Data Centres & DH in Tallaght

Delivering data centre heat to buildings through a heat network

JOHN O' SHEA - CODEMA

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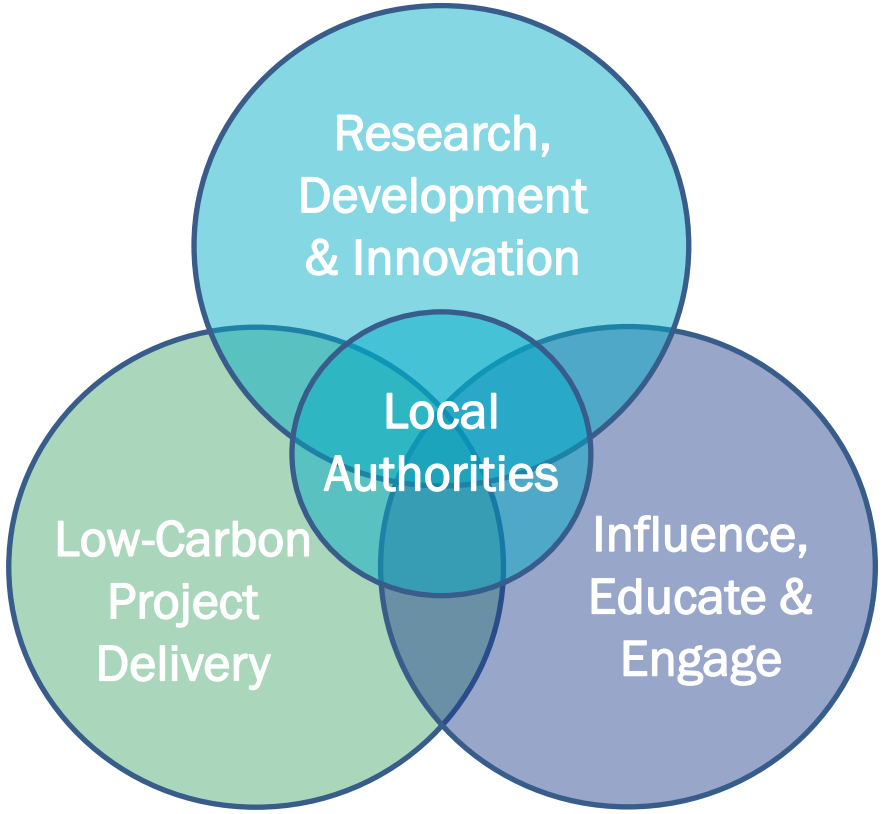

Comhairle Contae Átha Cliath Theas
South Dublin County Council

Comhairle Contae Fhine Gall
Fingal County Council

dlr Comhairle Contae County Council

Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

Where Codema Supports Local Authorities in DH

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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
5. EU policy recommendation papers

Business Case Development:

1. Techno-economic analysis & technology options appraisals (CBA, WLC, IRR, NPV etc.)
2. Business model options
3. Outline design & early optimisation
4. Risk analysis

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

Project Delivery & Capacity Building:

1. Pipes in the ground
2. Workshops with planners
3. Working with 3rd level Institutions
4. Best practice
5. Funding applications
6. Training & upskilling for DHC

Impact on **Ireland's Energy**

- In 2028, **29% of all Electricity demand** will come from Data Centre
- The growth in Data Centre demand will require close to **€9 billion investment** in generation and grid
- By 2030, Data Centres will be responsible for a **13% increase of carbon emissions** on the grid

