



Webinar Series:
Ideas that Move Us Forward

Date: 27-Oct-2020 | Time: 10:00 (CET)

Decarbonisation of Heat and Power



Webinar
Series

The energy sector in Europe is rapidly changing, affected by many factors and trends.



MEGATRENDS

decarbonisation
& sustainability

A dark blue background with a complex network of light blue circles and lines, resembling a molecular or data network. Two white circular callout markers are positioned on the left and right sides of the image.

MEGATRENDS

decarbonisation
& sustainability

GENERATION

renewables, energy efficiency,
electrifications of heat, ...

A dark blue background with a network of light blue circles and lines, representing a complex system or data network. Three white circles are positioned at the top of three text blocks, connected to them by white lines.

MEGATRENDS

decarbonisation
& sustainability

GENERATION

renewables, energy efficiency,
electrifications of heat, ...

TECHNOLOGY

smart grids, hydrogen

BUSINESS MODELS

energy performance contracts,
synthetic PPAs, emission
trading system, ...

MEGATRENDS

decarbonisation
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renewables, energy efficiency,
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smart grids, hydrogen

BUSINESS MODELS

energy performance contracts,
synthetic PPAs, emission
trading system, ...

MEGATRENDS

decarbonisation
& sustainability

FINANCE & FUNDING

European green deal, new energy
finance, blockchain tokenization, ...

GENERATION

renewables, energy efficiency,
electrifications of heat, ...

TECHNOLOGY

smart grids, hydrogen

Technological innovation
is a key enabler of this
ongoing **revolution.**

Opening up **huge opportunities**
for all the stakeholders:
energy producers, users,
technology suppliers.

We estimate an addressable
market of **25 GW** for
large heat pumps in Europe...

INNOVATIVE TECHNOLOGIES FOR ENERGY



Turboden, a group company of **Mitsubishi Heavy Industries**, is an Italian firm and a global leader in the design, manufacture, and maintenance of **Organic Rankine Cycle (ORC) systems**, highly suitable for distributed generation.

Thanks to its long experience in the energy efficiency sector, today Turboden expands its solutions offering with **gas expanders** and **large heat pumps**.



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TECHNOLOGIES FOR DECARBONISATION

ORC SYSTEM

LARGE HEAT PUMP

GAS EXPANDER

NEW

NEW



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TECHNOLOGIES FOR DECARBONISATION

ORC SYSTEM

electric power generation and cogeneration from multiple heat sources, such as renewables, traditional fuels, and waste heat from industrial processes, waste incineration, engines or gas turbines. Sizes range up to 40 MW per unit.

LARGE HEAT PUMP

NEW

GAS EXPANDER



TECHNOLOGIES FOR DECARBONISATION

ORC SYSTEM

LARGE HEAT PUMP

heat transfer from a low-temperature source to a higher-temperature user (e.g. district heating, industrial processes) using electric power.
Typical size 2 – 30 MWth
with high lift $>100^{\circ}\text{C}$.

NEW

GAS EXPANDER



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TECHNOLOGIES FOR DECARBONISATION

ORC SYSTEM

LARGE HEAT PUMP

GAS EXPANDER

electric power generation from reduction of gas pressure from the transportation level to the distribution level within pressure letdown stations. Suitable for gas distribution networks and industrial sites.
Typical size 200 – 2,000 kW.

