WELCOME TO
DEVELOPING DISTRICT HEATING IN IRELAND
CONFERENCE

4th OCTOBER, 2016
The Marker Hotel | Dublin 2 | Ireland

organised by The Irish Bioenergy Association

#districtheat2016 @CodemaDublin @IrishBioenergy
The De-carbonisation of Heating in Ireland
2015 SEAI Study

- National comprehensive assessment for Ireland to support compliance with Article 14(5) of the EED 2012/27/EU

- To identify the cost effective potential for heat networks and high efficiency cogeneration across Ireland based on a heat mapping process

- To obtain better understanding of how these may benefit Ireland

- To support the development of further policy and guidance in this area.
METHODOLOGY

• Counterfactual - business as usual technologies, including boilers (gas, oil and solid fuel), and electric heating.

• Alternative technologies - building scale systems, including heat pumps, biomass boilers, and micro / small scale CHP.

• District heating technologies - large scale solutions, including large gas CHP, biomass boilers, biomass CHP, waste heat from power stations and industry, large heat pumps, and geothermal.
HEAT MAPPING

- Spatial description of heat demand data
- Detailed dataset and spatial distribution enables heat maps to support analysis of community energy schemes, or other schemes where spatial and geographic information may be of use
HEAT MAPPING

• An Ireland-wide heat map forms the basis for the assessment of district heating network and high efficiency CHP potential analysis

• Linear heat density is a measure of heat demand per unit road length – a good proxy for network costs

• The spatial resolution used is the Small Area
• a small number of zones are cost effective
• a large proportion of the heat demand is borderline cost effective
• non cost effective zones can have a significant additional cost
Conclusions

• Largely Low density heat demand

• Areas unlikely to be viable for heat networks - more appropriate for alternative low carbon technologies

• Economic potential estimated at 300 GWh per year identified, with a cost benefit of around €33million NPV, largely based on a zone in Dublin.

• Types of economically viable schemes:
  • Large scale schemes (Dublin) – small cost benefit, mainly reliant on waste heat
  • Small scale schemes – larger cost benefits, limited heat provision potential, likely off the gas network locations, boiler-based
What's required - Target action to 2020

Energy efficiency: expand existing programmes, retrofit 50-70k homes per year

Renewable electricity: 200-250 MW of additional generation per year

Renewable heat; 300,000 homes or 3,000 services sector buildings or 200 large industrial sites

Renewable transport: 400-500 million litres of biofuel
Heating

Total Primary Energy Requirement: 10,833 ktoe

- Biomass, Other Renewables and Wastes: 581 ktoe
- Wind: 442 ktoe
- Hydro: 61 ktoe
- Electricity Imports (net): 185 ktoe
- Electricity Transformation: 2,222 ktoe
- Natural Gas own use / loss: 64 ktoe
- Briquetting: 13 ktoe
- Oil Refining: 71 ktoe
- Aviation: 745 ktoe
- Transport (excl. Aviation): 3,777 ktoe
- Total Final Consumption: 9,833 ktoe
- Gross Electricity: 2,405 ktoe
- Thermal: 4,239 ktoe

Note: Some statistical differences exist between inputs and outputs. RES-E Normalised wind and hydro. RES-T adjusted to account for double certificates.
Renewable Heat
Other Considerations

- Policy and Regulatory Climate
- Heat market and heat service
- Tax Positioning of District Heating
- Absorptive Capacity of Receiving Environment
- Targeted Activity will Precipitate Change
Consumer Decision Making Process

- Regulation
- Financial support e.g. low interest loans with grants
- Information campaigns, promoting services, audits
Jim Gannon
Future Heat Scenarios for Ireland

James Glynn, Brian Ó Gallachóir, et al

Developing District Heating in Ireland Conference 4th October 2016
Overview

• Key Messages
• Context
  • Past and recent trends for RES and RES-H Targets
  • Looking at Short Term to 2020
    • RES 2020 targets
  • Long Term to 2050
    • Low Carbon Energy System scenarios
Key Messages

• We’re not on track to meet our 2020 targets (RES or CO₂)
• Due more to neglect of RES-H rather than wind objections
• We have policy measures in place for RES-E and RES-T
• Beyond 2020, RES-H even more important
• Key options wood, renewable gas and renewable diesel
• We urgently need effective RES-H strategy and policies
Mandatory Targets for Ireland

- Directive 2009/28/EC on MS Renewable Energy targets
  - Ireland - 16% RES by 2020
  - also 10% RES-T (to encourage 2nd generation biofuels)
- Decision 406-2009 on MS non-ETS GHG emissions targets
  - Ireland - 20% reduction by 2020 relative to 2005 levels
- Decision XXX-2016 on MS non-ETS GHG emissions targets
  - Ireland - YY% reduction by 2030 relative to 2005 levels
Renewable Energy - where are we now?

