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6February 2026

To: alternativecleanheatsolutions@energysecurity.gov.uk

Exploring the role of alternative clean heating solutions: a Consultation

Dear DESNZ Net Zero Buildings Clean Heat Team,

Sustainability First is a charity and think tank focussed on social and environmental issues in the energy and water sectors with an extensive track record of engagement on policy and regulatory issues.

Sustainability First has taken a long-standing interest in alternative forms of electric heating that might be suitable for smaller homes, typically lived in by those on lower incomes. We have had a particular interest in the topic of storage heaters. This thinking is encapsulated in the Grid Edge Policy 2020 report[1] "An Electric Heat Pathway: Looking beyond heat pumps". While some policy issues have moved on there is still much of relevance in that report. The report drew in part on the Ofgem work in 2015 on electric heat[2], which also remains relevant today.

Storage heaters are an inherently flexible solution with future potential which is largely untapped. With flexibility, in particular Consumer Led Flexibility, one of the vital stepping stones to Clean Power 2030, it feels insufficient credit is given to the future-facing role of storage heaters. The Clean Flexibility Roadmap picked up on the role that storage heaters could play - and committed to more work – but this is not referenced in the Consultation. While heat pumps may be operated flexibly to some degree - not yet established at scale - they are not inherently designed to do so and are dependent on additional thermal storage or the thermal mass of the building to retain heat while switched off. We have previously referred to storage heating as a Cinderella solution[3] in relation to heating. This title still feels apt in the context of this Consultation on alternative heat.

Based on our past work we are very concerned at DESNZ's choice of housing archetypes for their model and this consultation - being all houses, albeit of varying sizes. This ignores the particular challenges faced by customers living in flats, which represent over 20% of properties in England and over 35% in Scotland. The Grid Edge Policy report shows that many of these properties have no gas supply, and that storage heaters were likely to be a more cost-effective

[1] https://ssen-innovation.co.uk/wp-content/uploads/2022/08/NIA_SSEN_0039-Electric-Heat-Pathways-Final-Report.pdf

[2] https://www.ofgem.gov.uk/sites/default/files/docs/insights_paper_on_households_with_electric_and_other_non-gas_heating_1.pdf

[3] https://utilityweek.co.uk/electric-storage-heating-cinderella-solution/

solution for these households rather than heat pumps (notwithstanding greater heat pump efficiency). It is crucial that the housing archetypes considered do genuinely represent the range of properties across GB. In particular, for this to be a just transition, proper consideration must be given to properties that are more typical of those on lower incomes.

Another theme that we have repeatedly highlighted is the paucity of available data on patterns of heat usage to inform policy thinking around heat – and the potential role that smart meter data could play in filling this gap. Our work in this area is set out in our PIAG paper on Heat[4]. One issue we highlighted was the limited understanding of hot water usage. As an example, the Consultation includes a single figure (20%) for how much of a total household heat load is for hot water. On a positive note, the Consultation does acknowledge that certain heating types may be more suitable for properties that are only used occasionally. However, there is limited understanding across the sector of patterns of heating – when heat is used, the need for instant heat, the different requirements across rooms that may be used more or less frequently. Given that all these factors are relevant when comparing customer needs across heating types, a better understanding of current customer usage patterns would seem vital.

Since the PIAG work DESNZ have published their "Follow-up Survey on Heating Patterns and Occupancy"[5] which helpfully explores some of these issues. However, that report acknowledges the limited sample size and reliance on survey data and points to the potential role smart meter data could play.

Finally, in terms of high-level comments we are unclear on the purpose of this document on alternative heat technologies or on the timeframes envisaged. In places the consultation is very prescriptive, seemingly arguing that particular technologies may not be suited to certain housing types. In due course, government may become more prescriptive and decide to ban or phase out certain heat technologies (for example, fossil-fuel boilers in new build homes) or possibly become more directive on bio-fuel substitution. There may also be choices to be made around which technologies should be eligible for subsidies or low interest loans. But beyond this, and for the foreseeable future, we would assume that the market in heating technologies will continue to be driven largely by customer choice, supported by the supply-chain. Perhaps once the RESPs are well-established and gain sufficient 'buy-in' on more regional or area-based approaches to heat decarbonisation (including district heat) this may change. For the near term however, there would be much value in far wider access to independent advice on the pros and cons of different heat solutions according to personal circumstance - but this document feels too narrowly focussed to fill that role.

