District heating: coordination and development

Report of the fourth workshop of the Scottish Heat Networks Partnership Practitioner Group

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This workshop brought together 59 members of the SHNPPG practitioner group with six international visitors to explore approaches to coordination for district heating, and to learn about recent developments in Scotland, relating to spatial planning, analysis of the potential for district heating and the use of large heat pumps. The workshop combined presentations with round-table discussion, drawing on the wide range of expertise within the group. This report summarises key points.

While the success of the workshop rested on the high quality input across participants, we were particularly grateful to our international visitors for their contributions. SHNPPG members were able both to learn about district heating development in other countries, and to hear reflection from informed visitors on current activities in Scotland. Our visitors were:

- Caren Herbstritt, Scientific Advisor, Hamburg Parliamentary Green Party.
- Birger Lauersen, Danish District Heating Association.
- Matthias Ederhof, EnergieNetz Hamburg eG.
- Mirco Beisheim, Kultur Energie Bunker Altona Projekt (KEBAP), Hamburg.
- Kerstin Walz, University of Hamburg.
- Sören Becker, Leibniz Institute for Research of Society and Space.

We are also grateful to Falkirk council for inviting the group to Grangemouth, supporting the workshop and organising a highly informative bus tour of the Grangemouth refinery, Calendar Park heat network, the Helix and the Kelipes.

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1. Day 1: Introduction to Grangemouth

The workshop began with an optional afternoon session (attended by 42 participants). This followed on from a local authority coaching session in the morning which was part of the EU STRATEGO project.

1.1. Matthew Farell, Falkirk Council: District Heating and Energy in Falkirk

Matthew gave an overview of Falkirk council's work on heat networks. This work was in part prompted by challenges faced by the Grangemouth refinery and a collaborative effort between the council, Scottish Government and other stakeholders to find ways of improving the competitiveness of the area. One intervention explored was to reduce energy costs and improve environmental sustainability, and heat networks were identified as a means to achieving that.

Three potential heat networks have been identified in different zones, including the refinery area and a new development area to the West (Falkirk Gateway). The council has approached various local industrial companies to explore either providing or using heat from the network. Companies vary in their response, with some very open to the idea but others less interested in something beyond their core business.

1.2. Adekoyejo Olugbile, Falkirk Council: Callendar Park CHP Development Plans

Adekoyejo gave an overview of the council's strategic priorities, and how the Callendar Park CHP scheme addresses those (addressing fuel poverty, achieving early intervention, improving infrastructure and the built environment, and being greener). The Callendar Park estate includes 9 multi-storeys, built in the 1960s/70s. Six of these were retrofitted with district heating in the mid-2000s. Engagement with tenants was an important part of the retrofit project, and included residents touring Aberdeen CHP schemes, demonstration flats, an open day and regular news letters. In 2011 the Callendar House Museum was also connected to the network.

In future the council plans to connect the remaining 3 tower blocks to the system, in part because replacement of the existing individual gas boilers is becoming increasingly difficult. Falkirk is also interested in increasing the value of the electricity generated by its CHP engine by creating a private wire network to supply schools and council buildings.

1.3. Bus tour of Grangemouth

Falkirk council arranged a bus tour of the proposed district heating areas and the existing heat network at Callendar Park.

The tour began with the refinery and industrial area. Two significant developments are the construction of a new facility to store and process hydrocarbons imported from America, and the clearing of disused facilities to make way for new industrial development. We also passed by some significant existing structures that a heat network would have to fit within, including a motorway and the historic Antonine Wall.

Figure 1. Cooling towers at Grangemouth industrial site.

The tour then visited Callendar Park where Adekoyejo and the local plant manager described the operation of the system. Currently the CHP engine sells electricity to the national grid, and during the summer months is turned off, heat being provided by backup/top-up gas boilers during this period.

