DISTRICT ENERGY AND SMART NETWORKS

HEAT NETWORK PARTNERSHIP

DISTRICT HEATING WORKSHOPS: TECHNICAL

Dominic Bowers
Director, Energy Solutions

28th May 2014
1. What do we mean by ‘district energy’
2. Why it’s relevant now
3. LA role in developing local energy projects
4. Case studies
5. Making it smart!
6. Q&A
District Energy – a definition

• Generating energy local to its point of use
• Distributing over local networks of pipes (district heating) and cables (private wire network)
• Supplying local buildings: homes, businesses and the public sector estate
• Using locally available sources of energy:
  ─ Energy-from-Waste facilities
  ─ Biomass
  ─ Waste heat from industrial processes
  ─ Rejected heat from buildings
• District Energy = local energy
What’s the context of ‘Local Energy’

- Continuing upward trend in energy prices
- Increasing the incidence of fuel poverty
- Lack of trust in the ‘Big 6’
  - Price hikes
  - ‘Profiteering’?
- Security of supply concerns
  - Increasing demand / insufficient capacity
- Government policy
  - Localism agenda
  - Heat Strategy
To what extent do you trust or not trust each of the following sectors to act in your best interest?
Why ‘Local Energy’

• A route to sustainable energy provision
  — through utilising energy locked up in the waste we produce and converting it to heat and power our communities

• Uses district energy networks
  — capture surplus and waste heat and distribute it to homes and offices

• It’s affordable
  — more efficient than centrally produced power or grid gas

• It’s accountable
  — because it’s locally owned
Local authority role

- Addresses statutory obligations
- Manage a property portfolio
- Major energy user/buyer
- Data holder/aggregator for own estate and others
- Trusted supplier
- Stakeholder manager
- **Access to funding:** DHLS/ REIF / ECO / GIB / PPP
Case studies

LONDON BOROUGH OF ISLINGTON
Bunhill Heat and Power

GATESHEAD COUNCIL
Town Centre District Energy Scheme
Project development process

- Objective setting
- Data gathering
- Project definition
- Options appraisal
- Feasibility study
- Detailed financial modelling
- Detailed business modelling
- Soft market testing
- Procurement
- Delivery

Aims of strategy:

• To inform the development of planning policy aimed at encouraging DE uptake
• To safeguard existing district and community heating systems for future connection
• To identify and preserve key energy infrastructure (i.e. potential energy centre sites)
• To ensure that the Borough is in the best position to make maximum use of available DE funding programmes when they arise
• To have a sound understanding of the commercial issues around DE deployment.
Islington Decentralised Energy Strategy
Islington Decentralised Energy Strategy

Bunhill Heat and Power

Key
- DE growth corridor
- Preferred district scheme heat supply point

Archway redevelopment
Gifford St
Metropolitan Kings X
Citigen
South cluster “B”

- **Connected loads**
  - Existing residential: Stafford Cripps Estate, Redbrick Estate and St Luke’s Estate (~ 500 dwellings)
  - Finsbury Leisure Centre and Ironmonger Row Baths
  - Mixed use new-build: Seward Street (161 residential units, 6 commercial and 1 retail)

- **DH network**
  - 1.5km of heat mains
  - Sized to meet peak demand of existing buildings, allows for future network expansion

- **Energy centre**
  - 2.0MWe gas engine CHP unit
  - 115m³ thermal store
  - Top-up and standby provided by local boilers
Bunhill Heat and Power
Map of heat demand in Gateshead
Constraints assessment
Strategic development – network flexibility
Gateshead Town Centre DE Scheme

Proposed Energy Centre Location
DE network – private wire network
• **Connected loads**
  – Existing residential blocks (replacing communal heating and individual gas fired systems in 400 dwellings)
  – Administration, legal and education buildings
  – Creative arts buildings

• **DH network**
  – 3km of heat mains initially, expanding to 8km
  – Sized to meet peak demand of connected buildings, allows for future network expansion

• **Energy centre**
  – 2.6MWe gas engine CHP unit
  – 2 x 135m$^3$ thermal stores
  – 2 x 7.0MW top-up and standby gas fired boilers
DE network – future expansion
What is a ‘smart’ heat network?

