ABERDEEN CITY COUNCIL

COMMITTEE	Communities, Housing and Infrastructure
DATE	24th January 2017
DIRECTOR	Pete Leonard
TITLE OF REPORT	Progress Report for Torry Phase 1 District Heating Network
REPORT NUMBER	CHI/16/320
CHECKLIST COMPLETED	Yes/~~No~~

1. PURPOSE OF REPORT

To update the committee on the progress of the feasibility report for Phase 1 of the heating network in Torry as required by resolution xvi relating to the report 'Energy from Waste Inter-Authority Agreement' considered by Council on 24 October 2016.

The output of this feasibility report will inform the committee on the following:

- Technical viability of the proposed district heating network including a proposed route for the heat network
- Benefits and constraints of the district heating network
- Highlighting risks associated with the district heating network at design, procurement, delivery and operational stages of the heat network
- The capital, operational and revenue cost options in delivering the heat network
- Further development of the district heating network for future expansion

2. RECOMMENDATIONS

That the committee:

1. Approves the further development of the Phase 1 District Heating Network in Torry based on the technical and economic viability assessment presented in the feasibility report attached at Appendix 1 with an estimated capital cost of £9.5m.
2. Notes the decision taken at full Council on 24 October 2016 with regard to Energy from Waste Project budgets and the HEATNET project, and

submits the estimated Phase 1 Torry District Heating Network project cost for consideration in the Council's budget process.

3. Instructs the Interim Director of Communities, Housing and Infrastructure to undertake stakeholder engagement in relation to the Phase 1 Torry District Heating Network utilising the outputs from the feasibility study.
4. Instructs the Interim Director of Communities, Housing and Infrastructure to proceed to the next stage of appointing a project team, developing a business case, procurement strategy and project plan to deliver this project subject to the allocation of the estimated Phase 1 Torry District Heating Network project cost in the Council's Capital Plan.
5. Instructs the Interim Director of Communities, Housing and Infrastructure to report progress of this project to the next Communities, Housing & Infrastructure committee.

3. FINANCIAL IMPLICATIONS

The feasibility report undertaken by Ramboll Energy has identified that there is an economic case for the development of the first phase of a District Heating Network in Torry. The case includes a series of conservative assumptions that provide comfort that the preferred option will cover its costs over the life of the project, generate sufficient income to offset the cost of investment and provide savings to householders in comparison to continuing to use gas, oil or electric heating (see Appendix 1). The construction capital cost is estimated at £8.7M, which allows for optimism bias and contingencies in line with industry standards. In addition, there will be resource implications in relation to project management and specialist support to the procurement and project implementation phases, estimated to bring the total capex cost of the project to approximately £9.5M.

The next steps are to establish a project team, develop a detailed business case, procurement strategy and project plan in advance of commencement of a procurement process.

The Council has committed at its meeting of 24 October 2016 to spend £365,000 through the HEATNET European match funding project, to release over £600,000 of funding to support the acceleration of Phase 1 of the District Heating network. These monies can be used to supplement the total cost of delivering Phase 1 of the District Heating Network. One of the conditions of the HEATNET project is that the monies are spent on some heat network installation by the end of financial year 2018/2019.

Ramboll has indicated that the median case assessed in the study (Option 2) demonstrates that a Net Product Value of £806K and Internal Rate of Return of 4.1% can be achieved over an expected 40-year life of the project.

Once the heat network is in place, there will be future revenue costs for the heat network in terms of network maintenance and operation which are in the region of £217K per annum what are offset by income in excess of £543K per annum.

4. OTHER IMPLICATIONS

The Project Lead for this work will seek services and advice from the Project Management Office (PMO), Commercial and Procurement (CPS), Legal Services, Finance, Asset Management and Housing.

The project team appointed for this project will liaise with the various community groups and stakeholders on this project.

5. BACKGROUND/MAIN ISSUES

5.1 Background

District Heating Networks are commonplace in north European and Scandinavian countries and usually comprise one or more heat sources providing hot water into carrier mains running through towns and cities where there is a high density of houses, public buildings or businesses or a combination of all three. Hot water from this main is then fed into a heat exchanger in each household/property. The heat exchanger warms up water for both heating and hot water in the same way gas boilers do, meaning existing internal radiators and pipework are used within the household and hot water for washing/cleaning is always available instantly.

