

# **Learnings from low temperature DH implementations in urban heat recovery** *-different ways of collecting surplus heat and main findings*

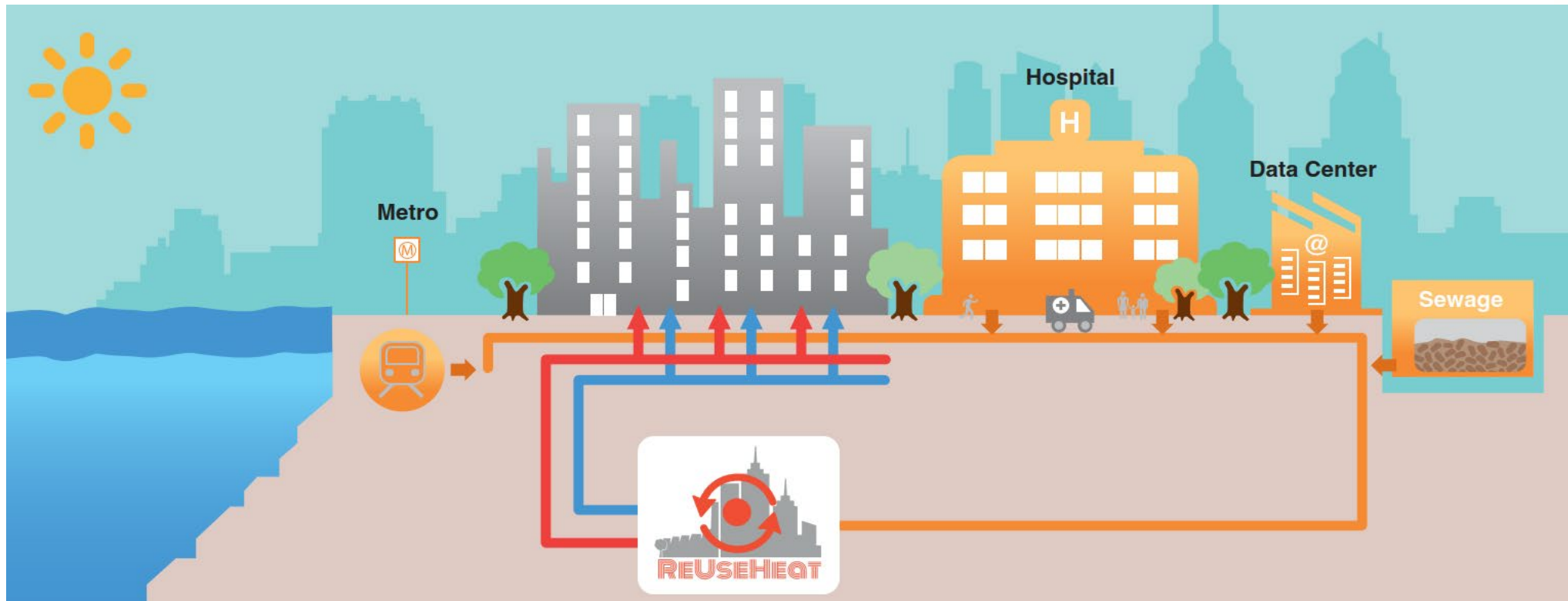
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Swedish Environment Research Institute (IVL)  
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# Agenda

1. The ReUseHeat project
2. Different ways of collecting surplus heat
3. Stakeholder action needed
4. Main learnings

# The ReUseHeat project



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 767429

[www.reuseheat.eu](http://www.reuseheat.eu)

