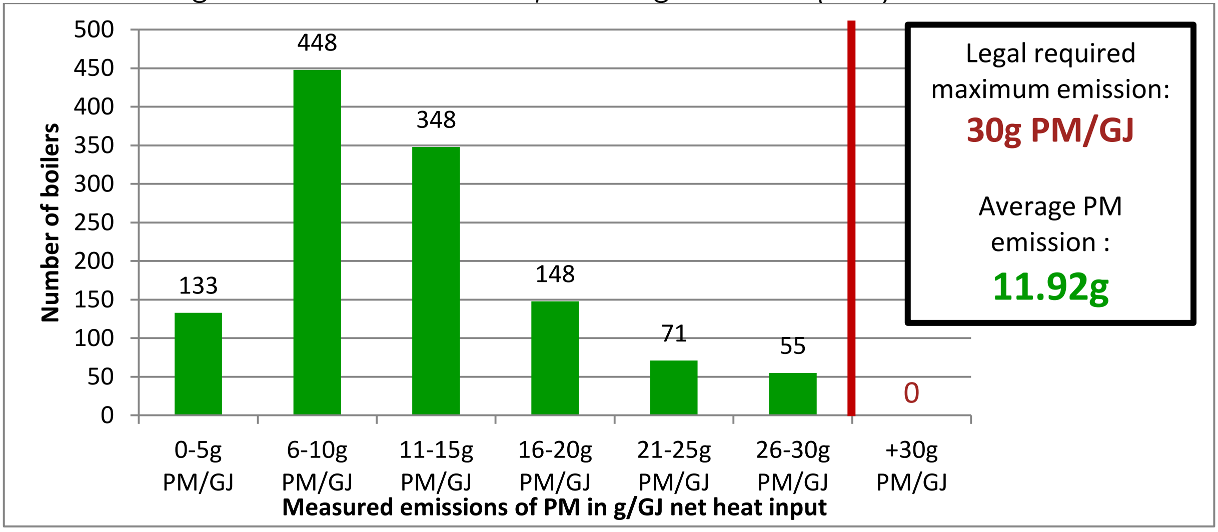
[11] Mitchell, PhD Thesis, University of Leeds, 2017. Emissions factors from the EMEP (European Monitoring and Evaluation Programme) and GAINS (Greenhouse gas and Air Pollution Information and Simulation) databases.



Together, this suggests that the main issue of emissions from wood burning in urban centres is related to open fires and in part old stoves that do not meet the new Ecodesign standards. However, this illustrates the issue of wood burning in urban areas, unlike the rural, off-gas-grid, which this Call for Evidence focuses on. It does although demonstrate that modern biomass boilers should be of much less concern in rural areas in relation to air quality, as any wood-burning emissions are more likely to originate from open fires.

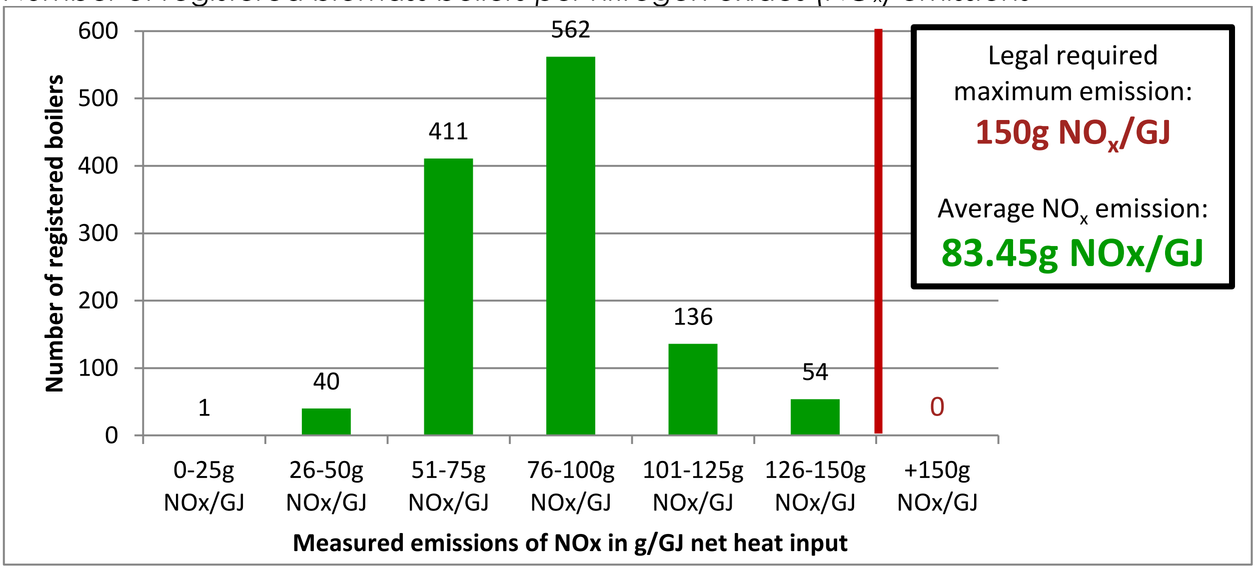
Biomass boilers that are installed under the Renewable Heat Incentive and commissioned after 2013 are required to meet the RHI air quality requirements. The air quality requirements set limits on the emissions a product can produce. Products must operate within these limits to be eligible for the Domestic and Non-domestic RHI scheme. Under the scheme, PM emissions must not exceed 30 grams per gigajoule net heat output, and NO_x emissions must not exceed 150 grams per gigajoule net heat output. Products affected by these requirements will need to have an RHI Emission Certificate, which includes information about the product, the test laboratory, tested fuel types, and emissions. Analysis of these certificates suggests that biomass boilers, in general, have been tested at particulate matter emission levels that are considerably below the legal limit, as illustrated by the figure below. However, please note that these are data from lab tests rather than in situ testing, where emissions generally are expected to be somewhat higher.

Number of registered biomass boilers per nitrogen oxides (NO_x) emissions



It shows that 77% have tested measured PM emissions at less than half the legal limit, and 48% emitted less than a third of the legal threshold. This is also the case for NO_x, where 38% had measured NO_x emissions at less than half of the legal limit, and 84% emitted less than two-thirds of the legal maximum (i.e. 100g NO_x/GJ or less).

Number of registered biomass boilers per nitrogen oxides (NO_x) emissions[12]



As noted above, it is important to recognise that in situ emissions differ from emissions in test centres. Emissions will depend on a number of factors such as boiler type, consumer patterns, boiler usage, fuel quality, the moisture content of the fuel, and whether the correct fuel is being used in the installation. It is important that consumers are educated on what fuels are appropriate to use in their heating systems, how to use their boilers to avoid increased emissions (i.e. avoiding cold starting, compared to steady state running), and how to maintain the system. If regulated according to current standards and regulations, the deployment of modern biomass boilers would not have a significant impact on the air quality in off-gas-grid areas.

[12] Based on RHIEC data for 1,205 biomass boilers obtained from BEIS.

The latest generation of biomass boilers can be fitted with electrostatic precipitators in their flue path which remove over 80% of the residual particulate matter from the flue gasses. If these were mandated (as they are becoming in some areas of Austria and Germany), particulate emissions from supported biomass boilers could be reduced still further. The technology exists now and is available for deployment.

Sustainability and availability (GHG)

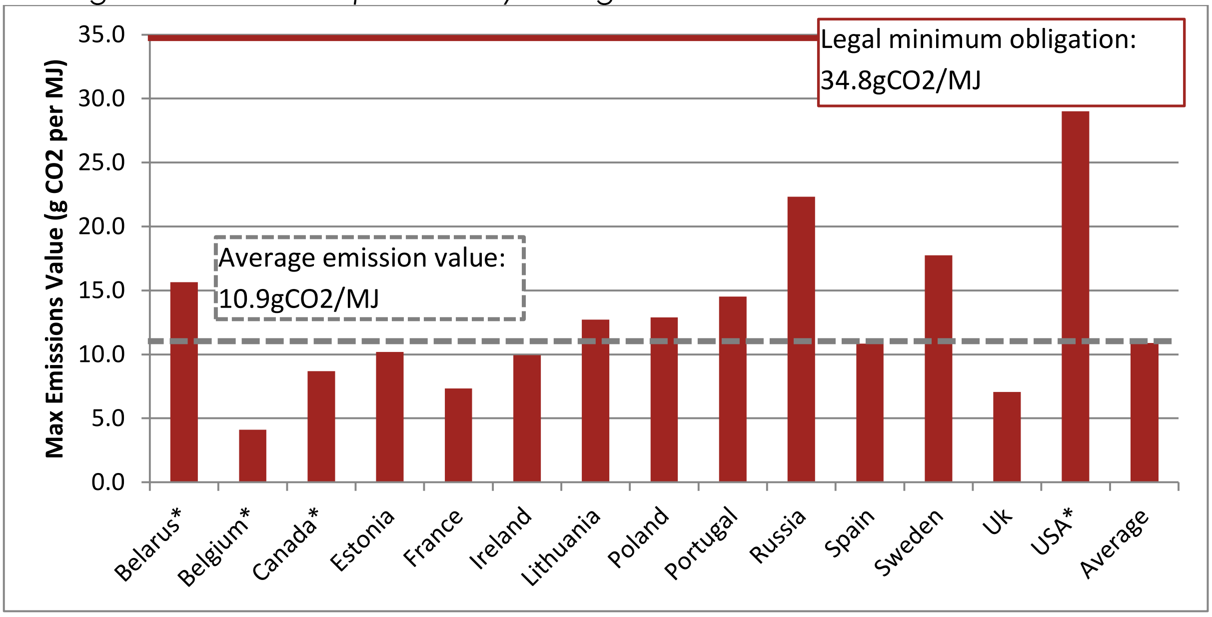
Since 2015, new sustainability regulations have been implemented for biomass fuels, which have allowed increased understanding of the life-cycle emissions related to the biomass heat supply chain. The Government has created the Biomass Suppliers List (BSL), on which self-suppliers and fuel suppliers register their fuels and feedstocks. Non-domestic RHI participants with boilers over 1,000 kW, however, need to self-report to Ofgem, instead of the BSL. To register their fuel on the BSL, biomass suppliers must demonstrate that their woodfuel emissions are at least 60% less carbon intensive than the average EU fossil fuel equivalent and that it meets the *UK Timber Standard for Heat and Electricity*'s definition of legal and sustainable wood. A life-cycle analysis is undertaken for each fuel sold to a Government supported biomass heat boiler under the RHI. Analysis of all fuels registered on the BSL show that most fuels registered originate from the UK, and the most popular fuel type is virgin pellets (see table below).

