

# IrBEA Bioenergy Webinar Series 2020

The Irish BioEnergy Association are hosting a series of one hour webinars relating to wood fuels, biogas and biofuels

## WEBINAR 2

*District Heating – Decarbonising our heat demand*

DATE: Wednesday 24th June 9.30 - 10.30am



# About the Irish Bioenergy Association (IrBEA)

- Representative organisation for the Bioenergy Sector on Island of Ireland.
- Sectors of Biomass, Biogas, Biofuels, Energy Crops and Wood Fuels.
- Broad and Growing Membership across all the sectors.
- Work on behalf of members through Representation, Lobbying, Advocacy, Networking, Technical Support & Advice, Knowledge & Information sharing.
- Engaged in a number of Research, Development and Demonstration Projects.
- EIP Small Biogas Demo Project, Interreg Three C Project, Biomass Installers and Designers Registers and the Wood Fuel Quality Assurance Scheme (WFQA)
- To become a member and find out more check out [www.irbea.org](http://www.irbea.org) or our social media channels.



# Webinar No 2 – Agenda

- Opening by Chair – Seán Finan ([seanfinan@irbea.org](mailto:seanfinan@irbea.org)) - IrBEA CEO.
- Presentation by John O'Shea - Energy Systems Analyst - Codema.
- Presentation by Steve Richmond - Head of Marketing & Technical – REHAU.
- Panel Discussion and Q & A with Presenters and Noel Gavigan IrBEA Technical Executive.
- Webinar Attendees can submit Questions through the Q & A tab at the bottom of the screen and we will endeavour to answer as many of your questions as possible during the panel discussion.

# District Heating – Decarbonising our Heat Demand

JOHN O' SHEA  
Energy Systems Analyst - Codema

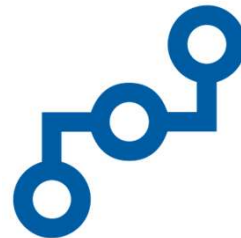


# OUR TEAM

- Founded in 1997 as **not-for-profit** organisation
- Leading the **Energy Transition in Dublin**
- Energy Advisers to the **four Dublin Local Authorities**



