REA & WHA response to BEIS consultation on Renewable Heat Incentive: Biomass Combustion in Urban Areas

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.

General Comments

The REA and WHA support the Government's aim to improve air quality; however, the proposals to ban RHI support for biomass combustion in urban areas will be counterproductive. It will needlessly limit options for the decarbonisation of heat, especially in larger public and private sector buildings, while negatively affecting the Government's ability to meet its decarbonisation targets. Rather than the blunt intervention stopping support for urban biomass RHI installations, the Government should be focused on promoting and enforcing quality standards. This will ensure the deployment of biomass boilers in urban areas fitted with high-performance filters that appropriately address the emissions concerns raised by the draft Air Quality Strategy.

In Appendix I of this consultation, we attach a briefing sheet which provides further context for considering air quality and biomass heating, highlighting what is already achievable and where policy attention would be best placed when it comes to addressing air quality concerns. We encourage BEIS to consider these points and would welcome the opportunity to come in and discuss these issues directly with the RHI team to provide a fuller context to these proposals.

In Appendix II, we attach a summary of a short industry survey conducted during the consultation by the WHA, which sought to capture a snapshot of the impact that the proposals will have on the modern biomass industry. In short, whilst the impact on pipelines varies between organisations, respondents highlighted that, on average, 40% of their project pipeline could be affected by the consultation's proposals. In addition, should the proposals come into effect as of January 2019 (as suggested by the Impact Assessment), they will cost respondents an illustrative average of nearly £2.2 million in lost sales (with some companies, who focus on larger scale projects, suggesting losses of £10-20 million). For further information, please see Appendix II (attached).

The consequences of the reforms illustrated by the WHA survey are substantially different from that of the governments Impact Assessment (IA), based on historic RHI deployment data. This, in part, is due to the IA failing to account for the RHI reforms that have come into force over the last twelve months. Most notable are the changes made to biomass tariff levels which now favour larger plants running for longer hours. This has reduced the

attractiveness and economic feasibility of smaller, rural schemes, impacting deployment for off-gas grid properties to such an extent that is clearly visible in today's deployment statistics.[1] Now, the new proposals threaten to remove customers in urban, on-gas grid areas where industrial users, requiring larger installations, are predominantly located. Commercial applications include properties like hotels, leisure facilities, care homes, as well as public sector applications, such as health and education facilities, public swimming pools, council offices and innovation in district heating schemes. The proposed changes render larger users, which are now reacting to the recent reforms and constitute a share of sector growth potential, ineligible for support.

Furthermore, the emissions values from such applications, as of December 2018, will already be tightened for larger scale biomass boiler projects under the Medium Combustion Plant Directive (MCPD), requiring the industry to already meet new SO_2, PM_x and NO_x emissions levels. The industry is geared up to do this and a range of filter technologies are available to ensure new emission standards are met within commercial projects, undermining the need for these prohibitive proposals.

The consultation also ignores experience from every other developed country which has seen the successful deployment of biomass heating across their economy. In Europe, biomass heating in homes and industry has contributed to significant progress towards decarbonisation – in Sweden, for example, almost every town and city has a district heating system, providing heat to domestic properties and steam to industry. Two-thirds of the plants have switched from oil or gas to biomass, and 90% are Combined Heat and Power plants. In Germany, support is tiered on the basis of the emissions profile (efficiency) of systems, ensuring that the highest levels of subsidy support are only awarded to the best-performing systems. This also ensures that capital costs associated with installing performance-enhancing technology, such as ceramic or ESP filters are reflected in tariff payments received. Under the long-running renewable energy support schemes in Germany, grants are not only provided to those installing a biomass system on a €/installed-kW-basis, but they are also 'topped up' where the installation meets certain enhanced emissions criteria. These include the provision of a minimum number of litres of buffer capacity in the system, the installation of flue gas clean-up technology such as a bag filter or ESP, hydraulic optimisation of the system and certificated testing. Furthermore, additional support of up to 50% of the basic grant can be awarded if the building it's being installed in is efficient, and a further 10% of the basic grant can be awarded to improve the efficiency of the heating system in the building. This combination of measures drives installations which are appropriately sized optimised for efficiency and which are suitably clean for urban areas.[2] Far from restricting biomass heat use in urban areas, other countries in Europe are ensuring their support mechanism incentivise the application of the cleanest technologies with the lowest emissions, recognising the role biomass has to play in decarbonising heat.

Excluding new RHI installations in urban on-gas-grid areas will also not address the fact that in some locations, excluding background concentrations, peak emissions from domestic

[1] RHI Statistics (2018) https://www.gov.uk/government/collections/renewable-heat-incentive-statistics
[2] BAFA (2018) Heating with renewable energies https://translate.google.com/translate?sl=auto&tl=en&js=y&prev=_t&hl=en&ie=UTF-8&u=http%3A%2F%2Fwww.bafa.de%2FDE%2FEnergie%2FHeizen_mit_Erneuerbaren_Energien%2FBiomasse%2Fbiomasse_node.html&edit-text=&act=url

fireplaces and inefficient stoves (commonly used as secondary heating for aesthetic reasons as well as comfort) are thought to contribute up to 31% of the concentrations in air of $PM_{2.5}$, particulate matter harmful to health[3]. These forms of heating are meant to be regulated by Clean Air Zones and DEFRA Exemptions, both of which are currently poorly enforced and their remains low public awareness about the legal requirements amongst both suppliers and users. As recognised by the consultation itself, emissions from wood-fuelled biomass-boilers, by comparison, are far smaller and controllable through the use of high-performance filters (See Appendix I for further data). Indeed Biomass boilers are already strictly regulated in terms of their particulate emissions – without which they would not be eligible for the RHI.

The industry is also greatly concerned about the negative and unjustifiable message the proposals send the public about the impacts of renewable, low-carbon biomass heat technologies. While a total ban on biomass boilers in urban areas is not being proposed, only the support for such projects, this is not the message that is sent to the public. BEIS's own impact assessment acknowledges that the proposals would have a negative effect on the deployment of such technologies. The decarbonisation of heat is the biggest challenge the energy sector faces when it comes to meeting our carbon targets. Biomass is recognised as having a key role to play in meeting our climate obligations by the CCC, IEA and IPCC. At the same time, the range of technological filters available today means that there is no need to pit low emissions against carbon savings - both aims are perfectly achievable where the correct emission standards are put in place. The removal of support for biomass in urban areas sends a damaging message that biomass heat is universally bad, taking the UK further away from its climate goals.