Fuel origin and fuel types on the Biomass Suppliers List, April 2016

Country of origin	Number of fuels	Fuel types	Number of fuels
Belarus	4	Pellets - virgin	2984
Belgium	1	Pellets - waste virgin blend	16
Canada	1	Firewood - virgin force dried	250
Estonia	71	Firewood - virgin force dried	250
France	6	Firewood - virgin naturally seasoned	906
Ireland	19	Firewood - waste virgin blend	30
Lithuania	5	Briquettes - virgin	6
Poland	55	Briquettes - waste virgin blend	98
Portugal	31	Chip - virgin force dried	317
Russia	1208	Chip - waste virgin blend	51
Spain	23	Chip - waste virgin blend	51
Sweden	7	Chip - waste	1
United Kingdom	3770		
USA	3		

The average GHG emission value for Biomass Suppliers List fuels is 10.9gCO2/MJ, which constitutes an 87.47% GHG saving compared to the EU fossil heat average. On average, the imported fuels have a slightly higher emission value compared to UK fuels, which generate a 91.88% GHG saving in average (see chart below).

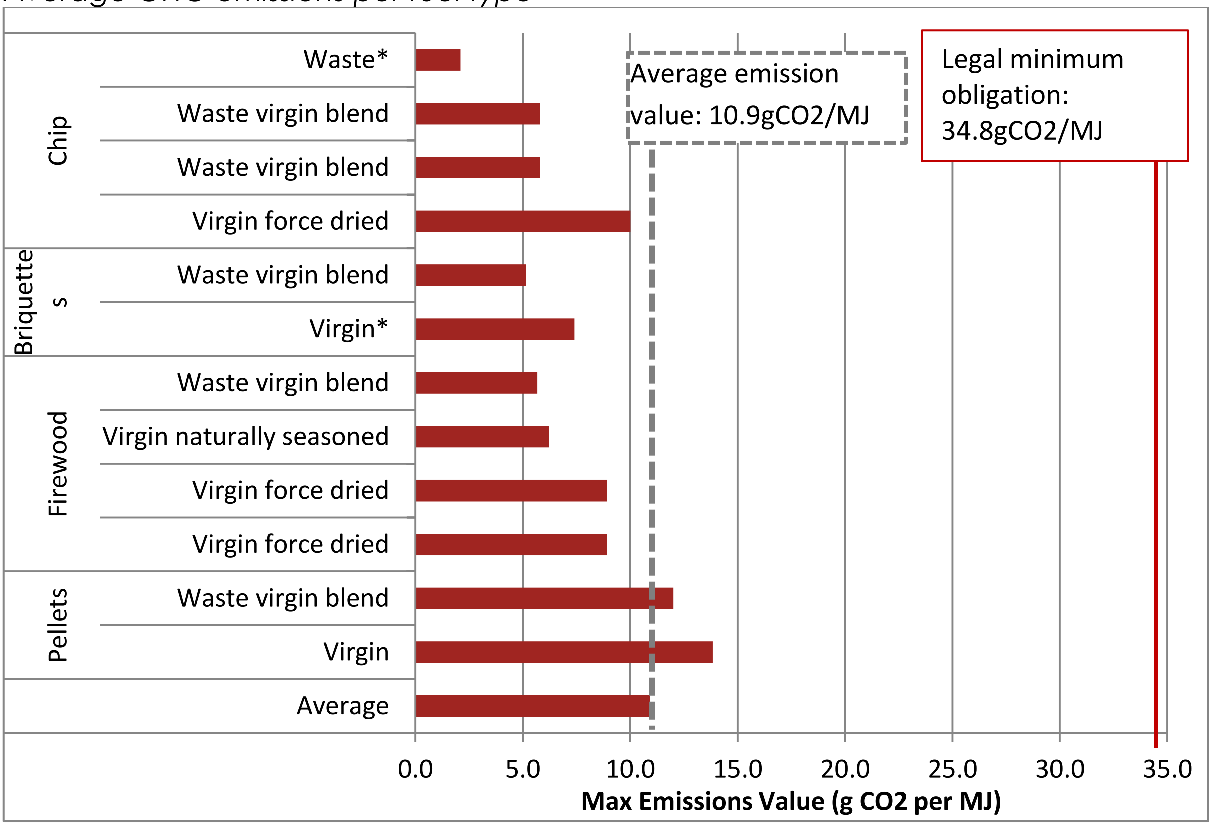
Average GHG emissions per country of origin



Note: * fewer than 5 fuels originate from this country, making the average more susceptible to outliners. Data originate from the BSL and has been analysed by the REA.

On average, looking at the different types of fuel, wood chip usually had a lower GHG emission value than other fuel types, but all fuel types deliver significant carbon savings.

Average GHG emissions per fuel type



Note: * fewer than 5 fuels originate from this country, making the average more susceptible to outliners. Data originate from the BSL and has been analysed by the REA.

This analysis does not weigh the registered fuels by volume sold but assumes all fuels are sold in equal volumes. Additionally, if one particular fuel is available for sale in 50 different depots around the UK, it will be registered 50 times on the Biomass Suppliers List. To provide a further assessment, the REA has been able to obtain volume data of the 75 most used fuels on the Biomass Suppliers List, where 95% of the volume originate from the UK, 3% from Russia, 1% from Estonia, 0.7% from Portugal, 0.4% from Latvia, and 0.4% from Poland. The data above is thereby somewhat skewed by the BSL registration methodology, and when assessed by volume, the majority of fuels sold originate from the UK.

Fuel origin of the 75 most sold fuels on the Biomass Suppliers List

Country of origin	Number of fuels	Percentage of total volume sold of the top 75 fuels	Average GHG saving per volume (minimum 60% GHG saving)
UK	55	95%	97.7%
Russia	10	2.6%	83.7%
Estonia	3	1.0%	81.8%
Latvia	3	0.4%	86.5%
Poland	1	0.4%	87.9%
Portugal	3	0.7%	83.2%

Note: The average GHG saving is calculated by weighing the GHG saving for each fuel by their volume. E.g. if 900 tonnes have been sold of fuel A with a GHG saving of 60% and 100 tonnes of fuel B with a GHG saving of 70%, then the average GHG emission for the two fuels are 61% ((60%*0.9)+(70%*0.1)=61%).

The 75 most sold fuels under the Biomass Suppliers List have a combined Max Emissions Value of 2.57gCO_2/MJ when weighing the GHG saving by volume sold. This constitutes a 97.0% GHG saving compared to the EU fossil heat average. Even when excluding waste fuels, the most sold fuels delivers a GHG saving of 90.7% compared to the EU fossil heat average. However, excluding waste fuels from the group would not be a fair or accurate reflection of the GHG savings in biomass fuel market, as waste fuels do make up a significant part of the fuel market. This would indicate biomass heat fuels achieve significant GHG savings compared to the fossil fuel average.

<u>Sustainability and availability (Forestry)</u>

We do not believe there are grounds for concern regarding the impact of biomass heat on forestry, indeed the opposite is actually happening. We will below refer to several reports and statistics illustrating that the forests supplying wood fuel are growing in the UK and EU. There is similarly an untapped potential for the growth of sustainable non-woody biomass such as energy crops. Biomass fuels are one of the few sources of energy where demand will actually stimulate availability.

The Government's own UK Bioenergy Strategy state that "*our analysis indicates that sustainably-sourced bioenergy could contribute by 2020 around 8-11% to the UK's total primary energy demand and around 12% by 2050 (within a wide range of 8%-21%)*".

We have mainly focused on UK and EU forestry as these would be the main sources for the biomass heat fuel. North America, South America, East and Southeast Asia, Africa, and Australia are not considered to be suppliers for UK biomass heating. This is also illustrated by the fuels registered on the Biomass Suppliers List, where 75% of fuels originate from EU countries accompanied by the Russian fuel making up 23% of registered fuels. It is worth noting that these numbers only refer to listed fuels and not the actual volume in which each of these fuels was used. Despite making up 23% of BSL listed fuels, the Russian fuels could account for less than 5% of the total volume used by consumers, as noted above.

UK Forestry:
The annual increment of the volume of wood in England's forests is around 7.4million cubic meters of timber. Over the next 20 years, the average annual coniferous increment is forecasted to reduce to 2.5 million cubic metres in the period 2032-36. The woodland area in the UK has, since the 1900s, continuously increased every decade, with UK woodland area increasing from 4.7% in 1905 to 13.0% in 2015[13]. This is at a time when the use of biomass fuel has increased. DECC commissioned the "UK and Global bioenergy resources and prices"-report in 2011 from AEA, Oxford Economics, Forest Research, and the Biomass Energy Centre, which shows that by 2020, the UK could have had access to about 1,800 Petra joule of bioenergy supply; equivalent to 20% of current primary energy demand in the UK. Over the next 20 years, the average annual hardwood increment is forecasted to increase to a maximum of 5.0 million cubic metres and then fall back to 4.7 million cubic metres in the period 2032-36[14]. The market for hardwood in the UK is mainly aimed at woodfuel, which is the only significant market for hardwood roundwood[15]. Without an active demand for hardwood for woodfuel, there would be little demand for this, eliminating the economic incentive to grow and supply UK grown roundwood.

