HEAT AND THE CITY

20/02/18

Response to Scottish Government's "Second consultation on local heat & energy efficiency strategies, and regulation of district and communal heating"

Authors

David Hawkey, Ruth Bush, Margaret Tingey and Jan Webb. School of Social and Political Science, University of Edinburgh.

Contact: dave.hawkey@ed.ac.uk / 0131 650 2841

Postal address:
Chisholm House,
University of Edinburgh,
High School Yards,
Edinburgh,
EH1 1LZ

We are happy for our response to be published with our names, and for Scottish Government to contact us.

For more information on our research on policy and practice for heat and energy efficiency, please visit www.heatandthecity.org.uk.

General Comments

The LHEES and DH regulation process will be a critical part of Scotland's decarbonisation programme. Particular strengths of the proposal are:

- setting an area-based strategy with a strong role for local government backed with appropriate resources,
- using socioeconomic assessment to both shape the geographical fleshing-out of heat policy and to underpin specific delivery mechanisms (district heating consents/concessions),
- situating near-term decisions in long-range considerations,
- coordination of energy efficiency with heat supply (though incorporating wider local changes to energy, particularly around transport, would further improve the approach and reflect the Scottish Government's emphasis on a 'whole systems' approach),
- coordination of strategy on district heating users and potential industrial heat suppliers,
- establishing governance mechanisms for district heating, which currently lacks regulation.

However, there are aspects of the proposals that need further development in specific ways we discuss below. The most significant of these is the absence of a clear and compelling case for heat supply technology choices and their timing, particularly in areas currently served by the gas grid. Below we suggest ways in which LHEES would contribute to testing and establishing the spatial and temporal case for deploying low carbon heat supply technologies. Along with the Energy Research Partnership (2017), we argue the narrative around heat and hot water needs to change from focusing on the *business* case for low carbon heat to the *societal* case for heat

decarbonisation. The LHEES process is an opportunity to engage in granular detail with the societal case for change in specific places, and thus contribute to reformulating the heat policy narrative.

There are also aspects of an effective system that we argue are currently missing from the proposals. In particular, mechanisms to mitigate demand risk for district heating development and a clear site of responsibility for ensuring heat decarbonisation generally or district heating development specifically. These are difficult issues to address when specific heat decarbonisation initiatives are framed as opportunities for users and/or investors (particularly apparent in the consultation's approach to district heating 'consents') rather than necessary or optimal contributions to a societal project of heat decarbonisation. Under an 'opportunity' framing, the case for government to impose requirements on building owners in order to realise heat decarbonisation projects is weak – why mandate connection to a system whose rationale is that it is financially attractive? Why impose responsibilities on particular organisations when projects are already in their interests? The consultation adopts both the *business case* and *societal case* framing of heat decarbonisation, but the latter is somewhat vague when translated into a case for specific changes (including when and where they should happen). The LHEES process should address this vagueness by establishing a clear and compelling case for particular interventions where such a societal case can be made.

Thus, while we are disappointed that some ideas explored in the first consultation have not been carried forward (particularly not taking forward mandatory connections to district heating and establishing zones as merely indicative), we recognise a clearer case in their favour is required for them to be justified, and argue the LHEES heat planning process is a necessary step in establishing such a case. These mechanisms should not be abandoned, but considered as possible future interventions that may be required once the LHEES process has set out more clearly the future of heat in Scotland and the trajectory to securing it.

Questions

Q1. Do you agree with our proposed overall approach to LHEES? Y/N

Yes.

Structure of LHEES development

LHEES are an opportunity to develop a more strategic approach to energy efficiency and heat decarbonisation. There are several issues that make heat a challenging policy area, which LHEES could help address:

- The Energy Research Partnership (2017) argues the aggregate financial costs of low carbon heat are likely to be higher than the incumbent system. Low carbon heat thus has a financial disadvantage against continued fossil fuel use. But given the decarbonisation objective, options for energy efficiency and low carbon heat should be compared with alternatives that similarly meet carbon objectives. One way to achieve this is to start with the long term view: under a given constraint (e.g. a 'carbon envelope' for the domestic and service sectors, as set out in the draft Climate Change Plan) what would be the most cost effective (in socioeconomic terms) configuration for heat and energy efficiency in future?
- Heat networks exhibit various economies. These take various forms, but generally the costs and risks associated with connecting users and heat sources to an existing network are lower than developing a new system. To quantify this for Scotland we have analysed the Scottish heat map, and found the extent of cost effective district heating is

approximately 50% higher when a planned approach is taken than the current fragmented, ad hoc development pattern. We consider this a conservative estimate as it only accounts for the location of heat demand and so ignores other scale economies (e.g. more efficient heat production and less required redundancy) (Hawkey, 2017). Because of this, part of the justification for an early phase of heat network development will lie in the opportunities it unlocks for the future development phases. To account for this, district heating planning needs to start from the long-term perspective and work back to the present.

- Relatedly, because of the longevity of energy distribution infrastructures, choices on heat supply should be made by reference to long-term energy system dynamics. In particular, patterns of electricity generation and demand in future will be very different to today, so national and local heat strategies should be oriented to that context. For example, one of the contributions of district heating would be to electricity system balancing through heat storage, a critical issue to mitigating demand peaks in scenarios with high penetration of individual heat pumps (Sansom, 2014).

Consequently, we suggest LHEES should broadly have a three-part structure:

1. Long-range vision of energy efficiency and heat supply for each local authority area. I.e. articulation of what the strategy aims to achieve over the long-run (at least 20 years) and where.
2. Transition plan, setting out what needs to happen and (broadly) when in order to fulfil the long-range vision.
3. Delivery priorities, setting out the near term actions that can be taken in each area to take steps along the transition.

In an idealised world, where the future can be accurately predicted, a long range vision would specify which heat supply approach would optimally satisfy Scottish Government objectives for every building. In reality there are a range of uncertainties, including over future prices and performance of technologies, demographic change and climate change. Nonetheless, the process should aim to identify places where the long-range optimal approach is the same across a reasonable range of assumptions and scenarios, and a transition plan should set out an understanding of when and how uncertainties should be resolved.

Long range vision

Establishing a long range vision at a local level is made challenging by interactions between heat and the wider energy system, including the impact of heat plans in other localities. For example, if the volume of hydrogen available at a given price in future is limited, it makes a difference to one local authority's planning if other local authorities are also planning to use hydrogen for heating. Similar considerations apply to electricity and bioenergy, and, indeed, planning heat supply will also be affected by other demand side developments, particularly transport.

Because of these system interactions, local authorities do not have the capacity to create long-range visions individually. Instead this aspect of LHEES development requires a degree of central coordination, not just to ensure consistency of approach but to account for aggregate impacts of each authority's strategy in the long term. As such, we suggest creating a long range vision should be a shared task between a central body and local authorities. The central body would begin by proposing a Scotland-wide[1] vision that satisfies the Scottish Government's

[1] Of course, relevant energy system developments do not end at the Scottish border, but concern both wider GB energy systems and (through interconnectors) developments elsewhere in Europe. There may be benefits to integrating Scottish heat planning with more extensive energy planning (e.g. including heat planning in England). This is obviously beyond the scope of this consultation, and there may be diminishing returns to aggregating beyond

objectives, which would be presented to local authorities. LAs in turn would either accept the vision for their area or propose changes. In an iterative process the central body would take these changes on board and update the overarching vision (to ensure it continues to satisfy policy objectives).

The process of establishing a long range vision should draw on the Scottish Government's investments in analytical capacity. In particular, the Scottish TIMES model and the Scottish Heat Map will be central to this process. They should be used in combination with a methodology for calculating the socioeconomic impact of different heat outcomes, and a set of scenarios or range of plausible assumptions about the future (e.g. upstream energy prices, infrastructure and equipment costs, technology performance). For a given set of assumptions and a socioeconomic model of costs and benefits, the central body would be able to calculate energy efficiency improvements and heat supply vectors that are (socioeconomically) optimal, taking into account interactions across all local authority areas. This would build on the analytic approach taken in the UK's National Comprehensive Assessment (NCA) of the Potential for CHP and District Heating (Ricardo Energy and Environment, 2015).