ENERGY  
AWARENESS

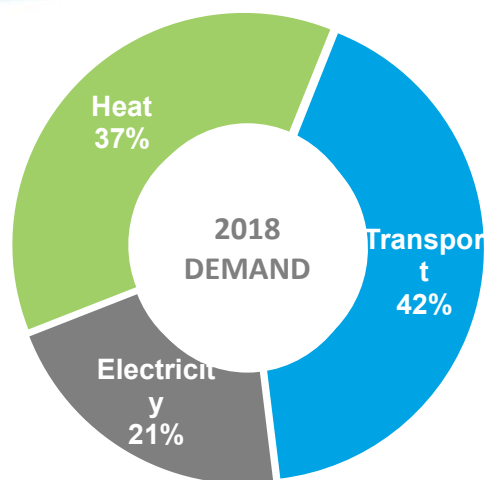


PROJECT  
MANAGEMENT

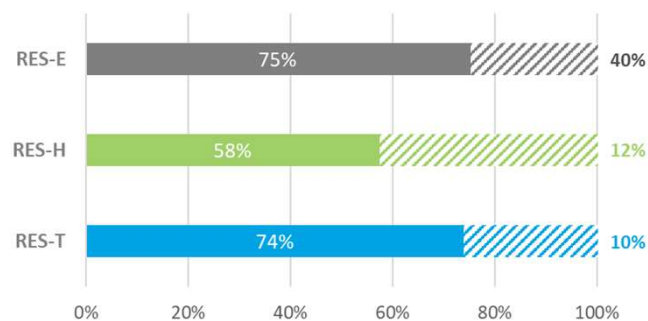


MATCH  
FUNDING

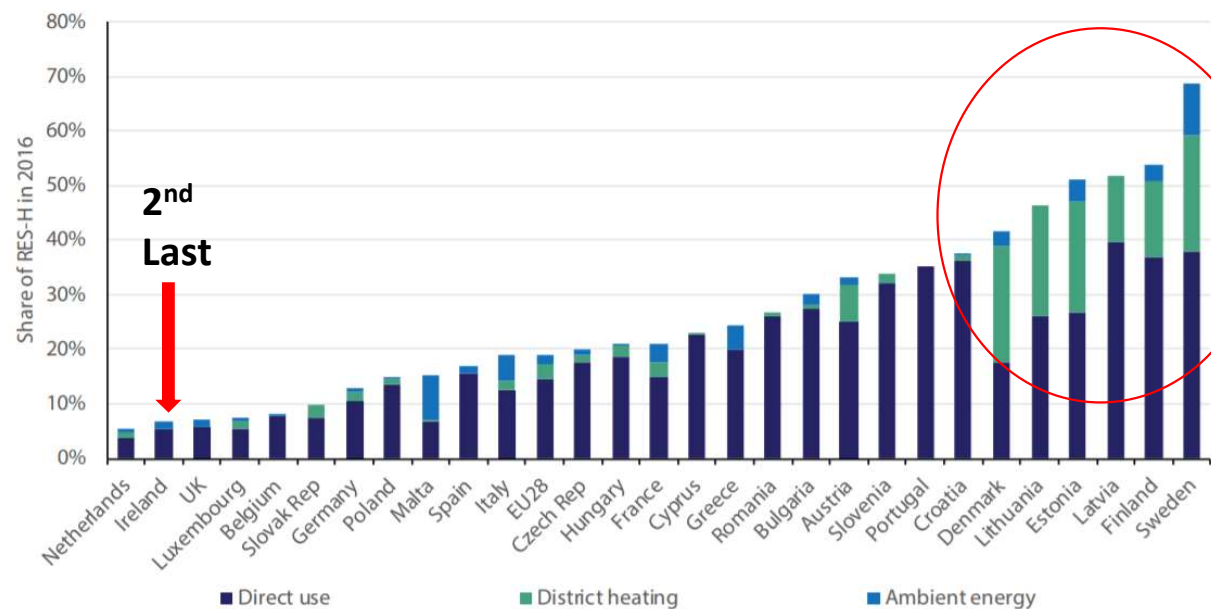
# Renewable Heat in Ireland



Progress to 2020 Targets



Renewable Heat in Ireland: 2016



Source: Eurostat

# EU, National & Regional Policy

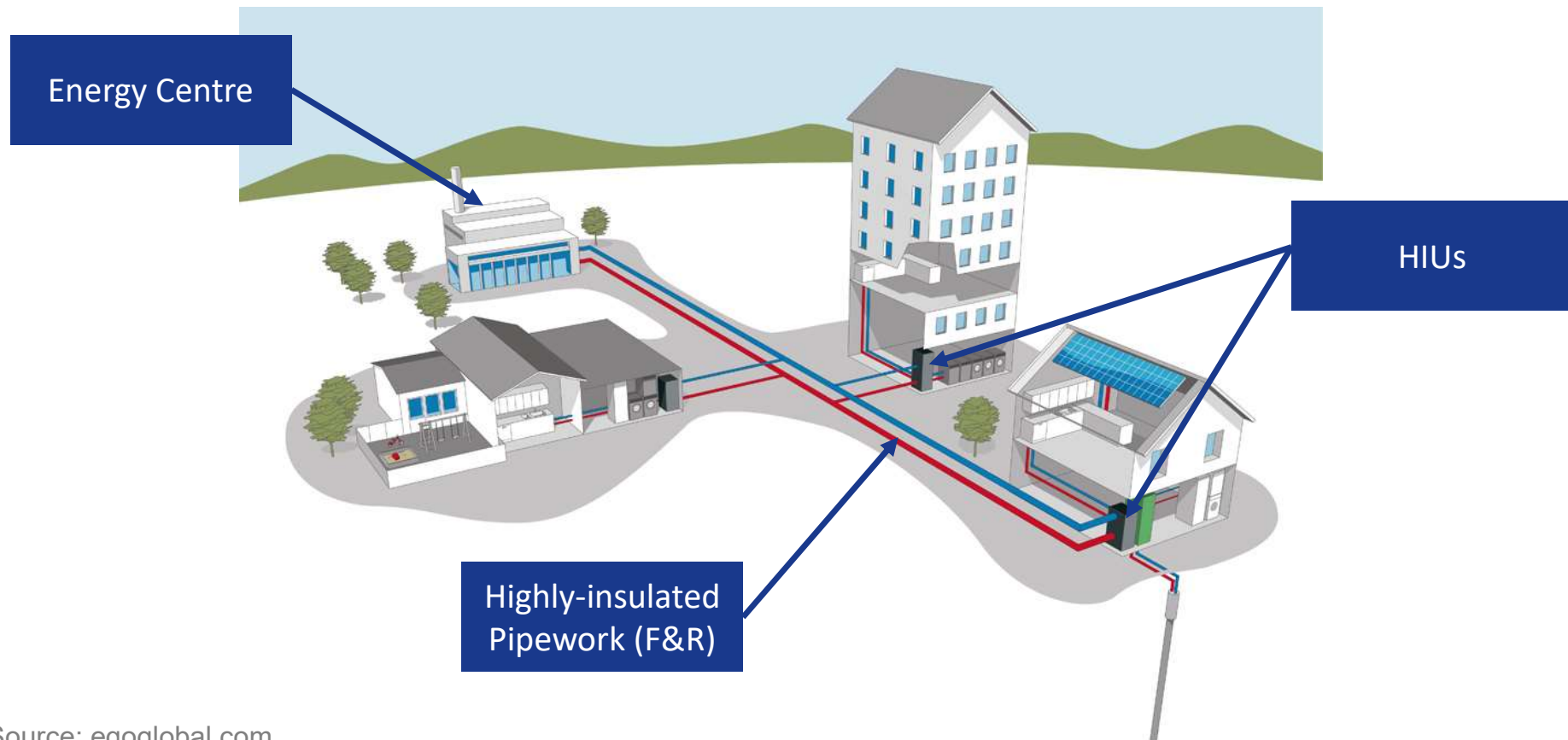
- Energy Efficiency Directive Article 14 – comprehensive assessment and adequate measures to develop DH if cost effective
- Climate Action Fund - €25M awarded to DH in 2019
- CAP 2019 – Three specific actions for DH and seen as enabling infrastructure for geothermal action
- Programme for Government 2020 – Learn from pilots and upscale
- EMRA RSES – RPO 7.38 (heat mapping & high-level feasibility), RPO 7.35 (SEZ)
- LA Planning Policy – Low-carbon DH, waste heat, geothermal



