Linlithgow Natural Grid 'Heat From the Street'
Local Energy Challenge Fund Phase 1
Final Project Report

4th April 2016

Executive Summary

This initiative was conceived in pursuit of **Linlithgow Natural Grid (LNG)**'s core objective of energy independence for the town. As with most concepts LNG's **'Heat from the Street'** (**HftS**) developed over time and at the point of submission of the Phase 2 funding application in February 2016 had evolved as follows:

Concept

The aim of the HftS Concept is to comprise the initial node in an innovative and expandable **Linlithgow Heat Network**.

The key elements of HftS are a new **Energy Centre,** utilising recovered heat from sewer wastewater and powered by solar electricity and underground district heating links initially connecting six nationally prestigious and historic community buildings at the heart of Linlithgow, including St Michael's Church, Burgh Halls and Linlithgow Palace.

This aerial image from the heat study by Infinitas Design identifies probable location of energy centre, heat storage, flow pathways and so on:

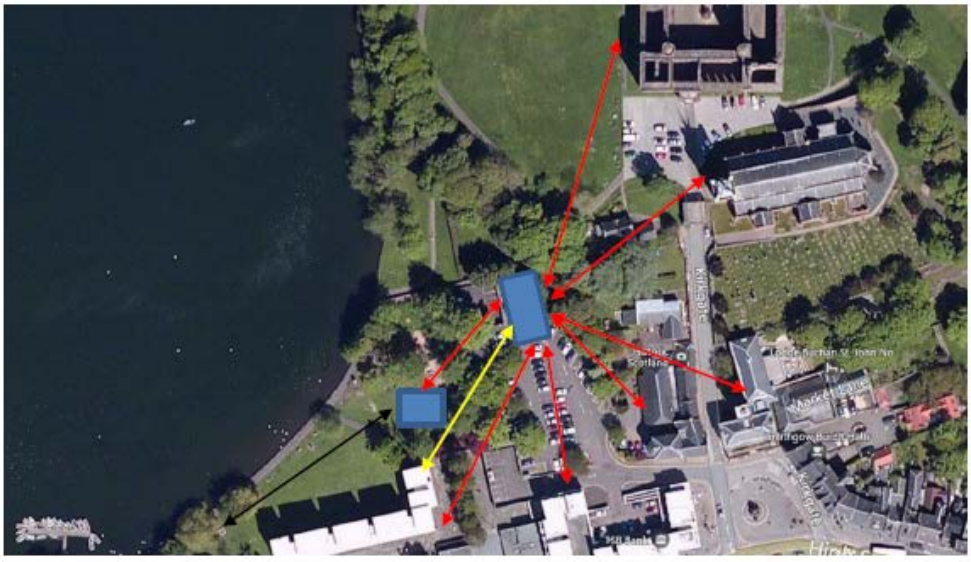

Figure 22 Location of thermal store and proximity to generation and loads (not to scale)

Heat flow pathway

Sewage flow path

Power path

The energy centre will house a sewer waste-water heat recovery system, combined with heat exchanger and water-based heat pumps to raise flow temperatures to desired levels for buildings connected to the district heating network. Solar PV panels will be installed on the Vennel flat-surfaced roofs to power the nearby Energy Centre, with year round top-up supplies from the grid.

Smart Energy Model
As innovative as James Watt's steam engine was, his 'Smart' business model was also first of a kind, as he agreed with Cornish tin mine owners to swap the use of his engines for one third of the coal they saved by replacing inefficient Newcomen engines they used to pump out water.

Inspired by Watt's smart business model of sharing carbon fuel savings by 'pumping water as a service' and by the similar Danish approach to investment in carbon energy savings, **Heat from the Street** aims to be the first Scottish project which combines renewable energy with waste heat recovery for the benefit of a local community.

The concept aims to mobilise finance capital (public & private); use of underutilised capital assets (eg public land & buildings); and the **Renewable Heat Incentive (RHI)** to deliver savings in natural gas and electricity use to be shared between stakeholders.