However, whereas the NCA only calculated three scenarios, it will be important to take into account a greater range of uncertainties in setting out long-range LHEES visions in order to minimise investments that are subsequently regretted. As assumptions change (prices, technology performance, success of CCS, etc.), so too will the output of the optimisation model. Generating a range of area-based, Scotland-wide heat scenarios will provide valuable insight for heat decarbonisation:

1. Areas where the optimal heat supply vector is the same across all, or most, plausible scenarios and assumptions. For example, the calculations would be expected to find some high density areas where district heating would be the optimal socioeconomic option across all assumptions. In these areas Scottish Government and Local Authorities could have a high degree of confidence as to the most appropriate approach to heat and energy efficiency in the long run (though there may be additional questions about timing the deployment of technologies, as discussed below).
2. Areas where different assumptions/scenarios identify different approaches as being socioeconomically optimal in the long run. These areas would be excluded from targeting low carbon heat supply deployment in the near term. However, they would still be important for heat planning. Sensitivity analyses should be used to identify which uncertainties the optimal outcome depends on, meaning knowledge development activities could be targeted at resolving these uncertainties.

While this kind of long-range analysis is not uncommon in energy policy debates it has not yet filtered through to heat planning. In particular district heating development proceeds by comparison to the financial cost of fossil gas, an approach reinforced by the definition of 'low regrets' heat networks being those that are currently financially viable. Long range planning, that accounts for the higher cost of hydrogen compared with natural gas, would, *ceteris paribus*, lead to district heating being considered 'low regrets' across more extensive areas. (This is reflected in the UK Government's scenarios for the 2017 Clean Growth Strategy which found *a greater* role for district heating in a hydrogen scenario than in one where hydrogen is unavailable.[2]) Conversely, many contemporary district heating networks use gas CHP and their financial

a given scale. Nonetheless, it would be worth investigating the question through the LHEES development process whether heat planning in Scotland would be improved by integrating with heat planning (and broader energy system planning) elsewhere.

[2] Assessment of the extent of non-gas heating in high-gas future scenarios would potentially identify areas where the gas network is likely to be wound down, which may help target the remainder of the Iron Mains Replacement Programme to minimise the stranding of this asset.

viability depends on income from electricity. A long-range approach to planning would need to address the residual emissions from gas CHP, and may conclude that some prospective schemes that would be financially viable in the present may impose higher long-run socioeconomic costs than non-heat network alternatives.

The model of socioeconomic assessment used to optimise long-range visions of heat and energy efficiency would be different to models used to plan a transition or to prioritise near term action. This is discussed further in response to question 5.

Transition plan

Once the long range vision has been established (including places where uncertainty in future heat supply is high and places where it is low), the next question to address is how to get there from here. There are three important considerations: timing, resolving uncertainties, and addressing barriers. Consideration of transition introduces additional socioeconomic costs and benefits (outlined here and in question 5).

Timing

The roll out of heat supply technologies will take time and resources. The transition plan should set out the timing of technology roll out, taking into account

- **Limits on the pace of change**, including supply chain capacities and opportunities to change heat supply. I.e. upper limits on the pace at which a technology can be deployed (or limits to the growth of this pace) will mean fulfilling the vision is dependent on adequate progress being made. These could be expressed as periodic benchmarks.
- **Benefits of delaying investment**. There may be economic benefits to delaying investment, particularly where public finances are to be used, while the economy grows (i.e. so public spending on heat decarbonisation is a smaller share of overall spending). This would have to sit within the envelope set by limits on the pace of change. There may be other resource management considerations that are considered more important, such as ensuring steady progress (and steady expenditure).
- The **relative cost effectiveness** of making progress in particular places or with particular technologies (e.g. in some places where the long run is certain, deployment of low carbon heat technology may achieve policy objectives such as carbon abatement more cost effectively than others)
- Opportunities to **coordinate change**, particularly to minimise the number of times SEEP visits each building by taking a 'whole building' approach to interventions.

Handling uncertainties

The Committee on Climate Change has developed a 'critical path' approach to handling uncertainties. In essence this asks what progress needs to be made by when if heat decarbonisation options are to be kept open. For example, if one plausible future scenario has a high degree of individual electrically driven heat pumps and very little low carbon gas or district heating, what state would the heat pump supply chain need to be in each year to ensure this possibility wasn't locked out? The Committee has commissioned studies into this question for both heat pumps (Frontier Economics & Element Energy, 2013) and district heating (Element Energy, 2015). Similar analyses for hydrogen would aid transition planning (for example, when would hydrogen-ready burners need to be incorporated into new boilers, what progress is needed on CCS or low-cost electrolysis by when?).

Within LHEES, identification of 'critical paths' would go beyond the CCC's analysis to incorporate an area-based approach. This would likely work in different ways for different technologies. For heat pumps, for example, issues to which the 'critical path' assessment relates

are less place specific than for district heating. That is, a significant way heat pump deployment keeps options open is by ensuring adequate growth along supply chains. By contrast district heating options would be kept open by establishing infrastructure in the right places, from where it would extend as needed. Consequently the notion of a critical path implies more place-specificity for district heating than for heat pumps. Planners (whether central or local) may therefore have more discretion in where they targeted 'critical path' enabling heat pumps than heat networks.

In addition to considering the 'critical path', the LHEES process, by making visible the sensitivity of long-term optimal solutions to current uncertainties, could support research and development efforts. These could include deployment projects aimed at revealing currently uncertain costs. That is, in developing a transition plan, consideration should be given to how technology deployment can generate knowledge which helps areas switch from an uncertain long-range optimum to higher confidence in which technology should be used where and what timescales are feasible for deployment.

Addressing barriers

Barriers in this sense are not generic barriers to market efficiency, but specific issues that challenge progress on fulfilling long-range heat decarbonisation. The LHEES process should support identification (and possibly quantification) of these and other barriers, which in turn should guide development of policy to address them. That is, an important consideration of planning the transition to low carbon heat will be changing market and policy frameworks within which individual projects are financially viable. This could be based on assessment of 'business as usual' dynamics and comparison with progress identified as necessary (such as 'critical path' progress), drawing on techniques such as behavioural modelling (c.f. Delta Energy and Environment, 2016).

For example, the Energy Research Partnership (2017) estimates the aggregate financial costs of a decarbonised and more efficient heat system are likely to be higher than current use of gas. Not only is this a difficult policy issue in its own right, but it has potential for first-mover disadvantages (Frerk & MacLean, 2017). One approach to addressing this may be to socialise the costs of transition, either through energy bills or general taxation.

Delivery priorities and programme

Whereas the transition plan should consider how policy and market frameworks should be changed to enable heat decarbonisation, it is also important that LHEES identify what progress can be made in the near term within existing markets and support mechanisms. Furthermore, as indicated in the consultation document, additional considerations such as fuel poverty mitigation might inform near term prioritisation of areas (though we argue the case for fuel poverty guiding the long-term vision for heat decarbonisation is weak). The processes listed under stage 6 in the consultation document (page 11) would form a central part of near-term prioritisation.

Much of the process described above goes beyond current practice, and would be additional to the programme-delivery orientation of recent heat planning programmes. It would allow clearer future-oriented targeting of near term development/delivery effort and afford assessment of the outcomes of delivery programmes against the trajectory of change deemed necessary to meet long range objectives.

Socioeconomic assessment and target setting

The consultation suggests local authorities would adopt targets before conducting socioeconomic assessments. This is the wrong way round if socioeconomic assessments are to identify the most appropriate heat and energy efficiency approaches for different areas, and where there are uncertainties as to what the long-term optimal approach is. Targets should instead be derived from the planning stages set out above, in particular from the transition plan

section. Note this may imply different targets for different local authority areas. For example, it may not be appropriate for a local authority to adopt stretching targets for low carbon heat supply when (a – long term) socioeconomic assessment is inconclusive as to which approach should be taken (b – transition) the risks (or socioeconomic costs) of delaying progress in the area are considered low and (c – near term) progress can be made in other local authority areas because uncertainties are low or analysis suggests delaying action carries more significant risk, and this progress would be adequate to national targets.

Participatory planning

The process outlined above depends on complex technical and socioeconomic calculation. However, because of the potentially disruptive nature of some of the interventions arising from LHEES (e.g. street-works, upgrading buildings' fabric, changing heat supply vectors and technologies), there is a case for exploring the role of participatory planning in the development of these strategies. Mechanisms that give local people a say over choices made in LHEES (such as citizens juries) would mean they both to respond to local conditions and are more likely to be broadly acceptable to the public. Indeed, local authority officers involved in the SEEP pilots have told us they see local public engagement around LHEES as critical. Participatory processes may also help raise awareness of the SEEP programme, ensuring that when the programme comes to an area people understand what is being asked of them in the context of changes across Scotland.

