



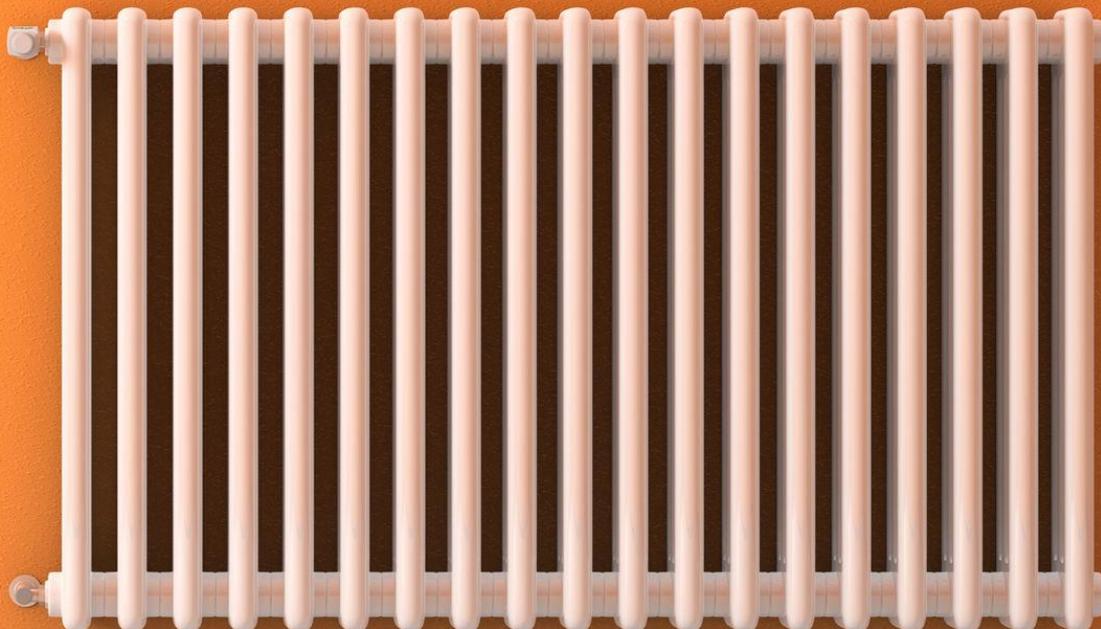
Achieving Net Zero:

Regulating the Decarbonisation of Heat

Sustainable Energy Association policy paper

January 2020

We are seeking industry feedback on specific questions listed at the end of this paper. Please submit your responses to these questions by 12 February to info@sustainableenergyassociation.com



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Executive Summary

- In the Clean Growth Strategy the Government committed to phasing out fossil fuel heating in properties off the gas grid by the end of the 2020s. Taking that commitment as a starting point, the Sustainable Energy Association is proposing an emissions standard for heating that takes a carbon intensity approach, setting a limit to the permitted emissions per kWh of heat provided.
- The regulation would be a function of both the carbon (CO₂) intensity of the fuel and the efficiency of the heating system. The value is calculated using the kgCO₂e/kWh of heat provided.
- Provided that a heating technology is efficient enough, uses a low enough carbon fuel, or a combination of both, it can continue to be installed whilst heating sources which are incompatible with net-zero are phased out. The regulation would apply to heating systems only at the point of replacement.
- This standard should be facilitated by enforcement measures detailed in the Building Regulations and accompanied by incentives for low-carbon heat to support uptake. To ensure the necessary reductions in building emissions are achieved, regulation must form part of a whole house approach alongside associated measures to reduce energy demand and incentivise early adoption of low carbon heating.

Introduction

Heat decarbonisation is one of the toughest challenges facing the UK as we strive to meet the recently set net-zero target by 2050.¹ To date, relatively little progress has been made in this area. The Committee on Climate Change (CCC) in their recent Progress Report to Parliament identified the development of a low-carbon heat strategy as a key priority over 2019/20 to prepare for a net-zero target.² This paper aims to contribute to the formation of such a strategy, focussing on the introduction of regulation. The aim of the regulation is to guarantee that heating is on the trajectory needed to reach net-zero by 2050 and to reduce carbon emissions substantially enough to avert the worst of the climate crisis.

Why regulate?

Regulation forms an important part of a range of policies that need to be deployed to enable the decarbonisation of heat. By regulating, certainty will be provided to the market that the transition to low-carbon heat is inevitable whilst setting out how that will be achieved will provide confidence and stability. This will provide a strong signal to investors and manufacturers of low-carbon heating systems to scale up investment and production, incentivise installers to upskill to be able to install new methods of heating and encourage the innovation that will be necessary for current fuels to develop lower carbon alternatives.

There is a widespread consensus of the need to change, even amongst those companies currently supplying fossil fuel heating systems, who recognise their current offerings will be incompatible with averting the climate crisis and meeting net-zero by 2050. There are various low-carbon alternatives being suggested as potential decarbonisation options that would need to be developed further to replace current heating systems. There are also already well-established and

proven low-carbon heating methods that can be deployed now to advance the heat decarbonisation process immediately. Therefore it is therefore important that regulation does not reduce the number of viable options, but primarily guarantees that carbon emissions are decreased sufficiently to meet climate targets. The proposed regulation provides the framework for low-carbon fuels to develop and the certainty that there is a place for them.

Regulation often works best when it is part of a holistic policy approach. Whilst there are potential new solutions that may be developed in the future there are also heating systems that offer immediate and substantial carbon savings if deployed now. This huge carbon saving potential should be recognised by offering financial incentivisation for the early uptake of these systems in replacement of fossil fuel heating systems. Moreover, the cost of transitioning to a low carbon heat source is likely to be higher for early adopters and support will be needed to ensure that fuel poor households are not left behind. It is a mutualistic approach that will work best when used alongside regulation.

An emissions standard for heating

The Clean Growth Strategy aims to phase out the use of fossil fuels off the gas grid in the 2020s.³ This regulation is designed with the off-grid commitment primarily in mind with the option of extending it to ensure the delivery of low-carbon heat to homes on the gas grid beyond 2030. This is supported by independent advice on setting a carbon intensity standard as an interim measure to fill in policy gaps.⁴ In addition, increasing levels of public awareness amongst consumers is aided by setting a clear date and timeline.

As a minimum, the regulation should commit to the standard up to 2030 to provide confidence that the decarbonisation of heating in the highest emitting, off-grid areas will happen (see Figure 1). A decision would need to be taken about the future of the gas grid before 2030 and ideally in the mid-2020s as recommended by the CCC.⁵

The CCC's Net-Zero Report, advises that all heating system installations must be 'low-carbon' by 2035 such that the share of low-carbon heating in our homes rises from 4.5% today to 90% by 2050.⁶ This is a key consideration and the projected part of the emission standard proposed in this paper suggests a possible level (see Figure 1). Essentially, by 2035, heating systems being installed must either already be, or have a clear and expected route to, heating without producing greenhouse gas emissions in 2050.

