Smart city heating and cooling in Europe

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celsius smart cities

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GOTHENBURG (lead partner)

LONDON, ISLINGTON

COLOGNE

GENOA

ROTTERDAM

20 PARTNERS

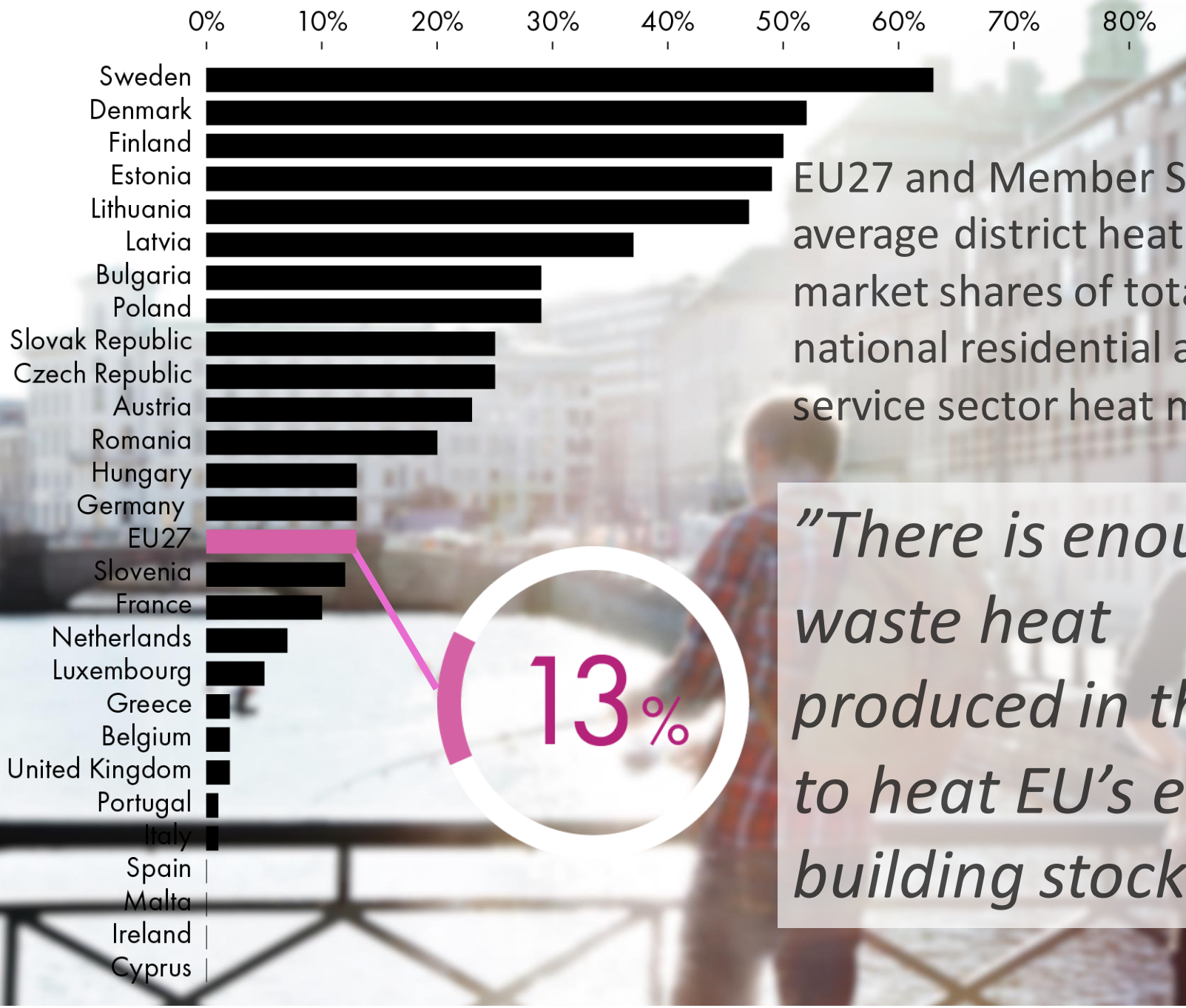
4 YEARS

Demonstrators

CELSIUS toolbox

Study visits

CELSIUS expert group



EU27 and Member State average district heating market shares of total national residential and service sector heat markets

”There is enough waste heat produced in the EU to heat EU’s entire building stock”