Data sources: Eirgrid, Irish Academy of Engineering

Data Centre **Waste Heat**

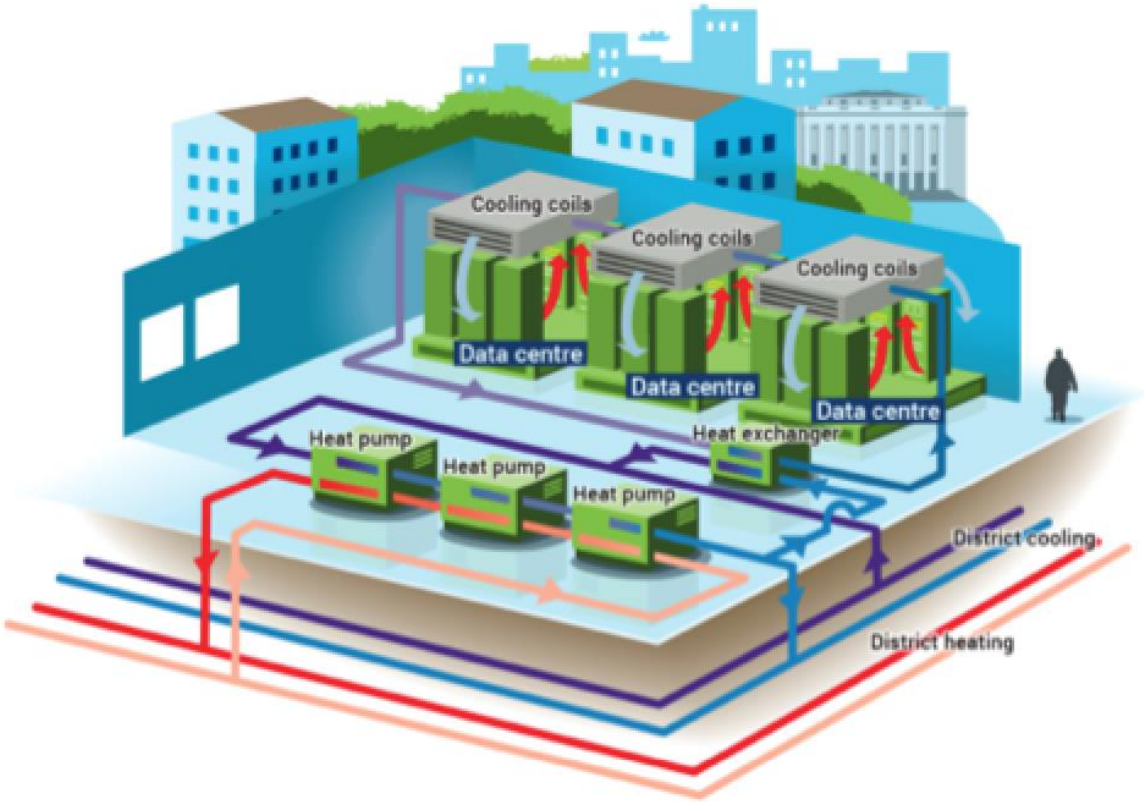
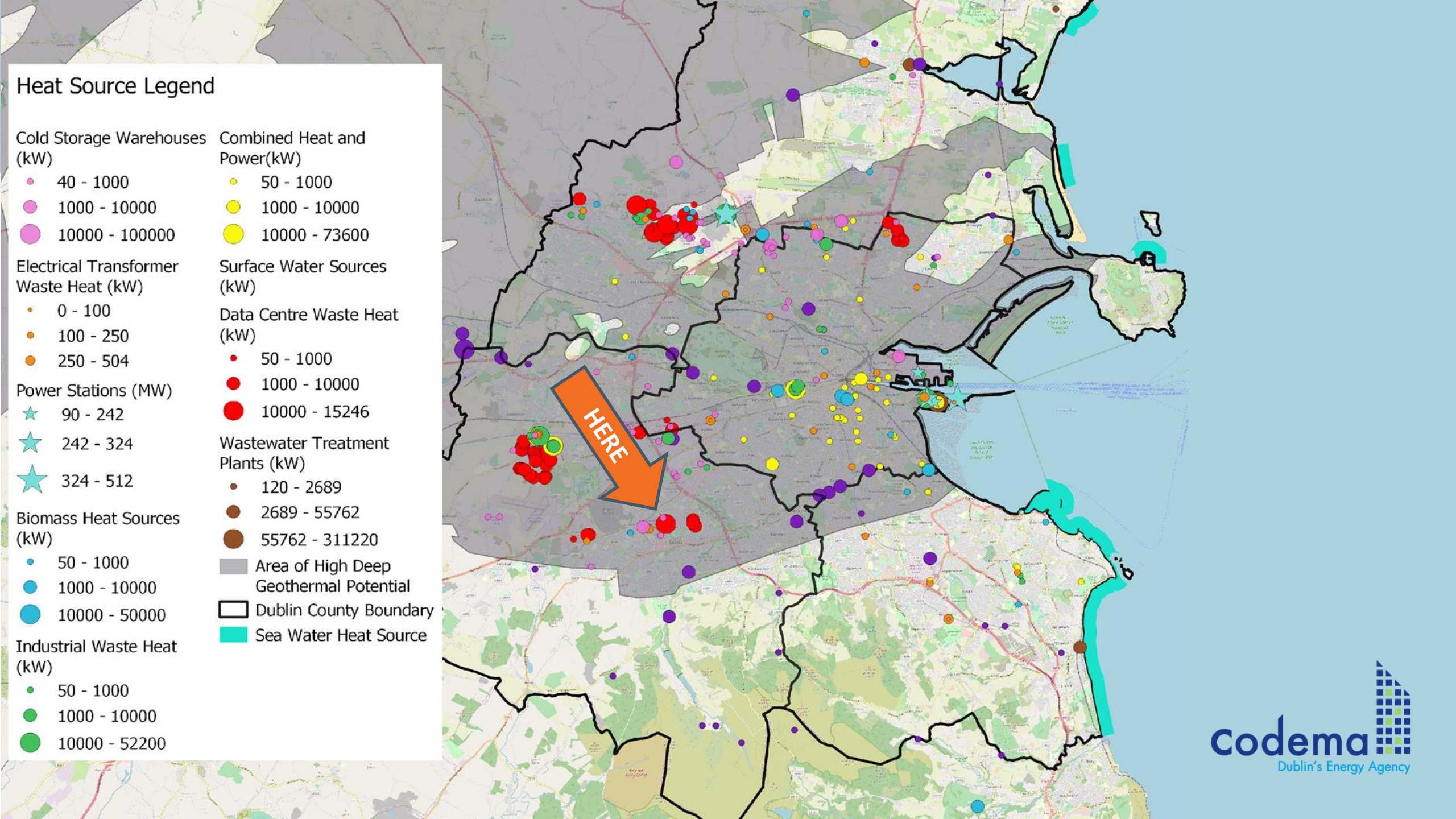


Image from datacenterfrontier.com

1 MWh of electrical load produces
~750 kWh thermal energy

Recovered heat temperature ranges:
Air cooled 25°C - 35°C
Direct liquid cooled 40°C - 60°C


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)
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
Sea Water Heat Source
HERE
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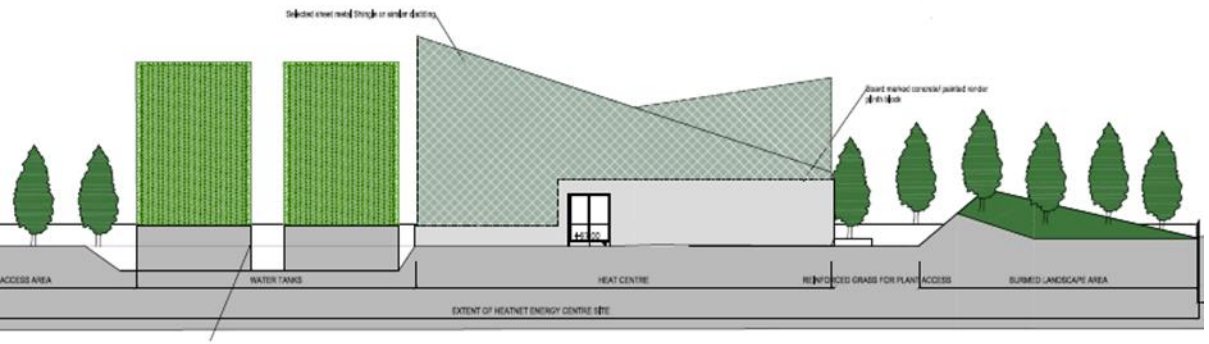