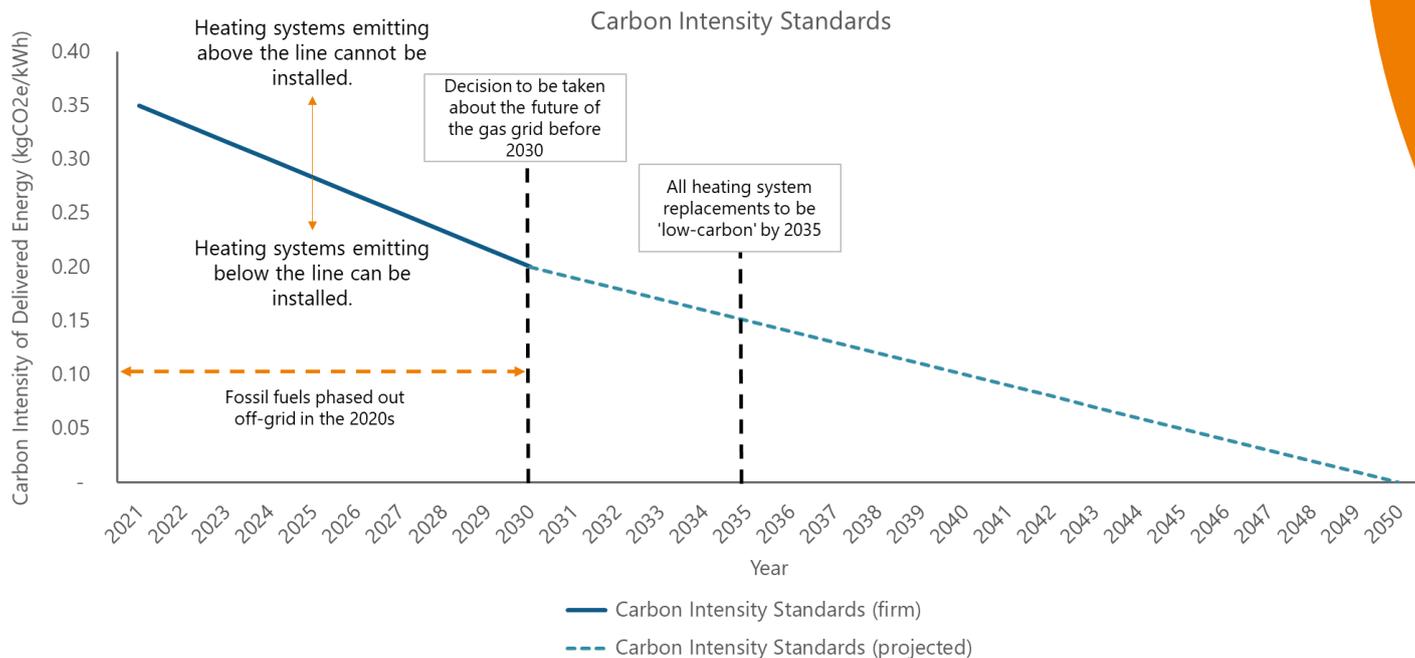


Figure 1: Proposed Carbon Intensity Standards Regulation

Carbon intensity standard

A carbon intensity regulation would set a limit to the permitted emissions per kWh of heating provided. This takes into account both the carbon intensity of the fuel as well as the efficiency of the heating technology. The carbon intensity standard is calculated by identifying the carbon intensity of the fuel – a value of kgCO₂e/kWh – and the efficiency of the heating system, taking into account both space and domestic hot water heating requirements. The emissions intensity of delivered heat is then calculated by dividing the carbon intensity of the fuel by the efficiency. This value is then compared to the regulated standard that must be achieved at the time of replacement to ascertain whether the required standard will be met. Essentially, as long as a heating technology is efficient enough, uses a low enough carbon fuel, or a combination of both, it can continue to be installed and heating compatible with net zero will be phased in.

The level of the regulated standard has been calculated to ensure the government’s commitment to phasing out fossil fuel in the off grid in the 2020s is achieved. It is set at a level that allows for a steady decrease in the carbon intensity year on year, whilst still allowing time for a decision about how the gas grid will be decarbonised. This decision about the future of the gas grid would need to be taken before 2030 and ideally in the mid-2020s as recommended by the CCC.⁷

The CCC advise that emissions from heating in the average home fall to 1.9tCO₂ to reach the Fifth Carbon Budget.⁸ With this carbon intensity regulation in place, the average heating emissions from off-grid homes could fall and reach the level needed for the Fifth Carbon Budget, but only alongside a reduction in heat demand of around 30% through the installation of energy efficiency measures across the existing housing stock.

Without a complementary improvement in energy efficiency, the standards would need to be further tightened, implying a quicker switch to low carbon heating methods. A ‘whole house’ approach will be fundamental to ensure the regulation achieves the overarching aim of decarbonising heat to meet net-zero in 2050.

Implementation of the standard

The regulation is designed to encourage uptake of low carbon heating systems over time to meet the government’s commitments. It is therefore important that consumers, industry and the market more generally are given adequate notice of the regulatory trajectory to plan improvements and invest. There is also a need to take into consideration natural boiler replacement cycles to enable a smooth transition.

It is proposed that the standard would only apply on a rolling basis to heating systems at the point of replacement and as such would not be retrospectively applied to in-situ heating systems. These heating systems will be allowed to remain in homes until they require replacement. Publicising a clear trajectory will help households make informed decisions about their heating systems, for example, they may choose to install a system which meets future carbon intensity standards before they are required to do so to futureproof their home and minimise potential future expenditure.

The standard would mean that when the heating system comes to the end of its lifetime, the replacement system put in place must adhere to the carbon emissions intensity standard at that point in time. The replacement system could then continue to operate at the standard granted until that system comes to end of its life (see Figure 2 which provides an illustrative example of a home heated by oil requiring a replacement in 2023).