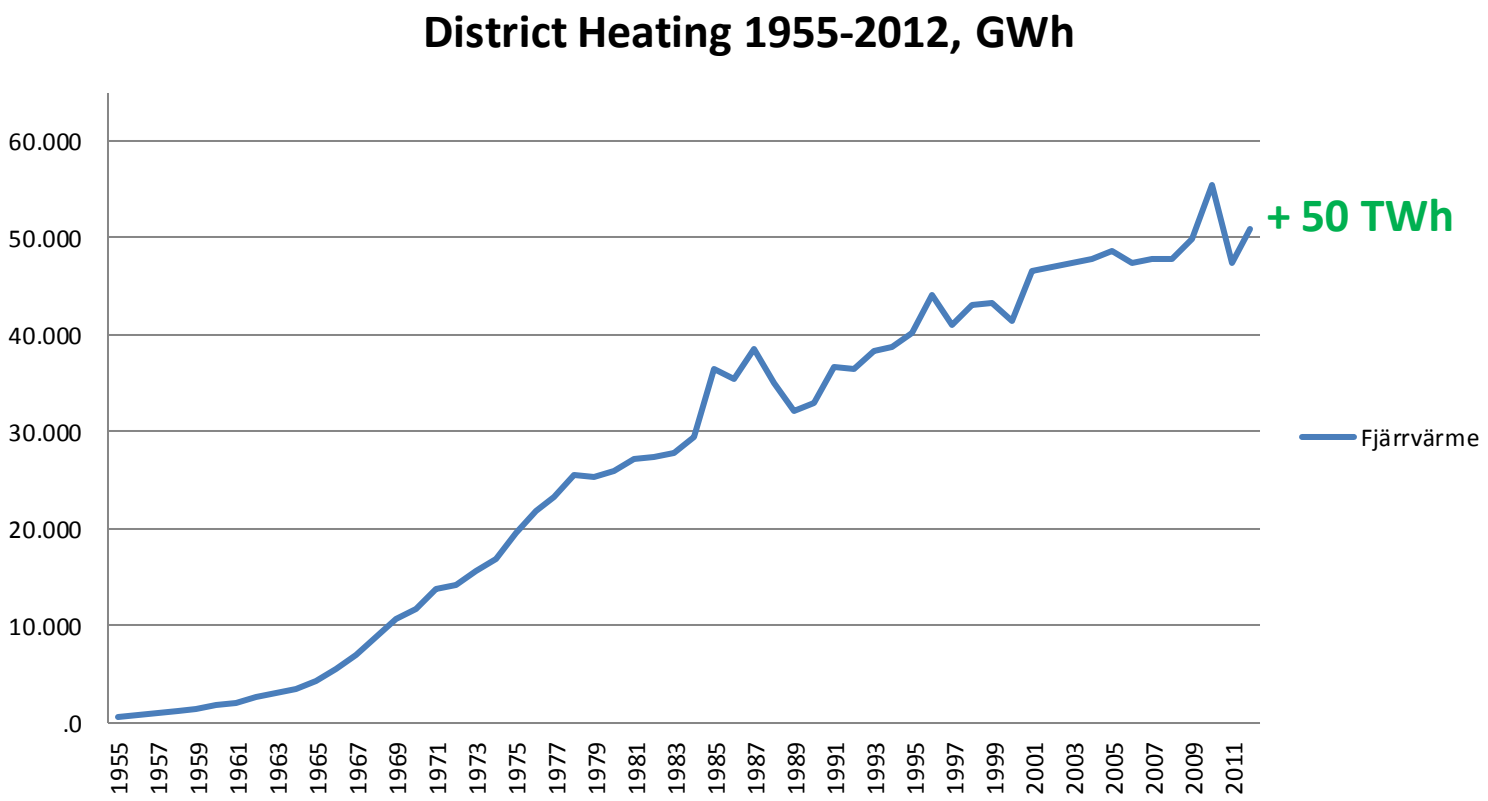
District heating, Sweden

- Sweden introduced DH in the late 1940s

- More than 240 of the 290 municipalities
- Still growing
- Turnover 2 billion Euro

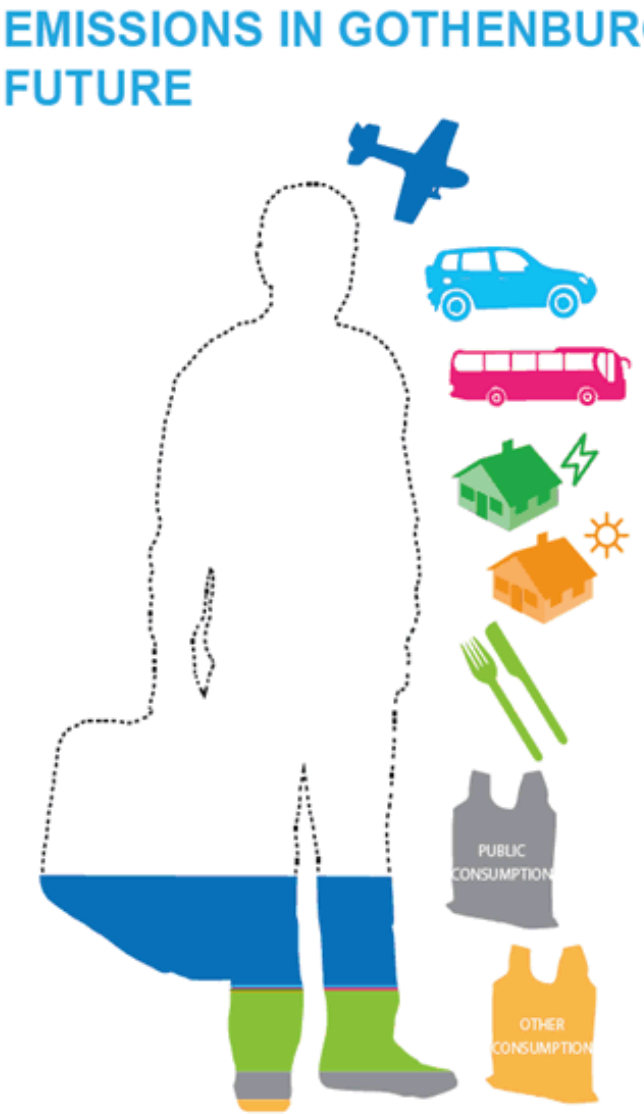
- In 2012, DH distributed over 53 TWh
  - 60 % residential
  - 30 % service sector
  - 10 % industry