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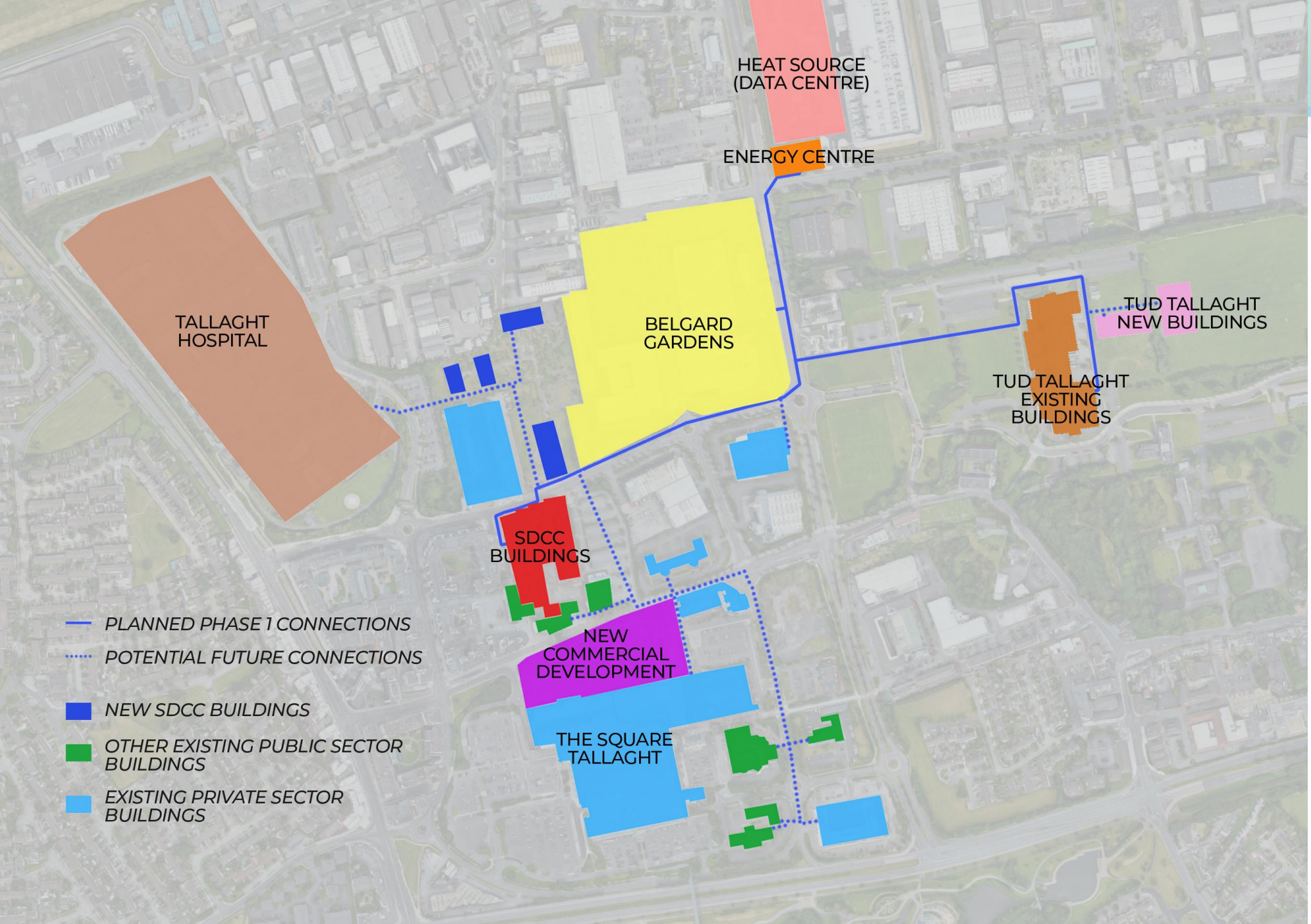
Tallaght District Heating Scheme

