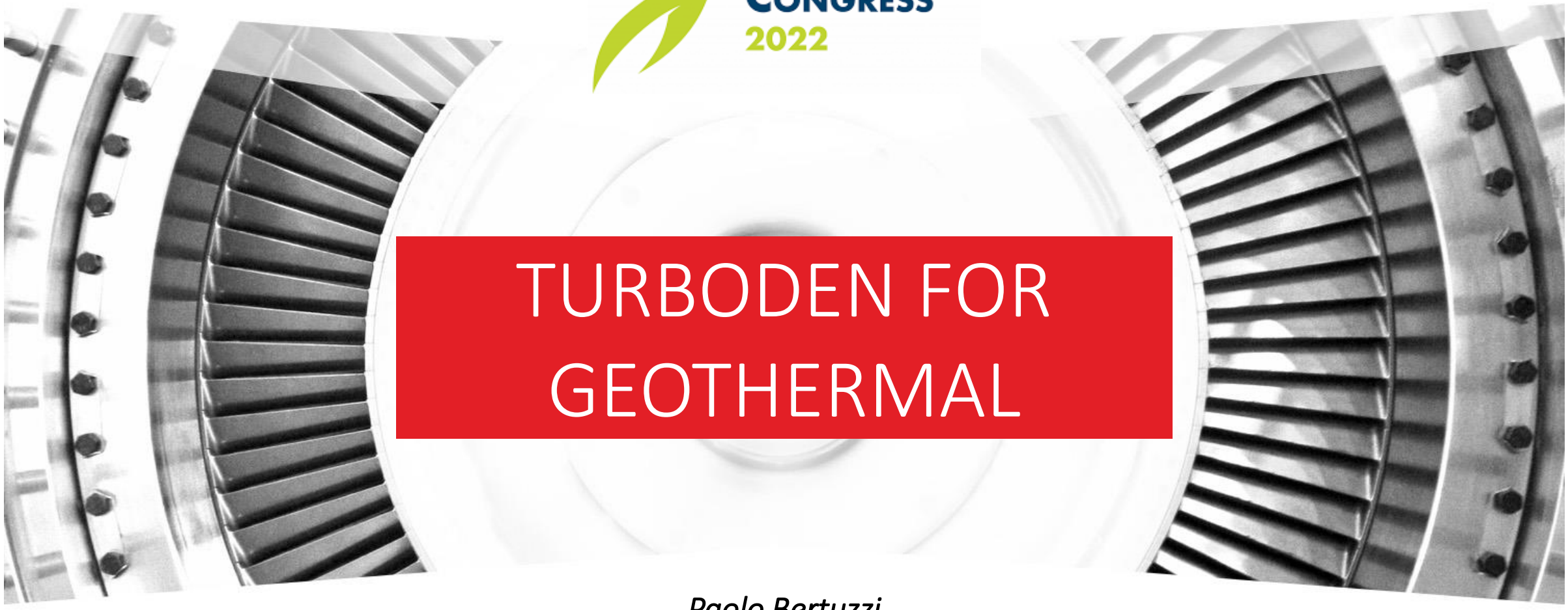
clean energy ahead
TURBODEN

EUROPEAN GEOTHERMAL CONGRESS 2022

MOVE THE WORLD FORWARD MITSUBISHI HEAVY INDUSTRIES GROUP



TURBODEN FOR GEOTHERMAL

Paolo Bertuzzi

Managing Director & CEO Turboden S.p.A.