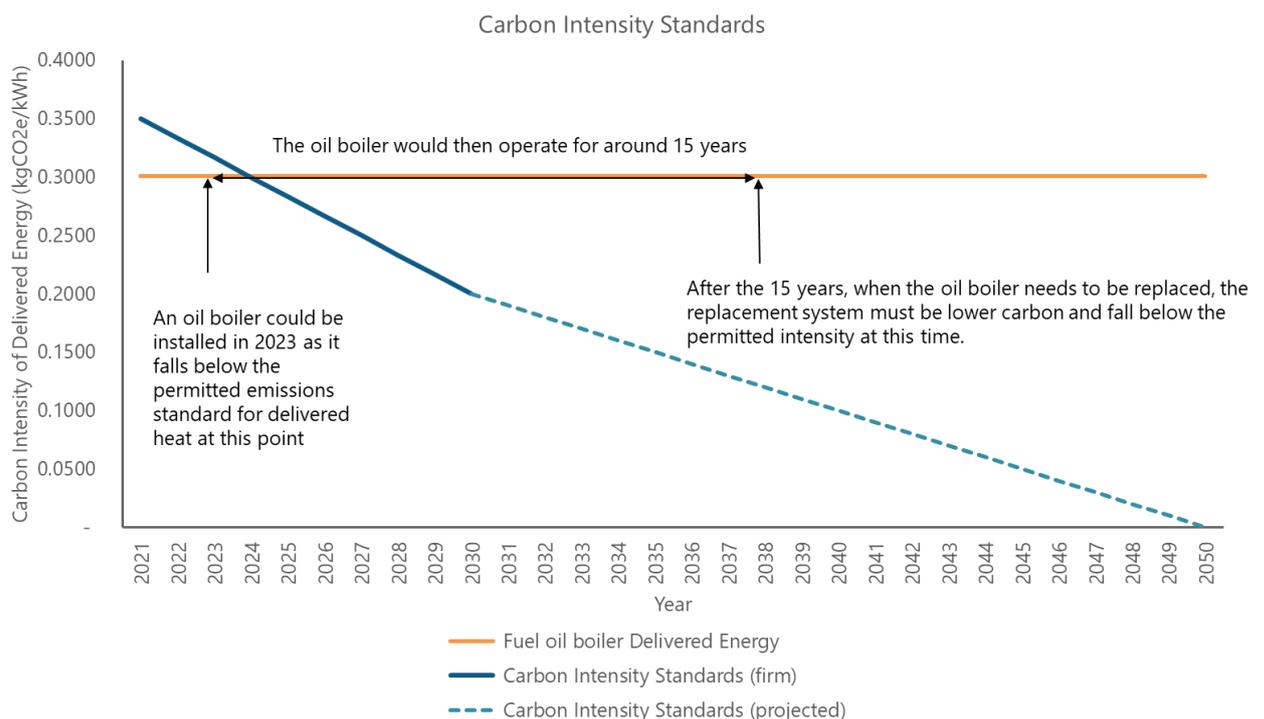


Figure 2: An example of how the regulatory standard would work

Table 1 below provides further illustrative detail of how the regulation is calculated and how it may affect a home heated by an oil boiler and the supply chain delivering the heating fuel and system.

Table 1 - Calculating the Emissions Intensity of Delivered Heat

	Fuel provider: Carbon Intensity of the Fuel	Heating system manufacturer: Efficiency of the Technology	Household and installer: Emissions Intensity of Delivered Heat – Can the system be installed?
Description	<p>The consumer chooses a fuel that they would use for the heating system.</p> <p>The carbon intensity of the fuel is identified – this will be a value of kgCO₂e/kWh.</p>	<p>The heating technology to use this fuel is chosen.</p> <p>The efficiency of the heating system is then considered.</p>	<p>The emissions intensity of delivered heat is then calculated by dividing the carbon intensity of the fuel by the efficiency of the heating system.</p> <p>This value is compared to the regulated standard that must be achieved at the time of replacement and if it meets this level the system can be installed.</p>
Illustration			
Example	Fuel oil is chosen with a carbon intensity of 0.268 kgCO ₂ e/kWh.	An oil boiler is selected with a design efficiency of 0.89 COP.	<p>The carbon intensity of the delivered heat would be: $0.268 / 0.89 = 0.301$ kgCO₂e/kWh.</p> <p>In 2023, when the regulated level is at 0.317 kgCO₂e/kWh the system could be installed.</p> <p>In 2024 when the regulated level is at 0.300 kgCO₂e/kWh the system would not be permitted to be installed.</p>
What policy tool would be used?	Fuel suppliers would need to have certification of the carbon intensities of the fuel that they provide.	Heating technologies would need to be tested to get an efficiency rating. E.g. ErP rating database.	<p>The installer as part of Building Regulations (Part L) would have to complete this assessment. Once installed, customers would have a heating system installation code/certificate that fuel suppliers would have to use to make sure that they are supplying fuel of the awarded intensity or better.</p> <p>The codes could be stored on an open database similar to the one currently used for EPCs.</p>

As noted above, a clear trajectory will aid early adoption, but it is also important that support mechanisms, including financial incentives are introduced alongside the regulation to enable

this. The following section outlines the impact the regulation would have on current heating technologies. The level of the carbon intensity standard influences phase out rates for each fossil fuel solution and the time at which households will switch to lower carbon alternatives.

This paper does not propose the full suite of incentives or financial support mechanisms however we have set out some ideas below which could be considered:

- Introducing a subsidy scheme and/or a boiler scrappage scheme to help overcome the upfront cost barrier associated with the transition to low carbon solutions.
- Providing equity loans similar to the Home Energy Efficiency Scheme in Scotland. This encourages homeowners or landlords to make home energy efficiency improvements through the provision of loans that are repaid upon the sale of the property. Such a scheme would include loans for moving to low carbon heating.
- Providing saving schemes designed to support households planning for a future switch to a low carbon heating system, for example saving mechanisms like the Help to Buy and Lifetime ISAs which rewards households for saving towards a specific goal.
- Reflecting the value of lower carbon heating solutions in property prices and the taxes paid by households using variable council tax and stamp duty rates.

What would this mean for current heating technologies?

The SEA is technology agnostic and understands that there is no silver bullet in the heat decarbonisation process, as such a range of solutions will be required, and no options should be disregarded. A carbon intensity regulation complements this approach as it does not pick winners, rather it identifies the technologies and/or fuels that simply must change in order to decarbonise our heating.

There is a need to decarbonise as soon as is practicably possible. Considering this, existing solutions offering significant carbon savings should be deployed immediately to help avoid the worst potential consequences of the climate crisis.

There is interest in the development of biofuel alternatives to traditional heating fuels, which would perform through heating methods that consumers are familiar with, but these are still largely in development or only hold a very small fraction of the market share.⁹ A carbon intensity standard is a means to ensure that the potential for development of bio-alternatives is encouraged whilst also allowing other readily available technologies to be deployed. The regulation will ensure that the most cost-effective, technically feasible low carbon solutions are deployed in a timely manner without limiting available options.

Below we outline how the regulation could impact a range of heating solutions and how it may influence consumers' decisions regarding their heating systems in the 2020s. The technologies are discussed in the order of phase out based on the proposed carbon intensity levels.

Coal Heating

Coal has the highest carbon intensity of all the heating fuels considered. About 170,000 homes are heated by coal. From the introduction of the regulation in 2021, newly installed coal boilers would immediately need a proportion of biocoal (see Figure 3) or would be replaced with a lower carbon alternative heating system.