Tionól Reigiúnach Oirthir agus Lár-Tíre  
Eastern and Midland Regional Assembly



# What is District Heating?



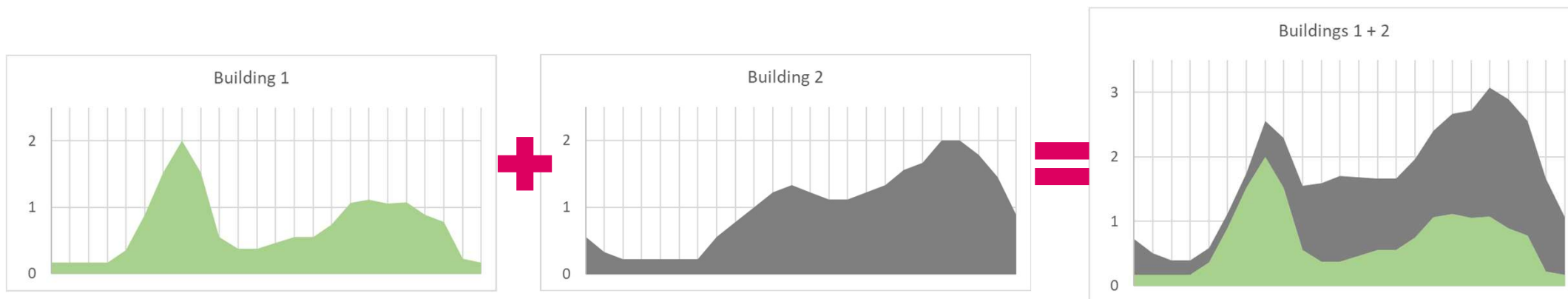
Source: eqoglobal.com

# District Heating Pipes



# What Makes DH So Cost-Effective

## 1. Diversity of Demand:



2

+

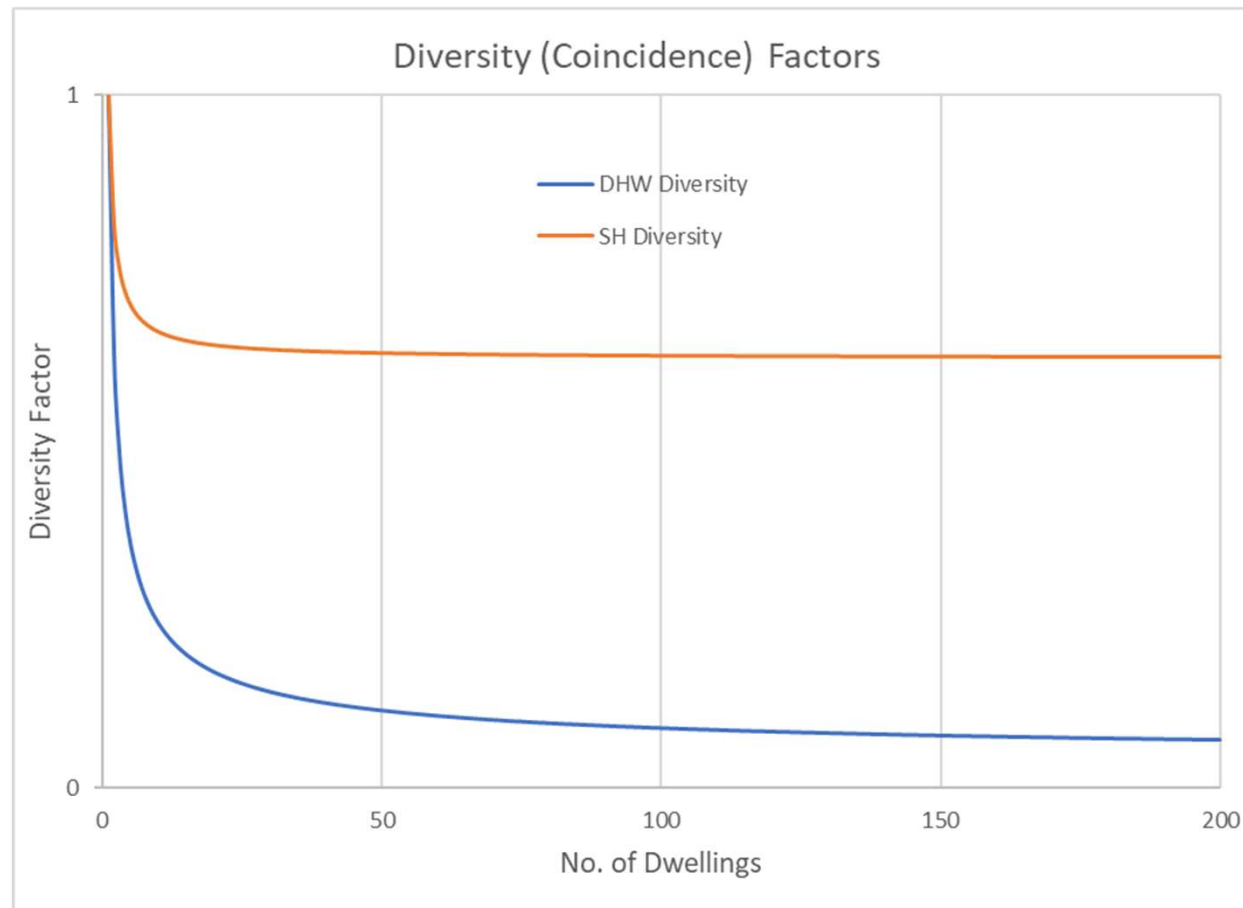
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# What Makes DH So Cost-Effective



# What Makes DH So Cost-Effective

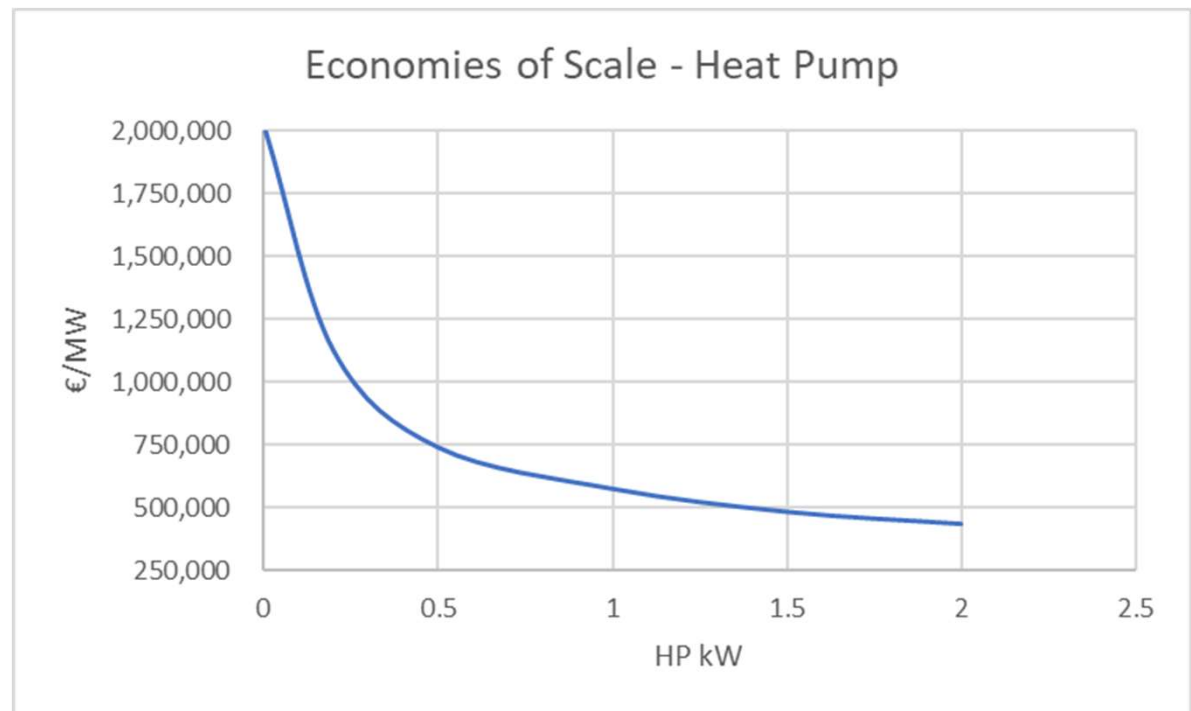
## 2. Economies of Scale:

### Individual Heat Pumps:

200 x 5kW = 1,000kW  
Cost €2,000,000

### District Heating HP:

1 x 1,000kW =  
1,000kW Cost  
€500,000



# DH – more than just a heating solution



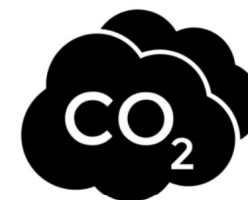
Industrial Waste Heat –  
increasing plant efficiency



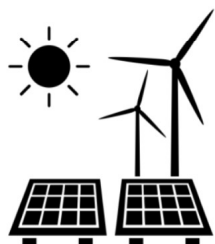
Thermal Storage – Cheap  
Energy Storage for Large Scale  
Demand side Response



Customer Safety – no  
onsite combustion or fuels



Low-carbon & lower  
local air pollution



Integrate more Renewable  
Electricity – Large scale Heat  
Pumps & Electric Boilers &  
RE CHP



