COOL DH & Celsius Talk:

"Low Temperature District Heating"

Thursday April 16, 2020

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The Celsius Initiative

- a European project that lives on -

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How it started

Based on the premise that **cities and districts are in a position to take the lead in the energy transition**, London and the Islington Borough, Rotterdam, Cologne, Genova and Gothenburg came together to create CELSIUS.

The **European Project CELSIUS** was funded under the 7th Framework Programme. It:

- ✓ Developed innovative solutions for district heating and cooling
- ✓ Assembled a **network of 72 cities** and **68 City Supporters** between 2014 and 2017
- ✓ Influenced European policy through position papers

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Our purpose

- ✓ **Accelerate the energy transition** through the deployment of smart and sustainable heating and cooling solutions in cities.
- ✓ **Support the implementation** of the 2015 Paris Agreement and the Sustainable Development Goals to build a sustainable future.

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Our philosophy:
Don’t re-invent the wheel!

- ✓ There are many **innovative and efficient solutions** that have already been tried and tested.
- ✓ **The Celsius Toolbox assembles solutions** – including practical information, best practices & lessons learned.
- ✓ **The Celsius network** brings together experienced cities and other stakeholders to share experiences and exchange ideas.

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A demand-driven collaboration hub

- ✓ Continuous **knowledge sharing** through the newsletter, webinars, workshops and the Celsius Toolbox.
- ✓ **Hands-on support for cities** through the forerunner groups.
- ✓ Influencing European **policy**.
- ✓ Support **innovation, replication and scaling** of pilots and demonstrators.

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The Celsius Forerunner Groups

Building the future together

- ✓ Reach as many decision/ validation points as possible in the cities
- ✓ Knowledge sharing from the demand and needs of the cities. Cities will be co-creators of the process and decide the support they want
- ✓ Collaboration with experts from industry, research, projects and other supportive organisations
- ✓ Matchmaking with other cities having faced similar challenges , with experts from the Celsius network and with the industry

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Let’s talk!

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www.celsiuscity.eu - @celsiuscity

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Low Temperature District Heating

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The experts

Steen Olesen
Project Manager in Smart Energy Systems at COWI

Christian Holm
Senior Specialist at Danish Technological Institute

Sara Kralmark
Project Manager in Business Development at Kraftringen

Moderator

Gabriele Pesce
Project Officer at Euroheat & Power

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Steen Olesen
Project Manager in
Smart Energy Systems at COWI

What is LTDH and how it opens the spectrum of possible waste heat sources to be used?

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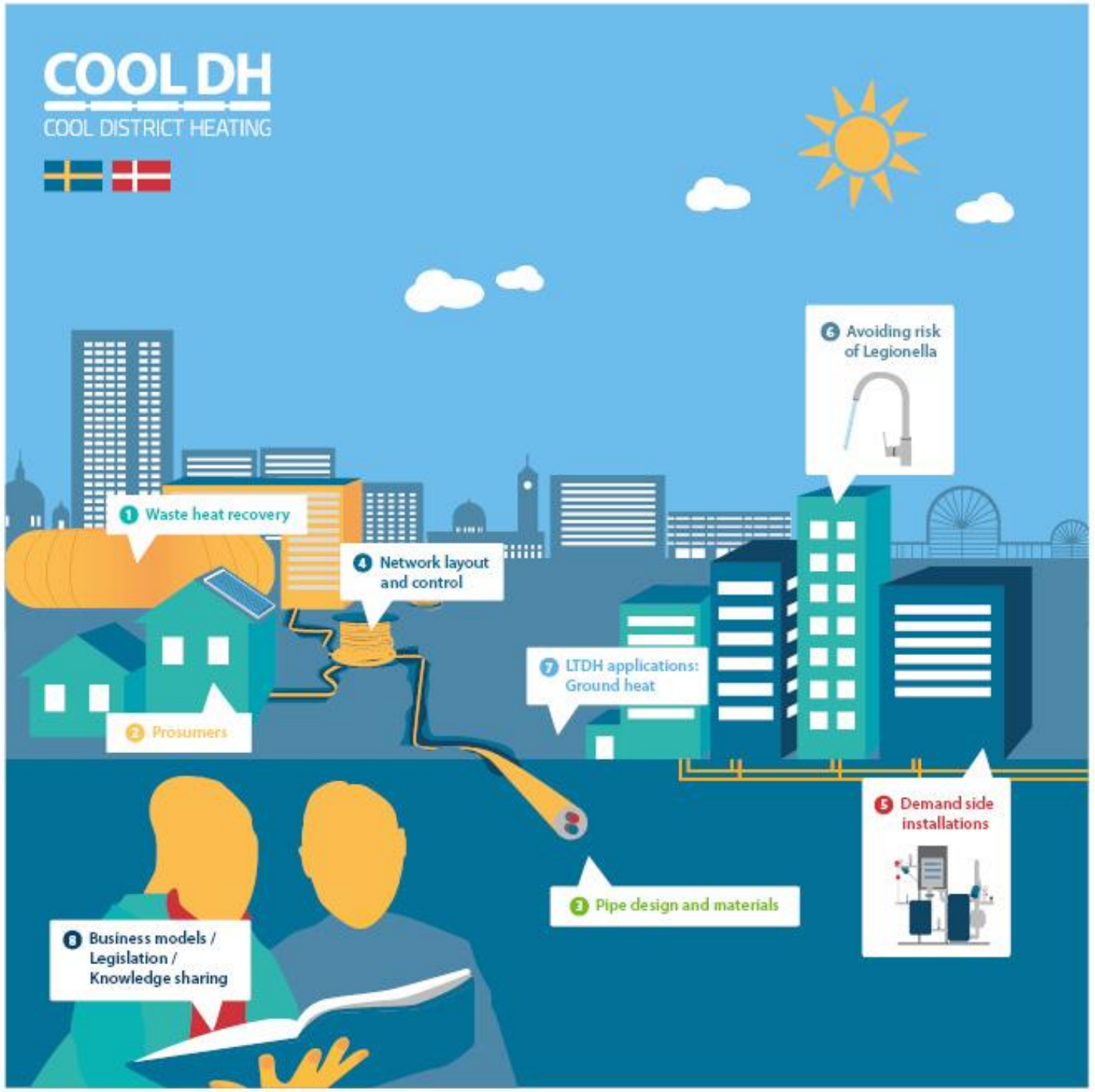
COOL DH