DH Development in Sweden

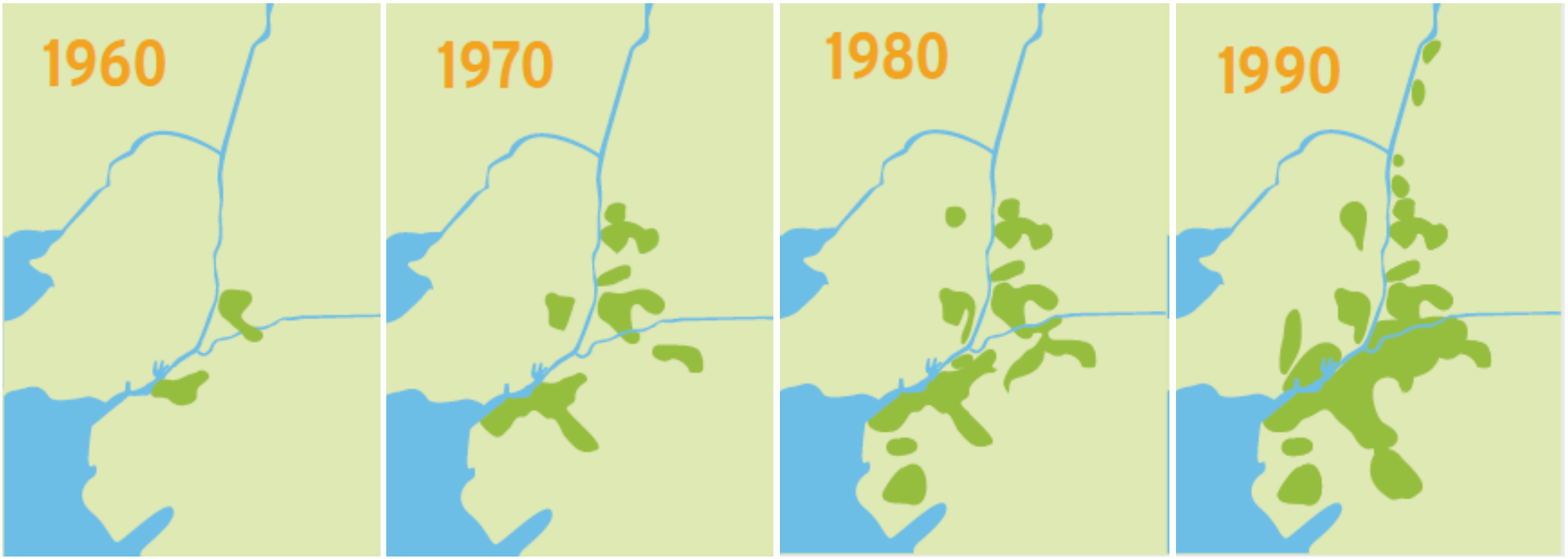


Climate agreement

- The Climate agreement was adopted by the City Council in September 2015
    - By 2050 the city will have a sustainable and fair level of carbon dioxide emissions
    - By 2030 all district heating is produced from renewable sources, waste incineration and waste heat from industries.