Heat Source: Data Centre Waste Heat

Interreg
North-West Europe
HeatNet NWE
European Regional Development Fund

Comhairle Contae
Átha Cliath Theas
South Dublin County Council



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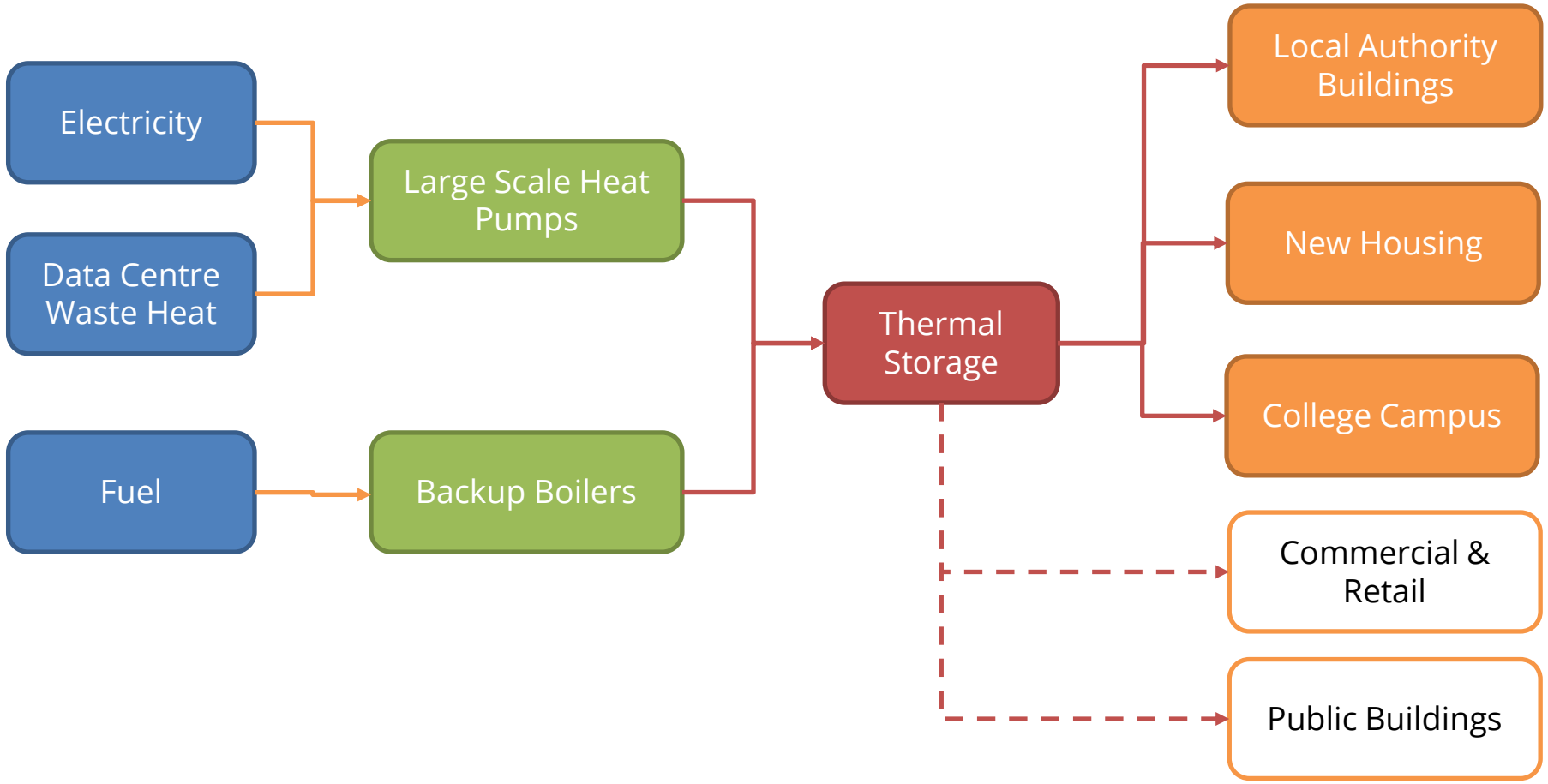
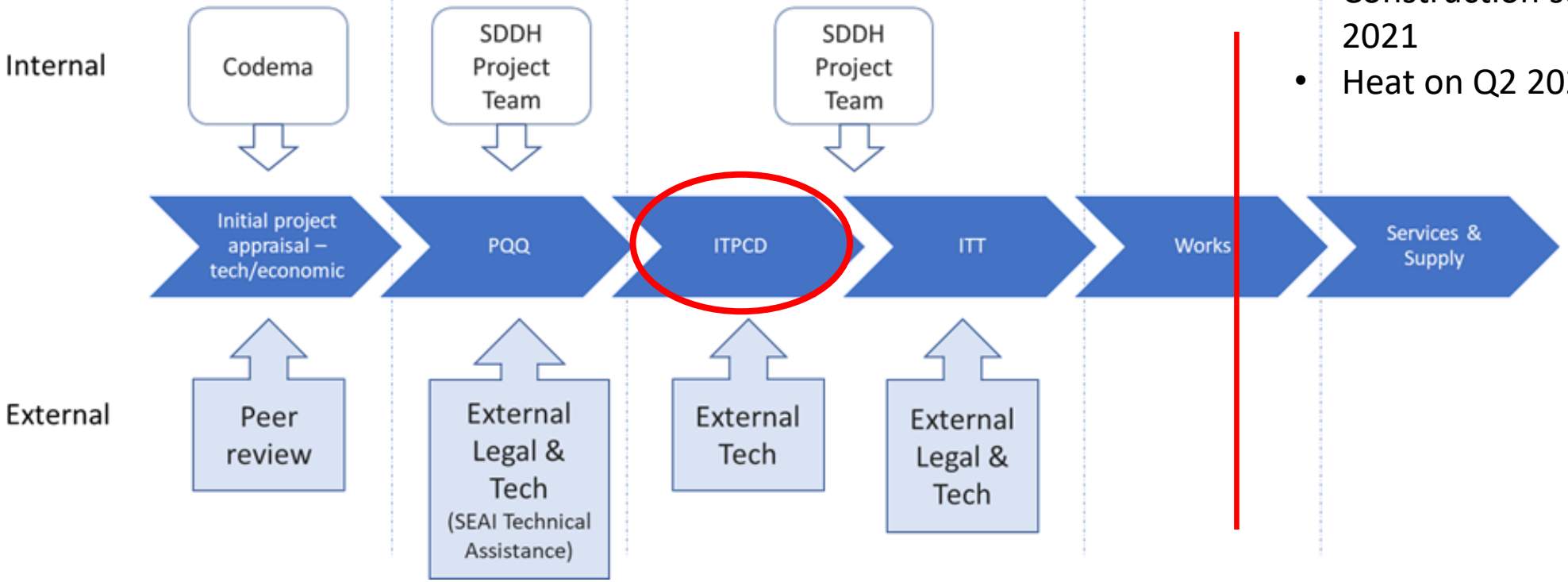
TDHS Design Concept



Design Developed Through Competitive Dialogue



- SDDH Co. set up
- Secured funding – CAF, HeatNet, SDCC, ESCo
- Construction started Q1 2021
- Heat on Q2 2022

TDHS Design Concept

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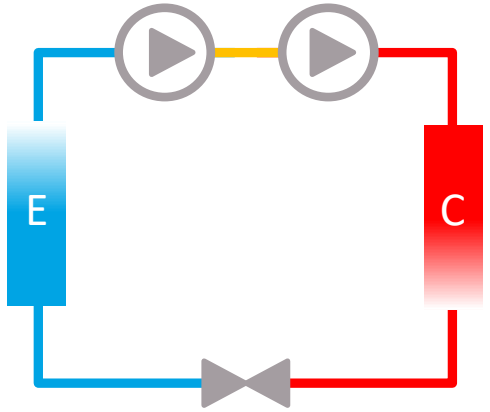
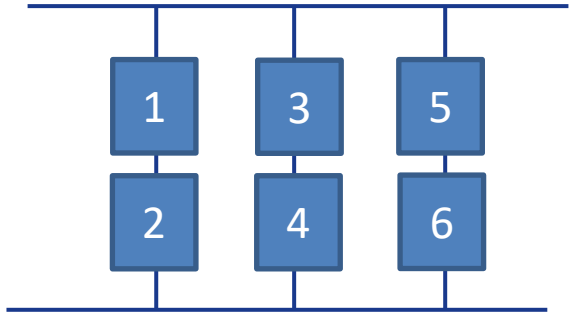
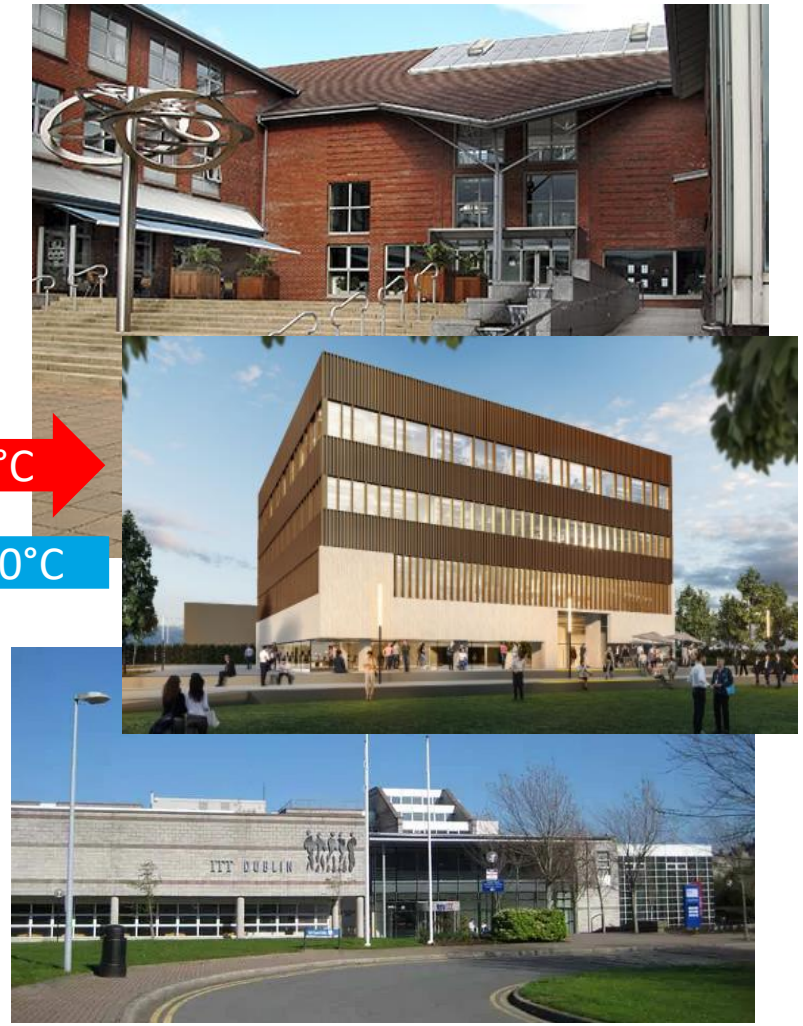
2-Stage Heat Pump