DECC's analysis in the UK Bioenergy Strategy suggests "*a reasonable level of domestic feedstock that is now available for the production of energy in excess of 75TWh of bioenergy. There is potential for this to rise by at least 20% to around 90TWh by 2020 with further growth potential leading up to 2030 (our low estimate assumes 110TWh).* […] *Supplies from UK forests are also expected to increase. Around 10 Million green tonnes of wood each year is currently harvested in the UK from woodlands and forests. Harvested timber supplies a range of markets including sawmills, panel board producers and energy generation. In recent years significant progress has been made in developing the woodfuel supply chains (in 2007 around 0.5 Million tonnes of wood were delivered to energy markets, increasing to 1.5 Million tonnes in 2010)*"[16].

The Forestry Commission's 50-year forecast of timber availability does not suggest any concern with biomass availability[17 & 18], but this does not include the positive

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13 Forestry Commission, Woodland Area, http://www.forestry.gov.uk/website/forstats2015.nsf/0/4E46614169475C868025735D00353CC8?open&RestrictToCategory=1
14 Forestry Commission, Woodlands indicator 3: Annual increment of volume of wood in England's forests (p. 45): http://www.forestry.gov.uk/pdf/FC-England-Indicators-Report-20152.pdf/$FILE/FC-England-Indicators-Report-20152.pdf
15 Forestry Statistics 2015 - UK-Grown Timber, Deliveries of UK-grown roundwood, http://www.forestry.gov.uk/website/forstats2015.nsf/0/187E23791CE53F068025735200491AFF?open&RestrictToCategory=1
16 UK Bioenergy Strategy, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48337/5142-bioenergy-strategy-.pdf
17 Forestry Commission, hardwood availability forecast http://www.forestry.gov.uk/pdf/50_YEAR_FORECAST_OF_HARDWOOD_AVAILABILITY.pdf/$FILE/50_YEAR_FORECAST_OF_HARDWOOD_AVAILABILITY.pdf

impact of demand for biomass fuel. With increased demand for biomass, previous undermanaged forests would be brought into management and thereby increase its availability[19]. It is a common misconception that the increased use of biomass will lead to reduced use of wood in panel board and construction, but Forestry Commission statistics show that the as softwood deliveries to energy markets have increased, deliveries to sawmills have increased and deliveries to panel board mills have remained broadly stable between 2005 and 2014[20]. Increased demand for biomass fuel creates an economic signal to the forestry market that devalued residue and by-products have an economic value, thereby supporting increased forestry growth.

Defra has in a forestry policy statement[21] outlined how the Government intends to work with the forestry sector to bring more woodland into active management, including the development of the woodfuel market. The policy clearly outlines how the use of woodfuel is seen as a positive factor for UK's forestry sector and will enable more undermanaged woodland to be brought into management. Thinning trees in dense woods to produce the fuel, it opens up the forest, which encourages more woodland growth, rather than less, and benefits woodland biodiversity, wildlife, and local economies. A lack of active management means that sunlight can often no longer reach the woodland floor. Rarely grazed by livestock, woodlands are often overgrown with brambles and suffering from high levels of nutrient pollution, which encourage plants like nettles instead of our specialist woodland flora[22].

The UK woodland area has continuously increased every decade, with UK woodland area increasing from 11.3% in 1999 to 13.0% in 2015. Of the area in the EU, 41%, 178 million ha, is covered with forests and other woodlands, with about 75 % of that area potentially available for wood supply[23]. The European Commission's *Study on the Wood Raw Material Supply and Demand for the EU Wood-processing Industries* state:

- "In all the analysed products and product groups, the production in Europe is either declining or relatively stable. However, in sawmilling and especially pellet production, there are high hopes among the producers that future demand will be increasing. However, the low price of sawn wood in comparison with the relatively high price of logs keeps sawmilling's competitiveness at a low level, although the increasing demand for the by-products of sawmilling partly compensates.

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18 Forestry Commission, Softwood availability forecast http://www.forestry.gov.uk/pdf/50_YEAR_FORECAST_OF_SOFTWOOD_AVAILABILITY.pdf/$FILE/50_YEAR_FORECAST_OF_SOFTWOOD_AVAILABILITY.pdf

19 Forestry Commission, Millions of tonnes of wood being wasted every year http://www.telegraph.co.uk/news/earth/earthnews/8603921/Millions-of-tonnes-of-wood-being-wasted-every-year.html

20 Forestry Commission, Forestry Statistics 2015 - UK-Grown Timber, Deliveries of UK-grown roundwood, http://www.forestry.gov.uk/website/forstats2015.nsf/LUContents/824A4E0E2DDEDC858025731B00541EFF

21 Government Forestry and Woodlands Policy Statement, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221023/pb13871-forestry-policy-statement.pdf

22 Forestry Recommissioned, Bringing England's woodlands back to life, http://www.plantlife.org.uk/uploads/documents/WR_web.pdf

23 Study on the Wood Raw Material Supply and Demand for the EU Wood-processing Industries, http://ec.europa.eu/DocsRoom/documents/11920

- "Between 2000 and 2010, wood raw material use in the EU-27 bio-energy sector grew (ca. +82 million m3 RWE) more than double in comparison to the growth of both pulp and paper and of wood products. Following this significant growth, the wood raw material use of the bio-energy sector approached the wood raw material use of the wood product sector.
- "The sawmills are in a key position in this because saw logs are the most valuable parts of the trees and hence the most interesting one from the wood sellers' point of view. To get the market of wood raw material running, it is therefore extremely important that the sawmills are profitable and act as drivers for the wood market. This brings also pulpwood as well as energy wood to the market and other forms of woodworking industries, pulp and paper industries as well as power plants can benefit from this as well as from the industrial residues. This trickle-down effect is often referred to as a "cascade"."

The *State of Europe's Forests 2015 Report*[24] from Forest Europe which concludes:

- "Between 2005 and 2015 the average annual sequestration of carbon in forest biomass, soil and forest products reached about 720 million tonnes, which corresponds to about 9% of the net greenhouse gas emissions for the European region
- "Despite the fact that the European forest sector was affected by the recent global economic recession, it seems now on a steady path of recovery. Europe still remains one of the world's biggest producers of equivalent roundwood and has moved from being a net importer of primary wood and paper products to a net exporter. In particular, as reported in the document, information on total roundwood production was provided by 38 countries, representing 60% of the forests in the Forest Europe area.
- "Sustainable forest management in Europe is directly contingent on sustainable markets for forest products and vice versa. The consumption of roundwood and all of its products and by-products is a factor in the sustainable development of the forest sector. Profitability in most forests is dependent upon sales of roundwood, and, to a growing extent, sales of forest residues for energy. The revenue from sales of wood supports most activities and treatments in forests. The price of sawlogs is particularly important for the profitability of forest operations, thus the demand for solid wood products plays a crucial role in the mobilisation of pulpwood and forest residues. In this context, it is worth noting that the recognition of the environmental benefits of the use of wood in construction is slowly increasing throughout Europe. This could result in far greater consumption in the future.
- "Wood consumption in Europe remains well below forest growth. Thus, harvests fall short of annual growth by approximately 36%."

Finally, Eurostat data show that from 2014 to 2015 EU forest and other wooden land gained 322.800ha, which means that *EU forests are increasing by the size of a football field every minute*.

There are therefore little grounds for concerns over the sustainability of biomass heating and its impact on forests and woodland. In fact, the demand of the biomass heat sector for wood fibre actively supports the growth of the UK and Europe's forests.

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[24] FOREST EUROPE, 2015: State of Europe's Forests 2015, http://www.foresteurope.org/fullsoef2015

UK Energy Crops:

There is an enormous potential for further developing UK produced biomass. The NFU suggest that the UK should be aiming to produce 10 million tonnes of indigenous biomass. This should be made up from 4 million tonnes of straw, 3.5 million tonnes of perennial energy crops such as short rotation coppice (SRC) and miscanthus (grown on 350,000 hectares of farmland) and 2.5 million tonnes from enhanced woodland management (particularly bringing unmanaged woodland back into management). The Energy Technology Institute suggest that domestic sources of biomass could provide 6% of UK's energy by 2050 and could reduce the cost of meeting the UK's 2050 carbon targets by more than 1% of GDP[25]. Furthermore, to this point, several reports and academics have found significant land available for the production of perennial energy crops. Lovett, A. et al. (2014)[26] conclude that there is a large area of potentially available land for planting of perennial energy crops in Great Britain, even after making allowance for food production - at around 3.5 Mha, towards the top of the range cited in the 2012 Bioenergy Strategy. Aylott et al (2010)[27] suggest that 7.5 million tons of biomass (from short-rotation coppice) is realistically available from 0.8 million ha of poorer land in England.

The straw and woodland resource are already there waiting to be exploited. Currently, perennial crops have an area of around 10,000 – 15,000 hectares so a significant increase in planting will need to be stimulated for this potential to be realised. SRC and miscanthus can be grown on marginal agricultural land so it shouldn't compete with food production.

There are additional fringe benefits of producing biomass in the UK. Trees and perennial energy crops can assist with water quality improvements and are part of a toolkit of measures assisting in flood mitigation. When planted appropriately trees and perennial energy crops are a very effective and low-cost route to helping the UK meet the Water Framework Directive objectives and reducing the economic impact of floods[28]. Haughton et al. (2015)[29] found that biomass crops could enhance biodiversity in agricultural landscapes, supporting wider sustainability goals. Willows grown as SRC can provide early sources of pollen and nectar for pollinating insects in late winter early spring. This could be exploited to help rebuild pollinator populations and potentially could lead to higher yields of insect-pollinated food crops. Home-grown biomass production would also facilitate rural regeneration by creating jobs and rural wealth creation opportunities.