EGC 2022, 18-20 October, Berlin

TURBODEN ORC TECHNOLOGY & GEOTHERMAL

Experience in over
50
countries

With
400+
Installations worldwide

Tot. fleet capacity
800+
MWe

Cumulative operation time
20 million
hours

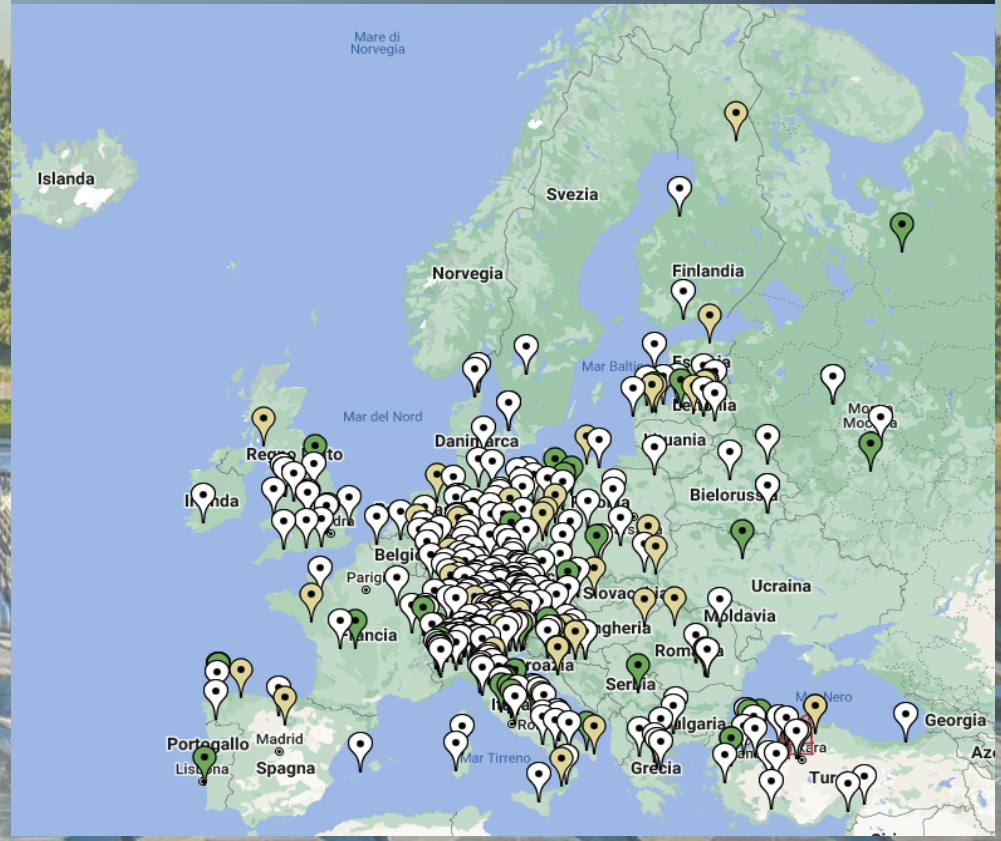
Experience
42+
years

First geothermal plant
1999

EGEC GEOTHERMAL

EGEC active member
since 2009

Market leader in EU with 350+ ORC plants
of which 8 geothermal plants



TURBODEN SOLUTIONS FOR GEOTHERMAL

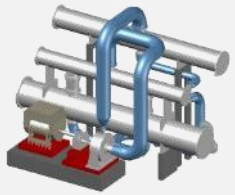
Temperature of geothermal resource

40°C — 100°C — 200°C

1

40 – 70°C

Low temperature



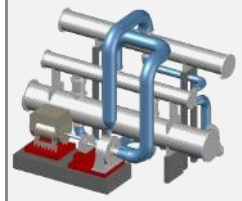
LARGE HEAT PUMP
From low to higher temperature heat, e.g. for DHN.

2

60 – 120°C

Medium temperature

DIRECT USE
Medium temperature heat can be used directly if low or medium temperature users are available for DH.



LARGE HEAT PUMP
From medium to higher temperature to provide steam for industries.