...a decentralised energy network with an ‘intelligent’ central control system that integrates data from the energy centre, district heating network, heat meters, heat interface units, customer heating systems and external sources to maximise the value of heat and power produced...
What makes a smart heat network

1. Embedded Sensors
2. Smart Heat Meters
3. Smart Heat Interface Unit
4. Centrally Controlled Customer Heating systems
5. Active Network Control
6. Control of Generation Mix
7. Integrated Control System
8. Link to Smart Grids
Embedded heat network sensors

Acquire operational and performance data to manage the system

- Flow and return temperature
- Differential pressure
- Flow rate
- External temperature
- Leak detection
Smart heat meters

• Interface between the central control system and the smart heat interface unit
• Manages data on heating demand patterns that can help to improve supply management
• Has local control logic to modify customer demand patterns
• Simplifies metering and billing for supplier and customer
• Variable tariffs to incentivise responsible use
• Real time and historic energy use
Smart heat interface units

- Integrated with the smart heat meter and customer heating systems
- Controls the supply to customer heat and hot water systems in response to variations in demand or price in order to derive the greatest value from the system
- Contains local control logic to assist with demand management
Centrally controlled customer systems

• Heating control linked to the central control system, via smart meter and heat interface unit
• Can allow sequencing of heat supply between individual buildings to reduce instantaneous peak – utilises thermal inertia of building to maintain internal temperature
• Altering of flow rate to maintain network temperature differential
• Can control hot water generation and storage to smooth peaks and improve efficiency of central plant operation
Active heat network management

• Distributed heating network control
• Uses data from network sensors to automatically modify the network control to improve operational efficiency and or capacity.
• When combined with information from the central control system and smart meters it is possible to further regulate supply to improve system operation
Control of generation

• Controls the operation of the energy centre generation and storage, based on data gathered from network sensors and customer smart meters.

• Use external and internal data to inform best value generation mix
  • CHP
  • Heat Pump
  • Electrode Boiler
  • Energy Storage
  • Boilers
Integrated heat network control

- Integrated network control platform that uses data from:
  - Customer heating systems
  - Smart heat interface units
  - Smart heat meters
  - Network sensors
  - Energy Centre
  - External sources
    - Temperature forecasts
    - Utility prices
    - Triads
Linking to smart electricity grids

- Energy Centre can supply local smart electricity grids
- Smart heat network can respond to signals from smart grid to maximise value of heat and power produced
- Use smart electrical storage to further improve value from smart DH network
  - EV charging
  - Batteries
  - Compressed air
How do Smart Heat Networks create value?

- Control demand to allow CHP operation when value of electricity is greatest
- Reduce peak demands
- Increase efficiency of CHP plant
- Variable user tariffs to incentivise use patterns
- Better understanding of system operation
  - Prolong asset life
  - Real time performance assessment
  - Proactive maintenance
- Integration with smart electricity grids
Questions...
Heat Network Partnership – Technical Workshop
Heat network delivery in London
Case studies and key issues

Stephen Cook, Arup Energy and Climate Change Consulting
28 May 2014
Contents

- London’s DE delivery programmes
- Heat sources for urban settings
- Planning practicalities
- Commercial issues
London’s DE delivery programmes
London strategic and policy context

Target to meet 25% of London’s energy needs from decentralised energy sources by 2025

New development subject to Mayor’s energy hierarchy in London Plan:

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy
London DE Masterplanning (DEMaP) programme

Capacity building – training and ongoing support to local authority staff

Heat mapping – grants to boroughs with ongoing support

Energy masterplanning – techno-economic modelling of key opportunity areas

Planning advice – local DE policies and safeguarding future connections for DE opportunity areas
Outcomes of DEMaP

Corps of knowledgeable local authority planners and energy officers

Guidance documents on energy masterplanning and project delivery

Growing integration between development planning and infrastructure investment

A pipeline of DE projects
DE Project Delivery Unit (DEPDU)

GLA £3 million, 3-year programme for DE project development which is delivered as a free service to project sponsors. The programme operates through a single delivery team for the whole programme.

Key roles:

• Project initiator: GLA team
• Technical analysis and project advice: Arup DEPDU team
• Project sponsor: London boroughs
Support provided on DEPDU

The programme provides technical, financial and commercial assistance to Project Sponsors (borough councils or other organisations). Multiple projects for each sponsor may be supported.