Overall, the WHA and REA oppose the introduction of the ban on RHI support for urban biomass projects, yet do support action on air quality. As such we recommend Government:

- Focus on the implementation of both emission standards and enforcement activities for urban biomass projects. The industry will be able to respond to these standards with projects that include high-performance filters. This will address both emission concerns and be more effective in enabling the UK to meet carbon obligations.
- Enforce regular maintenance checks on urban biomass boilers, which are properly evidenced, so as to ensure they are running at the highest level of performance.
- Address the broader problem of ensuring that existing regulation, such as Smoke Control Areas and Defra Exemptions, are complied with and that the rules are well understood by suppliers and consumers of wood fuel.

[3] Fuller et al. 2017, pg. 4 https://uk-air.defra.gov.uk/assets/documents/reports/cat05/1801301017_KCL_WoodBurningReport_2017_FINAL.pdf

Answers to Consultation Questions

1. Does your interest in the RHI relate to the operation of the scheme in a particular geographical area? (indicate all those that apply)

a) England - yes
b) Wales - yes
c) Scotland - yes

2. a) Do you agree with the proposal to remove RHI support for biomass in urban areas off the gas grid? No.

b) Please provide any available evidence in support of your response.

The REA and WHA welcome and support the Government's aim to improve air quality. In particular, we consider it sensible to reduce levels of PM_x given their capacity to damage human health. This being said, Appendix II, highlights a summary of an industry survey conducted by the WHA, which captures the impact proposals to remove support for biomass combustion in urban areas would have on the modern biomass industry. In short, and whilst the impact on pipelines varies between organisations, respondents highlighted that, on average, 40% of their project pipeline will be affected by the consultation's proposals. In addition, should the proposals come into effect as of January 2019, they will cost respondents an estimated average of £2.2 million in lost sales (with some companies projecting losses of £10-20 million), and £5.4 million in non-recoverable funds. For further information, please see Appendix II (attached).

As such, rather than banning biomass combustion from the RHI in urban, on-gas-grid areas entirely, we would make three main recommendations:

Firstly, that biomass boilers are fitted with appropriate particulate filtration systems. There are a number of options whose implementation can ensure that the low levels of particulate emissions produced during biomass combustion are not released into the atmosphere. This includes the use of bag houses – heat-resistant fabric filters which have an extremely high particulate collection efficiency (quoted at 99% or above[4,5]). Ceramic filters are quoted in DEFRA's 2018 Air Quality Expert Group report on *The Potential Air Quality Impacts from Biomass Combustion* as removing PM_x and NO_x with an efficiency rate of 99%[6] . Another type of filter is an Electrostatic Precipitator (ESP) which removes particulate matter from gas using an electrostatic charge. Our members have noted that ESPs are increasingly used on biomass installations and, as such, the barriers to wider uptake are likely very low. While it is recognised that the use of such filters will raise the cost of projects, making the commercial

[4] USEPA (1998) Particulate Matter Controls, pg.1.4 https://www3.epa.gov/ttncatc1/dir1/cs6ch1.pdf
[5] ASTEC (1999) Baghouse Applications, pg. 4 https://www.astecinc.com/images/file/literature/Astec-T-139-Baghouse-Applications-EN.pdf
[6] DEFRA (2018) Air Quality Expert Group report on The Potential Air Quality Impacts from Biomass Combustion, pg.51

viability of projects under the RHI more difficult, if emission standards are set at the right level the industry will respond and be able to deliver commercially viable projects. Thus, instead of banning support for biomass combustion outright, the Government could limit RHI eligibility in urban areas (or more appropriately, Clean Air Zones) to units with filtration systems such as ESPs. This would have the effect of ensuring very low emissions from biomass combustion and therefore improve ambient air quality.

A number of WHA members have submitted certificates demonstrating the very low emissions that can be achieved through modern technologies. These anonymised values in the below table are illustrative of the emission levels being achieved by technologies that are currently available and being installed in the UK and Europe. We have encouraged members to submit these emission certificates directly to BEIS within their own responses and would also encourage BEIS to look across all the available technologies to understand the range of emission values that are being achieved. BEIS should aim to set appropriate standards, in line with what is already available, to ensure appropriate technologies are the ones being installed in urban areas:

Sample Number	Particulate Matter (g PM/GJ)
1	18.8
2	1.8
3	0.6
4	1.0
5	1.0
6	7.9
Average	**5.183333333**
RHI PM ELV	**30**

Secondly, domestic biomass boilers should have regular maintenance checks mandated. This way, poor performance, decreased efficiency and higher particulate emissions associated with sub-optimally maintained systems can be avoided. This will ensure that only the highest performance biomass boilers are supported on the RHI.

Thirdly, address the broader problem of ensuring that existing regulations, such as Smoke Control Areas and Defra Exemptions, are complied with and that the rules are well understood by suppliers and consumers of wood fuel. This will address the primary sources of such dangerous emissions such as fireplaces and inefficient stoves (see Appendix I).

3. a) Do you agree that for the purposes of this restriction, the criterion should be based on being both urban and having access to the gas network? No.

b) Please provide any available evidence in support of your response.

We believe that the criterion for RHI-exclusion should be based, initially, on a failure to demonstrate emission values within those parameters set by the RHI and the MCPD as of

December 2018. Secondly, that it should pivot on the provision of evidence (e.g. invoices or certificates) showing regular maintenance checks. This should be an ongoing obligation of urban biomass accredited to the RHI. Please note that a proposal of maintenance periodicity is included in Section 7b).

The REA and WHA largely agree with the boundaries set out by this consultation in relation to 'urban' and 'on the gas grid'. This being said, it is worth pre-empting an issue with such categorisation. Should 'on the gas grid' be used as an uncompromising filter, it risks capturing those households for which, although in reach of the gas grid, it is economically unviable to secure connection. Where such cases are found, there should be the option for households to provide proof that they are unable to connect, much like there are existing provisions for those wishing to install a septic tank rather than connect to the mains sewage system. The Government should also consider the capacity of renewable alternatives to fulfil the heating needs of an average urban household. Of these, we believe that the heat demand of an existing property (i.e. not an ultra-efficient, new build) is likely best served by a small domestic pellet boiler, as opposed to a GSHP, for example. As such, this response questions whether the Government wish to so bluntly exclude support for modern renewable biomass from urban areas. The use of appropriate emissions standards would resolve this issue, allowing the installation of biomass systems where appropriate and still ensuring low emission values.

4. a) If 'you have answered No' to Question 3, what method would be more appropriate and why?

We believe that mandated regular maintenance checks can ensure that RHI biomass boilers in urban areas are air quality compliant. Given currently numbers of urban, on-gas-grid biomass boilers, as noted in the consultation, the proposed maintenance checks should generate a relatively low administrative burden and are a worthwhile trade-off compared to the carbon savings lost by simply excluding all biomass boilers from urban areas.

b) How could this criterion be verified by Ofgem?

