# The Public Sector's Role in Developing 4th Generation DHC

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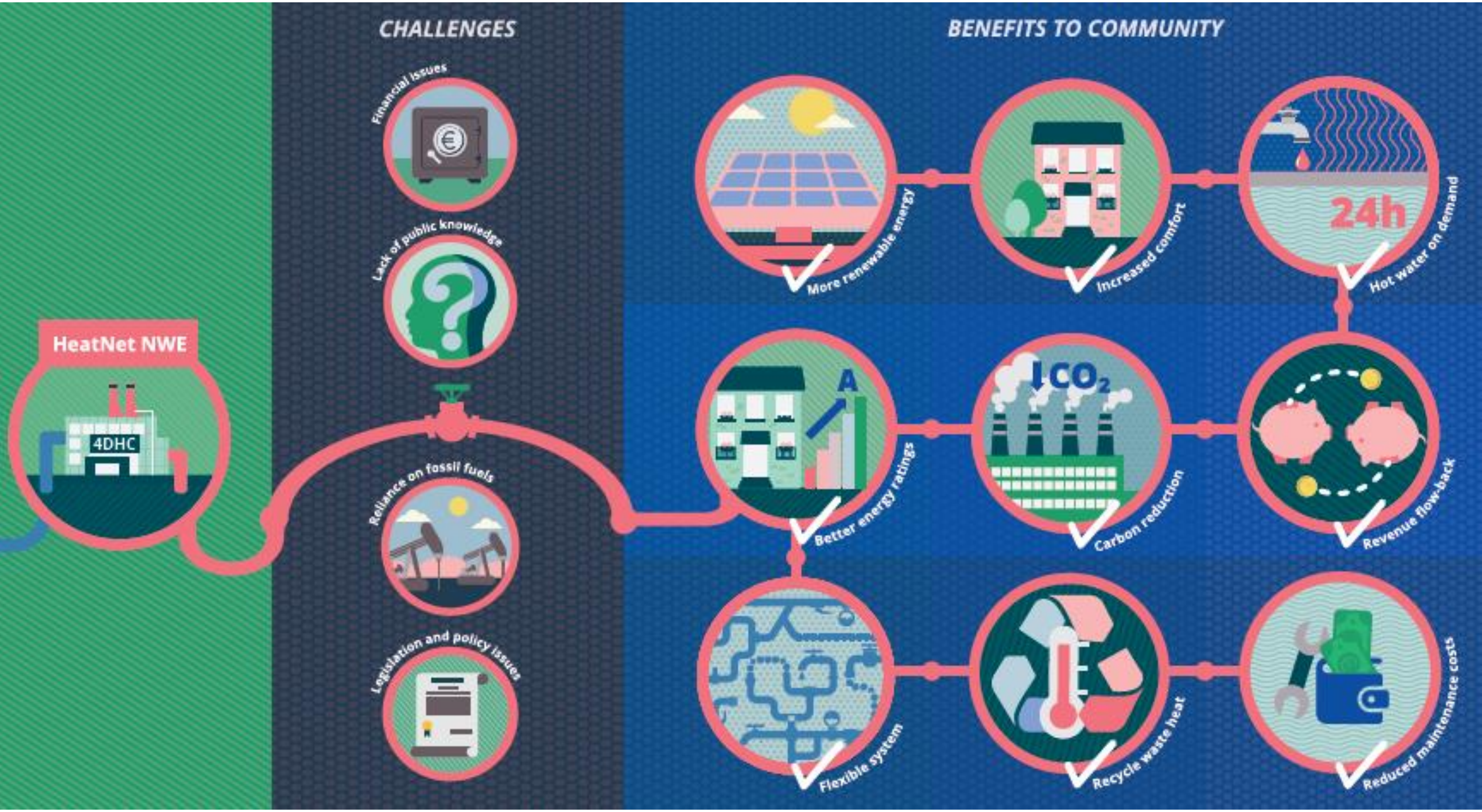
# Welcome to HeatNet Webinar!

*Dec Mc Cormac, Project Manager*
*HeatNet NWE*

Further Information:
https://www.nweurope.eu/projects/project-search/heatnet-transition-strategies-for-delivering-low-carbon-district-heat/


CHALLENGES
BENEFITS TO COMMUNITY
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4DHC
Financial issues
Lack of public knowledge
Reliance on fossil fuels
Legislation and policy issues
More renewable energy
Increased comfort
24h
Hot water on demand
A
Better energy ratings
$CO_2$
Carbon reduction
Revenue flow-back
Flexible system
Recycle waste heat
Reduced maintenance costs

# Today's Webinar Presenters

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*Donna Gartland*
*Senior Energy Planner*

*John O'Shea*
*Energy Systems Analyst*

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# Introduction to District Energy

*Donna Gartland*
*Senior Energy Planner*
*Codema – Dublin's Energy Agency*

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# What is District Heating & Cooling (DHC)?

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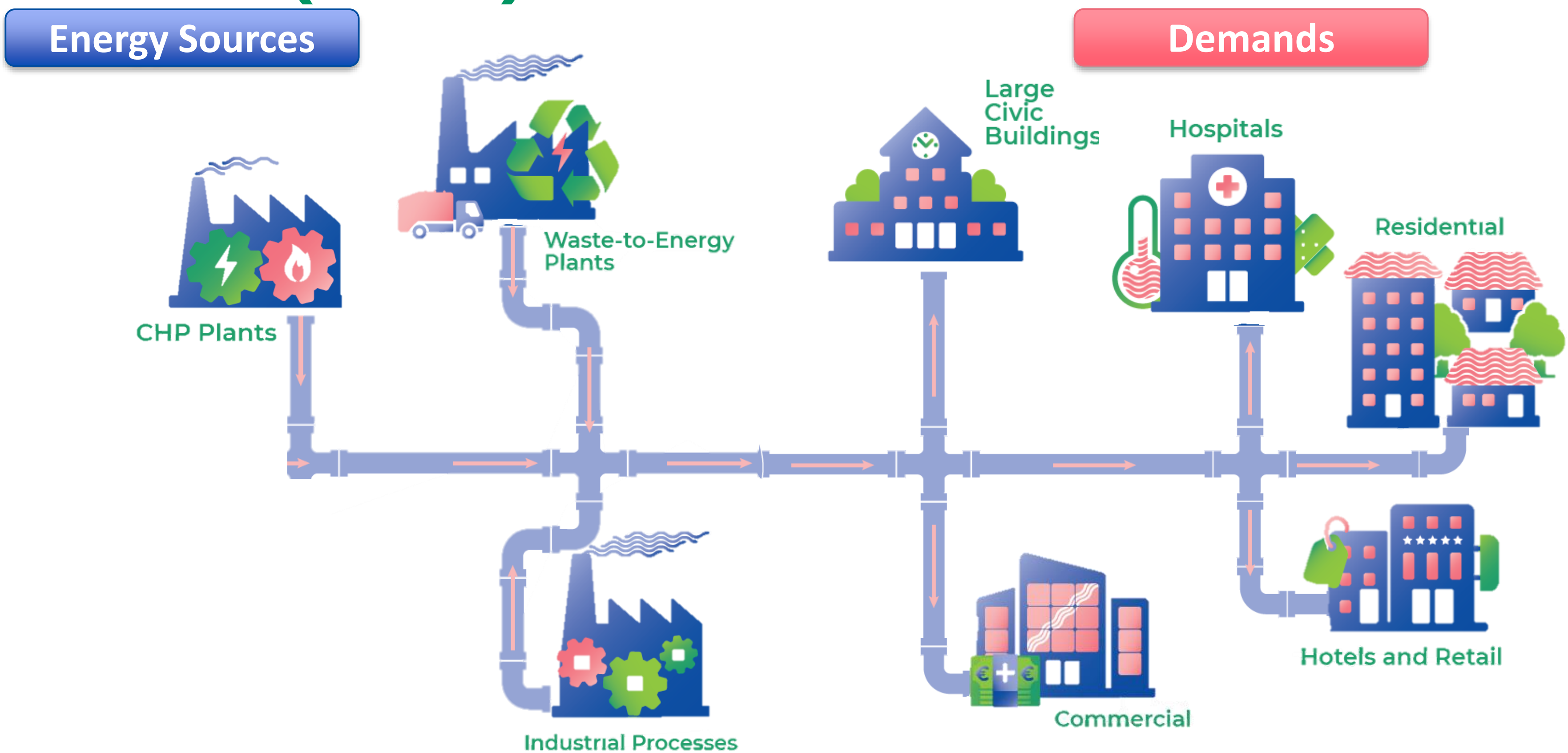

# What is 4th Generation DHC?

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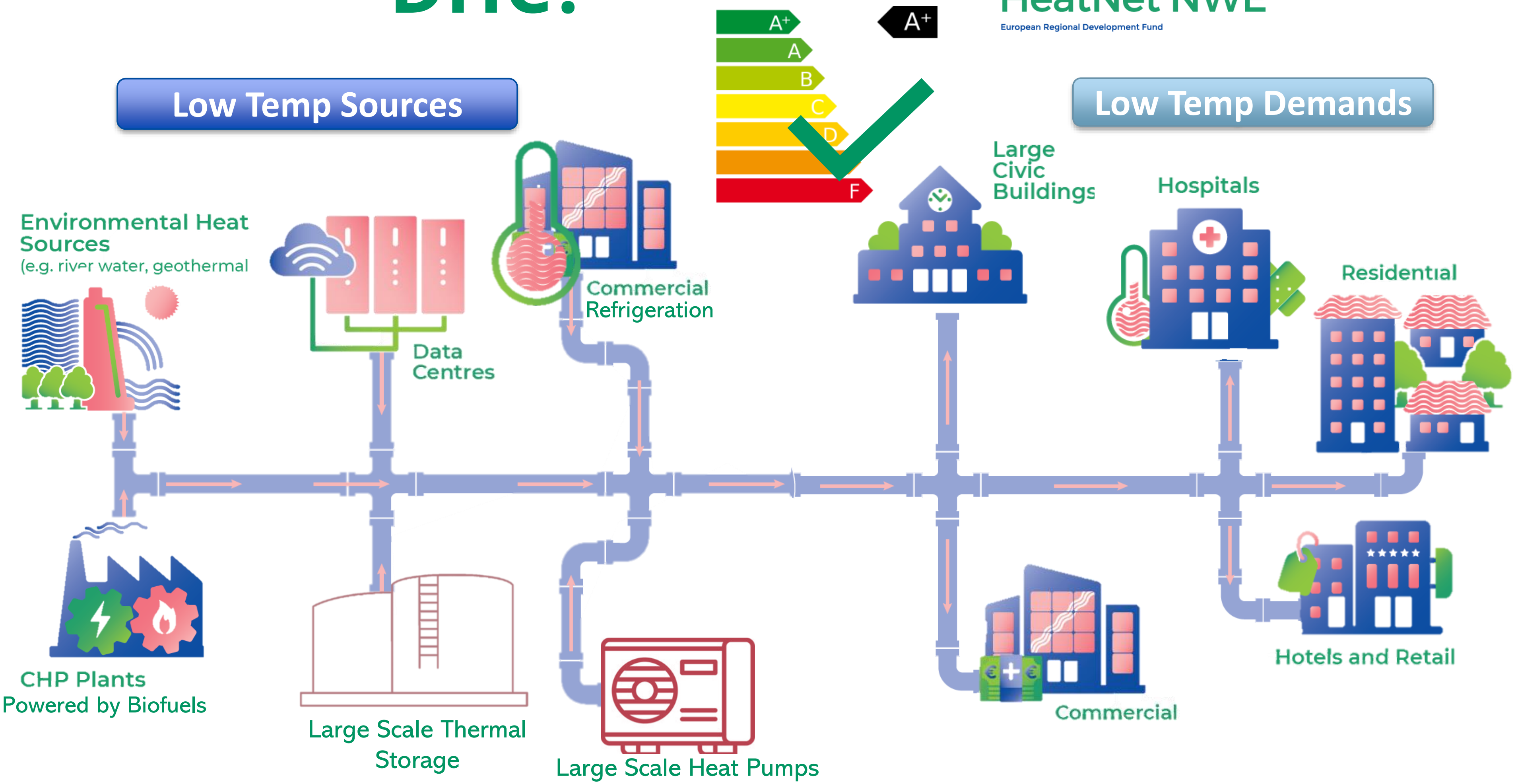
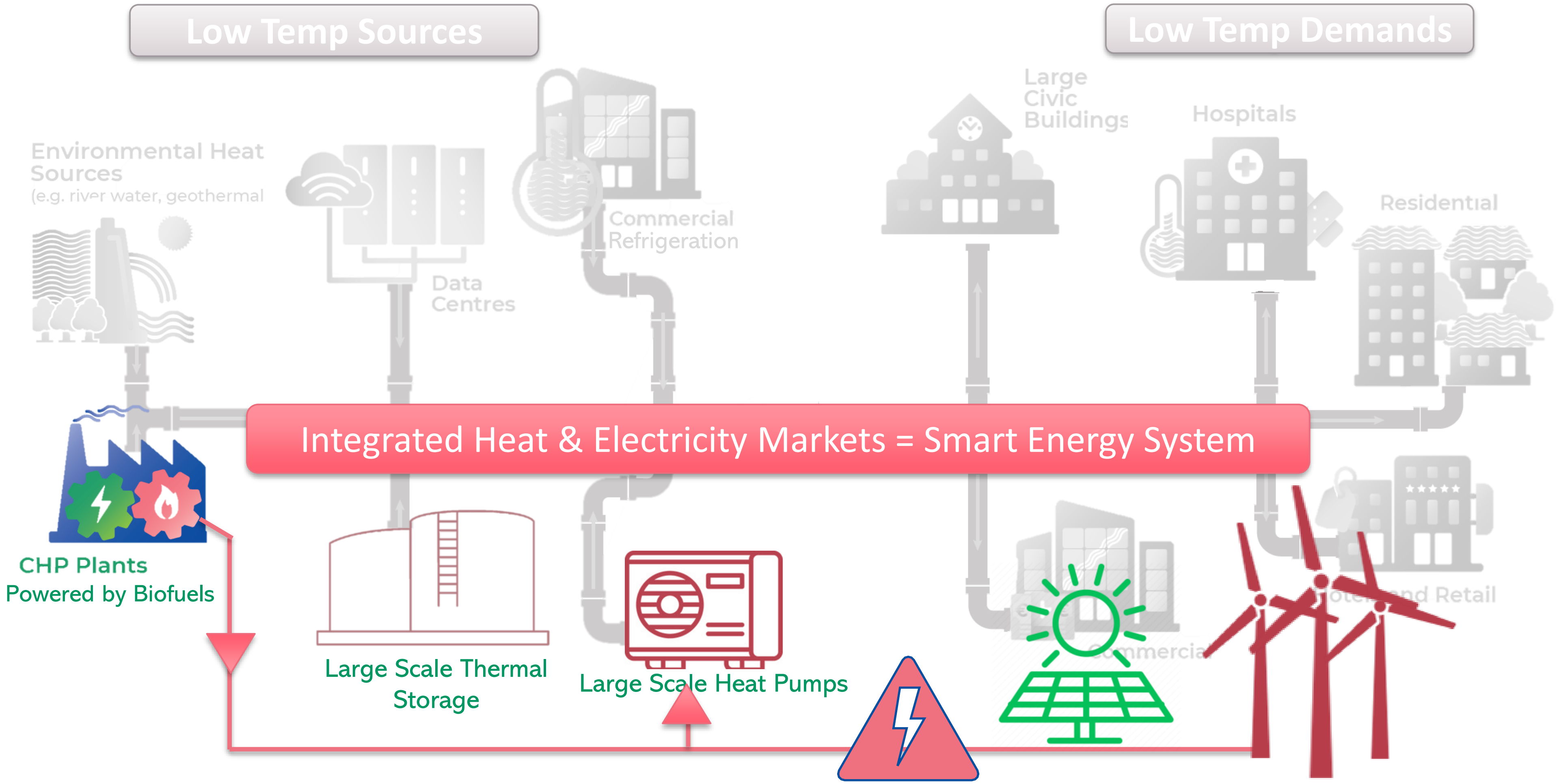


