

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



- 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.

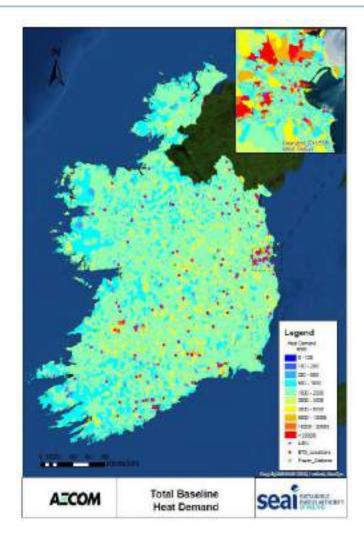


- Counterfactual business as usual technologies, including boilers (gas, oil and solid fuel), and electric heating.
- Alternative technologies building scale systems, including heat pumps, biomass boilers, and micro / small scale CHP.
- District heating technologies large scale solutions, including large gas CHP, biomass boilers, biomass CHP, waste heat from power stations and industry, large heat pumps, and geothermal.



HEAT MAPPING

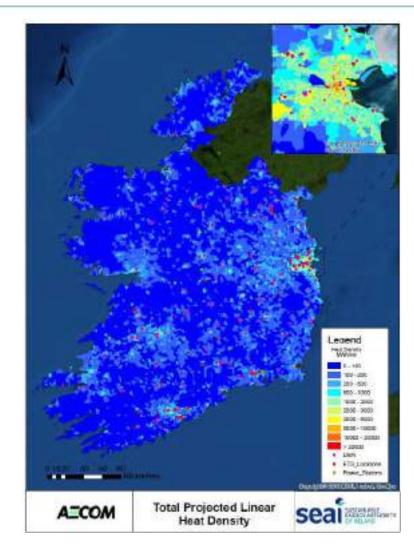
- Spatial description of heat demand data
- Detailed dataset and spatial distribution enables heat maps to support analysis of community energy schemes, or other schemes where spatial and geographic information may be of use





HEAT MAPPING

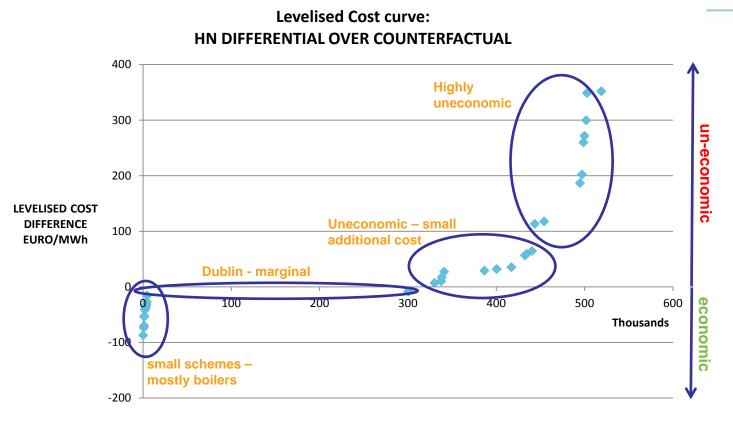
- An Ireland-wide heat map forms the basis for the assessment of district heating network and high efficiency CHP potential analysis
- Linear heat density is a measure of heat demand per unit road length – a good proxy for network costs
- The spatial resolution used is the Small Area





NATIONAL CBA – HEAT CURVE

ERGY AUTHORITY



HEAT DEMAND CUMULATIVE, MWh

- 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

- 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, boilerbased



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

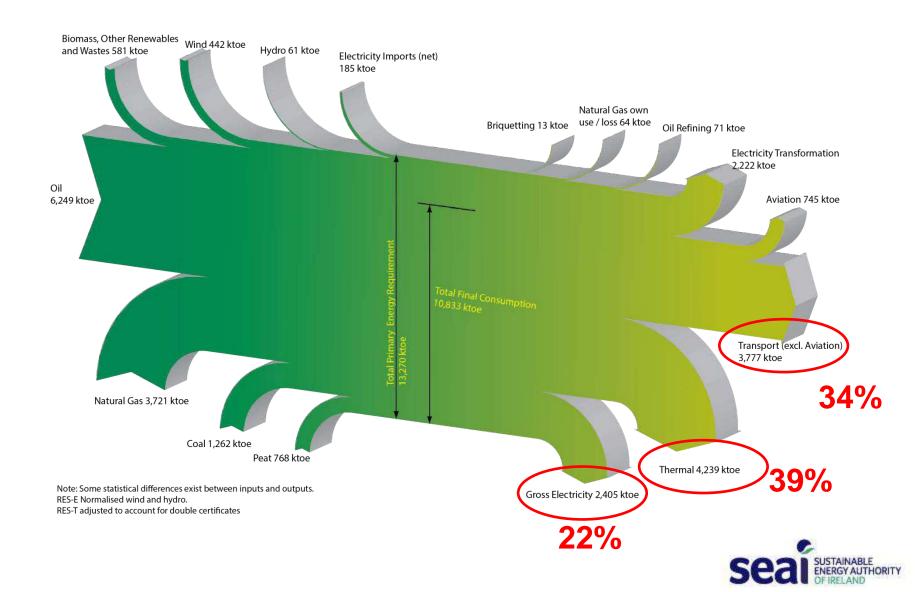
Renewable heat; 300,000 homes or 3,000 services sector buildings or 200 large industrial sites



Renewable transport: 400-500 million litres of biofuel



Heating



Renewable Heat



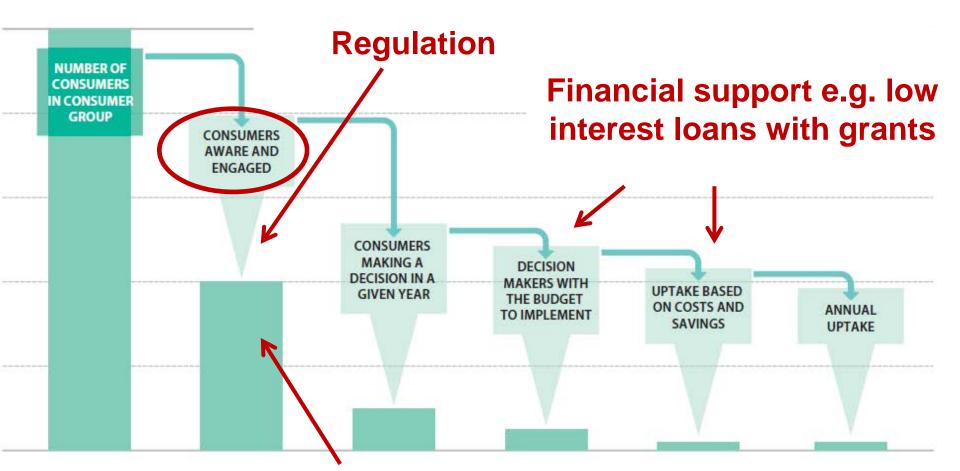


Other Considerations

- 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



Information campaigns, promoting services, audits





Jim Gannon





The Sustainable Energy Authority of Ireland is partly financed by Ireland's EU Structural Funds Programme co-funded by the Irish Government and the European Union.



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

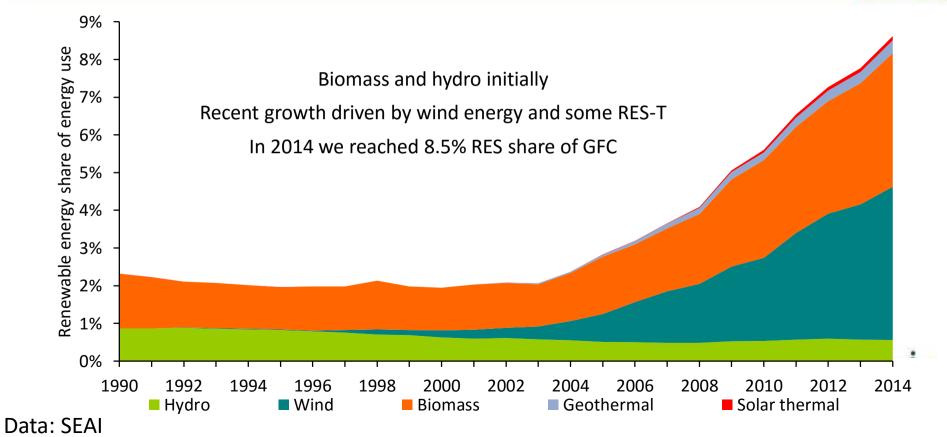






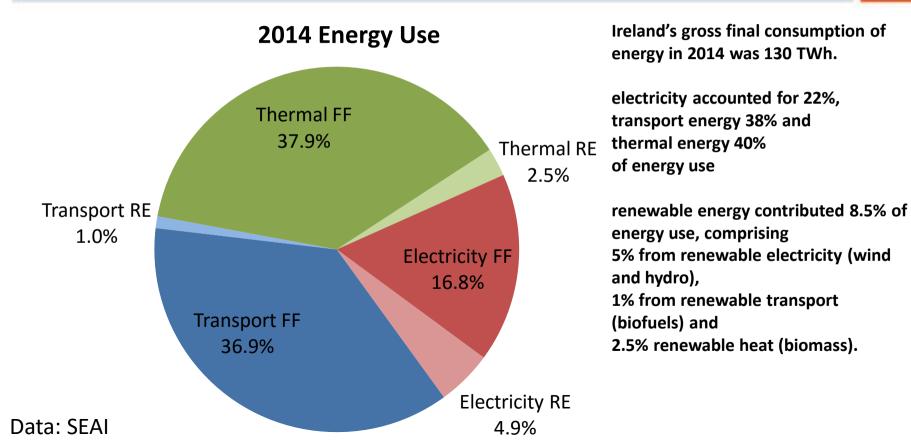


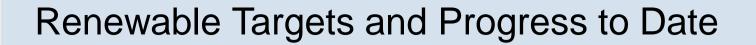
Renewable Energy - where are we now?



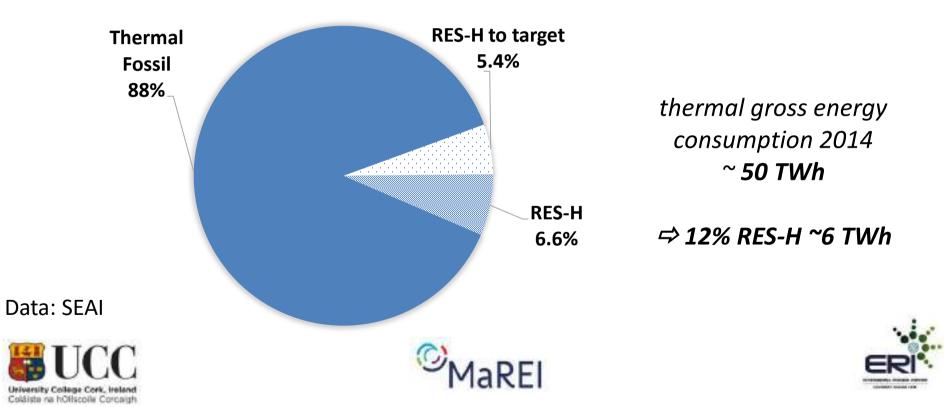
Ireland's gross energy consumption 2014











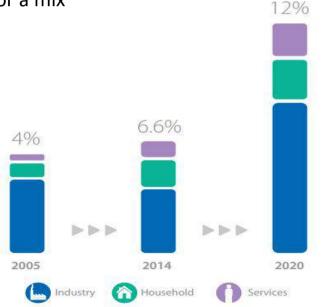
Renewable Heat – is 12% RES-H sufficient?