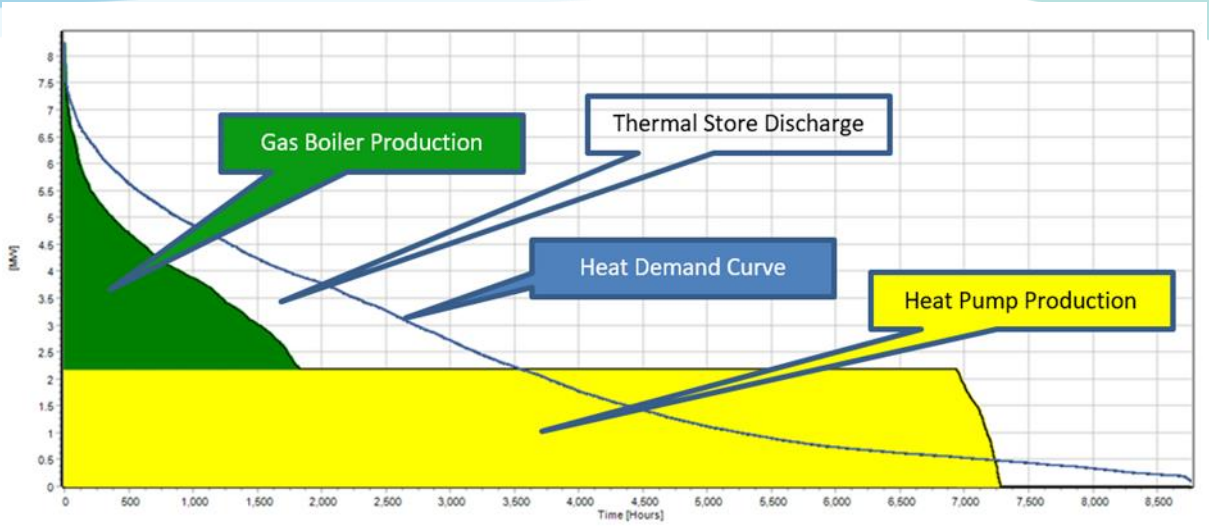


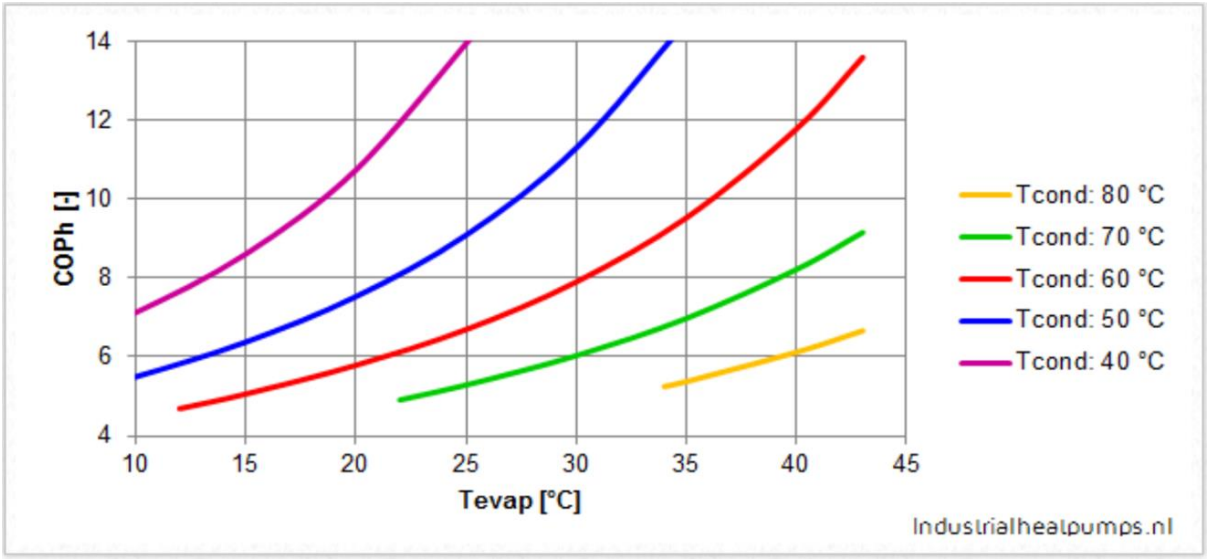




The Heat Pump

- Refrigerant (GWP, ODP, Temps, H&S, F-gas regs)
- Compression stages/cascade
- Sizing and phasing – maximise HP contribution with least financial burden
- TES (Accumulator tank, Buildings) – reduce peaks, more cost-effective alternative to battery energy storage
- Effect of source & supply temperature regimes