# What is 4th Generation DHC?



# Why should we develop DHC?

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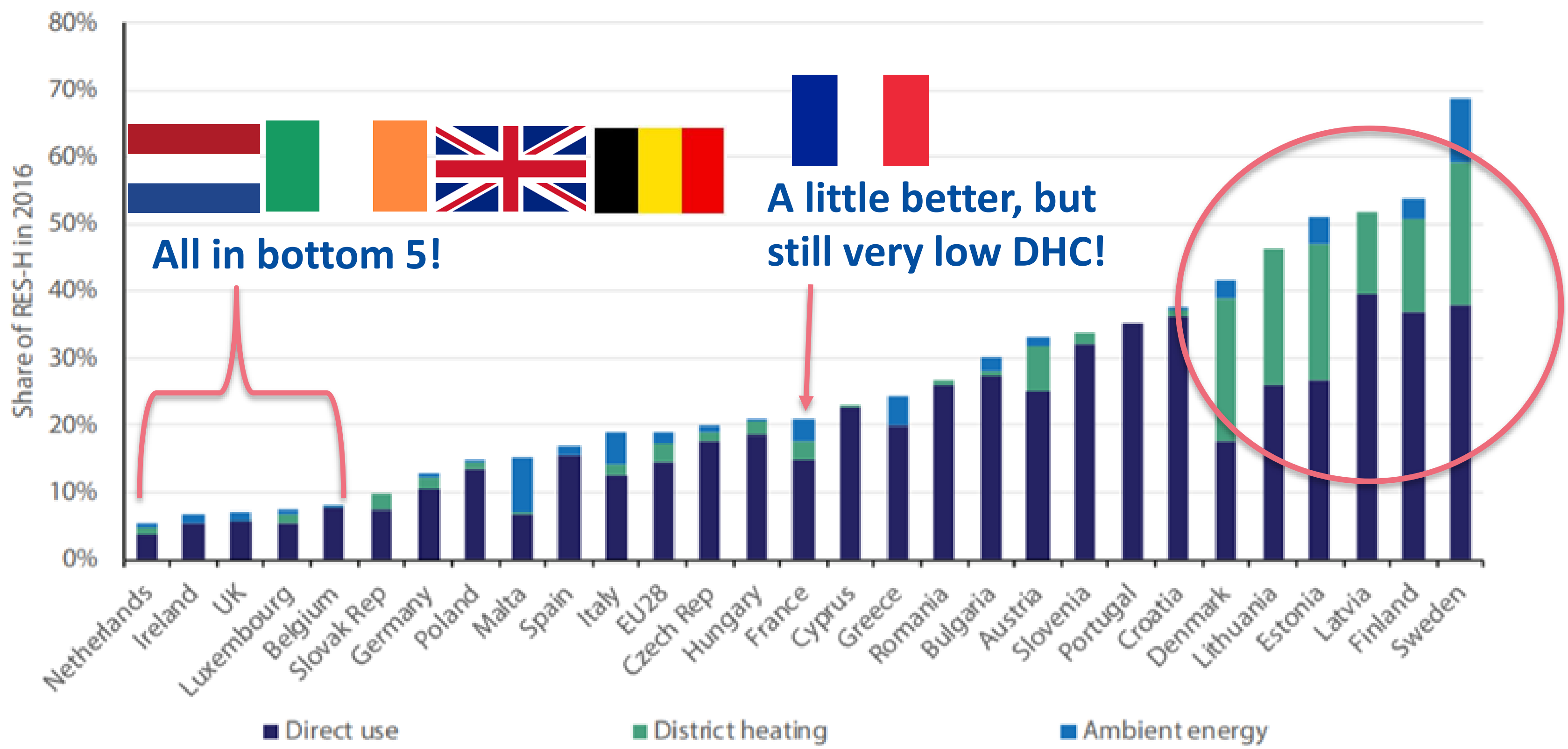
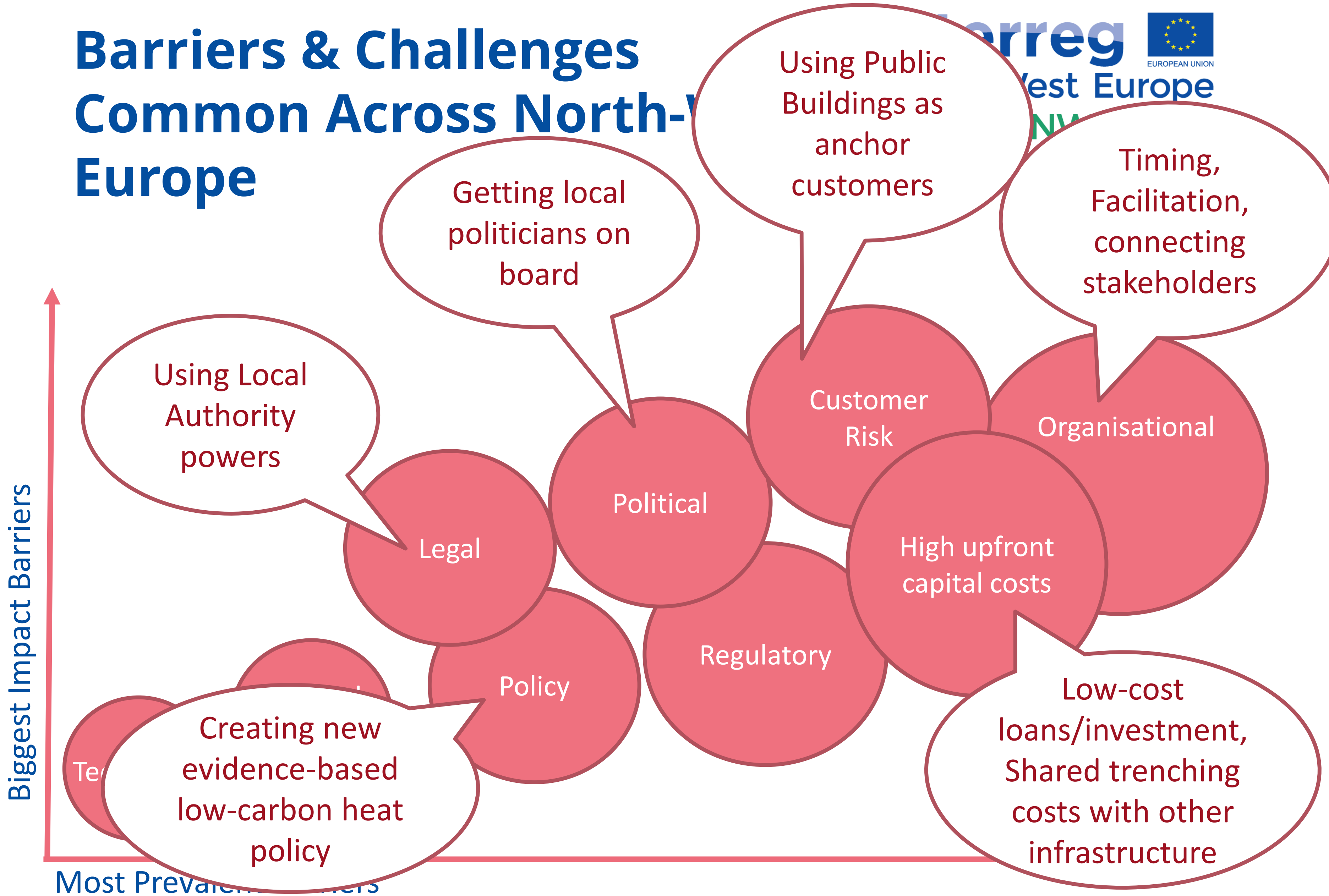



ource: Eurostat

# Barriers & Challenges Common Across North-
# Europe



# Barriers & Challenges in Ireland

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- No tradition of DHC – lack of knowledge (across all sectors - academia, public bodies, semi-state utility companies & customers)
- No municipal utilities - all delivered by national level bodies
- Municipalities have low level of autonomy
- All energy policy & regulations controlled at national level – difficult to change
- Current energy policy never designed with DHC in mind – creates unintended barriers
- No long-term planning – energy plans changed with changing political parties
- No national level Heat Plan (although there are transport & electricity plans)

**....BUT things are changing! ☺**

# Why should Public Authorities be involved?

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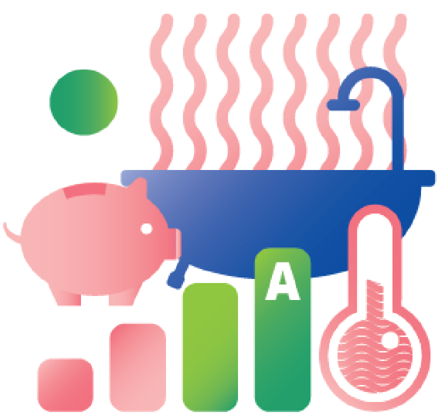
## Economic benefits

- Lower energy and maintenance bills
- Sustainable revenue stream
- Local job creation
- Cost-effective compliance with building regulations
- More attractive to industry




## Social benefits

- Reduced fuel poverty
- Better energy ratings
- Improved comfort
- Greater security of supply
- Hot water on demand

# Why should Public Authorities be involved?

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**Heat is a <u>local level energy issue</u> – it can't be solved effectively with only top-down approach**

**Most of the barriers can be <u>mitigated or de-risked by municipalities</u>**

**Most countries that have successfully rolled-out DHC did so <u>through municipalities involvement</u>**

(Also now in Ireland there are new obligations for municipalities to create supporting planning policy for DHC!)