The nature of the statutory duty

The consultation proposes local authorities would have a duty to produce a LHEES and to report on progress toward its fulfilment. The consultation does not propose local authorities be given a statutory duty to make progress on energy efficiency and heat decarbonisation (e.g. to meet targets). There are various issues to consider in relation to the statutory duty. The Committee on Climate Change (2012), for example, has argued that LAs are critical to climate change mitigation (i.e. not just district heating development) and proposed the introduction of a statutory duty for LAs to 'develop and *implement* low-carbon plans' (p9, emphasis added). But there are differences of opinion among LAs and other parties on the desirability of a statutory energy function *per se*, particularly if this is merely a 'box ticking' exercise rather than a means of conferring meaningful resources (see Webb, Tingey and Hawkey, 2017). At a UK-wide practitioner workshop we held in June 2017[3] we gathered opinions on the effectiveness of a statutory duty on energy. Some participants argued that a statutory power would overcome current uncertainties, drive structural change and mobilise resources to create a single problem-owner for local clean energy planning and implementation. It would also establish the route for coordination between national and local energy system planning and development. Others thought that it risked limiting local discretion and creativity, causing LAs to look instead for the lowest cost route to compliance. Clarifying expectations is hence a necessary part of building a consensus on the role and responsibilities of LAs for energy initiatives and on the operation of any statutory functions.

Q2. What are your views on asking local authorities to report on tackling fuel poverty and climate change in the LHEES rather than the LHS?

There are a range of developments across Scottish heat policy with which LHEES should be coordinated. These include minimum energy performance standards for existing buildings (currently being developed for the private rented sector) and the new fuel poverty strategy (and definition). In some cases there may be tensions between these issues (e.g., some local authority

[3] https://heatandthecity.org.uk/event/local-authorities-and-energy-investments-challenging-research/

officers see tensions between decarbonisation and fuel poverty objectives in some places). *Because* of these tensions it would be prudent to incorporate the gamut of heat and energy efficiency issues into as few distinct processes as possible, in order that where policy objectives pull in different directions this is identified and tackled as early as possible, rather than allow different parts of policy to work against each other after local strategies and procedures have been put in place.

However, as we discuss below in relation to socioeconomic assessment, the role of fuel poverty in guiding LHEES should be clearly specified. In particular, fuel poverty should not be a consideration when asking what the long-term most appropriate combination of heat supply technologies and energy efficiency for a given area should be (that is, in setting the 'long range vision'). This is because the long-range vision for heat should be based on ensuring the fabric efficiency of buildings is no longer a driver of fuel poverty (as proposed as a 2040 target by Scottish Government, 2017a). Choices on low carbon heat supply should seek to minimise the overall whole-system costs of heating from a collective societal perspective. To the extent that fuel poverty considerations would lead to different decisions these would in effect reduce costs to some households by increasing them by a greater amount across the rest of Scottish society. A better approach would be to minimise whole-system costs and transfer financial resources to the fuel poor. That is, the question of how a low carbon heat system is paid for should in principle be held distinct from the question of how those costs can be minimised. Furthermore, it is households rather than buildings which are fuel poor, and the future level and geography of household incomes are more unpredictable than the location and use of buildings.

However, fuel poverty may well be considered appropriate to setting near term priorities or aspects of transition, though how this would work in practice is likely to vary from case to case – some interventions may prioritise fuel poor areas where they are likely to reduce the cost of warmth, but others may target non-fuel poor areas if, for example, the intervention relies on 'able-to-pay' household contributions. Our comparison of the Scottish Heat map with Changeworks' datazone analysis of fuel poverty indicates the current geography of urban fuel poverty cuts across the geography of district heating potential (Hawkey, 2017). Thus district heating networks that grow strategically are unlikely to be concentrated in places where fuel poverty rates are either high or low, but to encompass both as networks roll out from the highest heat density areas.

Q3. Do you agree with our proposed overall approach to zoning? Y/N

Yes.

We are supportive of the principle of zoning to identify priority areas for energy efficiency upgrades, and to set best area-based socio-economic solutions to low carbon heat. We are not however convinced that the proposals as currently framed will be effective in securing actual changes. For energy efficiency upgrades, where the local authority leads the programme, zoning may be effective as a means to prioritise areas, building on the present HEEPS-ABS model. Area-based models for all buildings however will require new regulatory standards, and some incentives such as cost contribution and/or low cost loans, for commercial and domestic property owners, in order to secure their participation in an area-based scheme

Proposed zoning for district heating lacks any requirement on building owners to connect, and hence has no effective means of enforcement; this seems to replicate the current voluntary arrangements which result mainly in small, single estate/campus, or social housing DH schemes being built. This will not secure the economies of scale which are necessary to ensure carbon savings from this network technology. As we acknowledge above, perceptions of uncertainty on

what heat supply approach will be most appropriate to the long-range decarbonisation programme make it difficult to conclude that any particular building should be compelled to connect to a heat network. The development of LHEES should give a far clearer indication than the Energy Strategy's scenarios on questions crucial to understanding what needs to happen within zones. These questions include: how much district heating is necessary to ensure climate change targets are met, where should these heat networks be located and over what period do they need to be developed. That is, LHEES should establish whether there is a compelling long-term case for heat networks, or indeed any other specific heat supply technology for an area, and a clear case for taking action in the near term. We anticipate there will be, but to impose a requirement on building owners that is regarded as fair will likely require this is set out in a quantitatively robust way. Thus while Scottish Government currently does not intend to create powers of compulsory connection or legislative restrictions on technologies that contradict a zone's designation, it should ensure the possibility of these uses is kept open in the design of zoning powers.

Ideally the zoning for upgrade of existing building stock would be organised on a 'whole building' basis, including retrofit for identified best value low carbon heat solutions; this minimises disruption and is more likely to secure area-based progress on decarbonisation. The current proposals seem more likely to continue the present incremental approach.

Q4. What are your views on the proposed district heating consent process?

The creation of an area-based system for the governance of district heating development will be critical to securing a step-change in district heating development, moving beyond the predominantly piecemeal and fragmented pattern that has characterised the sector in the UK throughout its history. It will provide an interface between heat planning within LHEES and infrastructure delivery. This should be understood as the interface between a *societal case* for heat decarbonisation and a *business case* for specific action. While the consenting process as outlined in the consultation goes some way to supporting the business case (though it could go further), the management of the relationship between socioeconomic issues and commercial issues needs much more development.

Supporting the business case

The consultation proposes granting certain rights to consent holders including wayleaves and permitted development. These would, of course, support the business case for district within the specified zone. A long-running difficulty for district heating business models has been the level of business rates, which the Scottish Government has offered a reduction on. This contribution to district heating business cases should be written into the consent process to give a clear signal of the longevity of this reduction.

What is lacking however is a means to ensure that applications for DH developments will be forthcoming. This requires a means of securing the commitment of building owners to connect, hence ensuring that the system will be both economically viable, and effective in reducing greenhouse gas emissions.

Aligning business and societal perspectives

There are a number of ways commercial drivers around district heating are unlikely to automatically align with objectives in LHEES. The consultation contains some requirements in §56 that would contribute to mitigating this problem, but the issue should be more clearly articulated and, in particular, a more dynamic approach to ensuring heat network development follows the trajectories set out in LHEES. Due to uncertainties these cannot be written into

consents at the outset, so the consent system will need to allow public authorities to issue new directions from time to time as energy systems change.

How and why are commercial drivers and LHEES strategic drivers misaligned? Actions the maximise commercial return are not necessarily those that maximise decarbonisation. For example, from a decarbonisation perspective connection of large heat loads is an important first step in establishing infrastructure to extend more generally to comprehensively decarbonise heat in that area. From a commercial perspective anchor loads are relatively attractive but the incentive to connect additional smaller users is weak. This is because extension beyond anchor loads adds complexity with relatively limited returns. We have observed these problems in existing concession models within the UK, which have frustrated public authorities' efforts to see heat networks expand beyond their 'phase 1' development (Hawkey *et al.*, 2016 chapter 6; Webb, Tingey & Hawkey, 2017). We have also explored this issue quantitatively, using the heat map to take into account the spatial relationships between heat users. Our model is indicative as it actually asks about extending district heating from high density areas to lower density areas as a proxy for extending from large users to smaller ones. Nonetheless, we conservatively estimate that, for a given heat sales price, a development model that seeks to maximise coverage rather than financial returns would reach 50% more of Scotland's heat demand (Hawkey, 2017).

There are further ways that the interests of a consent/concession holder might not align with the strategic objectives of an LHEES. Linking together adjacent heat networks developed by different consent holders is likely to contribute to enhancing overall system efficiency (both energy and cost efficiency). In some cases interconnection may be in the commercial interests of both consent holders, but this will not always be the case: in some instances interconnection will, for example, reduce the operation of one side's heat generation assets, threatening their income. This is already the case where existing heat networks rely heavily on electricity revenues from gas CHP, and so are reluctant to accept alternative heat inputs no matter how cheaply they are offered.