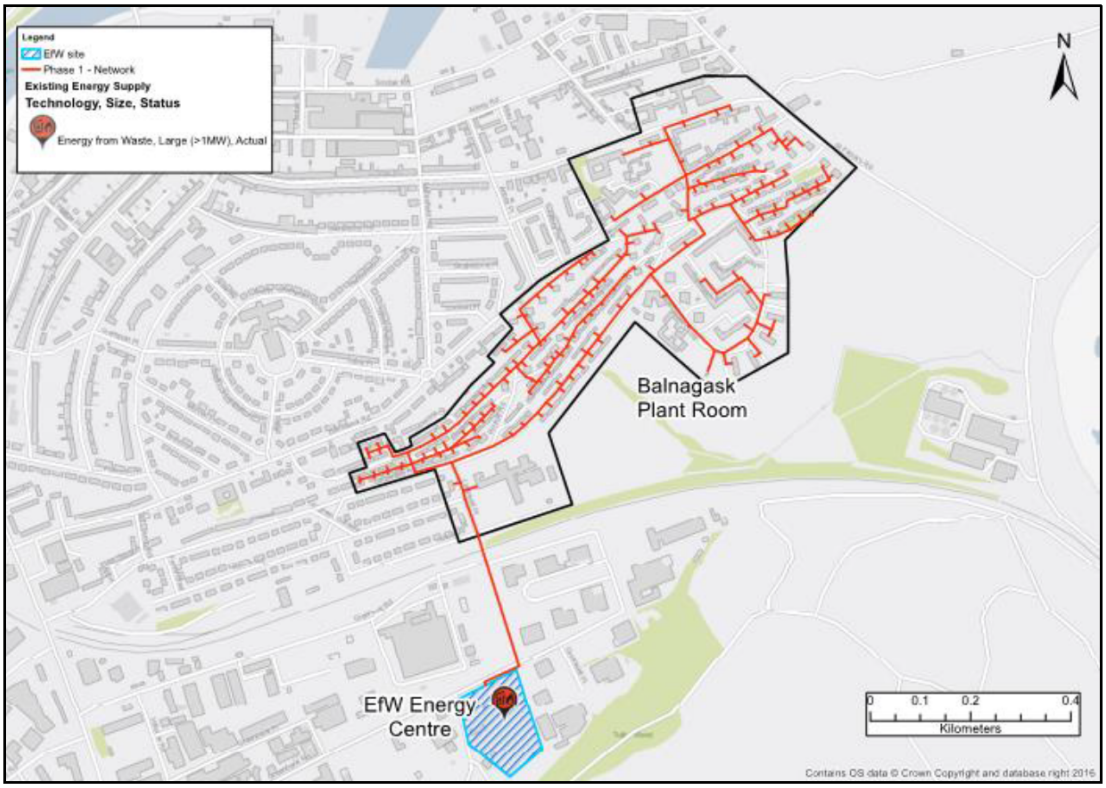
The opportunity to develop a District Heating Network in the Torry area has arisen from the need for the Council to provide an alternative to the current practice of landfilling non-recyclable waste. Following an extensive site selection and assessment process, Planning Permission was granted on 10 October 2016 for a facility in East Tullos that would use the non-recyclable waste from Aberdeen City, Aberdeenshire and Moray Councils to generate heat and power.

This decision was followed by a further decision on 24 October 2016 to join with the partner authorities and proceed with a procurement process for the design, build and operation of Energy from Waste (EfW) facility in East Tullos. Resolution xii to the 24 October Council meeting asked for members 'to agree that a heat network is of fundamental importance to this project both in order to meet the permit requirements of SEPA but also to provide low-cost energy to those living in nearby communities'. This resolution was agreed unanimously. The proximity of heat users was an important factor in site selection and there is recognition that the high density of Council owned properties in parts of Torry and the high levels of fuel poverty make the case for a District Heating Network connected to the East Tullos EfW more favourable.

