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BEYOND LHEES: The path to heat network delivery and learnings from UK projects

Response to webinar questions

Document Approval

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Ener-Vate Webinar 11th Jan 2024: Questions and Responses

1. Once Local Authorities have completed their LHEES and Delivery Plans what are their next steps?

Whatever role a Local Authority is planning to play in the delivery of HNs, we suggest they should be fully aware of the significant value they can contribute and their negotiating position with any potential third-party suppliers/partners. Senior management will look to understand the range of risks and rewards that alternative options could offer them prior to any decisions on investment.

As such we would encourage authorities to proceed with the following activities:

- Identification of the key internal project sponsor
- Identification of person responsible for maintaining view on evolving policy both from Holyrood and Westminster
- Stakeholder identification and role mapping
- Visioning and zone prioritisation exercise – "what will our local HN landscape look like in 2035?"
- Techno-economic feasibility assessment of priority zones including consideration of reasonable grant support scenarios
- Further maturity of the zone model, taking into account new local data sources
- Further development of risk assessments and mitigation plans for potential key constraints e.g. engagement with DNO on capacity limitations at potential energy centre sites
- Options Appraisal of Delivery Models through workshop-based optioneering
- Agreement on vision and delivery model(s); understand investability and how you will leverage your areas of control

For those authorities with clear intentions to pursue low risk, minimal investment options, the depth at which the above activities are explored may be 'lighter touch' than those considering a more prominent role.

Once you have an agreed Delivery Model we would suggest formalising any external relationships with third parties and progressing your high priority schemes potentially using a zone portfolio prospectus approach.

We would recommend that a Local Authority uses independent advisers acting in their best interests to guide them through the above series of activities unless there is expertise in-house with experience of the strategic and commercial delivery options.

Is there funding from Scottish Government to cover this work?

Yes, the Heat Network Support Unit (HNSU) has made 'Strategic Heat Network Funding' available to Scottish Local Authorities. The guidance from HNSU states:

> *HNSU is providing additional support to build on existing LHEES work and support local authorities in developing a strategic approach to deploying large scale heat networks in their respective areas.*
>
> *Specifically, this supports aims to help local authorities to:*
> - *take a more strategic and commercial approach with regards to large scale heat network delivery;*

- *better articulate the nature and size of the large-scale heat network opportunity at a local level, emphasising analysis through a commercial and financial lens;*
- *understand the level of investment required to realise the opportunity;*
- *explore through engagement with local stakeholders the potential role that other organisations (especially other public sector bodies) can play in order to support successful area-wide deployment;*
- *understand through market engagement what criteria the private sector would need to be fulfilled in order to invest;*
- *understand the potential routes to market and identify a preferred delivery model (or models);*
- *understand the necessary governance structure to co-ordinate area-wide delivery under the preferred model; and*
- *build the business case for long-term area-wide large scale heat network deployment through the preferred delivery model.*

Through this activity, local authorities are expected to build the business case (or parts of a business case) that provides clear basis for decision-making on long term heat network delivery and sets the timeframe to do so.

Subsequently, outputs can also be used to inform LHEES Delivery plans, or through new tools, for example investment prospectuses, investment plans etc.

2. Is it correct that a “requirement to connect” doesn't apply in Scotland yet?

At this time there is no requirement to connect to a HN anywhere in the UK. However the recent consultations in both Scotland and England strongly suggest this is likely to be included in secondary legislation in some form to encourage the growth in the sector by offering ‘demand assurance’ to developers and investors.

The assets that are most likely to be required to connect where they are located within a designated HN zone are:

- Publicly owned buildings
- Commercial buildings with a heat demand that exceeds a specific threshold
- New buildings that have yet to be built
- Buildings (including domestic housing) that already have communal heating systems such as blocks of high-rise flats

The detail around any requirement to connect is still being discussed by government bodies and will be put out for wider consultation in 2024. The suggestion is that any buildings within a designated zone will be required to connect within a defined time window where there is a HN in the vicinity (either planned or in construction) that can provide a connection to low carbon heat. Pricing of heat by the HN operator must be competitive with alternative low carbon heating solutions (the counterfactual).

3. One of the key challenges we have found is some private operators wanting to cherry pick high value loads - stating they are not interested in social housing/domestic in need of retrofit. How can this be addressed?