For the most part the Consultation appears to focus on the costs of different solutions – and the implications for the grid at peak times - whereas customers' choices will also be strongly influenced by other factors such as disruption (if new radiators are needed, requiring wider redecoration), aesthetics, and how heat and hot water are used, including the ability to deliver a rapid boost. As the DESNZ Follow-up Survey highlights there is a wide variation in how different households use heat which will affect what is the most suitable heat and hot-water solution for them. DESNZ should be wary of advocating particular heat and hot-water solutions based on a

[4] https://www.smartenergydatapiag.org.uk/_files/ugd/ea9deb_adef2eaaa0e84179a318b260e75cec84.pdf

[5] https://assets.publishing.service.gov.uk/media/61449c5e8fa8f503bc6658dd/efus-heating-patterns-occupancy.pdf

“typical” customer, when there is such significant variation in customer usage patterns and priorities.

Linked to this, the DESNZ modelling assumes that people will opt for a single heat solution. In practice low cost direct electric heating (or infrared heat) may be a sensible solution for rooms that are only used occasionally – and may also be used as a top up at certain times. The Follow-up survey explored the use of supplementary heat and found 39% of households used supplementary heat in at least one room (for a range of reasons). Looking ahead, we flagged in our PIAG work the need to track how far people were using direct electric heat as a top up alongside a heat pump if the latter was not delivering the comfort required in certain rooms, in particular during cold weather. A better understanding of consumer practice on heat top-up matters if consumers are to be well-advised on their future heat choices. Moreover, top-up heat practices are also relevant to ensuring sufficient future capacity (generation, networks) at peak times.

Having said all that, we welcome DESNZ looking more widely at alternative options for heating and hope that the evidence generated through this Consultation will allow a richer picture to be painted going forward.

We have provided answers below to some of the questions where we have a particular insight. We also offer comments on the Analytical Note where we feel that a number of the assumptions are open to question and also unnecessarily downplay the future role electric storage heaters could play – either in certain kinds of property or for particular customer segments.

Yours faithfully,

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Judith Ward, Associate

Sustainability First

DESNZ Consultation: Exploring the role of alternative clean heating solutions

Responses to specific questions – February 2026

Consultation Questions

Q2 - Do you agree that (a) thermal energy storage systems and (b) electrical energy generation and storage (solar PV and batteries) can enable electric boilers to become a more efficient and cost-effective option to decarbonise heat?

Yes. In support of this view we would highlight the UKPN Watt Heat SIF innovation project[6] which involved Tepeo (a heat battery / boiler) and which demonstrated the benefits that thermal storage can provide in helping mitigate the need for reinforcement on the distribution network and providing valuable flexibility.

3 – Do you have any evidence or views on the role infrared heating could play in decarbonising heat?

We would agree with DESNZ that this is unlikely to be an effective whole house solution but, as flagged in our cover letter it is important not to think of heat in terms of a single solution. As a supplementary form of heat (for rooms that are used infrequently) or as a top up for comfort it has a clear role to play. In particular, in these settings the fact that it is heating the person not the room will make it more efficient.

4 – Do you agree that panel heaters and electric radiators should play a smaller role in decarbonising heat, given their comparatively lower efficiency (than heat pumps) and limited ability to load shift, leading to high running costs for consumers?

5 – In what circumstances, if any, would panel heaters or electric radiators be more suitable than heat pumps, thermal energy storage systems, biomass heating systems or hybrid heat pumps?

Yes – although, as highlighted in the Grid Edge Policy report they may have a role in situations where there is very low heat demand (for example either in well insulated small studio flats or rooms that are only used very occasionally where they can form part of a solution).

Our concern at present is that heaters such as oil-filled panel heaters are heavily promoted and increasingly being installed as a cheaper alternative (upfront outlay) to storage heaters in small properties / flats, despite being unsuited to lower-cost off-peak tariffs. As flagged in the Grid Edge Policy report, and supported by the most recent English Housing survey, there has been a progressive shift from storage heat to direct heat, in particular in the private rented sector where the landlord is primarily concerned about the upfront cost, rather than running costs for consumers.

The DESNZ Follow-up survey we reference in our cover letter also looks at the use of fixed or portable direct heating as a supplementary heat source alongside gas boilers[7]. Better data will be needed going forward to understand the extent of direct heat being used as a top-up on cold

[6] https://smarter.energynetworks.org/projects/10061545/

[7] https://assets.publishing.service.gov.uk/media/61449c5e8fa8f503bc6658dd/efus-heating-patterns-occupancy.pdf

days for homes with a heat pump – and the implications this might have for both grid and generating capacity.

6 – Do you agree that high temperature heat pumps could play a key role in decarbonising heating of buildings?