3

100 – 200°C

High temperature

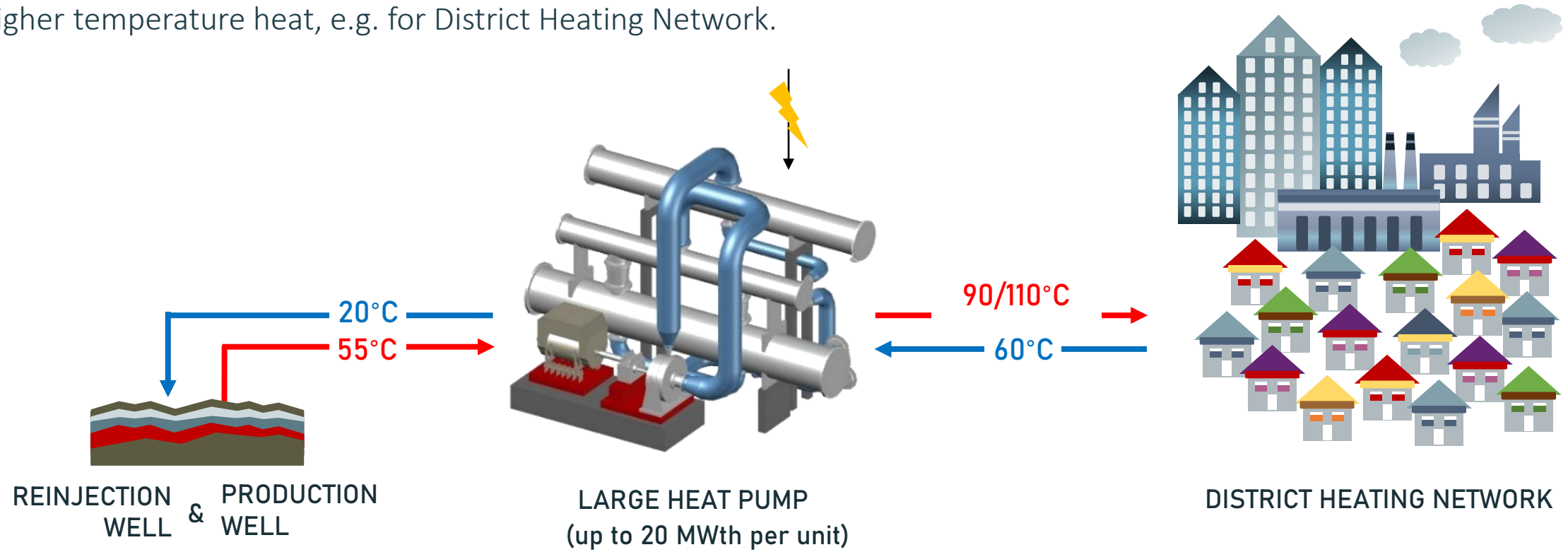
ORC
High temperature heat can be used for:
- Power generation
- Cogeneration
- Hybrid solutions

DIRECT USE
High temperature heat can be used directly if low/medium/high temperature users are available.