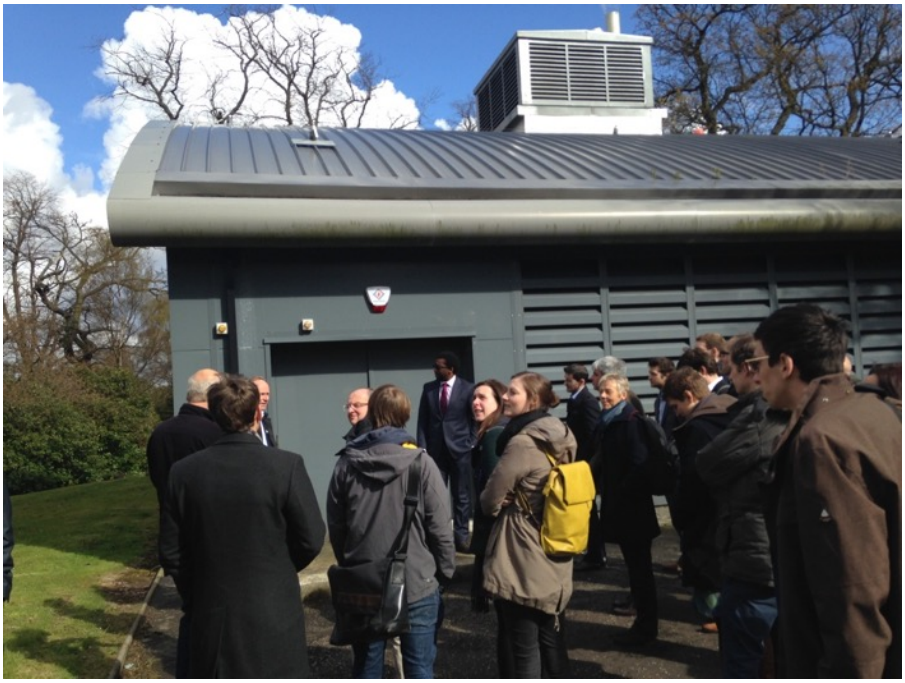

Figure 2. Adekoyejo Olugbile describing the Callendar Park CHP and district heating scheme infront of the system's energy centre.

Finally, the tour visited the new Helix Park and the Kelpies. In addition to these being impressive local amenities, they are relevant to how thinking about district heating in Falkirk is developing. Their success has both engendered optimism in the council's ability to deliver significant projects, and led to new ideas for development of the Falkirk Gateway area, with an increased emphasis on tourism and other opportunities (leisure, hotels, education and student accommodation). Falkirk council officers argue a heat network could form an important part of this new thinking, both because the increased scale of development would improve the viability of a heat network, and the provision of sustainable energy would be more attractive to building users.

2. Day 2, Morning: Coordinating multiple stakeholders

The second day was opened with a welcome by Douglas Duff, Head of Economic Development & Environmental Services, Falkirk Council. He emphasised the council's expectation that Falkirk will see significant changes to its local economy in coming years, and that district heating could be a core aspect of ensuring sustainability in the area. Falkirk council welcomes opportunities to learn from other experts in Scotland, and Douglas argued that to be effective, support from Scottish Government needs to be kept as simple as possible.

2.1. Birger Lauersen, Danish District Heating Association: Multiple stakeholders in district heating

Birger Lauersen discussed the variety of stakeholders involved in district heating in Denmark, how they relate to each other and how they interact with ongoing development of district heating away from fossil fuels and towards renewable energy. He drew a distinction between two broad Danish models of district heating. The first, usually associated with relatively small systems, is vertically integrated: heat generation, distribution and supply all undertaken by a single organisation, often organised as a consumer cooperative. The second, associated with larger systems, formally unbundles generation, distribution and supply, though often these functions are undertaken by separate municipally-owned companies. District heating is regulated under Danish law to operate on a not-for-profit basis.

A large share of heat used in district heating is produced by CHP plants, though there are interesting cases of surplus industrial heat feeding networks. Three large schemes (e.g. heat from a cement works) make up the bulk of industrial heat off-take, alongside a number of smaller schemes.

Different kinds of heat network organisation approach new forms of heat supply in different ways. Some can be quite conservative, for example small consumer cooperatives whose main focus is to minimise consumer prices. Other small schemes, however, can be relatively quick to move into new areas. Larger systems can be like "tanker ships" – they take a long time to change course, but when they do the effect is significant.

Birger also drew attention to what he regarded as a potential artificial competition between renewable energy and energy efficiency, which he associated with poorly thought-through support programmes. He gave an example of a building connected to a heat network installing solar thermal, and suggested the positive impact of capturing solar energy for heat would be more significant at the level of the heat network rather than the building.

2.2. Matthias Ederhof, EnergieNetz Hamburg eG: Community participation in district heating in Hamburg

Matthias gave an overview of the role citizen groups in Hamburg have played in shaping decisions about the future of gas, electricity and district heating networks in that city. A referendum in 2013 asked Hamburg citizens if the networks should be brought back into public ownership, and should be managed on principles of democratic control, climate friendliness, and social justice. A majority of voters agreed, and consequently the district heating network is in the process of being "remunicipalised".