The consent system therefore needs to include robust mechanisms to keep district heating development aligned with LHEES strategies, not only the near term priorities but fulfilling the development identified in the transition plan. A key challenge here is that future development cannot be written into the specification of a consent because of interacting uncertainties. While exploration of these through the LHEES development process will give some indication of how LHEES strategies will develop as uncertainties are resolved, public authorities will need to retain powers to shape district heating development over time.

The mechanisms the consultation proposes to allow public authorities to govern heat network development in a given area focus on ensuring fulfilment of a plan set out when the consent is awarded. Setting conditions at the outset represents continuity in district heating development as a bounded project. A step change in district heating delivery requires a shift to district heating schemes continuing to grow over time. As the conditions into which these systems grow will evolve (including updates in LHEES) a more dynamic approach to governance is required.

What would a dynamic approach to governance look like? We would argue against expanding the system of incentives alluded to in the consultation to a dynamic mechanism for directing activities of consent holders. This would be a complex and likely expensive way to achieve LHEES objectives. Consider development of district heating in an area adjacent to one where a heat network is already present. Two options for the new area would be creating a new stand-alone network or extending the existing system. Where the extension would be more cost effective the existing consent holder would nonetheless have a commercial rationale to only extend at just below the cost of a new network, as this would maximise their net income while securing the contract for the work. Dynamic governance of consents should ensure the scale efficiencies of assets created within a consent area are available to society and the natural

monopoly economic characteristics of heat networks are not unfairly exploited by their operators.

The right balance is not between ensuring strategic development and dynamic responses to unanticipated proposals arising outwith the public sector (of which there are vanishingly few in the UK beyond those driven by London planning policies), but between the commercial interests of consent holders and the dynamic societal interests represented by consent granters. Getting this balance right will interact with the way heat networks are financed. The more strategic district heating development relies on commercial finance, the harder (or more costly) it will be to exercise dynamic governance over heat network growth. Experience with PFI (in areas other than district heating) indicates not only that it has been more costly than public investment would have been (National Audit Office, 2013), but investors impose constraints on projects to prevent deviation from their original model in order to protect their revenue stream (Webb & Hawkey, 2017).

These issues could be addressed by public funding of heat networks, putting consent holders more clearly in the role of delivery agents rather than entrepreneurial investors. Public funding here could be direct public investment or some form of bond issue (perhaps a low carbon heat bond). Another approach would be to establish clear rules for compensation of investor-consent holders when public authorities impose new requirements. This could be achieved by requiring consent holders to adopt standard transparent accounting procedures specific to heat networks (as are required under Dutch district heating regulation) on which public authorities would base their judgement of compensation (including compensation in the event public authorities wish to terminate a consent before its expiry and take control over its assets).

Transparent heat-specific accountancy would have ancillary benefits. A lack of access to data has frustrated at least one UK local authority's efforts to guide development of concession-based heat networks in their area. Accounting procedures specific to heat networks would also improve transparency in district heating business models, and mitigate heat users' perception that their monopoly supplier is exploiting them. These perceptions, whether accurate or not, are common where European heat networks have transferred to private ownership.

There is, however, a real risk that the cost of developing the consent process is not justified by subsequent limited use. For example it is extremely unlikely that any speculative DH development applications will be made, when there is no means for an applicant to secure guaranteed long term heat load. Rather than seeking to cover every potential model of (a) where consents originate and (b) the relationship between consent grantor and consent holder, Scottish Government may have to make choices as to what the model the consent system is tailored to.

Who should grant consents?

It will be critical to ensure that standard, centrally devised, procedures are used, in order to avoid ad hoc decision making in different parts of Scotland. Consents should be structured around the content of LHEES, but consideration should be given to whether local authorities or a central body should be responsible for issuing and (dynamically) managing consents. This is likely to be a complex process imposing significant resource issues on local government that may be better handled by a central body. A centralised approach should, nonetheless, require assent from the local authority before a consent is granted (this is roughly the approach the Norwegian government used until recently), and local authorities should have a clearly specified role in ongoing governance of consents in their area.

Bidding for consents and recruiting users

The consultation suggests in some circumstances applicants for a consent would need to demonstrate sufficient demand from customers to join a shared schemes once it is available. A similar requirement is placed on Norwegian applicants for area-based district heating licences,

but in those cases it is the applicant rather than the public authority which has identified the zone. For strategic district heating initiatives emanating from LHEES and tendered for delivery, requiring applicants/bidders to engage with potential users (particularly with the key anchor loads in the area) would duplicate effort not only on the part of applicants but also of building owners. It is difficult to see how this could work productively in practice given the likelihood building owners would seek to negotiate arrangements to their advantage. If competing applicants were to engage building owners with distinct offerings, building owners may only agree to connect to the applicant which offers the best terms. If one applicant can outcompete others for every building in an area, this would indicate it was offering the most cost effective scheme overall, and so would be a positive outcome. However, if different building owners have different preferences between applicants (perhaps one applicant offers a substantial discount to a hospital while a competitor offers more favourable terms to the neighbouring university) the result may be that no single applicant can secure agreement with enough buildings for their proposal to be viable.

The alternative would be for building owners to make agreements with multiple applicants irrespective of the differences in their offering, in which case the requirement for each applicant to engage individually with building owners would lose its point. A more efficient approach would be for the consent granter to secure agreement from building owners, perhaps taking account of particular conditions required by anchor loads and stipulating them as minimum conditions in the tender. Giving the consent-granter responsibility for securing the user base (or, at least, the anchor loads) would mitigate connection risk, and could be a complement to the ADE Task-force's proposal that public authorities underwrite demand risks. It could also simplify the public procurement issues that need to be overcome in order for different public sector bodies to commit to a district heating scheme (see response to question 13).

In particular, what are your views on:

a) the appropriateness of any potential options for a relevant body to act as 'the developer of last resort', to ensure completion of development?

The role for a 'developer of last resort' is more extensive than ensuring completion of development. The function should be regarded as a backstop that can be called on when district heating development in a consent area fails to fulfil the aims of the LHEES strategy. In particular, if district heating development is to change from a fragmented patchwork to strategic networks *that grow*, the notion of 'completion of development' is unhelpful.

This function is probably best secured at national scale; multiple local developers of last resort may stall projects for lengthy periods while councils with limited expertise seek to fulfil evolving strategic growth objectives.

b) options for ensuring that district heating operators have similar or the same rights as other statutory undertakers for permitted development and wayleaves

We agree that a licensed DH operator should have equivalent rights to other statutory undertakers for permitted development and wayleaves. Project costs are likely to increase without this, because of the additional time required to gain all relevant permissions, including responding to any landowner objections.

Please provide any appropriate evidence to explain your answer.

Q5. What are your views on the proposals for socioeconomic assessment?

We support the general approach set out in the consultation document. Socioeconomic assessment is likely to be critical to the success of LHEES in establishing a compelling societal

case for specific changes in specific places. This is important for establishing legitimacy of and buy-in to the actions arising from the LHEES process. We draw attention to one of our findings from our research as part of the SEEP pilots evaluation that clearly illustrates this role: local authority officers reported socio-economic assessment was an important way to provide evidence to local politicians of the local value of low carbon heating projects and energy efficiency programmes. The support of local politicians and senior local authority management is critical to the success of local energy initiatives, both within the SEEP pilots and more broadly, because it bring specific pressures for action and assembly of resources (Webb, Tingey & Hawkey, 2017).

The consultation doesn't set out detail on what socioeconomic methodologies would look like, but we note that across different decision making contexts (or simply, across different questions) different methods may be needed, though these of course should be consistent. We suggest the following considerations for the decisn of socioeconomic assessment.

Setting long run visions. In our response to question 1 we argued LHEES should be structured around long-run visions, with a transition plan and near-term priorities designed to fulfil long run objectives on heat decarbonisation. In our response to question 2 we argued fuel poverty is not relevant to decision making on long-run energy efficiency and heat supply choices. In part this is because the Scottish Government's fuel poverty strategy seeks to eliminate poor building fabric as a cause of fuel poverty by 2040, so LHEES long-run visions should be based on meeting this target. That is, when exploring long run scenarios, a minimum level of fabric efficiency for every building should be adopted as a constraint that all scenarios meet rather than a variable to be optimised.