LOW TEMPERATURE

1

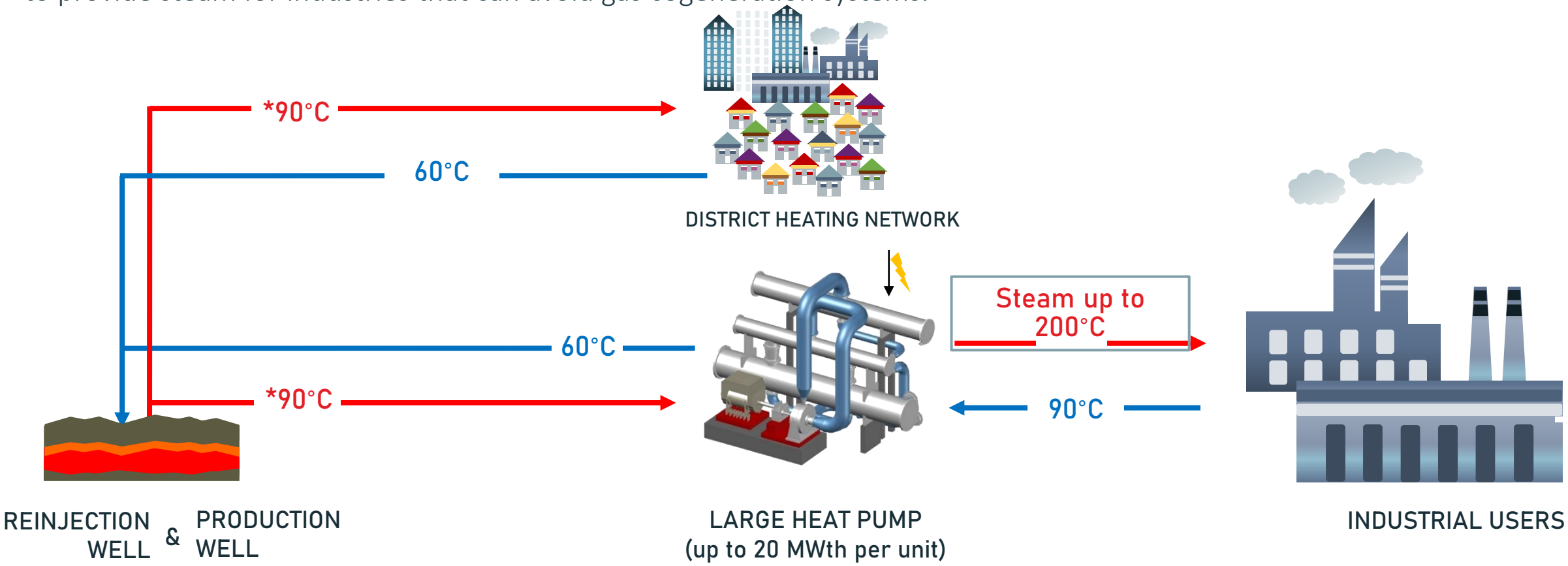
Low temperature heat can be used with the help of a heat pump to produce higher temperature heat, e.g. for District Heating Network.



MEDIUM TEMPERATURE

2

Medium temperature heat can be used with the help of a heat pump to generate heat at a higher temperature and to provide steam for industries that can avoid gas cogeneration systems.



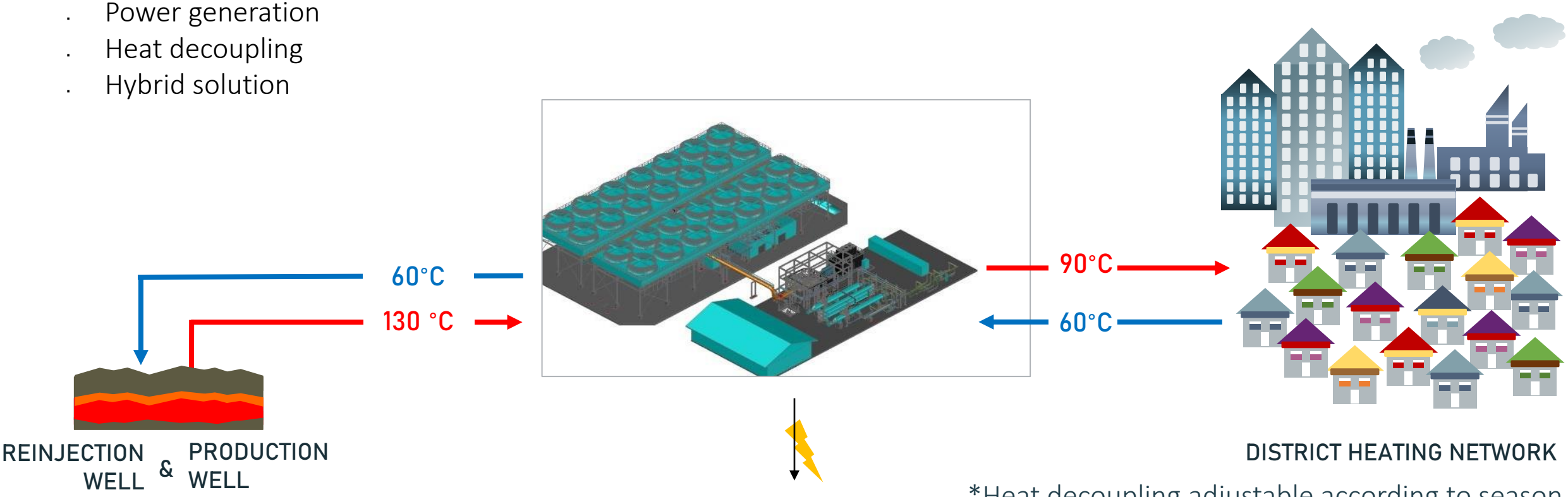
*In case of higher temperature from production well, District Heating can be fed by Large Heat Pump discharge (cascade configuration)