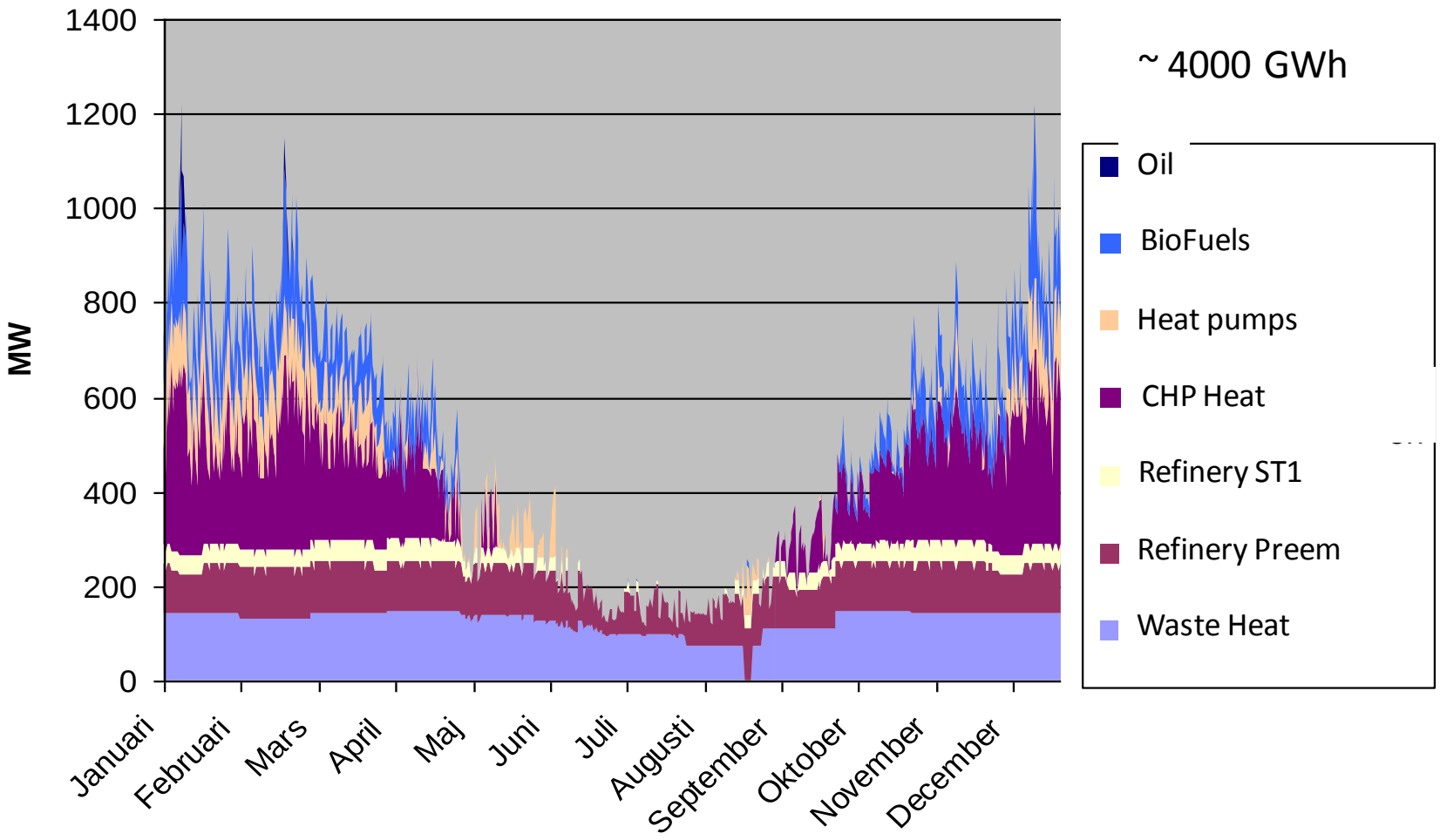


DH Development in Gothenburg

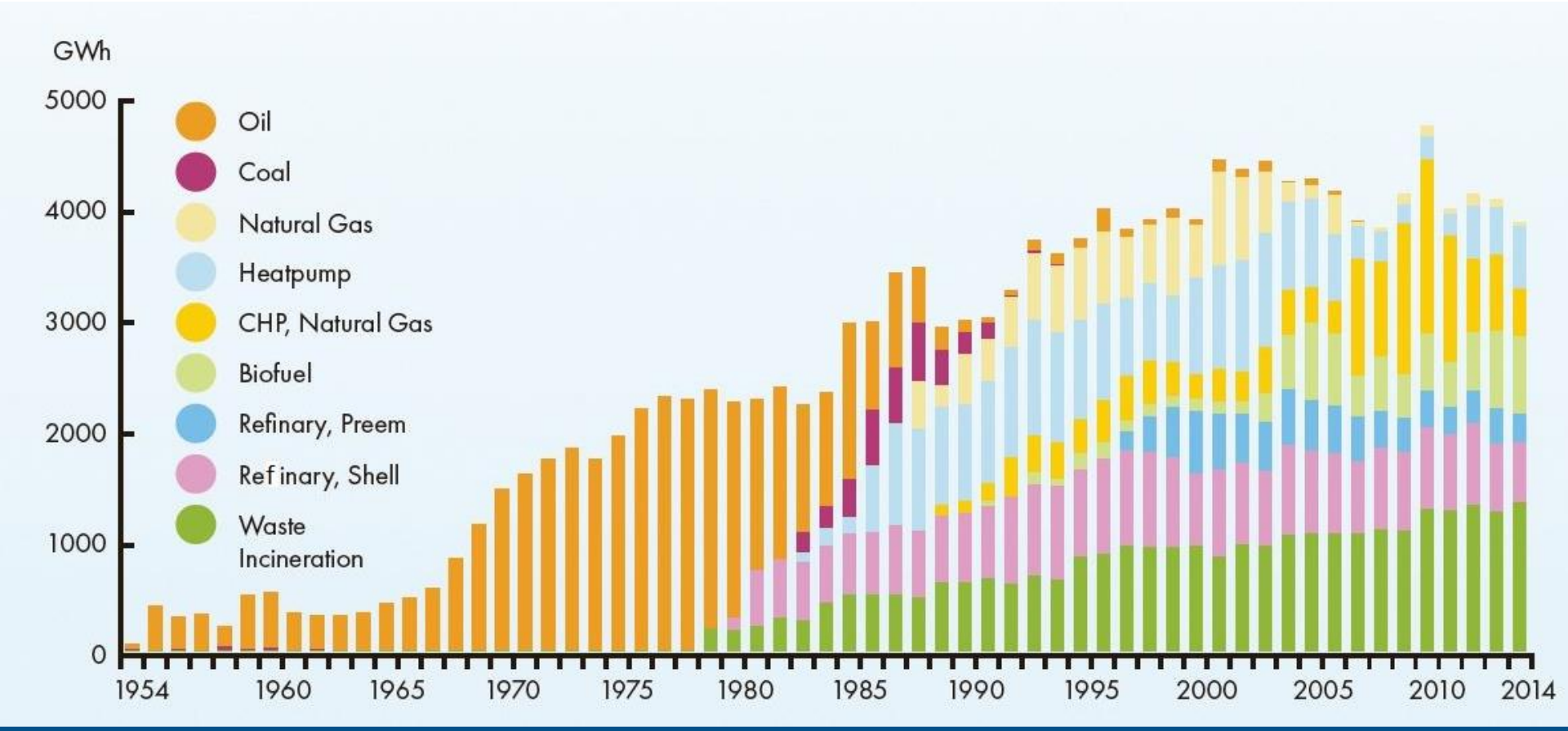


DH in Gothenburg today

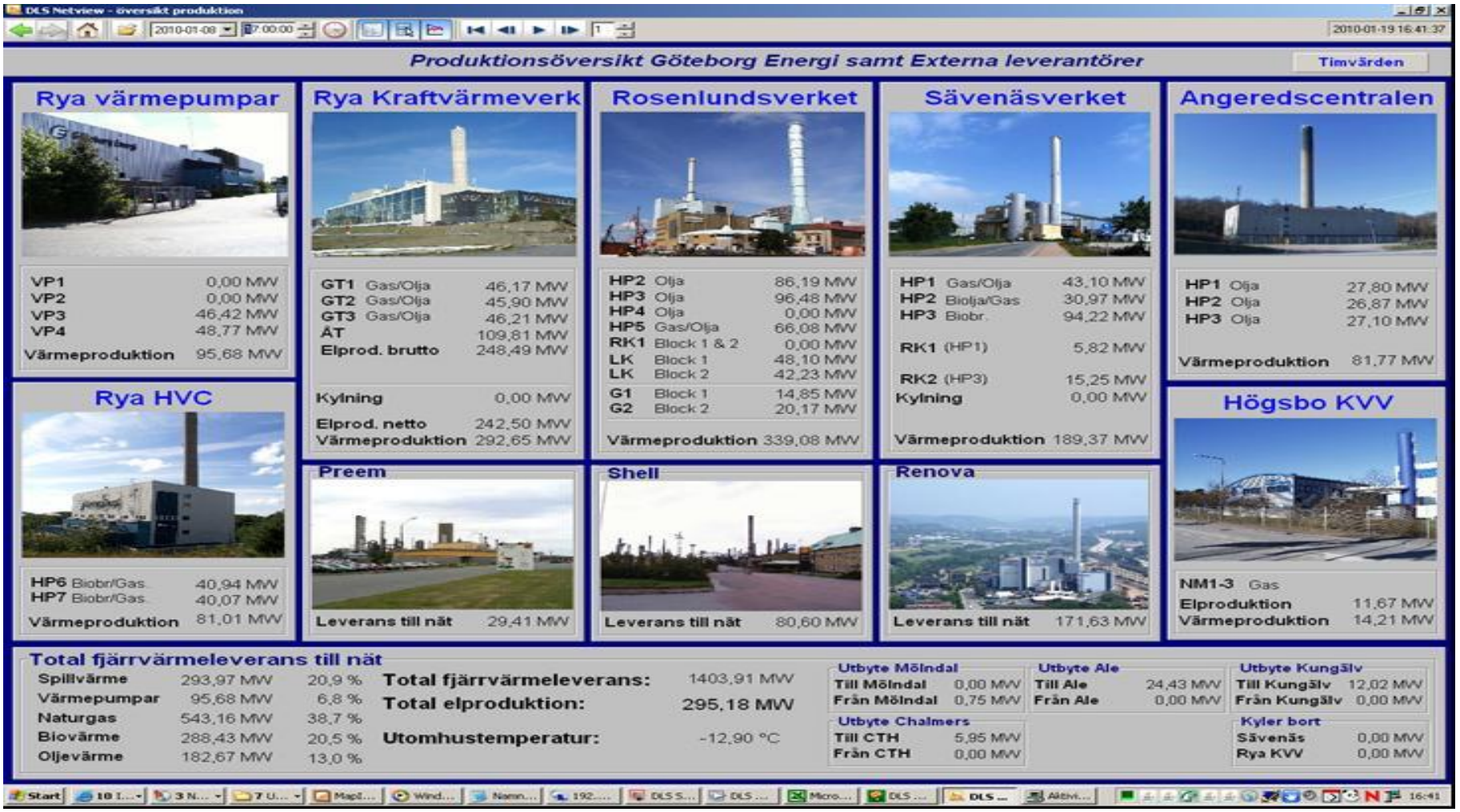
Demand over a year



DH Fuel Mix of produced heat, Gothenburg



Production Plants



Waste to energy

"In more than 400 waste-to-energy plants in EU27 only half of the energy is recovered as electricity or heat"

"100 million tonnes of non-recycled waste is deposited in landfills"

"That is equivalent to 200 plants the size of Renova (Gothenburg)"

Source: HEAT ROADMAP EUROPE 2050, Euro Heat & Power & Renova

Waste to energy