Less Fossil Fuel Imports –  
increased security of supply

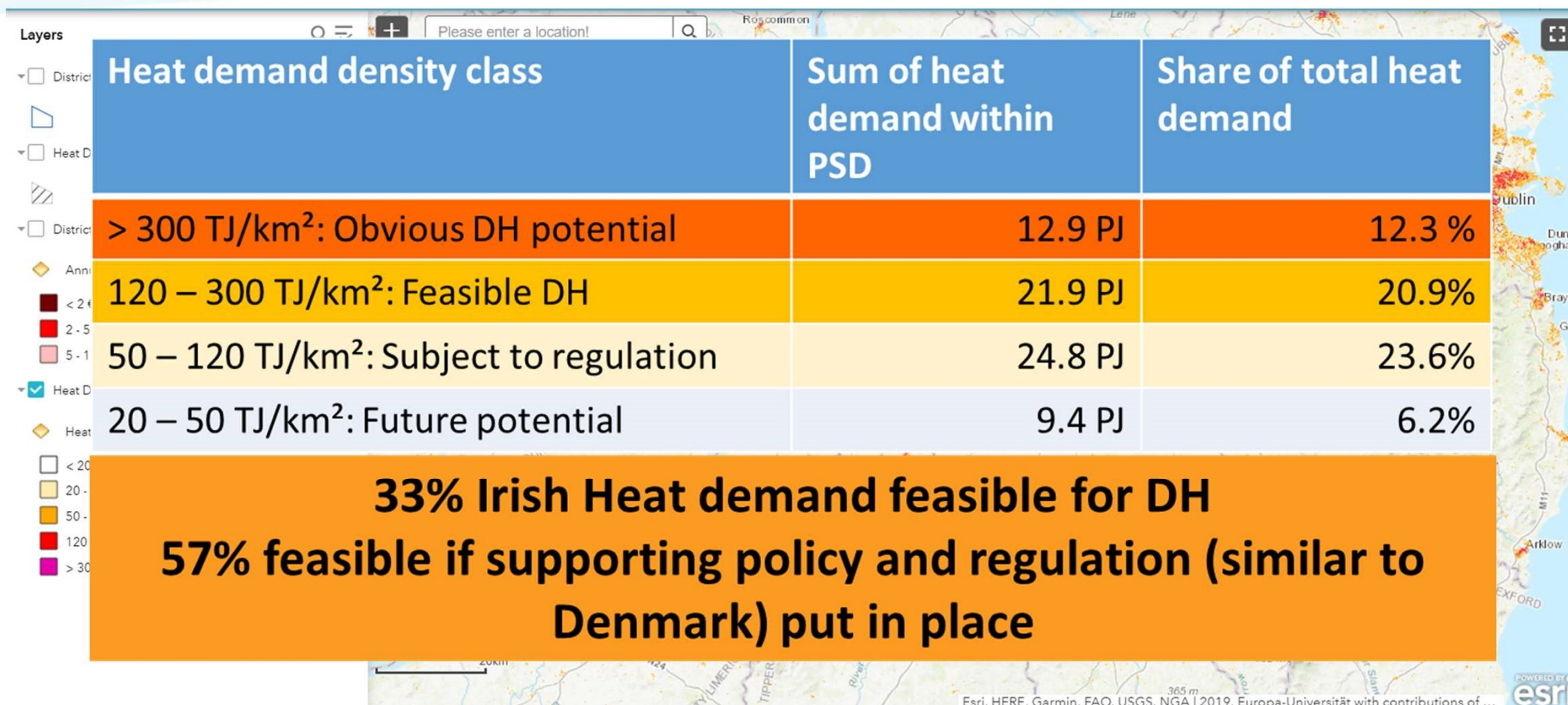


Low-cost heat – utilises  
waste and renewable  
sources of heat



New market – new  
local employment

# Heat Demand Density



# Heat Source Legend

## Cold Storage Warehouses (kW)

- 40 - 1000
- 1000 - 10000
- 10000 - 100000

## Electrical Transformer Waste Heat (kW)

- 0 - 100
- 100 - 250
- 250 - 504

## Power Stations (MW)

- 90 - 242
- 242 - 324
- 324 - 512

## Biomass Heat Sources (kW)

- 50 - 1000
- 1000 - 10000
- 10000 - 50000

## Industrial Waste Heat (kW)

- 50 - 1000
- 1000 - 10000
- 10000 - 52200

## Combined Heat and Power(kW)

- 50 - 1000
- 1000 - 10000
- 10000 - 73600

## Surface Water Sources (kW)

- 42.0 - 1000
- 1000 - 10000
- 10000 - 31080

## Data Centre Waste Heat (kW)

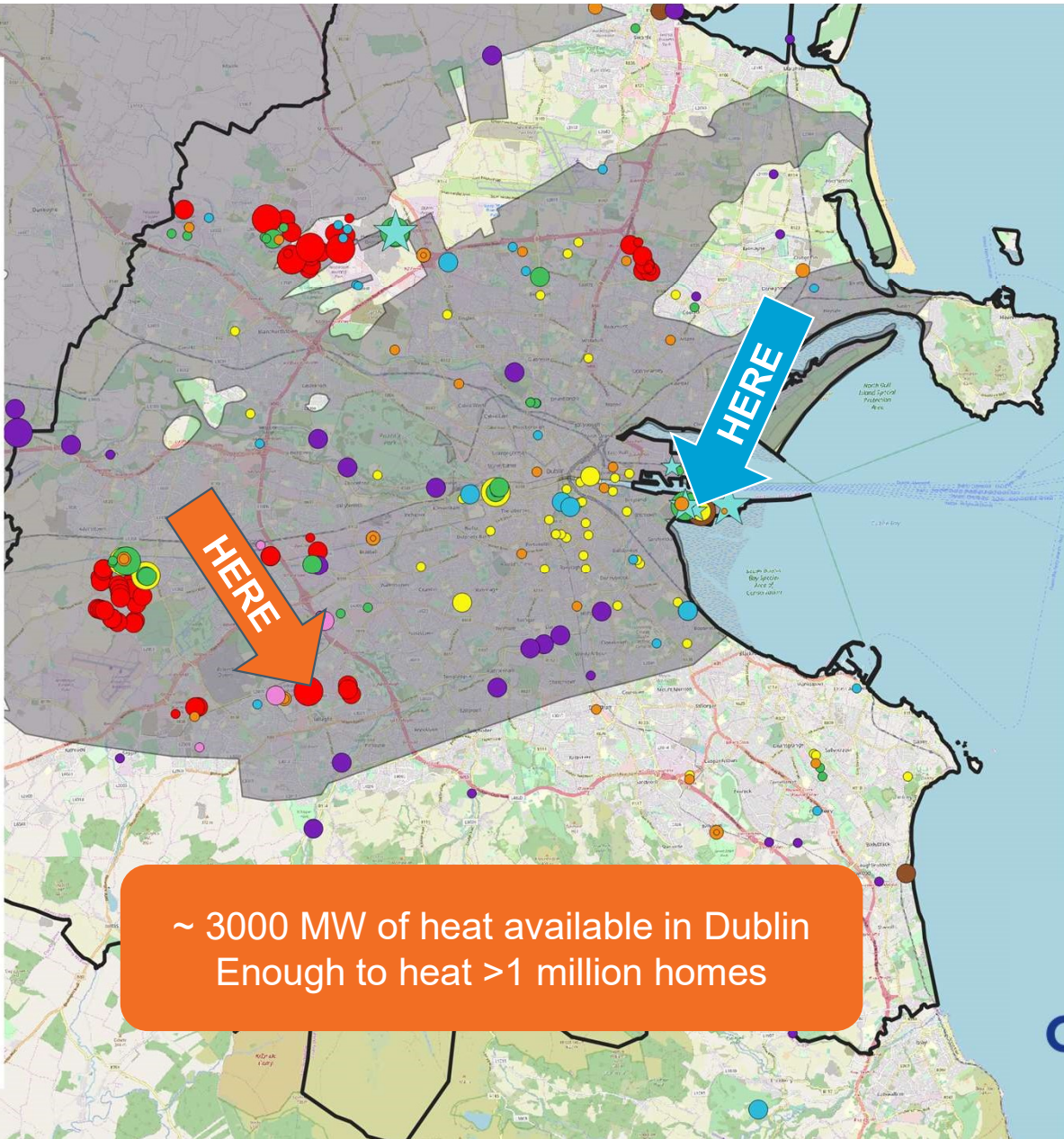
- 50 - 1000
- 1000 - 10000
- 10000 - 15246