This is perhaps not surprising given commercial companies are typically managed to optimise their profitability, although some may have longer-term outlooks than others. As we suggested, you need to fully understand the commercial drivers of any commercial 'partner' in detail before entering into any form of joint agreement with them.

There are a number of ways public bodies acting as project sponsors can encourage commercial partners to address long-term social objectives. Selecting a stable, financially strong partner or supplier that demonstrates real commitment towards social and environmental targets is, of course, key.

Likewise, ensuring social and environmental goals are clearly detailed in the tender specification for any procurement exercise may also secure these commitments. If you are intending to include incentives and penalties in your supplier agreements then it would be wise to discuss these at an early stage in negotiations, perhaps through a pre-engagement exercise with potential bidders to gauge their response.

We would suggest one way to limit cherry-picking is to group designated HN zones into groups that include a mix of different zone types and values – another reason why it is critical to understand HN zone values at an early stage in the process There should also be consideration of spatial contiguity when grouping. Groups can then be promoted to the market as a single multi-zone area through a zone prospectus. However clear commitments are still needed from developers on achieving connection levels across all zones in the prospectus.

As per the webinar, the level of control you wish to exert over the deployment of the heat network should form part of your strategic evaluation, that may point you to specific delivery vehicles e.g. a Joint Venture structure would likely allow more control on deployment and ongoing influence than a concession approach.

Finally, you need to have both an adequate set of metrics, as well as a mechanism to track that these goals are being achieved and the contract, in whatever form, is being correctly discharged.

4. To what extent do you think LHEES increases the commercial attractiveness of large-scale heat networks being built in Scotland?

Specifically in relation to HNs, LHEES is effectively a Local Authority scale mapping and master-planning exercise designed to identify indicative HN zones which offer the strongest opportunities for HN development, largely based on the spatial distribution of heat demand density of buildings.

The major value it offers is around being a first stage towards the definition of formally designated zones with conditions attached requiring buildings to transition to low carbon heat solutions. In the past the lack of demand assurance for developers and investors has hampered the expansion of HNs in the UK.

Some critics of this localised zoning approach contend that it lacks a strategic, joined up view that could be achieved through heat master-planning at a more settlement-wide or regional scale. System-wide energy planning for the UK is currently being taken forward at a regional scale by Ofgem and their latest proposals suggest Scotland would be divided into two regional zones (as with electricity DNOs) for this purpose.

As such the localised zoning approach could potentially hamper opportunities for the early stage development of larger scale HNs. It has been suggested that the status of HNs has yet

to reach that of critical national infrastructure requiring a more strategic design, development and investment approach.

5. It is going to be quite rare that the waste heat will be in future BOTH A- zero carbon and B- warm enough, so it is reasonable to conclude heat pumps will be needed. Do you have any observations about the complexities of the power purchase as this is layer of complexities not discussed yet.

In some cases waste heat from EfW plants may be sufficiently high temperature to support HNs without any additional temperature boost. However, as suggested, in many cases waste heat temperatures will require boosting through heat pumps which of course require electrical power.

A number of measures are being considered to try and reduce electricity costs which are crucial to the financial viability of heat pumps:

- The Scottish Government is looking for the UK Government to take action to rebalance electricity costs to shift a proportion of levies from power to natural gas.
- Industrial scale heat pumps can be connected to large scale power generation via private wire. This could result in significantly lower power costs for the heat generator. We have modelled instances where this leads to a positive return even where the waste heat is relatively low grade. However, where this is a result of some form of co-generation, there are additional commercial impacts to be taken into account such as whether a CfD has been let and whether it includes a private wire allowance.
- Alternative types of power purchase agreements (PPAs) could also offer significant power price benefits. HNs can be combined with large scale thermal storage to enable power to be purchased more flexibly during times of low demand when prices are cheaper and the heat is then stored for later usage.
- Likewise PPA sleeving arrangements can allow operators of HN energy centres to secure power at discounted prices especially if the same asset owner also owns renewable power generation assets elsewhere in the UK. A number of heat generation asset owners also develop renewable power generation assets.

6. You suggested undertaking a 'Visioning Exercise' for an area, and that this should involve some feasibility studies or technical work. Can the presenters comment on what essential information is recommended when local authority wants to plan and procure for a whole area or large zone? How much information do you need - Is it the same as the list on slide 16 & 17 (project specific masterplanning & feasibility), but just over a wider area? Where can we find efficiencies?
7. At risk of delaying progress, how in-depth should local authorities go in independent feasibility works to quantify zone value given that this will likely be redone were a commercial partner to be brought in

To address both the above questions together, we are suggesting Local Authorities consider undertaking a stakeholder identification and visioning exercise, perhaps over a 10-year timeline.