"1 % of Swedish household waste ends up in landfills "

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Göteborg Energi

celsius smart cities

Waste to energy

Renova (Co-owned by 10 municipalities in region)

~500 000 ton/annum waste is burned
~1 500 GWh heat is produced (~30 % Gothenburg)
~275 GWh electricity is produced
1 ton waste ~ 3,2 MWh (2,7 heat & 0,5 electricity)

~ 25 % of total revenues comes from heat & electricity production (~30 million £)

Göteborg Energi

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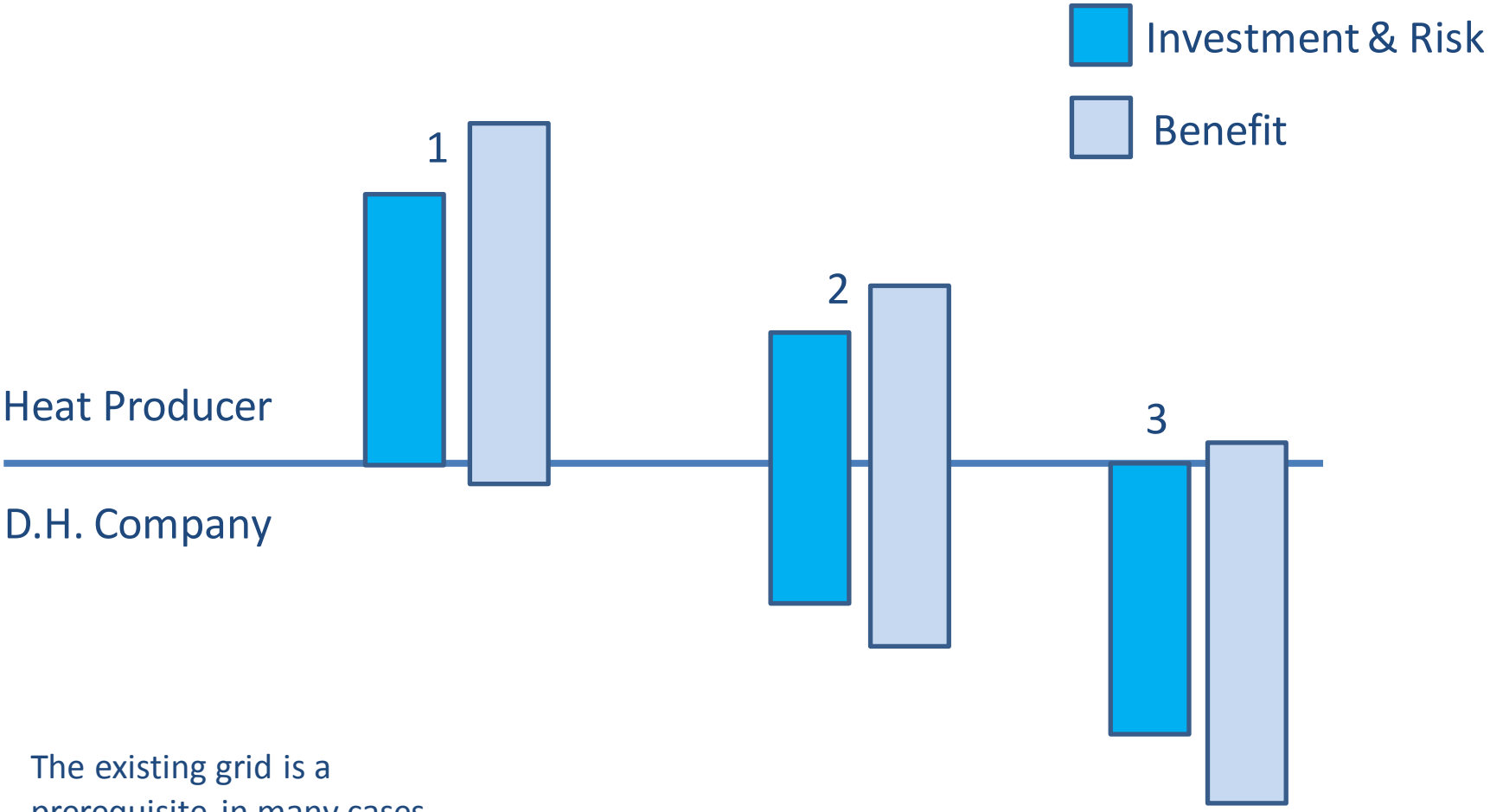
Sharing Value and Risk



