Written evidence submitted by Energiesprong UK (DHH0100)

# Summary

## Key points

1. Zero carbon hydrogen for heating (whether "blue" or "green") will result in a 200-400% increase in heating bills for consumers,[1] [2] [3] which would be politically unacceptable. Subsidising this cost via tax breaks or other mechanisms would only serve to hide this additional cost and have an impact on Government spending/revenue. There is no scope for cost reduction to anywhere near fossil gas heating costs since there are additional industrial processes and each individual step is mature or close to mature. Therefore, **hydrogen for heating should be ruled out** for the vast majority of cases, since there are cheaper and better alternatives.
2. Decarbonisation of heating **must be linked with substantially improving the thermal efficiency of buildings**. There are multiple additional benefits to improved building thermal efficiency, both social and economic. Simply replacing fossil gas boilers with zero carbon options outputting the same level of heat is inefficient and will result in higher bills for consumers.
3. The Energiesprong approach, supported by BEIS through the Whole House Retrofit programme (and hopefully the SHDF demonstrator programme), represents an **efficient, scalable and cost-effective route to decarbonisation of heat**, elimination of fuel poverty and other social/health benefits for residents. The Energiesprong approach is directly applicable to ~11 million existing homes, as well as new build. Cost reduction, technological, process and business model innovation can also provide knock-on benefits to the remaining properties as well as non-residential buildings, including in historic buildings.
4. The biggest barriers to heat decarbonisation are not technical, **they are social and political.** Government urgently needs to commit to large-scale decarbonisation of heat, mostly via electrification and retrofit, and focus industry and finance on achieving that goal cost-effectively. Communication to the public and politicians needs to be clear and precise on what every household/building owner will need to do and by when, and how Government will ensure the costs are shared fairly. A commitment to ending gas boiler replacements by 2035 would be consistent with net-zero targets and allow the public to have an open discussion on how to achieve and pay for the mass upgrade of the UK housing stock.

# What is Energiesprong?

Energiesprong is a whole-house retrofit approach, including heating systems. Installers are required to design, build and guarantee a solution that achieves net-zero energy over the year, with solar PV on the roof equal to the electricity demand for heat, hot water and appliances. To meet this requirement, heat demand has to drop to 30-40 kWh/m$^2$ (compared to >150 kWh/m$^2$ in many existing buildings) and in most cases heat is delivered via heat pumps. Combustion-based heating is not allowed, low-temperature heat network connections are possible.

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[1] https://pubs.rsc.org/en/content/articlelanding/2020/ee/d0ee02016h#!divAbstract
[2] https://www.cedelft.eu/en/publications/2437/hydrogen-for-the-built-environment-knowledge-document-for-nijmegen-municipality
[3] https://www.cedelft.eu/en/publications/2139/hydrogen-routes-for-the-netherlands-blue-green-and-imports

Energiesprong was developed in the Netherlands where there is now an established industry delivering thousands of retrofits and new build homes per year. In the UK, the first 10-home pilot was complete in 2018, with a further ~50 complete to date and funding for another 150 secured. Energiesprong UK (ESUK, an independent market development team) supported the development of two successful bids under the BEIS Whole House Retrofit programme to deliver an additional ~150 retrofits by March 2022. Along with Turner & Townsend, the Mayor of London awarded ESUK a technical support contract to support social landlords in the capital. As a result of this work, the GLA recently launched an Innovation Partnership Procedure for net-zero whole-house retrofits including electrified heating, up to £10bn value over the next seven years.

The key innovation behind Energiesprong is a cost-neutral business model for social landlords. When the industry is at scale, the cost of installation will be offset by long-term savings and income equal to or greater than the value of the work. This makes Energiesprong an extremely cost-effective route to heat decarbonisation as well as delivering multiple other benefits including eliminating fuel poverty and providing resilience to future temperature rises. We estimate around 11m homes could benefit directly from Energiesprong retrofits, and the approach could indirectly benefit many other homes through cost reduction in components and innovations in business models.[4]

# Responses to questions

## 1. What has been the impact of past and current policies for low carbon heat, and what lessons can be learnt, including examples from devolved administrations and international comparators?