In addition, the programme undertakes a number of standardisation workstreams which support its mission to provide common replicable documentation, processes and procedures.
Achievements and key issues

1. Over £30 million in project delivery secured though DEPDU support, with significant progress on CHP from existing large scale DE sources

2. Programme structure has low transaction cost for each task order and allows for flexibility during task delivery


4. Programme success depends on GLA leadership and a clear and consistent vision

5. Project success depends greatly on sponsor’s capacity and commitment

6. Successful projects have not recapitalised programme funds
Heat sources for urban settings
Gas vs. low carbon heat sources

- Gas – proven, space efficient, simple, with mature supply chain
- LC heat sources – emerging technologies / supply chains, more complex, not conventionally cost competitive
- Grid decarbonisation will eliminate any carbon savings from gas CHP.
- London study:
  - secondary heat about equivalent to total heating demand (70 TWh/yr);
  - nearly half can be used with DHNs (30 TWh/yr)
Low carbon alternatives to gas in urban areas

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<th>Capital costs</th>
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<th>Air Quality Impact</th>
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</table>
Integrated heat strategy - 1

Solar thermal panels connected to DHW in each building

Biomass (B) and gas (G) top up boilers

DHW Cylinders & heat exchangers

DHN Energy Centre

Low temperature DH network

New buildings

Existing buildings

DHN Energy Centre

Bio-mass store
Solar thermal panels connected to DHW in each building

New developments

New developments

Heat store

Low temperature DH network

DHW Cylinders & heat exchangers

Gas top up boilers

Network Energy Centre

Water source heat pump

Local Reservoir / River
Planning practicalities
Role of policy and planning decisions

• Evidence base needed to identify the potential for DHNs

• National and local planning policy preference for DHN connections (energy hierarchy)

• DM policy requires evidence of efforts to identify / connect to local DHNs

• Planning decisions incorporate energy strategy commitments
  - specifying wet / communal systems
  - safeguarding future DHN connection route

• Planning agreement includes:
  - right/obligation to connect (reasonable endeavours basis)
  - regular review of energy strategy
  - contingency position if no DHN in time
Commercial issues
Concession arrangement

Brent are currently procuring a decentralised energy scheme for approximately 2500 homes.

DEPDU support:

- Pre-feasibility
- Feasibility modelling
- Detailed technical advice
- Contractual advice
- Procurement support
- Legal HoTs

“The Decentralised Energy for London programme has helped us realise our DE potential and has assisted us in bringing this project to market.”

Joyce Ip, Regeneration Project Manager, London Borough of Brent
Local authority led scheme

The Euston Road scheme in Camden is anchored on a major new development and will be delivered by LB Camden.

Planning powers were key for catalyzing scheme.

Following the DEPDU package of support, Camden elected to directly procure advice to complete the delivery of the project.
Challenges of suburban densities

DEPDU analysed several opportunities in Waltham Forest in NE London.

The area also provides limited potential for low carbon heat.

Returns on investment tended to erode as the scheme grew due to relatively low densities of demand.
Project viability tipping point

NPV [M£]

Connections

A-B 1 2 3 4
Conclusions
Conclusions

- The market for DH is growing but is still very small
- Heat network delivery at scale needs large scale coordinated programmes
- Local authorities must be involved but many lack resources / capacity / commitment
- Complexity is high and rising
Thank you

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Heat Network Partnership – Technical Workshop
Heat Network Partnership – Technical Workshop

Michael O’Neill, Craighall Energy
Heat Network Partnership:
Technical Workshop
District Heating Feasibility Studies
28th May 2014
Agenda

• Background & Introduction

• Deliverables From a Typical DH Feasibility Study
  – Project Plan
  – Individual & Complex Projects
  – Site Survey: Determination of Existing & Future Heat Requirements
  – Heat Network Options
  – Typical Energy Centre Layout, Plant Room Adaptation, Network Design and Specification
  – Typical DH Scheme Options for on-site and off-site Energy Generation
  – Outline & Full Business Case Deliverables
  – Typical Procurement Considerations (Time Permitting)

• Summary & Conclusion
Background & Introduction
RES Framework: District Heating & Decentralised Energy Specialists

• Resource Efficient Scotland recently appointed a Framework of 8 Consultants to provide technical support on decentralised energy (DE) and district heating (DH)