The maintenance checks of biomass boilers would require the submission of stronger evidence by accredited individuals (e.g. maintenance invoices/certificates) to Ofgem. This would highlight any installations which fall outside of RHI/MCPD air-quality compliance and these cases would then have an enquiry opened against them pending improvements within a fixed term.

c) Please provide any available evidence in support of your response.

The same system of providing evidence as part of the RHI is already in place through the provision of emissions testing certificates, ensuring that biomass plants meet the requirements stipulated in RHI legislation. In addition, we may look to Germany for guidance where the Association of Chimney Sweeps twice a year officially signs-off the cleaning and maintenance of installations. A similar independent body of biomass maintenance

professionals could provide the necessary evidence to Ofgem as concerns the fulfilment of this ongoing obligation.

5. a) Should installations that comply with stricter emissions criteria, such as those, under the Medium Combustion Plant Directive be included in this proposal? No.

b) Please provide any available evidence in support of your response

In the context of air quality, the REA and WHA argue that for biomass installations with a larger thermal input, these proposals are unnecessary. As of December 2018, the Medium Combustion Plant Directive (MCPD) comes into force, which regulates pollutant emissions from the combustion of fuels in plants with a rated thermal input equal to or greater than 1 megawatt (MWth) and less than 50 MWth. Included in this, is the regulation of SO_2, NO_x and particulate matter.[7] In fact, the Government has itself stated that the new regulations under MCPD are expected to produce a 43%, 9% and 22% reduction of emissions for SO_2, PM_x and NO_x, respectively.[8] Importantly for this consultation, the MCPD gives *lower* limits of emitted particulates than is currently required under current RHI emission certificates and will cover all boilers from 1MWth. In the context of urban air quality from biomass then, this legislation alone will limit emissions by requiring PM_x abatement technologies to be fitted, so as to comply with the revised emission limits.

6. a) Should biogas combustion remain eligible without geographical restriction?

Yes

(b) Please provide any available evidence in support of your response.

Excluding biogas combustion in urban areas goes directly against the UK's need to urgently address food waste. One of the most effective renewable energy technologies for dealing with waste is Anaerobic Digestion (AD), which produces methane-rich biogas from an organic feedstock. From an AD perspective, biogas production requires the input of organic matter, often derived from municipal and domestic food waste. Urban areas have comparatively high rates of food waste, given the density of households and industrial processes. Thus, ensuring that AD-biogas plants can be situated close to their feedstock supply reduces carbon emissions associated with feedstock transportation whilst also promoting a renewable, low-carbon industry.

Importantly, biogas plants are subject to air quality restrictions stipulated under the aforementioned Medium Combustion Plant Directive (MCPD). As previously mentioned, the MCPD gives *lower* limits of emitted particulates than is currently required under current RHI emission certificates. In the context of urban air quality from biogas then, this legislation

[7] MCP Directive http://ec.europa.eu/environment/industry/stationary/mcp.htm
[8] New Emission Controls will Help Improve Air Quality https://www.gov.uk/government/news/new-emission-controls-will-help-improve-air-quality

alone will limit emissions by requiring PM_x abatement technologies to be fitted, so as to comply with the revised emission limits.

7. a) Should existing biomass boilers installed under the RHI be required to have regular maintenance checks? Yes

b) Please provide any available evidence in support of your response.

If the argument here is to ensure that any new installations are air quality compliant, then there should also be a committed effort to regulate the emission levels from existing RHI biomass boilers. However, this should be limited to urban biomass boilers so as to reduce the administrative burden and only target those installations which are likely to have an impact on urban air quality.

If maintenance checks were to be mandated, then the REA and WHA recommend that proof should be required between 2-3 times per year for RHI-accredited systems (subject to consultation). Under this process, the participant would submit evidence (e.g. an invoice or certificate of maintenance) to Ofgem, who would then verify that the ongoing obligation has been met and that tariff payment may continue.

8. a) Do you have any other proposals on how to minimize the air quality impacts of biomass in the RHI? If so please provide further details here.

• Reducing the RHI emissions thresholds (e.g. particulate matter threshold from 30g PM/Gj to 15g). This is highlighted here because the AEA recently concluded that a large range of boilers are expected to meet the requirements of the RHI without the need for more expensive add-on particle abatement technologies[9]. A range of emissions factors for different boilers are provided in the report which varies from 3 g/GJ to 29 g/GJ, and hence within the limits set by the RHI (30 g/GJ). Thus, it is likely that with the addition of filtration technologies, a large number of modern systems would fall under a tightened PM threshold for the RHI. In addition, WHA and REA members have submitted emissions testing certificates indicating system performance well below the current RHI threshold (as low as 0.6g PM/Gj).

• Improving the current ongoing obligations of maintenance checks by moving from a self-declared to an evidence-based system (for example provision of maintenance invoices by participants).

• Tiered-support based on the emissions profile (efficiency) of systems. A similar system is used in Germany which ensures that the highest levels of subsidy support are only awarded to the best-performing systems. This would ensure that capital costs associated with installing performance-enhancing technology, such as ceramic or ESP filters are reflected in

[9] AQEG (2017) The Potential Air Quality Impacts from Biomass Combustion, pg. 51 https://uk-air.defra.gov.uk/assets/documents/reports/cat11/1708081027_170807_AQEG_Biomass_report.pdf

tariff payments received. Under the long-running renewable energy support schemes in Germany, grants are not only provided to those installing a biomass system on a €/installed-kW-basis, but they are also 'topped up' where the installation meets certain enhanced emissions criteria. These include the provision of a minimum number of litres of buffer capacity in the system, the installation of flue gas clean-up technology such as a bag filter or ESP, hydraulic optimisation of the system and certificated testing. Furthermore, additional support of up to 50% of the basic grant can be awarded if the building it's being installed in is efficient, and a further 10% of the basic grant can be awarded to improve the efficiency of the heating system in the building. This combination of measures drives installations which are appropriately sized, optimised for efficiency and which are clean.[10]

b) Are there any other issues you wish to raise with respect to RHI support for biomass in urban areas? If so please provide further details here.