What is LTDH and how it opens the spectrum of possible waste heat sources to be used?

by

Steen G Olesen, COWI A/S

COWI



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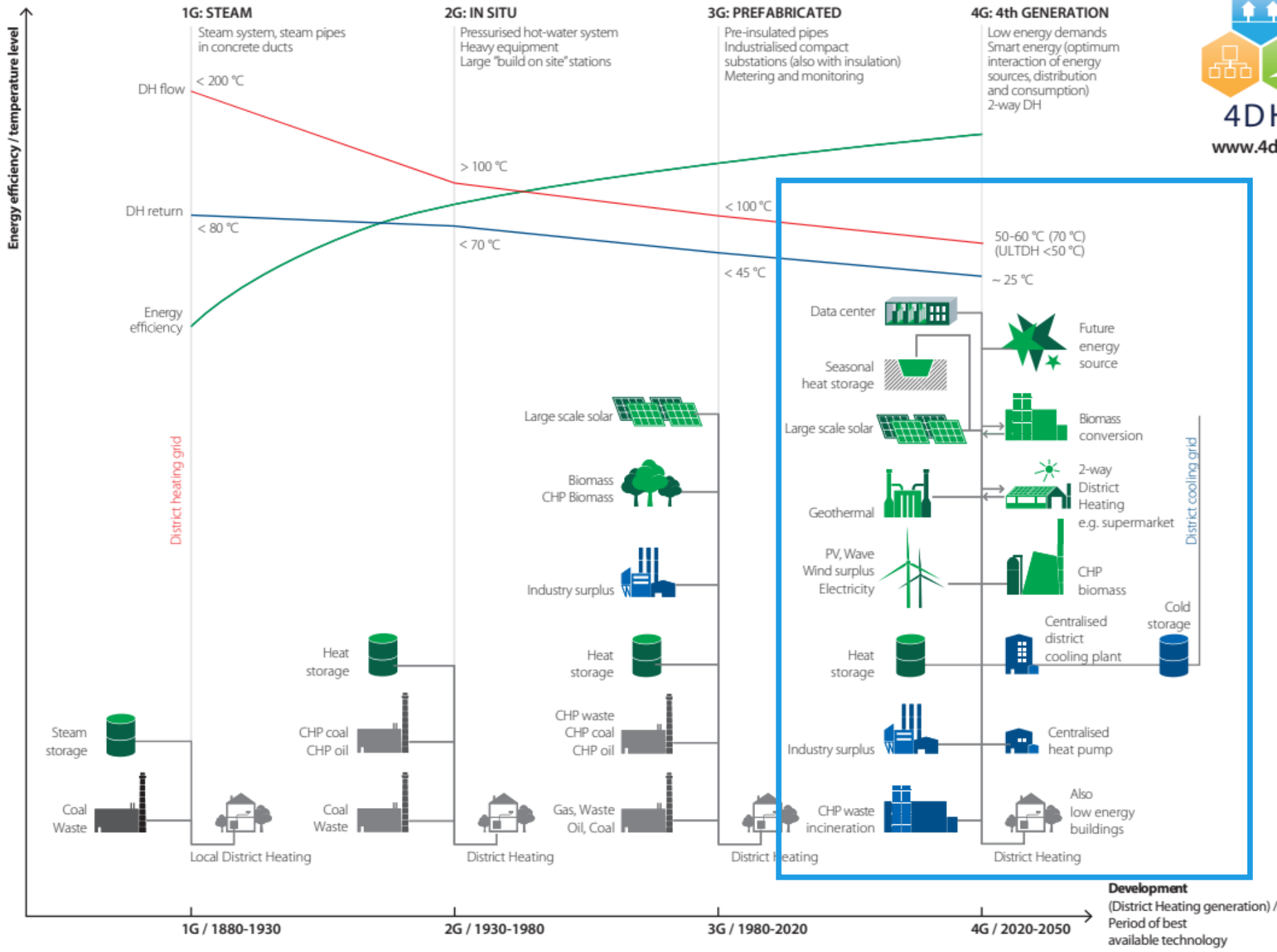
What is LTDH?

- LTDH is 4G->5G
- It opens the spectrum of possible waste heat sources to be used?