Without a vision the approach to development of HNs is likely to be largely reactive and lack a degree of strategic direction. *“By 2035 how many of your communities will take their heat from a low carbon heat network? Which zones are you prioritising? Are you going to group zones together to optimise fuel poverty objectives?”*

Once you have agreed a realistic vision (or multiple visions depending on different scenarios) you should consider the development of a techno-economic model (TEM) that provides some clarity over the commercial value of your high priority HN zones.

You are then in a position to provide realistic responses to questions like:

- Which HN zones are we considering as highest priority?
- How are we grouping HN zones to take them to market?
- What is the likely level of investment / control required to achieve our vision?
- What does the return on investment look like based on assumptions around investment and borrowing? What are the implications of including grant support?

You can then also ensure the opportunities you are opening up to the market are viable and investable. The analysis can be used to support negotiations with potential third-party partners or developers particularly if you are preparing prospectuses for an open competition. You are then in a position to challenge third parties on their submissions with tangible evidence and negotiate improved contractual terms.

If you need answers to more detailed financial questions, for example around phasing and returns at different stages, you will need to develop a more detailed financial model based on your TEM.

8. Should all Local Authorities undertake this techno-economic feasibility work whether they are actively investing in heat networks or not?

All Local Authorities should find a techno-economic feasibility study of high priority HN zones of value to future discussions both with internal stakeholders and third-party suppliers/partners. As commented within the webinar, understanding the potential value of the zone(s) is key to your negotiating position to enable you to maximise leverage, irrespective of the preferred contracting route.

Even for those authorities with a clear ambition to pursue low risk, minimal investment options and devolve as much responsibility for decision-making as possible to a central authority, we still recommend a high-level TEM should be undertaken to maximise your chances of achieving your strategic aims.

9. Would it be viable to simply say " the LA earns an x p/kWh fee" and are therefore motivated to make the zone as big/viable as possible. Do they really need to know how valuable it is in advance?

It depends on the Delivery Model and the nature of any agreement between a Local Authority and a partner/developer, but without knowing the approximate value of the scheme and potential returns, how would the Local Authority know whether [x] p/kWh represents a fair value or should it be [x] +10%, +20% +50%?

One option could be that for every kWh of heat sold to a customer, the LA receives x% that could accumulate in a ‘social fund’ to address energy efficiency improvement works for those in fuel poverty. This would clearly incentivise LAs to extend HNs to as many customers as possible and the need to understand the value of [x] is clear in this scenario.

However, some may argue they don’t want a Local Authority to be incentivised by such payments given their role as an independent licensing and permitting authority.

10. How advanced are discussions about "fair price"/"max price" of heat? Tricky at best of times but impossible if the electricity input for large central heat pumps is not fixed.

    We are expecting price control to be a key part of Ofgem derived consumer protection legislation at UK level. Price control is a relatively complex area as outlined in https://www.ofgem.gov.uk/sites/default/files/docs/2013/03/price_control_explained_march13_web.pdf . We would hope Ofgem would review their controls on a regular basis in line with market changes.

    Some developers of HNs may be more vulnerable to market price fluctuations depending on how they procure their power.

11. Are there not natural advantages in extending a network - "network effects"

    In most cases it is more efficient to extend an existing network provided there is existing capacity 'headroom' or the ability to add more capacity at reasonable capital cost compared with developing a new HN in the adjacent zone.

    Advocates of the zoning approach suggest it is the optimal way to grow HNs quickly across a larger city as one heat network developer is unlikely to have the capacity to grow a single network at the same rate as that achievable through parallel-tracking development using zones.

    Critics argue that limiting developers to arbitrary zones restricts their capacity to design HNs strategically and optimise them to keep costs to customers as low as possible. Some heat sources have substantial capacity to supply multiple zones so should be a shared resource but this may not be commercially straight-forward with a zone model.

    Zoning, in the eyes of some network developers, also limits their growth capacity to keep within relatively arbitrary zone boundaries. It also presents commercial barriers where there are logical reasons to connect multiple networks together. This may not happen without one developer buying out the other (through acquisition of their local ESCo). The overall cost of implementing and operating multiple HNs in one city is likely to be higher overall although, if developed by multiple commercial developers, these are costs borne by private investors rather than the taxpayer (assuming there's no initial grant funding).