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# How Public Authorities can Develop DHC

*John O'Shea*
*Energy Systems Analyst*
*Codema – Dublin's Energy Agency*

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# Roadmap for the Public Sector

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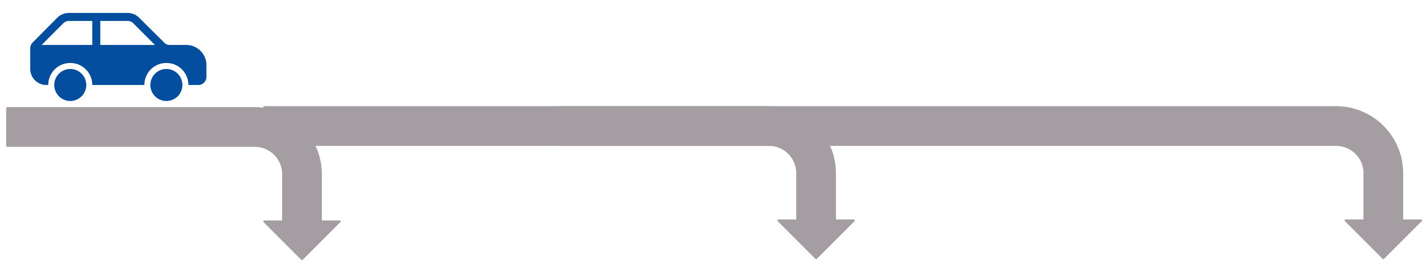
- Policy
- Planning
- Stakeholder Engagement
- Techno-economic
- Capacity Building
- Legal & Procurement



**Where to start?**
(Location, policy & market development)

**How?**
(Delivering viable projects)

**Why DH?**
(Benefits outlined by Donna)

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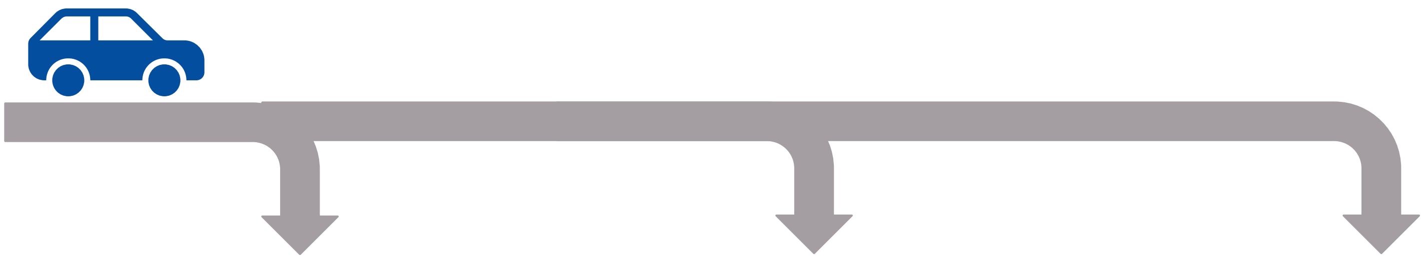

**Where to start?**
(Location, policy & market development)

# Policy



**Existing Examples from Local Authorities in Ireland:**

- Waste heat utilisation - where the primary operation on site generates waste heat
- Supporting the development of low-carbon heat networks in areas of potential
- Planning requirement to futureproof buildings for connection to DH within designated DH zones

# Policy

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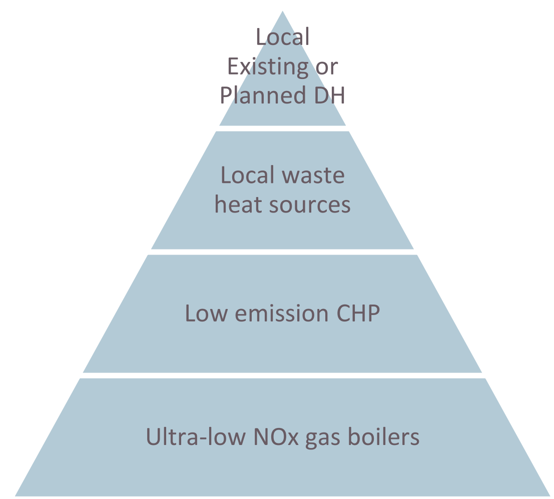
## **Further Policy Options – International Examples:**

- Designate DH zones based on demand
- Install communal heating in DH priority zones supplies in accordance with a heating technology hierarchy
- Provision of space (pipe runs, energy centres, thermal storage)
- Eliminate gas-fired central heating
- Further options outlined in the SDCC Transition Roadmap



# Where to Start? - Location

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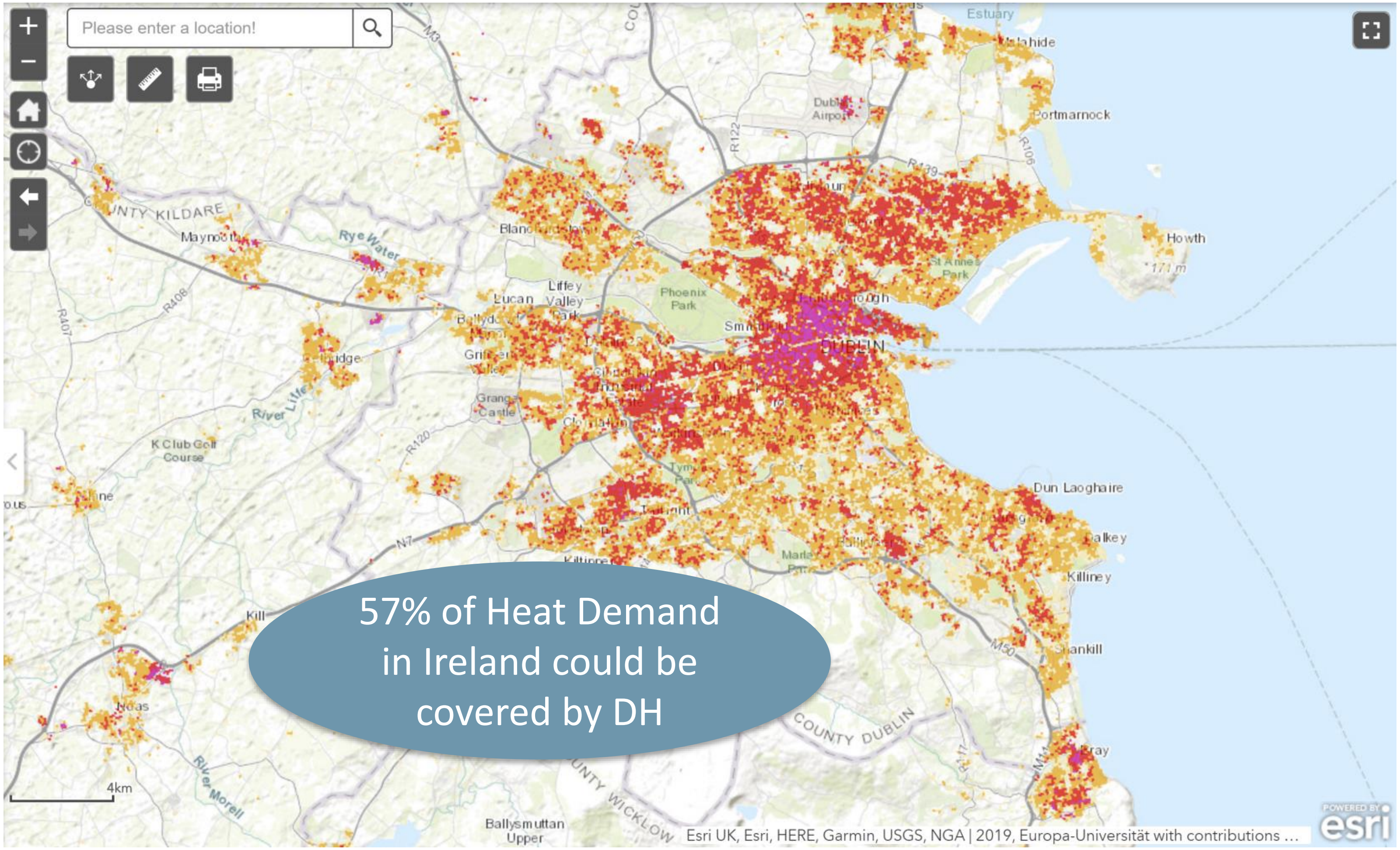


https://www.districtenergy.ie/heat-atlas

# Where to Start? - Location

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| Heat Demand | + | Heat Source | - | Physical Barriers | = | Start Here |
|---|---|---|---|---|---|---|

# Heat Sources

## 17 Heat Source Types Investigated – Approx. 70 different data sources used

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### Commercial:

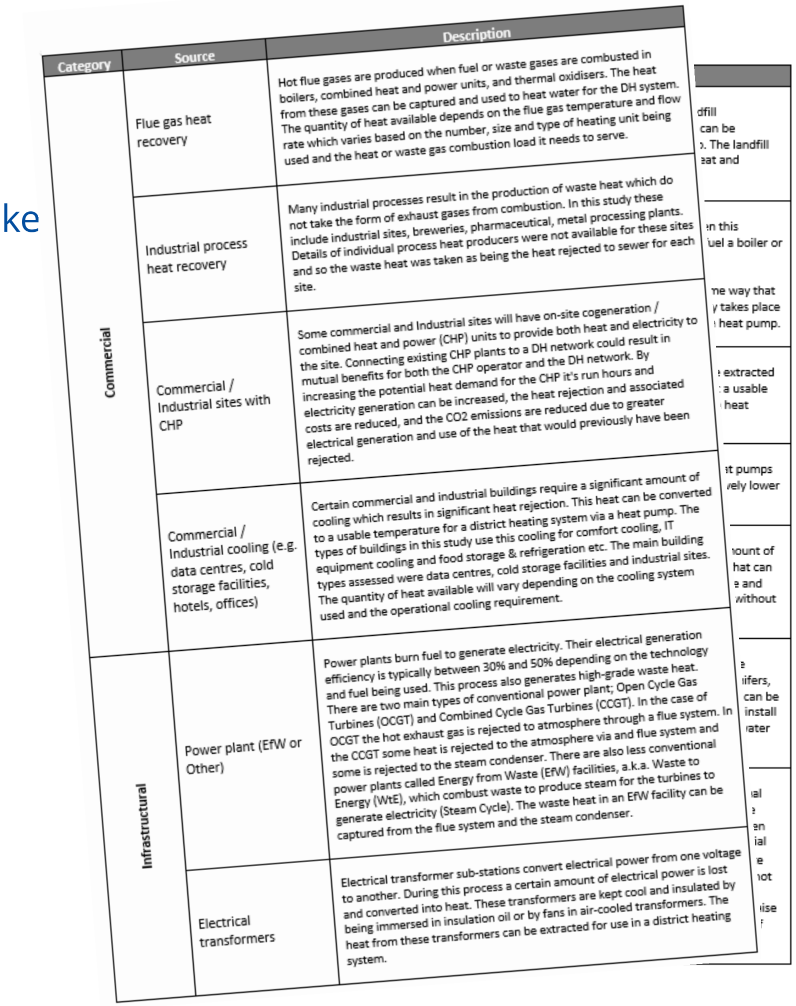
- Flue gas heat recovery
- Process heat recovery
- CHP excess heat
- Existing Biomass
- Commercial/Industrial Cooling with Heat Offtake (e.g. Data Centres)

### Infrastructural:

- Electrical power plants (CCGT, OCGT, EfW)
- Electrical transformer substations
- Landfill biogas
- Landfill waste heat
- WWTW biogas
- WWTW waste heat
- Sewer waste heat (EPA Licence data)