There is a relevant, wider point here which considers the trade-off between air pollution and carbon emissions. To meet the long-term requirements of decarbonising the energy system and the UK economy, it has been established by the Climate Change Committee that heating needs to be completely decarbonised by 2050. Whilst the REA and WHA accept that even modern, correctly installed and properly maintained biomass boilers do contribute to particulate emissions, the difference in *carbon emissions* is enormous. A parliamentary briefing from the Office of Science and Technology noted that gas boilers release between 210-380gCO_2eqkWh, whereas most biomass boilers are below 100gCO_2eqkWh[11]. Given the need to urgently decarbonise domestic heating and stay on track for the UK's 2050 carbon targets, it seems wholly irresponsible to both penalise and restrict support for an effective, affordable and already deployed renewable heating technology. Instead, we argue that urban biomass boilers should be subject to regular, stringent maintenance checks, as outlined in Sections 2b) and 7b).

More generally, the REA and WHA would like to reiterate the importance of biomass to decarbonising heat in the UK. Both now and in the medium- to long-term, policies to decarbonise heat using technologies such as biomass will be required in order to meet our carbon targets, and they will likely need to operate in areas where there is mains gas. As such, the proposals set out in this consultation threaten to stifle the speed and efficacy with which we can decarbonise, in particular, urban heat use. Again, instead of banning biomass combustion in urban areas, Government should consider appropriate emission standards and regular maintenance checks for the small proportion of urban RHI biomass installations in operation. This would enable action to be taken against those installations which are noncompliant.

In a recent, separate consultation response, the REA responded to DEFRA's concerns surrounding cleaner domestic burning of solid fuels and woods. Although the current

[10] BAFA (2018) Heating with renewable energies
https://translate.google.com/translate?sl=auto&tl=en&js=y&prev=_t&hl=en&ie=UTF-8&u=http%3A%2F%2Fwww.bafa.de%2FDE%2FEnergie%2FHeizen_mit_Erneuerbaren_Energien%2FBiomasse%2Fbiomasse_node.html&edit-text=&act=url
[11] Carbon Footprint of Heat Generation (2016), pg. 2
http://researchbriefings.files.parliament.uk/documents/POST-PN-0523/POST-PN-0523.pdf

consultation aims at biomass combustion in urban areas specifically, it is worth briefly reiterating that solid fuel sources for biomass, such as wooden pellets, are already managed under the Biomass Suppliers List (BSL) – adherence to which ensures eligibility for the Renewable Heat Incentive. In addition, two separate biomass-fuel certification schemes already exist in the UK: Woodsure and ENPlus. Both of these schemes set stringent conditions on the source and moisture content of fuel sources such as wood pellets, ensuring that they have below 10% moisture[12]. As the below Appendix shows, strict boiler emissions testing illustrates that 77.1% or 929 boilers accredited to the RHI have tested measured PM emissions at less than half the legal limit. Furthermore, nearly half of those tested (581 boilers) emit less than a third of the legal threshold.

Further to air quality concerns, several studies indicate the efficacy of intelligent boiler design in significantly reducing CO_2, NO_x and other pollutant emissions[13,14]. In particular, they highlight methods such as air staging, capable of producing 40% reductions in NO_x emissions from biomass combustion[15].

On this point, we would encourage BEIS to reconsider the EMEP/EEA data on which they have based their consultation proposals. We refer BEIS to the consultation response provide by AMP, who commissioned a study that calls into question the relevance of the EMEP/EEA data especially given that it is significantly out of date, not based on emission from systems located in the UK and includes only a few studies on wood burning. We do not believe the evidence provided on modern biomass boiler emissions is strong enough for BEIS and DEFRA to justify the proposals in this consultation.

That being said, even taking the data provided by EMEP/EEA the comparative advantage biomass boilers over fossil fuel systems and less efficient biomass systems is still demonstrated. In particular, despite variability across several installations, the comparison shows that a residential wood pellet boiler can release an equivalent amount of NO_x (g/Gj) as one fuelled by gas or fuel oil.[16] This begs the question as to why biomass boilers, in particular, are being targeted by these proposals. The data shows that at least on the metric of NO_x emissions, oil- and gas-fuelled boilers should be subject to an equivalent consultation proposing their exclusion from urban areas.

The same EMEP/EEA handbook makes it possible to compare emissions factors of other pollutants from open domestic wood burning to boilers and stoves fuelled by wood pellets. Across a range of metrics (NH_3, CO, NMVOCs, $PM_{2.5}$ and PM_{10}) it is clear that biomass

[12] ENPlus Handbook – Pellet Requirements https://enplus-pellets.eu/en-in/?option=com_attachments&task=download&id=145:ENplusHandbook_part3_V3
[13] Liu et al. (2013) Control of NO_x emissions of a domestic/small-scale biomass pellet boiler by air staging *Fuel* 103, 792 – 798

[14] Khodaei et al. (2017) Air staging strategies in biomass combustion-gaseous and particulate emission reduction potentials *Fuel Processing Technology* 157, 29 – 41
[15] Ibid.
[16] EMEP/EEA *Small Combustion Guidebook* pg.140, Table 3.51 https://www.eea.europa.eu/publications/emep-eea-guidebook-2016/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-4-small-combustion-2016/view

boilers emit significantly less than open domestic wood burning[17]. Namely, for CO, the measured upper limit on open fireplaces burning wood is 10,000 g/Gj, whereas for stoves and boilers burning wood pellets, it is 2500 g/Gj. For NMVOCs, the measured upper limit on open fireplaces burning wood is 3000 g/Gj, for stoves and boilers burning wood pellets it is only 30 g/Gj. Finally, for PM_{10} the measured upper limit on open fireplaces burning wood is 1680 g/Gj and for $PM_{2.5}$ it's 1640; whereas for stoves and boilers burning wood pellets the measured upper limits in testing on both PM_{10} and $PM_{2.5}$ is just 120 g/Gj. The above data demonstrates that modern biomass technology is comparatively very clean and therefore does not warrant exclusion from urban areas. This response directs readers back to our recommendations for the proper enforcement of existing regulations (such as Smoke Control Areas or DEFRA Exemptions), efficiency technology improvements (such as the fitting of ESPs) and mandated maintenance checks. These changes will ensure that the already low emission profiles of biomass technologies are made lower still, whilst providing renewable and low carbon heating for the future.

Given that the RHI is now geared towards supporting larger scale biomass projects, which will be covered by the imminent MCPD regulations, an additional point is that the majority of NO_x emission from biomass combustion is related to the nitrogen content in fuel (a small proportion is thermal NO_x created at during combustion). Our members provide systems fitted with 'Flue Gas Recirculation' (FGR) technology that meets the MCPD limit of <282mg/Nm3 NOx, even with fuel containing up to 0.44% nitrogen content (e.g. all virgin biomass). Furthermore, these high-performance levels can be achieved *without* the need for fitting systems with Selective Non-Catalytic Reactors (SNCRs). In other words, NO_x from biomass could, quite simply, be kept within emissions limits through simple technology additions like FGR or almost eliminated via SNCR. Once again, this serves to emphasise that we should be seeking to improve standards within biomass, rather than banning it altogether.