## Wastewater Treatment Plants (kW)

- 120 - 2689
- 2689 - 55762
- 55762 - 311220

## Area of High Deep Geothermal Potential

Dublin County Boundary



~ 3000 MW of heat available in Dublin  
Enough to heat >1 million homes

# Where Codema Supports Local Authorities

## Planning & Policy:

1. Energy Master-Planning (demand, sources, constraints) - Identifying Opportunity Areas
2. Planning policy to promote DHC & low-carbon heat
3. DHC national steering group
4. Transition roadmap

## Business Case Development:

1. Techno-economic analysis (CBA, WLC etc.)
2. Business model options
3. Outline design & early optimisation

## Stakeholder Engagement:

1. Identifying stakeholders (roles)
2. Effective communication (drivers)
3. Communication materials – Brochures, website etc.
4. Data sharing

## Procurement & Contracting:

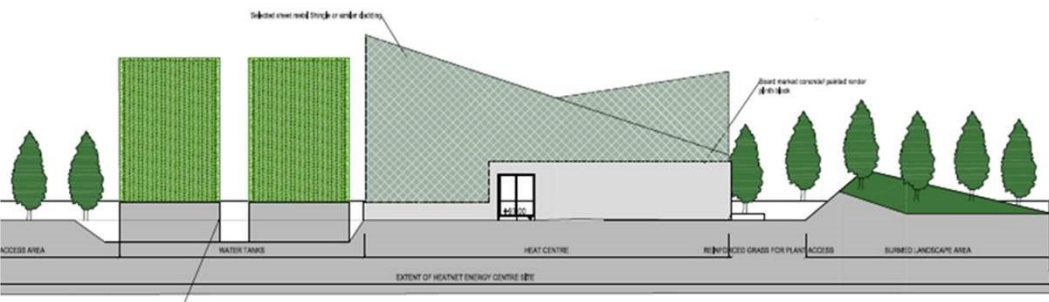
1. Technical advisors
2. Procurement strategy to leverage capacity & allocate risk – output based
3. Development of client requirements & standards
4. Bid evaluation & design review

## Project Delivery & Capacity Building:

1. Pipes in the ground
2. Workshops with planners
3. Working with 3<sup>rd</sup> level Institutions
4. Best practice

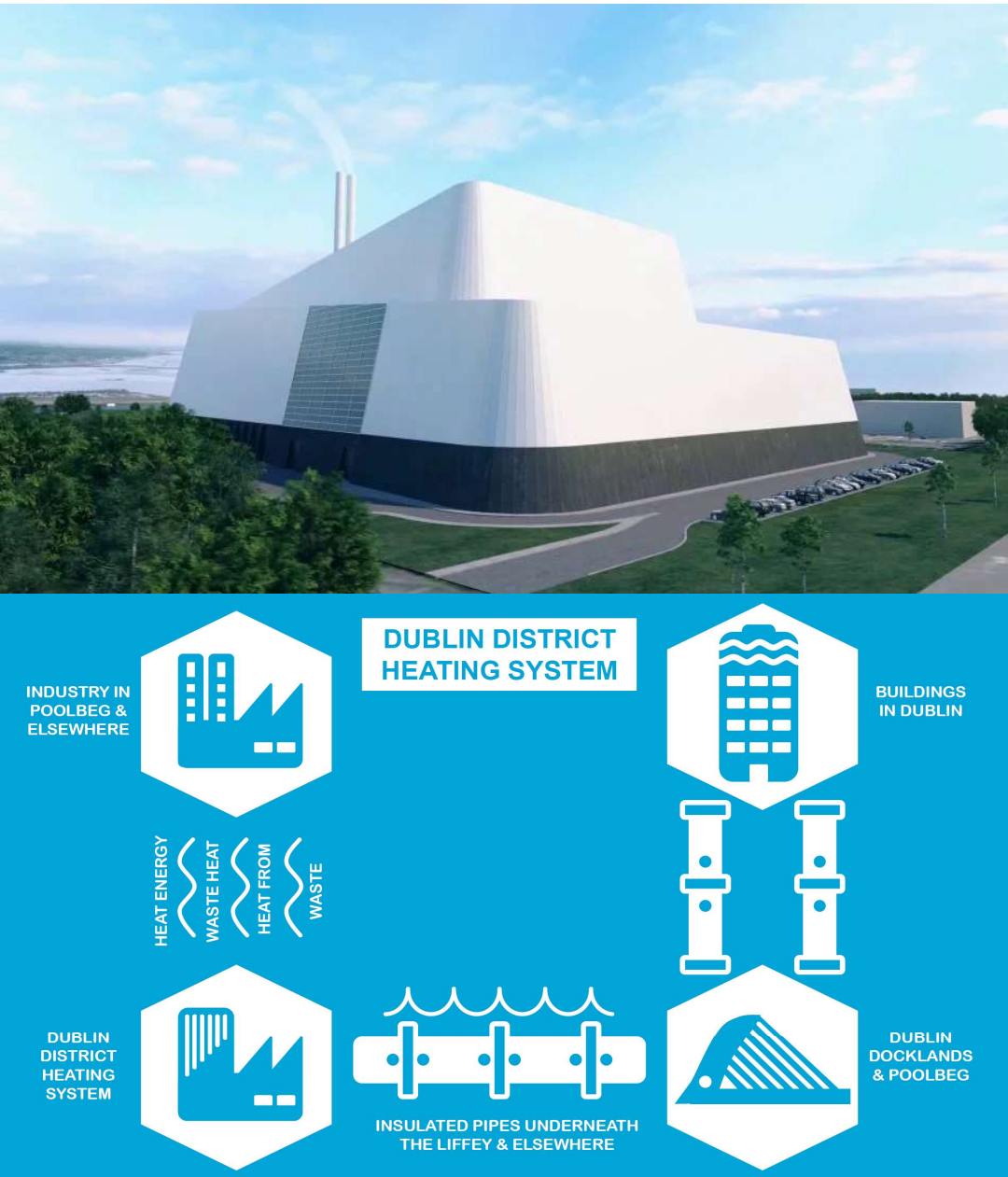
# Tallaght District Heating Scheme

Heat Source: Data Centre Waste Heat



# Dublin District Heating Scheme

Heat Source: Dublin Waste to Energy (DWtE)