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COOL DH aims to find ways to utilize low-grade waste heat

and…

- Integrate renewable energy produced locally
- Demonstrate the full system with all needed components
- Innovation & sharing of catalogue with new solutions

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COOL DH
COOL DISTRICT HEATING

COOL DH is a project that aims to find ways of utilizing low-grade waste heat in energy efficient buildings by optimizing **Low Temperature District Heating** (LTDH) solutions

www.cooldh.eu

COOL DH demo sites

Innovative project to utilize low grade heat sources, introduce RES and optimize low temperature DH solutions and implementation in two **demo sites**

Høje-Taastrup - Østerby (Denmark)

- ***Existing area*** composed by **renovated buildings**
- New LTDH network (55/30°C) with new PE-RT pipes
- LTDH supplied by City2 shopping center's cooling system

Lund - Brunnshög (Sweden) => 40.000 people

- ***New district*** under development
- New LTDH network (65/35°C) with new PE-RT pipes
- Surplus heat from research facilities (Max IV/ESS)

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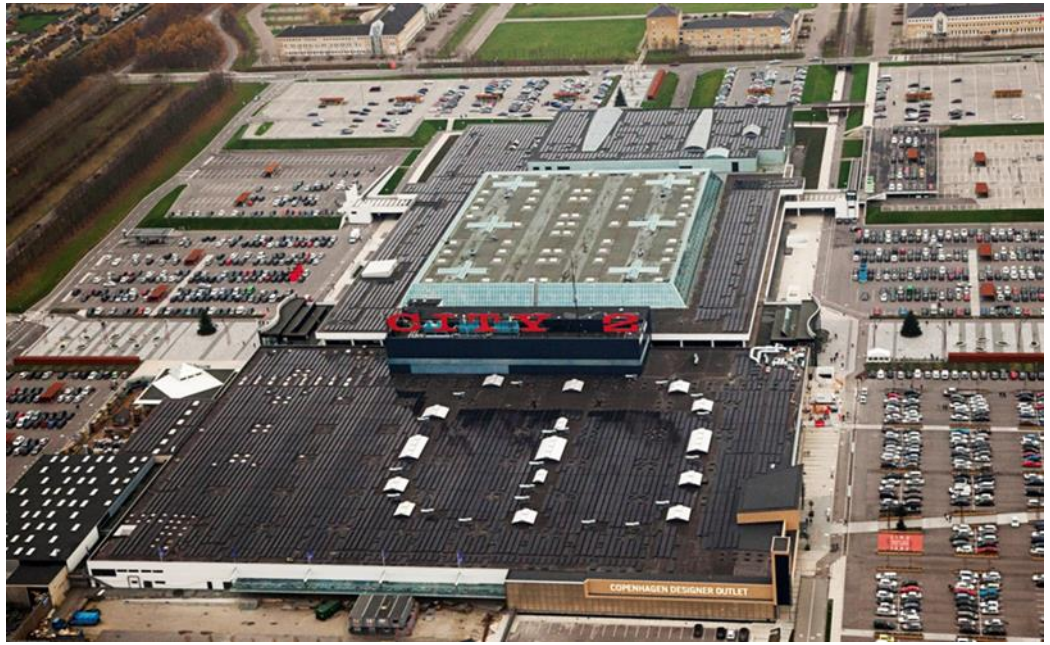
Prosumer: City2

- Large PV installation in 2014 combined with **successful EE strategy** has led to excess of local RES
- 10 years **feed-in tariff** for local RES decrease and run out in 2024
- DH Company approached City2 with a proposition to **deliver heating & cooling** based on the excess PV power, and to **rent a room** in the basement of the premises and to **take over the ownership** and operate as flexsumer in interplay with parallel local sources



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Østerby District

Approx. 36.000 m^2 building stock from the 80'ties

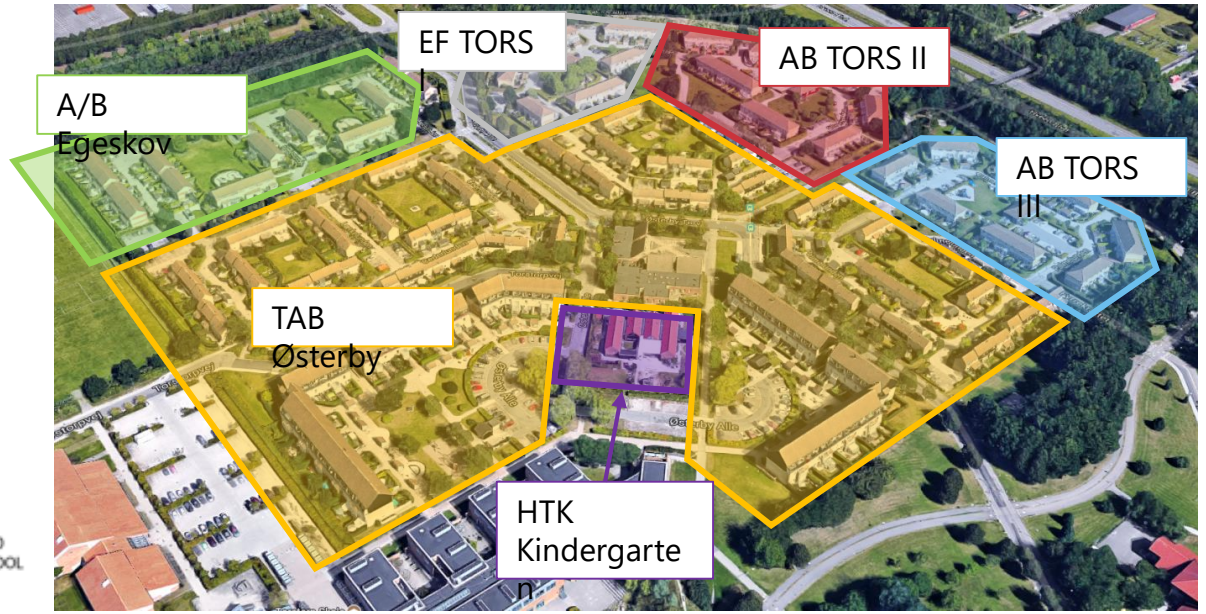
- 158 terraced houses
- A public kindergarten
- Social housing company