In the summer of 2016, the Council commenced commissioning of a feasibility study for the technical and economical viability of Phase 1 of a District Heating Network in Torry. This work has been carried out by consultants Ramboll Energy and is attached at Appendix 1. Ramboll was directed to focus on public buildings and social housing closest to the EfW and where fuel poverty occurrence is highest, predominantly in the Balnagask area.

Phase 1 of the District Heating Network would cover 814 homes, largely Council owned with 80 in Housing Association ownership (see Figure 1). There are a number of privately owned properties within the Phase 1 area but no assumption has been made that these will connect to the District Heating System within the study. Future connection of private properties represents an opportunity for further enhancement of the Business Case for the District Heating project and the private householders would benefit from lower heating bills. In addition Torry primary school, swimming pool and community centre are to be connected. The approximate length of Phase 1 heat network is 7.3km.

Figure 1. Proposed Phase 1 of Torry District Heating Network



This Phase 1 heat network offers a concentration of public sector controlled community, educational and residential properties that would be connected as the first stage of a wider ambition to expand in the future to the wider area. It is an area where secure cost, low carbon

heating would support vulnerable people in fuel poverty. Indeed, an important factor in considering the extent of Phase 1 has been to seek to maximise the opportunity to connect into those parts of the community that currently face the highest levels of fuel poverty.

The opportunity to distribute heat from the EfW to existing and new communities has the potential to address a number of key objectives to benefit the sustainability of the community including:

1. Utilising low carbon sources of heat and maximising the efficiency of low carbon power generation;
2. Delivering heat at an advantageous cost to customers in order to assist customers in fuel poverty;
3. Creating new jobs locally in connection with the construction and operation of the system;
4. Investment in large scale low carbon heat infrastructure to support Local and National Government's long term objectives for carbon emissions reductions;
5. Heat network infrastructure provision to existing properties in order to reduce carbon emissions from existing building stock;
6. Heat network infrastructure provision to new development that supports developers obligations for meeting Scottish Government Building Standards;
7. The district heating network can accept heat from multiple sources and therefore new technology can be integrated when the infrastructure is in place; and
8. Opportunities, through large scale thermal storage and heat pump technology to balance heat and power networks, thereby improving system efficiency.

The first stage of the feasibility study has been to identify energy (heat, cooling, and electricity) demands for all relevant properties based on real meter readings, heat map data and benchmark data based on CIBSE design guidance TM46 as well as other relevant benchmark data. The demand assessment considered the available information on building heating systems and compatibility issues regarding connection to district heating.

Consideration has been given to the changes to fabric energy efficiency and heating system configuration that may be viable to improve the overall performance of a district heating network.

A series of scenarios have been developed for each of the network options. Consideration was made of how technologies may be combined and deployed in stages to provide security of heat supply and to match the delivery timescale and consider the measures needed to safeguard additional heat sources.

A series of options were developed to define a network route connecting a series of properties (including safeguarding potential

expansion options). Consideration was also made for oversizing pipework to safeguard future connections.

The model used by the consultants compares all scenarios to a business as usual cost of heat production to consumers and provides information on the lifecycle costs and economics. The methodology employed when completing the options appraisal included:

- Assessing the business as usual cost of heat to each of the consumers in order to estimate reasonable tariffs for district heating. This included specific project cost savings (e.g. energy / utilities, future backlog / maintenance spend, etc.);
- Working with LCITP, the Council and stakeholders to coordinate the development of appropriate assumptions for the two potential district heating networks;
- Identification of the capital and operating costs as well as provision for lifecycle replacement for each of the options considered;
- Identification of operational efficiencies;
- Ensuring the potential financial benefits (including savings compared to the BAU) of collaboration with public or private sector partners are identified and, if appropriate, captured within the financial appraisal;
- Analysing each option in turn and ensuring that the preferred option is deliverable to budget; and
- Producing a lifecycle cash flow and determining the IRR, NPV and simple payback and carbon savings to each of the stakeholders.