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[25] Bioenergy, Enabling UK biomass http://www.eti.co.uk/bioenergy-enabling-uk-biomass/

[26] Lovett, A. et al. (2014) Global Change Biology - Bioenergy 6, 99–107, https://ueaeprints.uea.ac.uk/48133/1/gcbb12147.pdf

[27] Aylott et al (2010) Biofuels 1(5), 719–727, http://www.tandfonline.com/doi/abs/10.4155/bfs.10.30

[28] Forest Research, Woodland for Water: Woodland measures for meeting Water Framework Directive objectives, http://www.forestry.gov.uk/pdf/FRMG004_Woodland4Water.pdf/$FILE/FRMG004_Woodland4Water.pdf

[29] Haughton, A.J., Bohan, D.A., Clark, S.J., Mallott, M.D., Mallott, V., Sage, R. and Karp, A., 2015. Dedicated biomass crops can enhance biodiversity in the arable landscape. GCB Bioenergy, http://onlinelibrary.wiley.com/doi/10.1111/gcbb.12312/full

In addition, the BEIS commissioned report from April 2018 *Innovation needs assessment for biomass heat*[30] highlights that "both in the UK and globally, energy crops [such as short rotation coppice (SRC) and short rotation forestry (SRF)] have the potential to be a major source of biomass to 2050, and can be used for all bioenergy routes, including to heat, power, transport fuels and chemicals. This relies primarily on significantly increasing the rate of planting from today, as well as in parallel increasing yields".

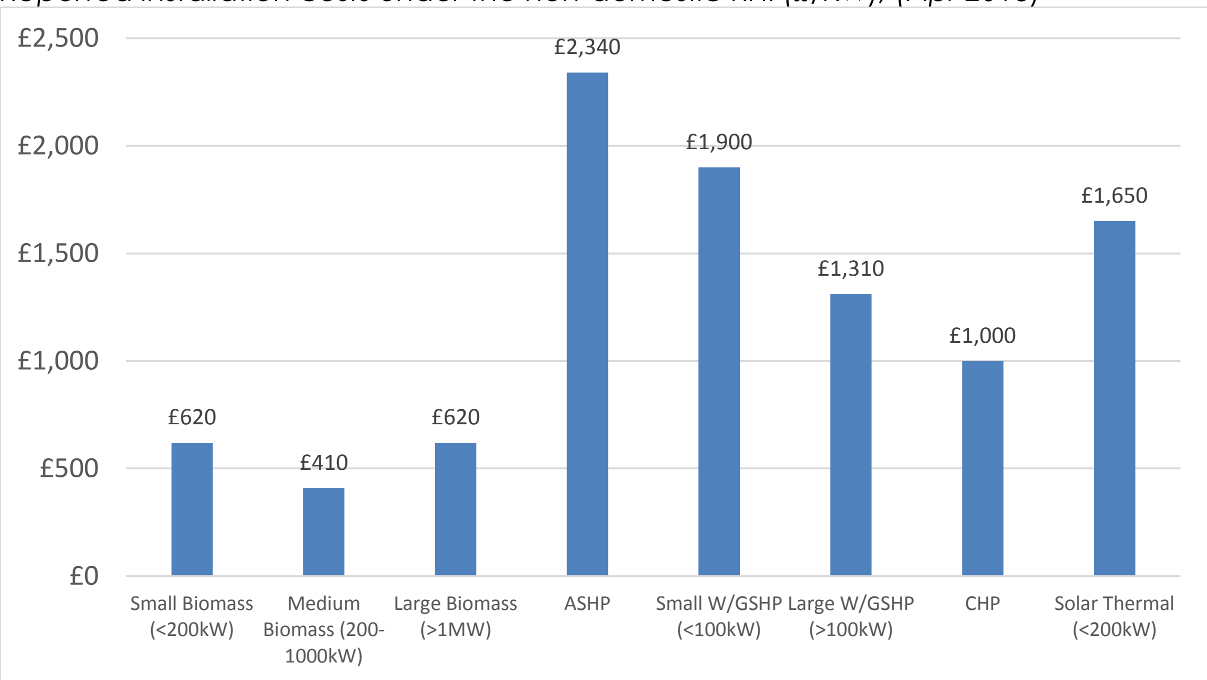
There is also a great potential for using fuel from residues, which are currently being land spread and can be used to make heat and power.

<u>Cost-effectiveness</u>

Biomass boilers offer one of the most cost-effective low-carbon heating options in the off-gas-grid market. They provide sustainable heating in domestic off-gas-grid properties, with high-temperature heating which is more likely to work in older houses. Biomass systems have been most effective at replacing oil boilers among the supported technologies under the Domestic RHI, with 56% of biomass boilers replacing an oil boiler compared to 23% of heat pumps and 22% of solar thermal installs.

Looking at the cost of installation data released by the Government, it is clear that biomass is the cheapest low-carbon renewable heating option within the domestic and non-domestic RHI.

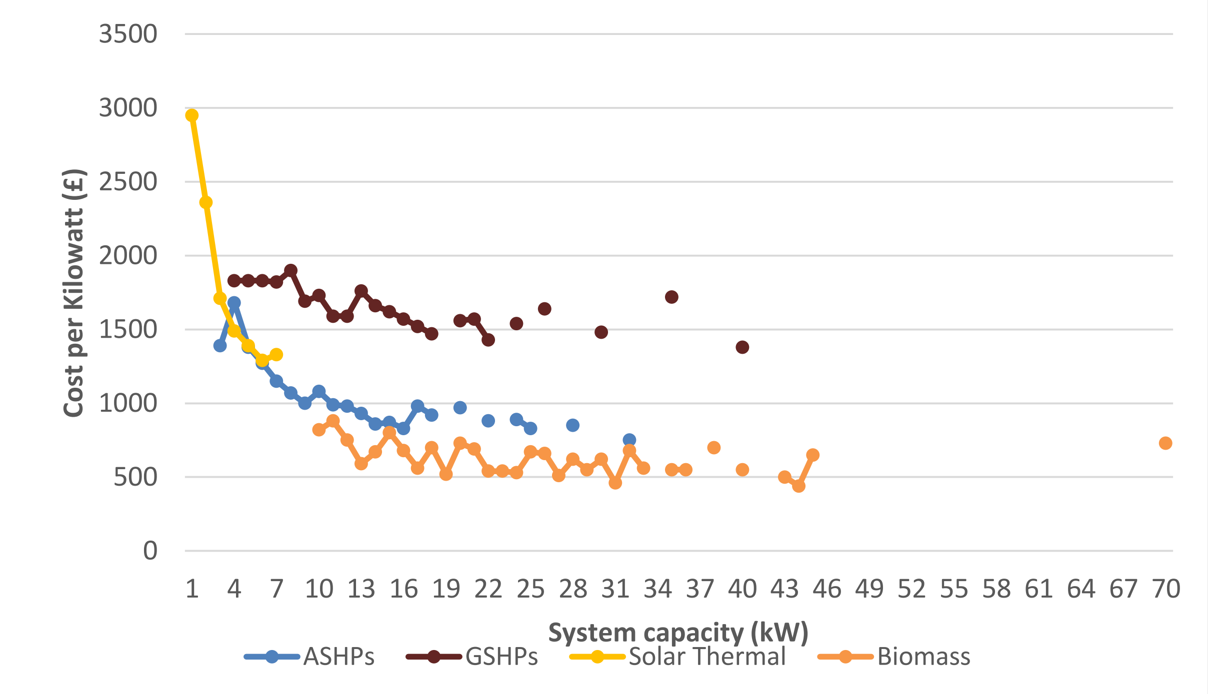
Reported installation costs under the non-domestic RHI (£/KW), (Apr 2018)



Note: The number of applications contributing to the averages after data cleaning processes was applied, including the removal of outliers, including any installation with an installation cost of zero and the highest and lowest 5% within each technology, based on the total cost per kilowatt. All costs are presented on a nominal basis and represent cost recorded at the time of application. Costs are rounded to the nearest £10 for presentation.

[30] BEIS (2018), Innovation needs assessment for biomass heat, https://www.gov.uk/government/publications/innovation-needs-assessment-for-biomass-heat

Average domestic RHI reported installation costs (Apr 2018)



Note: Technology/capacity combinations with fewer than 20 applications are not included. In addition, BEIS has excluded installations with installation costs of zero and capacity of zero or greater than 90 KW. All costs are presented on a nominal basis and represent cost recorded at the time of application. Costs are rounded to the nearest £10 for presentation.

Recent figures for the financial year of 2016/2017 show 13,446 people are employed directly or indirectly by 702 companies through the biomass boiler industry in the UK (i.e. in installation and maintenance, manufacturing, and design and development)[31]. The Government will benefit from the biomass installation and fuel supply chain build up under the RHI. BEIS has spent considerable efforts supporting training, skills, development of industry standards, and quality of installations.

[31] REA REview 2018, https://www.r-e-a.net/resources/rea-publications

Hybrids and gas driven heat pumps

10. Are there any oil and heat pump hybrids currently on the market (in the UK or elsewhere), and if so how does the cost compare with conventional systems or with a heat pump? Could they be used with bioliquids? What impacts do they have for domestic and business consumers, for example in terms of ease of use and comfort levels?

11. We understand there are gas heat pump hybrids on the market that can be used with LPG. How widespread are these (in the UK or elsewhere) and how does the cost compare? Could they be used with biopropane or other biogases? What impacts do they have for consumers, for example in terms of ease of use and comfort levels?

12. What role might hybrids have in the short term to facilitate the longer term transition to clean heating off the gas grid?

We are concerned that hybrids could delay the full transition to low carbon heating and will lock in the continuation of high carbon fuel. If the entire heating sector needs to be decarbonised by 2050, then the last gas boiler will need to be installed in 2035. The Government has decided to start with the off-gas-grid sector prior to decarbonising the on-gas-grid properties. If hybrid heating systems, which essentially are merely more effective fossil fuel system, will be allowed to be installed in the 2020s in the off-gas-grid market, then the UK will still have oil heating well into the 2040s. This will make the overall decarbonisation of heat significantly more difficult.

The only route for hybrid options is where the fuel is 100% renewable and low-carbon, such as liquefied green gas or compressed green gas in combination with heat pumps, biomass boilers etc.

Electric heating, including heat pumps

13. **To what extent are space requirements an issue during a heat pump installation? How often are heating distribution systems replaced (hot water tanks, radiators and/or pipework)? How often are additional thermal efficiency measures for the building required?**

In general, space is less of an issue in rural, off-gas-grid properties compared to on-gas-grid, dense areas. However, there are still space restrictions that will make it difficult to install a heat pump (or a biomass boiler). Not all properties will have the necessary space to install a heat pump and alternative option will need to be considered. For example, to achieve high efficiency for ground source heat pumps, it is required to lay the loops deeper, rather than just under the surface, which does necessitate a garden space. But this does not detract from the fact that the majority of rural properties will not be limited by space requirements.