Matthias is a founding director of EnergieNetz Hamburg eG, a cooperative founded nine months before the referendum both to support the case for remunicipalisation, and to establish a vehicle for financial participation of citizens. While it has not been possible for the cooperative to take an ownership stake in the networks, EnergieNetz Hamburg is active in citizen participation in decisions around the heat network. After the referendum it was clear that adversaries in the debate would have to work together to make remunicipalisation a success. For this a "Heat Dialogue" process was set up, hosted by EnergieNetz Hamburg. Regular expert roundtable meetings and open to the public, and operate on principles of openness and transparency. The rules of the meetings emphasis respectful dialogue and ensure members of the public have good opportunities to ask questions (half the time at each meeting is reserved for Q&A). Matthias regarded the dialogue as successful and argued that it had led to changes in the way the Hamburg government thought about the future of the heat network, challenging the assumption that a large power plant was required to provide heat and opening up exploration of more decentralised heat production.

2.3. Charlotte Johnson, University College London Energy Institute: Heat networks and 'the community'

Charlotte Johnson argued for more creative thinking about the role of households and communities in district heating. Drawing on research into several schemes in London she argued that users of district heating often wanted to have a more significant role than just that of passive consumer or potential victim of fuel poverty. She presented cases where resident groups had organised themselves to put pressure on a heat network operator to make changes to the system, a cooperative which had taken control of a communal heating system, and a group of households willing to invest their own money to secure their shared heating system.

2.4. Michael King, District Energy Procurement Agency

Michael King presented the District Energy Procurement Agency (DEPA), an initiative he has been developing in partnership with Manchester City Council and supported by the UK Department of Energy and Climate Change. DEPA is modelled on the Swedish procurement club Värmek, and would be owned by its local authority members. As such it would be able to procure goods and services for district energy schemes on their behalf, and would aim to reduce costs both for local authorities and industry through specialist expertise in district energy procurement and economies of scale.

3. Day 2, Afternoon:

3.1. Mike Doble, Ricardo Energy and Environment: National Comprehensive Assessment of the potential for combined heat and power and district heating and cooling in the UK up to 2030

Mike Doble presented the UK's National Comprehensive Assessment (NCA[1]), a study required under the EU Energy Efficiency Directive. The directive requires an assessment of the potential for CHP and district heating/cooling based on cost-benefit analysis. Ricardo Energy and Environment conducted the assessment for both the Scottish and UK Governments.

The assessment draws on a significant amount of data, representing characteristics of every building in the UK. This posed a considerable data challenge, both in ensuring the quality of the data sets drawn on and in the complexity of running the analysis.

The results of the cost benefit analysis were sensitive to some key input assumptions. The core scenario analysed included financing costs reflecting commercial rates of return, and found only a very small cost-effective potential for district heating of 7% of heat demand analysed in Scotland. Alternative scenarios found considerably higher cost-effective potentials for district heating: reducing the financing cost to zero (interpreted as a 'de-risked' scenario) resulted in an estimate of 45%, and raising the carbon price to a very high level (£500/tonne CO_2) resulted in 35%.

3.2. Amy Brown, Scottish Cities Alliance: Approaches to planning and district heating

Amy Brown presented work led by the Scottish Cities Alliance on spatial planning policies for district heating. A common approach to district heating across Scottish planning authorities would enable local policies to be more effective while establishing a level playing field across local areas. The work includes a review of planning policies adopted in three English local authorities and drafting of new policy being led by Stirling and Aberdeen councils.

3.3. Ruth Bush, Scottish Government: STRATEGO project in Scotland

Ruth Bush described work that had been done through the European STRATEGO project, describing how it linked analyses of national potential

[1] The NCA report submitted to the commission can be found at https://ec.europa.eu/energy/sites/ener/files/documents/Final_NCA_Report_for_publication.pdf

(such as the National Comprehensive Assessment) with Scottish and local government activities. STRATEGO aims to maximise international knowledge transfer, and Ruth described the outcome of a study tour to Aalborg in Denmark. In addition to finding the scale and technological innovation in projects visited inspiring, Scottish local authority officers were able to reflect on factors in Danish success that would make a difference in Scotland.

3.4. Graham Esson, Perth and Kinross Council: Using heat pumps for heat networks, Perth city River Tay heat pump and district heating with solar farm

Graham Esson described an innovative project led by Perth and Kinross Council supported by the Local Energy Challenge Fund. The project is integrated into a planned new Food and Drink Park, and will distribute heat extracted from the River Tay by a 2MW heat pump to five small business units, 211 homes and a primary school. The site will also include a solar farm with 75kW capacity. While analysis of the Scottish Heat Map did not *lead* to the project, that resource has been helpful in shaping it.

3.5. Dave Pearson, Star Renewables

Dave Pearson gave an overview of Star Renewables and their development of a 14MW heat pump which produces heat at 90ºC from sea water for a district heating network in Dramen, Norway. He also presented his perspective on options for district heating in Scotland, arguing there is much potential for large heat pump use across the UK where many cities are situated on rivers.