• Specific pieces of work will be procured through this framework by mini-competition
  – strategic support to accelerate the development of DH and DE projects in Scotland
  – Focussed on enabling organisations to implement DE projects and assisting in the promotion of best practice

• This presentation will focus on the inputs and outputs from a typical District Heating Feasibility Study........from high level feasibility to more detailed pre-design report covering detailed cost benefit and technical analysis

• Examples are provided to define a route map for Local Authorities, NHS, Universities or RSL’s prior to construction of a district heating system
Decentralised Energy Master-planning – Akin to the RIBA Plan Of Work

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<td>Strategic definition</td>
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- Core objectives
- Procurement (variable)
- Programme (variable)
- Town planning (variable)
- Key support Tasks
- Sustainability checkpoints (opt)
- Information Exchanges
- Government gateway (opt)

Design activities

- Intelligent brief
- Procurement, programme and planning

Developing design information

- Project outputs

Feedback

Projected outcomes
Components of A Simple District Heating Network

**Energy Centre**
- Supply, installation and commissioning of the CHP Generator including LV/HV power systems
- Supply and commissioning of Boilers
- Builders Work/Structural upgrading
- Supply and installation of acoustic enclosures, ventilation/cooling equipment, access platforms
- Supply and installation of pipework, pumps, valves
- Supply and installation of control panels, control sensors, fire and gas alarm systems and associated electrical wiring works.
- Electricity, gas and water connections

**DH Pipe**
- Supply and installation of District Heating mains system including pre-insulated pipework materials pipework installation, and associated civil engineering work

**Building**
- Supply only of pipework, valves, heat exchanger etc
- Supply of heat interface units
- Supply of radiators
- Installation of pipework, pumps and valves heat exchanger heat interface units, radiators etc
Sources of Decentralised Energy

- Anaerobic Digestion (AD)
- Photovoltaic Panels (PV)
- Combined Heat & Power (CHP)
- Tri-generation: Combined Cooling, Heating, and Power (CCHP)
- Heat Pumps
  - Wind Turbine
  - Hydrogen Fuel Cells
  - Hydrogen Mini Grid Supply for vehicle use
  - Energy from Waste
  - Solar Thermal Heating
  - Gasification of bio-fuels
Thermal Generation, Transmission & Distribution

- Natural Gas Boilers
- Biomass Boilers
- Bioliquid Boilers
- Biogas Boilers
- Biomass CHP
- Bioliquid CHP
- Biogas CHP
- Natural CHP
- Ground, Water & Air Source Heat Pumps
  - District Heating for heat distribution
  - District Cooling networks
  - Smart Electricity Grid Networks
  - Smart Metering and Automated Billing
DH Feasibility Studies:
Typical Project Plan
## Typical Client Project Plan

<table>
<thead>
<tr>
<th>Workstream 3: Development of District Heating Feasibility</th>
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<td>3.1 Thermal Energy Demand Assessment</td>
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<td>3.2 Preliminary DH Network Options Development</td>
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<td>3.3 Identify preferred DH Network(s) option</td>
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<tr>
<td>3.4 Develop Financial Information for preferred Option</td>
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<td>3.5 Project Financial Appraisal</td>
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<td>3.6 Thermal Energy Demand Assessment</td>
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<td>3.7 Preliminary DH Network Options Development</td>
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<td>3.8 Identify preferred DH Network(s) option</td>
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<td>3.9 Develop Financial Information for preferred Option</td>
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<td>3.10 Project Financial Appraisal</td>
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<td>3.11 Thermal Energy Demand Assessment</td>
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<td>3.12 Preliminary DH Network Options Development</td>
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<td>3.13 Identify preferred DH Network(s) option</td>
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<td>3.14 Develop Financial Information for preferred Option</td>
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<td>3.15 Project Financial Appraisal</td>
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<td>3.16 Combined Scheme (North Glasgow &amp; City Centre North)</td>
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<td>3.17 Preliminary DH Network Options Development</td>
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<td>3.18 Identify preferred DH Network(s) option</td>
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<td>3.19 Develop Financial Information for preferred Option</td>
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### STAGE 4: RECOMMENDATIONS AND FINAL REPORT