@ReUseHeat

# The ReUseHeat project- urban heat

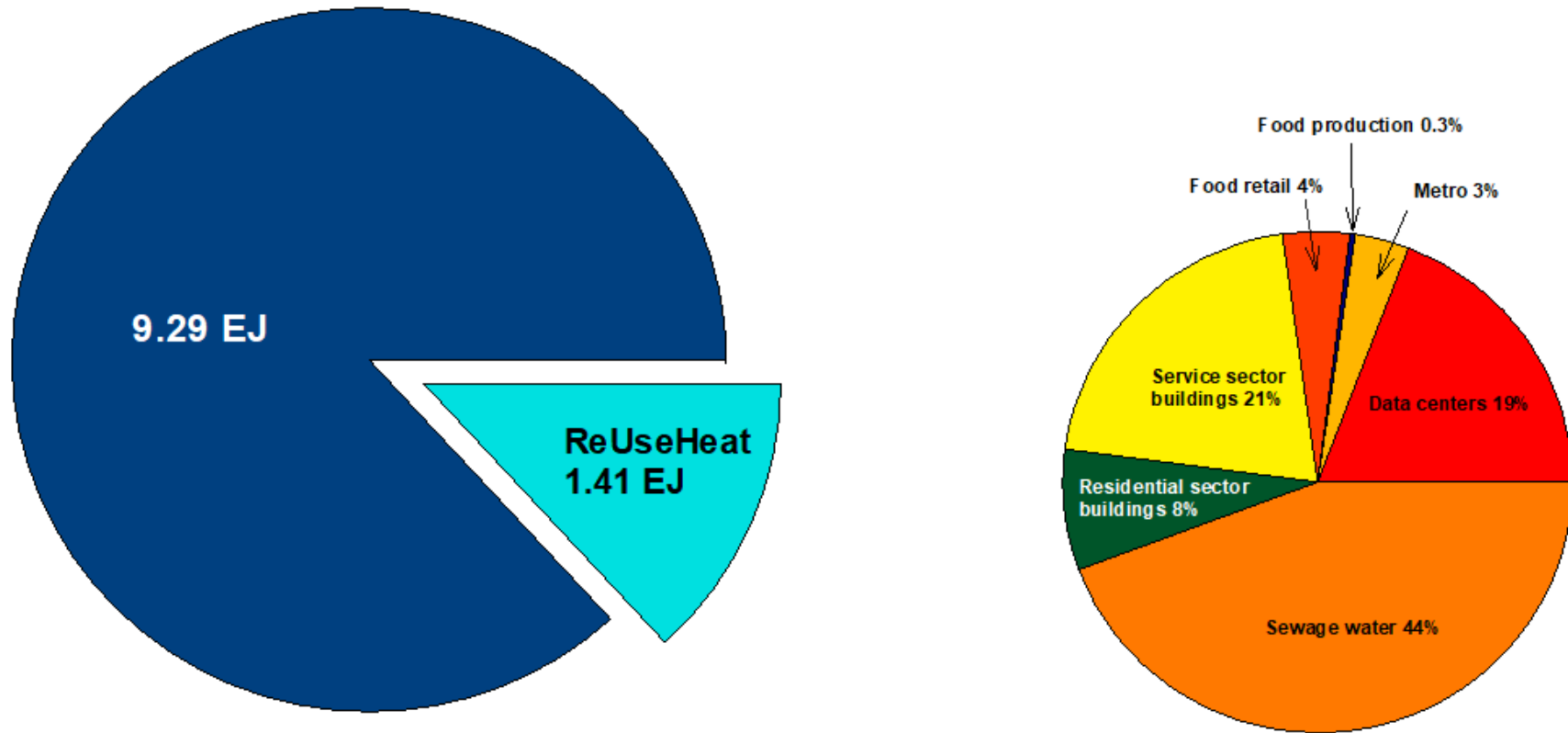


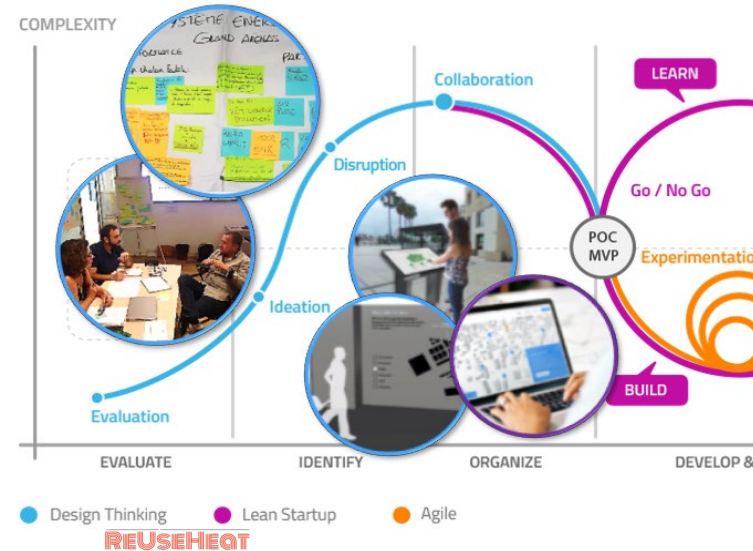
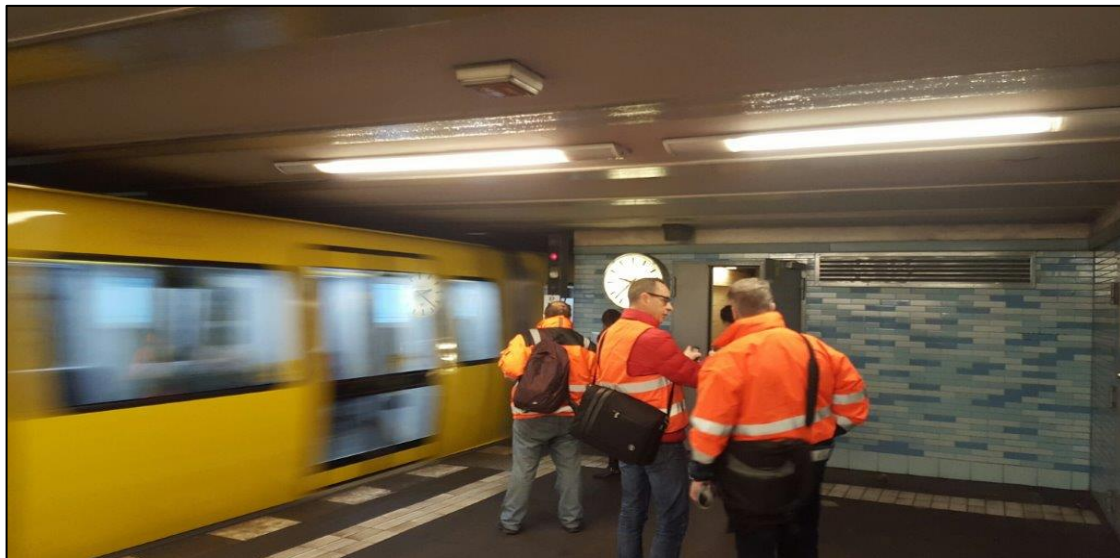
Figure 1. Energy from ReUseHeat as a part of the European heat demand for buildings further split (to the right) into the seven individual sources of ReUseHeat urban waste heat

# The ReUseHeat project- business aspects

- Stakeholder analysis
- Risk exposure
- Contract writing
- Business models
- Suggestion for more implementation