Biomass and hydro initially

Recent growth driven by wind energy and some RES-T

In 2014 we reached 8.5% RES share of GFC

Data: SEAI
Ireland’s gross energy consumption 2014

Ireland’s gross final consumption of energy in 2014 was 130 TWh.

Electricity accounted for 22%, transport energy 38% and thermal energy 40% of energy use.

Renewable energy contributed 8.5% of energy use, comprising 5% from renewable electricity (wind and hydro), 1% from renewable transport (biofuels) and 2.5% renewable heat (biomass).

Data: SEAI
Renewable Targets and Progress to Date

- RES-H to target: 5.4%
- RES-H: 6.6%
- Thermal Fossil: 88%

Thermal gross energy consumption 2014:
~ 50 TWh

⇒ 12% RES-H ~6 TWh

Data: SEAI
SEAI: to achieve 12% RES-H by 2020

- 300,000 homes
- 3,000 services/public sector buildings or
- 200 large industrial sites
- or a mix

A larger RES-H target may be required as
- 40% RES-E + 10% RES-T + 12% RES-H ≠ 16% RES
- May need up to 16% RES-H ~ 8 TWh
Ireland’s Low Carbon Pathway to 2050

% of 1990 CO₂ emissions

- Power Sector
- Transformation
- Residential
- Services
- Industrial Processes
- Industry
- Agriculture (Energy)
- Transport
- BAU
Ireland’s Energy System 2050 (-80% CO₂)

TFC 136 TWh
Elec 25%
Heat 31%
Scenario analysis to address uncertainty

- **Irish TIMES** finds least cost pathway to meet energy service demands and policy constraints
- **Assumptions in all scenarios** - macro drivers from ESRI economic projections – fuel prices from IEA WEO 2012 – technology dbase from PET, DECC, JRC –
  1. **BaU** – business as usual – unlikely but useful reference
  2. **CO2-80** – 80% reduction in 1990 CO$_2$ emissions by 2050
  3. **No Biolmp** – CO2-80 but with no bioenergy imports allowed
Story of Heat Demand to 2050 by Sector

![Heat Demand Chart](chart.png)

- **Residential**
- **Industry**
- **Services**
- **Agriculture**

<table>
<thead>
<tr>
<th>Year</th>
<th>Scenario</th>
<th>Residential</th>
<th>Industry</th>
<th>Services</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>BaU</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>CO2-80 No CCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>BaU</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO2-80 No CCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No CCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No BioImp</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ireland’s gross final consumption of energy in 2050 under Low Carbon scenario is 136 TWh.

electricity accounts for 22%, transport energy 35% and thermal energy 43% of energy use

renewable energy contributes 49% of energy use, comprising 11% from renewable electricity (wind, solar PV and hydro), 19% from renewable transport (biofuels and biogas) and 18% renewable heat (biomass and biogas).
Conclusions

- We’re not on track for RES and may need 16% RES-H
- Due more to neglect of RES-H rather than wind objections
- We have policy measures in place for RES-E and RES-T
- Beyond 2020, RES-H even more important
- Key options wood, renewable gas and renewable diesel
- We urgently need effective RES-H strategy and policies
Collaborators and funders

Roinn Cumarsáide, Fuinnimh & Acmhainní Nádúrtha
Department of Communications, Energy & Natural Resources

SFI For what’s next

Energy Exemplar

Queen’s University Belfast

EPA Environmental Protection Agency

Gas Networks Ireland

ESRI

Eirgrid

NTR Foundation

Securing a greener future

SEAI SUSTAINABLE ENERGY AUTHORITY OF IRELAND

UCD Dublin

PSI

Paul Scherrer Institut

KTH

UCL

UCL Energy Institute

IIEA Energy Technology Network

Comhshaol, Pobal agus Riatts Áitiúil
Environment, Community and Local Government

University College Cork, Ireland

Coláistí na hOllscoile Coralóg
Future Heat Scenarios for Ireland

James Glynn, Brian Ó Gallachóir, et al

Developing District Heating in Ireland Conference 4th October 2016
District Heating – an Important part of a Sustainable Denmark

Morten Jordt Duedahl
Business Development Manager
DBDH
Promote District Energy for a Sustainable City Transformation

Established in 1978

65 members
  – Leading actors in Denmark
  – 2/3 Manufacturers, Consulting Engineers
  – 1/3 Utilities

Magazine HOT|COOL

www.dbdh.dk
Technically DH is NOT Complicated

- Like your own boiler – a lot bigger and a lot smarter!!
- Moving “free” heat to a useful place
- Extremely well proven technology/system/idea!!