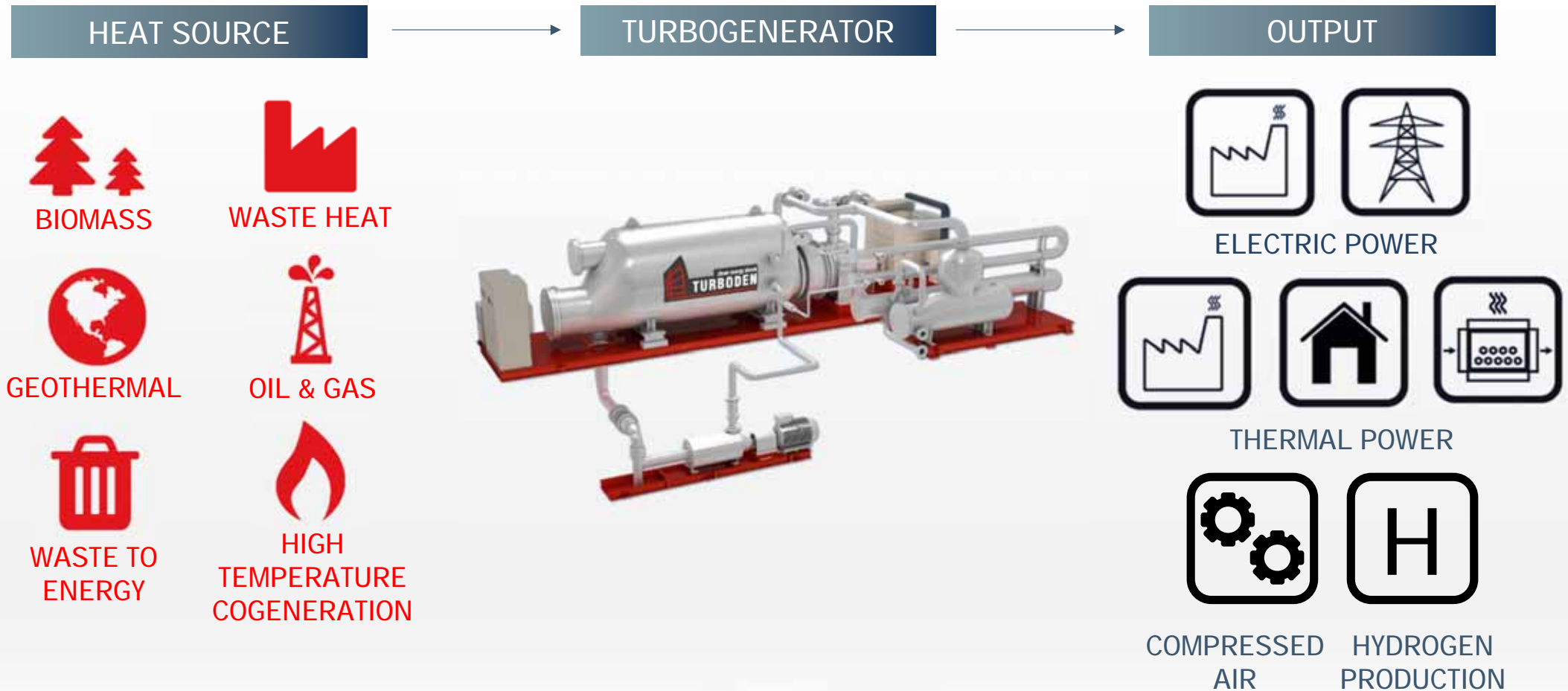
NEW

NEW

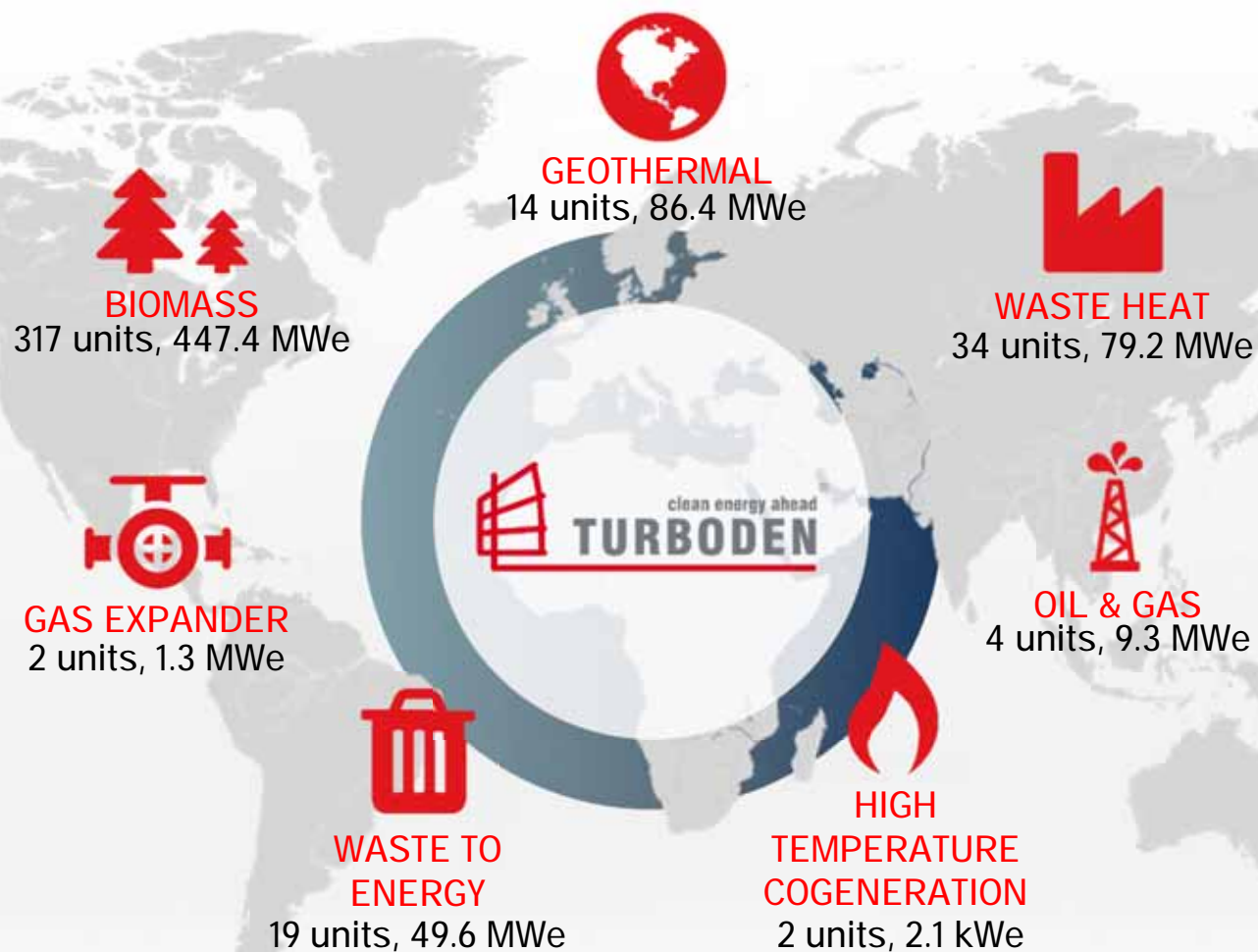


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ORC FLEXIBLE TECHNOLOGY FOR HEAT & POWER