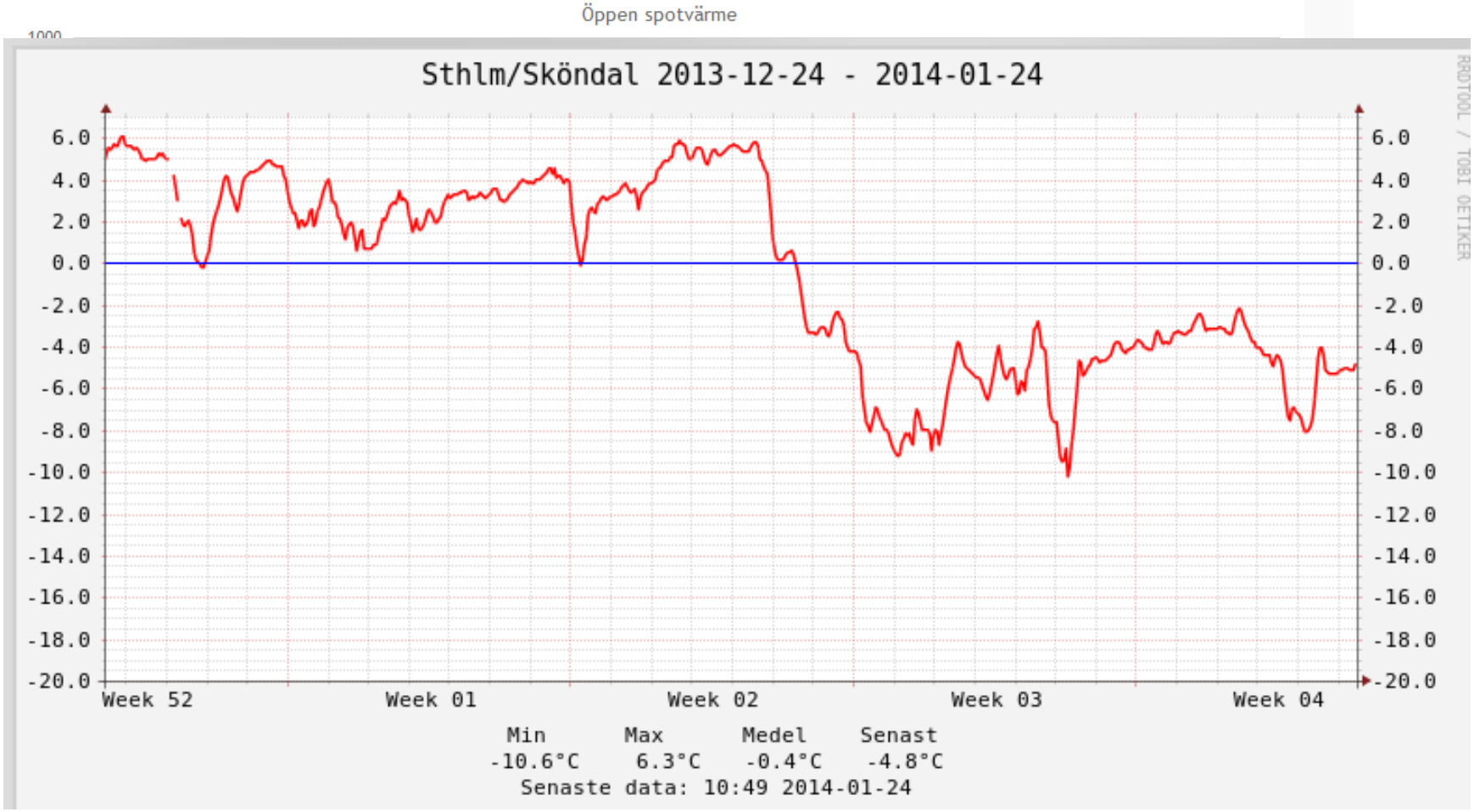
The existing grid is a prerequisite in many cases. (Sweden)