DH is fuel agnostic!

Storage

Pipes, pumps, valves . . . Heat demand
District Heating in Denmark

- 64% of all households (1,671,000)
- 98% in Copenhagen
- +19,000 (2015)
- Today ~450 schemes
Future Targets

• National
  – 2035 Carbon Neutral Heat
  – 2035 Carbon Neutral Electricity
  – 2050 Transport ??

• Copenhagen and many other cities
  – 2025 Carbon Neutral

• Technical and economical limit ~75%
Denmark’s Wake Up Call

- First oil-crisis - 1973
- 99% oil and coal = import dependence
- Inefficient energy use
- Sustainable solutions needed!!
- Support from all levels of society
Consistent Energy Policy
Long Term planning

Legislation
- 1976 – Electricity Act (CHP, Cost Eff)
- 1979 – Heat Supply Act + RES + WtE
- 1986 – Decentralized CHP
- 1990, 1993, 2008 – Increased biomass (new CHP and conversion)

Incentives
- 1981 – Investment grants for biomass DH/CHP
- 1984, 1992 – Subsidies for CHP
- 1994 – Financial support to establish DH on biomass or natural gas
- 1991 – High energy tax and CO₂ tax on fossil fuels

Clear business model
- Non-for-profit
- Municipal guaranteed loans

Plan – Coordinate – Legislate - Support
Danish Background

• Bottom–Up AND a Top–Down approach
• Natural monopoly
  – Governance
  – Optimisation
  – Consumer protection
• Goals and Framework Conditions
  – Long term, Stable but not Constant
Planning and zoning in Denmark

- Natural Gas and District Heating
- Choice of heat solution must be beneficial to:
  - Society
  - Consumers
  - District heating company
- In the zone
  - Natural monopoly
  - Mutual obligation - connection and delivery
Evolution of District Heating
Evolution of District Heating
The Future

- A central part of Smart Energy Systems & 2050 targets
- Integrate surplus wind and solar electricity
DH Costs less than Natural Gas

~60% of schemes cost less than natural gas
~66% of end user spend less compared to natural gas

Heat Prices incl VAT 2015
385 schemes (18,1 MWh – 130m² standard house)

All district heating schemes arranged after price

Source: Danish District Heating
Denmark’s DH Carbon Footprint

- DH is 58% “green” in 2015
- 46% lower carbon emission pr DH unit produced

Source: Danish District Heating
Why do customers like district heating?

• What’s not to like?
• Well informed customers
• It works!
• Accepted as a utility – not for profit
• ”Like district ...what??”
• Cost less and no price fluctuations
• District Heat or Freeze - Only choice
• Easy: fuel, carbon, green, safe...
Getting started!
Connectability

Planning is the Key!!

DH-Islands - a fine start
Connectability

- Technical (e.g. pressure, temperature)
- Fuel sources – any available
- Customers – any available
Connectability

• Economy
  – Agreed principle
  – Who benefits

• Legal and ownership
  – Flexible today
  – Flexible in the future
  – Merger, management, sell off, production...
Connectability

• Competences
  – Shared services
  – Connect before the pipes!
Dis-connectability?

Objective
• Fuel poverty  Carbon footprint
• Jobs  City development
• Cost savings / revenue  Comfort

Project Development
• Technical development – feasibility, design
• Business model – ownership, finance, customers

Solution
• IRR - Comparison to Gas
Thank you

Morten Jordt Duedahl
Business Development Manager
md@dbdh.dk
www.dbdh.dk
Location location location
The home of Hamlet Castle

The easy pun:

To District Heat or not to District Heat

Collective or individual solutions
The bad example 😊 Elsinore

Facts:
District heating to half of Elsinore.

How did this come about?
Who are we!

Established: End 1960s
Employees: ≈ 25

Annual heat demand: ≈ 800 TJ incl heat loss
Grid: ≈ 150 km
End consumers: ≈ 3,500 Heat exchanger points. Around 20,000 people

Production facilities: 1 wood chip boiler, 8 natural gas boilers

Turnover: ≈ 47,6 mio.EUR
Profit = 0 EUR
How to: District Heating

Natural monopolies:
- No profit
- All change has to be beneficial to consumers, society and Us
One step back...

In the beginning..

One heating station...