A GLOBAL FLEET



Experience in over
45
countries

With
390+
installations

Electric power generated
22 thousands
GWh

Cumulative operation time
17.5 million
countries

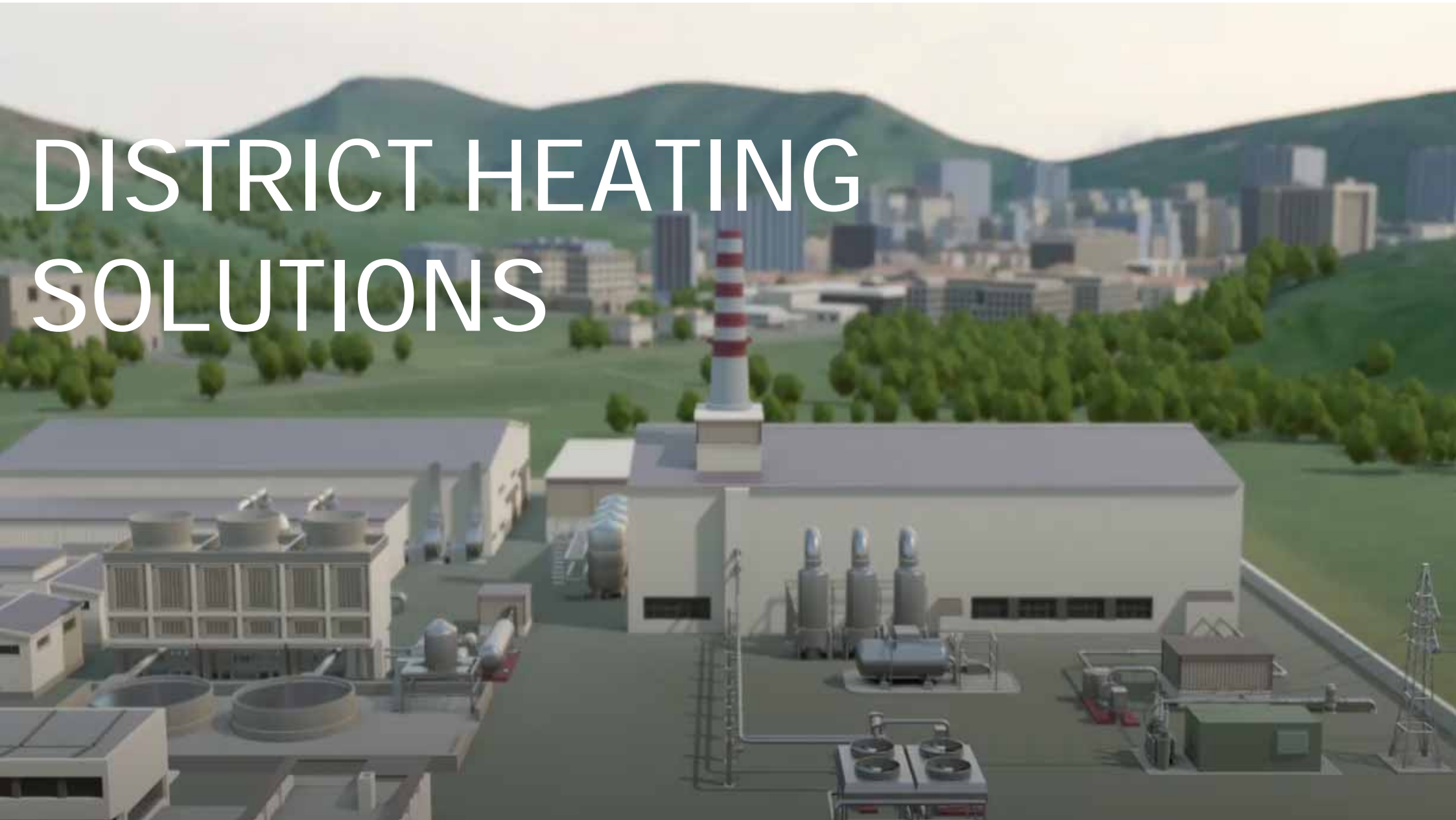
Carbon dioxide emissions
23 million tons
avoided

Last update: October 2020



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DISTRICT HEATING SOLUTIONS



COGENERATION NETWORK IN BAVARIA

GEOTHERMAL PROJECTS IN BAVARIA

4 heat & power, 2 power only



25
MWth

delivered to the local
district heating


27
MWe


delivered to the local
electrical grid

GEOTHERMAL & BIOMASS PROJECTS IN BAVARIA

21 serving the district heating



 = heat & power plant

 = power only plant



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WATER TREATMENT RESIDUES VALORISATION