There is merit in extending the set of constraints to also include greenhouse gas emissions, to ensure the carbon envelopes proposed in the draft Climate Change Plan are achieved (Scottish Government, 2017b). This approach contrasts with setting a price for GHG emissions and only adopting measures whose carbon cost effectiveness falls beneath this price. In addition to the reasons given against this abatement-based approach in the draft Climate Change Plan, setting a carbon envelope would avoid the difficulty of choosing a GHG emissions price in the context of strengthening international and Scottish climate change targets. Furthermore, given the established commitment that Scotland will move to a 'largely decarbonised heat system by 2020' (Scottish Government, 2015), a carbon price approach to the long run would only be relevant to a small minority of heating.

The draft Climate Change Plan also proposes targets for the proportion of heating met by low carbon technologies. This metric too could be adopted as a constraint when constructing scenarios for the long-run vision.

Scenarios constructed for the long-run vision would likely be based on principles used in other socioeconomic assessments. These include adopting a social perspective on the value of time (discounting) and excluding transfers (such as taxes) which do not represent resources being used up. Current UK Government guidance (DECC, 2015) values changes in gas consumption at the Long Run Variable Cost which excludes most costs of the gas distribution network. The logic is that maintenance and operation of the network represent fixed costs which, if avoided by one household decreasing its consumption, are nonetheless borne by society through slightly higher charges to all other users. In the context of LHEES, avoided gas network costs will need to be taken into account where relevant (i.e. when considering scenarios that include winding down parts of the gas network). In addition the possibility of avoiding some of the remaining costs of the Iron Mains Replacement programme through non-gas heating roll out in the near term should be incorporated into the analysis.

Long run costs and benefits should be embedded in a whole-systems perspective to account for interactions with changing electricity systems and competing demands for energy resources (particularly bioenergy).

One consequential issue for analysis of long run costs and benefits for heat will be how financing costs are handled (that is, the costs of equity returns and debt interest). For district heating systems, where costs are dominated by capital costs and asset lifetimes are long, the cost of heat is highly sensitive to the rate of return assumed. The appropriate role of financing costs in socioeconomic calculations is somewhat ambiguous. Recent UK Government guidance advises financing costs should be taken into account when adopting a society-wide perspective, arguing these represent real costs of risk and uncertainty (DECC, 2015). However, other UK government guidance (Office of the Deputy Prime Minister, 2004:p.110) argues "analysis should exclude … finance costs as they represent transfers without a change of resources in the economy." The National Comprehensive Assessment effectively took both approaches, estimating potential both with and without financing costs (describing the latter as a de-risked) scenario. The impact was highly significant to the results: for Scotland the inclusion of finance costs reduced the 2025 socioeconomic potential for district heating from 45% of heat demand to 7%. Scottish Government will need to decide its approach to financing costs, and (if finance costs are included) to scenario assumptions both about public and private finance and about commercial risk.

Opportunity costs. One advantage of developing long-run analyses with fixed targets (for emissions or low carbon heat penetration) is that it could underpin a notion of opportunity cost that would support decision making in the near term. For example, if long-run analysis indicates option A is the best approach for a given area in meeting the targets, and option B is the second best (or the default) approach, the cost difference between A and B can be considered the opportunity cost of failing to deliver A. More concretely: if, for example, long-run assessment indicates for a particular area that district heating has a lower socioeconomic than hydrogen, the difference between the two can be thought of as the cost of failing to develop a heat network. This construct would be a route to linking long-run thinking to decisions about individual connections (the third use outlined in the consultation). For small users the decision whether to connect to a heat network likely has little impact on the system's overall viability and so the opportunity cost when a small user doesn't join a heat network would be minimal. For a large anchor load whose participation is important to establishing a heat network and extending it out to other users, the opportunity cost calculation would be much more significant, and would reflect the contribution the anchor load's connection to a heat network would make to minimising the costs of heat decarbonisation. Where the opportunity cost associated with individual decisions is found to be high there would be a clearer case for the intervention of public authorities to ensure the connection goes ahead, which could extend to compulsory connection.

Transition planning and near-term prioritisation. In our response to question 1 we suggested some considerations that would be relevant to mapping out a route to decarbonised heat, including considerations of timing. These may be considered part of a socioeconomic assessment, even if not all are amenable to expression as costs and benefits in monetary-equivalent terms. For example, the resolution of uncertainties or the reasons for keeping options open under uncertainty may not find ready expression in quantitative terms that can be mechanically traded off against other considerations in a cost-benefit analysis. Similarly near-term prioritisation, for example responding to patterns of fuel poverty, may be more helpfully construed as a means of selecting between options rather than an additional cost-benefit variable. Socioeconomic assessment, in linking the long-run to the present, may need to be a form of multi-criteria analysis rather than a univocal cost-benefit assessment.

There is a difficult balance to strike in setting up socioeconomic assessment methods between the complexity demanded by whole-system interactions and inter-temporal dynamics, and the need for the process to be sufficiently transparent that it is understood and effective in presenting a compelling case for specific decisions. While there are still a lot of unknowns about how such an approach could be put into practice, not just in terms of methodology but also establishing its use within decision making, we anticipate there will be challenges in terms of:

- Accessing relevant and accurate data to inform such analyses
- Building a shared understanding of the role of socio-economic analysis within strategy development and implementation amongst the wide range of stakeholders that will be required to use it.

Support of local politicians and senior management within councils is critical to the development of ambitious LHEES and successful delivery of its projects and programmes. This local leadership is also an important element of establishing local public support and understanding about the changes proposed within LHEES.

Proposed methodologies for the different forms of socioeconomic assessment should take into account their role in presenting a societal case for specific measures that is meaningful to different stakeholders. In particular, buy-in from local government senior management and elected officials will be better secured if locally relevant impacts are clearly visible in multi-criteria assessments, particularly for near-term prioritisation. Thus alongside national priorities on climate change mitigation and fuel poverty eradication, socioeconomic assessment should also consider assessment of impacts on job creation and economic benefits, air quality, health and social care, and skills and education.

Q6. What are your views on the proposals for data for LHEES?

Please explain your answer, including any available evidence or examples.

Early feedback from Local Authorities in relation to our evaluation of LHEES pilots suggests that streamlined access to accurate building-level data will be a necessary requirement for minimising the costs of developing the LHEES. Data sharing agreements need to be negotiated at Scottish level, rather than this work being unnecessarily duplicated in each LA, resulting in delay and uncertainty about compliance with data protection laws.

Meeting Scotland's climate change targets for decarbonising heat from buildings is also likely to be helped by use of surplus heat from industrial sources. We know that the existing voluntary arrangements for industry with surplus heat to provide data about potential off-site heat provision result in patchy provision. Continuing this voluntary arrangement will weaken LHEES development, result in delay while parties seek to negotiate access to data, and is likely to weaken the socio-economic case for DH projects, which may lose the benefit of using surplus heat, and converting 'waste' and environmental pollution into a low carbon 'resource'.

Our comparative European research on heat and energy efficiency policies for example has shown that large industrial heat users can act in collaboration with local plans for low carbon district heating. In Hamburg in 2017, a contract has been drawn up between Aurubis AG (copper refinery) and Enercity Contracting Nord GmbH (DH developer and operator) for industrial waste heat supply to the regeneration area of Hamburg Hafencity East. Aurubis investment is expected to be €17 million. Enercity Contracting Nord will invest €16 million in developing a heat transport pipeline to the Hafencity & back up energy centre. Aurubis will receive about 30% of the investment from the German Federal Ministry for Economic Affairs and Energy (BMWi) via the public infrastructure bank KfW. A similar level of funding is planned for Enercity Contracting Nord from ERDF via the city Authority for Environment and

Energy (BUE), as well as the German Ministry BMWi. Enercity is the municipal enterprise for Hannover city and Region.[4]

Q7. What types of data information would industry be willing to provide a local authority or national delivery mechanism to develop LHEES, so that they can identify opportunities (potentially in aggregate) for heat demand reduction and heat recovery, both on and off site?

No comment

Q8. What data from industry would be most helpful in developing district heating projects?

As responses to the first consultation made clear, supply to district heating is not the only option for improving the resource efficiency of energy inputs to industrial sites. It would therefore be helpful to the heat planning process to understand not only the volume and temperature of heat sites currently eject, but also the costs of efficiency improvements to reduce heat rejection. This is likely to be a schedule of costs and energy savings rather than a single figure as there are multiple changes at any given site that would improve efficiency. This would allow comparison with the cost of heat capture for district heating as an alternative to efficiency improvements.

Historically in the UK plans for district heating involving industry have suffered from closure of sites before investment in heat capture and transport has been recovered (in some instances, before networks were even built). Additional useful data in planning district heating would therefore be the period over which an industrial site owner would be willing to agree to supply heat. If some agreement concerning the use of the site in the event an industrial process shut down could be struck, this might support longer-term confidence in the use of the infrastructure connection, though the owners of industrial sites may be reluctant to make commitments of this kind.