More broadly, it is important to compare the levels of NO_x emissions from modern biomass boiler and stove combustion against other urban sources. A comparative study of biomass boiler emission factors conducted last year by DEFRA indicates that domestic wood log burning releases nearly 94 times as much NO_x than wood pellets in an RHI certified boiler (please see Appendix I for further information).[18] Elsewhere, transport still accounts for 49 per cent of UK NO_x emissions[19]. Thus, if the Government are truly concerned with urban NO_x levels, they should prioritise action towards its primary causes.

[17] Tables **3.39** and **3.44** of the EMEP/EEA handbook show the upper measured limit of NH3 is 148 g/GJ when burning wood on an open fire, as compared to 24 g/GJ when burning wood pellets in a biomass boiler or stove. Firstly, open domestic woodfuel use is responsible for much greater contributions of dangerous air pollutants. Secondly, because NH3 is produced from incomplete combustion, improvements in technical efficiency and wood pellet fuel can dramatically reduce the levels of NH3 released.

[18] DEFRA (2017) *Assessment of Particulate Emissions from wood log and wood pellet heating appliances* https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1801291425_170201_Defra_NAEI_appliance_testing_summary_Issue1_Final_copy.pdf

[19] DEFRA (2018) 'Emissions of Air Pollutants in the UK, 1970 to 2016' https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/681445/Emissions_of_air_pollutants_statistical_release_FINALv4.pdf

In summary, when regulating the use of biomass installations in urban areas, BEIS should work towards ensuring that regular maintenance is carried out to guarantee the highest possible levels of efficiency. Furthermore, existing Smoke Control Areas should be properly enforced to ensure that the most PM_x-intensive combustion methods are prohibited or penalised in densely populated, urban areas. Beyond this, the Government's priority should be getting every household off coal, smokeless coal, and other manufactured solid fuels based on fossil fuels as well as decarbonising heating through the support and promotion of renewable alternatives. It is an obvious benefit of being able to achieve two Government aims at once by moving the UK completely away from high-carbon fuels for heating whilst also significantly improving air quality. At present, the most efficient biomass boilers fitted with high-performance filters have particulate emissions within the range of modern gas boilers. As such, the focus should be on decarbonising domestic and non-domestic heat rather than penalising existing forms of comparatively efficient renewable heating.

Appendix I:

Air quality and Biomass Heating

- **The vast majority of urban particulate emissions originate from transport, with "other fuels", which includes wood heating, making up only 3-4% of PM/NO_x emissions**
- **Research shows that urban wood burning mainly originates from open fires and older stoves**
- **Biomass boilers are strictly regulated, and most boilers emit less than half of the legal limit of particulates**

In the UK, more energy is used to provide heating and hot water in our buildings and industries than for any other purpose. As a result, a third of the UK's carbon emissions originate from heating. Heat in the UK is currently supplied predominantly by fossil fuels - with less than 6.5% [2015] from renewable sources.
At the same time, urban centres are facing severe air quality issues with air pollution limits frequently breached[20]. National and local policies aim to reduce emissions in urban areas, where the concentration of emissions are highest. Overall, the majority of air quality emissions originate from road transport, however, some have also been identified as originating from wood burning. As figures 1 and 2 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. This white paper further looks at the evidence on how biomass boilers are regulated, urban wood-burning emissions, and origin of the emissions.

[20] Carrington, D. (2017, Jan., 6), London breaches annual air pollution limit for 2017 in just five days, *The Guardian,* Retrieved from https://www.theguardian.com/environment/2017/jan/06/london-breaches-toxic-air-pollution-limit-for-2017-in-just-five-days

Figure 1: Origin of NO_x emissions in Greater London (2013, GLA LAEI2013 update)

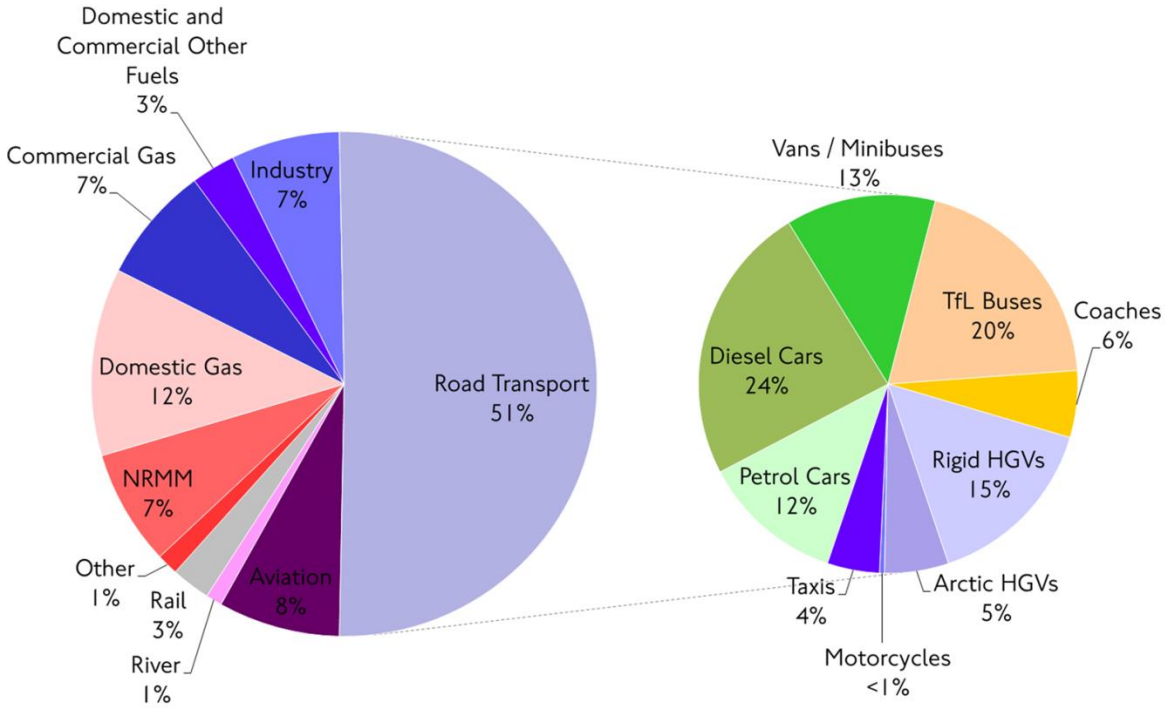
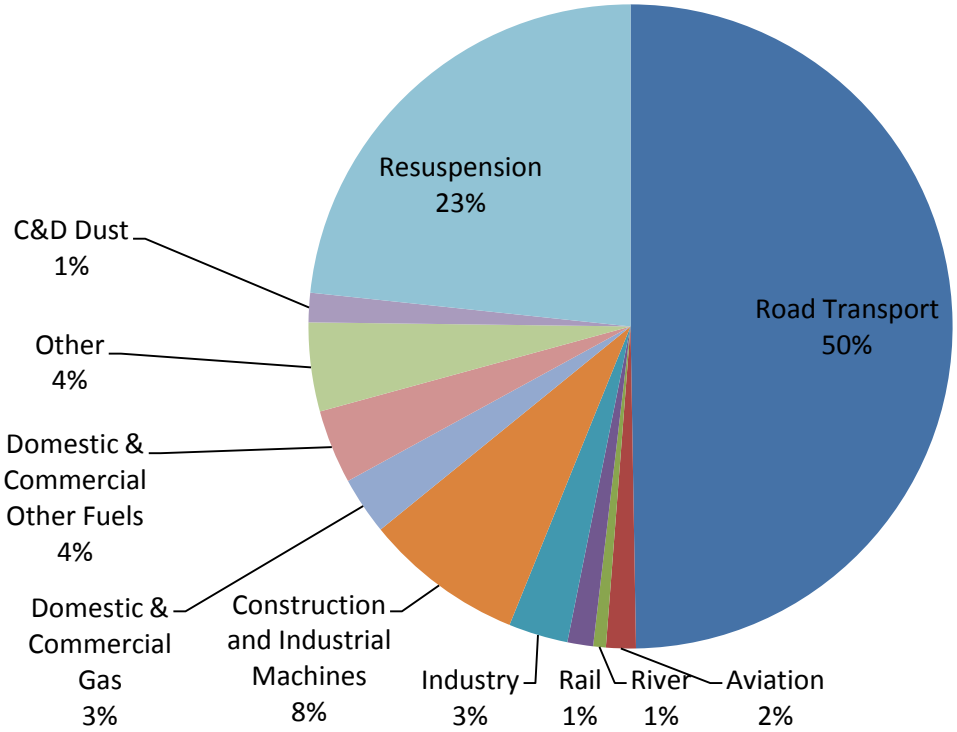