Price Models TPA - an example

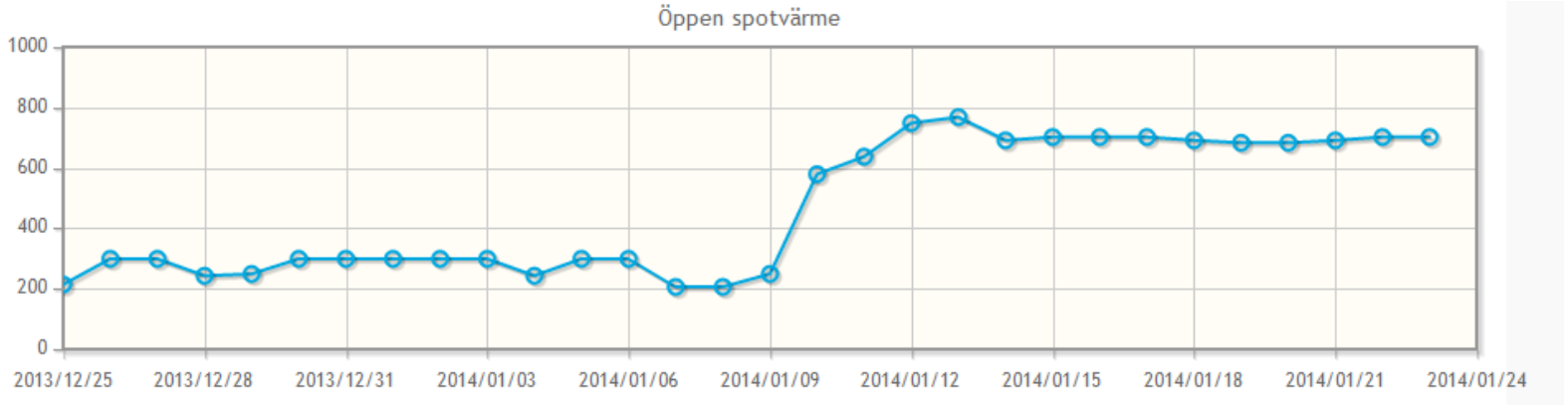
	Dagens Inköpspris 2014-01-23	Morgondagens Inköpspris 2014-01-24	2014-01-25 (Prognos)	2014-01-26 (Prognos)	2014-01-27 (Prognos)	2014-01-28 (Prognos)	Funktioner
Öppen spotvärme	702.00 SEK/MWh	691.00 SEK/MWh	683.00 SEK/MWh	683.00 SEK/MWh	683.00 SEK/MWh	637.00 SEK/MWh	
Öppen returvärme	586.00 SEK/MWh	576.00 SEK/MWh	570.00 SEK/MWh	570.00 SEK/MWh	570.00 SEK/MWh	531.00 SEK/MWh	
Öppen restvärme	50.00 SEK/MWh	50.00 SEK/MWh	50.00 SEK/MWh	50.00 SEK/MWh	50.00 SEK/MWh	50.00 SEK/MWh	
Temperaturprognos	-5.4°C	-4.8°C	**Senast Uppdaterad:** 2014-01-23 10:50:29				
Aktuell Temp Observatorielunden	-5°C		**Senast Uppdaterad:** 2014-01-24 10:00:00				

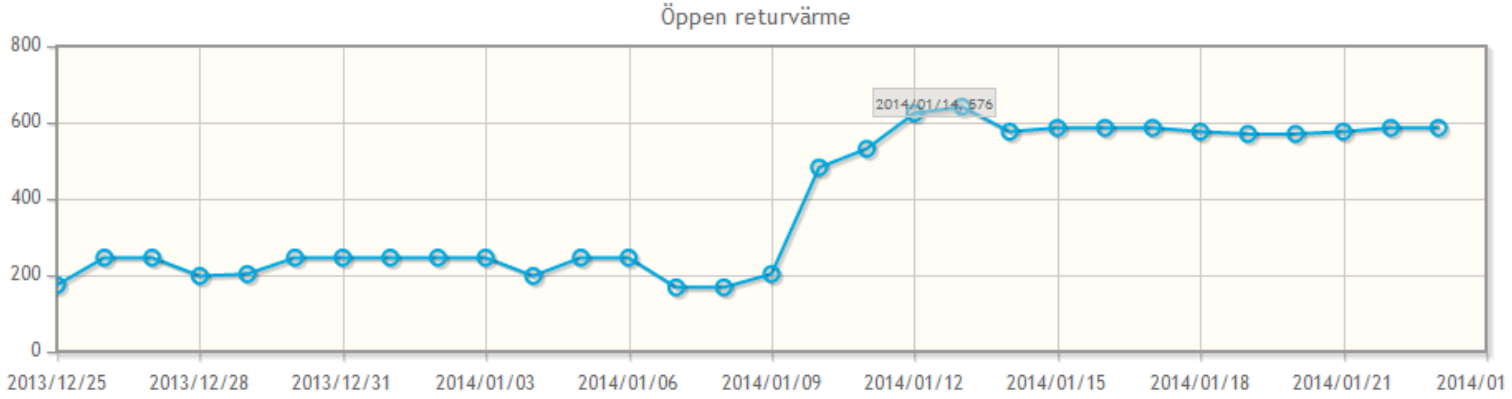
800 SEK/MWh ~ 75 £ /MWh
600 SEK/MWh ~ 55 £ /MWh
50 SEK/MWh ~ 4,75 £ /MWh

Price models - an example



Price models - an example





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Current Challenges

- Increasingly scarce resources
- Climate change
- Growing energy need
- Fuel poverty
- Fuel dependency

Barriers

Technical Political Economic Social

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Benefits

- Decreased primary energy use
- Decrease in greenhouse gas emissions
- Energy efficiency
- Energy security
- Cost-effective heating
- Improved air quality

The CELSIUS offer

CELSIUS toolbox

Specialist workshops

CELSIUS expert group

Demonstrators

Social Toolbox

- End user engagement
- Business models and funding
- Regulations and policy frameworks
- Case studies and methodology

Technical toolbox

- End user demands
- Sustainable energy supply
- System integration
- Storage and peak shaving