12. I completely agree with the point Peter Baynham made regarding operating temperatures. To avoid such anomalies, I would encourage DH developers to consult with the NHS Health Boards at the earliest opportunity.

    Our experience is that many NHS facilities will require high temperature heat – it is possible that lower temperature heat from a HN can be boosted on-site through a heat pump to supply, for example, a hospital campus.

13. I might be ill-informed but the way the zone works in Drammen (Norway) where we built the fjord sourced heat pumps is that the zone operator is obligated to connect ALL buildings that wish to be in the zone. That's the quid pro quo for having an exclusive license.

    We believe that similar obligations may be imposed on HN developers as part of the consenting or permitting process. Of course, there will always be some valid exceptions where buildings may not be able to connect to a HN.

14. Scotland's Net Zero policy also states the eradication of fuel poverty by 2040. Large city/regional scale Heat Networks utilising all available waste heat along with industrial scale heat pumps, seasonal storage and grid balancing electric boilers will have a better chance to achieve this than small inner city zones.

    There is a valid argument for larger scale, strategic HNs at regional scale that are better able to utilise more limited sources of large scale, lower cost surplus heat. This is likely to require a more strategic, centralised approach to HN policy and implementation that clearly recognises them as critical national infrastructure.

    The current policy direction across the UK is more localised approach whereby smaller HNs at zone level are developed, potentially in parallel within the same city, and, over time, gaps in provision across a city are filled.

    Other challenges to the localised zoning model are: (1) some heat network developers are sufficiently large that they are primarily interested in city-wide scale schemes rather than individual zones (2) on a related point, given investability, financial investors are ideally looking for major infrastructure projects of £100-250M+ scale which are likely to be at a city-wide or regional scale.

15. The impact of potential energy efficiency retrofit measures needs a lot of consideration as well.

    We agree but extending our webinar to cover LHEES energy efficiency areas was not practical. We would suggest the roll-out of HNs is not held-back by large scale energy efficiency programmes. In reality any excess capacity of heat supply within HNs resulting from reduced heat demand due to energy efficiency improvements of customers can then be utilised by extending the HN to new customers.

16. With a vision of looking out 80 years, can heat networks address cooling?

    Heat networks can be designed effectively to provide cooling as well as heating. While the demand for cooling is not widespread currently in Scotland, as you say this may become so over an 80-year horizon.

    4th generation heat networks are likely to need a separate pipe network to circulate chilled water, so this does add significantly to capital costs. However, this generates opportunities to look at localised chilled solutions where demand is sufficient to make this economic. There are new absorption chillers entering the market that can operate on lower temperatures, therefore the network would just see this as another heat demand and would typically improve the heat balance by providing a summer demand. As stated, this does require sufficient local demand to justify the additional capital investment.

    5th generation low temperature heat networks can provide summer cooling alongside winter heat and this generally increases their efficiency.

    However there are disadvantages to 5th generation HNs particularly in denser urban areas. Each property requires its own heat pump to boost water temperature for space heating and usually requires bulky immersion heating for hot water requirements. This can increase customer electricity bills and put a significant additional strain on an already highly constrained electricity distribution network. It is possible for 4th and 5th generation networks to be deployed together on large mixed-use sites to play to the strength of each system.

17. Policy and regulatory landscape for HNs in Scotland is rapidly evolving – what might be issues?

There are numerous policy areas where detail is still evolving both within Westminster and Holyrood that will critically impact the HN market in Scotland.

For example:

- The requirement to connect buildings in HN zones is unclear. Exactly which types of buildings will be impacted? Will this requirement be on building owners? What happens if, as is common, building owners are absent and management rights have been passed up the chain to leaseholders or agents? What is the situation for buildings divided into complex multi-tenure units?

- Exactly how will HN zones be refined and then designated? Will they have the support of the wider community of commercial and domestic building owners?

- Given current budgetary constraints, what role will Local Authorities actually plan in HN development? What role will a central authority play? Will the new Scottish Government energy agency need to take more responsibility for developing HNs leaving the LAs as independent coordinators at the local level?

- How will waste heat emitters be persuaded to feed this heat into proximal HNs? Will larger businesses see this as an opportunity to generate an additional revenue stream or a distraction to their core business function?