Figure 2: Origin of PM_{10} emissions in Greater London (2013, GLA LAEI2013 update)



Urban Wood Burning Emissions

The research and measurement programme of Fuller et al. (2014)[21] suggest that emissions related to wood burning mainly arise from "a decorative or secondary heating source", from garden waste burning and from patio wood burners. This would indicate that the relatively minor emissions from urban wood burning are not from the types of biomass boilers as supported under the RHI, but instead from open fires and older domestic stoves.

Open fireplaces and older stoves differ from biomass boilers in a number of ways. Biomass boilers produce hot water for central heating systems and water heating and even process heat at commercial scale. They vary in size from 5kWth for low energy houses up to 5,000kWth or more for large building complexes or industrial process heat and are many times more fuel efficient than open fires. Pellet boilers operate with automatic feeding systems that bring in fuel from a storage room and can replace oil heating systems. Open fires and wood burning stoves which are the sole source of heating are unusual in urban areas, but more common in rural areas, where wood or other solid fuels are sometimes used provide direct space heating and central heating and hot water in homes.

The Government's Domestic Wood Survey[22] shows that 68% (2014) of wood burning appliances in London were open fires. Together with the results from Fuller et al (2014), this would suggest that the main issue of emissions from wood burning in urban centres is related to open fires and, in part, older stoves. Poor enforcement of Clean Air Act requirements, which are primarily intended to regulate pollution from domestic solid fuel, is undoubtedly a major contributing factor to urban air pollution in towns and cities.

The new EU Ecodesign Directive includes new emission standards for new wood stoves, and UK regulations were planned to be implemented prior to 2022. Many Ecodesign compliant stoves are available on the market now as "Ecodesign Ready" which is supported by Defra. Newer wood stoves are therefore expected to have significantly lower measured emissions.

Biomass boiler emission regulations

Biomass heating systems burn fuel such as wood pellets, chips or logs to provide central heating and hot water in homes, hospitals, schools, the public sector, industrial sites, not-for-profit organisations, small and large businesses, and care homes. They can also generate high-temperature heat for industrial processes.

Since September 2013, any biomass boilers installed and commissioned under the Renewable Heat Incentive (RHI) scheme have been required to meet strict air quality levels. 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. No

[21] 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

[22] 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

biomass boiler installed since September 2013 should receive any government support without meeting the requirements.

The analysis below assesses the RHI Emission Certificates for biomass boilers installed under the Renewable Heat Incentive in Great Britain.

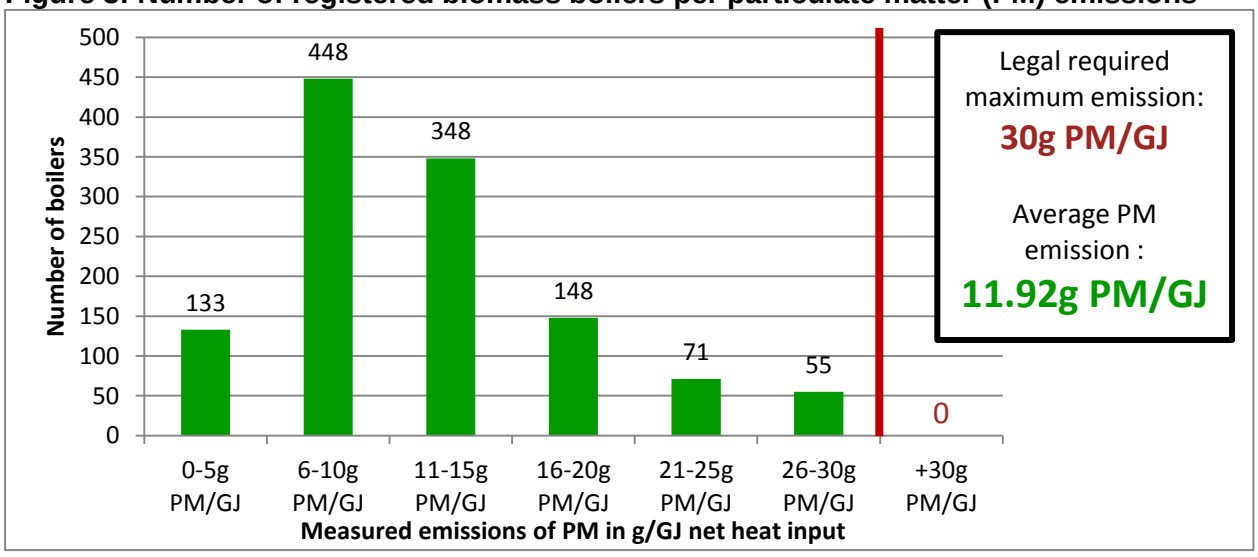
Methodology

Through a Freedom of Information Request sent to the Department for Business, Energy and Industrial Strategy, the Wood Heat Association has accessed data on the biomass boiler emission test scores. The data reflects the 1,205 biomass boilers that have RHI Emissions Certificates, with information on measured emissions of PM and NOx in g/GJ net heat input. As several boilers had different measured emissions depending on the type of fuel (usually wood chip and wood pellets), the average value was selected, since there was no further description to describe which value was most appropriate.