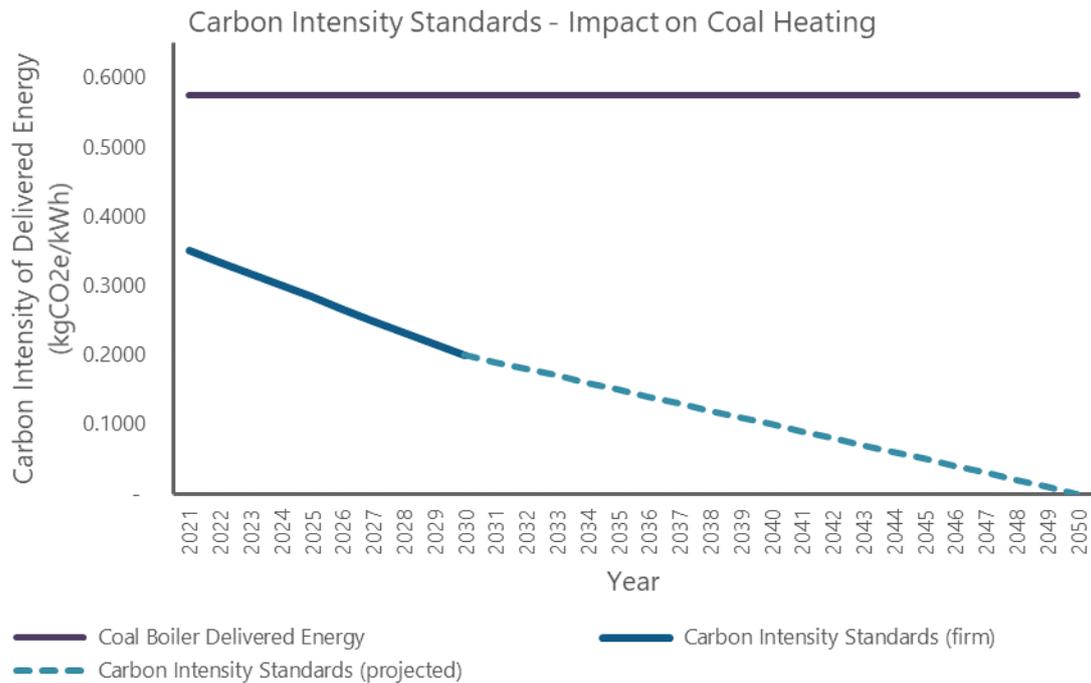


Figure 3: Coal Boilers Compared to the Carbon Intensity Standard

Due to the relatively high carbon intensity of coal, biocoal blends of up to 40% would still sit above the regulated level and so would not be allowed for replacement systems. The further blends that would be needed are shown in Table 2.

Table 2 -Biocoal Blend Proportions Needed Under the Carbon Intensity Standard

Biocoal Proportion	What year will this proportion be needed by?
20%	N/A
40%	N/A
60%	2028
80%	2037
100%	2048

Oil Boilers

Oil boilers are currently the main heating method used in off-gas grid homes with approximately 1.5m homes using oil as their primary heat source.¹⁰ Under the regulated level of the carbon intensity standard, they would be permitted to be installed with the conventional heating oil until 2024 (see Figure 4). After this point, the carbon intensity of delivered heat would need to be lowered for oil boilers to remain a viable option as we decarbonise heat.

Carbon Intensity Standards - Impact on Oil Heating

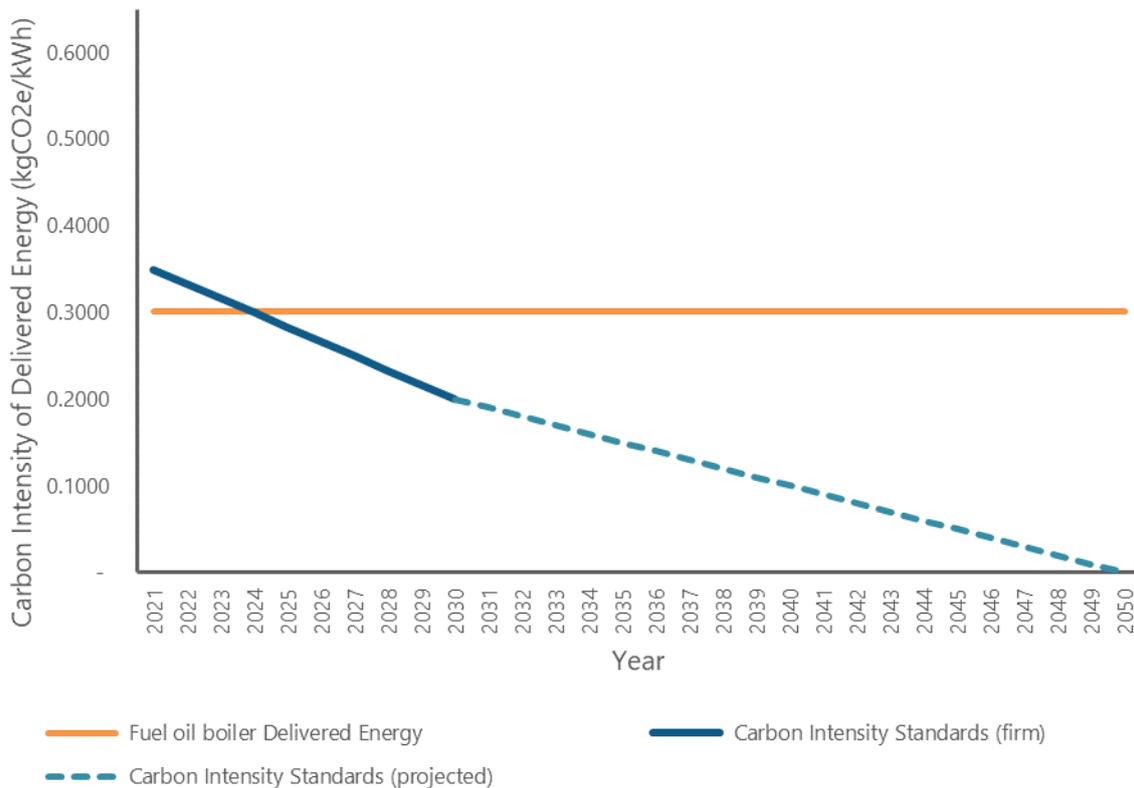


Figure 4: Oil Boilers Compared to the Carbon Intensity Standard

As a mature heating technology, the decarbonisation of oil boilers is more likely to be delivered through the development of a lower-carbon fuel rather than through improvements to boiler efficiency alone. The proportion of bio-oil (biodiesel considered in this case) would need to increase over time in the heating systems installed after 2024, the levels of which are shown below.

Table 3 - Bio-oil Blend Proportions Needed Under the Carbon Intensity Standard

Bio-oil Proportion	What year could this proportion be needed by?
20%	2028
40%	2032
60%	2038
80%	2044
100%	2050

LPG Boilers

LPG boilers are used in around 193,000 off-gas households in Great Britain, equating to around 5% of all off-gas grid homes¹¹. Under the regulated level of the carbon intensity standard, installations would be allowed in their current form until 2028 (see Figure 5).