The main barrier in retrofitting is instead the necessary altercations (such as under-floor pipework, larger radiators, insulation etc.). There are also issues with planning in Listed Buildings and in Planning Conservation areas, which could constrain heat pumps (and other onsite renewables).

14. **What potential is there for heat pump costs to come down (both kit and installation)? How can industry show leadership in making this happen?**
15. **Are there any drawbacks of smart/more efficient storage heaters, vs other types of electric heating? And, if so, how are these to be overcome? What are the benefits of smart and more efficient storage heater products compared to traditional storage heaters? In which types and tenure of buildings are storage heaters most likely to be useful? Would storage heaters be a likely solution where electric heating is not currently used? How about where electric heating is currently the secondary heating source?**

Although potentially better than traditional storage heaters, smart storage heaters still, at best, produce 1kWh of heat for 1 kWh of electricity consumed. This would make them an expensive method of heating a property and would not address fuel poverty. Since electric heating (storage or non-storage) tends to be installed in smaller, lower quality housing where the occupants are at a higher risk of suffering from fuel poverty, this does not appear to be an optimal solution unless combined with substantial discounts (>75%) for using electricity when demand is low to balance the grid. It is unlikely, given the cost of electric heating, that storage heating will be a valid replacement for other types of heating since it will result in heating costs rising.

However, there are new technologies entering the market, which are more efficient and available at a lower cost. These offer new solutions for the 1.5m households with electric storage heaters, and in combinations with smart meters, allows the consumer to access smart tariffs, assist grid balancing, and improves user control. These newer storage technologies will also lower the impact on the electricity grid of heat pumps.

Rural heat networks

16. Is there scope for more use of rural heat networks and communal heating systems? What are the barriers and how might they be overcome?

Yes, we believe there are further opportunities for development of heat networks in off-gas-grid areas. There are many towns, villages, and business parks where heat networks would be an effective method of decarbonising heating.

There is a common perception that heat networks are only economically viable in areas of high heat density. However, if the project is properly scoped and there is a locally available woodfuel source, there are certainly areas where biomass heat networks could provide a solution to decarbonising heating.

Rural areas have a far higher rate of fuel poverty than urban areas and so, if given the chance to reduce their heating bills, residents could be very willing to support the installation of heat networks. Northern areas of the UK, such as the highlands, have been identified as potential locations for heat networks as they have a higher base heat load due to colder temperatures. Also, with Scotland dominating the UK's forestry marketplace, there is a clear supply-chain for the woodfuel.

The system can provide both a short-term boost to the local economy by providing jobs in the construction of the plant/network and installation of HIUs/heat meters. It can also provide more jobs in operation and maintenance of the network. The need for local woodfuel production retains money spent on energy within the local economy. This, in turn, results in important employment opportunities in local forestry, fuel processing and transport. Also, local woodland is likely to be better managed if it is of increased economic value.

The main barrier to deployment is cost and lack of heat demand in off-peak months. Areas where it is possible for 'soft dig' pipe installation should be considered as this significantly reduces installation price. Also, towns and villages with known 'anchor' buildings such as leisure centres and hotels could provide the heat demand in off-peak months.

Another main barrier is the practical impact of laying heat distribution pipework to existing properties. Encouragement should be given to the installation of heat networks in new, off-gas-grid housing developments. Some of the barriers are concerns by householders about the reliability of the heat network and among potential operators about their liabilities. There is also uncertainty over the potential business rate. It should be noted that, other than for very large systems or systems supplying process heat, any heat source must be able to adjust to demand if the network is to operate at a sensible level of efficiency.

Clear guidance and rules on how heat costs can be determined over the long term are required to allay concerns from heat users (who are worried about being reliant on a single supplier for heat with no alternative if costs rise) and potential operators (who need to be assured of a reasonable return on their capital in the face of uncertain fuel costs).

The £320 million Heat Network Investment Program (HNIP) fund should help soften the blow of the initial expenditure and stimulate the market for rural heat networks as well as urban ones.

There are many examples of off-grid heat networks working very well in Europe. Austria, in particular, is a country where biomass district heating is used extensively. It seems the key to the eventual success of a district heating system is close cooperation between the local community and the ESCO involved in the installation.

17. Are there specific ownership and funding models that may be suitable for heat networks and communal heating systems in off gas grid areas?

A community ownership model where the community is empowered to run and benefit from the district heating network is likely to be more attractive than the offer of profit-making enterprises to deliver heat.

Innovation

18. **What evidence is available about further innovations to improve the performance, efficiency and customer proposition of heat pumps? Are there opportunities for innovation in delivery and installation, particularly those innovations that might reduce kit and installation costs or hassle for consumers?**
19. **What is the role of the heating industry in delivering cost reduction through innovation? What steps is the industry already taking and what more could be done?**
20. **What other innovation opportunities and innovative technologies are available for rural homes off gas grid? At what technology readiness level are they and do they require government support to move them towards the market?**

We believe that education and skills are crucial in ensuring high performance of low carbon heat technologies, such as heat pumps and biomass boilers. The installer plays a critical role in ensuring that consumers pick low-carbon heating, as they are the first person the consumer will discuss their heating with. Further education is needed to ensure that installers are aware of low carbon technologies, feel comfortable informing consumers of them, and have the skills and knowledge to install an efficient and high-performing system.

Over the past few years, the number of installers registered on the MSC database has dwindled, as the interest in the domestic RHI has reduced. Subsequently, many of the training programmes and companies providing them have closed. If the entire off-gas-grid area is to be decarbonised, then every oil boiler installer and heating engineer will need education and training in low carbon technologies.

In addition, there is a lack of sufficient requirements in the non-domestic heating sector. Although standards exist, there are no requirements to meet them or any coherent scheme or code to refer to. The Government has previously supported the development of Code of Practises for Water Source Heat Pumps[32] and Heat Networks[33], which have been developed together with CIBSE, the professional engineering association. It would be useful to also develop a Code of Practice for Biomass Heating as well to ensure that installations are highly efficient and comply with best practices. This would include:

I. A Code of Practice defining what is required to deliver a high-quality heating installation
II. Professional certification for heating designers/ installers/practitioners;
III. Training courses which are derived from and support the above structures;
IV. A Quality Management Scheme which provides an agreed framework within which high quality and highly efficient heating projects are delivered;
V. Improved regulation which identifies the minimum standards in all areas of an installation.

In the non-domestic sector, we would recommend introducing a quality management scheme for biomass boilers in line with the QM Holzheizwerke scheme,

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[32] CP2 : Surface Water Source Heat Pumps: CoP for the UK, https://www.cibse.org/Knowledge/knowledge-items/detail?id=a0q200000090NmPAAU
[33] CP1: Heat Networks: Code of Practice for the UK, CIBSE/ADE CP1, https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q200000090MYHAA2

as previously recommended by the Government[34&35]. We have previously expressed concerned about the lack of mandatory quality standards in place to protect the consumer, RHI scheme, and wider industry reputation. There are several European quality management systems in place which could be easily adopted in the UK, which focus on ensuring delivery of energy efficient, well-conceived biomass systems with low emissions. They involve proper design consultation at inception and monitoring after installation to ensure the system meets the design objectives. The QM Holzheizwerke system as used in Switzerland and Austria is a very cost-effective way of introducing a quality management system to the RHI scheme in the UK.

Recent changes to require the installation of heat meters on the output of heat pumps and electricity meters on the input will go far towards ensuring that consumers and installers can measure directly the COP of heat pumps which have been installed. This will drive up installation standards and is welcome.

The recently published BEIS report[36] *Innovation needs assessment for biomass heat* highlights the potential for innovation in bioSNG, gasification, pre-treatment technologies, and woody and grassy energy crops. It is worth highlighting the following section on woody and grassy energy crops:

> "Woody crops (such as short rotation coppice (SRC) and short rotation forestry (SRF)) and grassy crops (such as Miscanthus) can be specifically grown for energy purposes, with high yields and relatively low inputs. Developing improved and higher yielding breeds of energy crops is a priority to reduce costs, increase planting rates and improve sustainability performance. […] Innovation could lead to increased yields in 2050 of 67% for Miscanthus compared with 2017 yields to reach 18 oven dried tonnes per hectare per year (odt/ha/yr) and 64% for SRC to reach 14 odt/ha/yr. Higher yielding breeds could lead to a 33% reduction in feedstock production cost for Miscanthus to £45/odt and 34% reduction for SRC to £52/odt by 2050. Development of new breeds could also focus on improving sustainability, such as increasing water and nutrient efficiency, and allowing use of poorer quality or contaminated land.
>
> […] UK research institutions are world leaders in Miscanthus R&D and breeding and in collaboration with other countries have led the advancement in Miscanthus breeding over the last decade. To commercialise new breeds of Miscanthus, seed production programmes would be needed as well as follow up research projects to capitalise on advances made to date.
>
> Although some of these crops are grown extensively in other regions, current planted areas are small in the UK. Nevertheless, both in the UK and globally, energy crops are expected to be a major source of biomass to 2050, and can be used for all bioenergy routes, including to heat, power, transport fuels and chemicals. This relies primarily on significantly increasing the rate of planting

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[34] Renewable Heat: Standards and training, DECC August 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/451627/TandS_FINAL_Report_7_8_15.pdf

[35] "Desk Based Review of Performance and Installation Practices of Biomass Boilers", DECC 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/376805/Review_of_biomass_performance_standards.pdf

[36] BEIS (2018), Innovation needs assessment for biomass heat, https://www.gov.uk/government/publications/innovation-needs-assessment-for-biomass-heat

from today, as well as increasing yields to reduce costs and increase output. In the UK context, increasing planting rate requires supporting farmers to overcome initial costs and delayed payback from these crops, together with consistent policy to maintain stable market demand."

21. What can government do to ensure that future policy encourages and supports future innovations and cost reductions in technologies?