WASTE-TO-ENERGY PROJECT FROM SLUDGE

today



CUSTOMER

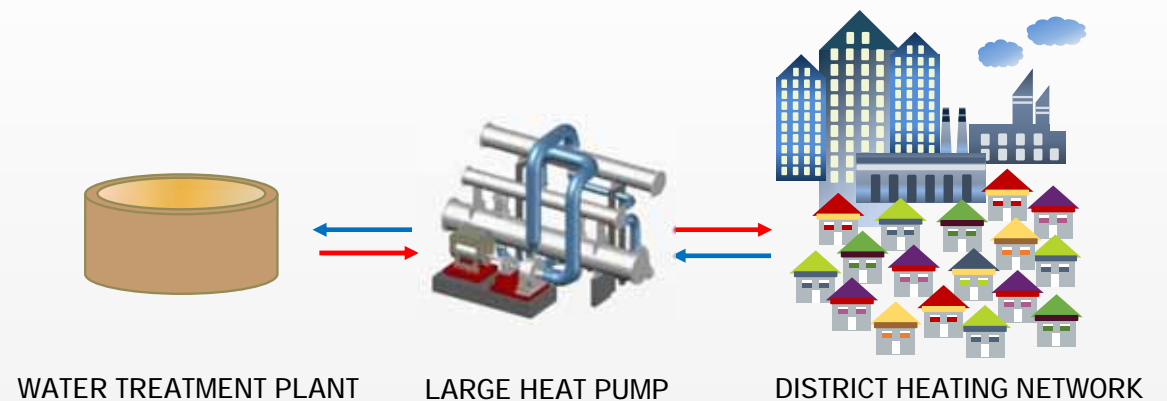
Suez International

DESCRIPTION

1.2 MW electric power generation from sludge incinerator with fluidized bed in a waste water treatment plant.

INTEGRATION WITH LARGE HEAT PUMP

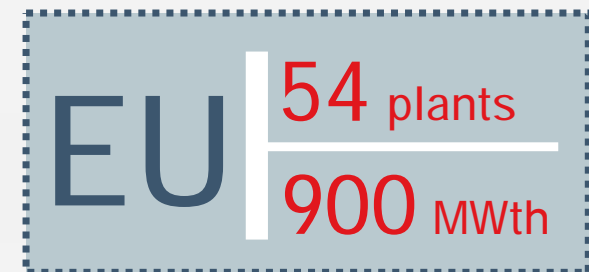
future



DESCRIPTION

Possibility to recover low-grade heat from sludge to produce heat to feed the district heating network through the use of a LHP unit.

Typical COP range: from 3 to 5



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EFFICIENCY ENHANCEMENT OF INCINERATORS