Q9. What data could be provided without compromising competitiveness of these organisations.

Please explain your answers, including any available evidence or examples.

Without clear explanations from producers of residual heat, it is difficult to understand the arguments about risk to competitiveness. In the case of the large scale Hamburg Aurubis copper refinery described in Question 6, it was suggested that the industry benefited from avoided costs of regulated discharge of waste heat to the environment and derived reputational capital from contracting with the city. There no evidence that the company regarded the provision of data as compromising competitiveness. The CEO has stated that the company could deliver significantly more district heating for the city of Hamburg, reducing CO_2 by circa 140,000 t per annum and that they are developing technical, financial and contractual bases for this supply.

[4] See https://www.aurubis.com/en/public-relations/press-releases--news/news/2017/17.02.2017---aurubis-and-enercity-enter-into-contract-for-delivery-of-co2-free-waste-heat-for-hafencity-east

Q10. What are your views on our proposed approach to district heating licensing?

Please explain your answer, including any available evidence or examples.

We support proposals for licensing DH as a means of setting a shared standard of best practice for technical performance, inter-connectivity of systems and customer protection. We agree that licensing should be carried out by a national body, with appropriate powers of enforcement. The proposed system combining licencing and concessions should be seen as a more efficient approach to regulation than a single mechanism, as it avoids duplication of effort in applying for a licence and demonstrating compliance with requirements common across all heat networks in Scotland.

We noted in our response to question 4 (on district heating consents) that there is a case for requiring heat network operators to adopt specific accounting practices to support transparency of business models. Lock-in to a monopoly supply can lead to perceptions that an operator is extracting monopoly rents meaning mechanisms to build trust in the fairness of an operator's business model is important. This is in addition to ensuring consumer protection standards around service levels, contracts, etc. Recent controversies around specific district heating schemes illustrate these perceptions, describing "an industry where commercial providers are under pressure to deliver a high return for private investors from a relatively small pool of customers," (Hodkinson & London, 2017:p.3). A survey of heat network users commissioned by the UK Department for Business, Energy and Industrial Strategy[5] in 2017 found that negative perceptions of district heating concentrated in systems operated by private companies. For example, the proportion of heat network users who said they want to switch suppliers was 16%, but this fell to 11% and 8% for local authority and social landlord schemes respectively and rose to 30% for privately operated schemes. (Note within the control group, households with gas boilers, 22% said they wanted to switch suppliers.) Establishing transparent accounting procedures for heat networks would be a minimal form of economic regulation to promote trust.

Q11. Taking into account the limitations of the Scottish Government's legislative competence in relation to consumer protection:

a) what are your views on our proposals around consumer protection

The proposals are an improvement on the current uncertainty over provisions, and should help to ensure common practice in the type of billing and service information provided to customers. The results of the CMA inquiry[6] into domestic heat supply standards are likely to be critical to eventual practice, and it seems likely that all DH operators in the UK will be subject to new requirements for customer protection (see summary findings from the BEIS Heat Networks Consumer Survey[7])

The main weakness in the Heat Trust scheme is the absence of transparency in heat tariffs; stronger protection should be provided, based for example on Danish practice of publishing heat tariffs online so that customers can compare prices. Minimally, the structure of tariffs, and the rationale for price setting and price increases should be set out in heat supply contracts. Standard accounting practices separating out heat supply from other activities for consent

[5] https://www.gov.uk/government/publications/heat-networks-consumer-survey-consumer-experiences-on-heat-networks-and-other-heating-systems
[6] https://www.gov.uk/cma-cases/heat-networks-market-study
[7] https://www.gov.uk/government/publications/heat-networks-consumer-survey-consumer-experiences-on-heat-networks-and-other-heating-systems

holders would support inspection of financial surpluses arising from heat sales, and be a route to securing user confidence that their monopoly heat supplier is not extracting monopoly rents.

b) how do you think could we provide a robust complaint resolution process in relation to District Heating in Scotland?

Please explain your answers, including any available evidence or examples.

No comment

Q12. What are your views on how consumer advice should be provided for district heating customers in Scotland – what form should this take? Who should it be aimed at? What should be provided?

Please explain your answers, including any available evidence or examples.

Consumer advice can help households make use of their heat control systems (in ways that optimise their efficiency), understand the structure of their tariff and the procedure for billing them. In our research at the Wyndford estate we found households struggling with all three issues, and note the work undertaken by Cube housing association in response to engage with households to identify and resolve problems. Changes to in-home technologies, the most efficient way of operating heating, tariffs and billing procedures will arise across the SEEP programme, not just for district heating, though in different form and combination for different buildings. There is clearly a case for support to be targeted alongside area-based programmes.

Q13. What are your views on the proposed approach to connecting heat users?

DH is most likely to be viable on a socio-economic basis in areas of heat density and diversity of load. In these instances, the continuing voluntary arrangements for connection of key anchor loads are likely to undermine the economics of development. Our research found that under current circumstances it is often extremely challenging to secure agreement that customers will connect prior to a network being in place (Webb, Tingey & Hawkey, 2017; Webb & Hawkey, 2017). A stronger requirement to connect will be necessary to ensure that DH is developed at the scale needed to make the investment viable.

As the consultation notes, one route to connecting anchor loads to a heat network within a concession area would be for the public estate to commit to a system. While we believe there is a case for general powers of compulsory connection, if these are not take forward, the approach to securing public sector connections should be strengthened. Public procurement rules are interpreted in the consultation as confining the ability of public bodies to make such commitments: energy supply to public bodies has to be procured through a competitive tendering process in which district heating operators have to compete. This means holding an area-based consent would not automatically mean public bodies' buildings would connect to the heat network. The consultation references Scottish Futures Trust (SFT) guidance which expands the issue. Several work-arounds are discussed in the guidance, including arrangements which keep the district heating operator as an in-house or arms-length organisation (e.g. the Teckal exemption). These approaches are likely difficult to adapt to connection of private sector heat demand and would perpetuate the current fragmented approach to district heating.

However, one route is discussed in the guidance which has not been tested: specifying characteristics of the energy supply when issuing a tender. Public authorities are generally able to make specifications in procurement (e.g. for sustainability), but the difficulty highlighted by SFT arises when specifications "have the effect of creating unjustified obstacles to the opening up of public procurement to competition." The issue, then, appears to be whether a procurement process that restricts the number of eligible suppliers is objectively justified. SFT states there is no directly applicable precedent for energy supply. Where the NHS has been permitted to issue a tender that restricted the number of eligible suppliers to one this was justified on objective grounds relating to the needs of the contracting authority (in that case, only one supplier was able to supply equipment compatible with existing systems). The SFT guidance suggests the risk of challenge to a public authority whose tender for energy had the effect of restricting competition to one supplier (the district heating concession holder) would be that "the justification would not relate to the functionality or characteristics of the energy, but rather its means of production." This appears to be based on the assumption that the tender would specify the energy had to be supplied by district heating. However, Scottish Government should explore what might be possible in this area, particularly in the context of socioeconomic assessment and long-run heat planning under LHEES. For example, would it be possible for public authorities to require energy supply to contribute to the objectives of an LHEES, or to demonstrate optimality in socioeconomic terms? Where strategic district heating zones have been identified, these should already be based on such considerations. This would mean the risk of an energy supplier other than the concession holder winning the tender would be low, but this restriction would be justified by reference to the duty of public bodies to act in "the way best calculated to contribute to delivery of the [Climate Change] Act's emissions reduction targets," (Climate Change (Scotland) Act 2009 §44). The importance of de-risking heat demand by connecting (at least) the public sector estate to networks in concession areas means (a) this possibility should be explored fully and (b) design of heat planning processes and socioeconomic assessment methodologies should take into account their use in establishing objective justification for a tender whose effect is to restrict the ability of parties other than the concession holder to bid.

Q14. What are your views on the proposed phased approach to non-domestic sectors with potentially usable surplus heat?

Please explain your answers, including any available evidence or examples.

For reasons noted in the consultation document, district heating development in Scotland is unlikely to start with surplus-industrial heat, but instead bring this on as heat networks grow. This underscores the importance of ensuring the suite of mechanisms under discussion results in heat network growth and not continuation of the piecemeal fragmented pattern of development. As heat networks grow, so too will the opportunities for financially viable and socioeconomically desirable connection of industrial sites. A phased approach that builds more mechanisms to support connection over time would match this trajectory.