The owners of buildings with major heat demand - St Michael's Church (of Scotland), Historic Environment Scotland (HES) and West Lothian Council (WLC) - will be founder members of a new bespoke LNG legal entity, akin to a new community-led energy services cooperative. LNG will develop further community energy projects over time through reinvestment of energy savings and expansion of the heat and power network. **Community Energy Scotland (CES)** will also continue to play a key 'technical partner' role, alongside other LNG associated energy experts.

LNG's 'shared savings' partnership model allows members connected to the heat network to reduce their per kWh costs by at least 10%, and to receive an end of year cash dividend or saving, depending on their actual level of consumption. This incentivises ongoing improvements in energy efficiency. The integration of renewable electricity from the solar PV installation means that the effective cost of delivered heat can be fixed for 20 years.

In a traditional Energy Services Company (ESCO), the profit from the sale of heat as a commodity to end users is retained by the heat supplier. LNG's key business innovation is the creation of a new **Community Energy Dividend** principally benefiting vulnerable residents in fuel poverty residing in the Vennel apartment blocks adjacent to the energy centre.

Network Development
Once the district heating scheme is operational, Vennel residents will benefit from energy-saving measures via grants and investment in draft proofing, glazing upgrades, and insulation measures that would not otherwise be affordable. There is scope for future expansion of the network to supply additional users and to connect new heat sources. 'Phase 3' of the proposed heat network aims to source heat from Linlithgow Loch water, and discussions are well under way with the above key partners and the Centre for Ecology and Hydrology.

Last but not least, the LNG Heat from the Street initiative aims to include an information hub for a range of bespoke community education activities, enhancing people's understanding of the heat network, and its local historical and heritage links.

Outcomes
The main focus of energy policy to date has been upon renewable energy which tends to be a rural resource. The HftS initiative accesses a resource – heat recovered from waste water – which is widely distributed throughout Scotland, and particularly in urban areas. To access an urban resource and to create a viable economic model for its extraction, distribution and use requires collaboration between a range of local and national stakeholders. Moreover, while the individual technologies of solar PV and heat pumps are tried and tested, our innovation is in the combination of these technologies.

It is clear that the urban development of new waste water heat projects requires local community support for the necessary infrastructure. Linlithgow's Heat from the Street project will provide the template for that model, by convening the required partners, integrating efficiently with the local electricity grid, and maximising local consumption of locally produced renewable heat and electricity.

For more detail on the specific work activity against phase 1 objectives, see below.

Final Progress Against Planned LECF Project Objectives

The table below summarises the final state of play in relation to the original project objectives set with some consolidation and refocus.

See Table 1: Summary Against Objectives below.

Table 1: Summary Against LECF Phase 1 Project Objectives

No.	Objective	Lead(s)	Key Activity, Conclusions and Recommendations
1	**Formalising the project partnership including its management structure.**	**LNG**	Key partner discussions with: - Historic Environment Scotland - West Lothian Council - St. Michael's Church (of Scotland) - Community Energy Scotland were concluded in February, including a final meeting with WLC councillors and Energy Manager, followed by a bid finalisation workshop with LNG members, CES and St Michael's 4th February. These discussions were instrumental in finalising the project approach, funding/financial arrangements, bid strategy and embryonic management structure. 11 letters of support were received from the above 4 and - Vital Energi - Transition Linlithgow - Linlithgow Community Development Trust - ASAW - Renewable Energy Services - Infinitas Design - Scottish Water/Horizons A Project Manager (full-time; 2 years) will be appointed. Job description drafted. Potential candidates being sourced. A proposed new LNG cooperative partnership (private company limited by guarantee) with key members/partners above would manage this and future projects. Phase 3: 'Heat from the Loch' is to progress in the first instance via HES, the newly appointed owners of the loch's bacterial problem, as well as the new founded LNG collaboration with the Centre for Ecology & Hydrology and other stakeholders. LNG is to play a key role in the mobilisation of solutions, including the next district heating proposal. This should build upon HftS.
2	**Detailed feasibility (heat) study**	**Infinitas-Design**	Final amendments to the heat study sorted. Agreed - viability of SHARC sewer wastewater heat recovery system and heat demand and supply of approximately 400 kWp thermal with a small amount for top-up (gas-fired) during severe winters. Very good match for demand and supply. Risk assessment completed – highest risks perceived are match-funding, planning and OfGEM compliance for RHI. Additional Solar PV generation would also supply hot water tanks. Technical summary included in bid document.