SEAI: to achieve 12% RES-H by 2020

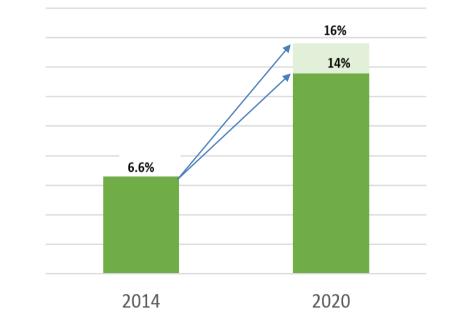
- > 300,000 homes
- > 3,000 services/public sector buildings or
- > 200 large industrial sites

➤ or a mix

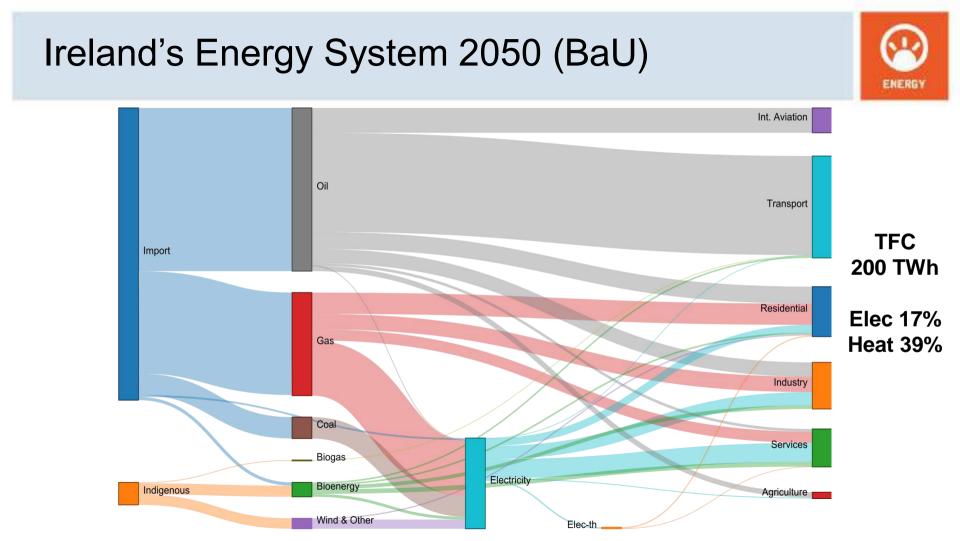


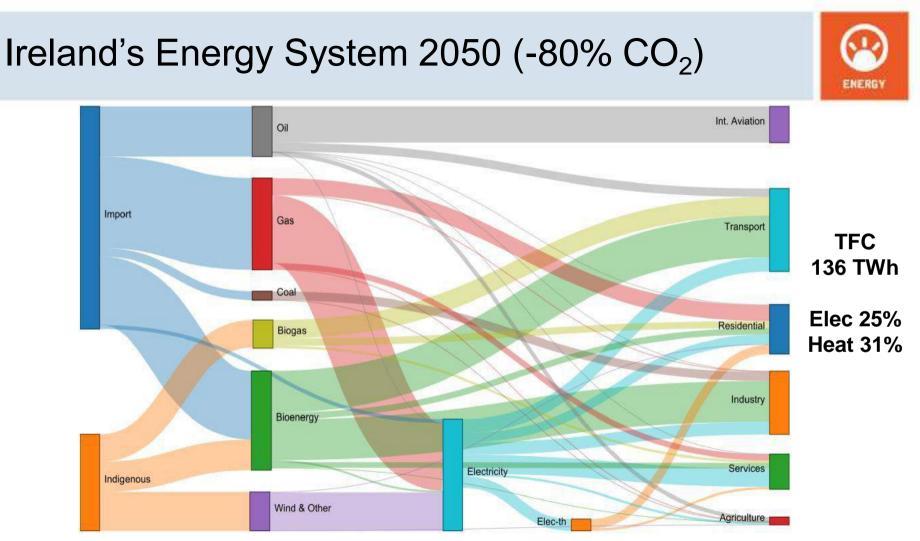
A larger RES-H target may be required as

- 40% RES-E + 10% RES-T + 12% RES-H \neq 16% RES
- May need up to 16% RES-H ~ 8 TWh



Ireland's Low Carbon Pathway to 2050 ENERGY 160% 140% Power Sector 120% % of 1990 $\mathrm{CO_2}$ emissions Transformation 100% Residential Services 80% Industrial Processes Industry 60% Transport 40% Agriculture (Energy) - BAU 20% 0% 1990 2000 2010 2020 2030 2040 2050

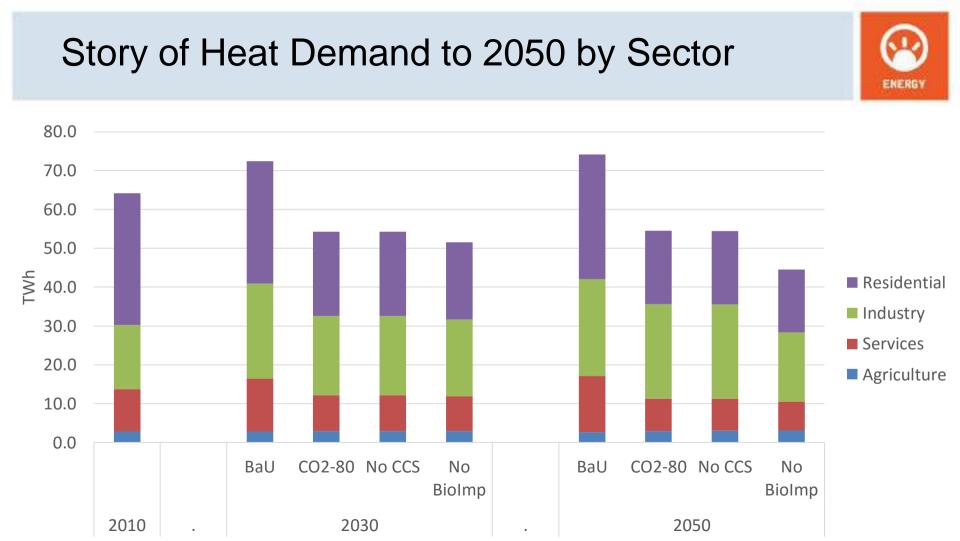


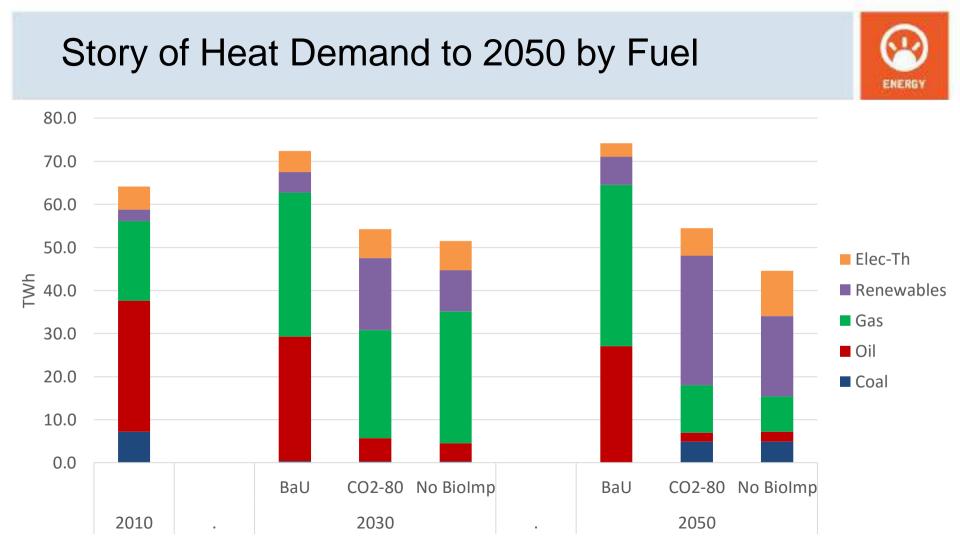


Scenario analysis to address uncertainty



- 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 CO₂ emissions by 2050
- 3. No Biolmp CO2-80 but with no bioenergy imports allowed

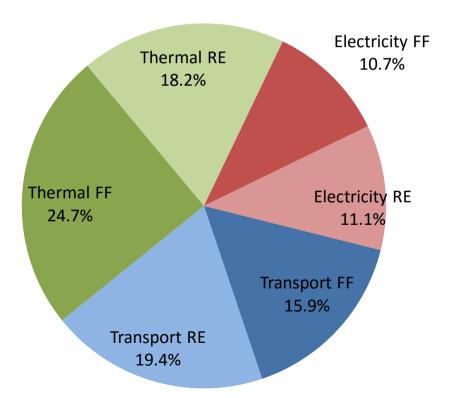




Ireland's energy mix 2050 – Low Carbon



2050 Energy Use - LC (-80%)



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 ENERG Queen's University Velfast Gas Science Foundation NERGY Networks Ireland For what's next Ireland ESR Environmental Protection Agency EIRGRID **NTR**FOUNDATION PAUL SCHERRER INSTITUT curing a areener future Roinn Cumarsáide, SUSTAINABLE ENERGY AUTHORITY * * * sea Fuinnimh & Acmhainní Nádúrtha Department of Communications, DUBLIN Energy & Natural Resources UCL ENERGY **HUCL** FREE**€**₩ SYSTEMS CENTER Comhshaol, Pobal agus Rialtas Áitiúil Energy/Technology Environment, Community and Local Government Coldiste na hOliscolle Corcalph



Future Heat Scenarios for Ireland

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District Heating – an Important part of a Sustainable Denmark

Morten Jordt Duedahl

dbdh.dk

Business Development Manager DBDH



Promote District Energy for a Sustainable City Transformation

Established in 1978

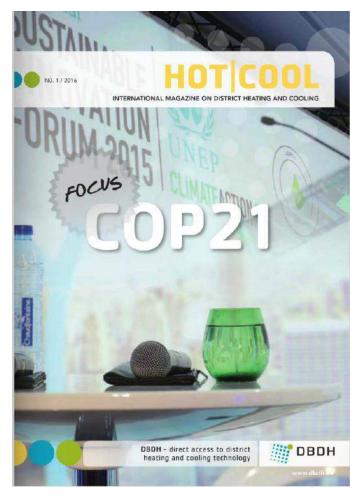
65 members

- Leading actors in Denmark
- 2/3 Manufacturers, Consulting Engineers
- 1/3 Utilities

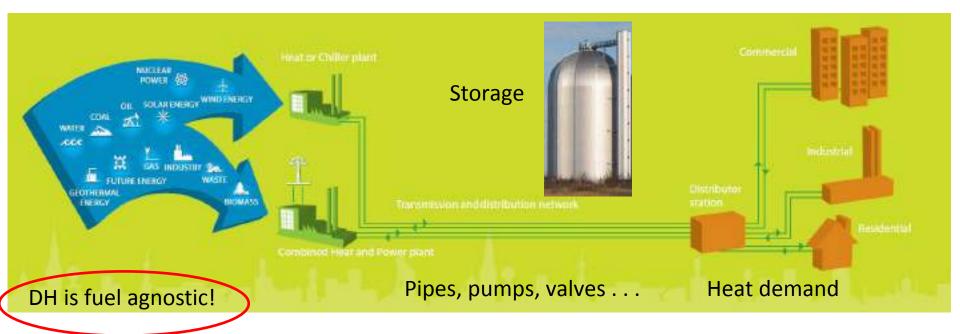
Magazine HOT | COOL

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!!
- dbdh.dk

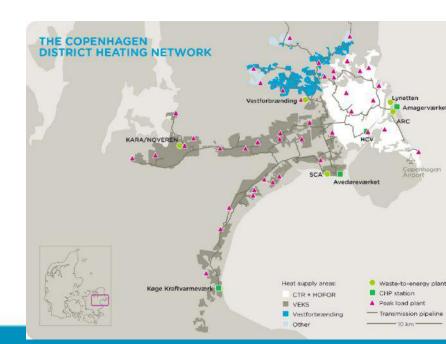
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District Heating in Denmark

- 64% of all house holds (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

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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



DBDH

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Plan – Coordinate – Legislate - Support

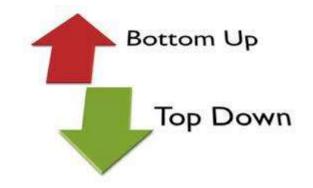


Danish Background

- Bottom–Up AND a Top–Down approach
- Natural monopoly
 - Governance
 - Optimisation

dhdh.dk

- Consumer protection
- Goals and Framework Conditions
 - Long term, Stable but not Constant