More detail is needed on what the mediation process would actually involve. The proposed approach would be applicable where connection is judged to be socioeconomically viable but, presumably, the industrial site and district heating operator cannot find a mutually acceptable commercial arrangement for infrastructure investment and heat supply. Would the role of the mediator be to construct an innovative commercial arrangement that the parties themselves lacked either skills or willingness to develop? Or would this be a channel by which commercial impediments to socioeconomically desirable outcomes would be revealed, allowing judgement of

whether further intervention (such as financial support or more onerous regulation) is necessary, either in the specific case or generally?

Q15. Requiring all regulated non-domestic sectors (see Box 1) with potentially usable surplus heat to carry out energy efficiency assessments, including heat (and its recovery, and onsite and offsite use), and implement recommendations where feasible.

We support this proposal, but suggest energy efficiency assessments take both the site's commercial perspective and a socioeconomic perspective. The latter would reveal instances where commercial drivers pull in a direction that doesn't contribute to overall societal wellbeing.

Q16. How should energy efficiency (including heat) be assessed across the regulated non-domestic sectors – including consideration for energy efficiency beyond the site boundary?

The consultation makes clear that the Scottish Government does not see industrial sites as the basis for new district heating development, but as additional heat suppliers to schemes that are already equipped to supply heat in the event the industrial site is unavailable. The phased approach, therefore, does not propose creating a regulatory mechanism whereby industries with surplus heat would have to *ensure* district heating development in order to be compliant. However, there remain various suggestions for the siting of industry to proceed by reference to LHEES district heating plans and to ensure they are 'district heating ready'. Under these circumstances an energy efficiency requirement would support plans to connect the industrial site to supply the heat network. As the heat network would not be under control of the industrial site, the relevant notion of energy efficiency would include exporting heat to the heat network, but not include the efficiency with which the heat network made use of that heat. Consideration would need to be given to the degree of control the industrial site may have over its export to the network in setting an energy efficiency standard. This would depend on the extent to which the district heating operator would take surplus industrial heat before other heat sources during periods of low demand (i.e. the summer).

Q17. Could a more consistent approach be achieved within the PPC regime, with the existing energy efficiency requirements for Part A sites being applied to Part B sites?

No comment

Q18. Which benchmarks or criteria should be used / considered in assessing energy efficiency?

No comment

Q19. What range of industrial processes should be covered, including size and sector, and why?

Please explain your answers, including any available evidence or examples.

Coverage should include energy industries, particularly thermal power generation and hydrogen production. Thermal power production may be best covered by coordinated UK-wide

regulations to prevent energy efficiency standards pushing plant (such as those bidding into capacity auctions) out of Scotland and into England. For hydrogen production, Scottish Government should encourage ongoing R&D to consider potential for heat capture to supply district heating – what impact would this have on different production processes (e.g. steam methane reforming or electrolysis) and how would heat capture compare with onsite efficiency improvements from a whole-systems perspective?

Q20. What are your views on the establishment of a national delivery mechanism to support local authorities in delivering their proposed functions for LHEES and district heating, and which could support delivery and governance of SEEP more widely? What form should it take? What functions should it have?

Please explain your answer, including any available evidence or examples.

Form of the National Delivery Mechanism

We support the proposal to create a National Delivery Mechanism. Given the range of functions it would perform and the specialist expertise it will need to incorporate it should be established as a new body.

There are some parallels between the proposed NDM and the support offered to local authorities in the LHEES pilots in the form of the consortium of nationally procured consultants and existing national public sector support programmes. Our early findings working on the evaluation of the LHEES pilots shows recognition amongst the pilot local authorities that received this support of the benefits of this form of nationally provided support. In particular, participating local authorities regarded a centralised approach to procurement beneficial in overcoming limitations on their in-house expertise and capacity, and they felt a central service would enable better sharing of learning across local authorities.

However, the balance of activity and responsibility between the NDM and local authorities needs careful attention. Our work on the evaluation of the LHEES pilots demonstrated a number of examples where the current staffing capacity and expertise within local authorities was not sufficient to develop and deliver an LHEES, even with additional external support through national support programmes and consultancy expertise. The distribution of roles and responsibilities between local authorities and the NDM will clearly have implications for what capacity-building within local government is required. We suggest that the process of piloting LHEES continues to place a focus on exploring the additional staffing and skills requirements that are required by local authorities in-house, alongside a NDM

As we argue in our response to question 2, there is a clear case for ensuring interactions between heat decarbonisation and fuel poverty are accounted for early in the planning of responses to both issues. We therefore agree it should be established as a central agency for fuel poverty programmes.

An important aspect of the NDM's overall role would be to mediate between Scottish and local scales of the transition to low carbon heat. As such consideration should be given to incorporating other aspects of low carbon transition which also have a multi-scalar character, particularly roll out of low carbon transport infrastructure.

Functions of the National Delivery Mechanism

The functions performed by the NDM should be oriented towards:

- Making most efficient use of skills and capacities in the public sector by pooling them.

- Ensuring opportunities for learning across local authorities.
- Streamlining procurement across the various activities arising from LHEES
- Providing an aggregate perspective on LHEES to ensure a whole-systems approach is taken and administrative boundaries do not prevent development of effective schemes (for example, ensuring opportunities for district heating schemes that cross local authority boundaries are not missed)
- Ensuring consistency in decision making, both through defining and updating methods of socioeconomic assessment, setting licence conditions and the parameters of dynamic governance of district heating consents.

The functions set out in §158 would benefit from delivery by a central body to secure the above objectives. Our suggestion for orienting LHEES to long-range system planning (question 1) also implies specific analytical and planning functions for the NDM. In addition, the following specific considerations arise from our work with the SEEP pilots that should inform the design of the NDM:

- **Local authority lack of in-house specialist energy skills**. The SEEP pilots demonstrate that, even with external support, local authorities need in-house specialist expertise to develop projects and commission external partners. Not all local authorities have this expertise, and in some authorities a recruitment freeze prevents them bringing this expertise in or replacing it when officers move on.
- **Lack of specialist public engagement skills**. Local public engagement around LHEES was seen as critical by the local authority officers involved in the SEEP pilots. However, some council energy staff did not feel equipped with the skills for engaging with the general public about the scale of change that is needed in energy efficiency and heating supply.
- **Lack of senior level and political support for the LHEES pilots.** There was a lack of strategic- and senior-level officers involved in delivering the LHEES pilots. The local authority leads recognised that going forward this would be necessary to achieve the level of decision making and resource allocation implied by LHEES and the ambitions in the Climate Change Plan.

We also note the proposed functions of the NDM include development roles (e.g. in LHEES preparation) and a regulatory roles (approving LHEES, licencing, etc.). Care should be taken in the design of the NDM to avoid conflicts of interest, either real or perceived, arising from these roles.

In our broader research into local authority engagement with energy an issue that has arisen multiple times (i.e. under a variety of models for centralised support on energy) is the need to capture learning and skills development within the public sector. That is, where external sources of expertise (such as consultancies) are used, care should be taken to ensure experience and skills development are not exclusively outsourced too. For example, development resources offered to local authorities should support in-house staff time and not be solely ear-marked for procurement of external consultancy work (Webb, Tingey & Hawkey, 2017). We have also found in Scotland that local authorities value public sector (or publicly supported) agencies they regard as 'mutual friends', emphasising the trust they place in this form of support.

Q21. Please let us know any views you have on the most cost effective way of supporting schemes that are socio-economically appropriate and in line with the local authority LHEES.

In principle support should be used to bridge the gap between what is required on socioeconomic grounds to meet heat objectives and the financial viability of those changes. However, the Energy Research Partnership (2017) argues the aggregate costs of a decarbonised heat system will be higher than the current system. In these circumstances it may be appropriate to alter the financial viability of low carbon solutions by increasing the cost of high carbon heating. This is clearly a difficult proposition and may be outwith the powers of the Scottish Government (e.g. increasing the currently low rates of tax on domestic gas). Nonetheless, development of LHEES transition plans should consider the balance between increasing costs for the incumbent system over time versus continuing to subsidise the majority cost effective low carbon schemes. Adding costs to high carbon heating would also be a route to socialising the cost of low carbon heat. While general taxation would be a more progressive way to achieve such socialisation it would imply higher subsidies as the financial viability gap would tend to be larger than an energy tax approach. Imposing higher taxes on energy would exacerbate fuel poverty, but could fund (alongside low carbon projects) financial support to low income households. This more targeted approach would contrast with the current situation where all domestic consumers benefit from reduced VAT on energy, not just those on low income.