HIGH TEMPERATURE

3

High temperature heat from geothermal fluid can be used for:

- Power generation
- Heat decoupling
- Hybrid solution



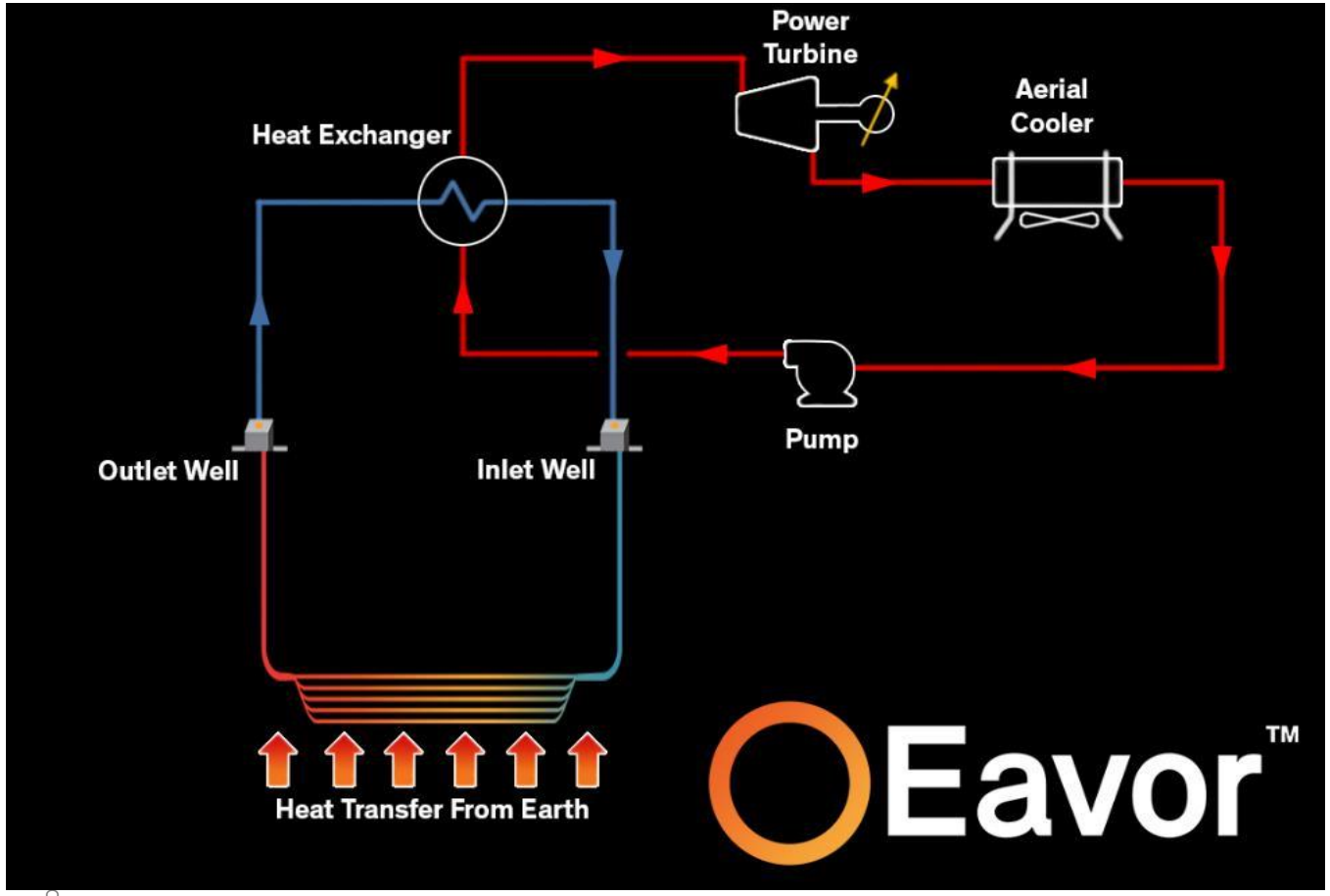
*Heat decoupling adjustable according to season. Different process scheme configuration can be adopted to optimize the heat decoupling, selection of best configuration is one of Turboden expertise. (e.g. Sauerlach geothermal plant)