District heating network

- **+35 years old**
- **One main heat exchanger**

Organization **(6 groups)**

- Kindergarten
- Social housing
- 4 housing associations



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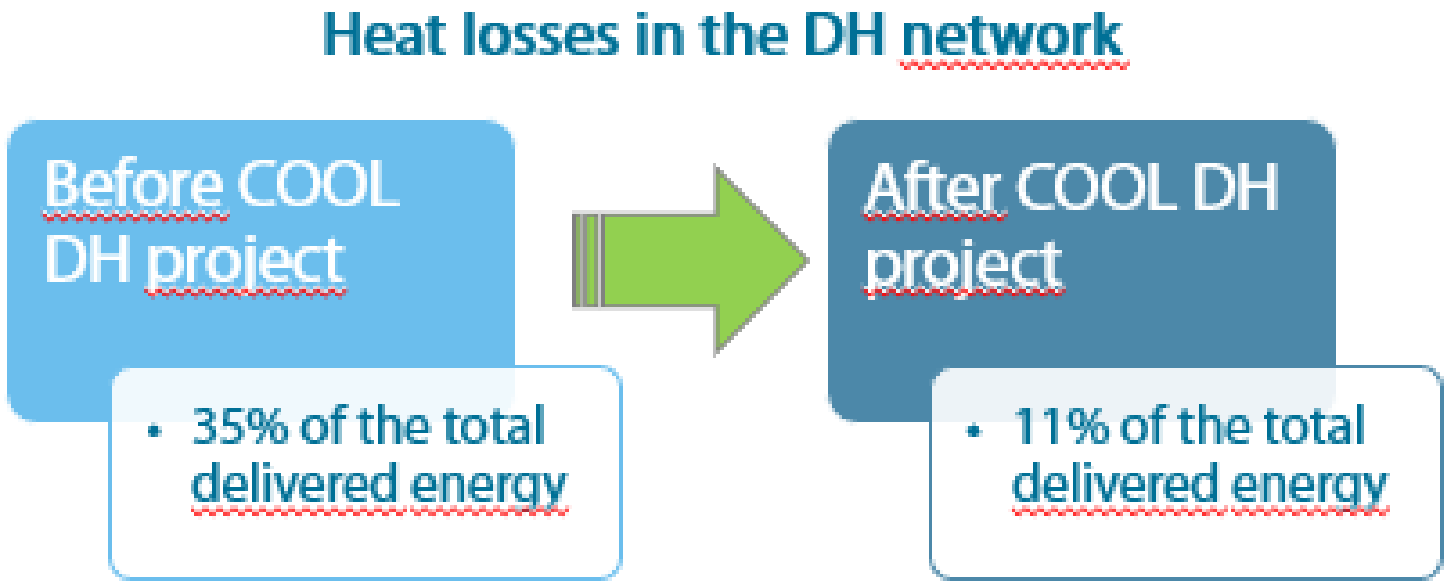
Advantage for users

- Less heat loss
- Less maintenance
- Energy supply based on renewable energy and surplus heat
- Lean operation & organisation



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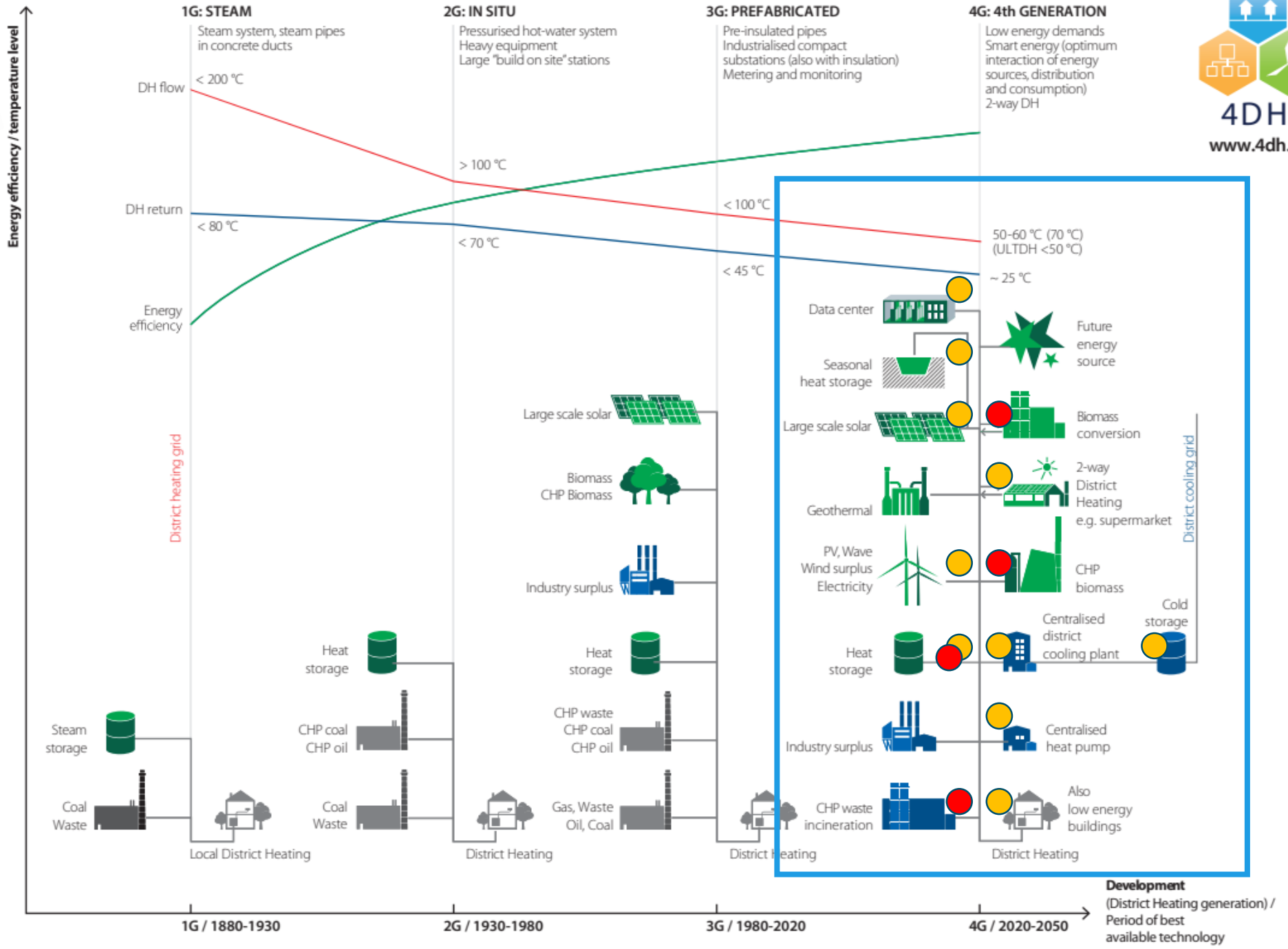
- Local DH grid in Høje Taastrup
- VEKS