Q22. We would welcome stakeholders' views on our suggested approach to wider UK heat market reform, and in particular:

a) **any additional evidence that can be offered around the approach that should be taken to decisions on decarbonisation of the gas supply**

The possibility of gas decarbonisation should not be taken as the possibility that other developments in heat supply may not be needed. While there is much research effort going in to understanding the potential for hydrogen, and the Scottish Government should draw on this to understand the costs of future hydrogen production and any limits to the volume of hydrogen production via different approaches (for example, electrolysis could be low cost if operated in response to electricity market imbalances, but the volume of hydrogen so-generated may be small compared with future heat demand). Understanding the potential for hydrogen is important to establishing a more intelligent approach to 'low regrets' district heating that can be established before UK government makes decisions on the future of the gas grid. An explicitly hydrogen-optimistic scenario should be developed to estimate the maximum contribution hydrogen could make in future and hence what is the minimum contribution other heat supply approaches will have to make. As noted above, BEIS's 'hydrogen' scenario actually estimated a higher potential for district heating than its 'electrification' scenario (UK Government, 2017).

b) any views on the issues being considered within the remit of the ADE taskforce

The ADE taskforce proposes demand risk for district heating developers be underwritten by public authorities. This would transfer one of the most significant risks of district heating from the developer to the public authority. While this is posited to reduce the returns demanded by commercial investors, the risk is not reduced but moved. We have argued above and suggested approaches to reducing demand risk, which could either be adopted to complement the taskforce's underwriting suggestion or reduce the need for underwriting. However, as we argue in our response to question 4 governance mechanisms are needed to align commercial incentives with the strategic direction of LHEES. One specific aspect of this alignment would be a greater role for public authorities in setting expectations for district heating roll-out, rather than this being the responsibility of the developer.

Q23. Please tell us about any potential impacts, either positive or negative, you feel our proposed approach may have on particular groups of people, with reference to the "protected characteristics" listed above.

We are not aware of any potential impacts on groups with protected characteristics.

Q24. Are there any special provisions/ measures we should consider/ make/ include:

a) to ensure protected characteristics are taken account of in the LHEES? In your opinion, should the LHEES process specifically include/ address the protected characteristics?

b)to ensure protected characteristics are taken account of in the socio economic assessment? In your opinion, should that process specifically include/ address the protected characteristics?

c) in terms of the installation of networks in order to minimise disruption to people with mobility problems or any other protected characteristic?

d) in terms of consumer protection, that would better assist in ensuring that people with protected characteristics will be safeguarded (taking account of our limited legislative competence in this area)?

e) in terms of communications, that would better assist in ensuring that people with protected characteristics will be kept informed and can fully participate?

Please explain your answers, including any available evidence or examples.

No comment

Q25. Please tell us about any potential costs or savings that may occur as a result of our proposed approach and any increase or reduction in the burden of regulation for any sector. Please be as specific as possible.

Please explain your answer, including any available evidence or examples

In considering this question Scottish Government should compare the proposed approach with a business-as-usual default approach to decarbonisation which would likely either miss carbon targets completely or achieve them in a way that misses economies associated with planning and efforts to secure scale economies. Indeed, a judgement on this question could be formed through the LHEES planning process, by comparing different scenarios.

Q26. Please tell us about any impact on individual privacy/ data that may result from our proposals. If there is an impact on individual privacy, are there any special provision/ measures we should consider/ make/ include that would better assist in ensuring that this privacy impact is lessened/ negated?

Please explain your answer, including any available evidence or examples.

No comment.

References

Committee on Climate Change (2012) *How local authorities can reduce emissions and manage climate risk*. [Online]. Available from: http://www.theccc.org.uk/publication/how-local-authorities-can-reduce-emissions-and-manage-climate-risks/ [Accessed: 21 May 2013].

DECC (2015) *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*. [Online]. Available from: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal [Accessed: 16 February 2016].

Delta Energy and Environment (2016) *Electification of Heat and the Impact on the Scottish Electricity System*. [Online]. Available from: http://www.climatexchange.org.uk/files/9814/8120/4245/Electrification_of_Heat_and_Impact_on_Scottish_Electricity_System_-_Final_report1.pdf [Accessed: 9 February 2018].

Element Energy (2015) *Research on district heating and local approaches to heat decarbonisation*. [Online]. Available from: https://www.theccc.org.uk/publication/element-energy-for-ccc-research-on-district-heating-and-local-approaches-to-heat-decarbonisation/ [Accessed: 3 February 2016].

Energy Research Partnership (2017) *The transition to low-carbon heat*. [Online]. Available from: http://erpuk.org/wp-content/uploads/2017/10/ERP_heat_transition-Oct-2017.pdf [Accessed: 20 November 2017].

Frerk, M. & MacLean, K. (2017) *Heat decarbonisation: potential impacts on social equity and fuel poverty*. [Online]. Available from: http://www.nea.org.uk/resources/publications-and-resources/heat-decarbonisation-potential-impacts-social-equity-fuel-poverty/ [Accessed: 9 October 2017].

Frontier Economics & Element Energy (2013) *Pathways to high penetration of heat pumps*. [Online]. Available from: https://www.theccc.org.uk/wp-content/uploads/2013/12/Frontier-Economics-Element-Energy-Pathways-to-high-penetration-of-heat-pumps.pdf [Accessed: 24 January 2018].

Hawkey, D. (2017) *What might district heating zones look like?* [Online]. Available from: http://www.gov.scot/Topics/Business-Industry/Energy/SEEP/SEEPPhase2/Identifying.

Hawkey, D., Webb, J., Lovell, H., McCrone, D., et al. (2016) *Sustainable urban energy policy: heat and the city*. Abingdon, Oxon ; New York, NY, Routledge.

Hodkinson, S. & London, R. (2017) *'Not fit for purpose' – Residents' experiences of E.ON's district heating system on the Myatts Field North Estate and Oval Quarter development in Lambeth, London*. [Online]. Available from: https://www.fuelpovertyaction.org.uk/wp-content/uploads/2017/04/MFN_OQ_EON_28-4-17_FINAL_EXEC.pdf [Accessed: 19 February 2018].

National Audit Office (2013) *Review of the VFM assessment process for PFI*. [Online]. Available from: https://www.nao.org.uk/wp-content/uploads/2014/01/Review-of-VFM-assessment-process-for-PFI1.pdf [Accessed: 10 May 2016].

Office of the Deputy Prime Minister (2004) *Assessing the Impacts of Spatial Interventions: Regeneration, Renewal and Regional Development*. [Online]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191509/Regeneration__renewal_and_regional_deveopment.pdf [Accessed: 5 May 2016].

Ricardo Energy and Environment (2015) *The national comprehensive assessment of the potential for combined heat and power and district heating and cooling in the UK: Report for DECC*. [Online]. Available from: https://www.gov.uk/government/publications/the-national-comprehensive-assessment-of-the-potential-for-combined-heat-and-power-and-district-heating-and-cooling-in-the-uk [Accessed: 4 November 2016].

Sansom, R. (2014) *Decarbonising low grade heat for a low carbon future*. PhD thesis. [Online]. London, Imperial College. Available from: https://spiral.imperial.ac.uk/bitstream/10044/1/25503/1/Sansom-R-2015-PhD-Thesis.pdf [Accessed: 13 September 2016].

Scottish Government (2017a) *Consultation on a Fuel Poverty Strategy for Scotland*. [Online]. Available from: http://www.gov.scot/Resource/0052/00527441.pdf [Accessed: 30 November 2017].

Scottish Government (2017b) *Draft Climate Change Plan - the draft Third Report on Policies and Proposals 2017-2032*. [Online]. Available from: http://www.gov.scot/Publications/2017/01/2768 [Accessed: 20 January 2017].

Scottish Government (2015) *The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland*. [Online]. Available from: http://www.gov.scot/Publications/2015/06/6679 [Accessed: 6 August 2015].

UK Government (2017) *Clean Growth Strategy*. [Online]. Available from: https://www.gov.uk/government/publications/clean-growth-strategy [Accessed: 13 October 2017].

Webb, J. & Hawkey, D. (2017) On (not) assembling a market for sustainable energy: heat network infrastructure and British cities. *Journal of Cultural Economy*. [Online] 10 (1), 8–20. Available from: doi:10.1080/17530350.2016.1226193 [Accessed: 30 March 2017].

Webb, J., Tingey, M. & Hawkey, D. (2017) *What we know about local authority engagement in UK energy systems*. [Online]. Available from: http://www.ukerc.ac.uk/publications/what-we-know-about-local-authority-engagement-in-uk-energy-systems.html [Accessed: 20 February 2018].