Tallaght District Heating Scheme

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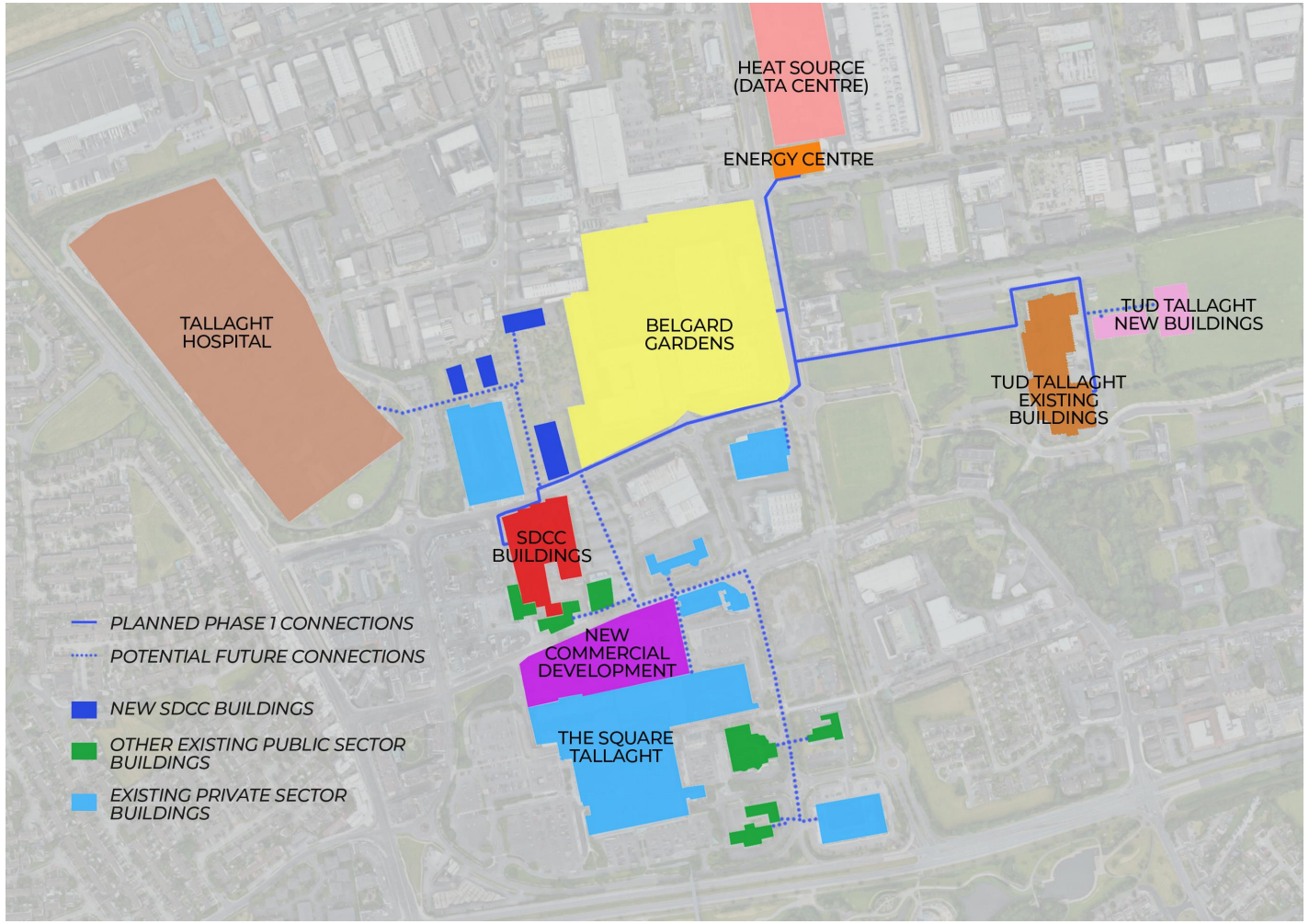
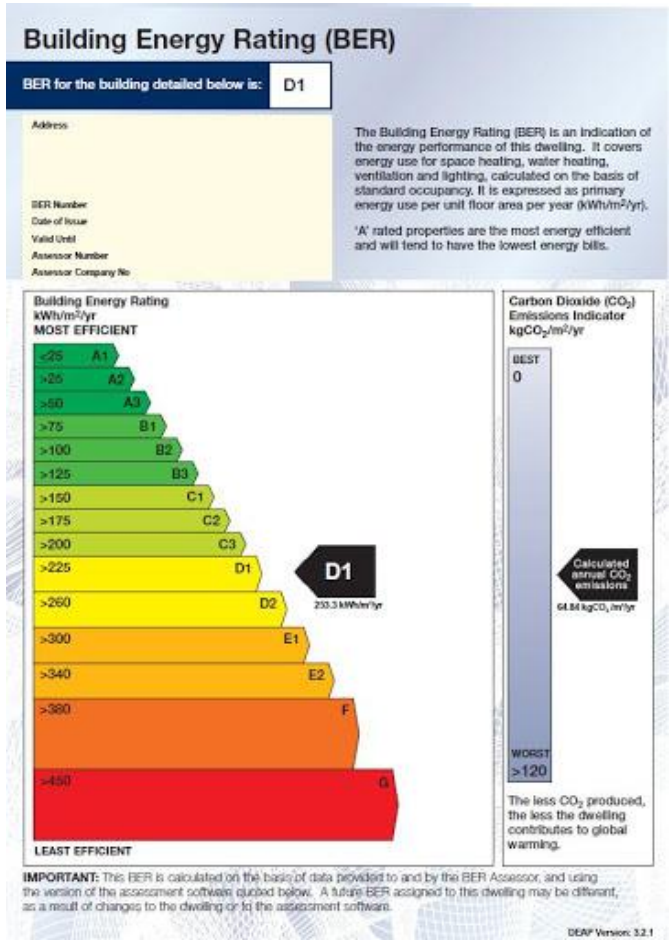


Energy System benefits:

- CO_2 savings of ~**1,400 tCO_2** per year for proposed Ph. 1
- Reduction in fossil fuel use for heating by **100%**
- Cleaner air – no particulates
- Utilises off-peak electricity
- Utilises waste heat which currently has no value
- Provides cooling as well as heating (high combined efficiency & lower water consumption)
- Integrates electricity and heat networks – allows balancing of the grid, greater utilization of renewable electricity