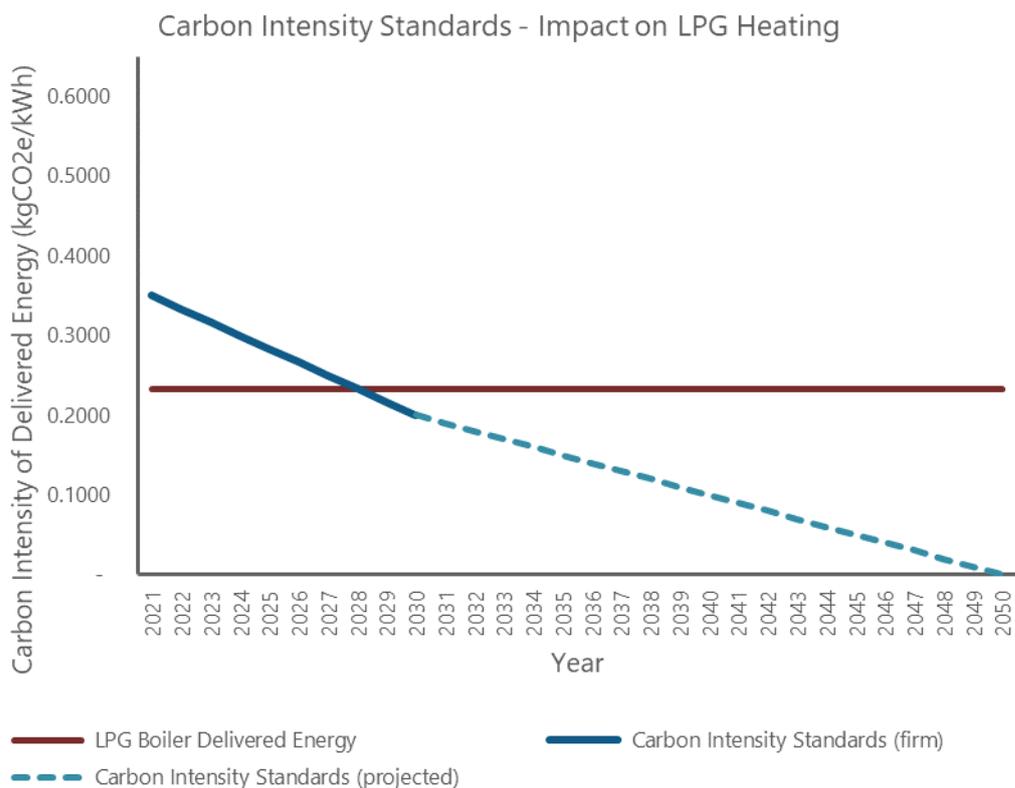


Figure 5: LPG Boilers Compared to the Carbon Intensity Standard

Again, the technology is well established and scope for potential efficiency improvements is limited, so boilers installed beyond this point will require bioLPG blends of fuel (see Table 4).

Table 4 -LPG Boilers Compared to the Carbon Intensity Standard

BioLPG Proportion	What year could this proportion be needed by?
20%	2030
40%	2033
60%	2037
80%	2040
100%	2044

Biomass Heating

Biomass is considered a low-carbon fuel so should be viewed as an important part of the decarbonisation mix. The use of biomass in heating can come through several heating technologies. This means that emissions can be further reduced through the use of more efficient methods of combustion. Despite the range in efficiencies between the technologies, biomass consistently offers carbon savings in the near term that fall well below the regulated level. With more efficient methods, such as biomass pellet boilers, the level of emissions today would be compatible up to the late 2040s based on the potential projected standards post-2030 (see Figure

6). After this point, alternative lower carbon or more efficient combustion methods may be needed.

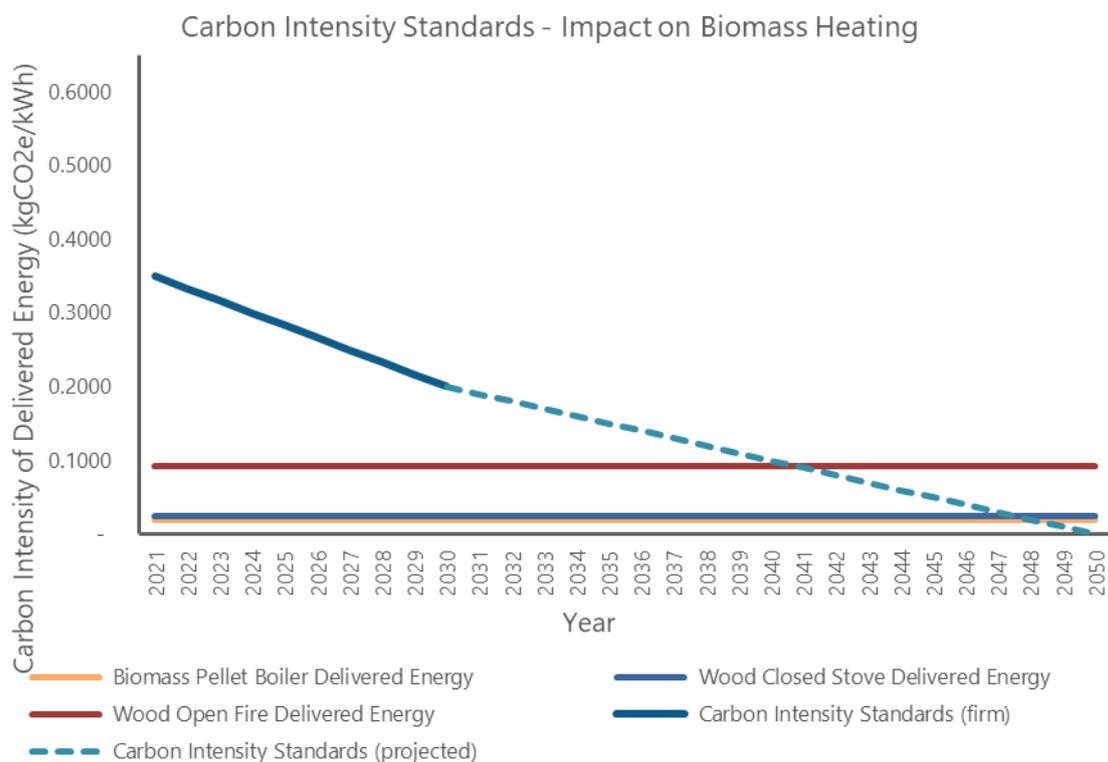


Figure 6: Biomass Heating Methods Compared to the Carbon Intensity Standard

Hybrid Heat Pumps

Hybrids work by combining the carbon saving provision from heat pumps with the use of a back-up boiler. They are normally designed with the heat pump taking the majority of the heating load and the boiler providing heat at times of very high demand or when price signals are favourable to do so. The sophistication of hybrid technologies can vary considerably, from fully integrated 'smart' communication between the two systems to two 'packaged' systems that the consumer selects when to switch on and off.

With hybrid systems installed, considerable carbon savings would be immediately achieved. Under the regulated level of emissions, they would be compliant well after 2030 (see Figure 7). It may also offer a diversified approach to the decarbonisation of heat, as advised by the CCC in their route to net-zero.¹²

Due to the variability in operation between hybrid systems, a generalisation has been taken for the average heat load of a heat pump in a hybrid system; the hybrid systems have been modelled with the heat pump taking an 80% share of the heating load.¹³ This variation between systems will have to be accounted for when considering hybrid heat pumps under this regulation. For example the different heating technologies of the hybrid might have to pass separately, removing the need for any load share considerations (see Feedback Questions).