The CAPEX figure of £8.67M for the energy centre, network and customer interfaces has been based on quoted prices for equipment from suppliers as well as cost data that are held by Ramboll from many previous projects. Other costs and revenues that will be applied within the model include:

- Capital cost of heat generation plant, energy centre(s), thermal storage, heat network assets and customer interface units.
- Operations and maintenance costs and planned asset replacement costs during the life of the project).
- Fuel costs.
- Wholesale price of the transmitted heat from EfW.
- Energy sales income

Ramboll has undertaken sensitivity analysis of the options considering the impact of different assumptions for the key variables that influence the project economics (for example, cost of heat, energy efficiency of pipework, cost of pipework installation etc.). Carbon dioxide emissions reductions and carbon emissions savings compared with ‘business as usual have been calculated and included in developing a preferred option.

5.2 Assumptions

In developing the financial and technical assessments relating to the project a series of assumptions have been agreed with Ramboll. In all cases conservative assumptions have been used that demonstrate a cautious approach is being taken. This approach has been taken to ensure that the financial viability is not over-estimated. Key examples of this are:

1. No income has been modelled for the connection of private properties within the Phase 1 area despite these having marginal cost to the District Heating Network but deliver additional revenue;
2. The network design for Phase 1 is sized so that it is suitable to supply all local authority and housing association properties in the wider Torry area as well as other major users outwith Torry, for example, the Robert Gordon's University campus could connect to the scheme at some point. The implications of designing this into the Phase 1 are higher pumping and associated plant costs;
3. All costs have been subject to a 25% optimism bias;
4. HEATNET funding up to £600K has been identified for this project, however, it has not been possible to confirm the value that can be utilised to offset capital investment, therefore no funding income has been included in the Economic Case in order to ensure that a conservative approach is taken to financial modelling.

5.3 Options Development

Ramboll has developed three options that are considered to be technically deliverable and take into account to greater or lesser degree the Council's future aspirations in relation to District Heating. The options are:

Option 1. This network design assumes that only local authority and housing association properties in phase one will connect to the DH network. This scenario was modelled in order to make a comparison between a limited network and the future-proofed network.

Option 2. This network design is sized so that it is suitable to supply all local authority and housing association properties in Torry as well as the RGU campus will connect to the scheme at some point. This builds resilience into the network and is a preferred option for the wider DH network in Torry. Again, 16 bar systems are preferable for networks that have large fluctuations in altitude. The implications of implementing a 16 bar system include higher pumping costs and associated plant costs.

Option 3. This network has been designed using the same methodology as Option 2 however all Heat Demands obtained from the

heat map have been reduced by 30% to account for the low confidence level of the data. This brings the average property heat demand down from approx. 11MWh to 8MWh.

6. Results of Torry District Heating Feasibility Study

The conclusion of Ramboll Study is that a cost-effective and technically viable Phase 1 District Heating Network can be developed in the Balnagask area of Torry based on the level of analysis and cost development taken at this stage. Figure 3 provides as summary of the relative NPV and IRR results for each of the three options.

Figure 2. Relative Economic Indicators for Torry Phase 1 Options

	NPV (£K)	IRR (%)
Option 1	1191	4.5
Option 2	806	4.1
Option 3	-1263	2.5

The most advantageous financial case can be made for Option 1, however this provides no scope for future expansion. Option 3 presents a pessimistic assessment in terms of uptake from householders and shows a small negative financial impact over the 40-year life of the project. Option 2 takes a median course and demonstrates that despite predominantly conservative assumptions on costs and funding, a positive financial case can be made for the project. On this basis Ramboll recommend that the costing for Option 2 be considered as the basis for progressing the project to the next stage.

6.1 Preferred Extent of Phase 1 District Heating Network.

Analysis of housing type, tenure and topography has driven a solution based around the Balnagask area that is predominantly social housing and a mix of medium high-rise, ‘stub’ blocks and mostly terraced houses. A total of 814 homes would fall within the area (see Figure 1). The large majority of housing within this area is either flats or terraced housing in Council ownership meaning a high density of connections can be achieved increasing the efficiency of the heat network. The topography of this area is also favourable in that there is relatively little height difference between the EfW and the highest property.

6.2 Economic Analysis

The Economic Analysis is based upon developing the Phase 1 District Heating Network with the scope to expand in future into other phases without the need to replace or upgrade key sections of the water carrier mains (Option 2). As with many District Heating Networks, it is

anticipated to have a long operational life and costs have been spread over a 40 year period.