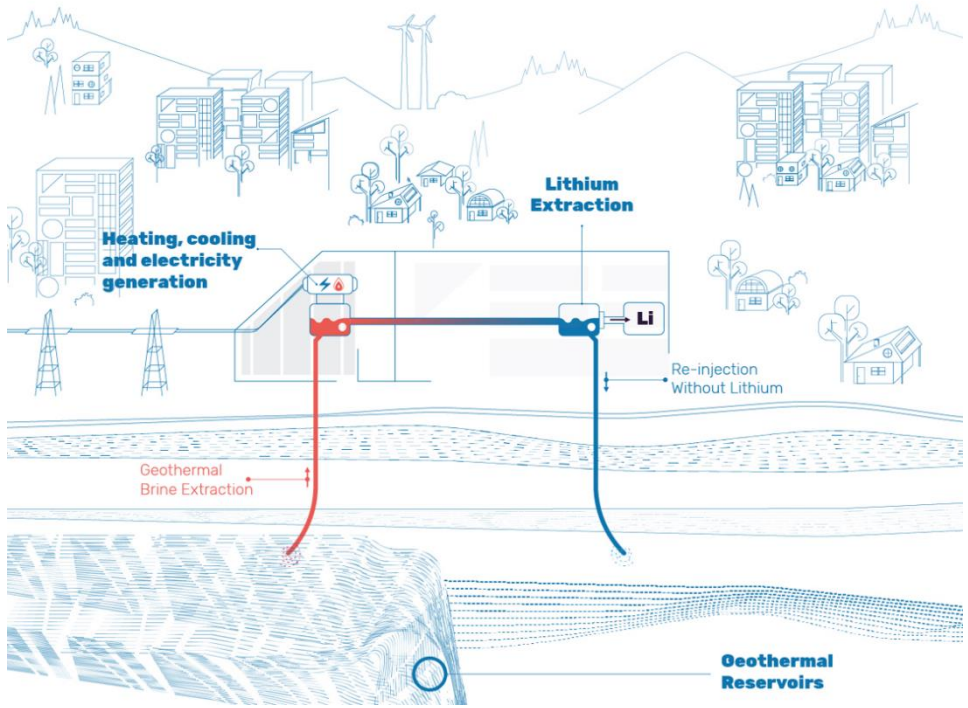
GOING TOWARDS A #GEOTHERMAL DECADE – HOW?