Comhairle Cathrach  
Bhaile Átha Cliath  
**Dublin City Council**

# Biomass Examples – Fjernvarme Fyn



## FJERNVARME FYN

- 97% of buildings in Odense supplied by DH (Including: biomass CHP, EfW, Data centre waste heat, etc.)
- Straw-fired CHP (32MWe, 88MWth) – commissioned in 2009
- 200,000 tonnes straw per annum
- 4 days worth of fuel storage on site
- Fuel priced based on energy content
- Consumes 4 bales per minute at peak production
- Can use up to 15% wood chip in years where straw is wet



# Biomass Examples – Assens



- Serves 3,400 customers in Assens
- Biomass CHP 45,000 tonnes woodchips & 3,500 tonnes pellets (5MWe, 10.3 MWth + 4.6MWth condenser)
- Flue gas heat recovery (gas from 140°C to 37°C) produces 5,000 litres per hour of condensate – also improves flue gas buoyancy so no pluming issues
- Electrofilter on flue gas – allows condensate to be reused in the CHP
- Can use woodchip with MC up to 60% (90% of rated capacity) – 100% capacity achievable with MC of 55% - pay per energy content (on-site testing)



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Engineering progress  
Enhancing lives

# District Heating design

IRBEA webinar, Weds 24<sup>th</sup> June

Steve Richmond



# REHAU

## in a nutshell

Leading  
developer in  
polymer-based  
solutions

- > **Founded in 1948**
- ~ **20,000** employees
- > **50** countries
- > **3.6 billion** Euro  
annual revenue



Operating globally  
but still family  
owned

Internally split into 5 divisions:



Automotive



Building  
Solutions



Window  
Solutions



Furniture  
Solutions



Industrial  
Solutions

# REHAU and district heating

Specialist sales & technical teams in the UK/ROI



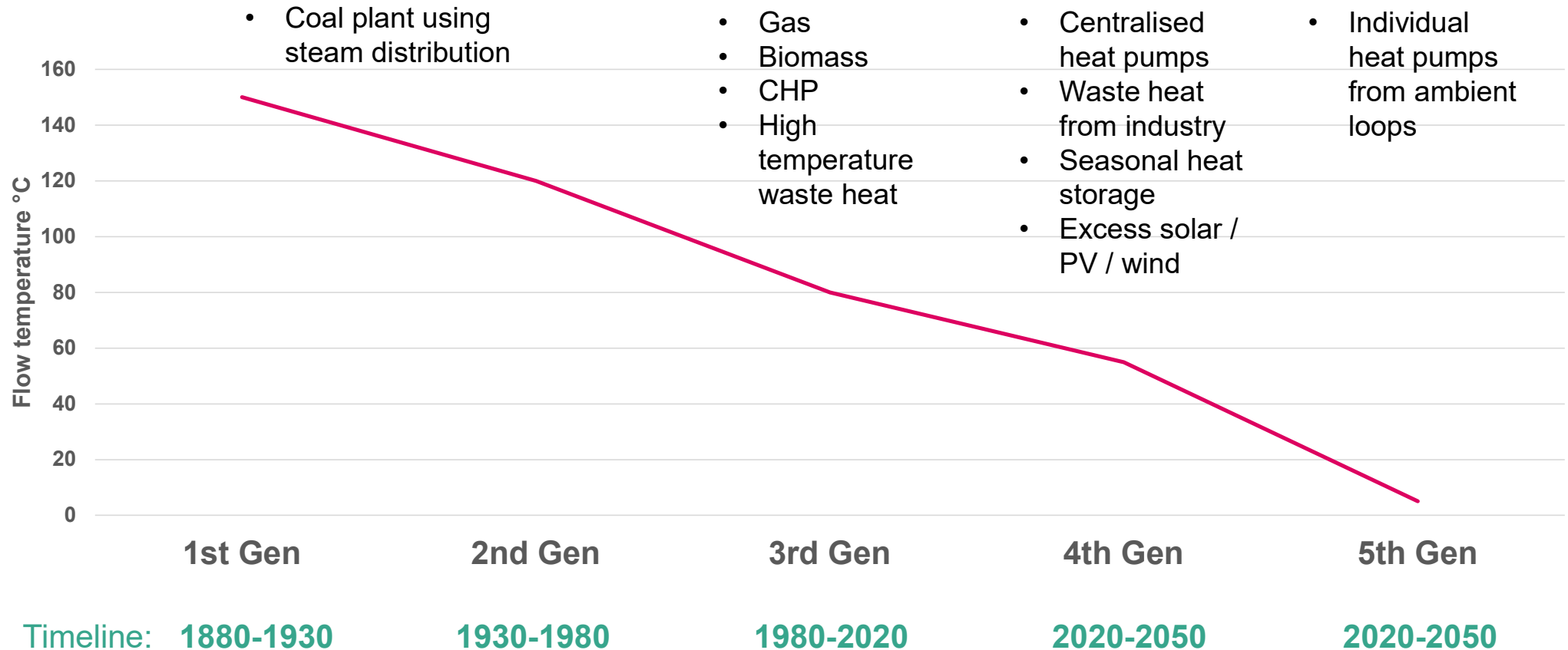
Only UK manufacturer of PE-Xa district heating pipes



Largest UK stock of district heating pipes



# Evolution of district heating flow temperatures



## Possible DH heat sources

Gas / gas CHP

Heat pumps

Biomass

AD / biogas

Solar thermal

Deep geothermal

Waste heat



# District heating pipe materials

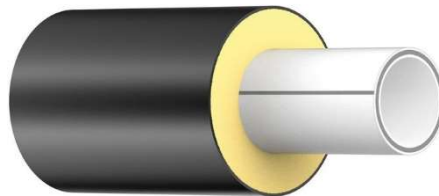
Steel (EN 253) or polymer (EN 15632)

Steel pipe with PU foam  
(bonded)



Welded

PP-R pipe with PU foam  
(bonded)



Butt-welded

PE-Xa pipe with PU foam  
(bonded)



Compression sleeve

PE-Xa pipe with PEX foam  
(non-bonded)