6.3 Capital Costs

The feasibility study looks in detail at the capital costs associated with the Energy Centre (the building located at the EfW where back up boilers, pumps and control systems are located), the distribution network and associated heat substations. Also included are capital costs associated with replacement of capital items during the life of the project. The total capital cost for Phase 1 construction is estimated to be £8.67M. It should be noted that overall capital allocation proposed is £9.5M. The additional allocation covers project management, procurement and specialist advice costs (5% of total project costs) and a project contingency (a further 5%).

6.4 Revenue Costs

Revenue costs for the operation and maintenance of the Heat Network are largely independent of the amount of usage within the system, especially in this scenario where the bulk of the heat supply is provided without charge from the Energy from Waste project. Revenue costs are stable throughout at approx. £217K/annum.

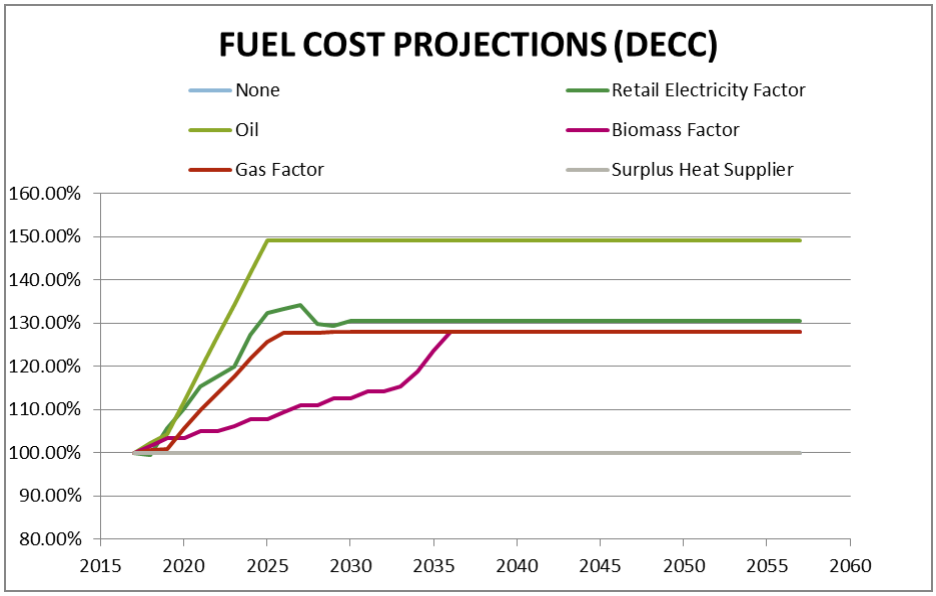
6.5 Income

As indicated above, no income is incorporated for connection of any private properties within the network area. This results in an income of approx. £543K/annum. There is an assumption that there will be a high uptake of users with the social housing area and this is a sensitivity that will need to be tested through the public engagement activities that are a recommendation of this report.

6.6 Saving to householders

The feasibility study has been predicated upon being in a position to reduce the cost to householders in comparison to current heat provision, predominantly from gas. Figure 3 shows the predicted costs of heat from all fuel sources other than that from the EfW facility (Surplus Heat Supplier) is forecast to increase significantly over the life of the project. As a result, this will provide savings to householders of in excess of 10% and for all users this represents a saving of more the £2.01M over the life of the project.

Figure 3. Future Fuel Cost Projections



Note: Costs based on projection provided by Department for Energy and Climate Change.

6.7 Overall Project Viability

The result of the financial, consumer and carbon modelling undertaken by Ramboll demonstrates that on a 40 year project lifetime, Option 2 is a viable proposition.

The Net Product Value (NPV) calculation (which provides the provision of whether whole life costs are recovered by income over the whole project) demonstrates that, taking account of the series of conservative assumptions the project would have a NPV of £806K. This figure is well within the margins of error that apply at this stage of the project development.

A further important financial indicator to consider is the Internal Rate of Return (IRR) for the project. Option 2 produces an IRR of 4.1%, which is in excess of that required to recover the costs of capital investment, taking into account the conservative assumptions used with the model.