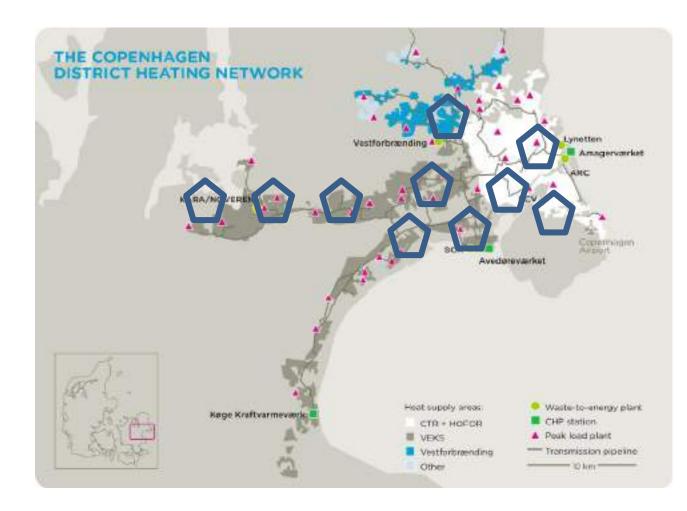
Planning and zoning in Denmark

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- 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



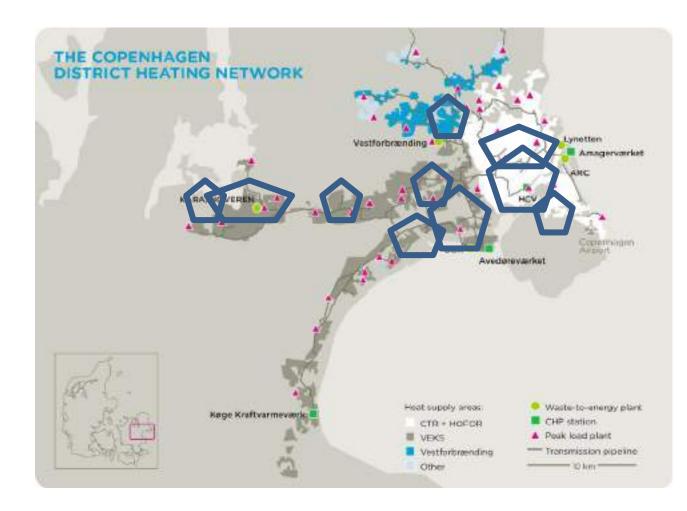
Evolution of District Heating



o dbdh.dk



Evolution of District Heating

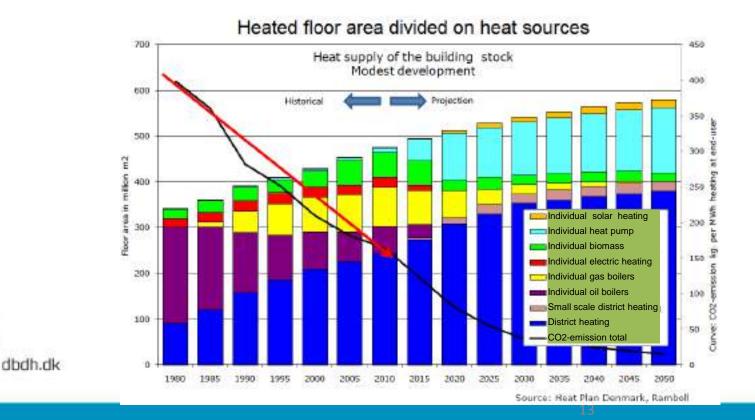


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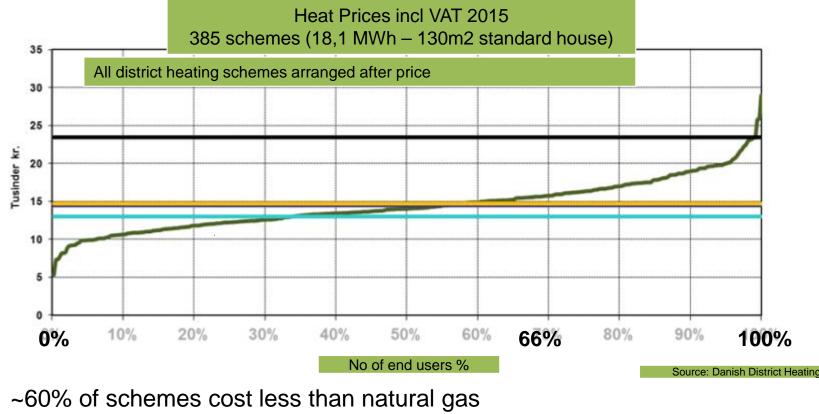
The Future

- -A central part of Smart Energy Systems & 2050 targets
- -Integrate surplus wind and solar electricity





DH Costs less than Natural Gas

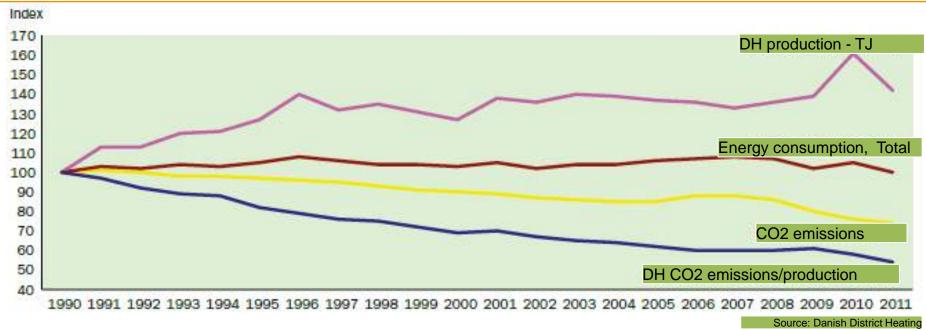


~66% of end user spend less compared to natural gas

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Denmark's DH Carbon Footprint

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



Why do customers like district heating?

- What's not to like?
- Well informed customers
- It works!



BDH

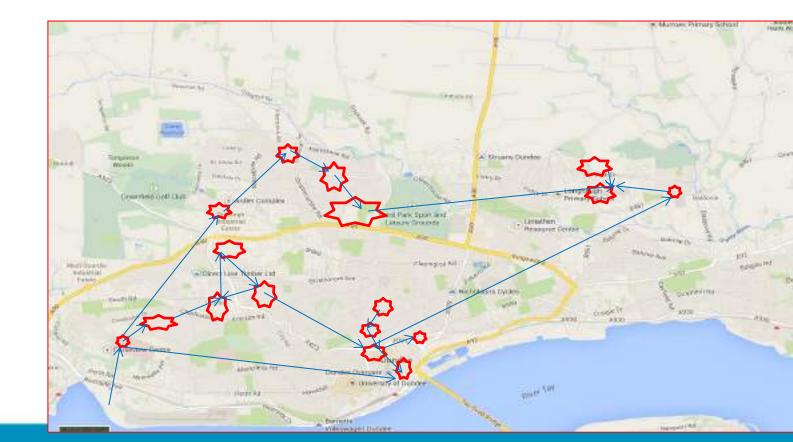
- Accepted as a utility not for profit
- "Like district ...what??"
- Cost less and no price fluctations
- District Heat or Freeze Only choice
- Easy: fuel, carbon, green, safe...

Getting started!



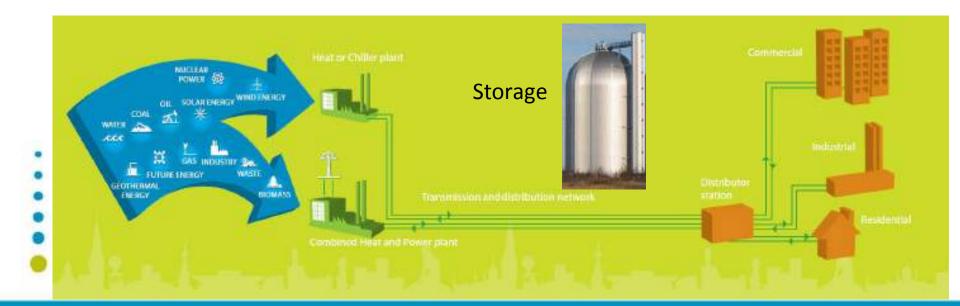
Planning is the Key!! DH-Islands - a fine start

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





- Economy
 - Agreed principleWho benefits
- Legal and ownership
 - Flexible today
 - Flexible in the future
 - Merger, management, sell off, production...



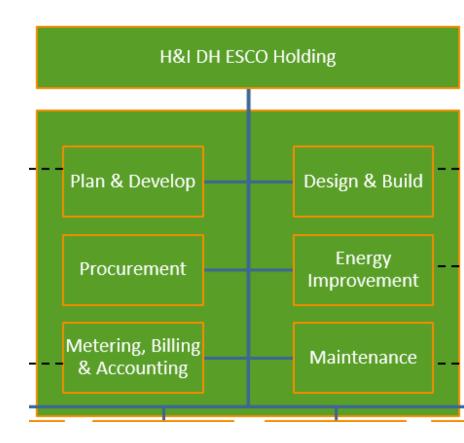
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• Competences

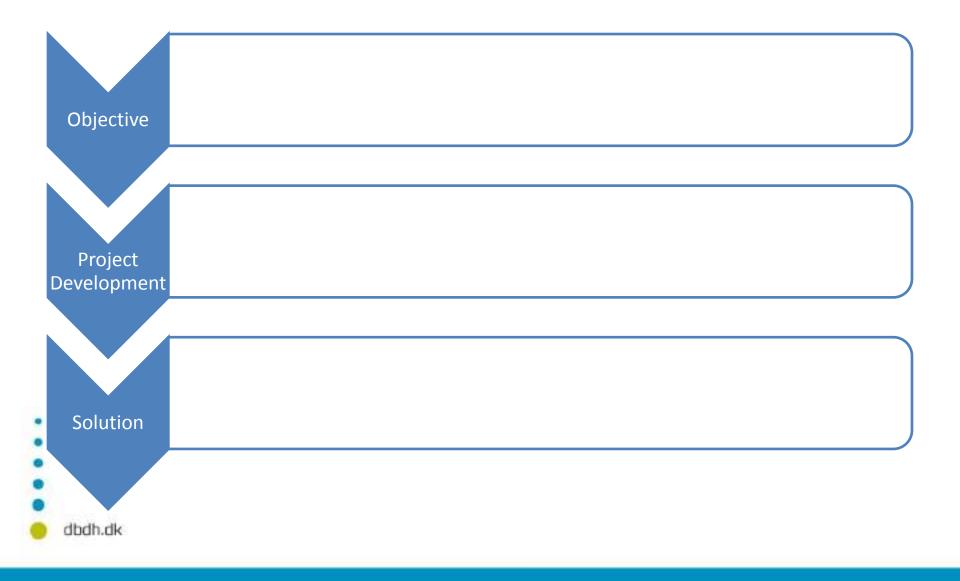
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- Shared services
- Connect before the pipes!





Dis-connectability?





Thank you

Morten Jordt Duedahl Business Development Manager md@dbdh.dk <u>www.dbdh.dk</u>

dbdh.dk





District Heating in Elsinore

Senior Planner Jakobi Pedersen 05.10.2016



Location location location





The home of Hamlet Castle

The easy pun:

To District Heat or not to District Heat

Collective or individual solutions



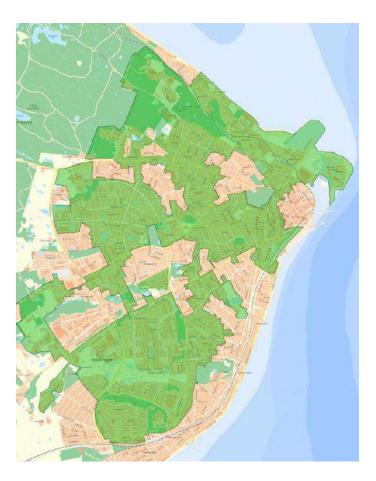


The bad example 😳 Elsinore

Facts:

District heating to half of Elsinore.