Organic growth
Present

- Supplying 9 existing DH systems over 30 km
- Heat delivered: ≈ 1.200 TJ/yearly
- 3 production Sites
  - CCGT unit at HØK
  - Combined cycle gas turbine – Thermal 60 MW, Power 60 MW
  - Storage: 2.700 GJ-heat
  - Heat production: ≈ 570.000 GJ/year
  - Electricity production: ≈ 145.000 MWh/year
- W-t-E Plant Norfors
  - Surplus heat during summer only
  - Heat delivery north ≈ 50.000 GJ/year
- DH heating Helsingør
  - 1 Wood chip boiler + 8 Natural gas boilers
Near future

Remodelling the present CHP plant
- Two fuel solution
  - Natural gas
  - Wood chips

District Heating price - transmission

- Gas CHP
- Wood chips
Planning for a better future

- Laws
- Taxes
- Heat demand
- Competition
- Economy
- Speed of change
- Visions
Future

Helsingør
Gurre-Tikøb
Espergærde-Kvistgård
Hellebæk-Saunte
Potential
The vision... maybe
Jakobi Pedersen

Email: jpe@fh.dk
Tlf: 0045 24 45 14 76
The Role of Biomass in District Heating in Ireland

Joe O’Carroll
Managing Director
Gaelectric Renewable Energy Developments
Presentation Contents

• Gaelectric Overview
• Energy Market Changes
• Biomass - Forms & Uses
• Sample Projects
• What we Need for a Sustainable Renewable Energy Future
• Summary
Gaelectric Background

- Expert team of 90+ professionals - distributed across the Republic of Ireland ("RoI"), Northern Ireland ("NI"), Great Britain ("GB") and the ("US").
- Interests across several renewable platforms; Onshore & Offshore Wind, Energy Storage, Bioenergy & Solar PV.
- Business model: develop, build, own/manage, finance, trade and operate.
- In 2014 Acquired Imperative Energy Group & entered Biomass and Solar businesses.
- Development, permitting, construction, market, asset management, forecasting and finance capabilities all in-house — a company key differentiator.
Our Ethos & Long Term Partners

Our Ethos
- Green Future
- Hard Work
- Respect & Partnership
- Innovation
- Empowerment

Our Partners
- Dresser Rand
- Tesla
- Siemens
- Nord/LB
- Enercon
- BlueBay Asset Management
- Stobart Group
- Proventus

Gaelectric
Gaelectric’s Mission

Putting the power in the hands of the consumer

A champion of ALL forms of Renewable Energy

Putting the power in the hands of the consumer
Energy Market Changes - Consumer

• Corporate Greening emerging as a key trend
• Datacentre pipeline requiring massive energy infrastructure investment and driving demand for green energy
  – Consumer of power; supplier of heat
• Behind the Meter generation and storage - will be further driven by RHI in ROI
• Energy efficiency and demand side management
• Smart metering and real-time pricing
WHY BIOENERGY?

• Bioenergy is a **completely sustainable** energy source, which can be generated from local agricultural activity

• Bioenergy is the **most proven** form of renewable/clean energy
  – 80% of renewable energy is currently derived from biomass
  – Mature technology & business models in many markets, particularly in Scandinavia & Central Europe

• Bioenergy is the **most flexible** form of renewable energy
  – Can be used for Heat, Power/Electricity, and Transport
  – Can be used in Combined Heat & Power (CHP), offering high conversion efficiencies
  – Can be stored & used on demand, unlike wind energy

• The disadvantage of Bioenergy compared to other sources of renewable energy is its finite capacity
  – Access to fuel supply is key
Best Use of Biomass

1. Significant baseload of thermal energy (heating and/or cooling)
2. Suitable for:
   a. Leisure Centres
   b. Healthcare Facilities
   c. Processing sector (food and drink, pharma)
   d. District heating
3. Only consider biomass CHP where there is consistent demand for low grade heat
4. Better to displace oil than natural gas
Energy Networks

• Currently spending €millions on NEW gas distribution networks. Recent developments:
  – Cashel, Co Tipperary
  – Cahir, Co Tipperary
  – Gort, Co. Galway
  – Loughrea, Co Galway
  – Ballinrobe, Co Mayo
  – Monasterevin, Co Kildare
  – Dozens more in Phase 3

• Conventional Planned System:
  – Gas Transmission (large pipes)
  – Gas Distribution (small pipes)
  – Individual gas boilers to convert gas to hot water
Time running out

- Gas is coming to a town near you soon!