Analysis of biomass boiler emissions

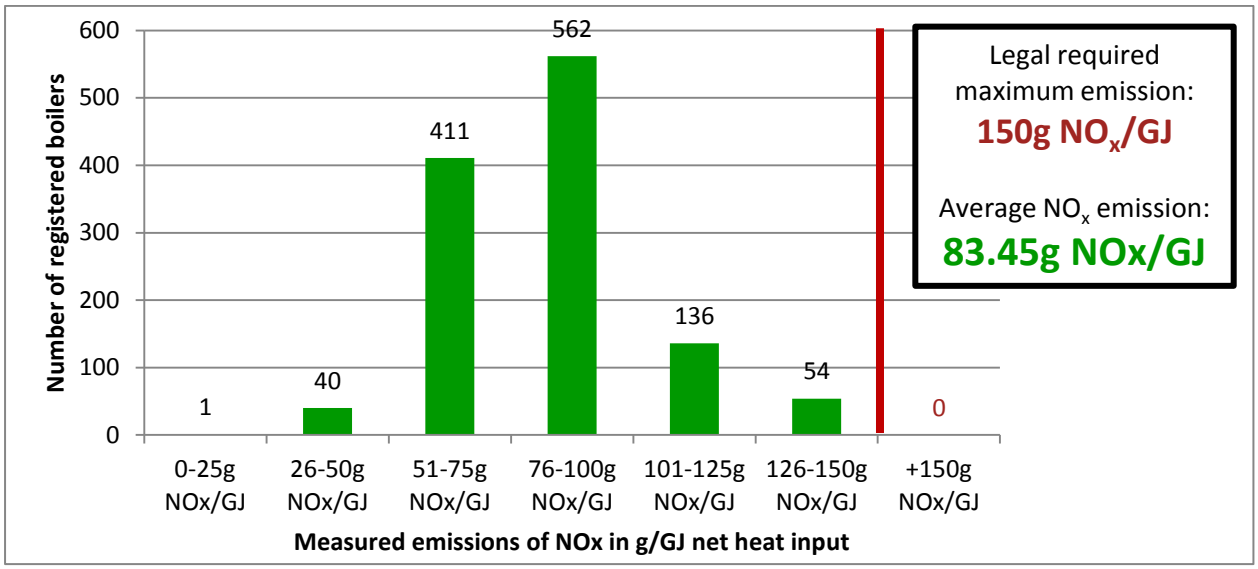
The analysis of the emissions test results confirms that the measured emissions for all boilers are within the required maximum. The average grams of PM emissions per gigajoule net heat output are 11.92g PM/GJ, well below the limit of 30g PM/GJ. As demonstrated by figure 3, the vast majority of boilers have particulate matter emissions that are considerably below the legal limit. Figure 3 shows how many tested boilers have measured PM emissions within different emission ranges, which shows that 77.1%, or 929 boilers, have tested measured PM emissions at less than half the legal limit, and 48.2%, or 581 boilers, emitted less than a third of the legal threshold.

Figure 3: Number of registered biomass boilers per particulate matter (PM) emissions



The average grams of NO_x emissions per gigajoule are 83.45g NO_x/GJ, also notably below the legal limit of 150g NO_x/GJ. Figure 4 demonstrates that the vast majority of biomass boilers had measured emissions in the range of 51-100g NO_x/GJ. Specifically, 37.5% 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).

Figure 4: Number of registered biomass boilers per nitrogen oxides (NO_x) emissions



Conclusion

PM_{10} and NO_x emission analysis for London shows that the majority of emissions originate from road transport and other forms of transport. In urban centres like London, only 3-4% of air quality emissions stem from "other fuels", and it is unclear how much of the "other fuels" related emissions can be attributed to wood heating. Measurement programmes show that the emissions related to wood burning mainly originate from garden waste burning, patio wood burners, and "decorative or secondary heating source[s]"; and government data show that most of the decorative/secondary heating sources in London are open fires.

Unlike open fires and old (non-Ecodesign) stoves, the majority of RHI-registered biomass boilers are strictly regulated by Ofgem in terms of their PM and NO_x emissions, and analysis of official emissions certificates shows that the vast majority of RHI supported biomass boilers emit less than half of the legal limit, and most significantly less if operated in line with manufacturers' instructions.

This, and the fact that most biomass boilers are installed off the gas grid makes it unlikely that biomass boilers contribute significantly to urban air quality issues, as the main causes are transported, and the few emissions originating from wood heating stem from open fires. Whilst biomass boilers do contribute to air quality problems, their contribution is, evidently, negligible

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Appendix II

RHI Industry Survey Results

The WHA conducted a short survey in order to assess the impact proposals to ban biomass combustion in urban areas would have on industry. We received a total of 23 responses. Whilst these do not represent the entirety of the industry, the WHA believes that the range of views expressed captures a snap shot of potential impacts on the modern biomass industry. The results indicate consequences very different to those suggested by BEIS's Impact Assessment which is based on historic RHI deployment data and does not take into consideration the RHI reforms seen in the last year that will change deployment behaviours.

Given time constraints of the consultation period, this was a brief survey. However, we would be happy to explore the responses further with our members in conjunction with BEIS so that Government can better understand the impact of the consultation proposals.

Q1 - Assuming the ban comes into force as of January 2019, as used in the Government's Impact Assessment, what percentage of your project pipeline could be affected by the proposed ban on RHI support for future biomass projects in urban areas?

- While the impact on pipelines varies between organisations, respondents highlighted that, on average, 40% of their project pipeline will be affected by the consultation's proposals.

Q2 - What is the value of the potential sales that could be lost in relation to your answer to Q1?

- On average, the proposals will cost respondents an illustrative average of nearly £2.2 million in lost sales (with some companies, focused on larger scale projects, projecting losses of £10-20 million).