How did this come about?





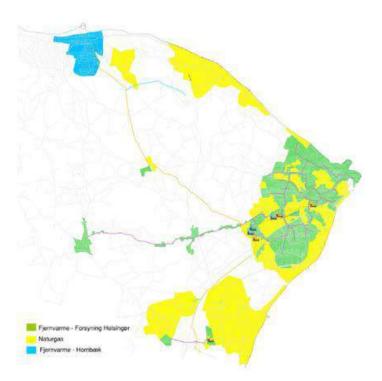
Who are we!

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: \approx 47,6 mio.EUR Profit = 0 EUR





How to: Distric Heat

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

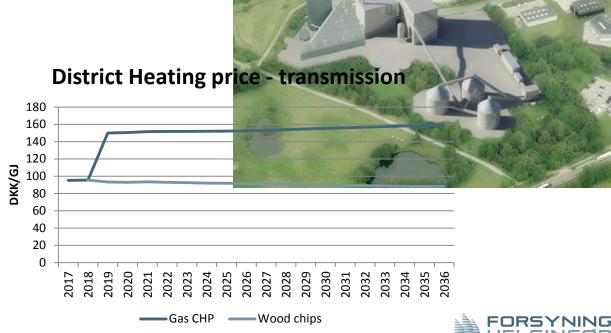




Near future

Remodelling the present CHP plant

- Two fuel solution
 - Natural gas
 - Wood chips





Planning for a better future

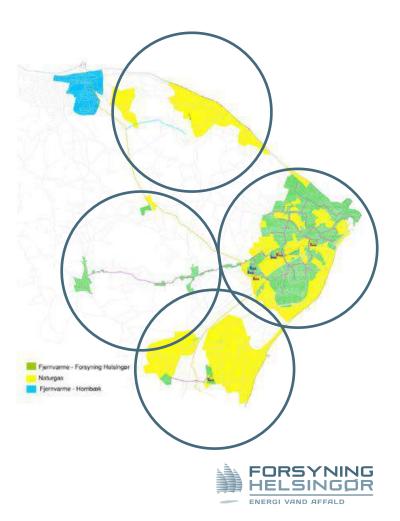
Laws Taxes Heat demand Competition Economy Speed of change Visions



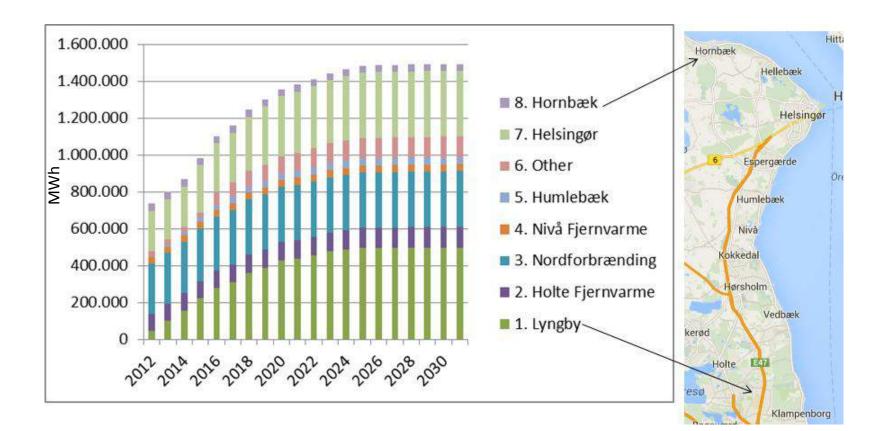


Future

Helsingør Gurre-Tikøb Espergærde-Kvistgård Hellebæk-Saunte

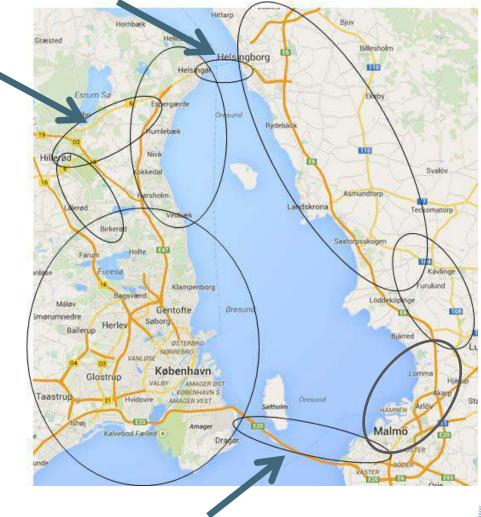


Potential





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

- Gaelectric's Bio

- Founded in 2004, International operations headquartered in Dublin, Ireland.
- Expert team of <u>90+ professionals</u> distributed across the Republic of Ireland ("Rol"), 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 <u>all in-house – a company key</u> <u>differentiator.</u>

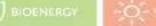


Our Ethos & Long Term Partners





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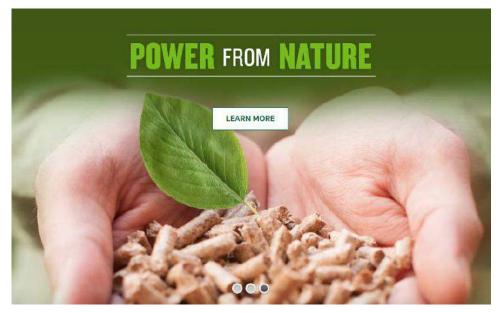
MARKETS

Gaelectric's Mission



Putting the power in the hands of the consumer

A champion of ALL forms of Renewable Energy





Energy Market Changes - Consumer RE 100

- 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

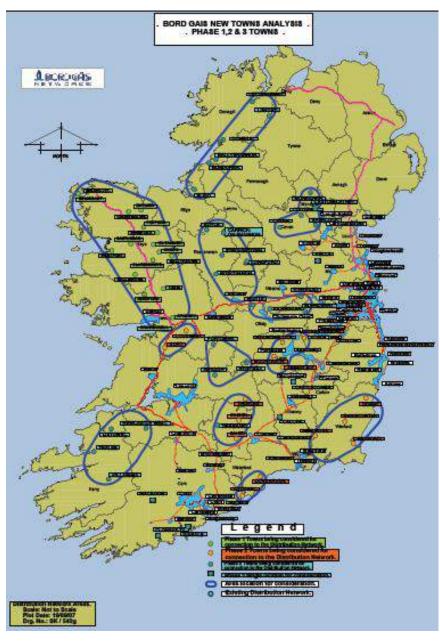
- 1. Significant baseload of thermal energy (heating and/or cooling)
- 2. Suitable for:
 - a. Leisure Centres
 - b. Healthcare Facilities
 - c. Processing sector (food and drink, pharma)
 - d. District heating
- 3. Only consider biomass CHP where there is consistent demand for low grade heat
- 4. Better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

TRADING & MARKETS

Gas is coming to a town near you soon!

"...we cannot become over reliant on natural gas..."

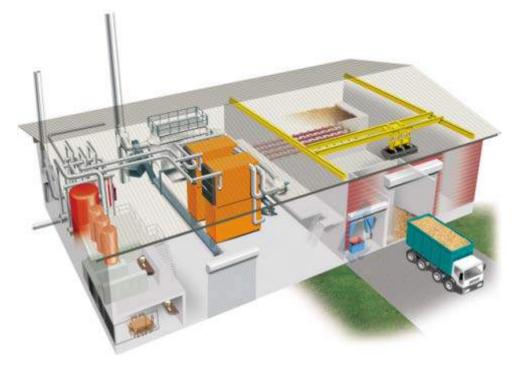
John Mullins Former CEO Bord Gais February 3rd, 2011



Alternative: District Heating

MARKETS

- 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 (100years +) 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

TRADING & MARKETS 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,

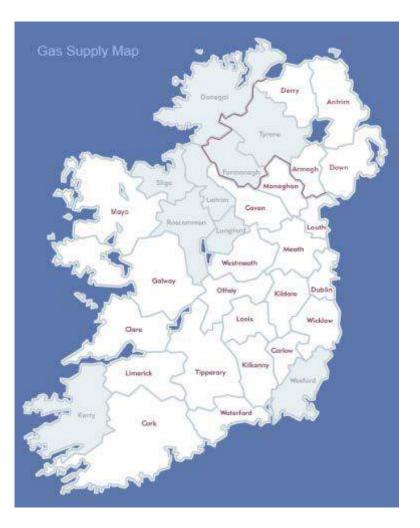
MARKETS

- 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*



TRADING & MARKETS



Sample Project: GOVERNMENT BUILDINGS

- <u>District Heating Scheme</u> 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

MARKETS





Sample Project: NEC, Solihull, Birmingham

- 16.5 MWe Biomass CHP
- >£75m CapEx
- Large Commercial District Heating and cooling network <u>REPLACING NATURAL GAS</u>
- Private wire power supply





TRADING & MARKETS







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 <u>must</u> 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

Dublin's Energy Agency



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



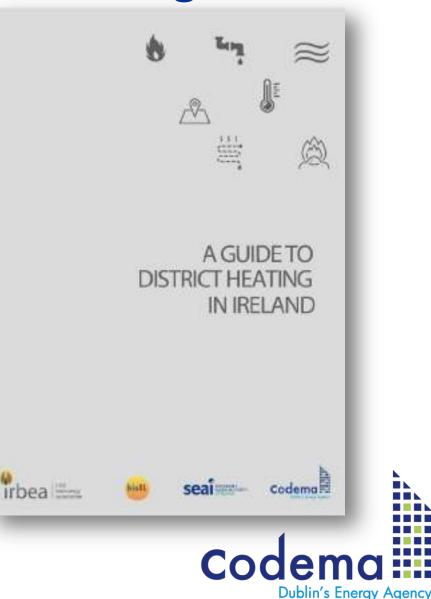


A Guide to District Heating in Ireland

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

STATUTORY

2014

EN

The Heat Network (Meterin

Made - - - -

Laid before Parliament

Coming into force in accord

These Regulations are made by the Secret purposes of section 2(2) of the European C energy sources(b) in exercise of the powers co

P. Intr

Citation and commencement

1.-(1) These Regulations may be cited as the 2014.

(2) Except as provided in paragraphs (3) a December 2014.

(3) Regulation 9 comes into force on 31st D

(4) Regulations 4(4) and 6 come into force of

Interpretation

2. In these Regulations-

"authorised person" means-

- (a) the Secretary of State,
- (b) the Scottish Ministers, or

irish

(a) a norman authorized under manifation 10(2):



Raising standards for heat supply

💱 chpa



DISTRICT HEATING MANUAL FOR LONDON

MAYOR OF LONDON





Frequently Asked Questions on DH

Is Ireland cold enough for DH?



15 MWh/year

15 MWh/year

Average Danish Vs Average Irish

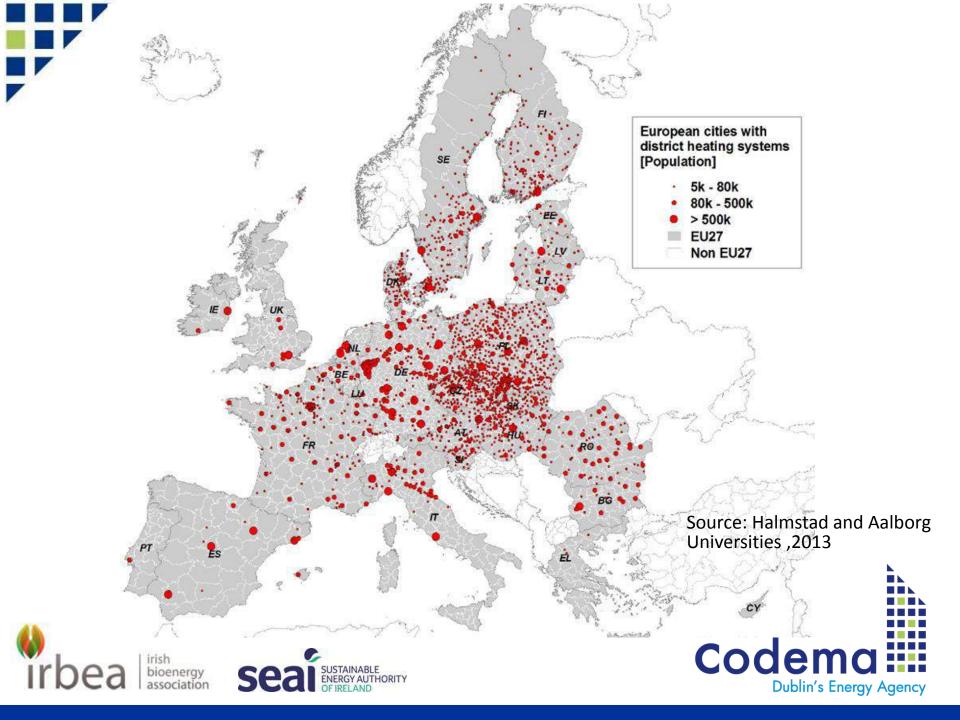


18.2 MWh/year 18.1 MWh/year

Average Dublin Vs Average Copenhagen

Codema

Dublin's Energy Agency



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?