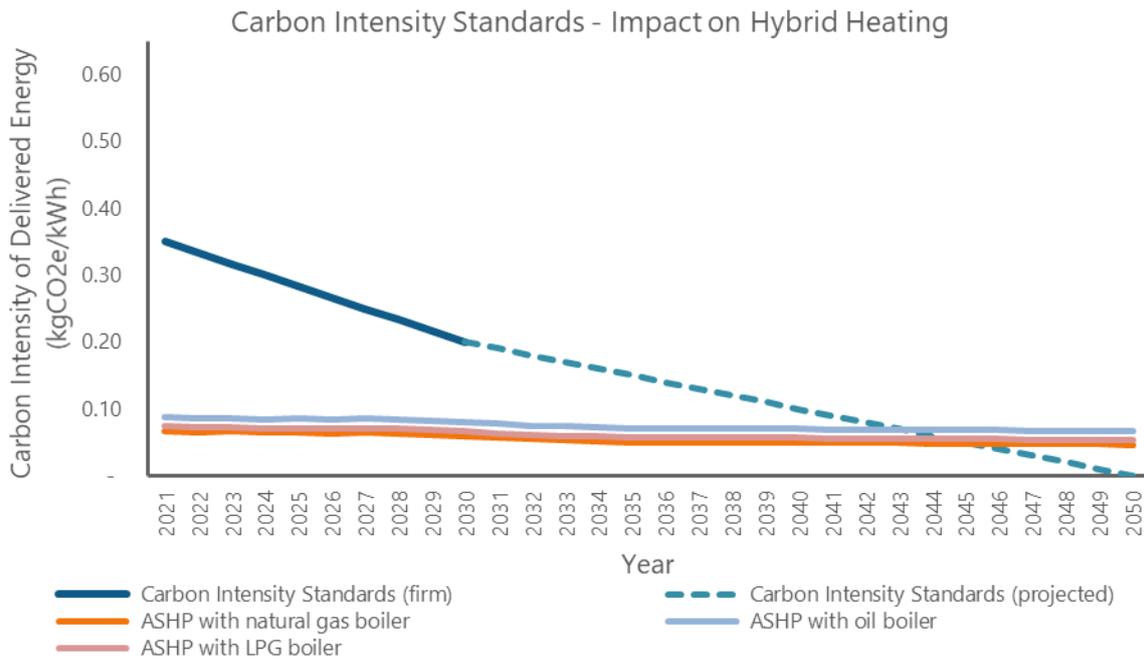


Figure 7 1: Hybrid Heat Pumps Compared to the Carbon Intensity Standard

Electric Heating

The increase in renewable electricity generation over the past decade has been a huge success story in the UK's decarbonisation to date. Decarbonisation of the electricity grid looks set to continue, meaning that electricity will become an increasingly clean power supply for heating.¹⁴

Under the proposed regulation, both direct electric heating and heat pumps are on a trajectory that is predicted to be within the requirements of the carbon emissions intensity standard until close to 2050 (see Figure 8). This is based on currently electricity decarbonisation projections. If the full decarbonisation of the electricity supply is achieved, electric heating would of course be net-zero compatible in 2050.

Carbon Intensity Standards - Impact on Electric Heating

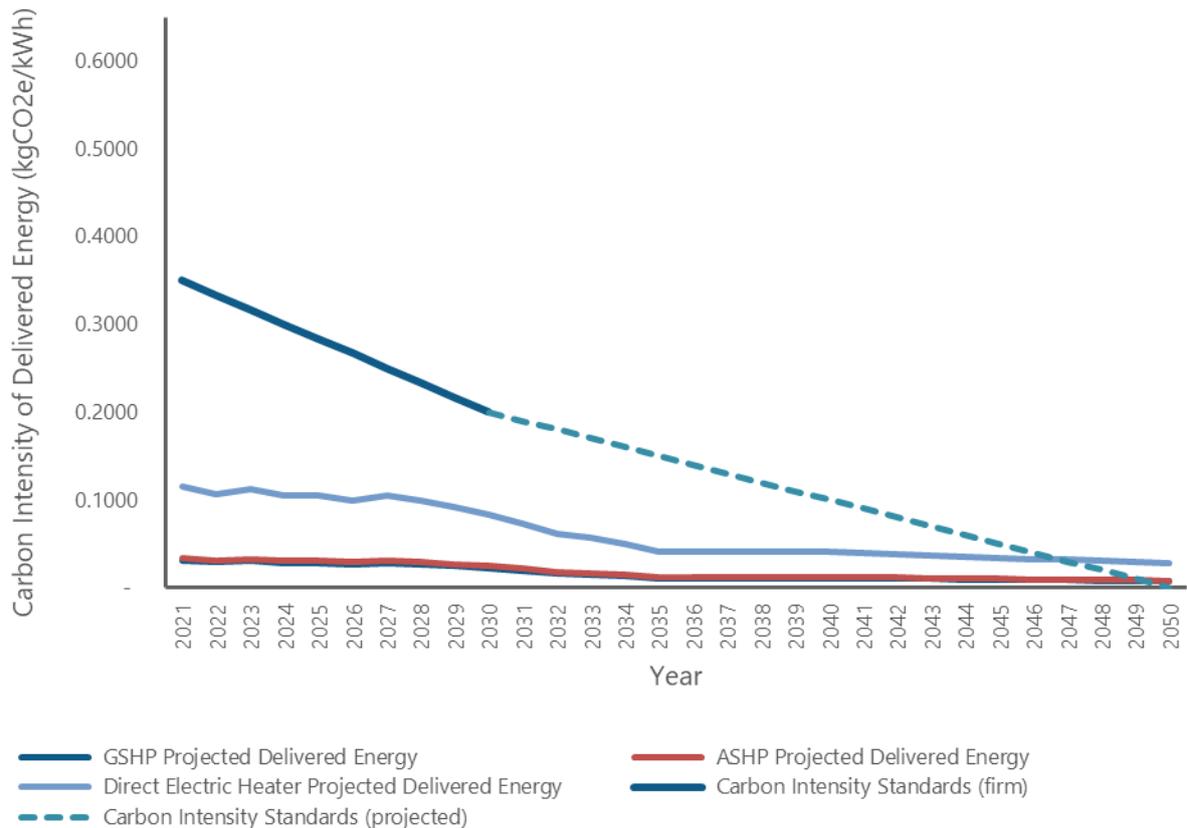


Figure 8: Electric Heating Methods Compared to the Carbon Intensity Standard

Natural Gas Boilers

Natural gas boilers currently form the vast majority of all heating systems in the country and are reliant on the fuel being delivered through the gas network. The gas supply could be decarbonised through the introduction of hydrogen or biomethane blends. Currently, these can only be blended to a certain extent due to feedstock or technical constraints. Recent trials have shown that hydrogen can be blended into the natural gas supply up to 20%¹⁵, but it is believed that the feedstocks required to supply the whole gas grid with biomethane are not realistic, limiting its potential to around 5% of UK gas consumption.¹⁶

The homes currently heated using the gas grid will need to decarbonise, regardless of the approach taken, in order to meet net-zero. This means a decision about the future of the gas grid must be taken before 2030 and ideally in the mid-2020s, as advised by the CCC (see Figure 9).¹⁷

The roll out of hydrogen through a regionalised approach of industrial clusters is an option currently being explored for the decarbonisation of the gas grid. If a regionalised industrial cluster approach is adopted it is likely to allow some properties to continue utilising natural gas boilers for longer than others, making the universal approach offered under the carbon intensity standard more complicated.

As shown in Figure 9, the 2030 carbon intensity level proposed would mean that homes on natural gas boilers would be unable to be installed as like for like heating systems replacements after this point if the gas grid does not decarbonise in the region. Ahead of 2030, the applicability of using the carbon intensity standard towards 2050 should be discussed and the use of exemptions in

areas identified as suitable for hydrogen considered. To completely devolve the exemptions process to local authorities risks overly fragmenting the regulatory landscape for industry. To maintain coherence, exemptions could be granted by an independent body and only apply to larger areas such as combined authorities or industrial clusters with significant potential for hydrogen.