4. Roundtable discussions

4.1. Roles of public sector, commercial and community organisations

Participants were split on the potential significance of community involvement in district heating. Some suggested community ownership could increase trust in schemes and the Community Empowerment Act may play a role. Others questioned the extent of community engagement with energy in Scotland, and regarded district heating as more challenging for community groups than other initiatives such as wind and solar.

The role of local authorities as intermediaries was raised at several tables, as a means of identifying opportunities to link up different stakeholders, leading coordination and building confidence and buy-in to district heating. However, the capacity of local authorities to play these roles is an important challenge, particularly as they face further budget reductions and have to fulfil statutory functions before engaging in additional activities such as local

energy development. The demands of interdepartmental working, often required for district heating, were also cited as challenging.

A range of views were also expressed on the benefits and drawbacks of public sector ownership models. Some participants doubted the performance of public sector companies, citing historical examples of perceived failure (nationalised energy and rail companies). Others countered that the model of private sector ownership is not delivering services and infrastructure society needs now and in the future. Some participants argued for an unbundled approach to district heating development, seeing different sectors playing different roles across generation/distribution/supply. For example, public ownership might be suitable for long-lived pipe infrastructure.

4.2. Integrating industrial surplus heat

Brokering agreement between industrial plant and district heating networks was regarded as potentially beneficial but difficult to achieve. While industries may be happy for their surplus heat to be used, they were regarded as likely to be wary of possible additional costs or complications of an activity outside their core business. In particular it was thought unlikely that industries would guarantee heat availability. Some mitigating approaches were discussed, including integrating multiple sources onto a network, creating additional incentives for industry to make use of waste heat, and simplifying/clarifying the process by which industry would engage with a heat network, perhaps through the oversight of a district heating regulator.

4.3. Building a user base / cost of finance

The cost of finance may be related to the capacity of a heat network developer to build a market. Reportedly, Danish heat networks can borrow at interest rates around one percentage point lower if buildings in the district heating area are required by the municipality to connect. This led to some discussion around how user bases in Scotland could be built up, and the lack of a comparable obligation to connect. Some social housing heat networks have found it very difficult to get private sector tenants to sign up. Other schemes have found it too difficult to connect PFI schools to heat networks. Competition with low price gas was identified as an important barrier to a voluntaristic approach to building up a user base, with some arguing additional funding is needed if heat networks are to be sufficiently competitive with gas alternatives to meet policy goals.

4.4. Planning

While Scottish Government planning guidance includes district heating, several participants considered these policies in practice lack “teeth”.

Developers and land owners were considered to be uninterested in the benefits of district heating as they were felt not able to capture them. Some discussions identified housing developers as conservative, looking to stick to what they know. Others saw more active resistance from some developers lobbying local politicians, arguing that requiring district heating would reduce new housing and associated construction employment. One participant compared district heating with Sustainable Urban Drainage Systems. When they began to be required in planning policy they were also met with resistance, but have now become well understood and accepted across developers.

4.5. National Comprehensive Assessment

Several participants commented that the NCA was quite complicated and found it difficult to draw conclusions from a single presentation. Some groups wondered about the criteria that had been used to assess potential, and in particular were interested in whether the results would change if a greater emphasis was placed on fuel poverty alleviation. Research at Dundee University was cited on bronchial illness, and the possibility of quantifying the health-cost impact of fuel poverty, which could then be incorporated into the cost-benefit analysis. Some possible tensions were also highlighted, with social needs regarded as more acute in rural areas but heat demand concentrated in urban areas. The sensitivity of the NCA results to assumed returns on investment prompted some to argue that this reflected the dominance of the 'big 6' energy companies in the UK energy market.

5. International discussant: Mirco Beisheim

Mirco Beishiem is an energy activist from Hamburg who has developed a project to convert a wartime bunker into a combined cultural centre and sustainable heat energy centre, which will feed into the Hamburg district heating network once it has been remunicipalised. We invited Mirco to give his reflection on the discussions he heard at the workshop. He noted the importance of information on the various potential heat sources for district heating schemes, and observed many Scottish projects have a difficult starting point: no contracts for heat source, no grid for delivery, and no customers! He argued that the prices at which a system can purchase and sell heat are likely to be crucial to success, but also argued that district heating projects are an opportunity to encourage more active engagement with sustainability across a community. Reflecting on his experience in Hamburg he noted that participants in the bunker project are not technical specialists but people who feel that something needs to change to protect the future. He encouraged

SHNPPG participants to use district heating as a way to open up local discussions about "how we want to live" and to think beyond solely technical issues to explore ways of "activating the people!"