“…we cannot become over reliant on natural gas…”

John Mullins
Former CEO
Bord Gais
February 3rd, 2011
Alternative: District Heating

- Central energy centre on edge of towns
- MTHW Distribution network allowing heating and cooling to be delivered
- Individual heat metering
District Heating

• Benefits of District Heating
  – Generate Revenue for Local Authorities through JVs
  – Modern water distribution infrastructure can be laid at the same time - major cost benefits and efficiency gains - turn Irish Water infrastructure roll out into something more positive
  – One energy centre, single source of emissions - more effective abatement, better for environment
  – Efficient Energy Storage
  – Creates energy infrastructure to support multiple technologies
    – Biomass CHP
    – AD
    – Solar
    – Wind
    – Geothermal
    – Even gas, initially, when prices are low
District Heating

- Future proofed (100 years +) networks
  - No fear of medium term rise on gas prices
  - Removes gas supply concerns post-BREXIT
- Creates critical mass for biomass
  - Market pull for energy crops, rather than grant aided push
- Major job creation
  - Redeployment of construction sector during build phase
  - Ongoing employment in operational phase
  - Sustaining jobs back through the supply chain
  - Sustaining jobs at businesses on the network - low cost, low carbon energy
Proposed Bioenergy Zones
Areas with little current gas infrastructure

1. Northwest:
   • Donegal
   • Tyrone
   • Fermanagh
   • Leitrim
   • Sligo
   • Roscommon
   • Longford
   • Cavan (part)
   • Monaghan (part)

2. Southwest
   • Kerry
   • West Cork

3. Southeast
   • Wexford
Proposed Bioenergy Zones
*Areas with no current gas infrastructure*

Within these zones, Bioenergy:
- is the energy source of first resort
- supported by county dev. plans
- used by compulsion on new builds

Also,
- Bioenergy crop scheme targeted in these areas
- Retrofitting of towns with high heat densities with District Heating Schemes

Outside these zones there are still localised opportunities
BIOGAS Zones
Areas with existing gas infrastructure
Sample Project: GOVERNMENT BUILDINGS

- District Heating Scheme for all State buildings between Kildare Street and Merrion Street
- 2MW MTHW Biomass boiler
- Client: OPW
- DH System: Jones Engineering

Buildings heated:
- Dail Eireann
- Seaned Eireann
- National Gallery
- National History Museum
- Natural History Museum
- Depts of Finance, Agriculture, Enterprise, An Taoiseach
Sample Project: NEC, Solihull, Birmingham

- 16.5 MWe Biomass CHP
- >£75m CapEx
- Large Commercial District
  Heating and cooling network
  REPLACING NATURAL GAS
- Private wire power supply
Needs for a Sustainable Renewable Energy Sector

• 100% Renewable Energy vision
• Control (reduce) cost to the consumer
• Innovation & imagination across all facets of the industry
100% Renewable Energy

• EU targets are the beginning, not the end
• Seeing 40% RES-E as the end game:
  – limits creativity and ambition
  – fuels conflict in decision making in multiple key organisations
  – allows restrictive investment in the wrong areas
  – increases the overall cost of implementation at a later stage
• All RE opportunities must be taken when they are available
  – District/Community Heating instead of new gas infrastructure
  – DH supports all sources of renewable energy
Innovation & a little bit of imagination

• All forms of RE (incl for heat and transport) need to be encouraged and facilitated; also:
  – Energy efficiency
  – Demand side management

• Current thinking is too disjointed

• Industry has to work with regulators and network operators to educate legislators on need for, benefit of and most cost effective pathway to achieve 100% RENEWABLE ENERGY
Summary

We need Clear Riding Instructions from Legislators to all Regulatory and Statutory Bodies that 100% Low Cost, Low Carbon Energy **must** be enabled.

District Heating and Energy Storage (Electrical and Thermal) are central to this vision.
District Heating in Ireland

Results of the District Heating In Ireland Study

Donna Gartland, Strategic Sustainable Energy Planner, Codema
District Heating in Ireland

IrBEA Project funded by the SEAI’s RD&D Programme

Codema - Dublin’s Energy Agency and BioXi consultants

- 3 In-depth case studies of existing DH in Ireland
- 3 Techno-economic analyses of potential DH sites in Ireland
- A Guide to DH in Ireland
A Guide to District Heating in Ireland

Contents

- What is DH?
- Why DH?
- Barriers to DH
- FAQ on DH
- Steps to DH growth
- 3 TEA
- 3 Case Studies
Barriers to DH in Ireland

- General lack of knowledge
- Lack of integrated energy planning at local level
- Lack of supporting planning policy
- Lack of guidelines, regulations, policies, frameworks or standards at local or national level
Barriers to DH in Ireland
Frequently Asked Questions on DH

- Is Ireland cold enough for DH?

15 MWh/year  15 MWh/year  
Average Danish Vs Average Irish

18.2 MWh/year  18.1 MWh/year
Average Dublin Vs Average Copenhagen
Source: Halmstad and Aalborg Universities, 2013
Frequently Asked Questions on DH

- Aren’t the losses from DH systems very high?