### UK:

ESUK believes that high electrification with heat pumps is the most cost-effective and efficient route to heat decarbonisation. See response to Q3 for further details.

There have been 10,000 domestic heat pump installations per year since 2014 when the Renewable Heat Incentive was launched, with no noticeable growth beyond the first year. In contrast, solar PV supported by Feed-in Tariffs increased almost ten-fold from 20,000 per year in 2010 to 180,000 in 2011 before Government cut tariffs. Clearly there is a demand for renewable energy, but why did the RHI not stimulate demand as FiTs did for PV? There are several reasons:

1. Without significant energy efficiency measures and disruption, heat pumps were not competitive with fossil gas heating. Due to the failure of the Green Deal, the limited scope of ECO/CERT/CESP and the lack of regulation for existing homes, only early adopters can afford to upgrade the thermal efficiency and install heat pumps on gas-connected homes. This is not enough volume to drive the industry to greater scale.
2. Installing heat pumps in off-gas homes is much more favourable due to the higher costs of non-gas fuels such as oil, but off-gas homes tend to be rural, older and more likely to be heritage. To run efficiently, heat pumps need to deliver lower-temperature heat than combustion-based heating systems. This, combined with the high capital cost of heat pumps, created a high barrier for off-gas properties. Biomass boilers in contrast were very popular until tariffs were cut.

[4] https://www.green-alliance.org.uk/reinventing_retrofit.php

3. Failure to deliver the 2016 Zero Carbon Homes policy or to update SAP2012 to SAP 10 (which strongly favours heat pumps) meant that the new build industry has still not widely adopted heat pumps, which would have created a volume of ~150,000-200,000 per year.

### Other countries:

Energiesprong Foundation (NL) recently presented a comparison between the UK, Germany and Netherlands, key slide shown in Figure 1. Compared to The Netherlands and Germany, the UK invests **less** in retrofit, the cost of finance is **higher**, and energy prices are lower (creating a **less favourable** business case for retrofit and heat pumps). This is despite having a comparatively **less efficient** building stock.

| |  |  |  |
|---|---|---|---|
| Investment grant | 8K | 40% | ±2K |
| Cost of financing | <1.5% | 0.75% | 2-4% |
| Gas Prices (small consumers) | 0,092 | 0,063 | 0,049 |
| Electricity prices (small consumers) | 0.21 | 0.31 | 0.19 |

**FIGURE 1: COMPARISON OF KEY ENERGY EFFICIENCY COSTS**[5]

2. What key policies, priorities and timelines should be included in the Government's forthcoming 'Buildings and Heat Strategy' to ensure that the UK is on track to deliver Net Zero? What are the most urgent decisions and actions that need to be taken over the course of this Parliament (by 2024)?

It is clear that government policy has failed to deliver a scale heat pump industry. In order to get to the volumes of heat pump installations desired by the Prime Minister (600,000 per year by 2028), the following policies are needed urgently:

1. Set out a heat decarbonisation strategy for the UK so that every homeowner, private and social landlord understands what they need to do, when they need to do it and how Government will ensure that the cost of doing so will not be too onerous. We strongly recommend a "ban" on gas boiler replacements from 2035, similar to the ban on petrol/diesel cars. We believe the public will support change, but clear information and financial support (potentially in the form of zero interest loans or tax breaks) must be provided until the costs are equivalent to replacing a gas boiler.