Yes. The Analytical Note makes clear that high temperature heat pumps will be needed to provide adequate heat in homes with poor thermal insulation.

The fact that they are less likely to require replacement of radiators and the disruption that entails means that they are also likely to be an easier sell to many customers – including for smaller properties.

Customers need access to independent information and advice on the appropriate size of heat-pump to install. This may entail both technical and personal trade-offs and therefore choice on heat-pump size is ultimately a matter for the consumer. It would seem inappropriate for government to attempt to specify (e.g via regulations) that a customer may not make their own choice as to heat-pump size (which the consultation seems to imply could be the case).

8 – Do you agree that air-to-air heat pumps could play a key role in decarbonising heating of buildings without wet central heating systems?

As the DESNZ work acknowledges, an advantage of air-to-air heat pumps is their ability also to provide cooling. In our view this aspect should be given more emphasis. While passive cooling is to be preferred, in existing buildings there will be limits to what can be achieved.

As a result, the expectation, for example in FES 2025, is that cooling demand will increase very substantially over the coming decades. In many countries, like some parts of the US, it is already the key driver of peak demand. Promoting a more efficient cooling solution that spreads demand away from the peak, can be expected to deliver significant system benefits.

In this context air-to-air provides a more compelling proposition for some (better off) consumers who may be considering air conditioning -offering a two for the price of one solution.

That said installation of air-to-air can still be disruptive if new ducting is required.

Also, DEFRA must also urgently clarify how it proposes to deal with SF6 being used as a heat-pump refrigerant, including the DEFRA longer-term position on the availability of suitable alternatives.

17 – Do you have any evidence or views on the role heat batteries could play in decarbonising heat?

19 – Do you have any evidence or views on how future developments in the thermal energy storage market might help reduce strain on the electricity grid and how this could work with other technologies (like heat pumps or electric boilers) to become more cost effective?

We agree these have a role to play in supporting heat flexibility and reducing the strain on the grid. Again, we draw attention to the UKPN Watt Heat SIF project that explored this issue.

However, we would also note some of the practical challenges with thermal storage in terms of the size and weight of thermal batteries which will limit where they can be used.

DESNZ should also look at experience elsewhere on electric boilers and water tanks – e.g France, where there is widespread use of large electric hot water tanks – heated with lower-cost off-peak power - to heat water for wet radiator systems as well as for hot water.

Q20 Do you have any evidence or views on the role storage heaters could play in decarbonising heat? We would particularly welcome any evidence or views which take into account their

- **Potential to be used in certain buildings where other low carbon solutions may not be feasible or would be less cost-effective**
- **Impact on the electricity grid**
- **Any other factors you consider may be relevant**

As flagged in our covering letter to this DESNZ consultation, the document unnecessarily discounts the future potential of storage heaters. This includes the inherent customer value of a lower upfront cost than a heat-pump, the potential for lower running costs by charging at off-peak / lower priced periods and discharging when heat is needed, and the ability to offer flexibility services, both to the overall system (including frequency services) and to the networks. We would draw attention to the Grid Edge Policy report[8] which explored in some depth the role that storage heaters can play, noting the development of new smart, high heat retention heaters which we agree should be the required standard.

We would also draw attention to the past work by Ofgem on existing electric heat solutions[9].

Building types

The Grid Edge Policy report highlights the role that storage heaters can play in flats – which the DESNZ report does not discuss as a housing archetype despite the fact that in England over 20% of households live in them and over 35% in Scotland. With lower up-front costs and ease of installation, the report concludes that these are likely to be more cost effective and more practical than heat pumps in smaller properties and in particular in flats where there may be other practical challenges with heat pump installation.

It is vital that DESNZ looks at a more representative set of housing archetypes, including small flats that are typically lived in by households on lower incomes. For a just transition DESNZ must ensure that it understands the position for all sections of society not just those who are better off.

The report also looks at the position with hot water tanks which are increasingly being removed to free up additional space in smaller properties. That said properties with old style storage heaters will be more likely than many to have hot water tanks. The need for space for some form of thermal store is also an issue for heat pump rollout so should not be flagged as an issue just for alternative heating options.