Northern Western Europe – 10-15%
Eastern Europe – 15-25%
Lower heat densities = Higher heat losses
Higher heat densities = Lower heat losses
7% losses in Greater Copenhagen DH system
Frequently Asked Questions on DH

Examples of other FAQs answered in the study:

- What are the key components of a DH system?
- Is DH suitable for low energy buildings?
- Does DH cost a lot more than traditional heating systems?
- Are changes to heating system required when retrofitting DH?
- What are the design standards for DH?
- What type of excess and renewable heat is suitable for DH?
- What heat demand density is required for DH viability?
Steps to DH Growth

1. Energy strategies
Steps to DH Growth
Steps to DH Growth

1. Energy strategies
2. Energy mapping and modelling
Steps to DH Growth

75% of all Dublin City areas with heat demands >150TJ/km²
Steps to DH Growth

1. Energy strategies
2. Energy mapping and modelling
3. Energy planning and policy
Steps to DH Growth
Steps to DH Growth

1. Energy strategies
2. Energy mapping and modelling
3. Energy planning and policy
4. DH feasibility and design
5. Facilitator role of public sector bodies
6. Identify potential business models for DH
Techno-Economic Analyses of DH in Ireland

1. **Killarney, Kerry – Kerry County Council**
   Connecting existing large hotels and public sector buildings to a local biomass fed system

2. **Teagasc Grange Research Centre Campus, Meath**
   Connecting buildings on Grange campus to biogas CHP

3. **Ardaun, Galway – Galway City Council**
   Connecting a mix of new residential units in a new development to a renewable DH system
Techno-Economic Analyses of DH in Ireland

Hourly energy system modelling

- Hourly heat demand distribution profiles for various building types
- Hourly electricity market prices – CHP analysis
- Hourly weather data – ambient temps, solar radiation etc.

Ensures demand is met in all hours of the year
Techno-Economic Analysis: Killarney 1st phase DH system

- **22 buildings** - mostly large hotels with leisure centres
- Total heat demand **32 GWh** over **10.2 km** transmission network
- Linear heat density **3.1 MWh/m**
- Baseload **3 MW**, peak **15 MW**
Techno-Economic Analysis: Killarney 1\textsuperscript{st} phase DH system

Optimisation of system components

- Baseload unit – 3 MW Biomass CHP or Biomass Boiler
- Back-up/Peak Boilers sized to 120% - split into 2 units – 4 MW and 14 MW LPG boilers
- Optimal Thermal Store size – 400m\textsuperscript{3} (18.54 MWh)
Techno-Economic Analysis: Killarney 1\textsuperscript{st} phase DH system
Economic Results: Biomass CHP – REI vs RHI

• REI set to current REFIT3 - €126/MWh
• RHI set to current GB RHI 4.2p/kWh (SMP for Elec)
• 6% DR
• With REI – **14 year payback, IRR 4.4%**
• With RHI – **10 year payback, IRR 8.5%**
Techno-Economic Analysis: Killarney 1st phase DH system

Economic Results: Biomass CHP – NPV vs RHI
Techno-Economic Analysis: Killarney 1st phase DH system

Economic Results: Biomass Boiler

- RHI set to current GB RHI 2.05p/kWh
- 6% DR
- With RHI – 11 year payback, IRR 7.5%
Techno-Economic Analysis: Killarney 1st phase DH system

Economic Results: Biomass Boiler – NPV vs RHI

Graph showing NPV at 6% discount rate vs. cost/kWh, with current UK RHI compared.

Logos for IRBEEA, SEAI, and Codema.
Techno-Economic Analysis: Killarney 1st phase DH system

Emissions savings: Biomass CHP vs Current Supply

- Current emissions from heat supply 7,854t CO2
- Emissions from Biomass CHP DH 2,032t CO2
- Total CO2 savings (heat & elec) 10,060t CO2

Emission savings: Biomass Boiler vs Current Supply

- Current emissions from heat supply 7,854t CO2
- Emissions from Biomass Boiler 1,945t CO2
- Total CO2 savings 5,909t CO2
Techno-Economic Analysis: Killarney 1\textsuperscript{st} phase DH system

**Customer Benefits**

- Each customer saves at least 388t CO2/year
- Reduced energy cost - €3,000 - €35,000
- No maintenance of own heating plant
- No bulk buying of fuel

**Benefits to wider Kerry area**

- Increased local employment
- Use of local biomass resources
- ‘Green’ Tourism
Techno-Economic Analyses

TEA 2: Teagasc Grange – analyses use of on-site AD CHP to provide heat to campus

TEA 3: Ardaun, Galway – analyses use of biomass boilers and solar thermal to low-energy housing development