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4DH
www.4dh.dk

Thank-you for your attention!

Questions?

More info on www.cooldh.eu

sgon@cowi.com

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Christian Holm
Senior Specialist at the Danish Technological Institute

The Obstacles to be Solved Beforehand

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Christian Holm Christiansen
Danish Technlogical Institute

THE OBSTACLES TO BE SOLVED BEFOREHAND

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Introduction

- The RELaTED Project
- Planning and identifying surplus heat resources
- Barriers for district heating companies
- Barriers for surplus heat suppliers
- Other aspects

The RELaTED project

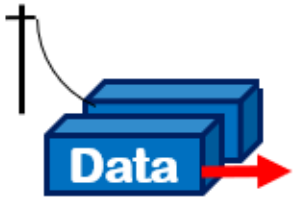
- New ultra-low temperature district heating concept (ULT DH)
- Heat sources considered:
  - Industrial surplus heat
  - Building integrated solar thermal
  - Reversible heat pumps
- Demonstration in 4 districts in 4 countries
  - Estonia, Serbia, Spain and Denmark
- Horizon 2020 project with 14 partners
- Until end of 2021

Website: relatedproject.eu

Planning and identifying surplus heat resources

- Identifying relevant industry and processes
  - Processes: Boiling, melting, drying, cooling etc.
  - Industries: Building materials, chemistry, food etc.
- Quantifying:
  - Temperature level: Direct or indirect injection
  - Load pattern: day/night, summer/winter
  - Heat capacity
- Proximity to:
  - District heating network
  - Heat load (heat demand)

Examples



Datacenter
~ 7000 homes

Print factory
~ 90 homes

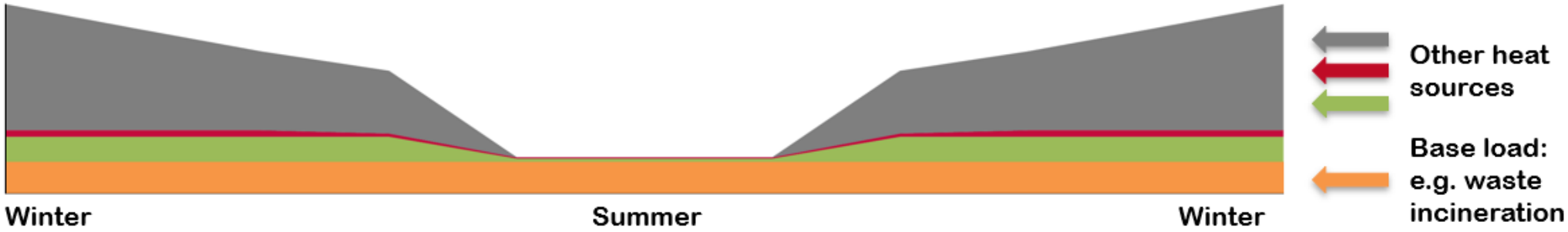
Supermarket
~ 20 homes

1 home = 18 MWh

Analysis > Business case

Barriers for district heating companies

- What is the surplus heat substituting?



- Network location of surplus heat supplier
  - Flow direction
  - Surplus heat delivered to flow or return pipe?