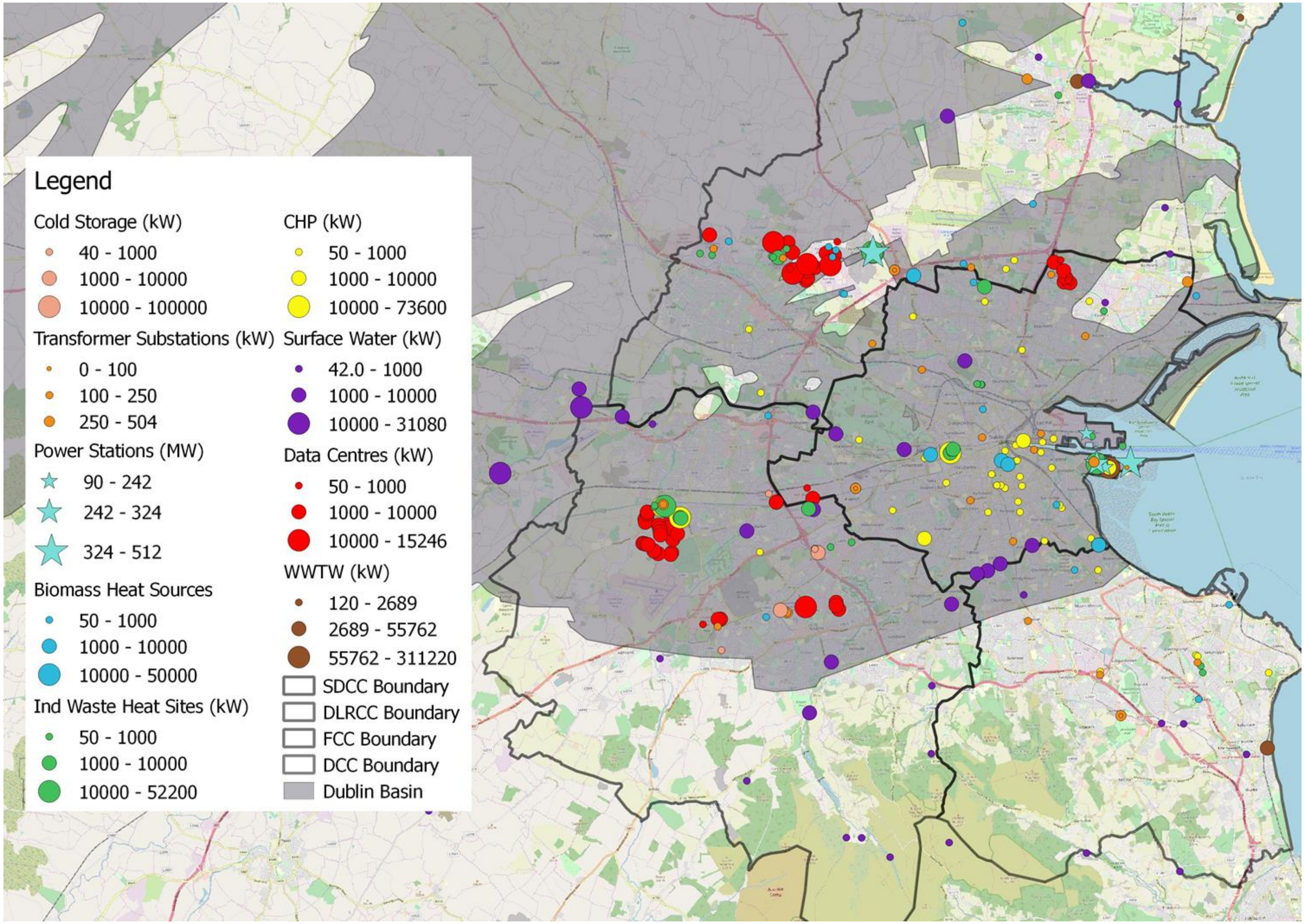
### Environmental:

- Air (ASHP)
- Surface water (HP)
- Ground (GSHP) – SEAI suitability map
- Deep Geothermal
- Mine water



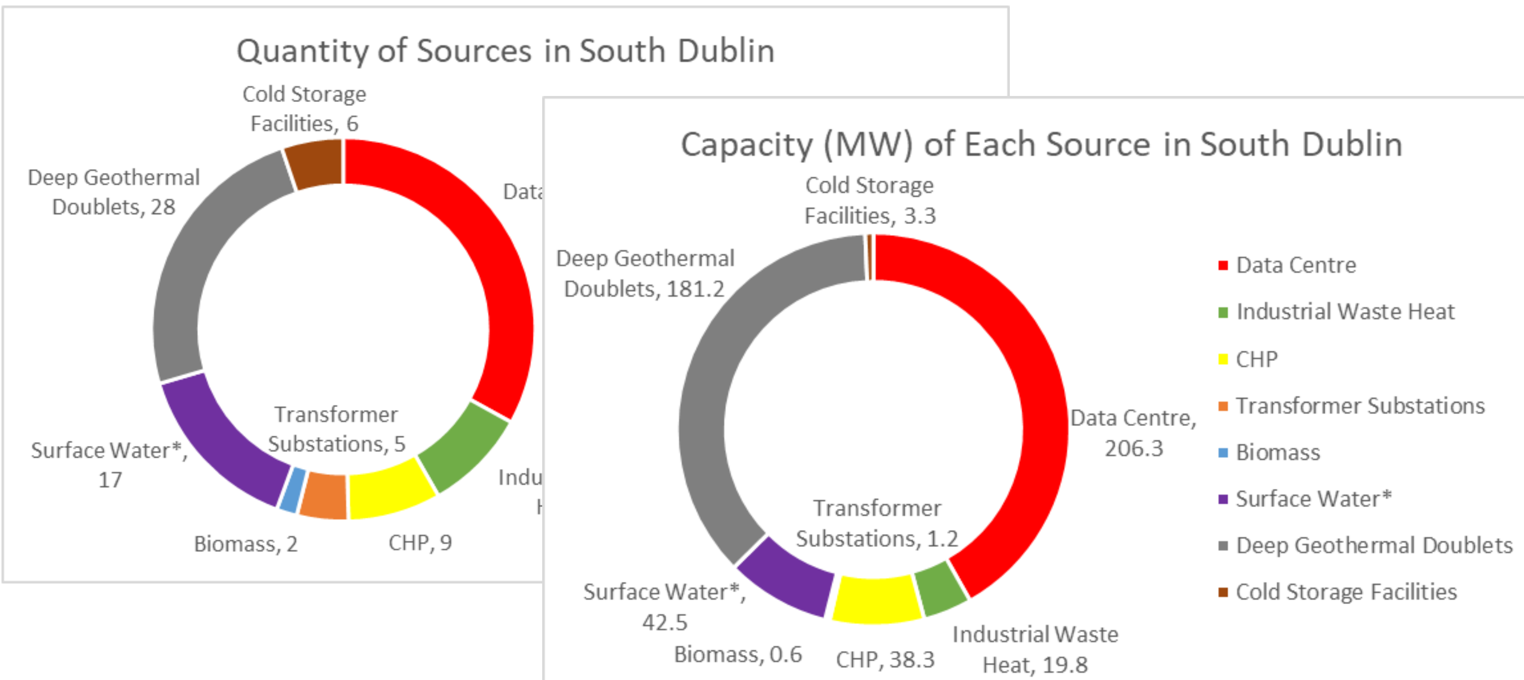
| Category | Source | Description |
|---|---|---|
| Commercial | Flue gas heat recovery | Hot flue gases are produced when fuel or waste gases are combusted in boilers, combined heat and power units, and thermal oxidisers. The heat from these gases can be captured and used to heat water for the DH system. The quantity of heat available depends on the flue gas temperature and flow rate which varies based on the number, size and type of heating unit being used and the heat or waste gas combustion load it needs to serve. |
| | Industrial process heat recovery | Many industrial processes result in the production of waste heat which do not take the form of exhaust gases from combustion. In this study these include industrial sites, breweries, pharmaceutical, metal processing plants. Details of individual process heat producers were not available for these sites and so the waste heat was taken as being the heat rejected to sewer for each site. |
| | Commercial / Industrial sites with CHP | Some commercial and Industrial sites will have on-site cogeneration / combined heat and power (CHP) units to provide both heat and electricity to the site. Connecting existing CHP plants to a DH network could result in mutual benefits for both the CHP operator and the DH network. By increasing the potential heat demand for the CHP it's run hours and electricity generation can be increased, the heat rejection and associated costs are reduced, and the CO2 emissions are reduced due to greater electrical generation and use of the heat that would previously have been rejected. |
| | Commercial / Industrial cooling (e.g. data centres, cold storage facilities, hotels, offices) | Certain commercial and industrial buildings require a significant amount of cooling which results in significant heat rejection. This heat can be converted to a usable temperature for a district heating system via a heat pump. The types of buildings in this study use this cooling for comfort cooling, IT equipment cooling and food storage & refrigeration etc. The main building types assessed were data centres, cold storage facilities and industrial sites. The quantity of heat available will vary depending on the cooling system used and the operational cooling requirement. |
| Infrastructural | Power plant (EfW or Other) | Power plants burn fuel to generate electricity. Their electrical generation efficiency is typically between 30% and 50% depending on the technology and fuel being used. This process also generates high-grade waste heat. There are two main types of conventional power plant; Open Cycle Gas Turbines (OCGT) and Combined Cycle Gas Turbines (CCGT). In the case of OCGT the hot exhaust gas is rejected to atmosphere through a flue system. In the CCGT some heat is rejected to the atmosphere via and flue system and some is rejected to the steam condenser. There are also less conventional power plants called Energy from Waste (EfW) facilities, a.k.a. Waste to Energy (WtE), which combust waste to produce steam for the turbines to generate electricity (Steam Cycle). The waste heat in an EfW facility can be captured from the flue system and the steam condenser. |
| | Electrical transformers | Electrical transformer sub-stations convert electrical power from one voltage to another. During this process a certain amount of electrical power is lost and converted into heat. These transformers are kept cool and insulated by being immersed in insulation oil or by fans in air-cooled transformers. The heat from these transformers can be extracted for use in a district heating system. |

# Heat Sources



# Heat Sources

- Total heat capacity identified within SDCC = 493 MW
- Total number of heat sources identified = 115




*Surface water could be over 10 times the listed capacity figure if mean flow was used

# Heat Demand

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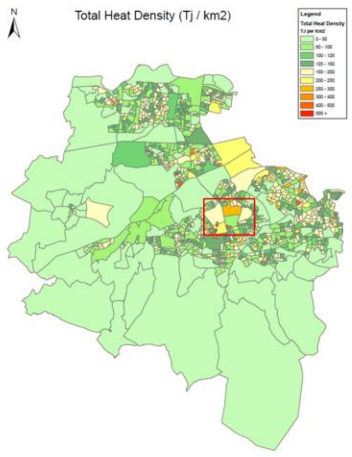
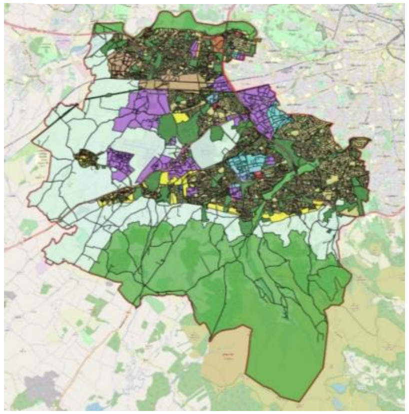
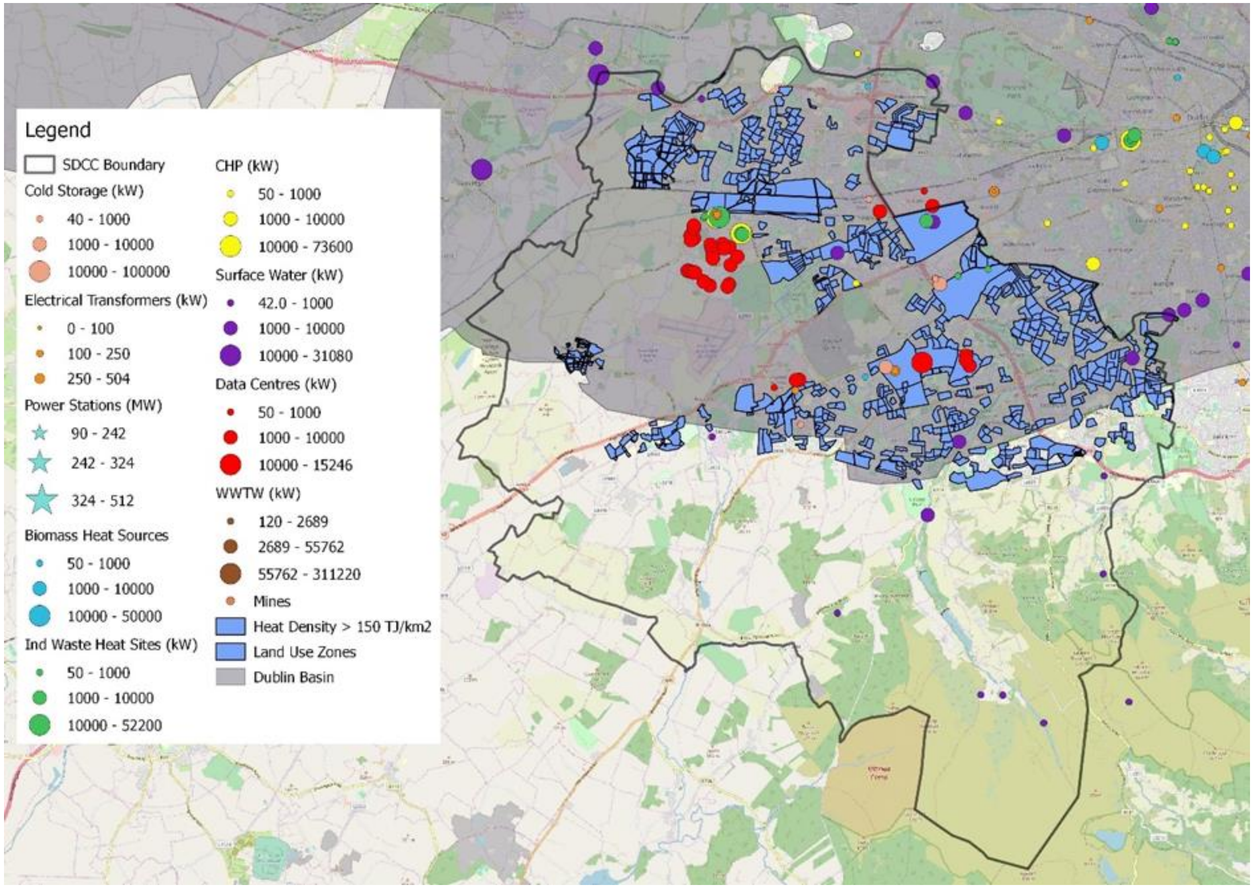
- Spatial Energy Demand Analysis (SEDA)
- Future land use zones (SDZ, RES-N, REGEN)