18. Should you treat zones individually or group them into a portfolio? Should you use a Zone Prospectus approach to take opportunities to the market?

Adopting a prospectus approach for promoting zones is logical although this requires an understanding of the value of zones both individually and as part of a group. Bundling HN zones into groups to minimise the risk of cherry picking should be considered.

Spatially contiguous zones could be bundled together to enable developers to optimise the design of larger networks across multiple zones. The party developing the zone prospectus should provide a sufficient level of detailed information around commercial value to enable a high-level assessment.
Commercial developers looking to compete for zone permits will not have access to building-level data from Scotland's Heat Map giving Local Authorities a significant advantage in value assessment.

19. Will there be lots of competition for attractive HN Zones in large cities and much less for others? How do we make zones in smaller urban settlements attractive?

The development phasing of HN zones is likely to be determined by the Scottish Government acting as a central authority.

In reality, it is likely that HN zones in large cities with strong potential returns will be prioritised for earlier stage development compared with zones in smaller, more isolated urban settlements. So, we would expect to see zones in larger cities progressing faster as these have the biggest potential to cut carbon emissions.

It is hoped that a range of developers will address this market some of whom will be more interested in large city schemes, others in smaller schemes. The latter are likely to be more

interested in smaller urban settlements especially if they are able to secure a permit and licence to develop multiple zones (grouped into a prospectus) in a phased way across several settlements.

To increase the likelihood of uptake for smaller zones, consideration needs to be given to the identification of economic sources of waste heat, to counter-act the higher costs per connection resultant from the lower off-taker density, particularly where the Local Authority may have a measure of control e.g. Energy from Waste facilities.

There are areas where Local Authorities have a measure of control to address the initial capital costs e.g. what brownfield sites does the Local Authority have that could be utilised for energy centre(s), with good electrical capacity? Reducing the capital expenditure, through making land available at zero to low cost to enable a better return may increase the likelihood of finding a suitable delivery partner, whilst having a further lever to maximise your control in the network targets.

Providing an effective prospectus to include all necessary zone information in an easily digestible format should help to promote it. Likewise limiting any obvious hurdles for the developer and ensuring they have sufficient scope to develop a profitable project will maximise its appeal.

It is possible there may be some competitive advantage for those LAs that are able to make their zones available to the market early in the process. There may be a stronger appetite amongst developers for those zones that come onto the market relatively early.

20. How do sponsors maintain sufficient control over pricing to address fuel poverty?

Irrespective of the Delivery Model, sponsors should retain a sufficient level of control over the HN developer/partner to ensure this happens. This could be through direct contractual requirements that LA / HA housing stock should be connected as part of the zone definition, or through more nuanced contract requirements.

For example, it is possible to include contract terms such as a reasonable % of generated net revenue must be set-aside in a social value fund to meet these objectives.

21. Should a Local Authority adopt one consistent Delivery Model for all its zones?

It is not essential, but it could simplify matters in terms of governance, procurement action and negotiating position. It will also allow for lessons to be learned as schemes roll out and become refined, as well as the resource requirement impacts of running different strategies for different schemes.

However, it is also worth bearing in mind the limitations this may impose, such as how to address different characteristics between zones and the resultant financial returns and your priorities, particularly where the options to group zones to achieve an overall fair return on investment may be limited.

Understanding the delivery model your immediate neighbours are considering may also be worthwhile for consistency across boundaries (see below).

22. How should LHEES address cross-border issues? Do we need to plan beyond LA scale?

Being able to plan HN projects that span LA boundaries is essential in situations where high demand loads sit on one side of a boundary and high supply capacity sits on the other side. This is quite typical for city-based local authorities. This requires early-stage coordination

and partnership working across multiple authorities perhaps working at a ‘City Region’ scale. This type of arrangement is encouraged by Scottish Government and examples already exist. There is provision for this under the Heat Network (Scotland) Act 2021, Section 52(1):

52 Two or more local authorities acting jointly in relation to heat network zone

(1) Where an area proposed for designation as a heat network zone falls within the area of more than one local authority, each of the local authorities in whose area the proposed heat network zone would be situated may act jointly to—

(a) designate the area as a heat network zone under section 46(1),

(b) request under section 47(4)(b) that the Scottish Ministers consider whether to designate the area as a heat network zone.