TDHS Specific Benefits



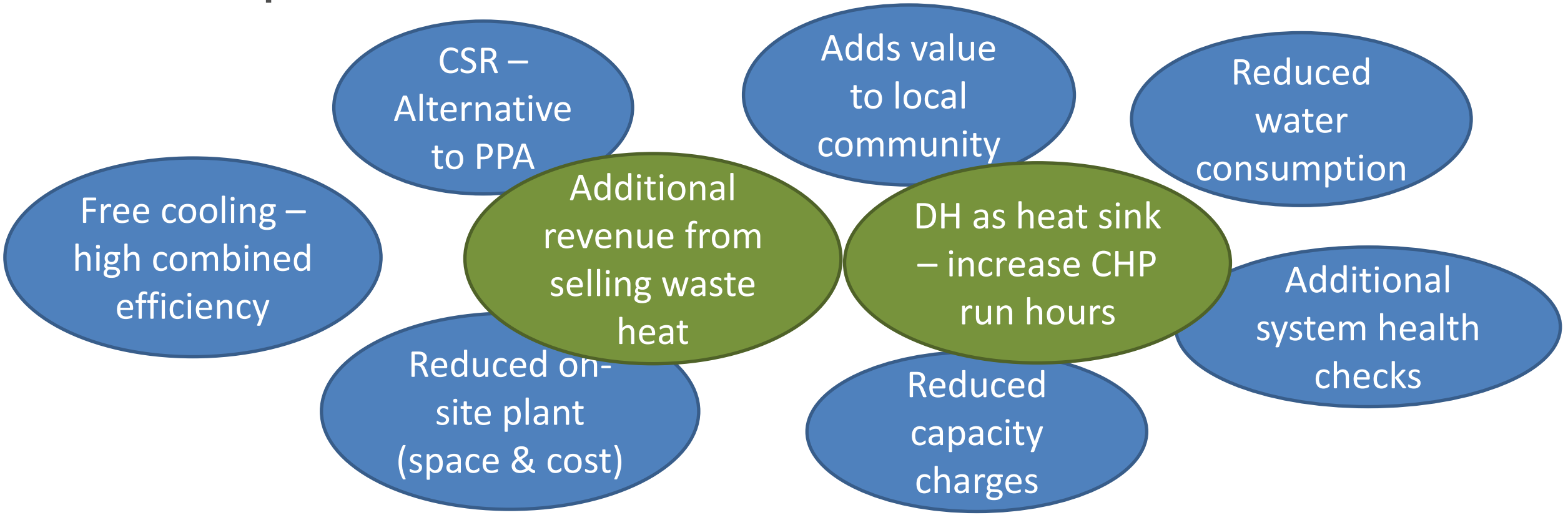
Developer benefits:

- Cost-effective Part L compliance – lower cost than the counterfactual
- Improved reputation
- Higher RE
- Trench sharing e.g. fibre optics
- Less noise (ASHP ~ 40-60 dB eq. to light traffic/conversational speech)
- No carbon monoxide or fuel leak risks
- Lower maintenance
- Provides low-cost (5 to 10% reduction), low-carbon heat
- Space saving – plant and TS are off site (€2350 per m^2)

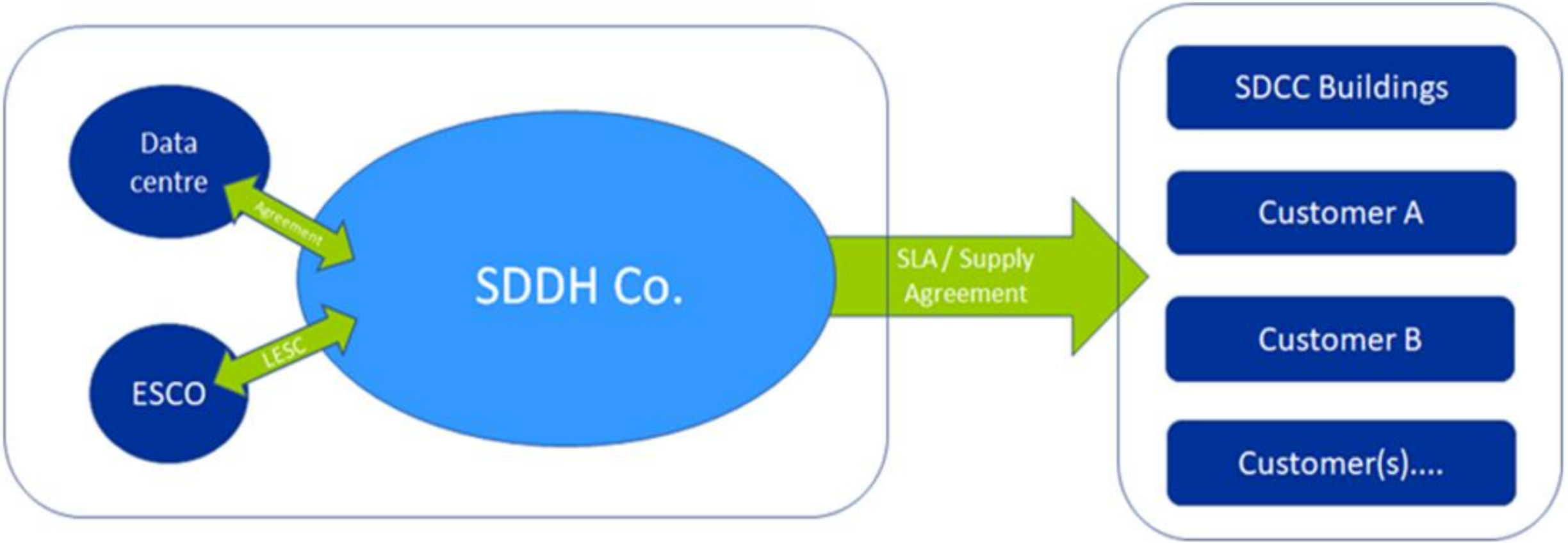
https://www.codema.ie/images/uploads/docs/TDHS_Marketing_Brochure_for_Developers.pdf

Pricing of the Waste Heat

- Waste heat available from data centre for **free** – no loss in revenue to DC for supplying waste heat, in fact there are **multiple benefits**.