- ✓ A clear and harmonized framework of policies, incentives and institutional commitment to implement **GW (not MW!)** of geothermal power, in the next decades.
- ✓ Rules to introduce **indexation of feed-in-tariff to face growing inflation** - most of geothermal plants have fixed PPA price for 10 - 20 years
- ✓ Financial support to **extend existing networks** (new wells, heat exploitation, …)
- ✓ **De-risking mechanism** from financial institutions to motivate investors
- ✓ More geothermal in **#InnovationFund** to promote innovation (such as the closed loop and advanced geothermal systems)

BINARY ADVANCED GEOTHERMAL SYSTEMS, LITHIUM

Joint development between **Eavor and Turboden** aimed at optimizing the design and operation of a baseload commercial Eavor-Loop™ + ORC system over a 30-year project lifetime, and dispatchable operation.





LITHIUM, and other valuable minerals extraction from geothermal brines, perfectly fits with Turboden ORC technology

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TURBODEN

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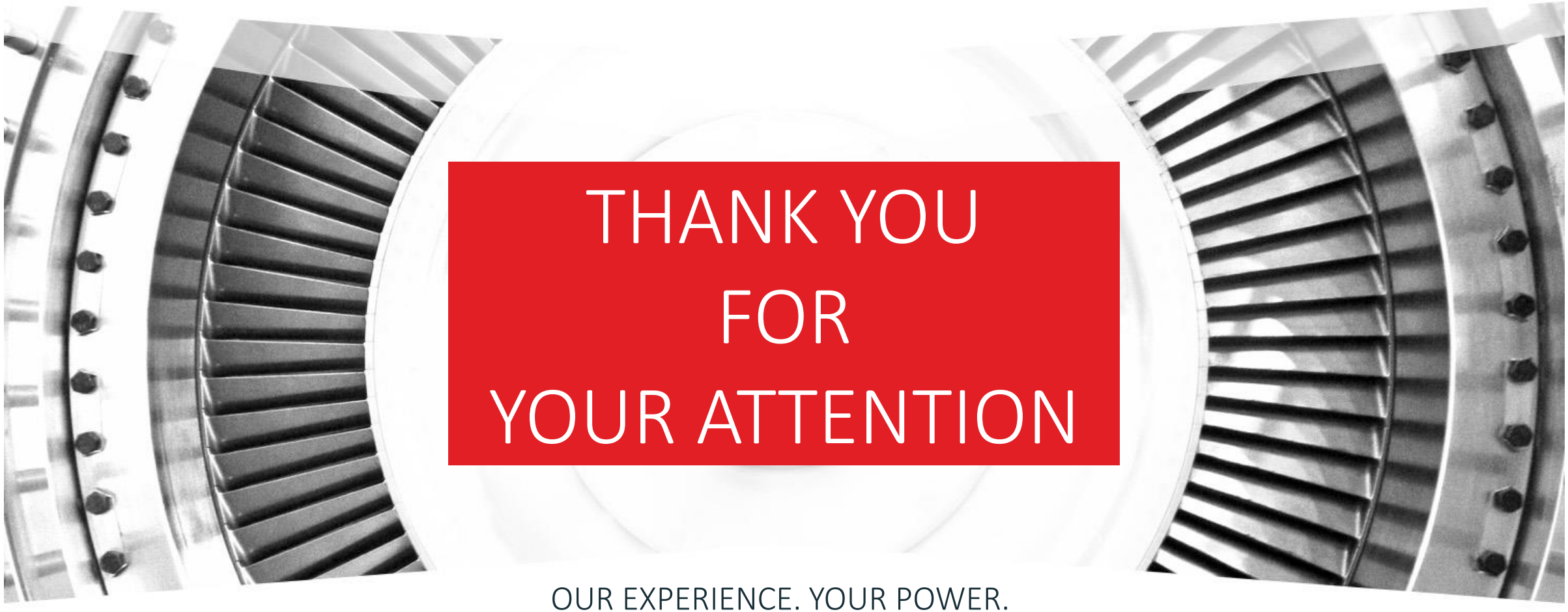

THANK YOU FOR YOUR ATTENTION

OUR EXPERIENCE. YOUR POWER.