REVAMPING OF EXISTING ENERGY FROM WASTE IN BELGIUM

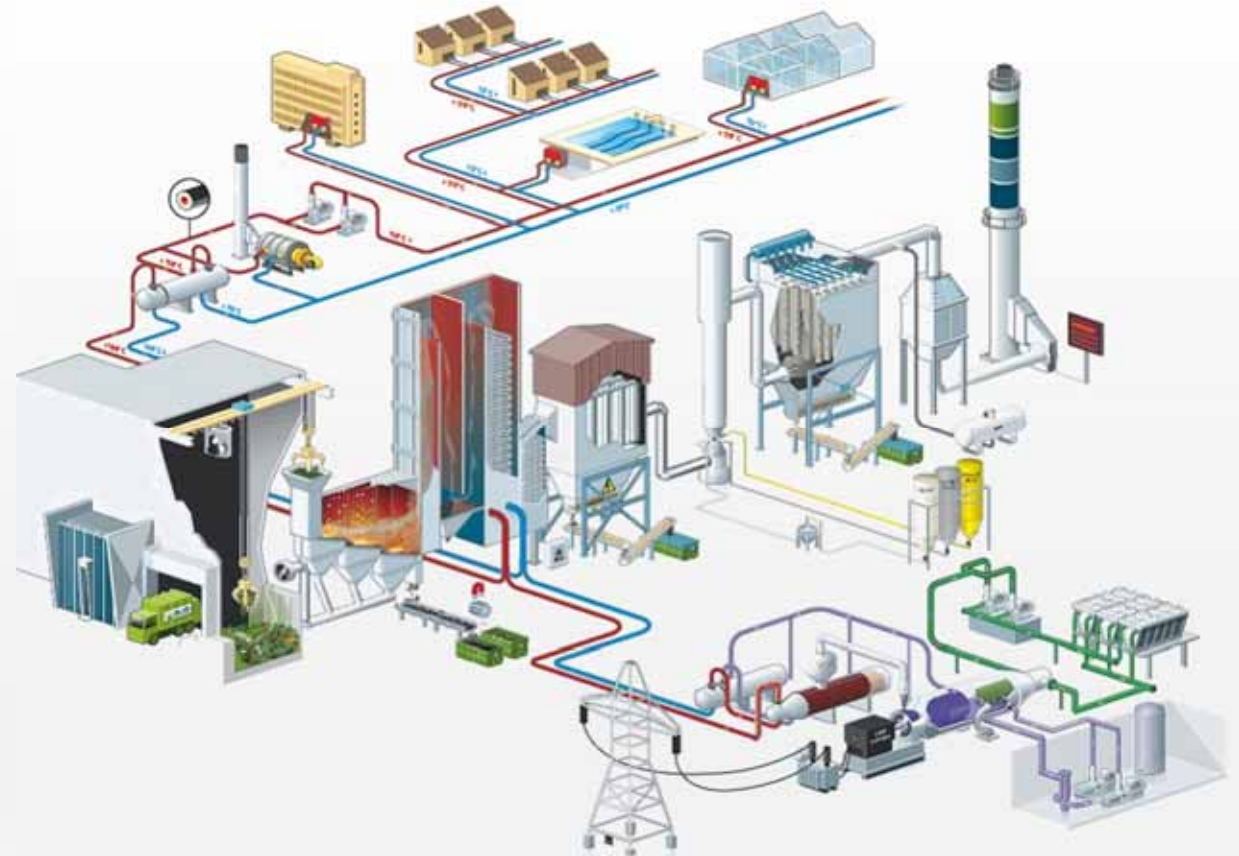


CUSTOMER

SPIE Belgium / MIROM Roeselare

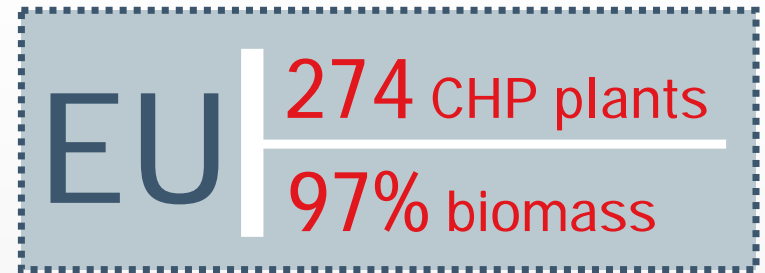
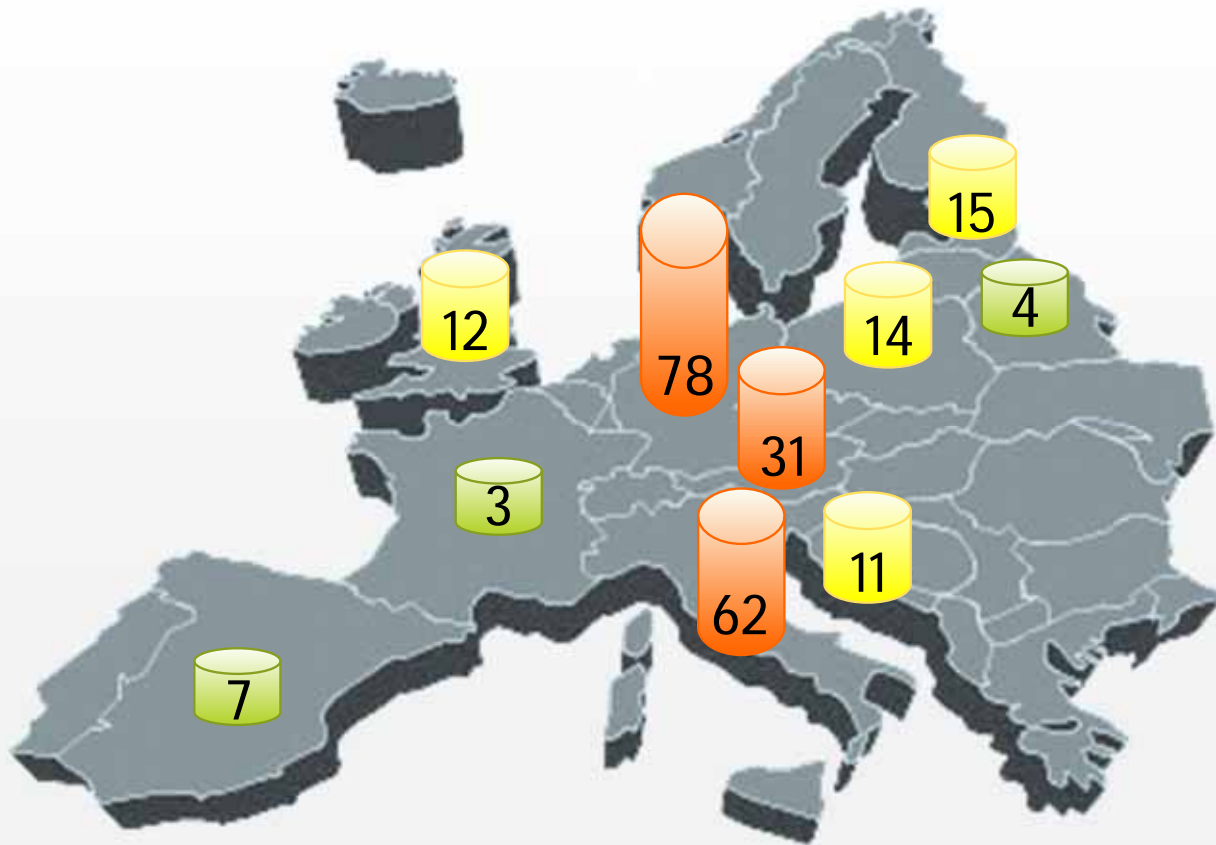
DESCRIPTION