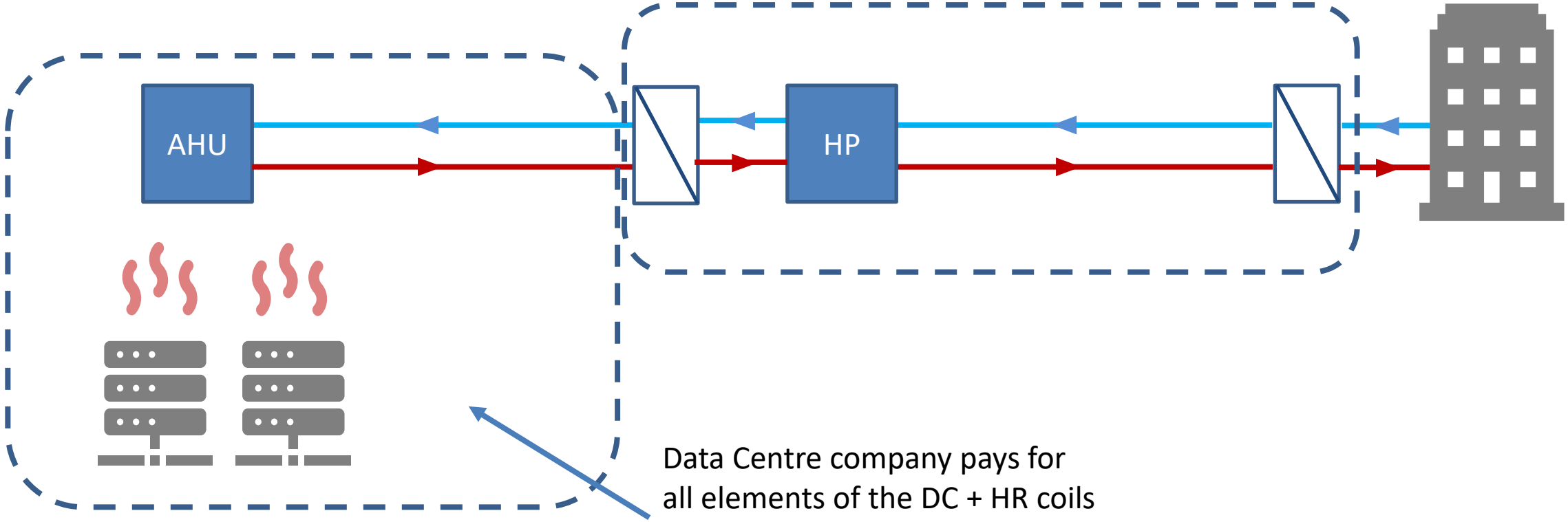


Relationship between stakeholders



Who Pays for What

DH Co. pays for everything up to and including the HEXs (EC, network, EC equipment, building substations)



Data Centre company pays for all elements of the DC + HR coils & pipework to the EC (planning condition)

TDHS Procurement – Handling Risk for DH Co.

- Output led approach to procurement – set out client requirements to be met (CO2/MWh, RE/MWh etc.)
- ESCo's bid in with a heat supply price
- SDDH Co. commits a % of the capital up front (supported with capital funding from CAF and HeatNet) – remainder supplied by ESCo
- A portion of the capital expenditure by ESCo is paid back as a fixed monthly payment over the duration of the contract
- O&M has both fixed and variable elements
- Technical risk was assigned to the ESCo but DH Co. retain control/ownership of the asset

Data Centre Waste Heat Policy Recommendations Paper

RECOMMENDATION PAPER

From Data Centres to District Heating & Cooling:
Boosting waste heat recovery to support decarbonisation

The climate emergency calls for a swift and radical transformation of the energy system. Delivering sustainable heating and cooling is fundamental to achieving Europe's climate neutrality ambition, as heating and cooling represent 50% of the final energy consumption in the EU.

The increasing reliance of our societies on digital infrastructures and data processing capacity will lead to increased demand in power and cooling. **Since 2010, the global internet traffic has grown 12-fold**. The resulting energy demand from data centres and data transmission networks was around 200 TWh and accounts for around **1% of global final electricity demand in 2019**[1]. This equals around 6% of the global district heating demand in 2014[2]. It can be expected that the total data produced will increase by a factor of 4 by 2025[3].

The EU Green Deal proposes a path towards sustainable societies and EU leaders agreed on more ambitious greenhouse gas (GHG) emission reduction targets for 2030 and carbon neutrality by 2050. In its recent publications, **the European Commission has put a strong emphasis on the decarbonisation, greater efficiency and circularity of the heating and cooling sector**. The EU Digital Strategy[28] announced a commitment to make data centres climate-neutral by 2030, with actions to be put in place in 2021 to 2022.

In this perspective, waste heat recovery from data centres (DC) is bound to play an important role, since **almost 100% of the electricity supply to the data centre is transformed into heat**. Its recovery fosters greater energy efficiency for DC and supports the decarbonisation of district heating and cooling (DHC). There is significant heat recovery potential from unconventional waste heat sources. Approximately 1.2 EJ (or 340 TWh) per year could be recovered from unconventional waste heat sources, including data centres, which corresponds to more than 10 % of the EU's total energy demand for heat and hot water[4].

The DHC and the data centre sectors acknowledge the convergence and synergies between their sectors with the recovery and use of the waste heat generated when cooling data centre facilities into DHC.

The present paper is a joint effort between Euroheat & Power (EHP), representing the district heating and cooling sector and stakeholders from the data centre value chain, all committed to delivering on climate targets.

EHP is committed to pursuing the **full decarbonisation of DHC networks** in Europe before 2050, to contribute to the goals set out in the Paris Agreement[5]. Data centre operators and trade associations agreed to take action to make data centres **climate neutral by 2030** and thus have the opportunity to provide carbon free thermal energy with the Climate Neutral Data Centre Pact (CNDP) [6]. The data centre sector is already on its way to be **powered by 75% renewable energy in 2025 and 100% by 2030.**

These sectors came together to propose recommendations on how to better support the uptake of DC waste heat recovery in the context of the European Commission's work on the "Fit for 55" legislative Package, as well as for the national implementation of EU rules and translation into local policies and planning.

[1] IEA analysis based on Masanet, E. et al. (2020). Recalibrating global data center energy-use estimates, Science, 367(6481), 984-986, https://doi.org/10.1126/science.aba3758.
[2] Sven Werner, International review of district heating and cooling, Energy, https://doi.org/10.1016/j.energy.2017.04.045
[3] IDCs Data age 2025 study
[4] ReUseHeat project report "Accessible Urban Waste Heat" https://www.reuseheat.eu/project-documents-newsletter/
[5] See: https://www.euroheat.org/wp-content/uploads/2019/09/Our-DHC-Decarbonisation-Pledge.pdf
[6] See the Initiative: https://www.climateneutraldatacentre.net/self-regulatory-initiative/

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[Recommendation Paper: From Data Centres to DHC - Boosting waste heat recovery to support decarbonisation]

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