# Physical Obstacles

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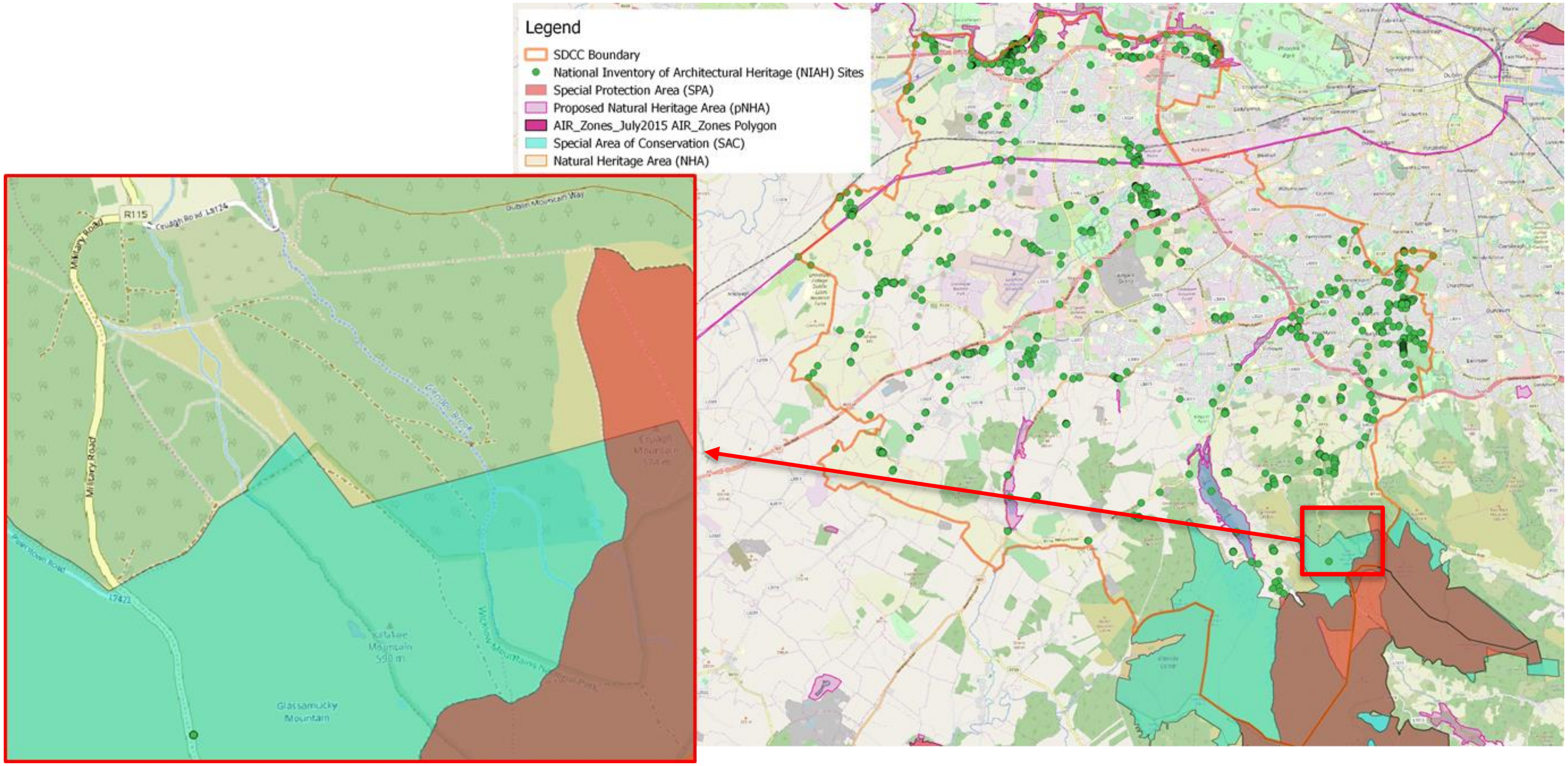
These obstacles include; Infrastructure, Historical & architectural heritage sites, Habitat, Rivers & lakes.



# Start Here

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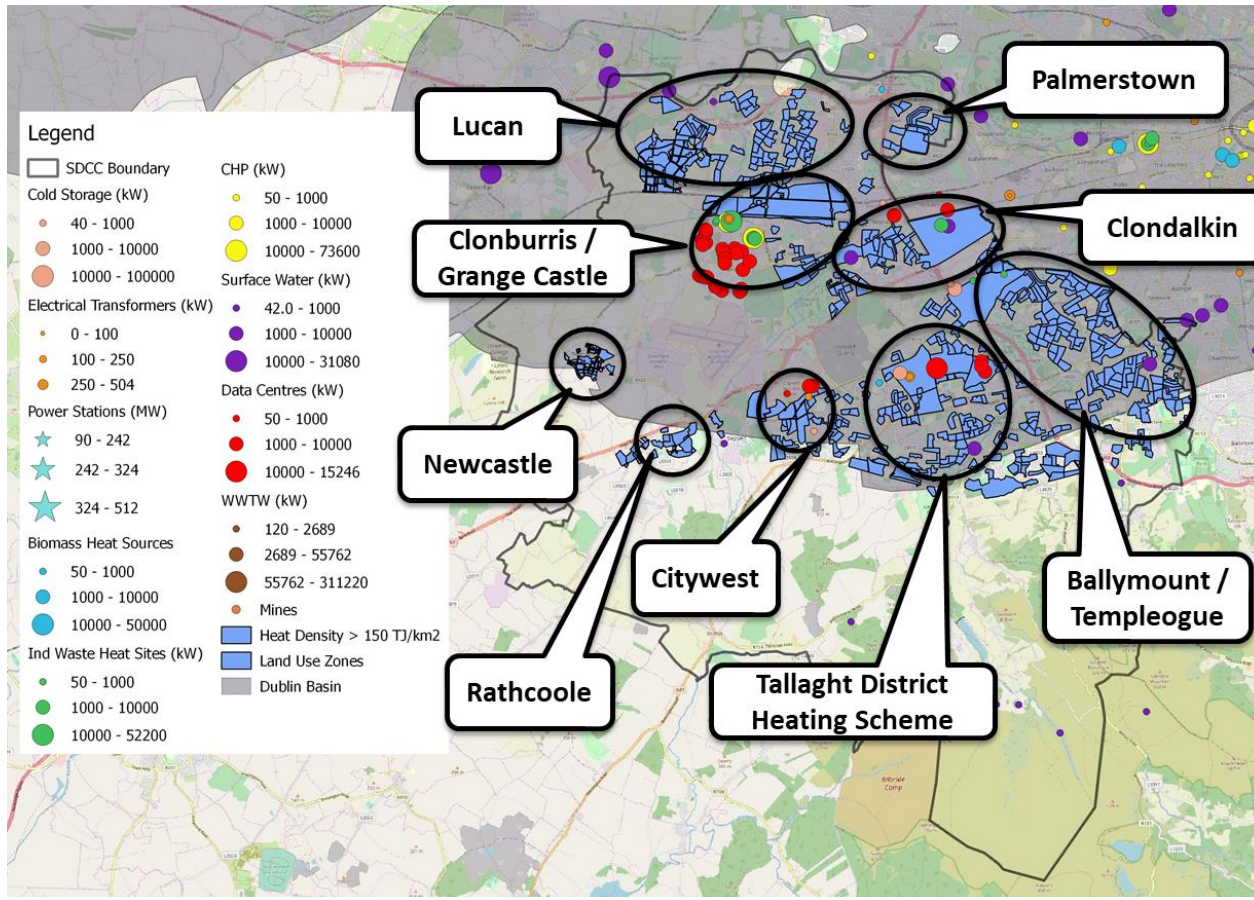
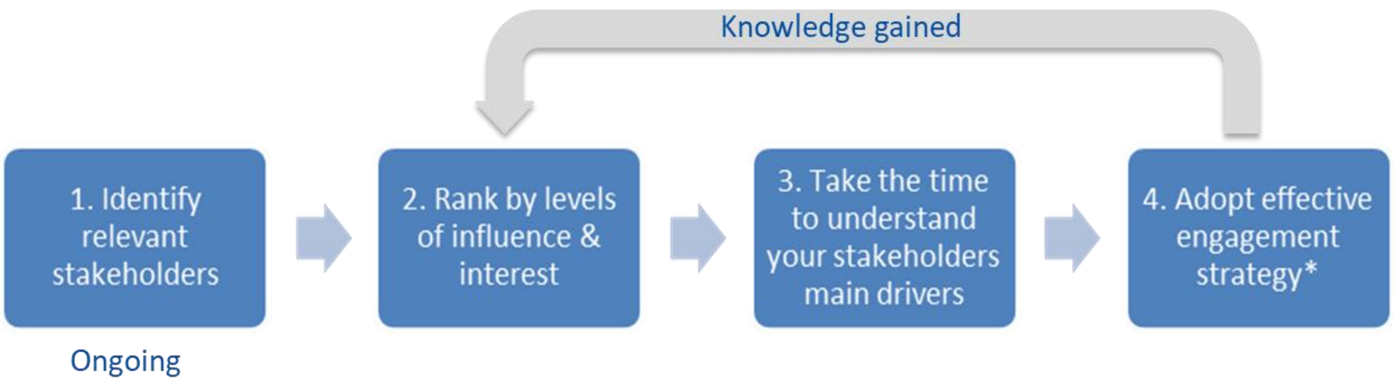
| Rank | Name |
|---|---|
| 1 | Clonburris / Grange Castle |
| 2 | Clondalkin |
| 3 | Ballymount / Templeogue |
| 4 | Palmerstown |
| 5 | Lucan |
| 6 | Citywest |
| 7 | Rathcoole |
| 8 | Newcastle |