3 MW electric power generation from a waste incineration plant, burning municipal solid waste.



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COGENERATION IN EUROPE



of which 679 MWth
delivered to the local
district heating



delivered to the local
electrical grid



15 YEARS OF SUSTAINABLE OPERATIONS

ONE OF THE LONGEST-RUNNING BIOMASS PLANTS



CUSTOMER

South Tyrol municipality

DESCRIPTION

1.5 MW electric power for the grid and up to 8 MW thermal power available to the local district heating.



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COGENERATION FOR A GREEN DISTRICT HEATING

THREE COGENERATION BIOMASS PLANTS
exploiting wood waste from surrounding areas



CUSTOMER

Linea Energia / a2a group

DESCRIPTION

the customer owns 3 ORC biomass plants producing 1MW electric power each delivered to the grid. The plants are designed to produce also thermal power for the district heating.

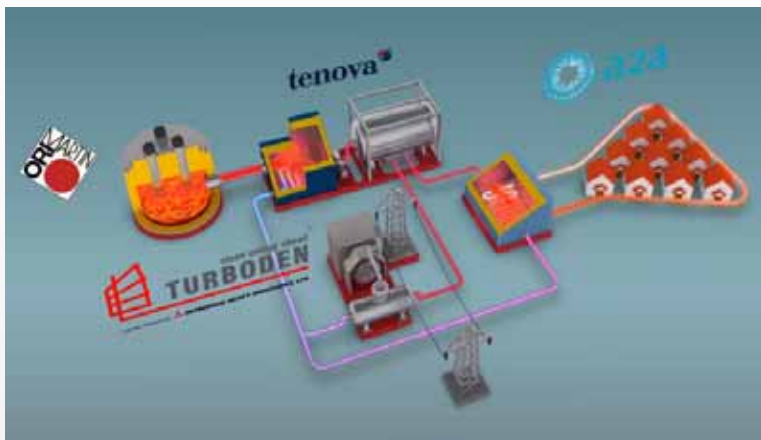


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WASTE HEAT VALORISATION IN STEEL INDUSTRY

WASTE HEAT RECOVERY PROJECT FROM STEEL

today



CUSTOMER

ORI Martin

DESCRIPTION

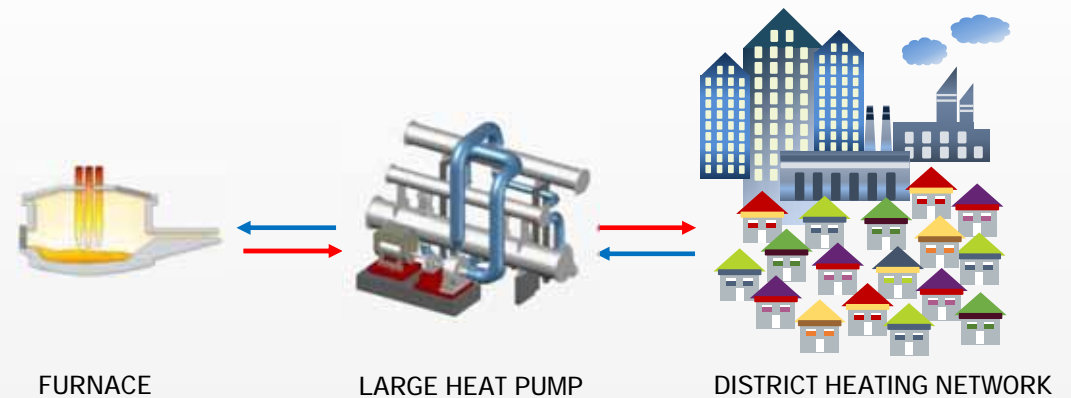
2.2 MWe power generation from waste heat from EAF in summer time + hot water to the local district heating operated by a2a in winter time

The project is financed by a European Project.



INTEGRATION WITH LARGE HEAT PUMP

future



FURNACE

LARGE HEAT PUMP

DISTRICT HEATING NETWORK

DESCRIPTION

Possibility to recover low-grade heat from EAF cooling water circuit to produce useful heat to feed the district heating network operated by a2a through the use of a LHP unit. High temperature output up to 120°C.

COP: 9.5

LHP size: 6 MWth



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INDUSTRIAL LARGE HEAT PUMPS



Large Heat Pumps allow **recovering low-grade waste heat** streams in industrial processes, aim at **generating higher grade heat** either for the **industrial processes** themselves or for external **heat users** such as **district heating** networks.