[5] Ron van Erck, Futurebuild 2020 presentation

2. Heat decarbonisation **must** go hand-in-hand with performance-guaranteed whole-house retrofit across all tenures over the same timescale. Heat pumps are not able to deliver heat cost-effectively to inefficient homes, and the vast majority of homes are not efficient enough.
3. Both 1 and 2 must be supported by regulation across all tenures. An opt-in approach will not achieve the required scale.
4. Heat demand intensity should be the key metric rather than EPC rating, and we believe 60-75 kWh/m$^2$ should be the minimum target, although 30-50 kWh/m$^2$ will be more cost-effective as it enables Energiesprong-type business models partly paid for through energy bills.
5. Kick-start the whole-house retrofit industry (with heat electrification) by formally committing to the Social Housing Decarbonisation Fund to the level promised (£3.8bn) in 2021. The recently-launched £10bn Retrofit Accelerator Homes Innovation Partnership is the ideal vehicle for ~£250m of the SHDF over 4-7 years, which we believe will enable the market to scale up, reduce costs and avoid the need for further subsidy. A ~1,300 home pipeline of projects is already in development.
6. Replace energy bill levies with a carbon tax on suppliers and directly fund innovation through government spending to create a low carbon heat/whole-house retrofit market. See response to Q5.
7. VAT is inconsistently applied for retrofit and low-carbon heat projects, particularly the off-site approaches that are crucial to reducing costs. Zero carbon should equal zero VAT.
8. Lower the cost of finance for net-zero retrofit. One of the main failures of the Green Deal was the high cost of finance. Lower interest via mortgage providers, public sector finance (e.g. the Mayor of London's Energy Efficiency Fund) will drive adoption and create an industry for "heat as a service" and "retrofit as a service".
9. SAP 10 needs to be adopted now, and the Future Homes Standard must be an effective ban on fossil gas heating, with high standards of thermal efficiency, brought in as soon as possible. Proven kWh/m$^2$ heat demand should be the key metric for compliance. Note that new-builds will only deliver around half of the Prime Minister's target for heat pumps.

## 3. Which technologies are the most viable to deliver the decarbonisation of heating, and what would be the most appropriate mix of technologies across the UK?

Table 1 gives a summary of all the currently available domestic heat technologies. ESUK considers heat pumps to be the most appropriate heating technology for most UK homes, however it should be combined with performance-guaranteed retrofit to 30-75 kWh/m$^2$ heat demand in order to ensure the heat pump is sized appropriately and heating costs do not rise. This is substantially lower than the "EPC C fabric first" target that BEIS is currently proposing, but consistent with the 40-50 kWh/m$^2$ required by the Whole House Retrofit and SHDFd programmes. We do not consider "EPC C fabric first" to be a meaningful or useful metric and we urge BEIS to use heat demand intensity (kWh/m$^2$) which is less open to interpretation and can be reliably measured.

Zero carbon hydrogen, whether "blue" or "green", will increase household heating bills by 200-400% unless government permanently subsidises the industry; it is also an inefficient use of energy. While on the surface it is attractive as it would require less disruption to households, the costs will always be high and this option ignores all the non-carbon benefits of retrofit such as improved comfort and indoor air quality. Hydrogen plus retrofit would of course offset some of this additional cost, but heat pumps will always be more cost-effective for the same heat demand due to their higher efficiency (assuming electricity prices don't rise significantly).

| **Heat decarbonisation technology** | **Can it be zero carbon?** | **Heating costs for end-user compared to fossil gas** | **Appropriate scale and use** |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Hydrogen (zero carbon, blue or green) | In theory, although very high risk of methane leakage for blue hydrogen | MUCH HIGHER | High temperature needs only, e.g. industry. Likely not at all for domestic heating. |
| Heat pumps + building thermal fabric upgrade (see note) | Yes, if grid is zero carbon. | MUCH LOWER | Almost all domestic buildings suitable with appropriate thermal upgrade |
| "Hybrid" heat pumps (biomethane/hydrogen) | In theory, although same issues for hydrogen and biomethane (detailed elsewhere) | Higher | High heat demand properties only. Less cost-effective than heat pump + thermal upgrade. |
| "Hybrid" heat pumps (fossil gas) | NO | Higher | Not appropriate (not zero carbon) |
| Biomethane | Yes, although country cannot meet current gas demand with biomethane | Higher | High heat demand properties only (e.g. historic buildings) |
| Biomethane CHP | Yes, although country cannot meet current gas demand with biomethane | Higher | High heat demand properties only (e.g. historic buildings) |
| Biomass | In theory carbon neutral but high emissions when burnt with slow sequestration through tree growth | Higher | Rural high heat demand properties only |
| Resistive electric heating (storage heaters, plug-in radiators) | Yes, if grid is zero carbon. | Higher | Only in highly thermally efficient properties due to running costs |
| Fossil gas | NO | Same | Not appropriate (not zero carbon) |
| Fossil gas CHP | NO | Lower | Not appropriate (not zero carbon) |

**TABLE 1: HEATING TECHNOLOGIES (SEE NOTES BELOW)[6]**

[6] Notes:

Although Energiesprong UK is currently focused on the social housing market, 1918-1980 houses and low-rise flats, the approach is adaptable to most property types. Listed properties are the most challenging, but they are a very small percentage of the total. Recent modelling undertaken on pre-1918 properties suggests that the majority can achieve heat demand intensities of <75 kWh/m$^2$. For properties with higher heat demand, biomass or biomethane may be suitable. We consider "hybrid" heat pumps using fossil gas/biomethane plus a heat pump to have very niche applications.