Q3 - Assuming the ban comes into force as of January 2019, as used in the Government's Impact Assessment, has your company already committed any non-refundable capital in future projects that could potentially be affected by the proposed ban?

- Just under one-third of respondents have committed expenditure that would be non-recoverable if biomass combustion is banned in urban areas as of January 2019, as indicated in the consultation impact assessment, totalling £5.4 million.

Q4 - If yes to Q3, could you indicate the level of financial commitment at risk from the ban coming into force?

- Respondents indicated that, on average, the proposed ban would cost them over £257,000 in non-recoverable financial commitment, totalling £5.4 million across those surveyed.

Q5 - Regardless of whether you have projects that may be directly affected by the proposal, what do you think the effect of the ban will be on the biomass heat industry?

- ~61% of respondents think that the proposed ban will be 'significantly negative' for the biomass heat industry, whilst a further 34% considered the potential impact to be 'negative'.

Q5b - Please explain your reasoning for the above answer (*selection of responses*)

- A ban will significantly reduce the visibility of biomass heat throughout the UK.
- It will damage uptake in rural areas.
- This approach shows a lack of understanding between fuels and fuel quality.
- A significant proportion of biomass enquiries still coming through are in urban areas. The industry is fragile enough without this additional reduction in potential projects.
- It sends a negative message on the impact of biomass heating on the environment. Whilst our business is almost entirely focused on rural areas, we have undertaken work in urban areas on the gas grid in the past and expect to do so again. I do not believe it is a proportionate or effective response to the problem of air pollution which is only very marginally impacted by RHI accredited installations.
- The industry is not in a strong position so the ban will have a disproportionate effect on the companies involved.
- This proposal unnecessarily undermines public perception and the positive environmental impact that this relatively young renewable and innovative technology has to offer in the UK.
- There are still applications - oil boiler replacement for instance - that would benefit from biomass installations in urban areas.
- The market for new installations is decreasing and any that do go intend to focus on bigger heat users e.g. industrial sites, prisons, care homes & housing blocks. If the RHI was to be cut on these sites in towns or on the urban fringe, it would lead to these users remaining on fossil fuels as heat pumps are less efficient and therefore more expensive than the current fossil fuel boilers.
- It will discourage investment in biomass more broadly.
- Negative, but it is part of the ongoing process of attrition by Government against the biomass industry.
- All large biomass installations are capable of emitting minimal NOx and PM by the judicial use of technology. The MCPD will capture any existing installations by 2025 (or 2029) and any new installations have to comply from Dec 2018 already. The RHI ELVs are in line with MCPD and if MCPD is good enough for oil or gas fired systems, why not for biomass - there is no difference. If there is a problem from wood smoke then the emitters are likely to be domestic open fires, barbeques, pubs and the like - none of these will be captured by a ban.
- Many urban areas have high fossil fuel use with large process loads. This is where we specialise as we provide biomass CHP with huge carbon savings. All our projects

are IED so particulates and emissions are monitored and abated. Our multi MW systems are cleaner than a stove.

- Most boilers with emissions certificates easily meet the emissions thresholds. In addition, the industry is working hard to bring down emissions even further. Most large heat users not already part of the RHI are in urban areas. Many opportunities for district heating are in urban areas.
- Previous revisions to the RHI, most notably changing the tariff level and Tier 1 hours to favour larger plants running for longer hours, have made smaller rural schemes economically unattractive. This is clearly reflected in current deployment rates. Changes to remove customers in urban areas and the gas grid will disproportionately impact on the remaining market for biomass heat, which is larger industrial users, commercial applications such as hotels, leisure facilities, care homes, etc..., and public sector applications, such as health and education facilities, public swimming pools, council offices and the like. The proposed changes, which are effectively a blanket ban, will render larger users ineligible for biomass and does significant further damage to the biomass heat industry.
- We deal predominantly with factories, many in the woodworking industry, which has significant amounts of manufacturing waste product which is ideal for biomass fuel. If they don't burn it most will continue to send it to landfill.
- The Government threatens to remove a significant number of potential new biomass projects in a knee-jerk reaction to pressure in relation to atmospheric quality that could be tackled better using existing legislation such as the Clean Air Act...
- There are many projects in areas with general gas access but without having a connection to the grid. Their only option other than biomass is oil or LPG, so this would clearly counteract the idea of RHI to get rid of exactly such installations. So the proposed measurements would significantly reduce the potential targets for changing from oil heating to renewable biomass heating and further shrink the market.
- Anything that gets banned is seen as a negative due to the publicity it would receive, which could impact the public perception of biomass power or biomass heat in off-gas grid areas.

Q6 Do you have any further comments or points to raise in relation to this consultation that you would like the WHA to consider including in its consultation response?
(*selection of responses*)

- Considering only air quality is to the detriment of carbon and greenhouse gas savings, both nationally and globally.
- The global community needs to be considered as well as the local 'air quality' issues. Poor air quality can be managed through the fuel supply chain management, as well as appropriate filtration. Natural gas is still a fossil fuel and cannot be considered as a solution for the next 100 years as it involves extracting carbon from below the earth's surface and combusting it in our atmosphere, which is naturally unsustainable.

- The proposed ban is yet another blunt instrument from the government which will have far-reaching consequences for the viability of the UK biomass heat sector. Rather than take the time to formulate policies which draw on the experiences of other countries in stimulating and sustaining sensible growth in the biomass sector, these changes will drastically limit the ability of the biomass heat industry to decarbonise the heating of those premises and organisations to which it is best suited. It would be far better to learn the lessons of other countries and apply these to the UK. For example, under the long-running renewable energy support schemes in Germany, grants are not only provided to those installing a biomass system on a Euros-per-installed-kW basis, but they are also 'topped up' where the installation meets certain enhanced emissions criteria. These include the provision of a minimum number of litres of buffer capacity in the system, the installation of flue gas clean-up technology such as a bag filter or ESP, hydraulic optimisation of the system and certificated testing. Furthermore, additional support of up to 50% of the basic grant can be awarded if the building it's being installed in is efficient, and a further 10% of the basic grant can be awarded to improve the efficiency of the heating system in the building. This combination of measures drives installations which are appropriately sized, optimised for efficiency and which are clean - in marked contrast to many of the behaviours seen in the UK under the RHI.
- Instead of banning biomass completely, they should encourage better emission controls, through improved or additional filters and/or electrostatic precipitators which will remove up to 90% of PM.
- Additional filtration should be mandatory in urban. The implementation of the medium combustion directive would and should negate the negatives due to regular emission testing.