KEY POINTS

- Highly **efficient** (optimal COP design)
- **Large-scale**: output from 3 MWth to 30 MWth per unit
- **High-temperature lift** (ΔT up to **100°C**)
- **High-temperature** output, including steam generation up to **200°C**
- Heat pumps fed by renewable electricity are a key means for clean heat generation, reducing the CO₂ footprint



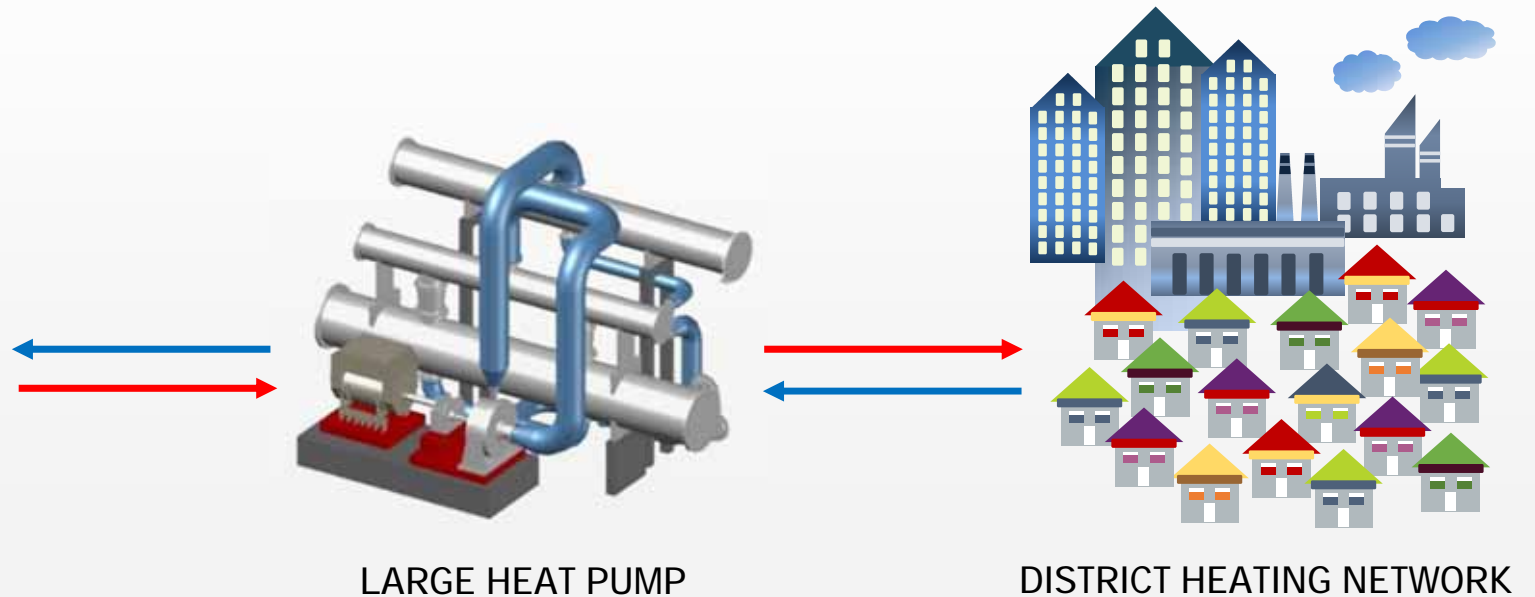
DISTRICT HEATING INTEGRATION WITH LHP

"FREE" HEAT

- Waste water
- River water
- Sea water (2-3°C)
- Groundwater
- ...

"INCOME GENERATOR" HEAT

- Power plants waste heat
- Power plants flue gas cleaning
- Cooling in industrial processes
- Data centers cooling
- District cooling
- Seasonal solar heat storage
- ...