There is a perception in the UK that heat pumps "don't work very well". This is not correct. Heat pumps are commonplace in countries like Sweden, Norway, Germany, France and Japan, some of which have significantly colder winters than the UK. The problem is that if the actual heat demand of the property is worse than modelled, the system will be undersized and will struggle to meet the heat demand effectively. **The problem is with the property, not the heat pump.** There is an over-reliance on modelled energy assessments in the UK and known performance gap for energy efficiency retrofits. User awareness of how to most efficiently use their heat pump is also an issue.

## 4. What are the barriers to scaling up low carbon heating technologies? What is needed to overcome these barriers?

**The biggest barriers are social and political.** It is technically possible to retrofit homes to a high standard and deliver zero carbon heat via heat pumps. It is financially viable if the industry can be scaled and the right mix of policies are in place. Other developed countries, many in colder climates, have high energy efficiency standards and mature heat pump industries.

Even with the right mix of policies (see responses to Q1 and Q5), scaling up low carbon heat will require major interventions in almost all of the UK's 29 million homes. The public will understandably have major concerns over this, which is why there must be a long-term strategy with clear implications across all tenures, backed by legislation and supported by fair policies and incentives. Politicians will also understandably be cautious about such major changes, so a cross-party consensus needs to be reached to ensure consistency of policy even when the Government changes.

From a technical and financial perspective, scaling up low carbon heating requires:

- Volume – start with social landlords (~20%), then private landlords (~20%), then owner-occupiers (~60%)
- Standardisation as much as possible at early stages to incentivise industrialisation and cost reduction
- Financial incentives for industry – both to enter the market and to reduce costs with the aim of eliminating subsidies
- Joined-up policies to create demand, e.g. MEES for all tenures, low interest finance

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a) Solar thermal excluded as it cannot provide space heating demand on its own
b) Thermal upgrade of properties will lead to lower consumer costs for all technologies. However heat pumps are generally more sensitive to the efficiency of the building and it is not recommended to install them in thermally inefficient buildings.
c) Heat networks have not been included as they are a distribution method not a fuel source. Heat networks should only be supported where they have a clear decarbonisation strategy.

5. How can the costs of decarbonising heat be distributed fairly across consumers, taxpayers, business and government, taking account of the fuel poor and communities affected by the transition? What is the impact of the existing distribution of environmental levies across electricity, gas and fuel bills on drivers for switching to low carbon heating, and should this distribution be reviewed?

With the right policies and approach, there does not need to be a net cost to decarbonising heat beyond scale-up and innovation costs at the early stages of the market.

There is clearly a cost to decarbonising heating, but in the social housing sector we already spend £5.2bn on maintaining and repairing buildings and energy systems, and tenants pay £4.2bn on energy bills, usually in exchange for poor comfort.[7] The net-zero Energiesprong approach achieves a cost-neutral or better business case for retrofit in social housing, through savings on maintenance and repairs backed by installer guarantees, plus diverting existing tenant spending on energy bills. Although there additional complexities such as long-term financing, there is no reason why the same approach cannot be applied to other tenures.