<table>
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<th>Workstream 4: Recommendations &amp; Final Report</th>
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<tr>
<td>4.1 Phasing and Delivery Plan</td>
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<td>4.2 Funding Options</td>
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<td>4.3 Possible Role and Remit of an Energy Partner</td>
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<td>4.4 Possible Role and Function of an ESCo</td>
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<td>4.5 Next Steps</td>
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<td>4.6 Final Recommendations</td>
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Typical Deliverables: DH Feasibility Study

1) Review and Verification of **Existing Client Energy Data** (Heat & Electricity)
2) **Site Survey** & preparation of a Bespoke Baseline **Energy Model**
3) **Technical Review** of Suitable Thermal Generation & Power Options
4) Review of **Constraints or Barriers** to Decentralised Energy Options - steam/hot water, Flow/Return temps, plant rooms adaptations, DNO Capacity, availability of infrastructure e.g. gas grid etc.
5) **Connectivity** with other local DH Networks (to feed or receive heat)
6) **Socio-Economic & Environmental Benefits Appraisal** – CAPEX/OPEX, NPV, IRR, CO2 Benefits etc.
7) **Recommendations**, Risk Register, Stakeholder Engagement Plan
8) **Route Map** with Procurement/Delivery/Funding Strategy
Deliverables: Individual & Complex Projects
Review of Existing Site Conditions: Site Survey Establishes Existing & Future Layout and Energy Flows

Client Data is Often the Key to success……..The Methodology & Approach to DH Feasibility is Broadly Similar With Varying Degrees of Complexity Relative to the size and scale of the project………………
Review of Existing Conditions: Identification of Boiler House and Plant Room Arrangements
Heat Consumption Data Developed – Example of Typical Domestic DH Network

<table>
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<tr>
<th>House Type</th>
<th>Gas</th>
<th>Electric</th>
<th>Total No. of Dwellings</th>
<th>Total Consumption [MWh/annum]</th>
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Review of Existing Conditions: Develop Bespoke Heat & Electricity Demand Profiles

Average Heat Demand

Average Electricity Demand
Development of Heat Network Options

Network Options For NHS De-Steaming Project
Typical Energy Centre Layout, Plant Room Adaptation, Network Design and Specification

Option For Energy Centre Layout

Plant room Adaptation Working Drawing

Network Options For NHS De-Steaming Project
Heat Consumption – City Scale Connectivity
Deliverables: Typical DH Scheme Options
For on-site and off-site Energy Generation
## Typical DH Scheme Options

1. **On-site generation, no interconnection** - Generate heat on-site for exclusive use of Client / private tenants within the development boundary

<table>
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<th>Advantages:</th>
<th>Simple DH network arrangement under single ownership/management</th>
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<tr>
<td></td>
<td>Local supply of heat, under control of Client / ESCo</td>
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<tr>
<td></td>
<td>Scheme not reliant on external sources of heat</td>
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<tr>
<td>Disadvantages:</td>
<td>Single heat source (albeit with backup boilers in energy centre building)</td>
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<tr>
<td></td>
<td>Client / ESCo responsible for all aspects of development - generation, energy supply contracts, O&amp;M, billing, etc. – and attendant risks [risk could be mitigated through third-party contract of role]</td>
</tr>
<tr>
<td></td>
<td>No interconnection to external heat sources means cheaper or lower-carbon sources of heat that may connect to a wider network are not available to development</td>
</tr>
</tbody>
</table>
Typical DH Scheme Options

2. **On-site generation, interconnection to external source of heat** - Generate heat on-site for use of Client / private tenants within the development boundary, but interconnect with nearby district heating developments / large consumers to either: (1) export heat; (2) improve resilience; or (3) allow for import of cheaper/lower-carbon heat

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Local supply of heat, under control of Client / ESCo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scheme not reliant on external sources of heat, however backup available</td>
</tr>
<tr>
<td></td>
<td>External source of heat may provide cheaper/lower carbon heat that on-site generation</td>
</tr>
<tr>
<td>Disadvantages:</td>
<td>Connection to external heat source will require contract to be setup that adds complication to scheme arrangement</td>
</tr>
<tr>
<td></td>
<td>Extra infrastructure required to connect external load, depending on proximity to scheme</td>
</tr>
</tbody>
</table>
Typical DH Scheme Options

3. **External heat supply with local backup generation** - Accept heat from external district heating development / large consumer via an interconnecting pipe, with on-site backup generation