More generally the Consultation fails to highlight the value that hot-water tanks may offer, including for using off-peak / low priced electricity. The Grid Edge Policy report flags how hot

[8] https://ssen-innovation.co.uk/wp-content/uploads/2022/08/NIA_SSEN_0039-Electric-Heat-Pathways-Final-Report.pdf

[9] https://www.ofgem.gov.uk/sites/default/files/docs/insights_paper_on_households_with_electric_and_other_non-gas_heating_1.pdf

water tanks are themselves becoming smarter. Independent advice is needed for consumers on the pros, cons and trade-offs of retaining or removing an existing hot water tank

Grid impact

The Grid Edge Policy report also explores the grid implications of storage heating (having been funded by SSEN Distribution). The key issue that it highlights is the need for ways of managing diversity of load to ensure that on constrained parts of the distribution network the storage heaters are not all charging at the same time overnight. This issue is wider than the simple randomisation of start times +/- 10 minutes discussed in the Smart Secure Electricity System Consultation (which relates to ramp rate not diversity of load).

This issue was brought to life recently with the changeout of RTS meters where, in Shetland, moving all storage heat customers to standard Economy 7 tariff was resulting in a high coincident load. This is being addressed through an urgent code mod P503 which will enable the DSO to effectively procure "diversity" of load by scheduling charging periods. This challenge is not unique to storage heaters but would apply equally to, for example, overnight EV charging once volumes increase (with likely clustering in particular streets) as highlighted by SSEN in its initial proposals for a Demand Diversification Service[10].

What this also demonstrates is the very valuable role that storage heaters can play as a flexible service. Although neglected by NESO in its CP2030 projections, storage heat was explicitly included in the Flexibility Roadmap (at Ofgem's instigation) given the very significant role it can play. Given the vital role that flexibility is expected to play in meeting CP2030, storage heaters should be given more support than DESNZ appears to do in this Consultation. While there is much discussion about the potential for heat pumps to operate flexibly this is typically dependent on the thermal mass of the property to support pre-heating – or requires a separate thermal store.

In contrast storage heaters are inherently flexible. Traditionally they have been charged up over night with heat discharged during the day, but going forward could be charged up whenever there is surplus energy on the grid.

Other considerations

One further aspect not considered in the DESNZ Consultation is the impact that tenure can have on the choice of heating solution.

While storage heating is listed in the document under "thermal stores", from the perspective of a private landlord the choice is more likely to be between direct electric heating and storage heating. Direct electric heating is cheaper to install for the landlord but more costly for the tenant. DESNZ should be looking at how to support the installation of storage heaters in preference to direct electric – rather than just focussing on what it sees as the theoretical ideal of near-universal heat pump installation.

We would also note that district / communal heating may represent a good alternative for some blocks of flats but is dependent on there being a single landlord to arrange installation. As such

[10] https://www.ssen.co.uk/globalassets/about-us/dso/the-future-of-load-managed-assets/dds-detailed-design---allocated-capacity-v1.0-external.pdf and https://smarter.energynetworks.org/projects/nia_ssen_0072/

it is more suitable for new build schemes (any tenure), or for social housing rather than private rented or mixed tenancy where individual properties will be taking decisions at different times – and where storage heaters are likely to offer the best solution.

Finally, the document refers to NEA work questioning the comfort levels provided by heat pumps. The Grid Edge Policy report explores some of these issues which relate to older style storage heaters as well as people understanding how best to use storage heater technology (and ensuring people are on the right tariff). This will be an issue for all novel forms of heating, including heat pumps. We note that the NEA response to this DESNZ Consultation is strongly supportive of storage heaters and Sustainability First endorses that view.

21 – Do you have any views on what further criteria, in addition to existing scheme criteria (e.g. SAP-eligibility), should be required for high heat retention storage heaters that are supported through government grant schemes, to prevent systems from drawing energy at peak times?

It is unclear why this is felt necessary and if the same requirement (ie to *prevent* systems from drawing energy at peak times) would be required of heat pumps or EV chargers.

For storage heaters their design is inherently aimed at a model where energy is drawn at night (or at other times of low demand / low wholesale prices) to be released when needed, including at peak times. With that inherent flexibility and higher tariffs at peak there is likely to be minimal use at peak times – unless top-up heat is used in addition in extreme cold. But to *preclude* storage heaters charging at peak risks leaving potentially vulnerable customers facing a cold home.

Elsewhere, Sustainability First has advocated exploration of the use of household capacity charges. These could vary by time of day and / or by season – and could offer a price-based incentive relating to maximum demand at the household connection. Such an incentive-based approach would be far less prescriptive than the proposal to prevent a particular technology drawing power at peak, and possibly just as effective.

Comments on the Analytical Note

We note the assumption that 98% of homes have **sufficient thermal mass to provide thermal comfort with either a low or high temperature heat pump**. We note that this relies on over 10% of heat pumps being high temperature (over 20% in off gas areas). Moreover, we urge DESNZ to continue to test this assumption through real world surveys rather than simply modelling, given we are picking up anecdotal evidence of issues in older buildings without cavity walls. We would also be interested to understand how far this takes account of the higher heat needs of the significant number of older people with limited mobility who require higher levels of heat to maintain comfort (and health) or the tougher climatic conditions in Scotland, for example.