# Where to Start with Stakeholders?

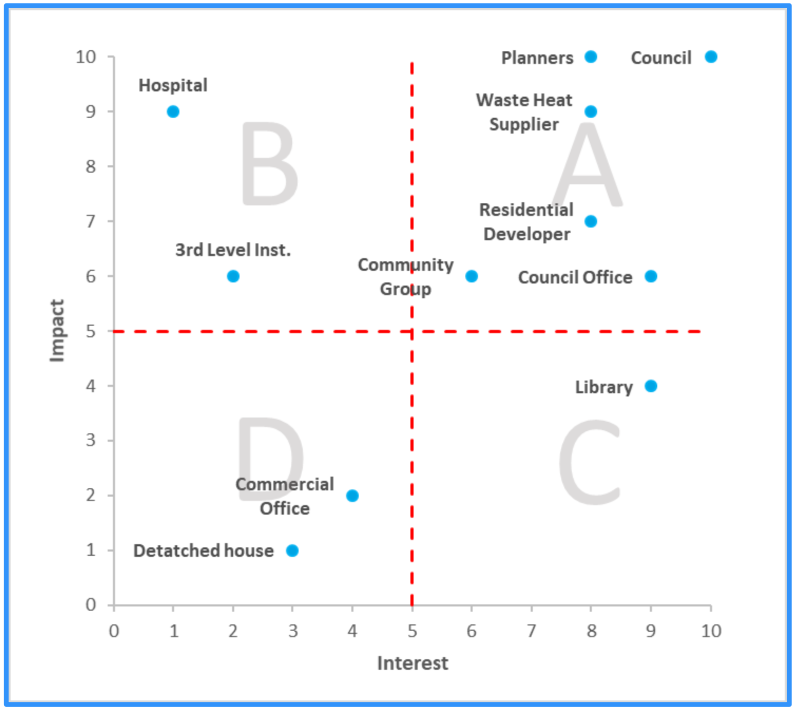


# Stakeholder Engagement

## Step 1 – Identify Stakeholders:

- Relevant stakeholders – anyone who might **contribute**, has an **interest** in or be **affected by** the DH scheme
- Think of **roles to be filled** to deliver the project and assign stakeholders to each role
- **Live list** that will be updated – more become known, changes in interest levels (e.g. personnel, drivers), load +/-

## Step 2 - Rank:



| Area | Drivers | Local Authority | Developer | Customer |
|---|---|---|---|---|
| Environmental | Carbon emissions reduction | ✓ | ✓ | ✓ |
| | Increasing renewable energy share of the heating fuel mix | ✓ | ✓ | ✓ |
| | Air quality improvement | ✓ | | |
| | Noise reduction | ✓ | ✓ | ✓ |
| Economic and financial | Reducing local authority energy costs | ✓ | | |
| | Job creation and stimulation of the local economy | ✓ | | |
| | Sustainable source of revenue for the local authority | ✓ | | |
| | Contract or service value for money | ✓ | ✓ | ✓ |
| | Space savings in connected buildings | ✓ | ✓ | ✓ |
| | Cost-effective compliance with building regulations | ✓ | ✓ | ✓ |
| | Increasing regional competitiveness – attracting industry with low-carbon, low-cost heat | ✓ | | |
| | Energy tourism | ✓ | | |
| | Trench sharing savings | ✓ | ✓ | |
| Technical | Resolving performance issues with existing building heating systems | ✓ | ✓ | ✓ |
| | Energy security and resilience | ✓ | ✓ | ✓ |
| | System reliability and maintainability | ✓ | ✓ | ✓ |
| | Innovation | ✓ | ✓ | ✓ |
| Social | Alleviating fuel poverty | ✓ | | ✓ |
| | Reducing energy costs to customers | ✓ | | ✓ |
| | Customer satisfaction (improved comfort, control, simple billing, customer service) | ✓ | | ✓ |
| | Regeneration of housing stock | ✓ | | ✓ |
| | Protection of vulnerable customers | ✓ | | ✓ |
| Political | Local authority capacity and skills development | ✓ | | |
| | Compliance with national or regional policies | ✓ | ✓ | ✓ |
| | Reputation | ✓ | ✓ | ✓ |
| Legal | Compliance with regulations | ✓ | ✓ | ✓ |
| | Compliance with planning policy | ✓ | ✓ | ✓ |
| | Compliance with metering/billing regulations | ✓ | ✓ | ✓ |
| Circumstantial | Planned new development (identified as a potential anchor load for an area-wide network) | ✓ | | |
| | Capital funding becomes available | ✓ | ✓ | ✓ |
| | Existing building or estate heating system reaching the end of its operational life | ✓ | ✓ | ✓ |
| | Local heat source (identified or planned, which could supply heat to buildings via a heat network) | ✓ | | ✓ |



## Step 3 – Stakeholder Main Drivers:

- Keeps your engagement **relevant and focused**
- Some **drivers may be positive or negative** depending on the individual stakeholder

# Stakeholder Engagement Strategy

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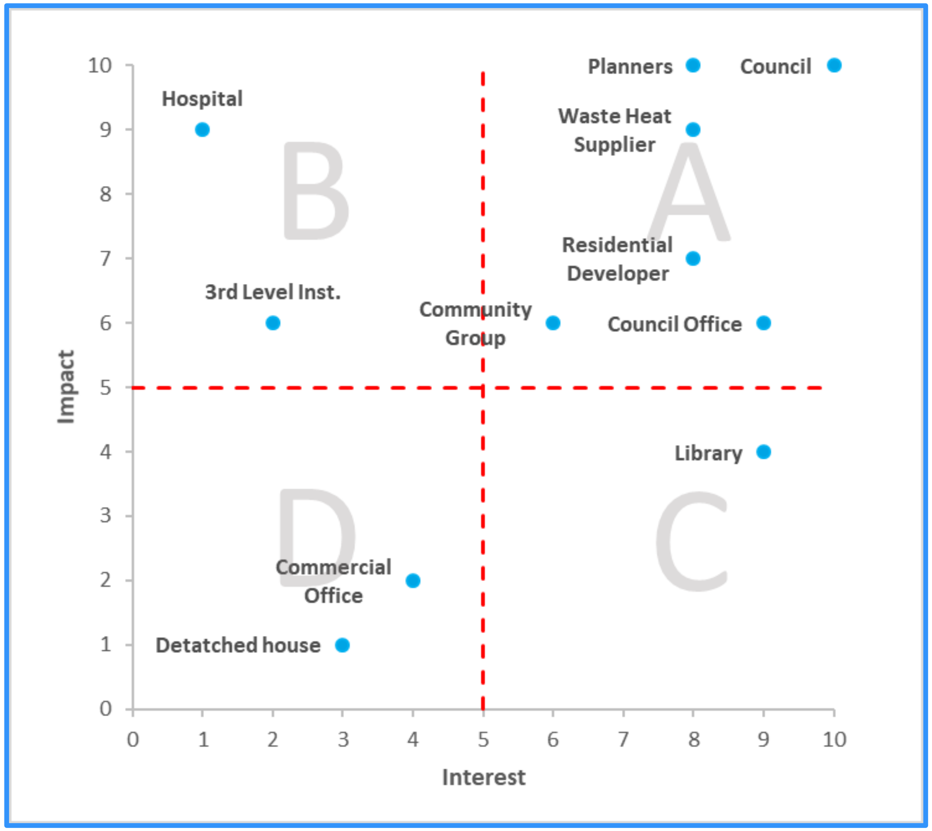
- **Category A:** two-way engagement (face to face meetings, emails, phone calls)
- **Category B:** encourage to share their views - sharing project progress updates and ask for comment
- **Category C:** keep informed about the project as it progresses – potential collaborator / influencer
- **Category D:** one-way engagement (e.g. brochures, webpage, mailing list)



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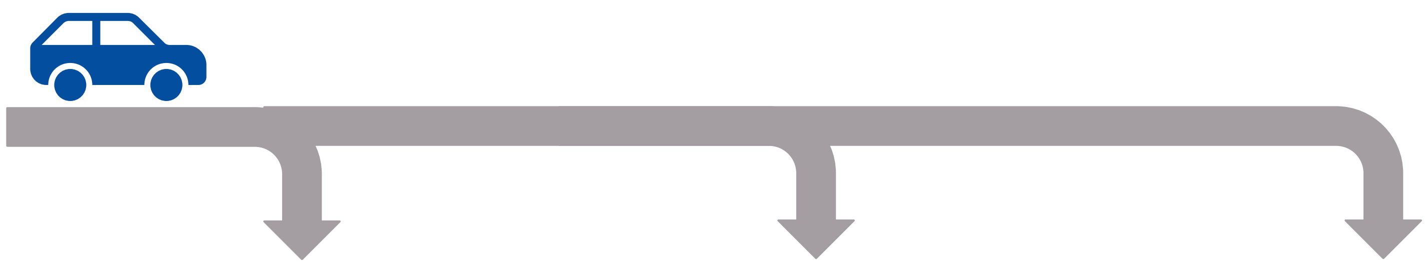

## How?
(Delivering viable projects)

# Techno-economic Analysis

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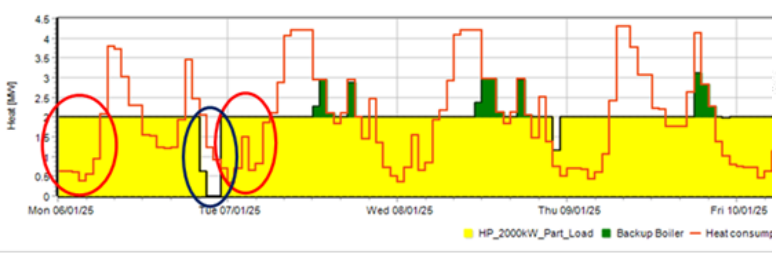
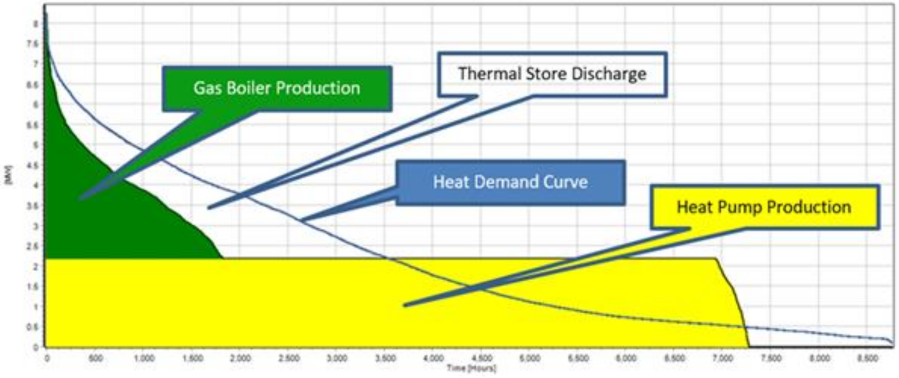
- Combined energy system and financial model
- Indicates the project's technical feasibility and financial viability (NPV, IRR etc.) - the main evidence base when deciding to take the project forward for development.
- Looks at the impact of technical design decisions on the business case for the project
- Helps ensure the scheme is optimized (low cost, low CO2)

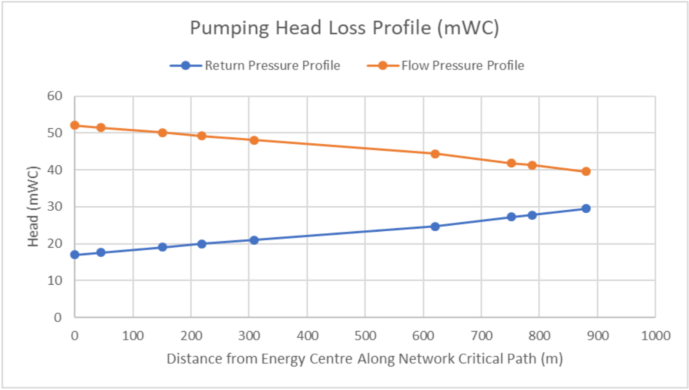


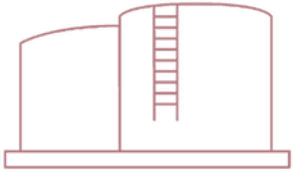
# Techno-economic Analysis

**Technical Considerations:**

- Supply temperature
- Network route – length, ground conditions, physical barriers
- Type of pipework – Steel, PEX, Insulation level
- Sizing for the future
- Heat supply technology options appraisal (including storage)
- Buildings connected and it's heating system




CHP Plants



Large Scale Thermal Storage

Large Scale Heat Pumps

# Capacity Building - Business Model Options

## Control vs Risk

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### PUBLIC SECTOR MODEL

**STRENGTHS**

- Can access public sector financing
- Revenue generation for municipality
- Greater control on flexible development, tariffs and network growth
- Can deliver aggregate demand and provide public sector anchor loads and reduce demand risk

**WEAKNESSES**

- Public body must carry technical and commercial risk
- Longer public sector procurement process
- Reduced access to equity funding
- Lack of ring-fenced budget can create risk on internal department budgets

### PUBLIC/PRIVATE HYBRID SECTOR MODELS

**STRENGTHS**

- Transfers more of the technical and commercial risk to the operator
- Shorter private sector procurement may be possible
- May be able to leverage third-party financing or can draw public sector financing