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Primary responsibility of heat passed over to third party</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Access to potentially cheaper or lower-carbon supply of heat through interconnected network</td>
</tr>
<tr>
<td></td>
<td>Backup provides resilience to scheme and fall-back supply of heat should external source have any issues</td>
</tr>
<tr>
<td>Disadvantages:</td>
<td>Rely on third party to supply heat – lost control of heat source and ability to set price of heat</td>
</tr>
<tr>
<td></td>
<td>Backup generation costs money, but may not be required</td>
</tr>
</tbody>
</table>
Typical DH Scheme Options

4. **External heat supply with no local backup generation** - Accept heat from external district heating development / large consumer via an interconnecting pipe, with no on-site backup generation

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Primary responsibility of heat passed over to third party</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Access to potentially cheaper or lower-carbon supply of heat through interconnected network</td>
</tr>
<tr>
<td></td>
<td>No CAPEX/OPEX costs for backup generation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disadvantages:</th>
<th>Rely on third party to supply heat – lost control of heat source and ability to set price of heat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No backup generation – lost resilience</td>
</tr>
</tbody>
</table>
Deliverables: Outline & Full Business Case
# Outline & Full Business Case Preparation

<table>
<thead>
<tr>
<th>New Development Scheme</th>
<th>Estimated Capital Cost Summary CHP DH to 2 New Development Schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CHP Station [£]</td>
</tr>
<tr>
<td>Port Dundas</td>
<td>2,577,000</td>
</tr>
<tr>
<td>Sighthill</td>
<td>1,977,000</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>£4,554,000</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>New Development Scheme</th>
<th>Estimated CHP DH Operating Cost benefit for Two New Development Schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual CO2 saving (Tonnes)</td>
</tr>
<tr>
<td>Port Dundas</td>
<td>1195</td>
</tr>
<tr>
<td>Sighthill</td>
<td>2,048</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>3,243</strong></td>
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# Annual Operating Performance & NPV Forecast

## Project A: Operating Performance

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual Total</th>
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<tbody>
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<td>Income</td>
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<td>Business Expenses</td>
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<tr>
<td>Brown Export Income</td>
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<td>Brown Export Income Day 1</td>
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<td>LEI’s income CIL exemption</td>
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<tr>
<td>Expenditure</td>
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<tr>
<td>CRP Natural Gas</td>
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<td>CRP Maintenance Cost</td>
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<td>Other Plant Maintenance Costs</td>
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<td>Rates</td>
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<tr>
<td>Legal &amp; Professional</td>
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<tr>
<td>Staff Cost</td>
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<tr>
<td>Office Costs</td>
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<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>48.000000</td>
</tr>
<tr>
<td>Total Expenditure</td>
<td>453.370</td>
<td>482.275</td>
<td>487.719</td>
<td>316.355</td>
<td>276.349</td>
<td>184.644</td>
<td>199.797</td>
<td>203.521</td>
<td>193.805</td>
<td>277.472</td>
<td>380.532</td>
<td>425.872</td>
<td>3,969.940000</td>
</tr>
</tbody>
</table>

## Project B: NPV Calculation

![NPV Calculation Diagram]
An Integrated & Structured Delivery Plan

The Challenge of Growth and Wider City Region Integration

I. Existing 300MW heat load estimated within City Centre Boundary
II. 500MW+ heat load across City Region
III. New City Infrastructure
   a) Polmuir energy from waste plant
   b) Scottish water effluent pipeline(s)
   c) SUDD Programmes
   d) Geothermal heat recovery from shallow mine workings (PRENEES)
   e) On-going development of CHP DH schemes (Athletes Village, Wyndford, Broxholm etc.)
IV. Sustainable Glasgow targets and tightening legislative requirements (30% carbon emissions targeted in Glasgow by 2020)
V. Funding availability – SFC grants to UoG or ECO funding only available until 2016, but new horizons exist with ever changing UK Government Policies e.g. RHI, FIT, CIO etc.
An Integrated & Structured Delivery Plan

Proposed Future Connection to Wider Area District Heating Network
## Risk Management Strategy & Delivery Plan