We strongly recommend that the Government supports the development of Code of Practices for Biomass Boilers in non-domestic properties, and, if necessary, for Air and Ground Source Heat Pumps as well to ensure that systems are installed as efficiently and thoroughly as possible. This will ensure that the installations meet best practices.

The funding requirement for Code of Practices is very modest and will be self-funding after the initial development of the documents.

For the domestic sector, it is equally important to ensure high-quality installations, and the development of a Competent Person Scheme would be the most efficient and least bureaucratic way to ensure this. The Microgeneration Scheme (MCS), while protecting consumers to some degree, was focussed largely on the sales process and had very little impact on the actual quality of installations.

Nearer term regulatory approaches

22. Please provide views and evidence on how different obligation approaches could be used to drive the transition to clean heating during the early 2020s? Are there any areas worth specifically targeting? Are there situations in which obligations would be counter-productive? Do you have any views on other short term regulatory options that could be pursued, besides those considered above?

A range of different policies will be needed to drive the transition to low-carbon heating in the off-gas-grid area. It will not be sufficient to merely bring in one policy change, such as a support scheme. Below we have outlined several policy options we believe the Government should adopt simultaneously to ensure a smooth transition to low-carbon heating in the off-gas-grid area by 2030:

Phase out of the sale of oil boilers, coal heating, and LPG:

Similar to regulations that mandated new condensing gas boilers in 2005 and condensing oil boilers in 2007. By prohibiting the installation of oil boilers after 2025, and mandating renewable, low-carbon systems, the Government could send a strong signal of where the market is moving. This will provide adequate time (5 years) for households off the gas grid to plan when to change their heating system without disruption and for the industry to meet the demand. This has in part already occurred in Denmark[37] and is being discussed in the Netherlands[38].

To ease the negative impact on fuel poor households, the phase-out could be combined with a boiler replacement scheme (grant scheme) for households with lower income. Additionally, certain exemptions can be made for circumstances where it is too difficult or costly to replace the system with a new low-carbon system and in these situations, a full assessment has to be carried out. The condensing boiler regulations included a points system and the more points a dwelling scored, the more likely it was that a condensing boiler couldn't be fitted.

However, if bioliquids or biopropane are supported as low carbon fuels then there are unlikely to be significant numbers of installations which can't be transferred from oil/LPG to a low carbon heating source.

Carbon taxation:

A mandatory fee levied to high carbon-intensive fuels such as oil, coal, LPG, natural gas to limit emissions of carbon resulting from the combustion of fossil, carboniferous fuels. Taxation should thus, on one hand, promote the more efficient use of energy and, on the other, enhance the attractiveness of alternative fuels and energy sources. By applying a levy on carbon, the externalities of GHG emissions are internalised to properly reflect the true cost of carbon in carbon-intensive fuels. This is one of the most effective and cost-effective options to transition to low-carbon heating.

There are several ways of mitigating the disadvantages of a carbon tax:

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[37] Renewable Energy World (2013), Denmark puts the brakes on heating costs with new legislation, https://www.renewableenergyworld.com/ugc/articles/2013/02/denmark-puts-the-brakes-on-heating-costs-with-new-legislation.html

[38] deVolkskrant (2018), Het doodsvonnis van de cv-ketel is geveld: over drie jaar praktisch verboden https://www.volkskrant.nl/economie/nederland-moet-van-het-gas-af-en-dus-gaat-de-standaard-cv-ketel-in-de-ban-mogelijk-al-over-drie-jaar~a4584848/amp

- Use the revenue to fund low-carbon, renewable heating aimed at off-gas-grid properties; lower tax other places; and/or green heating payments to low-income households.
- Only apply a carbon tax to certain technologies, exempt energy-intensive industries.

Revenue neutral policies receive more public support. But if it used to lower income tax they can be doubly regressive (i.e. raising a regressive tax to lower a progressive one) (example: British Columbia). Returning the revenue to fuel poor directly in form of green heating payments is not regressive (example: Green Check in Denmark or Alaska Permanent Fund). It should be implemented at an initial lower price and increased steadily over five years. It is important that this would be implemented among side other policy implementations and are part of a wider landscape of efforts to phase out carbon-intensive fuels. The Swedish carbon tax[39] is a successful example of steady implementation over a number of years while mitigating the disadvantages.

A carbon tax would attribute a difference in value between oil heating and green heating, similar to what the RHI has offered in terms of offering payment to green heating. The former would be more attractive as brings in revenue, whereas the latter requires expenditure. The carbon tax could be scaled up over a number of years unto around £25/MWh.

Tax breaks

Permitted deductions from income tax for domestic installations, most likely spread over 3-5 years. It would not require any funds to be budgeted by Treasury, but still provides a straightforward value to the sorts of property owners that would be likely to install low-carbon heating systems. These are some of the most commonly used policy incentives across Europe for incentivising low-carbon heat and should be considered by the Government.

A tax rebate could be claimed at the time of the annual tax return for higher-income households or through a mechanism to claim the rebate more frequently for lower-income households. The rebate should come to an end in 2025, when high-carbon fossil fuel would be phased out, which gives people plenty of time to change their heating system at the appropriate time without creating a rush. To become revenue neutral, the policy should be combined with a carbon tax.

Variable stamp duty

A Variable Stamp Duty-based scheme would see house buyers receive a discount if a property is above a given energy efficiency standard or has renewable heating, or pay a higher rate if its performance is poor. This is a strong option for incentivising retrofit because it impacts at the point of sale – a time when the majority of home renovations take place – and in time could strengthen the link between energy efficiency and house prices. Analysis from UKGBS[40] suggests such a scheme could deliver between 135,000 and 270,000 additional retrofits per year, annual carbon

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[39] Carbon tax – key instrument for energy transition", Svebio - Swedish Bioenergy Association, https://www.svebio.se/app/uploads/2016/12/Carbon-tax-paper_COP21_0.pdf
[40] UK Green Building Council, "Retrofit Incentives", http://www.ukgbc.org/policy-and-advocacy/task-groups/retrofit-incentives

savings of between 209,000 and 417,000t CO_2 and contribute £404m-£807m to GDP a year (with a near zero annual direct cost to Government). The Government could accelerate this by introducing a requirement for all mortgages taken on properties below a minimum EPC rating to be accompanied by an energy efficiency improvement plan.

The incentive can be designed so that properties in the 0 percent SDLT band were not penalised for poor performance, but were given a benefit if they chose to move into better-performing properties or if they chose to undertake improvements subsequent to moving into a new home. A further means of limiting the relative impact is by introducing an appropriate cap on the size of the benefit that could be received.

Any scheme of this nature would, however, have to be carefully policed. If the incentive was on the seller to improve the EPC prior to sale, then there is a significant risk of poor quality installations put in place just to tick boxes. A refund of stamp duty if the EPC is improved within a set period of a sale would be a more optimal solution, as new owners are more likely to insist on high-quality installation.

Variable rates of Council Tax

Variable rates of Council Tax which rewarded/penalised more/less efficient homes. Individual councils would need to use appropriate local property data to establish a baseline level of energy efficiency. Properties above a given point (i.e. those that are more energy efficient) could be given a percentage discount on their Council Tax bill, while properties below the baseline would have a percentage added. Households making energy efficiency improvements would simply supply evidence (again, potentially in the form of an updated EPC) to demonstrate the change, and to apply for a reduction in their Council Tax going forward.

Similarly to variable rates of stamp duty, it does not drive uptake in the social housing sector. It could also lead to a higher administrate burden on Local Authorities and could have a negative impact on fuel poor (which could be mitigated by capping the penalty or only applying rewards/penalties on certain properties). However, again, this policy should not be implemented in isolation but together with many other policies.

It would theoretically be possible to make the incentive "one-sided" (i.e. – only offering discounts to those above the chosen standard), though not without placing a potentially significant burden on council budgets.

Oil Boiler scrappage scheme

Non-repayable grants for 'trading in' old oil boilers for new, renewable heating options (e.g. biomass boilers, GSHPs). The move would lead to improved air quality and lower emissions, as well as supporting the development of a supply chain in renewable heating. The Government have previously funded boiler scrappage schemes for old boilers rated 'G' or below (but this was not targeted at particular fuel sources or replacement technologies)[41 & 42].

[41] £400 Boiler scrappage scheme: http://www.money.co.uk/energy/what-is-the-boiler-scrappage-scheme.htm

The policy has been successful with gas boilers and in other sectors (e.g. inefficient boilers & automotive scrappage scheme) and the RHPP had successful elements this policy could build on. It would be very effective at increasing uptake rapidly and would be an eye-catching initiative showing leadership in tackling emissions and air quality concerns. However, there could be a possible 'boom then bust' cycle for the industry, if it wasn't implemented properly. It could be considered to fund it from general taxation, rather than energy bills to avoid possible criticism as being regressive, or mainly aimed at low-income households.

Building regulations / Merton rule

Mandating installation of low-carbon heating technologies in new builds is the most cost-effective time to install them, where builders are already on site and the heating systems can be designed to fit the requirements to the low-carbon heating system. The Merton Rule, where local authorities could determine a requirement for on-site renewables and/or energy efficiency, has been effective in increasing requirements for more energy efficient new-build homes with low-carbon heating and renewables on-site. Although the new-build market is smaller than the retrofit market, we strongly support using building standards to mandate low-carbon heating in new buildings, and believe this can provide an early incentive for installers to seek the necessary training.

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The above proposals relate to owned properties rather than rented or social housing. Further policy options are available in the UK Green Building Council's "Retrofit Incentives" from July 2013[43]. If many of the above policies were implemented in parallel it would create a demand for low-carbon heating, which, if sufficient, would allow the industry to scale up and bring forward the vital cost reductions required, if the transition to low-carbon heating is to be successful. Demand inducing policies as the ones mentioned above are essential to heat decarbonisation. Supply policies, such as Code of Practice and skills/training programmes cannot stand alone and will only be effective in combination with several demand policies.

Non-domestic policies

Some of the above policies, such as carbon taxation, are also applicable in the non-domestic sectors.