LARGE HEAT PUMP

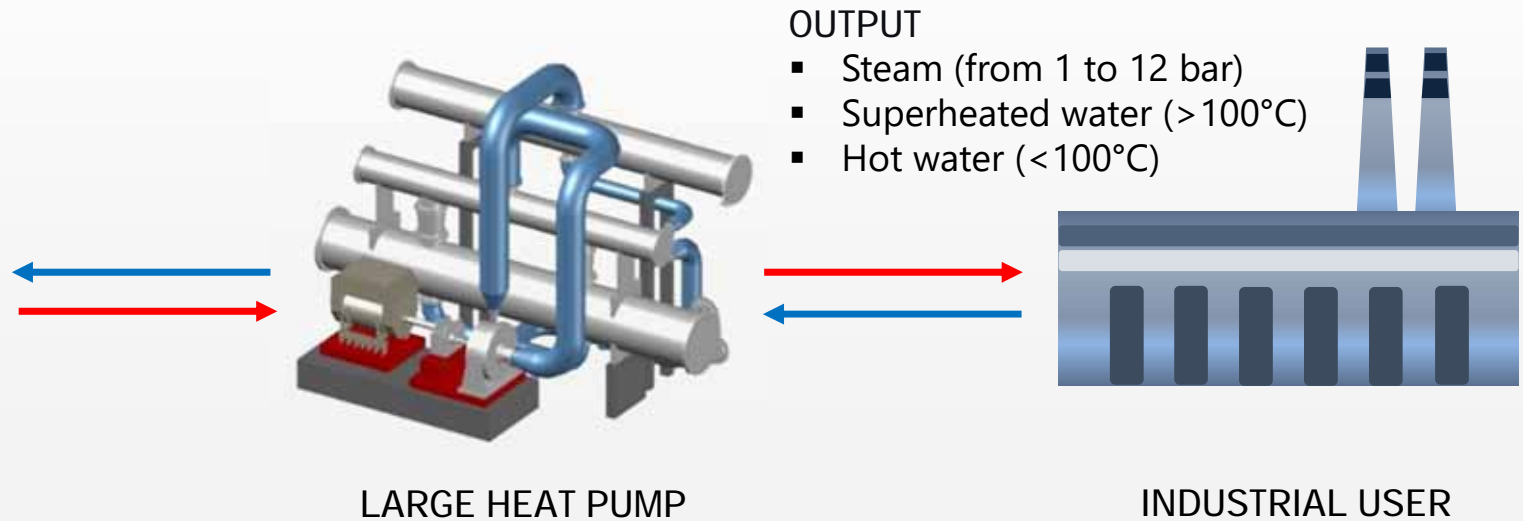
DISTRICT HEATING NETWORK



INDUSTRIAL PROCESS INTEGRATION WITH LHP

HEAT SOURCES

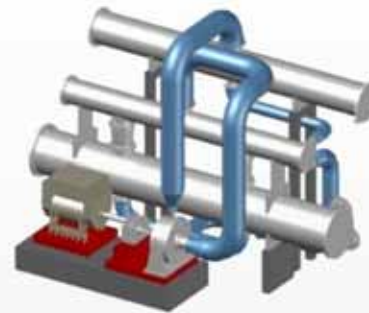
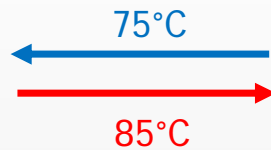
- Cooling circuits (e.g. cooling water circuits, cooling of industrial products, ...)
- Power plants waste heat
- Waste water



INDUSTRIAL PROCESS INTEGRATION WITH LHP

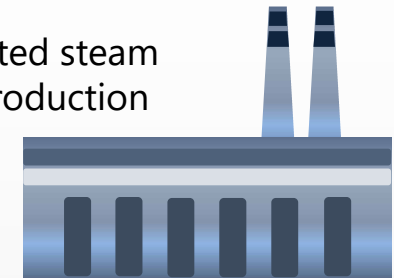
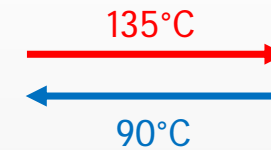
Plastic-making industry

HEAT SOURCE
Hot water from existing
cooling water circuit



LARGE HEAT PUMP
COP = 3.3

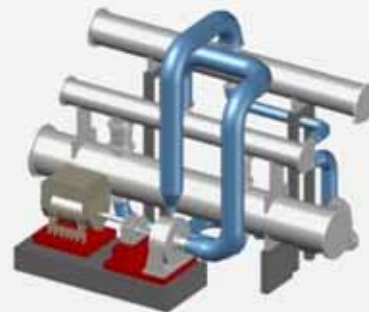
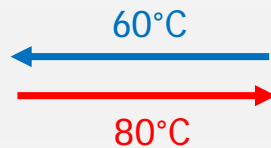
OUTPUT
2 bar(g) of saturated steam
needed for the production
process



INDUSTRIAL USER

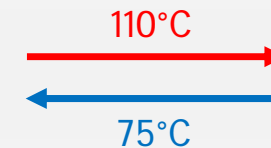
Synergy between industries

HEAT SOURCE
Cooling water from
industrial user "A"



LARGE HEAT PUMP
COP = 4.7

OUTPUT
Pressurized water for
industrial user "B"



INDUSTRIAL USER





AGROFOOD
& BEVERAGE



BRICK



RUBBER & PLASTIC



PHARMACEUTICAL
&
CHEMICAL



LARGE HEAT PUMPS



PAPER & WOOD



IRON & STEEL



OIL & GAS

IN INDUSTRY



GREENHOUSE



TEXTILE



WASTE WATER
TREATMENT

DECARBONISATION OF GAS DISTRIBUTION

GAS DISTRIBUTION NETWORK

Case history



CUSTOMER

main Italian gas distribution company

DESCRIPTION

1.3 MW electric power generation from gas pressure reduction in a natural gas letdown station.

GAS-FED INDUSTRIAL PROCESS

Case study



The project is financed
by a European Project.



CUSTOMER

major Italian steel company

DESCRIPTION

320 kW electric power generation from gas pressure reduction in a natural gas letdown station within a steel production facility.



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”

To some generations much is given.
Of other generations much is expected.

Franklin D. Roosevelt
Democratic National Convention (1936)

FIND OUT MORE