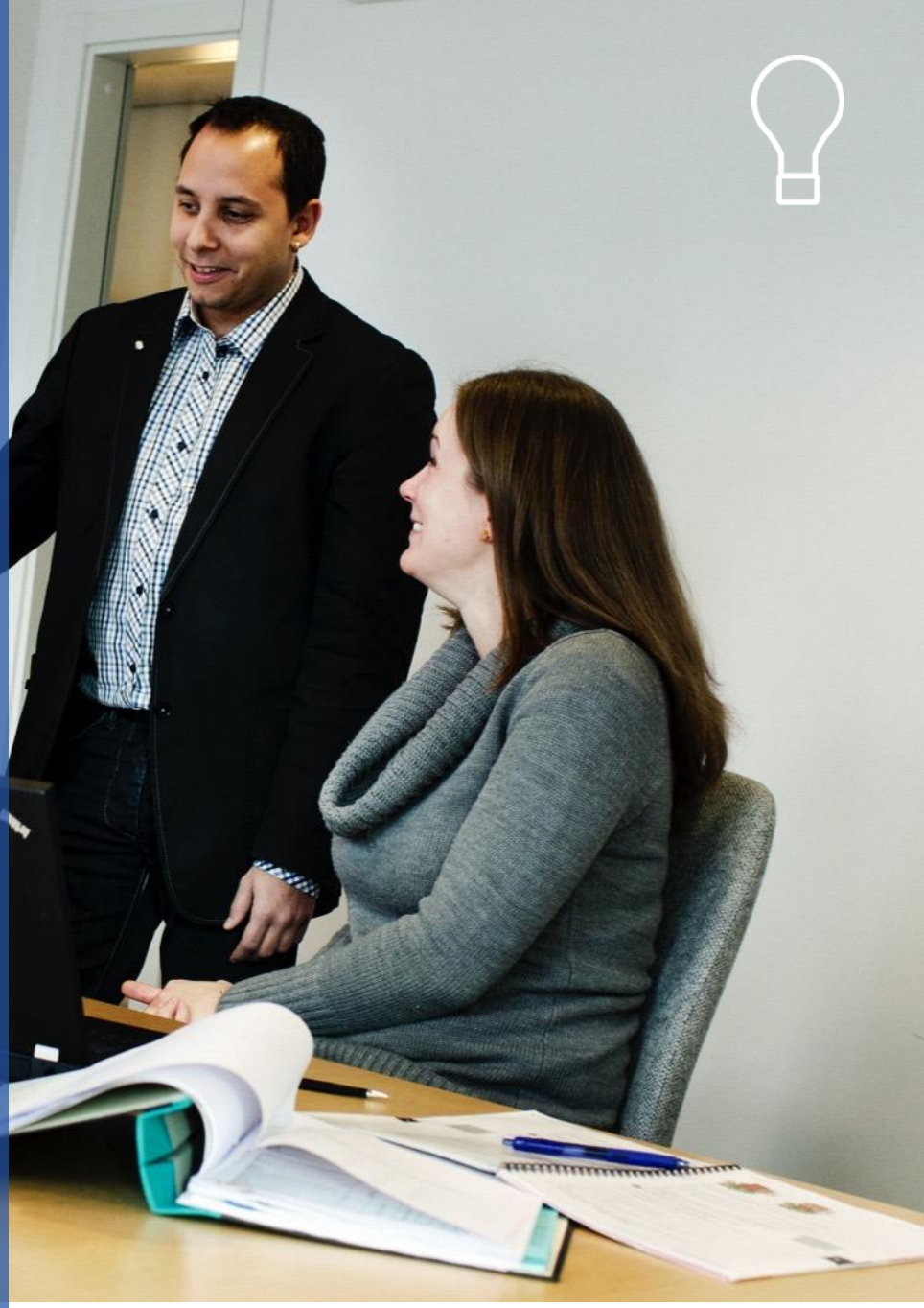
Specialist workshops

- Themed around specific topics
- CELSIUS Cities' challenges
- Webinars

https://www.youtube.com/watch?v=fsfohkMzNf4

Expert group

- Participates in Specialist workshops and webinars
- Produces the CELSIUS Toolbox
- Works on city-specific concerns



Demonstrators

5 categories:

- System integration
- Sustainable production
- Storage
- End-user
- Infrastructure

Vertical City – integrated systems

SYSTEM INTEGRATION

The offices, shops, hotel and apartments in this 160,000 m² use both district heating and cooling generated by renewable sources.

Rotterdam

Alternative heat supply solutions

SYSTEM INTEGRATION

RheinEnergie has started using bio-methane, wood pellets, geothermal and solar heating for the local DHC networks.

Cologne

Waste heat capture and utilization

SUSTAINABLE PRODUCTION

Residual heat from the London Underground mid-tunnel ventilation shaft is used for the district heating system

London & Islington

Waste heat recovery from sewage

SUSTAINABLE PRODUCTION

Heat from sewage water is now used for the DH system in six schools

Cologne

Cooling by river water

SUSTAINABLE PRODUCTION

Cold water from the river is fed to the DC network reducing the use of harmful cooling agents, electricity and cooling towers or compressors

Gothenburg

Heat hub storage

STORAGE

This structure is located in a strategic location to increase the effectiveness of the waste heat transportation and buffering capacity

Rotterdam

Short-term thermal storage

STORAGE

To help with energy balancing in the area a thermal store is integrated to support the use of waste heat and develop knowledge

London & Islington

District heating to white goods

END-USERS

Dish washers, washing machines and dryers use the DH instead of electricity for the heating demands of the machines, reducing the electricity consumption by 70-80%

Gothenburg

District heating for ships in harbour

END-USERS

For the first time a ship in regular service is being connected to the DH network instead of burning bunker oils while in the harbour

Gothenburg


The Beauty of Pipes

Thank you

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Celsiuscity.eu

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