Webinar Series:

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

Decarbonisation of Heat and Power

EUROHEAT & POWER

TURBODEN
The energy sector in Europe is rapidly changing, affected by many factors and trends.
MEGATRENDS
decarbonisation & sustainability

GENERATION
renewables, energy efficiency, electrifications of heat, ...
Ideas that Move Us Forward

Webinar Series: MEGATRENDS
decarbonisation & sustainability

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

TECHNOLOGY
smart grids, hydrogen
Ideas that Move Us Forward

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TECHNOLOGY
smart grids, hydrogen

BUSINESS MODELS
energy performance contracts, synthetic PPAs, emission trading system, …

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renewables, energy efficiency, electrifications of heat, …
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BUSINESS MODELS
- energy performance contracts, synthetic PPAs, emission trading system, …

FINANCE & FUNDING
- European green deal, new energy finance, blockchain tokenization, …
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.
TECHNOLOGIES FOR DECARBONISATION

- ORC SYSTEM
- LARGE HEAT PUMP
- GAS EXPANDER

NEW
NEW
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.
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°C.

GAS EXPANDER

NEW
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

NEW
ORC FLEXIBLE TECHNOLOGY FOR HEAT & POWER

HEAT SOURCE → TURBOGENERATOR → OUTPUT

- BIOMASS
- WASTE HEAT
- GEOTHERMAL
- OIL & GAS
- WASTE TO ENERGY
- HIGH TEMPERATURE COGENERATION

- ELECTRIC POWER
- THERMAL POWER
- COMPRESSED AIR
- HYDROGEN PRODUCTION
A GLOBAL FLEET

Biomass
317 units, 447.4 MWe

Geothermal
14 units, 86.4 MWe

Oil & Gas
4 units, 9.3 MWe

Waste Heat
34 units, 79.2 MWe

Waste to Energy
19 units, 49.6 MWe

High Temperature Co-generation
2 units, 2.1 kWe

Experience in over 45 countries
With 390+ installations
Electric power generated 22 thousands GWh
Cumulative operation time 17.5 million countries
Carbon dioxide emissions avoided 23 million tons

Last update: October 2020
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
WATER TREATMENT RESIDUES VALORISATION

WASTE-TO-ENERGY PROJECT FROM SLUDGE

**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

**CUSTOMER**
Suez International

**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

EU 54 plants
900 MWth
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.
COGENERATION IN EUROPE

EU
274 CHP plants
97% biomass

12 GWth
313 MWe

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.
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.
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

INTEGRATION WITH LARGE HEAT PUMP future

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
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
- …
DISTRICT HEATING INTEGRATION WITH LHP

LHP can extract low-enthalpy energy from geothermal resource and supply a district heating network at suitable temperature. Where electricity price is high, a possible technical solution is to combine LHP and Gas Engine.

1 MWth from natural gas = 1.80 MWth to DH (*)

(*) Thermal power to DH can exceed 2 MWth depending on the temperature of the heat source.
WEBSHARE SERIES:
INDUSTRIAL PROCESS INTEGRATION WITH LHP

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

OUTPUT
- Steam (from 1 to 12 bar)
- Superheated water (>100°C)
- Hot water (<100°C)
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

Synergy between industries

HEAT SOURCE
Cooling water from industrial user “A”

LARGE HEAT PUMP
COP =4.7

OUTPUT
Pressurized water for industrial user “B”
Ideas that Move Us Forward

Webinar Series:

LARGE HEAT PUMPS

IN INDUSTRY

AGROFOOD & BEVERAGE
BRICK
CHEMICAL & PHARMACEUTICAL
IRON & STEEL
PAPER & WOOD
GREENHOUSE
TEXTILE
OIL & GAS
WASTE WATER TREATMENT
PAPER & WOOD
GREENHOUSE
LARGE HEAT PUMPS
IN INDUSTRY
IDEAS THAT MOVE US FORWARD

Webinar Series:

DECARBONISATION OF GAS DISTRIBUTION

GAS DISTRIBUTION NETWORK
Case history

GAS- FED INDUSTRIAL PROCESS
Case study

CUSTOMER
main Italian gas distribution company

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

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.

The project is financed by a European Project.
To some generations much is given.
Of other generations much is expected.

Franklin D. Roosevelt
Democratic National Convention (1936)