1. Energy strategies





Methodology for LOCAL AUTHORITY RENEWABLE ENERGY STRATEGIES

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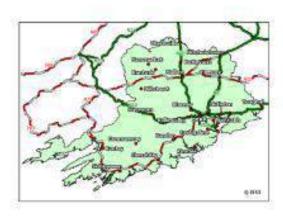
Dublin's Energy Agency

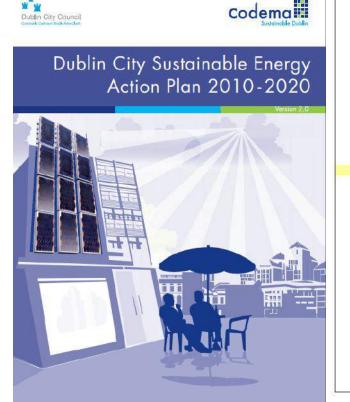


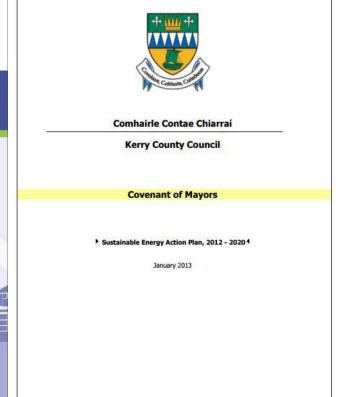


Cork County Council Sustainable Energy Action Plan 2010 – 2020

Covenant of Mayors







Rev 130118 Sustainable Energy Action Plan (SEAP)



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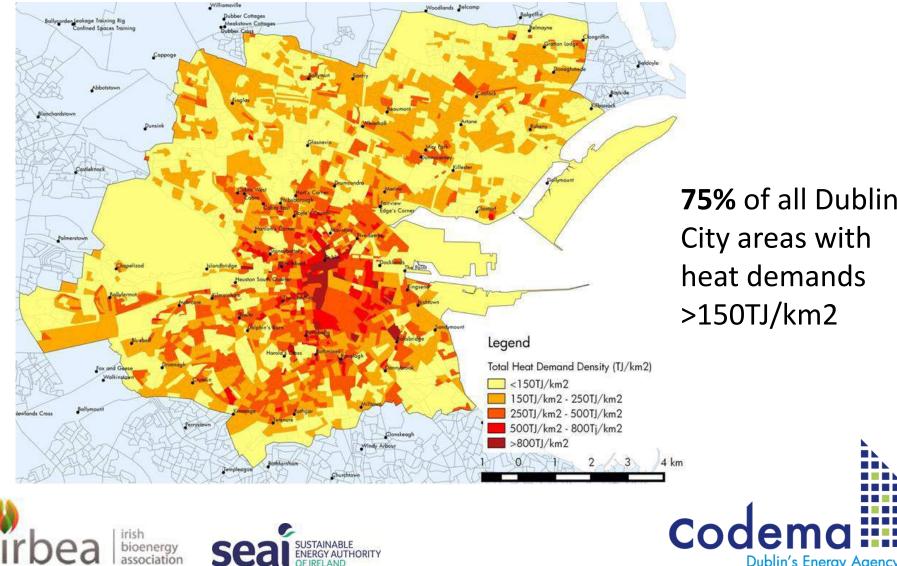




- 1. Energy strategies
- 2. Energy mapping and modelling







bioenergy association

sea

75% of all Dublin City areas with heat demands >150TJ/km2

Dublin's Energy Agency

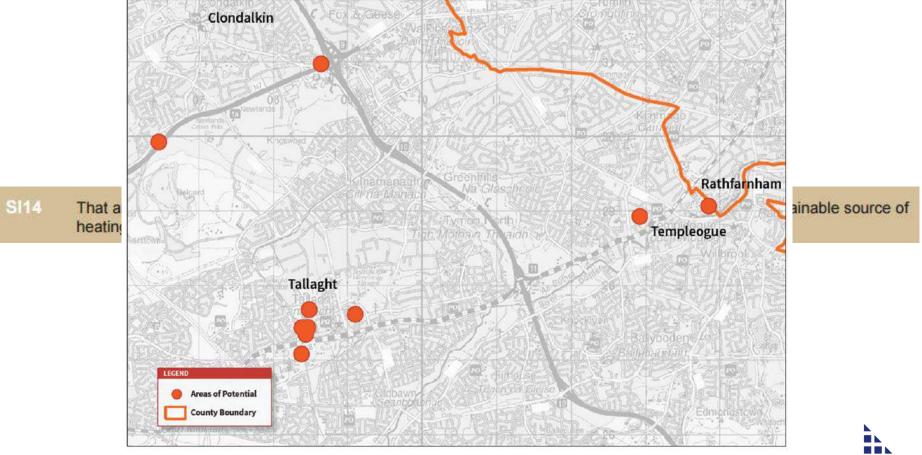


- 1. Energy strategies
- 2. Energy mapping and modelling
- 3. Energy planning and policy





Figure 10.3: Low Carbon District Heating Areas of Potential









- 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





- 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







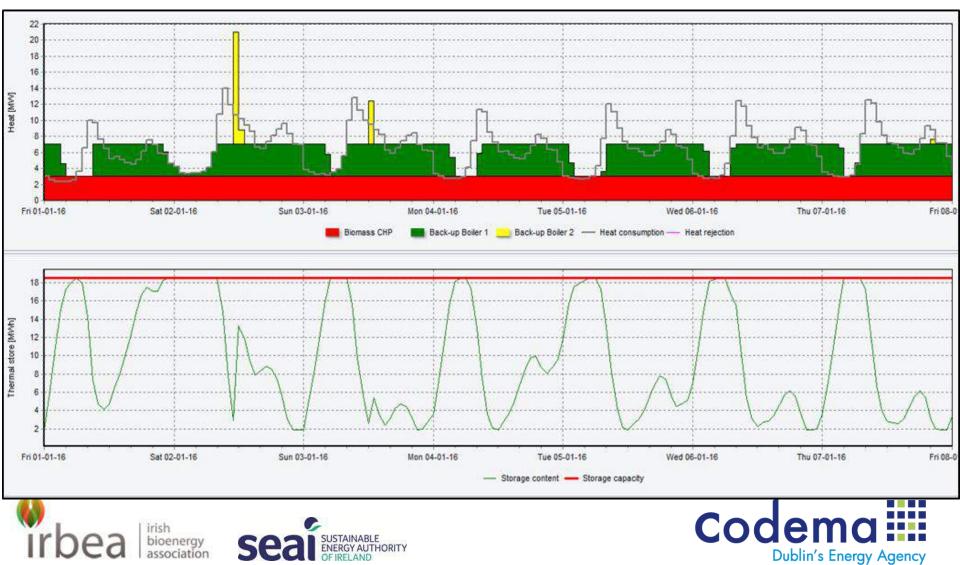
Optimisation of system components

- 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 400m3 (18.54 MWh)











Economic Results: Biomass CHP – REI vs RHI

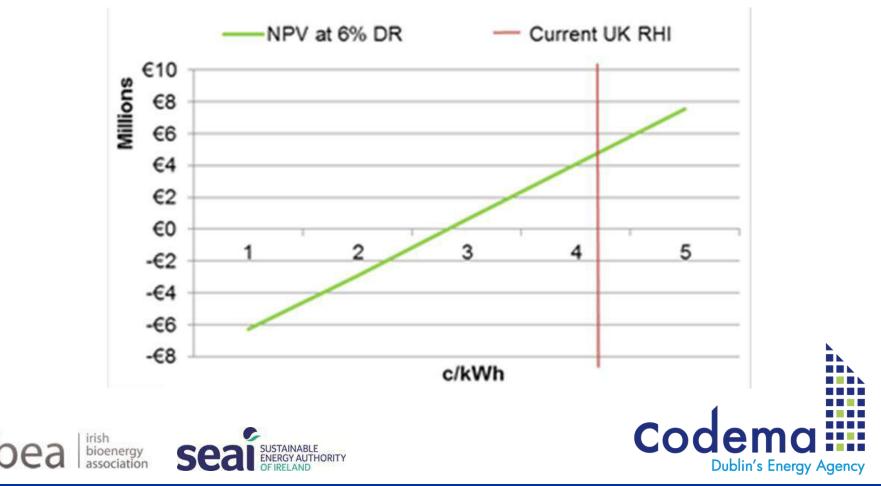
- REI set to current REFIT3 €126/MWh
- RHI set to current GB RHI 4.2p/kWh (SMP for Elec)
- 6% DR
- With REI 14 year payback, IRR 4.4%
- With RHI 10 year payback, IRR 8.5%







Economic Results: Biomass CHP – NPV vs RHI





Economic Results: Biomass Boiler

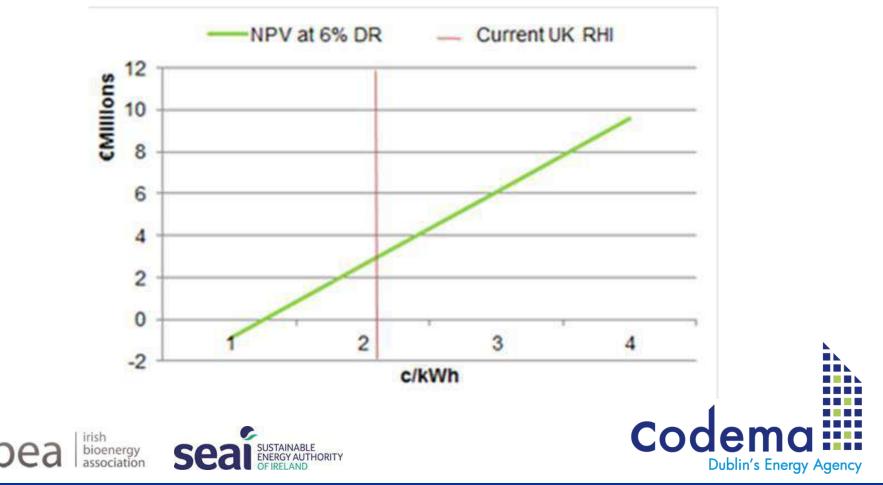
- RHI set to current GB RHI 2.05p/kWh
- 6% DR
- With RHI 11 year payback, IRR 7.5%







Economic Results: Biomass Boiler – NPV vs RHI





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) <u>10,060t CO2</u>

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 <u>5,909t CO2</u>







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...