Carbon Intensity Standards

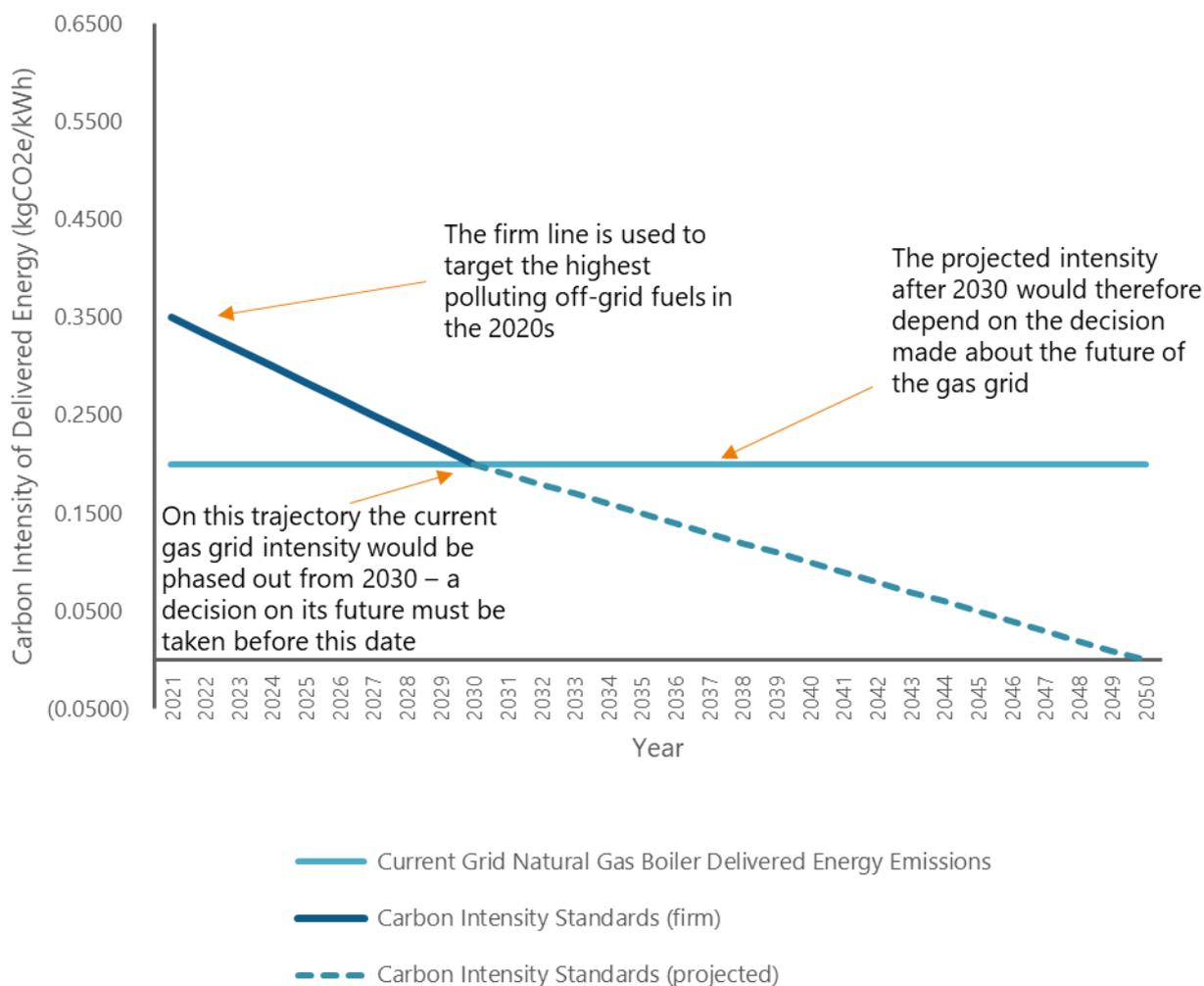


Figure 9: Future of the Gas Grid with a Carbon Intensity Standard

Wider policy context

The adoption of the 2050 net-zero target necessitates huge changes to the way that we heat our homes. However, large and widespread reductions in energy demand will also be crucial. By 2030, energy efficiency measures to reduce the average heat demand of homes by 35% could be needed alongside this regulation to meet the Fifth Carbon Budget. The SEA advocates a 'wrap then heat' approach to delivering low-carbon homes, ensuring that energy efficiency is of a high standard before installing low-carbon heating to minimise demand, reduce waste and ensure that heating systems are sized appropriately.

Reducing emissions from homes across the UK will play an important role in meeting the UK's Fifth Carbon Budget and this will come from both reducing demand and deploying low carbon heating.

The CCC have recommended that to meet the Fifth Carbon Budget, heating emissions from the average home will need to fall to 1.89tCO₂e per year.¹⁸ Further to the aspiration of making all homes EPC Band C by 2035, the UK Government has committed to phasing out fossil fuel heating in homes off the gas grid throughout the 2020's yet no clear pathway exists for achieving this level of emissions reduction. In new homes, the Future Homes Standard will prevent the installation of fossil fuel heating systems in new homes built from 2025 and the proposed uplift to standards in Part L of the Building Regulations in 2020 should increase the thermal efficiency of buildings.

The implementation of a standard such as the carbon intensity regulation should help to take these policy changes one step further by providing a clear trajectory for all property owners. The regulation will also provide the cornerstone for a robust and supportive policy framework to be developed.

The SEA recognises that the regulation alone may not be enough to reduce the average emissions sufficiently and needs to be accompanied by energy efficiency upgrades to the UK's building stock. The regulation should also be complemented by financial support and robust enforcement mechanisms to incentivise consumers and mitigate potential gaming.

The introduction of incentives to encourage households to considerably lower heating demand and switch away from conventional methods to available heating technologies that can immediately reduce emissions will be essential to drive early adoption. Without incentives the regulation could increase demand for spare parts as consumers look to extend the life of their current heating system, rather than upgrade it to a compliant low-carbon alternative. To offset any shift towards incrementalism, a new boiler scrappage scheme could be implemented to support consumers with the upfront capital cost of upgrades. The Heat Pump Association recently published a report¹⁹ outlining proposals for such a scheme, which the SEA fully supports.

The carbon intensity regulation may encourage consumers to move to electric heating solutions because electricity now has a lower carbon emission factor than natural gas and higher primary energy than gas. It does however currently have a higher cost than natural gas so there is a risk that vulnerable consumers might be adversely impacted if they install solutions which reduce emissions and carbon targets but lead to higher bills. Recognising the Government's targets on reducing fuel poverty, the regulation should therefore include an affordability metric. This metric could take the approach outlined in the Future Homes Standard consultation, for a Householder Affordability Rating encompassing the notional heat demand of the building. However, it is anticipated that testing of the metric in practice would differ from the current proposal for new builds in Part L, which is tied to EPC assessments. For example, if a heating system replacement was a distressed purchase i.e. the consumer had no heating, an affordability assessment could be designed to be carried out by an installer on-site.