Option 2 delivers substantial cost savings to householders over the life of the project of £2.07M. This equates to heating bills on average 14% less than the comparable gas costs.

The model estimates that there will be a saving of 107,666 tonnes of CO_2 achieved through the lifetime of the project (in comparison to gas heating). This demonstrates there is a significant environmental benefit to be achieved from the project. No assessment has been made on improvement in local air quality from the removal of gas boilers throughout the community; however it is evident that there will be some benefit.

The feasibility study demonstrates that, given this early stage of analysis and cost certainty, there is sufficient confidence that there is a project that makes financial sense to the Council, delivers fuel cost savings to householders (and thereby contribute to reduced fuel poverty) and achieve a more environmentally sustainable heat delivery system for those householders covered by Phase 1 of the Torry District Heating Network.

7. IMPACT

Improving Customer Experience –

Phase 1 of the heat network in Torry would benefit the customers connecting to the network as they could potentially get a reliable, affordable source of heat, which is has a low carbon impact. By connecting to the heat network, customers would also benefit from a reduction in their cost of boiler or heat system maintenance.

Improving Staff Experience –

The success of the heat network development and the achievement of the overall energy ambition of the Council would reflect on the dedication, commitment and tenacity of the staff involved in the EFW project, Powering Aberdeen, Waste Management, Energy Management, Planning, Procurement and other professional services throughout the Council.

Improving our use of Resources –

The use of district heating is one of the most efficient way of heating multiple residential/public/commercial buildings via a heat network. This heat network project will use heat produced as part of the EFW process and this process heat is used to heat the water for the district heating. By using district heating, there is potential to lower heat costs to the building users and it is more environmentally friendly compared to using heat from gas or electric heating that consumes fossil fuel sources.

The technology used in the energy production and distribution is a proven technology with minimum risk and complications. If a building or dwelling is connected to the heat network, there will be no requirement for individual boilers or other heat sources for these buildings, reducing costs and carbon.

Corporate -

This project will deliver the aims of:

- Aberdeen – the Smarter City Vision
  Smarter Environment (Natural resource)

Smarter Living (Quality of Life)

- Strategic Infrastructure Plan
- Powering Aberdeen
- Energy Management Service Plan

Public –

This report would likely to be of interest to the public in general and specifically for the community in Torry as the heat network will be developed in Torry, initially identified as Phase 1, and eventually expand to most of Torry in future phases.

8. MANAGEMENT OF RISK

Risk	Risk level	Mitigation/Control
Uncertainty around energy price forecasts	High	Include energy price sensitivity analysis in the business case. Inter-authority Agreement on Energy from Waste ensures that heat provision from the facility will not result in a charge to the Heat Network.
Network length and sizing	Medium	Ensure that Phase 1 design is modular in nature, such that future phases may be added with minimal upgrading required
Issues with the physical route for the proposed heat network, including technical constraints by existing infrastructure such as roads, rail tracks and buildings.	High	The route for the heat network needs to be technically viable on all aspects. Ensure that appropriate council officers from Roads, Planning and building control are consulted at early design stage
Ground risk	Medium	Utilise existing information to carry out ground investigation to confirm assumptions. Proposed area has little history of development prior to the current housing/public buildings
Council unable to secure the budget for building the heat network.	Medium	Ensure that the report findings from the appointed technical consultants are robust and scrutinised by Project Officers, Finance and other officers involved in the project.
The build programme of the EFW plant not going ahead as scheduled and delays.	Medium	Ensure that the relevant council officers are consulted and briefed on progress with the EFW. Identify options for back up boiler operation is possible for initial connections to meet requirements of HEATNET

9. BACKGROUND PAPERS

Appendix 1. Torry District Heating Network Feasibility Study (Ramboll Energy)

Council Committee Paper 29th June 2016: CHI/16/126 Heat Network Torry – Phase 1

Special Council Meeting 24th October 2016: Item 3 – Inter Authority agreement on Energy from Waste

Finance, Resources & Policy Committee 1st December 2016: CHI16/290European Project HEATNET

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