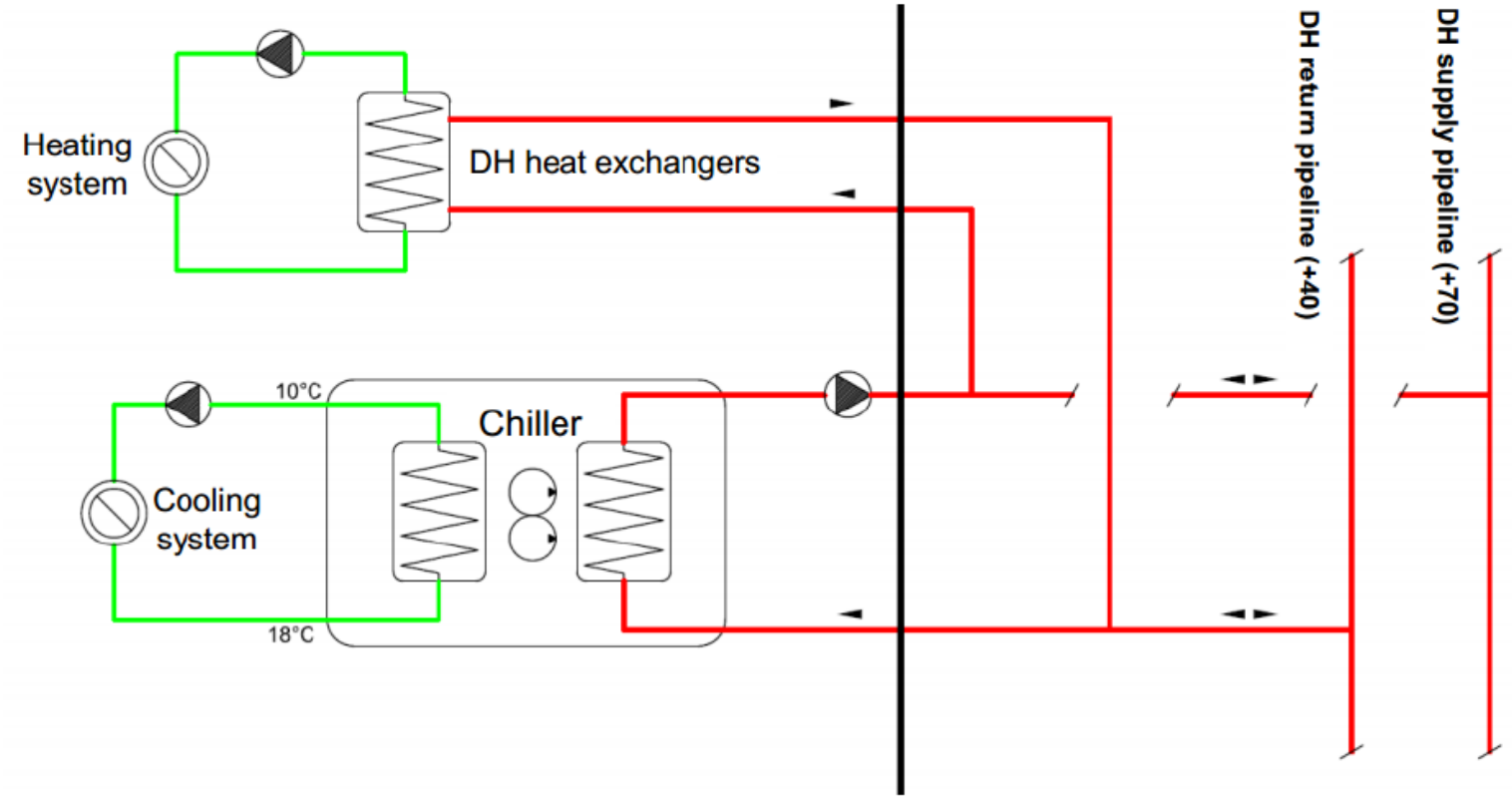
- Heat dispatching and control of several suppliers
  - Marginal price
  - Load and production forecasting

Barriers for surplus heat suppliers

- Heat recovery and energy saving priorities
  - Realisation internally (in company)
  - Realisation externally (by supply to district heating)
- Not core business to supply heat
- Unsecure future of suppliers business or the specific site
- No Non-Energy-Benefits (NEBs)
  - Improving production capacity
  - Saving of other commodities e.g. water
  - Etc.

Other aspects

- Regulation
- Taxes
- Billing



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Sara Kralmark
Project Manager in Business Development at Kraftringen

LTDH business plan for Lund, Sweden

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MAX IV
”Prosumers”
Price tariff for LTDH consumers
Price tariff for small LTDH producers

Price tariff for LTDH *consumers* – *background*

- Supply temperature 65 °C
- Return temperature 35 °C.
- A new type of distribution pipes made out of plastic → easier and cheaper to build.
- A solitary system with constant heat production (cost).