However, there is a need to ensure high awareness of the standards within the installer base. The introduction of this regulation and the transition to low carbon technologies will require a level of upskilling and increased understanding of carbon intensity. Many installers are likely to need to retrain in the installation of lower carbon alternatives over the 2020s. Policy and incentives need to be accompanied by a strong enforcement framework with measures available to penalise non-compliant installations. Installers could be supported by the development of resources that allow users to ascertain the replacement fuel type based on the current heating system and vice versa.

Regulating enforcement and ensuring traceability will be important to the success of the carbon intensity regulation. The creation of Buildings Passports could include information on the heating system, fuel type, installation and due replacement dates, and installer details. Product traceability in the built environment sector is underdeveloped when compared to other industries and a Buildings Passport could create a 'golden thread' transferrable between current and future owners, as recommended in the Hackitt Review. It could also provide an evidence base to inform other policy areas.

In addition, reporting on in-use performance is needed to ensure properties and heating systems perform as specified, with corresponding redress measures for consumers who are adversely affected by poor quality installations of replacement carbon heating systems.

Next Steps

The government must set out a clear roadmap to the decarbonisation of heat. Regulation in the form outlined will provide confidence to the market by providing a clear trajectory to work towards, ultimately with the aim of reducing carbon from the heating and hot water provision of homes, which forms 20% of the UK's total emissions²⁰. It will provide clear direction, encourage developments in biofuels, and increase uptake of readily available low carbon heating systems. The carbon intensity regulation should be implemented alongside a number of actions that will help to improve the UK housing stock's energy efficiency and encourage uptake of low-carbon heating.

The regulation outlined in this paper will help set the trajectory towards achieving the Fifth Carbon Budget. Crucially our analysis suggests that from 2035 only low carbon heating systems should be installed to meet the net-zero target. This means that any heating system installed from this point onwards is expected to provide heat with zero emissions in 2050.

It is recommended that the government consults on the introduction of a carbon intensity regulation to support the phase out of fossil fuels in off gas grid homes. This paper provides an indication of how a regulatory framework could be introduced and the impact it could have on the phase out of certain technologies. We are seeking views on this approach and will further develop the proposals based on feedback.

Feedback questions

The SEA would welcome feedback on the regulatory approach detailed in this paper and we invite and encourage industry stakeholders to respond to the below questions.

Questions on which we are seeking feedback:

- Do you have any suggestions for how an incentive scheme could be administered in a way that is complementary to the regulatory approach detailed above?
- There is a need for a system efficiency measure but only the heating product is benchmark tested at present. What should be included within a system efficiency measure/metric?
- How could a carbon intensity regulation be adequately enforced?
- How could an affordability metric be formed and administered?
- Should the installation of back-up boilers, as part of a hybrid heat pump system, have to comply separately with the standard?

- With this carbon regulation in place what else is required to ensure the carbon emission reduction is delivered?

Any other comments on the recommendations or themes discussed in the paper are welcome. In providing your answers to the above questions or any other comments, please be as specific as possible and explain your answers thoroughly so we can take them into account.

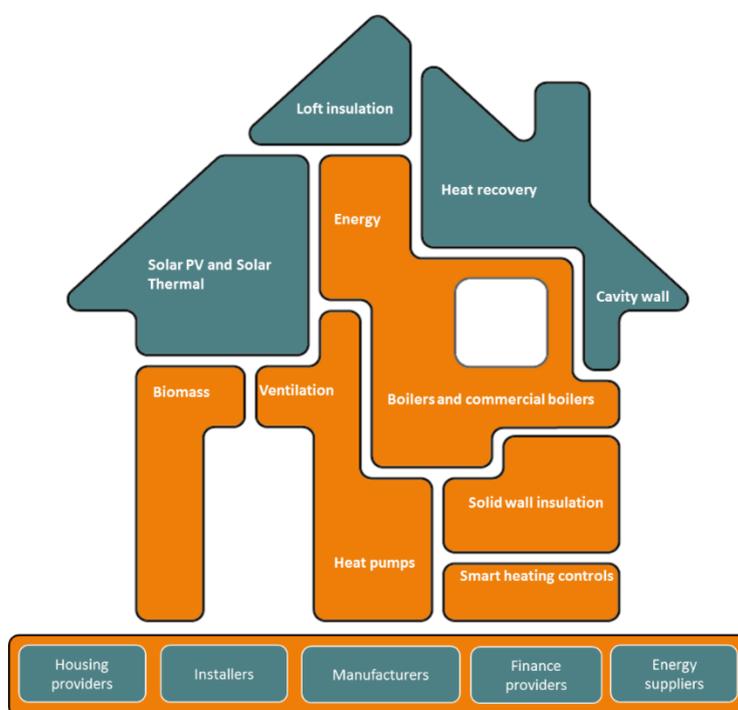
Please send us your comments by 12 February to info@sustainableenergyassociation.com.

About the Sustainable Energy Association

In a world of finite resources, the Sustainable Energy Association exists to help create living and working spaces fit for future generations. Our work seeks to align the interests of business, politicians and consumers to make this a reality.

We are industry leaders in energy in buildings. We are technology agnostic and provide objective, evidence-based policy positions which help shape how we think about, generate and use energy. We are constructive, collaborative and committed to achieving our vision, by ensuring that buildings are energy efficient, low carbon and warm.

The Sustainable Energy Association (SEA) is a member-based industry body. We draw on our wide-ranging membership from manufacturers of energy saving technologies and heating systems to housing associations with an interest in sustainable energy. SEA member's manufacture, distribute, install, retail or regulate a range of technologies, they also own and manage homes and supply energy. We take an objective 'whole building, technology agnostic approach' that recognises that there is no single solution to the energy challenges faced by the UK.



Appendix: Data Tables

Conversion factors		Value	Units
DEFRA	LPG	0.2145	kgCO ₂ e/kWh
DEFRA	Natural gas (current grid)	0.1839	kgCO ₂ e/kWh
DEFRA	Natural gas (100% mineral blend)	0.1844	kgCO ₂ e/kWh
DEFRA	Fuel oil	0.2678	kgCO ₂ e/kWh
DEFRA	Coal (domestic)	0.3447	kgCO ₂ e/kWh
Assumption	Biocoal	0.0131	kgCO ₂ e/kWh
DEFRA	Biomethane	0.0038	kgCO ₂ e/kWh
DEFRA	Wood (logs, chips and pellets)	0.0156	kgCO ₂ e/kWh
DEFRA	Biogas	0.0002	kgCO ₂ e/kWh
DEFRA	Electricity (current)	0.2556	kgCO ₂ e/kWh
BEIS	Electricity (projected up to 2050)		kgCO ₂ e/kWh
French Gov	BioLPG	0.0600	kgCO ₂ e/kWh
DEFRA	Biodiesel	0.0035	kgCO ₂ e/kWh
Design Efficiencies			
BEIS	ASHP	3.4000	SPF
BEIS	GSHP	3.7000	SPF
BEIS	Gas boilers	0.9200	COP
BEIS	Oil boilers	0.8900	COP
Assumption	Direct electric	1.0000	COP
DECC	Biomass Pellet Boiler	0.8000	COP
DECC	Wood Closed Stove	0.6500	COP
Assumption	Coal Boiler	0.6000	COP
DECC	Wood Open Fire	0.1700	COP
Hybrid Proportions			
WWU	Heat pump proportion	80.00%	

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