The current system of levies and subsidies is complex and creates perverse outcomes. It should be simplified and based on the following principles:

1. No direct or indirect support for carbon emissions or CCS. Technologies need to be able to compete fairly with all costs included (wider socio-economic benefits should also be accounted for). Some technologies will need support to get to maturity, but once there they should receive no additional support. The current market has a complex subsidy/support structure and is a non-transparent way of "picking winners", which undermines trust in the system.
2. Energy bill levies should be phased out and replaced by a transparent system of support for innovation via government. Levies are effectively stealth taxes and this undermines trust in the system. Combined with the first principle, this would lead to gas unit prices rising and electricity unit prices dropping. Modelling by Regen suggests that a cost neutral replacement of current levies with a carbon levy would result in 16% higher gas unit costs but 14% lower electricity costs.[8] This would benefit the financial case for low carbon heating systems such as heat pumps.
3. A clear, strong and legislated commitment to full heat decarbonisation across all tenures is required. Our preferred commitment would be "all homes to achieve a heat demand 30-75 kWh/$m^2$ and no gas/fossil fuel heating". Target date should be 2040-2050, with interim targets where appropriate.
4. Impacts on fuel poor households can be mitigated via requirements on social and private landlords to meet minimum energy efficiency standards. Zero-interest finance available via mortgage providers or other finance institutions can support retrofit of owner-occupied properties.
5. A robust system of measurement and installer performance guarantees is required to ensure consumer trust. "Warm rents" and heat-as-a-service type offers need to be backed by measured and guaranteed long-term performance. Modelled or assumed performance, especially using EPCs, is not enough and would undermine trust in the system as demonstrated by the Green Deal.

[7] Energiesprong UK calculations based on HCA Global Accounts, Ofgem and ONS figures
[8] https://www.regen.co.uk/graphic-of-the-month-reconfiguring-domestic-environmental-levies-into-a-carbon-levy-to-incentivise-low-carbon-heating/

## 6. What incentives and regulatory measures should be employed to encourage and ensure households take up low carbon heat, and how will these need to vary for different household types?

1. Create cost-effective whole house retrofit market
2. Ban on gas boiler replacements by 2035
3. Minimum energy efficiency standards based on measured thermal performance for all tenures
4. Ensure zero-interest finance options for retrofit and zero-carbon heat are available via mortgage providers and other service providers
5. Innovation support for solutions that are able to breakout of the traditional approaches and show potential to retrofit to net-zero
6. Allow new service offerings such as Comfort as a Service to be tested/proven at scale in social housing, where currently the housing-energy-consumer regulations make it very challenging
7. Level the VAT playing field for new whole-house solutions vs. traditional measures and private vs. public housing providers

## 7. What action is required to ensure that households are engaged, informed, supported and protected during the transition to low carbon heat, including measures to minimise disruption in homes and to maintain consumer choice?

1. Government must be clear and transparent about long-term and interim targets and what the impact will be on households. Our view is that people (including politicians) do not sufficiently understand the scale of the interventions required and it will take years to prepare them for change. Owners of domestic properties, whether individuals or landlords (social or private), invest substantial amounts of money into their properties and they need to be aware of what changes will be required over the next 29 years so that they can make appropriate investment choices.
2. Low or zero-interest finance will be required. This can be delivered by multiple routes, but via traditional lenders is most appropriate in many cases, following the German kfW model. This would allow owner-occupiers for example to finance a high-cost retrofit without increasing monthly mortgage payments.
3. Government should require real-life performance guarantees in all energy measures. The technology is available and cost-effective to properly measure property heat loss and monitor the ongoing performance of heating systems. Retrofit and low-carbon heat needs to be a high quality, trusted industry – “cowboys” not welcome.

## 8. Where should responsibility lie for the governance, coordination and delivery of low carbon heating? What will these organisations need in order to deliver such responsibilities?

ESUK believes this is most appropriate at a local/regional level, with local authorities coordinating with major property owners and owner-occupiers. It would make most sense to identify entire areas that will be disconnected from the gas grid as this will enable the remaining grid to work most cost-effectively. These areas can be chosen according to the most appropriate retrofit solutions for those properties, e.g. council estates suitable for Energiesprong retrofit. Other areas will not be viable for disconnection until the 2030s/2040s, e.g. privately owned pre-1918 properties. Gas network operators will also need to input in order to identify the most appropriate areas to disconnect.

The main thing local/regional authorities will need is clarity. A decision must be made soon on the future of the gas grid and how a managed reduction in gas connections will work in practice. Instead of a “town heated by hydrogen” as the Prime Minister announced, we should be aiming for a “net-zero town disconnected from gas”.

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