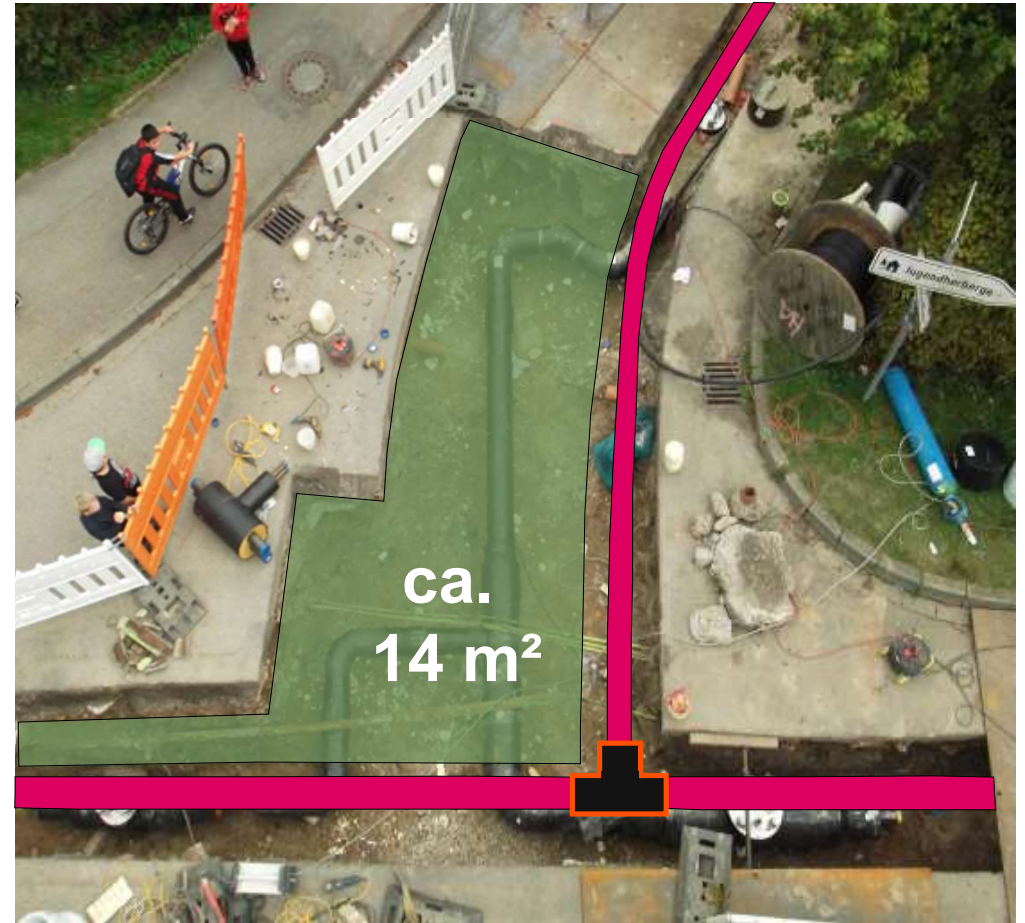
Compression sleeve

# Pipe Material Comparison

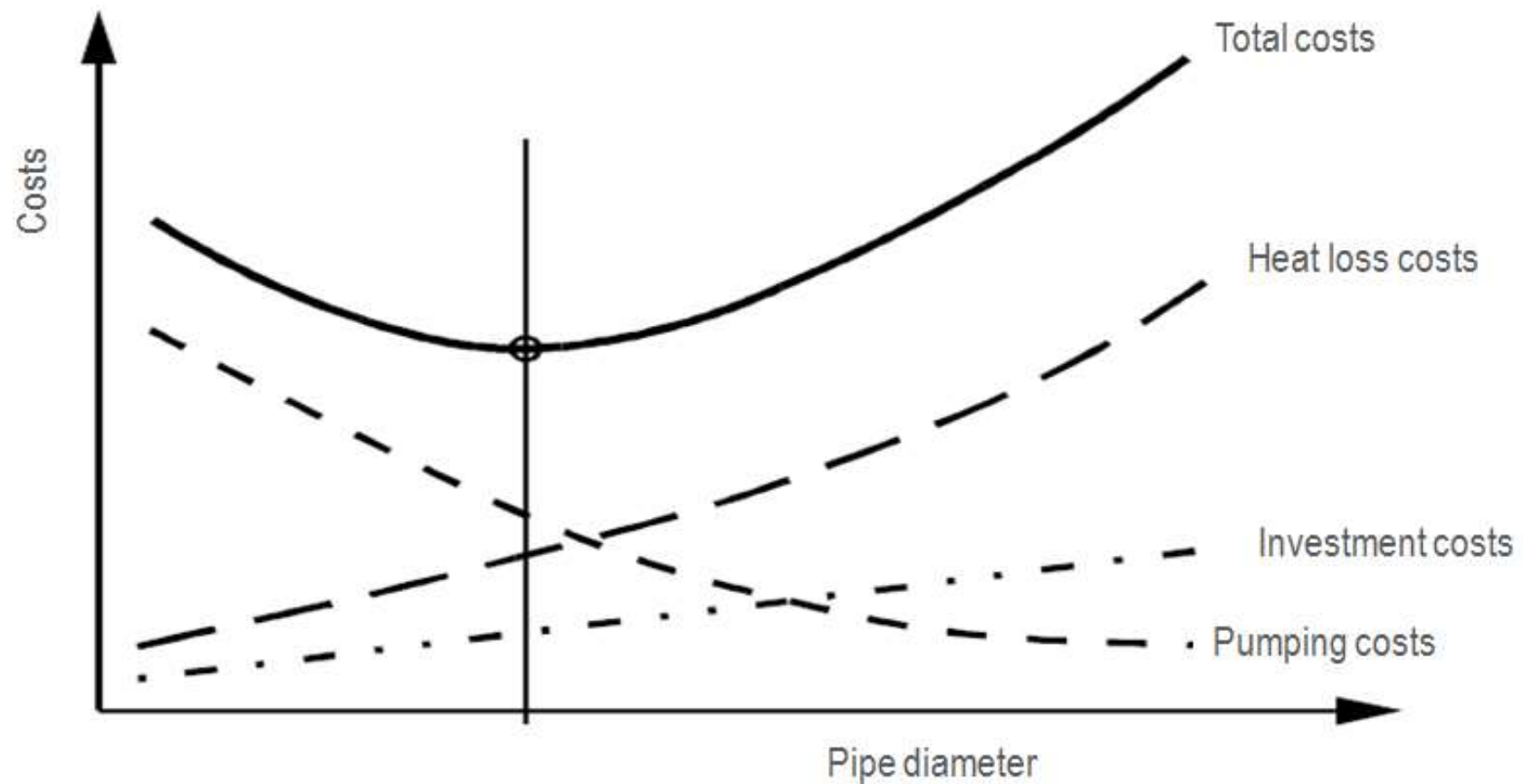


	Steel	PP-R	PE-Xa
Max pipe size	>DN1000	DN350 (400mm)	DN130 (160mm)
Pipe lifespan at 4G temps	>50 years	>50 years	>50 years
Coils / sticks	Sticks	Sticks	Coils
Complexity of install	Specialist steel welder	Civil contractor	Civil or mechanical contractor
Expansion loops needed	Yes	No	No
Leak detection required	Yes	No	No