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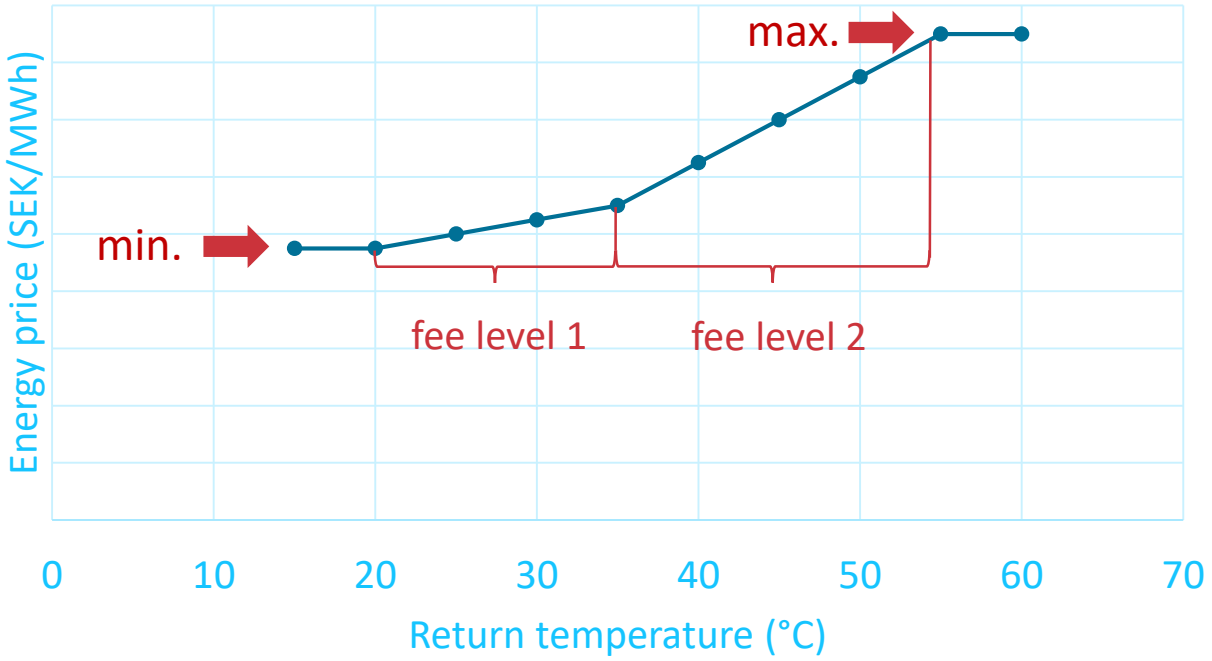
Price tariff for LTDH *consumers* – *result*

- Connection fee
- Minimum energy price and maximum energy price
- Return temperature fee per increasing degree, two levels:
  - 20 – 35 °C: fee level one, X SEK/°C
  - 35 – 50 °C: fee level two, Y SEK/°C



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COOL DH
COOL DISTRICT HEATING

Benefits and development potential

- Simple for customers to understand.
- Favors well-functioning substations.
- Soft values can include:
  - Provide heat exchanger installation instructions to the customers.
  - Offer help with dimensioning of heat exchangers as well as maintenance.
  - Perform yearly maintenance visits.
  - Apply remote reading and control of substations.

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Prosumers – pros, cons and questions

DH RESILIENCE

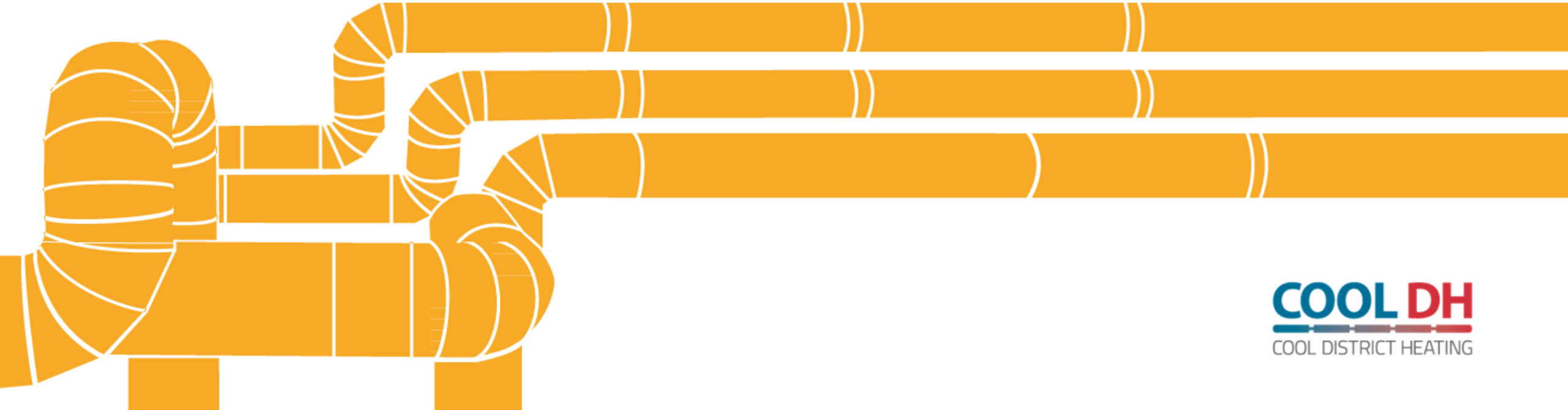
ALTERNATIVE USES OF CAPITAL

HEAT FORECASTS

HEAT QUALITY AND VALUE

PROSUMER STABILITY

INVESTMENTS & PB



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Price tariff for small LTDH *producers* – *prerequisites*

- Minimum supply temperature. (Brunnshög: 65-67 °C)
- “Alternative production cost” variable:
  - Invariant production price? → Fixed compensation! (ex. Brunnshög/MAX IV)
  - Varying production price? → “Market price” compensation! (ex. Stockholm Exergi Ltd.)