# ReUseHeat- demonstration sites



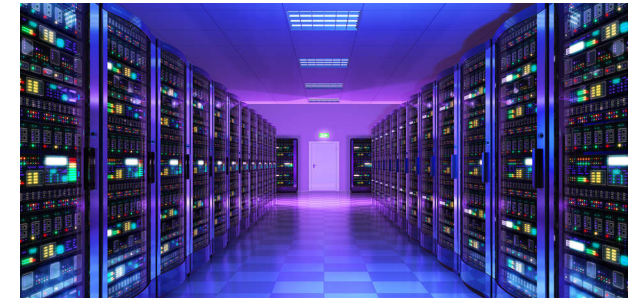
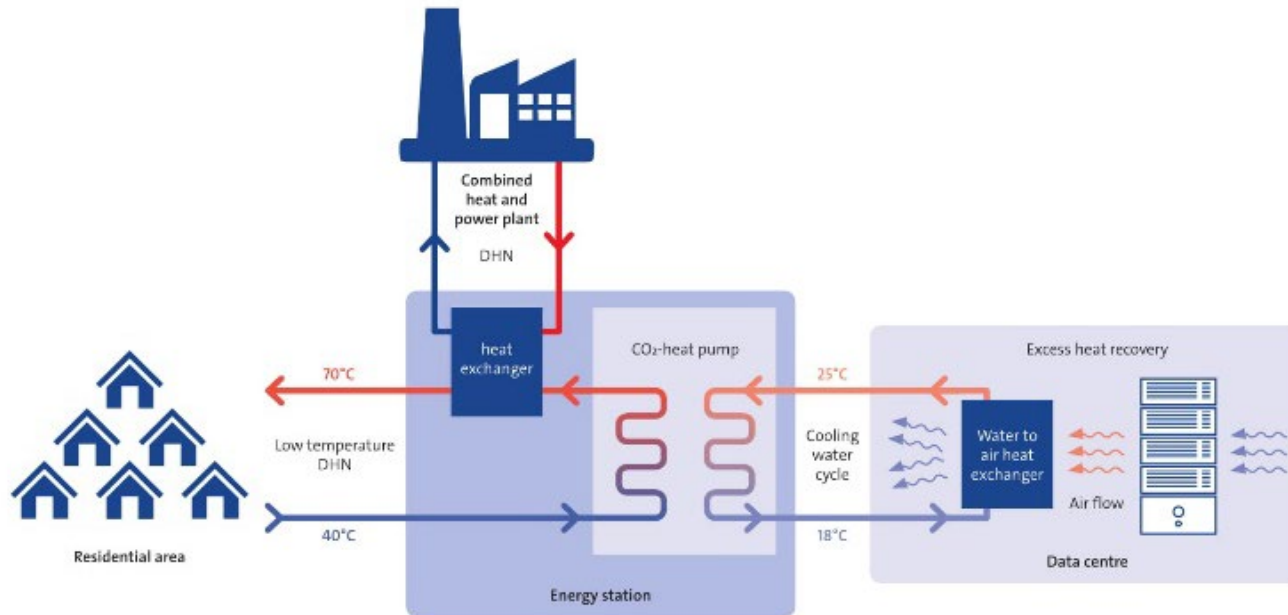
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# Different ways of collecting surplus heat



Datacenter

Heat source 25

Heat pump used to raise temperature to 70°C

Heat and hot water to 400 new buildings (residential and shopping mall)