**WEAKNESSES**

- Reduced control from public partner in certain aspects
- May need to provide higher rates of return which may result in higher tariffs and reduced flexibility
- Possible early exit by partner may compromise project objectives
- In concessions, liabilities may be consolidated into public sector accounts

Taken from the International Energy Agency Annex XI Report 2017

# Procurement Options

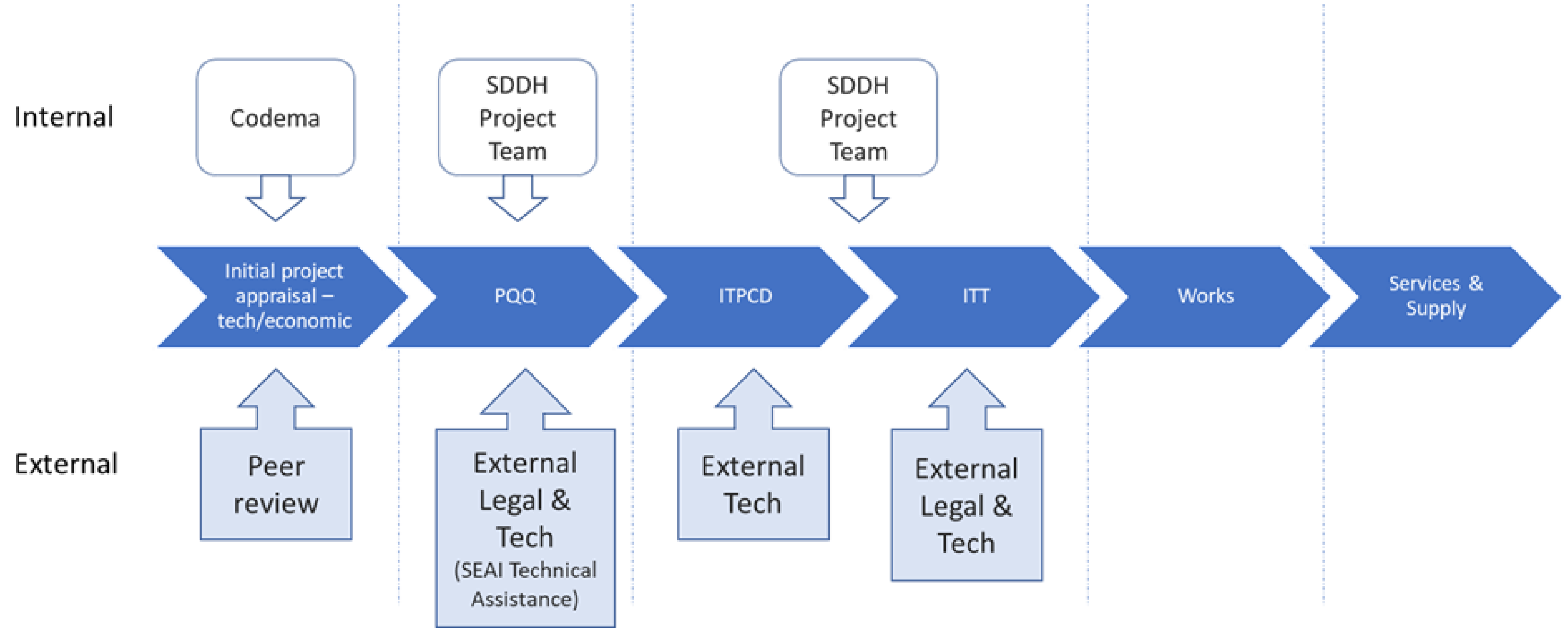
- There are multiple procurement options, each with certain benefits and weaknesses

- Example TDHS - CD was preferred:
  - Suitability to complex projects
  - No requirement to develop detailed specs
  - Transfers technical risk to ESCo but retains control

| Procedure | Where/When | Suitable option | Why |
|---|---|---|---|
| Open (Art 44) | Large number of suppliers and low value procurement | No | Too basic and restrictive |
| Restricted (Art 45) | More complex tender in a competitive market | No | Too basic and restrictive |
| Negotiated procedure with prior call for competition (Art 46) | Similar process to competitive dialogue, Large complex projects, e.g. PPP, Construction | **Yes** | Allows for award without knowing final value, and can negotiate |
| Competitive Dialogue (Art 47) | Large complex projects, e.g. PPP, Construction | **Yes** | Allows for award without knowing final value, however cannot negotiate |
| Innovation Partnerships (Art 48) | Where needs cannot be meet by services/products already on the market | No | Services/products already on the market |
| Negotiated procedure without prior call for competition (Art 49) | where no suitable tenders have been submitted in response<br><br>to a procedure with a prior call for competition | **Doubtful** | Needs to be an emergency situation where swift action is required |

# Example TDHS Procurement Flowchart

- External legal advice relates to the development of the **energy supply contract**



# How? – Roadmap for Public Sector Organisations - SDCC Example

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| | Short Term | | Medium Term | | | Long Term | |
|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| Planning | **Develop a heat map** | Use and continual improvement of heat maps | Create zoning areas for DH enabled buildings | Further investigation into the geothermal potential | | | |
| | **High-level ranking of opportunity areas** | Feasibility study for high ranking opportunity area | Funding & procurement for feasible project | Development of new DH network | Re-evaluate opportunity area rankings | Funding & procurement for feasible project | Development of new DH network |
| | **Include identified major growth areas in heat map / transition** | | Create development plan that looks to co-locate high heat demand with heat sources | | | | |
| | | Consider supplying new buildings from the return of older buildings | In 4DHC zones secure provision of thermal storage | | | | |
| | **Locate new development sites close to heat source** | Identify areas suitable for locating energy centres and thermal storage | Create low-temperature 4DHC zoning areas | | | | Investigate opportunities to link existing networks |
| | | | Consider opportunities for renewable heat sources | | | | |

# How? – Roadmap for Public Sector Organisations - SDCC Example

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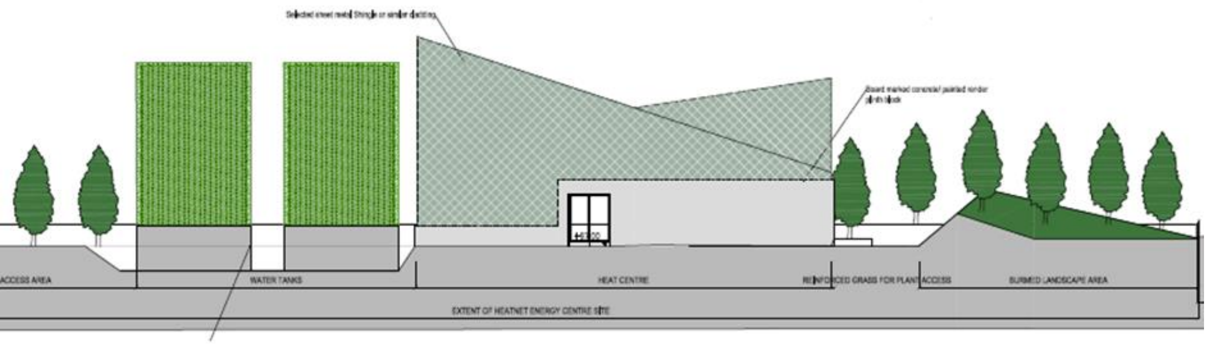
| | Short Term | | Medium Term | | | Long Term | |
|---|---|---|---|---|---|---|---|
| | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** |
| **Pilot - Proof of Concept** | | Develop TDHS as proof of concept | | Extend initial TDHS | | | |
| **Stakeholder Engagement** | **Continually engage developers / stakeholders** | | Highlight the whole energy system benefits | | | | |
| **Legal** | **Develop suite of legal documents** | | Update legal documents | | | | |
| **Policy** | **Continually work with national authorities for the inclusion of DH in applicable building regulations** | Encourage high density developments with futureproofed centralised systems | | | | | |
| | **Planning policy support for generation and distribution of low-carbon heat** | | | | | | |
| **Technical Guidance** | | Develop secondary system design guidance to improve connectability | | | | | |
| **Capacity Development** | **Create SDDH Co. - SPV** | Develop capacity within SDCC/SDDH Co. to manage the operation of TDHS | | | | Develop capacity within SDCC/SDDH Co. to operate the DH system | |

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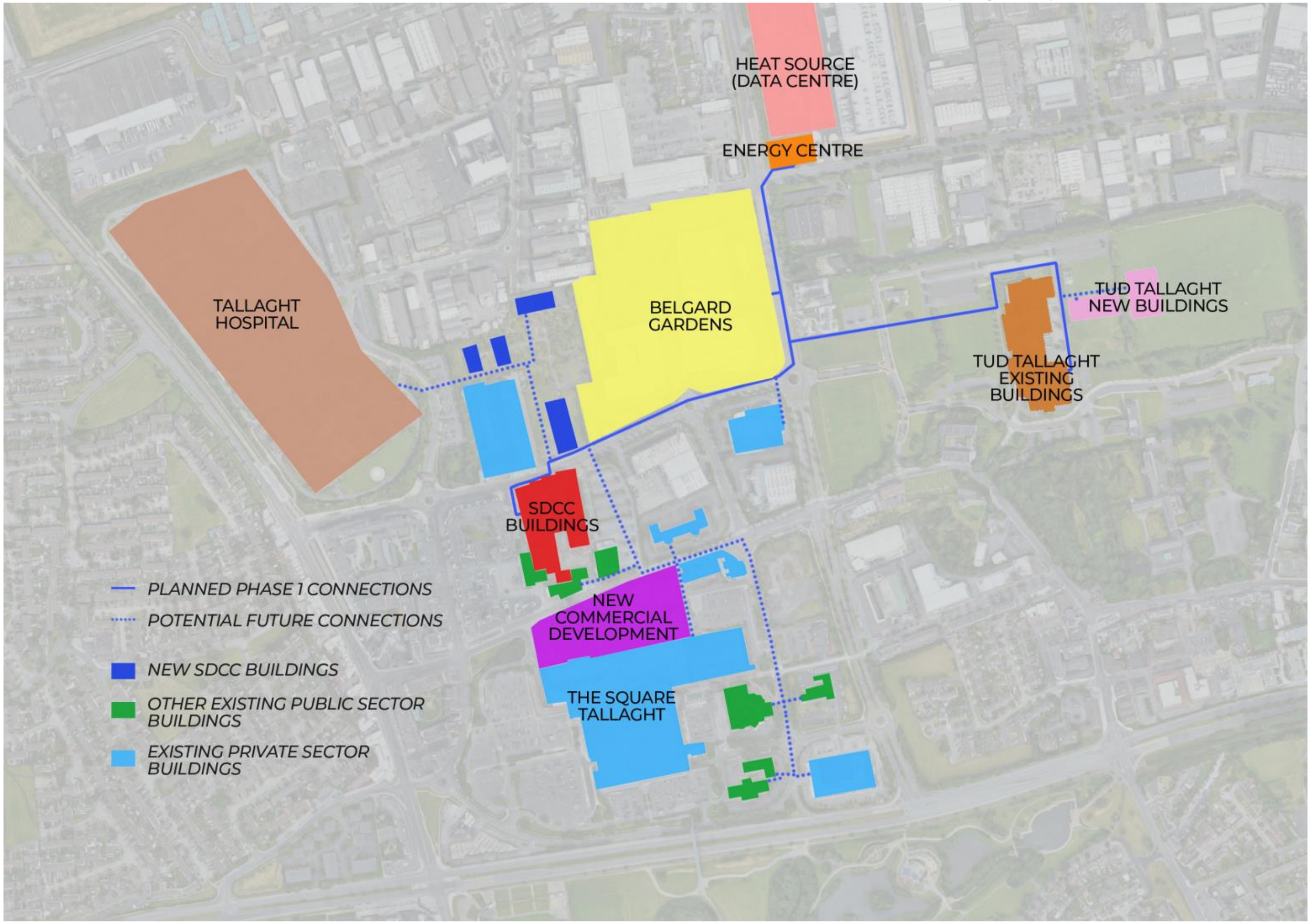
# Tallaght District Heating Scheme

Source: Data Centre Waste Heat


HEAT SOURCE
(DATA CENTRE)
ENERGY CENTRE
TALLAGHT
HOSPITAL
BELGARD
GARDENS
TUD TALLAGHT
NEW BUILDINGS
TUD TALLAGHT
EXISTING
BUILDINGS
SDCC
BUILDINGS
NEW
COMMERCIAL
DEVELOPMENT
THE SQUARE
TALLAGHT
PLANNED PHASE 1 CONNECTIONS
POTENTIAL FUTURE CONNECTIONS
NEW SDCC BUILDINGS
OTHER EXISTING PUBLIC SECTOR
BUILDINGS
EXISTING PRIVATE SECTOR
BUILDINGS