Details available in Guide...
Thank you

Contact:

**Donna Gartland** – Strategic Sustainable Energy Planner, Codema
donna.gartland@codema.ie
Ph: 01 7079818
Contents

• Irish district heating case studies
  • Charlestown, Dublin, Mixed Use Residential/Commercial
  • The Glen, Cork, social housing
  • Gweedore Business Park, Donegal, Commercial/industrial

• IrBEA Industry role
Charlestown Shopping Centre, Phase 1

- 285 apartments
- 18,800 m² retail
- Dunnes Stores as anchor tenant
Charlestown Shopping Centre, Phase 2
Connecting Commercial Tenants – Phase 1

• Not everyone connected
• Several units have alternate electric units for heating/cooling
• No contractual obligation
• Very cost-competitive ~ 4c/kWh Commercial
Connecting Commercial Tenants Phase 2

- New piping/pumps blanked off
- Cinema opted for gas to roof top units – high cooling load
- Gas prices near 10 year low
- No obligation to connect
- No culture of district heating
Connecting Residential Tenants

• Simple but effective HIU
• External access for maintenance / management
• Cost competitive ~ 6c/kWh
• No alternate heating mechanism
• Very few disconnects
Room for Improvement

Bad practice

Good practice
Retail Sector Heating Challenge

• ~40,000 Retail units in Ireland
• Over 80% heated with electricity

SEAI 2014: Extensive Survey of Commercial Buildings Stock
SEAI Commercial Buildings Survey

Primary heating fuel by sector

Sample size 100%

- Office: 543
- Retail: 543
- Restaurant/public house: 202
- Warehouse: 102
- Hotel: 106

- Electricity
- Natural Gas
- Oil
- Solid Fuel
- Wood Pellet
- Other (incl. no heating)

SEAI 2014: Extensive Survey of Commercial Buildings Stock
The Glen, Cork

• On ground of demolished 1970s flats
• 58 modern housing units
• 4 commercial tenants
Energy Centre

- 1 x 500 kW wood pellet boiler
- 5 x 100 kW cascading gas boilers
Heat Supply

- 1.1 km of distribution pipe range DIN65 to DIN100
- 1.3 km of spur duo piping DIN25
- Danfoss HIU internal to each residence
- Combined DH cost ~ €10k per unit
- Cost net of distribution ~ €4.5k per unit
- Internal DHW tank with electric immersion

Images: BioXL, Matt O’Mahony
Further learnings

• Poor revenue collection – led to blanket prepay decision in 2016
• New energy centre and network operator in 2016
• Innovative contract with energy efficiency bonus
• Challenges to set a fair heat price
• Pricing and revenue risk always resides with local authority
Gweedore Business Park

Managed by Údarás na Gaeltachta

30 commercial/industrial buildings
Spread over 70ha
Existing DH Network

- Wood pellet and solar thermal energy centre (300kW)
- 19 small end-users separately metered
- Charged 4.2 c/kWh for metered heat 2016
Future Expansion

- Feasibility underway
- SEAI support
- 2.8km new DH
- 2MW new load
- Likely to tender in 2017
Further learnings

• Challenges to set a fair heat price
• Confidence in third party services for O&M of DH network
• Adding load vs network losses is a key consideration for any expansion
• Need to define new tenancy relationships that cater for DH
• Need for clarity on planning exemptions
Industry Role?

• Clear need expressed for industry representation
• Proposal by IrBEA members to form District Heat Association
• Topics / themes
  • Promoting district heating as a sustainable energy solution
  • Training, standards, good practice
  • Networking, knowledge sharing
  • Legislation and regulation of DH infrastructure (development and operation phase)
  • Policy input, public consultations
Contact Tom Bruton
Email: tom.bruton@bioxl.ie

District Heat Presentation
Tom Bruton
IrBEA District Heat Workshop 4th October 2016
Developing District Heating in Ireland - 4th October 2016
Laura Walsh – Executive Engineer
Presentation outline

- District Heating Policy
- Reports to date
- Infrastructure to date
- Current phase (DDHS 2)
- Challenges for the future
District Heating & Combined Heat and Power

Dublin City Council has carried out a feasibility study on the implementation of a citywide district-heating network and proactively promotes its benefits and encourages its provision. District heating and Combined Heat and Power offer potential for more efficient heating of Dublin’s buildings, through utilising waste heat produced in generating electricity.

The advantages include higher energy efficiency and reduced consumption of energy resources.