Link to existing DHN (high temperature) for mitigating risk

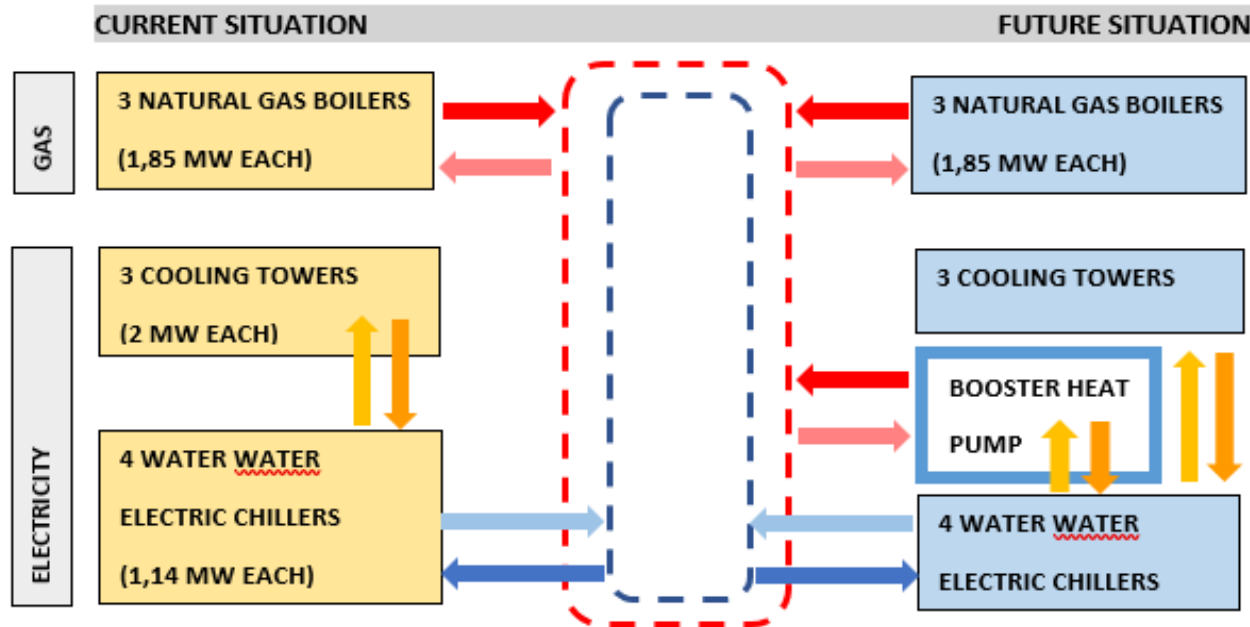


# Different ways of collecting surplus heat

## Lessons learned (from handbook at [www.reuseheat.eu](http://www.reuseheat.eu))

- Long distances between the heat source and heat consumer decrease performance and increase costs.
- A LTDHN is required for low-temperature sources
- Replicability is limited – each demonstration site is a different size, distance from the network and offers different temperatures.
- The reuse of waste heat is not a priority for data centre operators as it is not within the scope of their business: the data centre's key priority is the security of its operations and establishing a dialogue can take time.
- Waste heat recovery is new to DH operators, data centres and system installers.
- The heat pump market has limited choices of natural refrigerants with low global warming potential.
- The payback period is longer than usual at (due to the system being a novelty)- this is a result of carbon being priced too low
- For the Braunschweig demonstrator, it was important to mitigate the risk of not obtaining waste heat at all times with a pipeline to the high-temperature DHN.
- Data centres scale up activity gradually, so the full volume of waste heat is not available early in the data centre's operation.
- Only part of the waste heat volumes foreseen from the datacenter are recovered with the LTDHN
- The building owner may install solutions for hot water (hot water tanks rather than flow-through systems) that make heat recovery in summer difficult because overly warm water is returned to the heat pump. This must be discussed and agreed upon early on in the contract writing stage.

# Different ways of collecting surplus heat



Hospital

The demonstrator recovers low-temperature heat from the condensation circuit of the water-water electric chillers: 25-35°C  
Heat pump to raise the temperature to 50-55°C

# Different ways of collecting surplus heat

Lessons learned (from handbook at [www.reuseheat.eu](http://www.reuseheat.eu))

- Large tertiary buildings may have large facility schemes; each project will have a specific and non-generic solution.
  - Special attention must be given to agreements with public entities. The terms and deadlines are extended, and they take extra time to conclude.
  - Sensors and control elements are necessary to obtain useful data (deviations can be recognised by the hospital's BEMS more quickly).
  - Recovering heat from cooling towers has great potential.
- Seasonal heat recovery from cooling towers is insufficient; it should be year-round.
  - In-depth facility knowledge is important for successful heat recovery success.
  - Possible improvements must be evaluated for successful heat recovery.
  - The pandemic made work in the hospital sector extremely challenging.
  - Extreme weather made work in Madrid extremely challenging.

# Different ways of collecting surplus heat

2 concepts derived

Ernst Reuter Platz (Technical University)

+ proximity heat source and user

+ convenient placement of heat pump



Metro

Frankfurter Allée (Metro building)

- transmission pipeline needed source/ use

- heat pump between tracks

# Different ways of collecting surplus heat

Lessons learned (from handbook at [www.reuseheat.eu](http://www.reuseheat.eu))

- The distance between the heat source and the heat user is an important barrier to the economic viability of waste heat recovery from the metro
- The permits needed for waste heat recovery can be time-consuming to acquire when waste heat recovery experience is limited.
- Waste heat recovery is not the top priority of metro organisations nor of large energy companies, which makes the decision-making process difficult and slow
- Defining the limits of the waste heat recovery system takes time and knowledge and, to be efficient, several stakeholders need to work simultaneously to understand the limitations.
- Recovering heat from the tunnel can be difficult if it needs to account for the safety regulations of the metro operation
- Recovering heat from a metro tunnel necessitates the management of metal dust in the air.
- The ReUseHeat solution has the advantage of being highly modular and scalable. In a system where one ReUseHeat recovery unit is installed, it should be easy to scale up the number of heat recovery units.
- The surrounding soil conditions of a metro system will affect how warm the system is during Winter and Summer and its need for heating and cooling.
- The best stage to consider metro heat recovery is most likely when designing new tracks or stations so it can be a built-in





# Different ways of collecting surplus heat

How can awareness be created?