Amending Energy Savings Opportunity Scheme

The Energy Savings Opportunity Scheme (ESOS) is a mandatory energy assessment scheme for organisations in the UK that meet the qualification criteria. The Environment Agency is the UK scheme administrator. Organisations that qualify for ESOS must carry out ESOS assessments every four years. These assessments are audits of the energy used by their buildings, industrial processes and transport to identify cost-effective energy saving measures.

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[42] 2009 Car Scrappage Scheme http://webarchive.nationalarchives.gov.uk/20101214002059/bis.gov.uk/policies/business-sectors/automotive/vehicle-scrappage-scheme

[43] UK Green Building Council, "Retrofit Incentives", http://www.ukgbc.org/policy-and-advocacy/task-groups/retrofit-incentives

If the emphasis was moved away from energy reduction to CO2 emission reduction, this could open the door for to a lot of onsite low-carbon heat deployment in the commercial sector. A lot of the easy wins under the existing ESOS scheme (e.g. LED lighting) have already been done, making reducing energy use further challenging for energy-intense businesses, so renewable heat would be an easy and cost-efficient solution.

It brings the advantages of being part of an existing scheme, which has been running for a couple of years and would incentivise the deployment of renewable heat system in the commercial sector, unlike many of the other policy options. However, it only applies to larger companies with 250+ employees and a £39m turnover. ESOS was originally created to comply with an EU directive (2012/27/EU), and might not comply if the focus is shifted to carbon mitigation (although this might not apply after exiting the EU).

<u>Enhanced Capital Allowances (ECA) and Enterprise Investment Schemes</u>

It would appropriate that Government reconsiders support through tax incentives for renewable heat for the commercial sector. HM Treasury should be encouraged to provide support through Enhanced Capital Allowances (ECAs) and tax relief through the different forms of the Enterprise Investment Schemes (EIS).

Enhanced capital allowances have the advantage of providing a one-off upfront benefit rather than an ongoing liability for Government over 15-20 years. Similarly, the cost of such support would automatically reduce in real terms as system prices continue to fall; reducing the risk of overcompensation in the future. ECAs at least provide an attractive headline for investors and developers, bringing the tax relief on their asset purchase forward to their first year. This would provide a valuable incentive to both developers and investors in the absence of direct fiscal support.

Similarly, Enterprise Investments schemes have the potential to particularly support community scheme. Due to fears over double-subsidies the Venture Capital Schemes Manual currently explicitly excludes all energy generation activities from benefitting from EIS support; this includes the generation of heat. With more projects looking to build subsidy free, it is appropriate that this exclusion is revisited as it provides a valuable opportunity to offer investors the potential for good returns despite the risky nature of community schemes in comparison with purely commercial projects.

In the current market, we believe ECAs and tax relief through EIS could provide a cost-effective alternative for encouraging commercial investment. Furthermore, they have the potential to have the costs offset by driving commercial deployment of low-carbon heat systems, which in turn results in business development and job creation, which will deliver further opportunities for collecting tax revenue.

<u>Carbon tax</u>

Extending a carbon tax to non-domestic systems, combined with ECAs for businesses and grants or soft loans for non-commercial non-domestic users, could be an efficient solution. The supposed longer investment horizons of non-domestic investors should mean that they take account of a forthcoming tax rise when they are making investments with an expected lifespan of 20 years. It avoids a cliff-edge impact on organisations now, at a vulnerable economic moment, but creates a decent incentive.

23. What do you think about the options set out above for an obligation? Do you have any evidence as to potential impacts, burdens or unintended consequences?

Please find our views on the options mentioned in the Call for Evidence below:

Information provision obligation on fossil fuel boiler installers

Although it is a good idea to inform consumers of alternative choices to fossil fuel boiler, we do not believe this option is suitable or effective. Installers of fossil fuel boiler are just that and do not necessarily have the expertise required to give a full and adequate assessment of alternative heat technologies, in which they have not received training. There is also a significant financial incentive to not provide adequate or accurate information, as this may lead to a loss of business for them.

Similar situations have been observed with other low-carbon technologies, such as electric vehicles, where researchers have found that car dealers are a major barrier to boosting sales of electric vehicles, as electric vehicles are seen as less profitable for the dealerships. They therefore dismiss EVs, misinform the consumer, neglect to mention EVs, or depicting EVs as inferior[44].

It is therefore likely that such a policy will be completely ineffective in decarbonising heat. If obligations were to be put on installers, then it would be more effective to require them to undergo training in low-carbon heating options as part of the wider re-training of the installer base.

Funding for energy efficiency of homes

We support funding of energy efficiency programmes to reduce the energy demand in homes. This is a very efficient option of reducing carbon in the off-gas-grid area, where heat demand is higher and the energy efficiency of homes significantly poorer than on-gas-grid properties. However, it is also important to recognise that not all homes can practically or cost-effectively be insulated and have their heat demand significantly reduced.

A role for Distribution Network Operators (DNOs) or Gas Distribution Networks (GDNs) in supporting the take-up of clean heating

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Obligation on manufacturers or suppliers of oil systems

We are concerned that this policy would create unintentional consequences and believe it would lead to poor outcomes. We therefore do not support it.

If the last oil boilers should be installed in 2025 (as a realistic timeframe for decarbonising off-gas-grid heat; and considering that the last gas boiler needs to be installed at the latest in 2035), then the obligation should go from 10-20% of installations being low-carbon in 2021 to a 100% low-carbon obligation by 2025. Furthermore, installers that only install low-carbon technologies will be excluded and

[44] de Rubens, Gerardo Zarazua, Lance Noel, and Benjamin K. Sovacool. "Dismissive and deceptive car dealerships create barriers to electric vehicle adoption at the point of sale." Nature Energy (2018): 1. https://www.nature.com/articles/s41560-018-0152-x. Covered the BBC: http://www.bbc.co.uk/news/science-environment-44199160

will not benefit from this policy, despite retaining the expertise and having invested in skills and training over the past years.

If it was implemented like other obligation schemes such as the RO, the obligations would be met through trading of certificates of installations, so that a heat pump installer could benefit from installing a heat pump and sell the certificate to installers of oil boilers that have not installed a low-carbon technology. However, certificates of installation would create big opportunities for gaming, where installers could install the cheapest and least efficient low-carbon system with a "back-up" conventional boiler (at least until high-carbon systems were phased out).

The government policy should instead be demand-led, rather than supply-led, which means ensuring property owners have a reason to want green-heat systems.

<u>Obligation on suppliers of oil</u>

There could be an obligation on oil suppliers to supply bioliquids or bio-LPG, as there are a number of properties currently heated using LPG or oil for which low carbon heating is not an economic prospect for reasons of space or building fabric. However, it would put oil suppliers in a strong position to gradually take over the supply of green heating fuels, including biomass fuel. Finally, it would be very complicated if properties installed heat pumps, as oil suppliers would have to demonstrate the amount of oil that had been displaced by electricity.

24. What further options for short term regulation exist that we have not considered in this call for evidence? Do you have any evidence as to the associated impacts or burdens of any further options suggested?

See our response to question 22.

25. How can DNOs or GDNs take a leading role in deploying clean heating?

Financing clean heating

26. How can we encourage and unlock private sector finance in the absence of a subsidy?

27. If there was some targeted subsidy, such as for low income or vulnerable households or for building local supply chains, what would this need to look like? Do you have any evidence that subsidy is necessary?

As outlined above in our answer to question 22, then we believe there is scope for further support schemes, especially for households that do not have access to capital to pay for the higher upfront cost of low-carbon technologies, which are higher than fossil fuel systems.

Some intervention is needed to assist low-income household to make the switch to low-carbon heating systems. The RHI data suggests that there is an overrepresentation of owner-occupiers that took part in the scheme, and the rationale behind introducing the Assignment of Rights policy within the RHI was that BEIS had evidence that low-income or fuel-poor were underrepresented in the uptake of renewable heating. Furthermore, some form of direct support is still needed, as is clearly evident by the RHI deployment statistics: When a tariff was reduced, demand reduced in the subsequent quarters, which suggests that without subsidy, there is less demand.

We believe a domestic grant scheme or oil boiler scrappage scheme targeted towards low income or vulnerable households is most appropriate to support the transition to low-carbon heating. It should be emphasized that this should be in combination with as many as the policy options outlined in our answer to question 22. If these policies are not pursued, then a wider subsidy scheme is needed. As mentioned above, the current market framework is not sufficient to aid the decarbonisation of heat, and new major policies are required to assist this transition. A combination of (1) Phase-out of the sale of oil boilers, coal heating, and LPG, (2) Carbon taxation, (3) Tax Breaks (4) Variable stamp duty, (5) Variable rates of Council Tax; and (6) Oil Boiler scrappage scheme is needed to create demand for low-carbon heating (preferably all policies together), in addition to the initiatives to support the supply chains.

For non-domestic deployment, some support might be required for the non-commercial sector that will not be able to benefit from Enhanced Capital Allowances (ECA) and Enterprise Investment Schemes. Properties, such as leisure centres, hospitals, schools, nursing home etc., will not benefit from these policies and might need additional policy interventions, which may include direct government support.

As noted above, in other countries with high rates of low-carbon heating some form of support exists. In Austria, there are investment incentives ranging €200-€5000; in Denmark, there are tax exemptions for renewable technologies; in Finland, there are a combination of subsidy schemes and tax exemptions; France provides zero-percent-interest loans, direct subsidy, investment grants, and lower VAT for renewables; Germany provides zero-percent-interest loan and investment grants; Italy has both grant-based subsidy and tradable certificates; and Sweden has tax carbon since 1991. Some support will be needed.

These policies do, however, only focus on the off-gas-grid areas, where deep geothermal typically makes less economic sense, as there is usually not a bigger concentration of larger customers. Typically deep geothermal plants need customers of +30GWh per annum with low-temperature hot water demand heat, which is not common in off-gas-grid areas. There is therefore an argument for support for deep geothermal after 2021, as it is still an emerging technology with no plants in operating to date. After the first 50 plants in operation, the costs and risks will reduce significantly, which have been seen in many other European countries as the industry matures.