It is the policy of Dublin City Council

| SI62 | To support the development of energy efficient initiatives such as the district-heating network for Dublin and combined heat and power. |
| SI63 | To promote the use of Combined Heat and Power in large developments (see also section 17.1.4) |
| SI64 | To promote more sustainable development through energy end use efficiency, increasing the use of renewable energy, and improved energy performance of all new building developments throughout the city |
4.5.4.8 Dublin District Heating System

Development of a Dublin District Heating System, research and planned by Dublin City Council and Codema, the City Council's energy management company, since 2008, is planned to begin in the Docklands Area initially and then expand to other parts of the city. Communications with potential customers for the system found the overall response to the system among the Docklands community to be very positive.

SI14 That all proposed developments be district heating enabled in order to provide an environmentally sustainable source of heating and cooling.


Building design will be required to comply with criteria in the following key areas:

- Function and flexibility
- The use of ecologically-friendly building materials
- Thermal energy and integration into a District Heating Scheme
- Etc.
The Dublin District Heating System (DDHS) is currently being progressed by Dublin City Council, initially focussing on the Dublin Docklands Special Development Zone (SDZ) and the Poolbeg Peninsula. District Heating (DH) systems are thermal energy networks that distribute steam, or hot water, from heat sources through dual supply and return pipelines, to residential and commercial buildings, allowing heat to be bought and sold, offering greater energy efficiency, significantly reduced CO₂ emissions and reduced consumption of energy resources. The Dublin Waste to Energy Plant and other industrial facilities have been identified as potential and initial sources of waste heat within the local docklands area. Elements of the DDHS have been installed within the north docklands area, and within the new Liffey Tunnel which facilitates the roll out of district heating network both north and south of the river Liffey. During the life of the Plan DCC shall work to ensure the successful implementation of this critically important piece of infrastructure which will make Dublin City a more sustainable and energy efficient city, less dependent on imported and fossil fuels, more competitive and environmentally clean, thus attracting foreign direct investment, and aiming to be an effective leader in managing climate change.

**CC014: To support the development of energy-efficient initiatives such as use of District Heating and Combined Heat and Power, and to promote the use of CHP in large developments.**

**CC09: To encourage the production of energy from renewable sources, such as from Bio-Energy, Solar Energy, Hydro Energy, Wave/Tidal Energy, Geothermal, Wind Energy, Combined Heat and Power (CHP), Heat Energy Distribution such as District Heating/Cooling Systems, and any other renewable energy sources, subject to normal planning considerations, including in particular, the potential impact on areas of environmental sensitivity including Natura 2000 sites.**
Analysis of Heating Demand in Docklands Area

Dublin City Spatial Energy Demand Analysis

Dublin District Heating System Market Research

Analysis of Heating Demand in Docklands Area
Total Heat Demand Density (Tj/km²)
In 2011, **99%** of fuels used in Dublin City were **Imported Fossil Fuels**
Waste Heat = Cheap, Local, Low Carbon

~264MW waste heat in Dublin City
~ 38% of heat demand of Dublin City!
Looked at 3 scenarios
- Dublin Docklands
- Westgate
- City Wide DH Network

It was recommended that DCC progress plan to establish a district heating supply serving the Dublin Docklands Area (Scenario 1).
2008 Feasibility Report Scenario 1

CO\textsuperscript{2} reduction of 12,000 Ton / year
1.06\% CO\textsuperscript{2} Heating Emissions DCC
2008 Feasibility Report Scenario 3

CO² reduction of 32,000 Ton / year
2.8% CO² Heating Emissions DCC
New Developments Planned for the Docklands SDZ

DH Pipes under new LUAS (Line C1) to the 3 Arena (The Point)

Liffey Services Tunnel widened to accommodate DH Pipes
Installation of District Heating (DH) transmission pipelines (DH 400 mm) on Spencer Street, Spencer Docks, May 2008
DH pipes & Liffey Services Tunnel
Heat Storage & Generation

Heat storage tank at a Danish district heating plant

Peak / Reserve Boiler Station, Denmark

Storage Tank, Pimlico District Heating, UK
Dublin District Heating System – Phase 2
Timelines

Stage 1
Engineering & Business Strategy
- Business Model Options
- Engineering & Infrastructure Options
- Environmental

Stage 2
Planning and Design Stage
- Planning Submission
- Planning Approval
- Tender Documents

Stage 3
Tender Stage
- Planning Conditions
- Tender Process

First Customer

2017  2018  2019  ?
Challenges for the future

- Public Acceptance
- Capital Costs
- Competition from other energy providers (Gas & Electricity)
- Government Investment for distribution and connection
- No Regulatory Framework
- No guaranteed customer base
Thank You

Email: ddhs@dublincity.ie  Web: www.ddhs.ie