- Cities inform the citizens (ReUseHeat)
- Waste heat recovery is made standard
  - requested in building processes
  - make standard in public procurement
  - define what urban waste heat recovery is (=RES)



Water- Awareness

...demand will increase (end-user), construction companies, energy companies

# Different ways of collecting surplus heat

Lessons learned (from handbook at [www.reuseheat.eu](http://www.reuseheat.eu))

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>• To create awareness information must be focused on making the technology understandable and to explain its advantages in the simplest way possible, in terms of language and form of used media</li><li>• Data are not valuable if not contextualized via graphics or other contextual elements that users can relate to</li><li>• The Design Thinking approach for building a suitable MVP, based on a Wireframe model, tested via an Agile method end-user' feedback, and finally</li></ul> | <p>build the products and undergo the measuring and qualification of the products under real conditions, has been validated as an efficient methodology</p> <ul style="list-style-type: none"><li>• The development of a dashboard system, necessitates a review of data management and availability of, for example the DHCN</li><li>• Through the exchanges in <u>ReUseHeat</u>, a cross fertilization has taken place, where faults in data were detected and removed</li></ul> |
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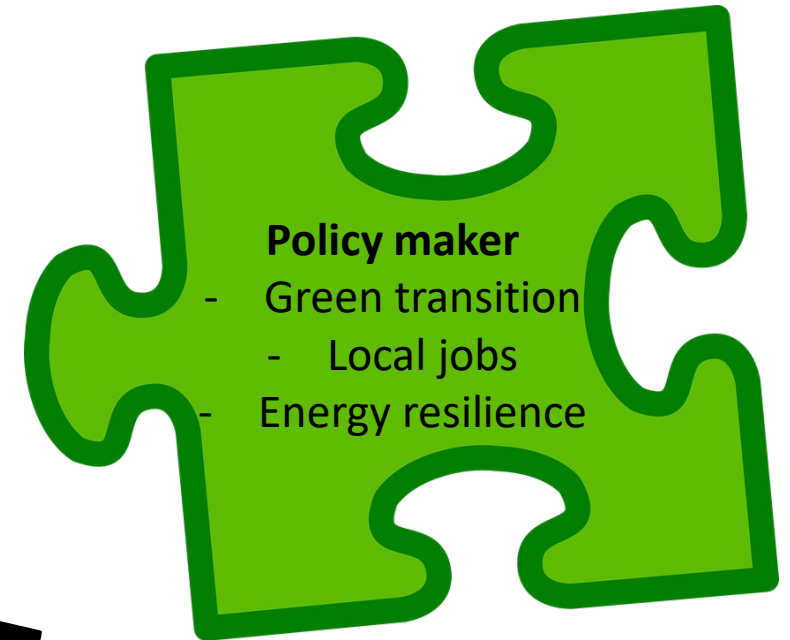
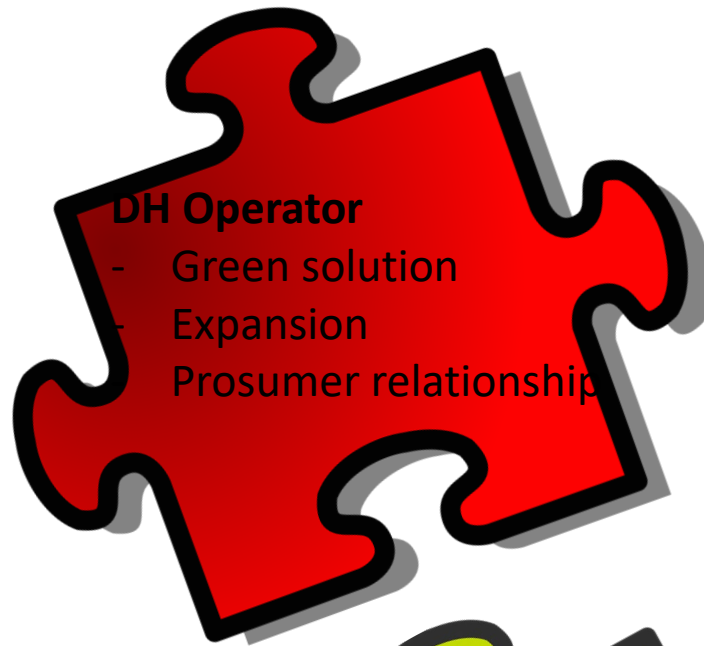
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# Stakeholders