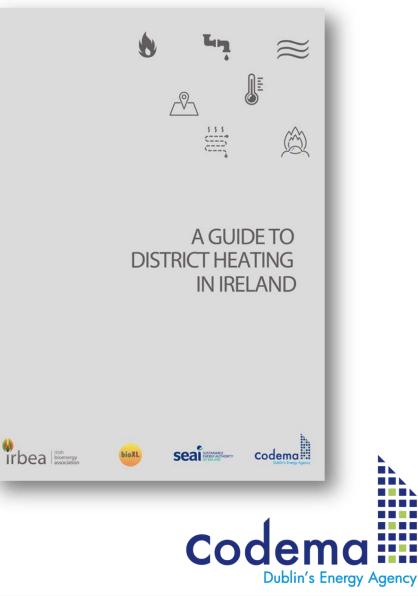




Thank you

Contact:

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District Heat Presentation

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Tom Bruton

IrBEA District Heat Workshop 4th October 2016



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

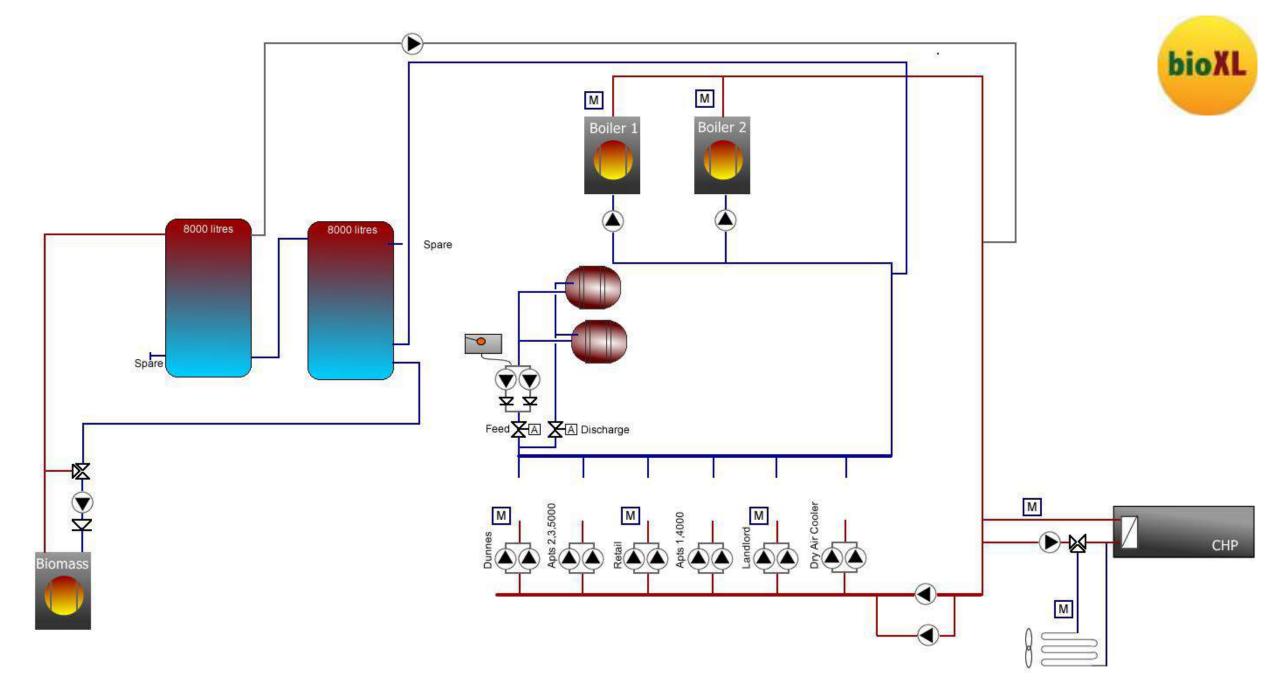
- 285 apartments
- 18,800 m² retail
- Dunnes Stores as anchor tenant



Charlestown Shopping Centre, Phase 2







Schematic Courtesy of Kaizen Energy







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

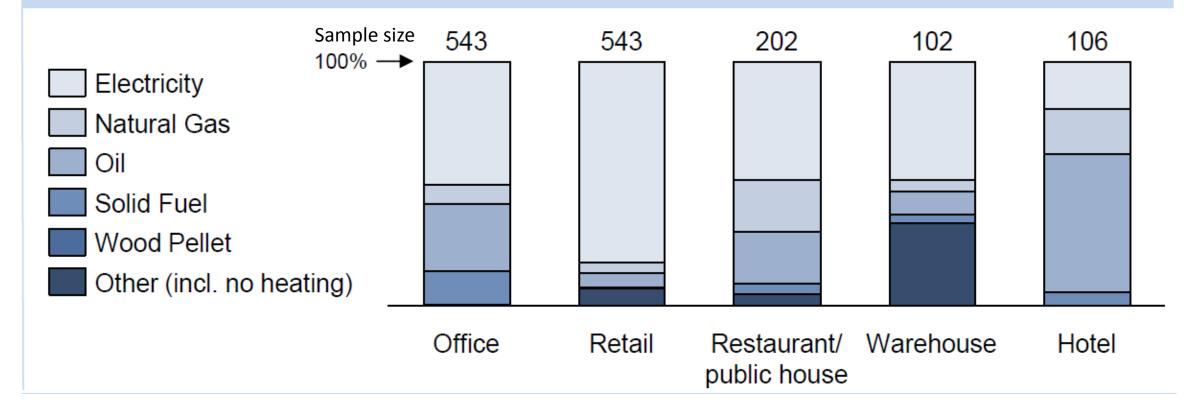


- ~40,000 Retail units in Ireland
- Over 80% heated with electricity



SEAI Commercial Buildings Survey

Primary heating fuel by sector



SEAI 2014: Extensive Survey of Commercial Buildings Stock

The Glen, Cork

- On ground of demolished 1970s flats
- 58 modern housing units
- 4 commercial tenants



Cork City Council Comhairle Cathrach Chorcaí





Energy Centre

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



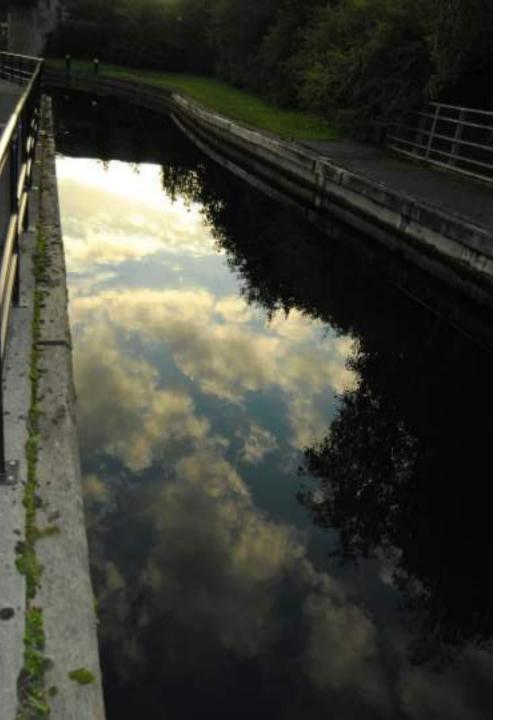




Heat Supply

- 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



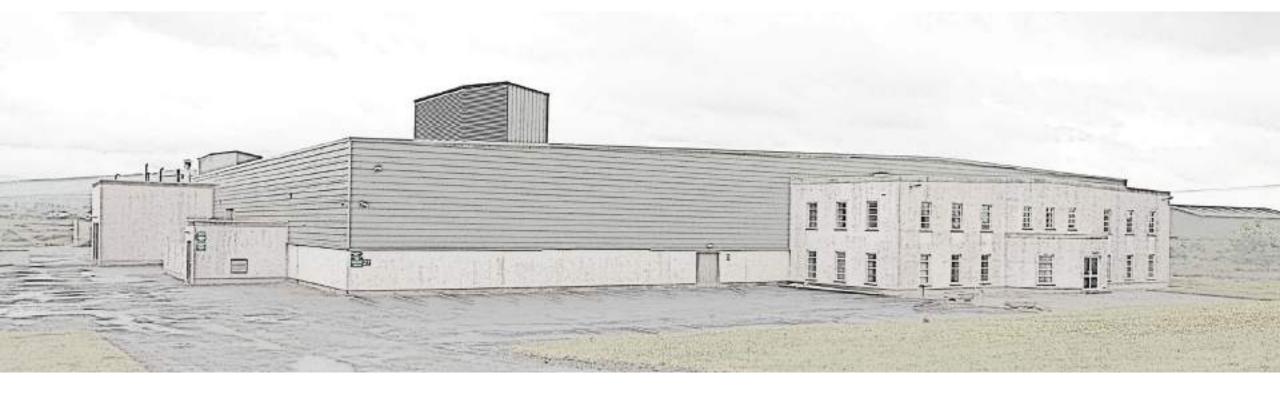
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Further learnings

- 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





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

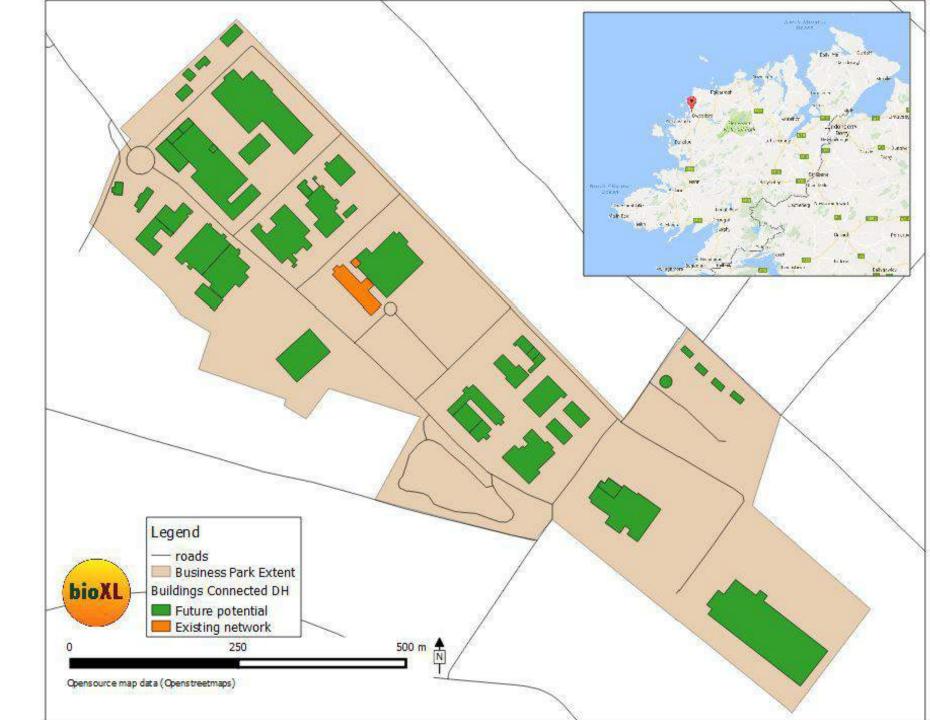
• Feasibility underway

Mott MacDonald

• 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

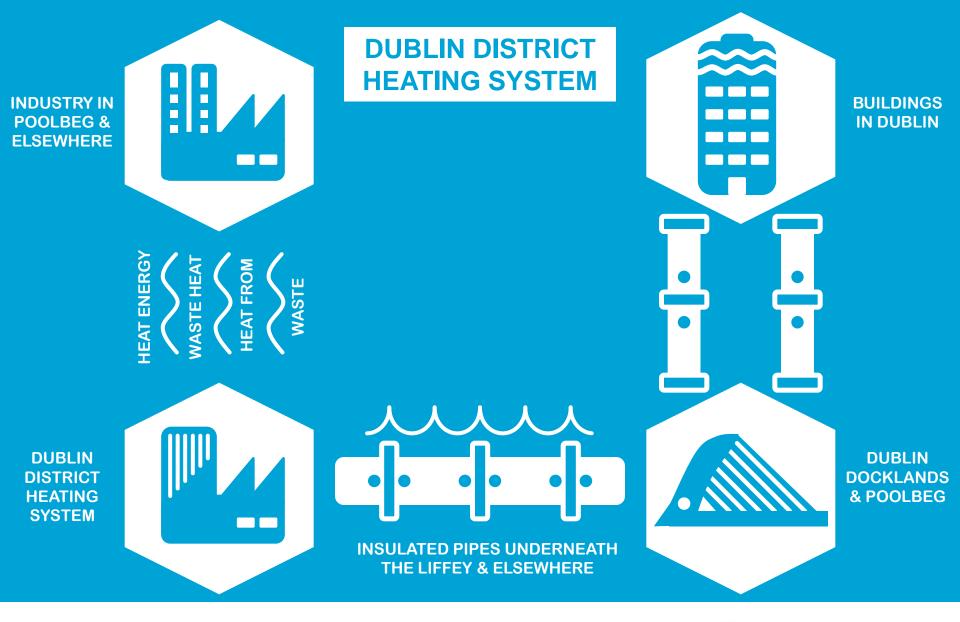
Contact Tom Bruton Email: tom.bruton@bioxl.ie