We comment in our covering letter on the **choice of archetypes** for the model which excludes smaller properties like flats. The analytical note shows that for the smallest archetype (mid-terrace house) the average annual heat demand (kWh) is 6400 with a floor area of <90 m2. The Grid Edge Policy report shows (based on DESNZ NEED data) that flats built post 1965 would typically have total gas demand (inc cooking) below this level. The Ofgem TDCV figures[11] give 7500 kWh as the lower quartile point for gas consumption – ie 25% of households have demand below this level. It is vital that DESNZ properly takes account of these customers who will typically be on lower incomes.

We note that the **capital costs cited for storage heaters** in the analytical note and in the consultation includes the cost of decommissioning the existing wet central heating system. This highlights the importance of being clear what the counterfactual is. For homes with existing old style storage heating or direct electric heat the cost of installing storage heating would not involve removal of a wet heating system and therefore the cost would be much less, noting also that they would already have a suitable source for hot water. This is important as we are seeing people taking out storage heaters to replace them with heat pumps which is unlikely to make sense but is driven by incomplete analysis and incorrect assumptions which suggest that heat pumps are always superior. Replacing old storage heaters with modern, smart, high retention storage heaters would be much cheaper up front and with a proper time of use tariff

We note the assumption that storage heaters will make use of **Economy 7 tariffs** which it is assumed are 30% below Green Book rates. The assumption is that 80% of usage will be at night which we would consider reasonable, though it may still be under-stating the level of night time usage for heat / hot water. We note that current Ofgem TDCV assumptions are 58% day / 42% night but this will include other usage not just heat. We have also highlighted in our work on Economy 7 tariffs[12] that many customers are on Economy 7 tariffs who no longer have storage heaters and for whom the tariff is unsuitable. In terms of the price impact of night time usage we would highlight the Octopus Snug tariff aimed at storage heat users with a night rate of 9p and a day rate of 31.65p[13]. This suggests a much more marked discount than the DESNZ modelling assumes.

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[11] https://www.ofgem.gov.uk/sites/default/files/2023-05/TDCV%202023%20Decision%20Letter.pdf

[12] https://sustainabilityfirst.org.uk/wp-content/uploads/2023/02/glen_dimplex_report_economy_7_Jan23.pdf

[13] Source: Octopus website (Eastern region postcode)

We note that the current **carbon impact** ignores the different carbon intensity of electricity generated at different times of day. Currently storage heaters if using 80% (or more) of power at night, and negligible amounts in the peak, will have a much lower carbon intensity than other forms of heat.

We were surprised at the assumption of an annual **maintenance cost** of £90 per annum for direct electric heat and storage heat (only marginally below the rate assumed for heat pumps post 2035). Both direct electric and storage heaters are inherently very low / zero maintenance. In contrast heat pumps require an annual service[14]. The Eunomia report explicitly states that maintenance costs for direct electric systems (which includes storage heaters) were found to be minimal.

In looking at the **capacity of the fuse** and whether a heat pump can be installed without an upgrade above 60A the assumption is made that any EV would be charged on a timed basis to avoid peak heat. In practice the DNO would expect to upgrade the fuse (rather than relying on customer behaviour to keep within bounds). Upgrades would typically be needed anyway to accommodate an EV charger – and the RIIO ED3 price control is set to address the related issue of unlooping (which is not mentioned in the DESNZ Consultation). With major upgrades needed to the distribution network under any scenario it is not clear that this should be a differentiator in terms of the choice between different heat solutions given that the need to upgrade to 3-phase would only arise for very large properties.

Finally, on a different theme we have stressed elsewhere in our response the need to properly take account of **different behaviour patterns of customers** in comparing across solutions rather than as here focussing purely on the building fabric. Previous work by the Energy Systems Catapult[15] highlights the very different behaviour patterns of consumers in terms of hours that they heat their home, the proportion of rooms they heat, the temperature that they prefer and the level of control they want. The cost effectiveness of different solutions will vary depending on these factors as well as the building properties.

[14] https://www.vaillant.co.uk/advice/understanding-heating-technology/heat-pumps/what-to-expect-from-a-heat-pump-service/#:~:text=Although%20heat%20pumps%20are%20a,are%20performing%20safely%20and%20efficiently.

[15] https://es.catapult.org.uk/news/smart-energy-services-for-low-carbon-heat/?download=true