# Steel vs polymer – space required on site



# Heat network design – a balancing act



# Twin pipes vs single pipes

2x UNO 25 = 10.9 W/m      DUO 25 = 7.6 W/m

Heat loss reduction with DUO → 30%

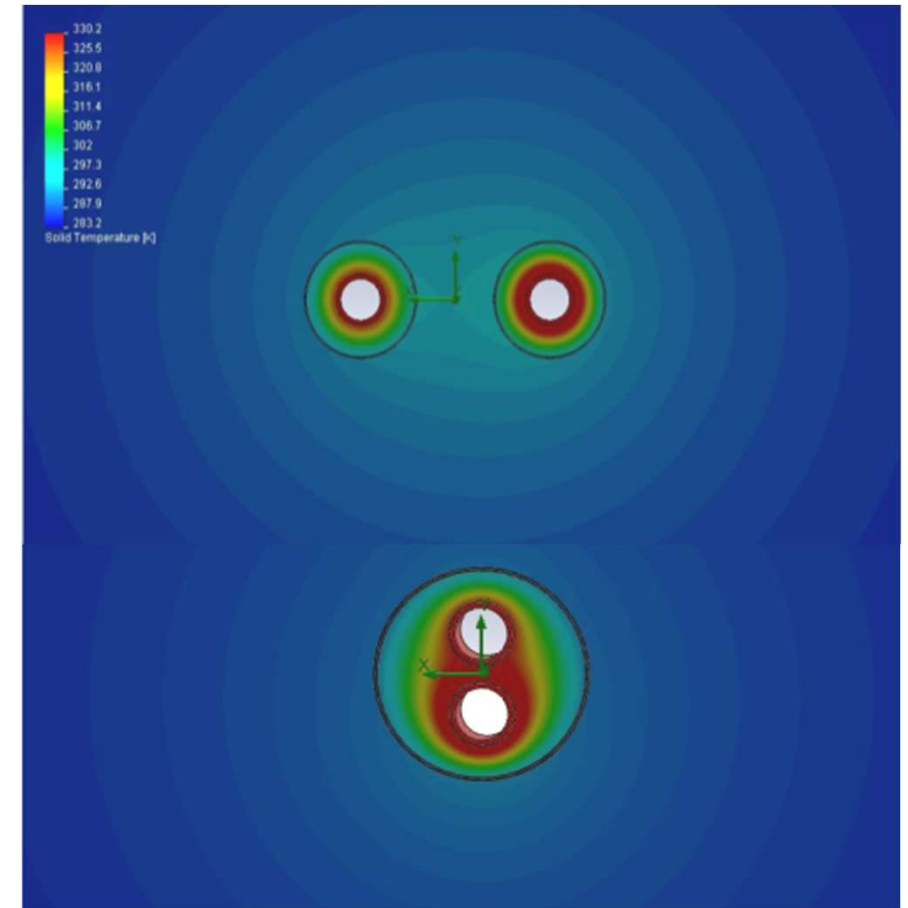
2x UNO 40 = 16.6 W/m      DUO 40 = 11.6 W/m

Heat loss reduction with DUO → 30%

2x UNO 63 = 19.5 W/m      DUO 63 = 13.1 W/m

Heat loss reduction with DUO → 33%

*Data taken at 80/50°C using RAUTHERMEX pipe.*



## $\Delta T$ scenarios

Diagram illustrating a network topology for a 2x5 grid of buildings (represented by building icons) connected to a central Plant (represented by a red box).

The connections and associated labels are as follows:

- Top Row (5 buildings):**
  - Building 1:  $\emptyset 110 \rightarrow \emptyset 90$
  - Building 2:  $\emptyset 110 \rightarrow \emptyset 90$
  - Building 3:  $\emptyset 90 \rightarrow \emptyset 75$
  - Building 4:  $\emptyset 125 \rightarrow \emptyset 110$
  - Building 5:  $\emptyset 125 \rightarrow \emptyset 110$
- Bottom Row (5 buildings):**
  - Building 1:  $\emptyset 125 \rightarrow \emptyset 110$
  - Building 2:  $\emptyset 110 \rightarrow \emptyset 90$
  - Building 3:  $\emptyset 110 \rightarrow \emptyset 90$
  - Building 4:  $\emptyset 90 \rightarrow \emptyset 75$
  - Building 5:  $\emptyset 160 \rightarrow \emptyset 140$

The central Plant is connected to the network via a red line.

# Design case study

## Cost comparison

Flow / return temperature (°C)		Network material cost (£)	% Cost saving to 80/60°C or Δ20K network	
Δ 20K	80/60	£188K	23%	
	60/40			
Δ 30K	70/40	£145K		
	65/35			
Δ 40K	70/30	£118K		37%

# Design case study

## Heat loss external distribution network

Flow / return temperature (°C)		Total heat losses (kW)	Saving on additional electricity demand @ 0.10 £/kWh HP COP 3	% saving to 80/60°C network
<b>Δ 20K</b>	80/60	36.63 kW		
	60/40	24.42 kW	£3,565 /a	33%
<b>Δ 30K</b>	70/40	24.48 kW	£3,547 /a	33%
	65/35	21.76 kW	£4,342 /a	41%
<b>Δ 40K</b>	70/30	16.26 kW	£5,948 /a	56%

A 4G heat network can reduce heat losses by 30-40% compared to an equivalent 3G network. CAPEX is influenced significantly by the operating temperatures and pipe choice.

# Case studies



## Hill Park, Glasgow

350 apartments – ASHP – Over 1km network



## Eleanor Street, Sheffield

127 properties – 1.9MW gas - Over 2km network

# Case studies



## Portmeirion, North Wales

Hotel & 30 cottages - Biomass – Over 3km network



## Dunbeg, Scotland

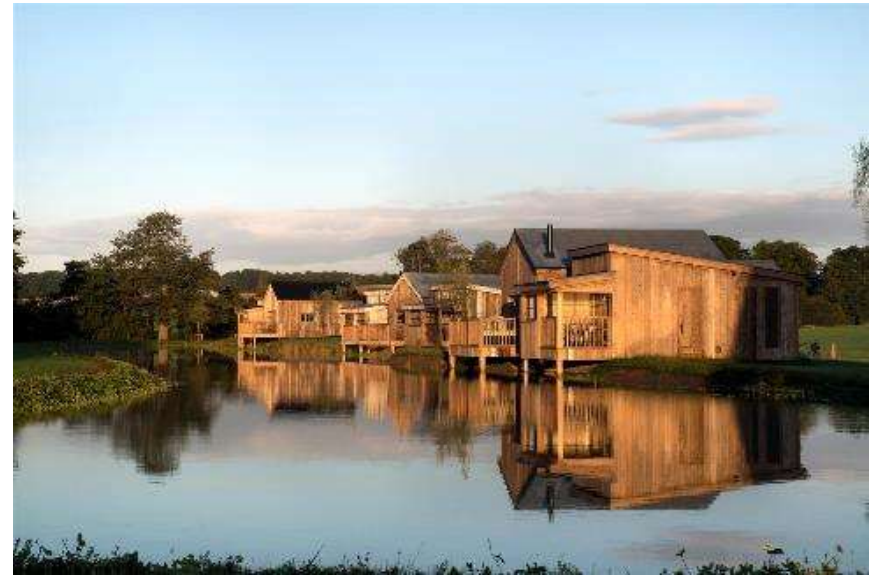
50 apartments – Biomass - Over1km network

# Case studies



## Riverside, Glasgow

Over 300 apartments – Gas – Over 500m network



## Soho Farmhouse Estate, Oxfordshire

45 luxury houses – Biomass – Over 7km network

**Engineering progress  
Enhancing lives**

# Thank you for your attention

Any questions?

[www.rehau.uk/districtheating](http://www.rehau.uk/districtheating)

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