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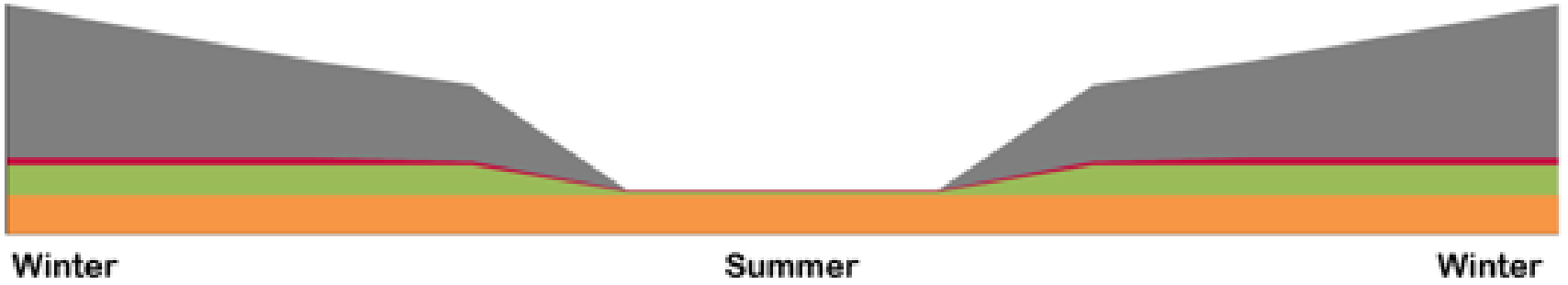
What is the surplus heat substituting?



- "Outdoor temperature" variable:
  - Fixed outdoor temperature demand of YY °C,
    … and/or the compensation decreases with increasing outdoor temperature.
  - Fixed season demand,
    … and/or the compensation varies with the seasons.

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Debate with the experts

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Project Manager in Smart Energy Systems at COWI

Christian Holm
Senior Specialist at Danish Technological Institute

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Moderator

Gabriele Pesce
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Additional slides

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Open District Heating® (ODH)
– A prosumer price model example from Stockholm Exergi Ltd.

- ODH Call: For prosumers with a steady and evenly distributed heat production.
  - Prosumer-heat temperature needs to be ≥ 68 °C
  - Prosumer-heat will be called for at outdoor temperature ≤ 12 °C and at all other times when there is a demand.
  - Payment to prosumer:
    - A fixed monthly component related to the capacity
    - A variable energy component related to alternative marginal cost, visualized through an hour-by-hour forecast for the next day and night (00.00 am to 24.00 pm)
- ODH Spot: For prosumers with a non-evenly distributed heat production.
  - Payment to prosumer through a variable energy component that decreases with increasing outdoor temperature and depends on delivery agreements.
    - Delivery to DH supply pipe
      - Fixed minimum supply temperature of 68 °C
      - Varying supply temperature of 68-103 °C
    - Delivery to DH return pipe
      - Minimum supply temperature of 3 °C higher than incoming return temperatures

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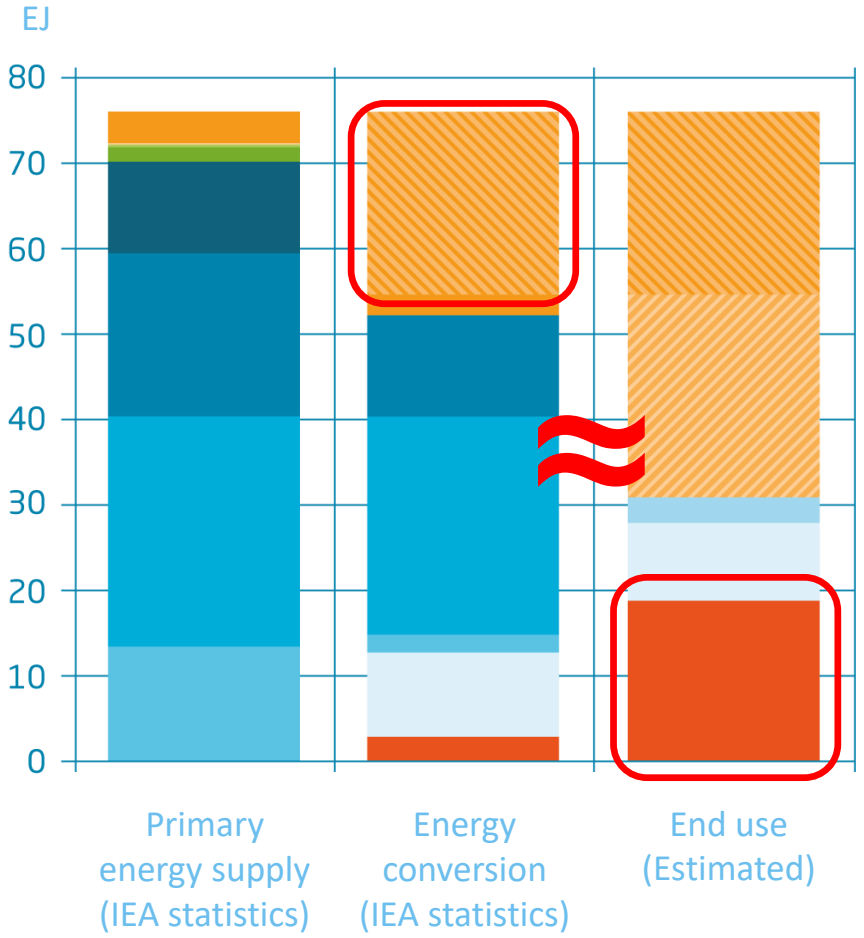
Energy balance in the EU 2012



- Conversion heat losses in the energy transformation sector
- Conversion heat losses in end use
- Combustible Renewables and Waste
- Solar/Wind/Other
- Geothermal
- Hydro
- Nuclear
- Natural Gas
- Petroleum Products
- Coal and Coal Products
- Transportation
- Electricity
- Heat

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