- DH grid operators
- Owners of waste heat
- End-customers
- Policy makers
- Investors







# Stakeholders

Interviews in 8 EU countries (76 respondents)- there are barriers

- Absence of legal framework for urban waste heat recovery
- Incentives for RES and CHP
- Absence of standardized contracts
- Diverging views on the value of heat
- Long payback periods
- Low technical maturity of existing solutions
- Low awareness about low temperature heat recovery



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# Stakeholders –and action needed

Interviews in 8 EU countries (76 respondents)- there are barriers

- Absence of legal framework for urban waste heat recovery
  - Incentives for RES and CHP
  - Absence of standardized contracts
  - Diverging views on the value of heat
  - Long payback periods
  - Low technical maturity of existing solutions
  - Low awareness about the possibility
- Policy upgrades needed!**
- Demonstration needed!**
- DH operator  
Waste heat owner  
Investor
- ...to eventually trigger end-users**

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# Main learnings

Technology is not the main stopper of urban waste heat recovery. Rather, it is the low level of maturity amongst necessary stakeholders to realize the opportunity, to identify who to collaborate with and how.

# Main learnings

Urban waste heat recovery investments have features that will be standard in the future energy system.

They, for example, make use of locally available heat sources without any incineration but as the price of carbon is not reflecting its future damage costs they are not seen as cost competitive in the short term.

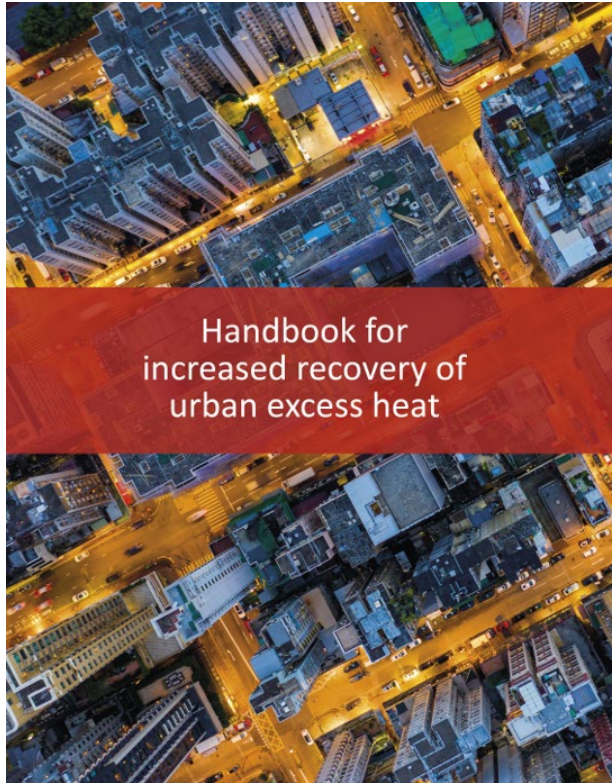


# Main learnings

Waste heat is mentioned and encouraged but important pieces of regulation are missing for derisking the investments and for creating a demand of waste heat recovery solutions as early as in the construction phase of buildings.

The problem is there for waste heat recovery in general but even more pronounced for urban waste heat since it is a largely unknown possibility.

# Thank you for listening!



Open for stakeholder feedback

[www.reuseheat.eu](http://www.reuseheat.eu)