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District Heat Presentation

Tom Bruton

IrBEA District Heat Workshop 4th October 2016



Developing District Heating in Ireland - 4th October 2016



Comhairle Cathrach Bhaile Átha Cliath Dublin City Council

Laura Walsh – Executive Engineer

Presentation outline

District Heating Policy

Reports to date

Infrastructure to date

Current phase (DDHS 2)

Challenges for the future



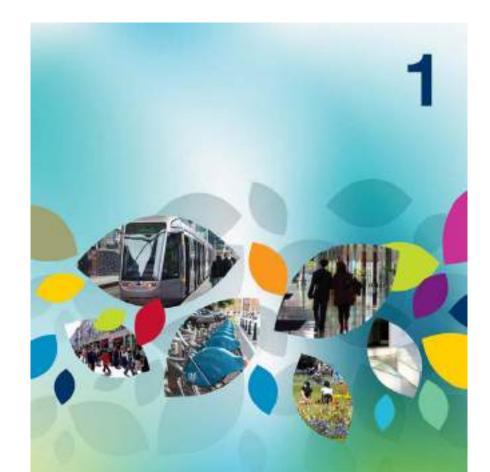
5.2.4.17 District Heating & Combined Heat and Power

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



Dublin City Development Plan 2011 – 2017 WRITTEN STATEMENT



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

4.14.2 [B] Design of the Building

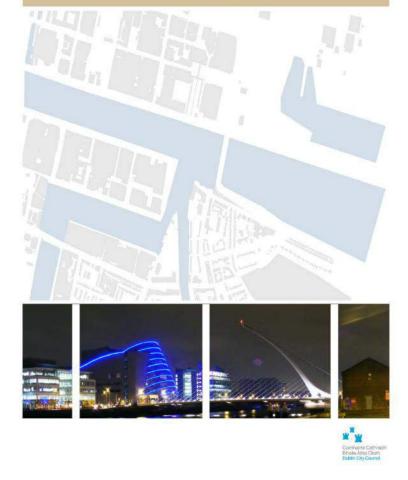
Building design will be required to comply with criteria in the following key areas:

- Function and flexibility
- The use of ecologically-friendly building materials
- Thermal energy and integration into a District Heating Scheme
- Etc.

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.





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

CCO9: 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.

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.

Draft Dublin City Development Plan 2016-2022 Written Statement - Volume 1



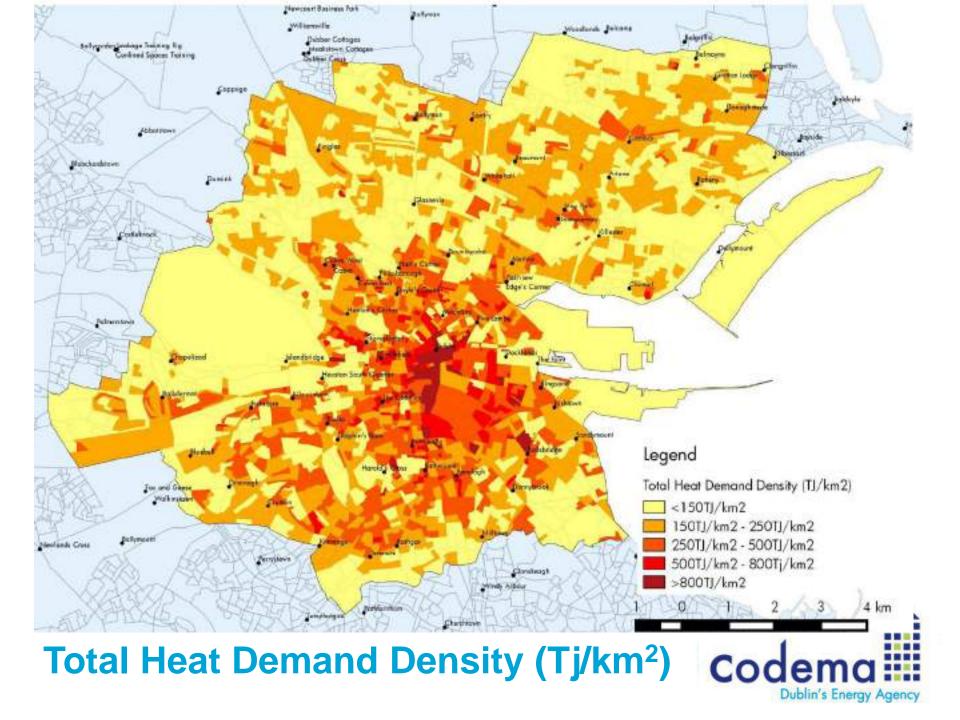
Codema Reports

Dublin District Heating System Market Research Version 2 September 2013

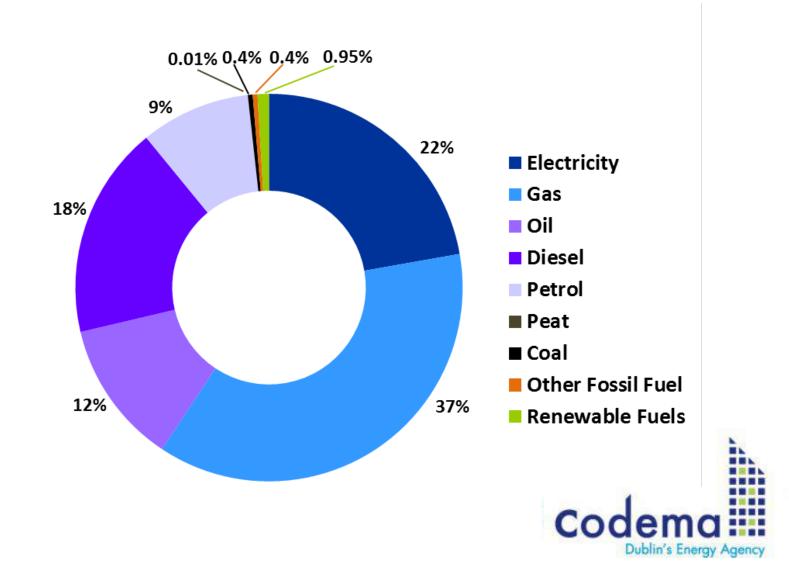
Dublin City Spatial Energy Demand Analysis June 2015

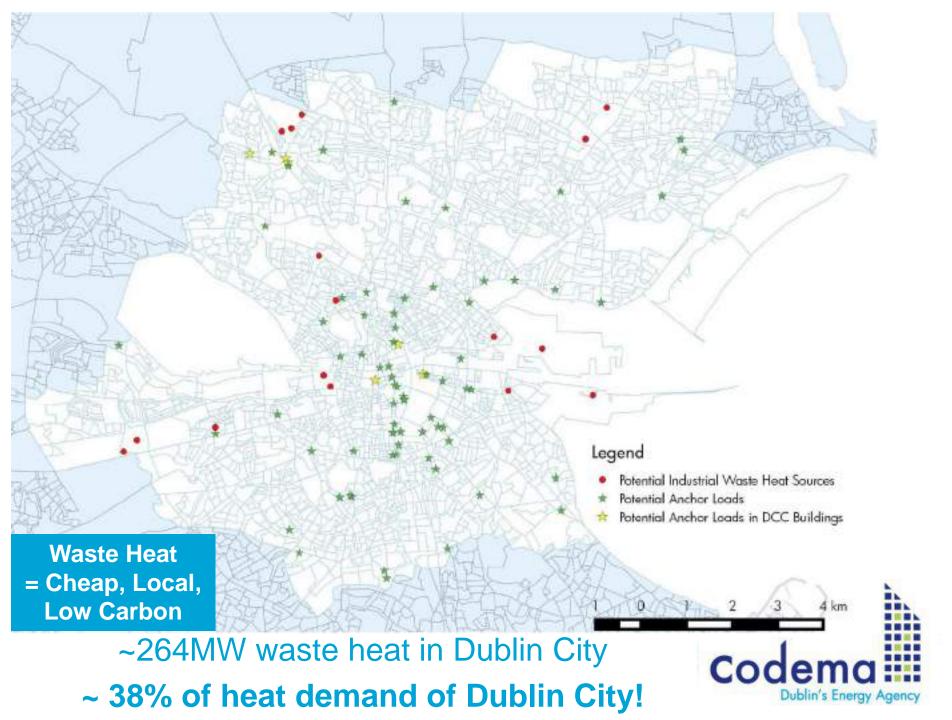
Analysis of Heating Demand in Docklands Area October 2015





In 2011, **99%** of fuels used in Dublin City were **Imported Fossil Fuels**

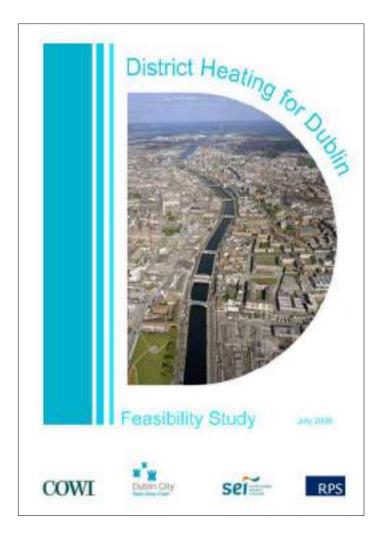




District Heating for Dublin - 2008

Looked at 3 scenarios

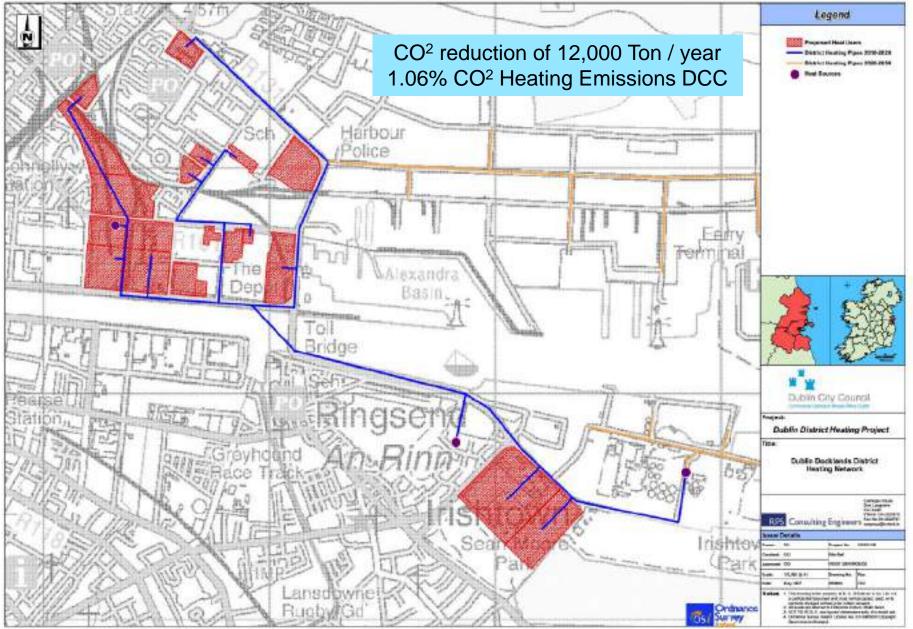
- Dublin Docklands
- Westgate
- City Wide DH Network
- It was recommended that DCC progress plan to establish a district heating supply serving the Dublin Docklands Area (Scenario 1).