Finally, the centralised production of low-carbon biomethane will need some form of Government support, either in form of direct government support, via GNO obligations, or other mechanisms, as the above policies only relate to on-site heat systems. Biomethane is a vital technology for the Government's long-term heat strategy, and it is imperative that the industry does not fall off a cliff after the end of the RHI in 2021.

New market approaches

28. Novel business models for selling clean heating have not taken off in the UK market, why is this? What is needed to stimulate the development of this market in the UK?

We believe that, in general, the market has been too small to generate significant innovation, although several innovative business models have been developed by various companies operating in the market. The uncertainty surrounding the RHI scheme following the various tariff degressions has also meant that companies have been reluctant to invest in innovation and new market approaches.

However, we have still witnessed some novel business models taking off under the RHI, such as domestic ESCO options. But these were used by companies that sold systems in inappropriate properties to a very poor standard, often to vulnerable consumers. Several of these companies have numerous complaints made against them with the Renewable Energy Consumer Code. Consumers gave away their RHI payments, which were deemed and therefore didn't depend on whether the system worked or was efficient, and were often promised unrealistically low fuel costs / energy bills. The Government is currently bringing in Assignment of Rights to regulate these business models, but we still have concerns as to whether the consumers will be adequately supported. Apart from ESCOs for heat networks, where the organisation selling the heat is operating the boiler and buying the fuel, we are concerned that these novel business models create significantly more harm than benefits.

We therefore support demand-led policies, rather than supply-lead, as the latter often creates unintended consequences.

29. What could be done, apart from subsidies, to encourage new approaches? Are there any approaches that have worked particularly well in other countries and that could be replicated in the UK?

30. What could be done to support a whole-house approach of combining interventions and technologies?

Local approaches

31. How can government best tap into and support community and local authority efforts? Are there any successful examples that can be build upon?

32. What could be done to drive action from local planning? What are the pros and cons of approaches that rely on local planning? What evidence is there that such approaches produce desired outcomes?

One of the concerns raised in relations to relying on local planning departments can be that some weigh Heritage over carbon emissions and environmental benefits in Planning Conservation Areas and Listed Buildings. Projects that are expensive could then be made almost impossible, by the contrary demands of unclear rules, when Heritage and Energy plans conflict.

33. Do local approaches provide a possible model for delivering a firm end to fossil fuel installations through regulation? For example, by establishing oil free zones starting where it is most deliverable, and joining them up over time.

Building the consensus around clean heating

34. How can we increase consumer awareness and interest in clean heating technologies?

Most research shows that consumers, in general, are not very engaged or interested in their heating, as they are often more interested in that their heating works rather than where the heating originate from. Temperature control, comfort, convenience, the certainty of cost, humidity, hotness of radiators, scheduling of heating, and aesthetics are often valued higher[45]. Some research from the Energy Technology Institute and Energy Systems Catapult[46] suggested that combining smart heating and smart controlling of heating (i.e. wider smart control, such as zoning) with low-carbon heating could engage the consumers more.

However, overall, it will be difficult to engage consumers without significant demand-led policy measures, such as fossil fuel boiler phase-out, carbon taxation, tax breaks, variable stamp duty and council tax, scrappage scheme, and energy efficiency programmes. There will be some consumers that the Government will be able to engage with via softer policies, such as an information campaign, however, these are a small minority and will not drive the transition to low-carbon heating in the off-gas-grid area. If substantial policies, like the ones listed above, are implemented, then they will drive demand for and engagement in low-carbon heating technologies.

35. What are the best methods of engaging directly affected consumers?

36. How can we best work with heating engineers to benefit from their knowledge and experience, and their access to customers?

There are several routes to engage with the consumers, but the most effective are through heating engineers and government announcements. The heating engineer is often the primary contact for consumers when considering a change of heating system and plays a crucial role in informing the consumer of heating options. It is therefore essential that heating engineers are retrained and educated in low-carbon technologies, which they are unlikely to do unless there is significant demand for these systems.

The low-carbon heating industry will invest in the marketing of their products and engage directly with installers and consumers if there is demand for their products.

[45] Energy Technologies Institute 2018, "How can people get the heat they want at home, without the carbon?", https://es.catapult.org.uk/wp-content/uploads/2018/02/FINAL-How-can-people-get-the-heat-they-want-at-home-without-the-carbon.pdf
[46] Energy Technologies Institute 2018, "Domestic Energy Services", https://es.catapult.org.uk/wp-content/uploads/2018/02/FINAL-Domestic-Heat-Energy-Services.pdf

Sector skills

37. What steps are needed to ensure installers, manufacturers and the entire supply chain have access to new skills frameworks?

Please see our response to question 18-21:

We believe that education and skills are crucial in ensuring high performance of low carbon heat technologies, such as heat pumps and biomass boilers. The installer plays a crucial role in ensuring that consumers pick low carbon heating, as they are the first person the consumer will discuss their heating with. Further education is needed to ensure that installers are aware of low carbon technologies, feel comfortable informing consumers of them, and have the skills and knowledge to install an efficient and high-performing system.

Over the past few years, the number of installers registered on the MSC database has dwindled, as the interest in the domestic RHI has reduced. Subsequently, many of the training programmes and companies providing them have closed. If the entire off-gas-grid area is to be decarbonised, then every oil boiler installer and heating engineer will need education and training in low carbon technologies.

In addition, there is a lack of sufficient requirements in the non-domestic heating sector. Although standards exist, there are no requirements to meet them or any coherent scheme or code to refer to. The Government has previously supported the development of Code of Practises for Water Source Heat Pumps[47] and Heat Networks[48], which have been developed together with CIBSE, the professional engineering association. It would be useful to also develop a Code of Practice for Biomass Heating as well to ensure that installations are highly efficient and comply with best practices. This would include

I. A Code of Practice defining what is required to deliver a high-quality heating installation
II. Professional certification for heating designers/ installers/practitioners;
III. Training courses which are derived from and support the above structures;
IV. A Quality Management Scheme which provides an agreed framework within which high quality and highly efficient heating projects are delivered;
V. Improved regulation which identifies the minimum standards in all areas of an installation.

In the non-domestic sector, we would recommend introducing a quality management scheme for biomass boilers in line with the QM Holzheizwerke scheme, as previously recommended by the Government[49&50]. We have previously expressed concerned about the lack of mandatory quality standards in place to protect the consumer, RHI scheme, and wider industry reputation. There are several European quality management systems in place which could be easily adopted in the UK,

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[47] CP2 : Surface Water Source Heat Pumps: CoP for the UK, https://www.cibse.org/Knowledge/knowledge-items/detail?id=a0q200000090NmPAAU
[48] CP1: Heat Networks: Code of Practice for the UK, CIBSE/ADE CP1, https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q200000090MYHAA2
[49] Renewable Heat: Standards and training, DECC August 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/451627/TandS_FINAL_Report_7_8_15.pdf
[50] "Desk Based Review of Performance and Installation Practices of Biomass Boilers", DECC 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/376805/Review_of_biomass_performance_standards.pdf

which focus on ensuring delivery of energy efficient, well-conceived biomass systems with low emissions. They involve proper design consultation at inception and monitoring after installation to ensure the system meets the design objectives. The QM Holzheizwerke system as used in Switzerland and Austria is a very cost-effective way of introducing a quality management system to the RHI scheme in the UK.

We strongly recommend that the Government supports the development of Code of Practices for Biomass Boilers, and, if necessary, for Air and Ground Source Heat Pumps as well to ensure that systems are installed as efficiently and thoroughly as possible. This will ensure that the installations meet best practices.

The funding for Code of Practices is very modest and will be self-funding after the initial development of the documents.

For the domestic sector, it is equally important to ensure high-quality installations, and the development of a Competent Person Scheme would be the most efficient and least bureaucratic way to ensure this.

38. What should the respective roles be for the fossil fuel market and the low carbon heating market in ensuring installers have the skills they need for the future?

The renewable heating market has previously been able to supply training courses for installers when there was more demand for this, and the market would be able to do this again if new policies created demand for low-carbon heating. However, it is important that the Government created the necessary framework to ensure that this will happen, such as supporting the development of Code of Practices and Competent Person scheme.

Other Options

39. What other options should we be considering to target key barriers to taking up clean heating?

40. What intervention would make the biggest difference ahead of any regulation?

The Government could announce the intention to bring in regulation to phase out fossil fuel boilers, introduce carbon tax etc. ahead of introducing them, to signal to the market the changes to the heating sector. However, these are only effective, if regulations are swiftly introduced. The lessons from the Zero Carbon Homes policy shows that the industry did not change by merely announcing upcoming legislation, and once it was announced that the policy would not be introduced, the industry abandoned the requirements. The first-movers and early adopters were penalised and out-competed by the late-adopters that had not yet invested in training and education.

Futureproofing new build homes

41. Why is oil being installed in some new buildings currently? Are there particular factors or characteristics that are leading to oil being chosen over lower carbon alternatives? What are the barriers to installing a clean heating technology in these buildings?

Oil boilers are largely being installed in new buildings today because they are cheaper than low-carbon heating and because building developers are familiar with the technology.

42. Do you have any evidence of the cost of retrofitting clean heating in current new build, compared to the cost of building to that standard now?

43. What are the relative costs and benefits of installing clean heating systems in new build compared to installing futureproofing measures?

44. What would be the most cost-effective and affordable measures to decarbonise new buildings? Please make reference to specific forms of clean heating or futureproofing measures.

It will not be cost-effective to install futureproofing measures if the Government will require all off-gas-grid properties to switch to low-carbon heating by 2030. Installing low-carbon heating in new buildings as they are built is the most cost-effective time to install them, where builders are already on site and the heating systems can be designed to fit the requirements to the low-carbon heating system.

For domestic properties, it is likely that in the vast majority of cases, heat pumps or connection to a district heating system would be the best option to mandate. For non-domestic buildings, a wider range of options may be required due to the wider range of heating types needed.

Requiring low-carbon heating in new buildings from 2021 would also be a great opportunity to create demand early for low-carbon heating, which would incentivise installers to seek the necessary training.