No.	Objective	Lead(s)	Key Activity, Conclusions and Recommendations
3	**Liaison with key local and regulatory stakeholders**	**LNG**	All discussions concluded satisfactorily with WLC, HES, DNO and Scottish Water prior to submission. Full planning application will be submitted subject to success of funding bid. DNO discussions concluded that a standard grid connection is viable with inhibitor given current grid fault and restrictions.
4	**Outline design of integration of PV installation with heat pump , and network connection interface**	**Renewable Energy Solutions**	Outline design drawings completed for 170-190 kWp system, subsequent to feasibility studies by RES and quote from ASAW previously. SPEN (DNO) was receptive to standard grid connection – new supply to the Energy Centre and G59 application for Solar PV surplus export subject to appropriate inhibitor.
6	**Initiate procurement for capital and installation costs**	**LNG**	It was agreed previously, as in the last monthly report, that stage 1 of Phase 2 would include the detailed design, planning and procurement (Apr-Sep). The estimated costs and quotes received to date have formed a solid basis for the bid and no further work is required at this stage. Procurement variation on major plant items and installation services of approximately 15% have been built into the final cost model.
7	**Financial modelling**	**CES**	Finance/funding model confirmed. Figures reviewed and agreed. James Watt inspired model based on sharing energy savings with community energy dividend for Vennel Flats. The 3 public building owners and bodies would continue to pay their current utility bills and these would be reconciled after each agreed period. RHI would provide the major incentive from a cash flow perspective. CES converted the original energy-saving model figures into the Ricardo spreadsheet – available in the associated final bid appendix. CES also confirmed the final State Aid rulings, including the findings in the heat study by Infinitas Design of the requirement to fund the heat delivery plant independently to avoid double subsidy with RHI. Courtesy of Scottish Futures Trust, RHI eligibility confirmed via correspondence with Ofgem.
8	**Draft terms for heat supply customers**	**CES**	Alternative shared community energy saving model via a new community energy services cooperative finally put forward and agreed in principle. This is NOT a conventional heat supply contract. Terms and conditions will be thrashed out and legally approved in the first 6 months of phase 2. This will include a 'light' energy-saving agreement within the cooperative partnership as well as KPI-style contract for the managing operator via LNG. Housekeeping requirements in terms of temperature control etc will also be applied to the building owners.

No.	Objective	Lead(s)	Key Activity, Conclusions and Recommendations
			This approach will provide the platform for Heat from the Street and projects to come as the district heat network expands with new energy hub inputs, including the loch water. The new district Heat Network (billing & metering) regulations 2014 (and RHI requirements) will be complied with and supported via in-situ heat meters and BMS.
9	**Bid development**	**LNG**	The final bid workshop on 4th helped complete all relevant application sections and the final strategy to help maximise LNG's chances to gain the award. CES were instrumental in the strategy including funding, financial, legal and technical aspects. One of St Michael's Church committee/elder representatives provided an excellent 'client-based sounding board', allowing the local LNG team and community representatives to consolidate, focus and emphasise they key components of the bid.

Final Conclusions

- Heat from the Street is a viable project technically and funding wise.
- Detailed design and planning in the first 6 months of Phase 2 will confirm whether the conclusions of the feasibility studies are sufficiently robust.
- The bid is strengthened by the high level of local support and multi-agency buy-in.