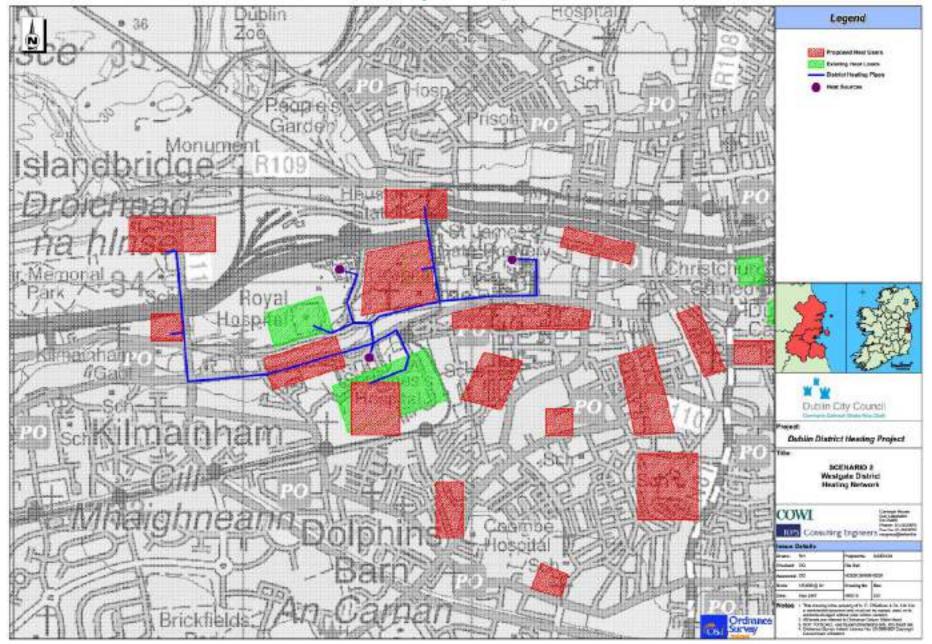


Comhairle Cathrach Bhaile Átha Cliath Dublin City Council

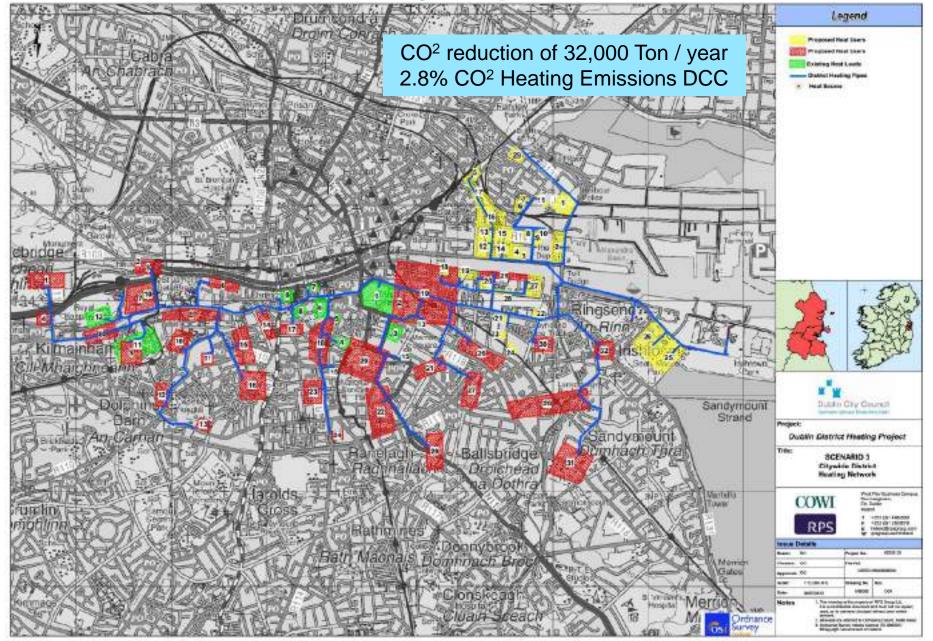
2008 Feasibility Report Scenario 1

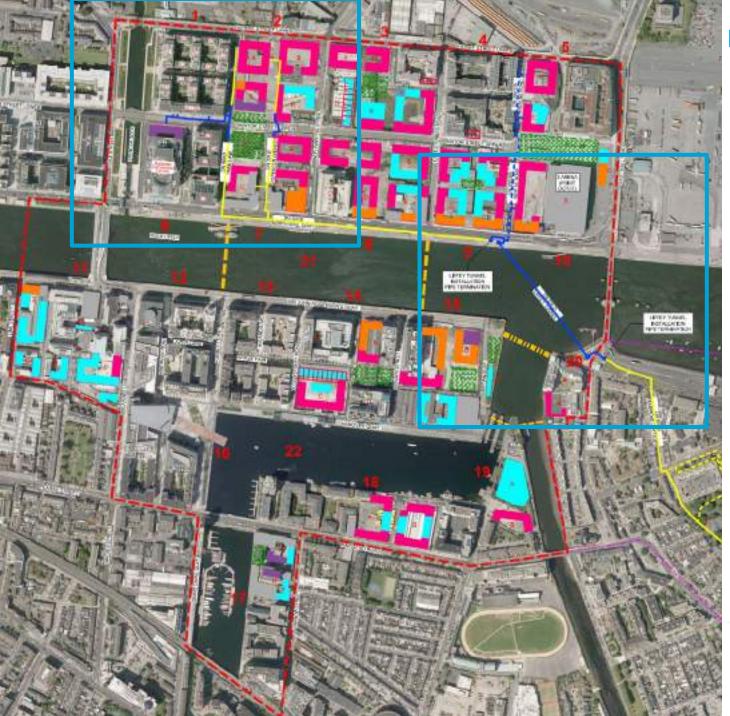


2008 Feasibility Report Scenario 2



2008 Feasibility Report Scenario 3





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 Spencer Docks, April 2008



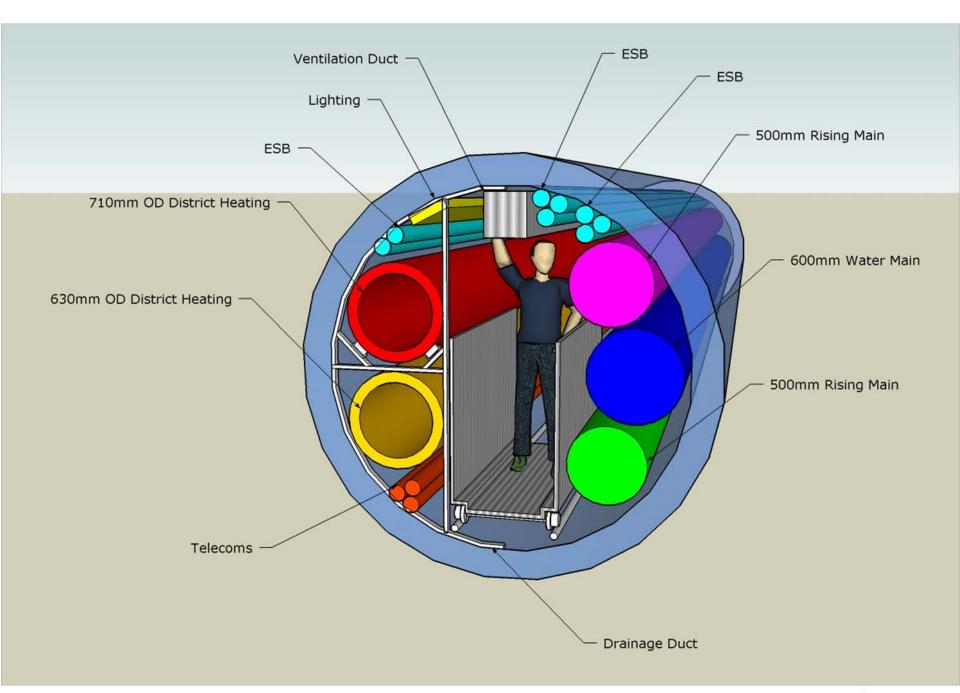
Installation of District Heating (DH) transmission pipelines (DH 400 mm) on Spencer Street, Spencer Docks, May 2008



DH pipes & Liffey Services Tunnel



Comhairle Cathrach Bhaile Átha Cliath Dublin City Council





Comhairle Cathrach Bhaile Átha Cliath Dublin City Council

Heat Storage & Generation





Peak / Reserve Boiler Station, Denmark

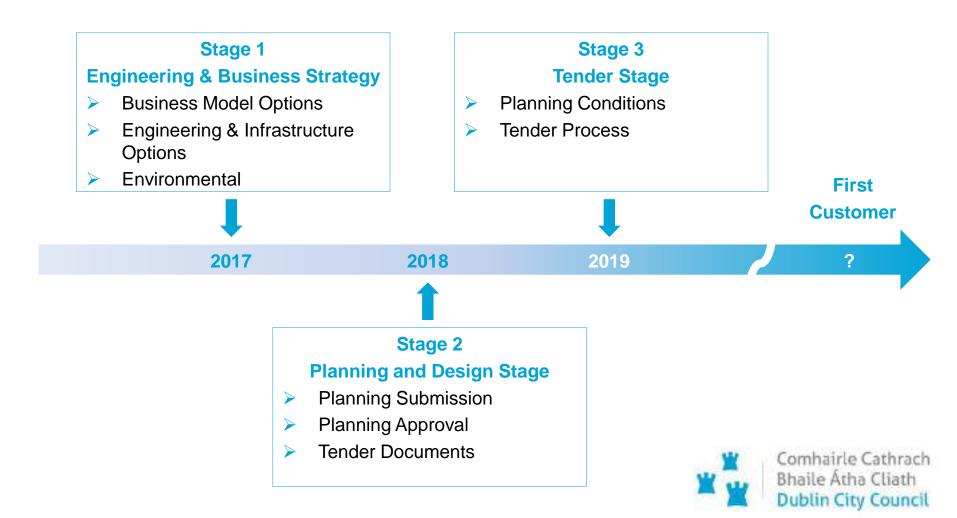
Storage Tank, Pimlico District Heating, UK Heat storage tank at a Danish district heating plant



Dublin District Heating System – Phase 2



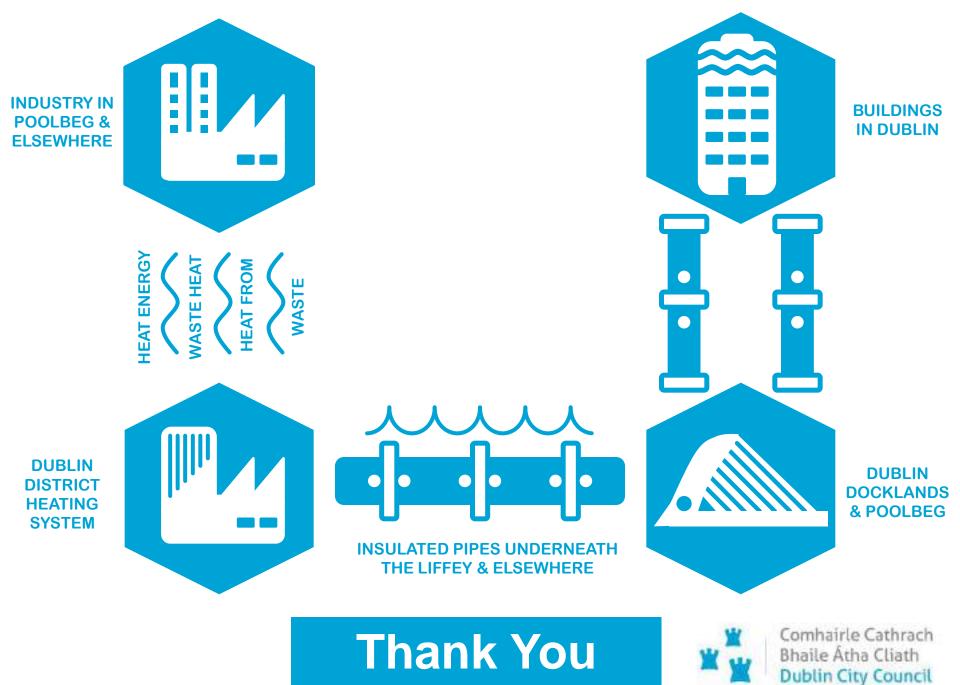
Timelines



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





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