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Risk Description</th>
<th>Mitigation</th>
<th>Owner</th>
<th>RI</th>
<th>Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of funding of capital for the business</td>
<td>To date we have a good track record of delivering projects that save cash and reduce carbon, which is a key objective for Council. It shows that these projects are a sound investment.</td>
<td>Dev</td>
<td>3</td>
<td>Review periodically</td>
<td></td>
</tr>
<tr>
<td>Inadequate scrutiny of finance</td>
<td>Audit controls already in place need to be more robust particularly in light of a move to a subsidiary company structure.</td>
<td>Dev / P&amp;O</td>
<td>3</td>
<td>Review periodically</td>
<td></td>
</tr>
<tr>
<td>Catastrophic technical failure</td>
<td>Generators and back up boilers are serviced regularly. Distribution pumps are duty standby, and it is intended to carry spares for these items. Underground piping is alarm monitored. There is therefore a degree of redundancy built into existing systems. Need to carry adequate spare parts.</td>
<td>Rep</td>
<td>4</td>
<td>Review periodically</td>
<td></td>
</tr>
<tr>
<td>Failure to deliver on capital projects</td>
<td>Careful management of projects is key to achieving project deliverables against cost and time. We have a good spread of experienced personnel to deliver projects.</td>
<td>Rep</td>
<td>3</td>
<td>Review periodically</td>
<td></td>
</tr>
<tr>
<td>Poor quality of installations leading to complaints</td>
<td>To date, the satisfaction surveys that have been carried out and word of mouth have yielded that overall satisfaction on installations is high. We need to maintain these standards going forward.</td>
<td>Rep</td>
<td>4</td>
<td>Review periodically</td>
<td></td>
</tr>
<tr>
<td>Alternative technologies for fuel input do not perform as well as gas firing</td>
<td>Careful and extended studies of various fuel technologies needs to be carried out to minimise the risk impact on the business.</td>
<td>Pol / Env</td>
<td>4</td>
<td>Review periodically</td>
<td></td>
</tr>
</tbody>
</table>
Typical Procurement: DH Works Packages

**Energy Centre**
- Supply, installation and commissioning of the CHP Generator including LV/HV power systems
- Supply and commissioning of Boilers
- Builders Work/Structural upgrading
- Supply and installation of acoustic enclosures, ventilation/cooling equipment, access platforms
- Supply and installation of pipework, pumps, valves
- Supply and installation of control panels, control sensors, fire and gas alarm systems and associated electrical wiring works.
- Electricity, gas and water connections

**DH Pipe**
- Supply and installation of District Heating mains system including pre-insulated pipework materials pipework installation, and associated civil engineering work

**Building**
- Supply only of pipework, valves, heat exchanger etc
- Supply of heat interface units
- Supply of radiators
- Installation of pipework, pumps and valves heat exchanger heat interface units, radiators etc
Typical Procurement of DH Works Packages

Energy Centre

• Supply, installation and commissioning of the Thermal Generator including LV/HV power systems (+ O&M Contract)
• Supply and commissioning of Boilers
• Builders Work/Structural upgrading
• Supply and installation of acoustic enclosures, ventilation/cooling equipment, access platforms
• Supply / Installation of pipework, pumps, valves
• Supply and installation of control panels, control sensors, fire and gas alarm systems and associated electrical wiring works.
• Electricity, gas and water connections
Typical Procurement of DH Works Packages

District Heating Mains

• Supply and installation of District Heating mains system including pre-insulated pipework materials pipework installation, and associated civil engineering work

Plant Room Adaptation, Domestic/Commercial Heating Systems

• Supply / Installation of pipework, valves, heat exchanger, Heat Interface Units, heat emitters/radiators etc.
Summary

1. District Heating is not new and should be welcomed for a range of social, economic and environmental reasons

2. District Heating is technology neutral. Choose the generation technology that suits your needs best

3. Clients should clearly define and prioritise key drivers for change at the outset (CAPEX/OPEX cost, socio-economic, environmental objectives etc.)

4. Willingness to look beyond your own horizons offers significant potential for decentralised energy projects

5. District Heat Networks are here for the long-term

6. Modular and phased scheme development is always an option

7. Where necessary, start small but always think big and consider the potential for future technology solutions.

8. RES and the Framework Providers are always here to help
Contact Details

Michael O’Neill, LLM, Pg Dip, BSc (Hons)
Director

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Glasgow
G4 9UD

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Mobile: 07944 213 265
Office: 0141 353 1612