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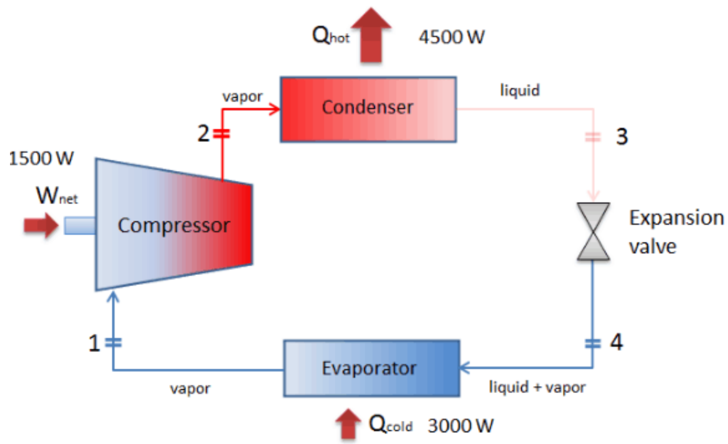
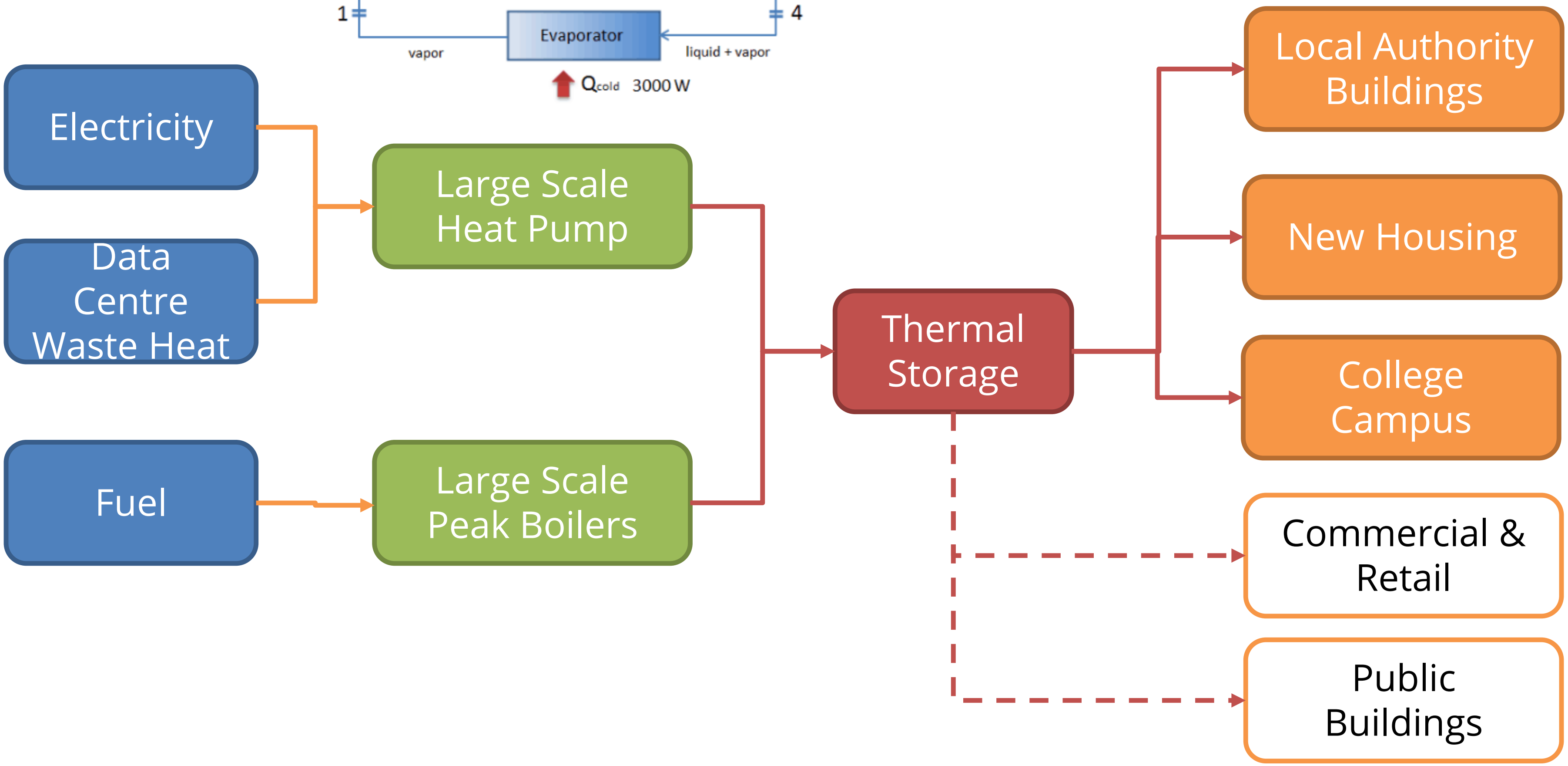
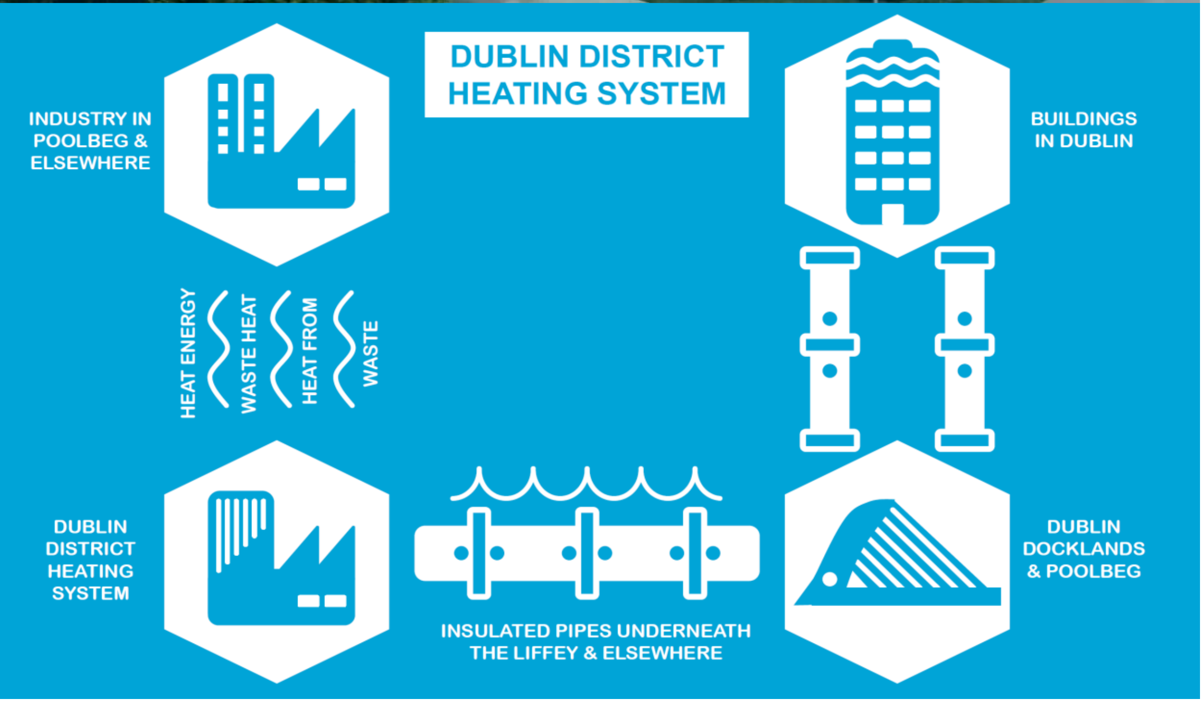


# TDHS Specific Benefits

- Utilises waste heat that currently has no value
- Provides cooling as well as heating (high combined efficiency)
- Integrates elec and heat networks – allows balancing of the grid, greater utilization of RE
- Has high potential for replication due to the growing number of data centres
- Contributes to South Dublins CO2 and EE targets
- Provides low-cost, low-carbon heat to residents in the Tallaght area

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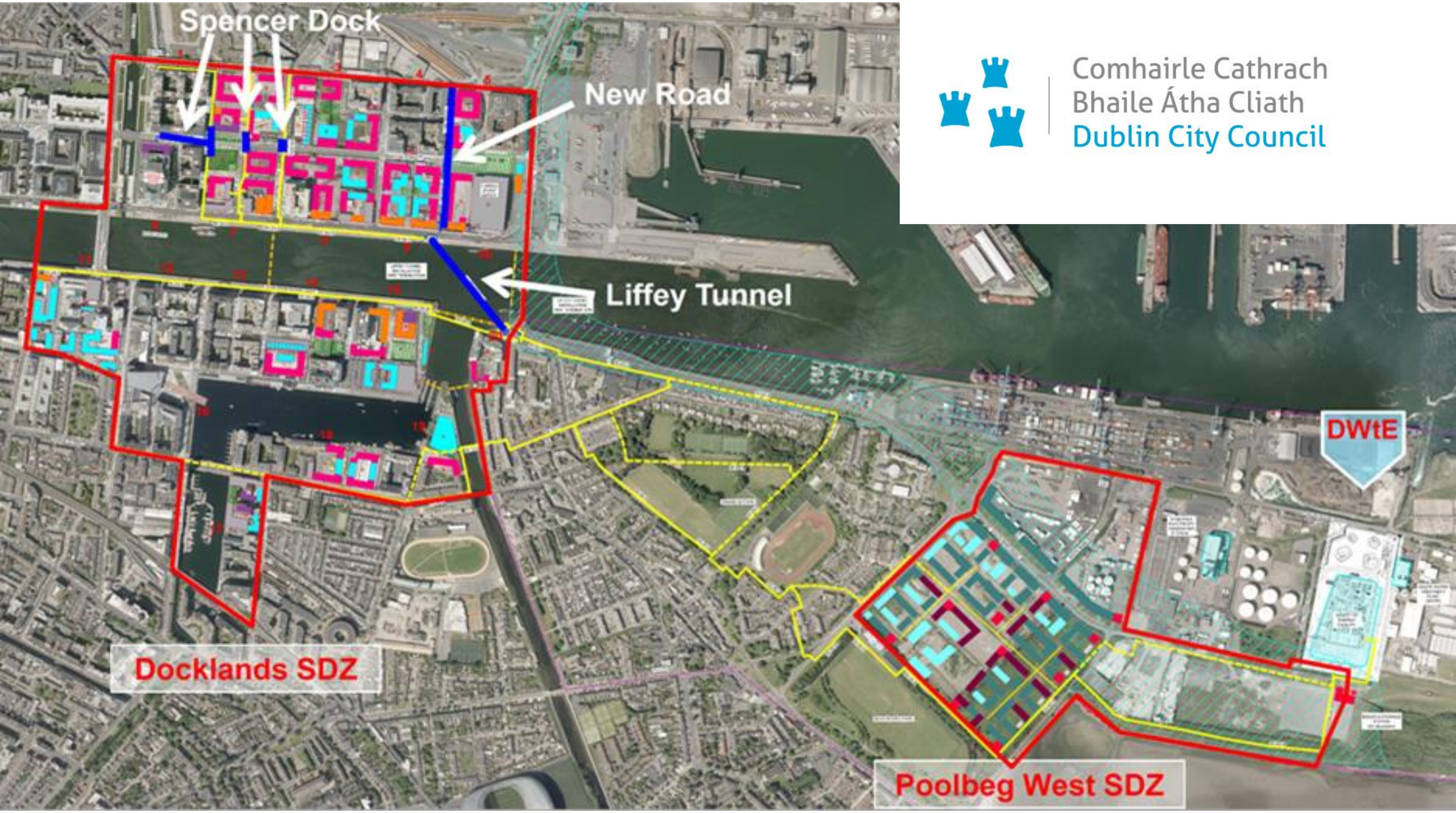
# Dublin District Heating Scheme

Source: Dublin WtE Excess Heat

Comhairle Cathrach
Bhaile Átha Cliath
Dublin City Council



# DDHS Specific Benefits

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- Utilises waste heat source
- Contributes to Dublin City Council's $CO_2$ and EE targets
- Provides low-cost-low-carbon heat to Poolbeg and Docklands area
- Decreases Dublin's reliance on imported fossil fuels

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# Q&A

For any follow-up to this Webinar please contact Codema:

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John O’Shea at john.oshea@codema.ie

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# Thank you!