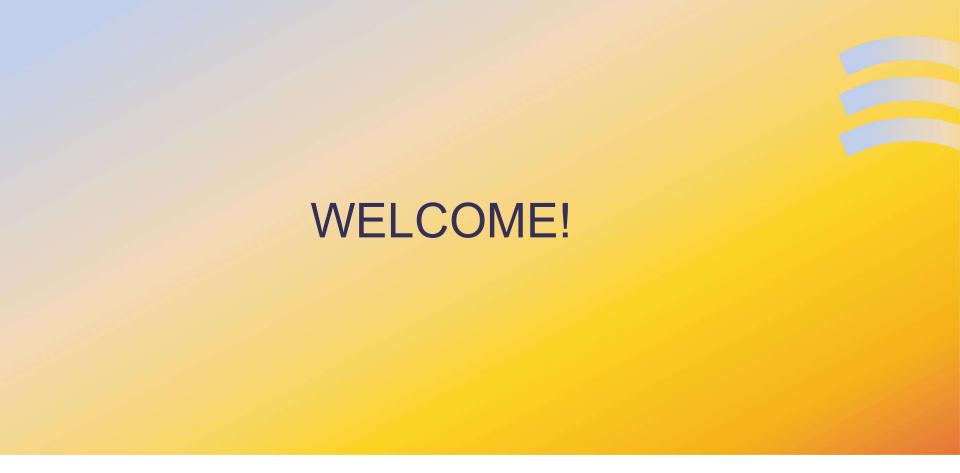


**Webinar: Watt's next** 

A shift to electric and efficient net zero industry











## A webinar organised with...







The European Heat Pump
Association (EHPA) is the
voice of the heat pump
industry in Europe, promoting
sustainable heating and
cooling solutions to support the
energy transition.

https://ehpa.org/

**KCORC** is an international knowledge center promoting research and collaboration on Organic Rankine Cycle technologies.

https://kcorc.org

The European Climate
Foundation (ECF) is a
philanthropic initiative
supporting policies and
partnerships to drive Europe's
transition to a low-carbon
economy.

https://europeanclimate.org



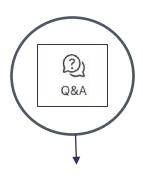
## **AGENDA**

Timing	Topics	Speakers
9:00 (5 minutes)	Welcoming	Rachelle Hajjar, Senior events officer, EHPA
9:05 (10 minutes)	The missing puzzle piece of industrial decarbonisation: Efficient process heating	Christian Noll, Managing Director, DENEFF
9:15 (10 minutes)	The right technology for any situation: Thermal Energy Harvesting	<b>Piero Colonna</b> , Professor, Deft University of Technology, KCORC
9:25 (15 minutes)	Case study 1: Heat Pumps, practical industrial implementation	<b>Laura Alonso</b> , Senior researcher and project coordinator, Tecnalia PUSH2HEAT EU project
9:40 (15 minutes)	Case study 2: ORC, practical industrial implementation	Roberto Bertanzi, Technical product development coordinator, Turboden
9:55 (25 minutes)	Q&A & live Slido	<b>Gian Luca Agliardi</b> , Senior associate and innovation program, European Climate Foundation (ECF)
10:20 (10 minutes)	Closing Remarks	Paul Kenny, Director General, European Heat Pump Association (EHPA)





### Question(s), thoughts? Share them!



Ask your questions and upgrade your favourite one(s), experts will answer you in the chat and during the Q&A!



Upvoted questions in the Q&A chat will be answered by speakers. You are welcome to raise your hand to ask a question with your mic (camera optional)



A live Slido will run during the Q&A session at the end of the webinar, to hear more on your thoughts!





The missing puzzle piece of industrial decarbonisation: Efficient process heating





## "Watt's Next: a shift to an electric and efficient net zero industry"

Christian Noll, Managing Director, DENEFF









**DENEFF** – The powerful voice of energy efficiency.

The missing puzzle piece of industrial decarbonisation: efficient process heating.

15 October 2025, online Webinar "Watt's Next: an electric and efficient net-zero industry."



image source: Pixabay



01	Most products in everyday life have one thing in common: They require process heat.
02	For most companies, becoming climate-neutral primarily means decarbonising their process heat.
03	Halving energy demand and cutting the energy bill by 21 bn euros per year – the case for German companies
04	Opportunity for European manufacturers: Enormous market potential for energy efficient and climate neutral process heat.
05	Growth potential is not enough; we need to strategically secure our



Frontrunners show: Decarbonising process heat efficiently is possible.

competitiveness.

O7 Politics has to act now: Implement Energy Efficiency First principle and tackle barriers of process heat decarbonisation.

# DENEFF is Germany's strong voice for energy efficiency and a knowledge pool for climate protection practice



Together, we are advancing the **energy transition** and the market for **saved kWh** - through effective **political** work, a strong **network** along the entire value chain and successful **innovation** projects.





#### **Politics**

Political decision-making, policy proposals and the latest information on relevant political developments



#### **Network**

Over 250 pioneering companies from technology manufacturers to consultants and financiers



#### **Innovation**

Development of innovative solutions and tools in an era of major transformation challenges



# Most products in everyday life have one thing in common: They require process heat.



**Paper** - required heat: ~100-200°C



Plastics - required heat: ~<100-400°C

**Metall** - required heat: ~<500-1000°C



**Beverage** - required heat: ~75°C

**Food** - required heat: ~90-250°C

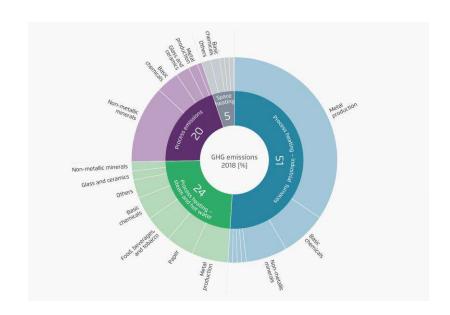
**Glas** - required heat: ~1400-1650°C

**Further areas:** chemistry, ceramics, limestone, building materials, tobacco, iron & steel, cast iron, cement, etc.

Photo from left to right: <u>Hümâ H. Yardım</u>, <u>Ahmadreza Rezaie</u>, <u>Eugene Chystiakov</u>; <u>Unsplash</u>



# For most companies, becoming climate-neutral primarily means decarbonising their process heat.



Source: Fraunhofer ISI (2024), based on national inventory reports, expanded with model data from Fraunhofer ISI for Germany

## Approximate structure of greenhouse gas emissions in the European industrial sector, 2018

- 75% of direct GHG emissions from industry at its own site come from heat applications.
- Most companies have no process emissions. For them, it is almost all about process heat.
- All other indirect GHG emissions can be solved through strategic procurement.
- Energy efficiency makes the transition affordable.

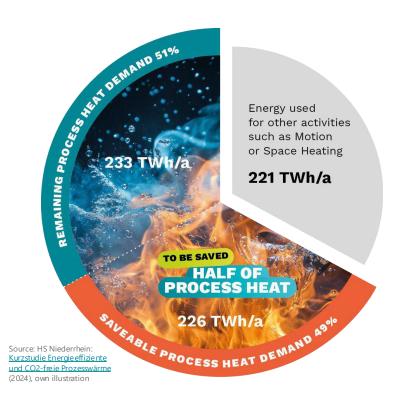
#### What is process heat?

It is the energy used in industrial production processes – e.g. to pasteurise milk, generate steam for the production of chemicals or melt glas.

Photo: Industrial gas oven, jaypetersen von Getty Images



# Halving energy demand and cutting the energy bill by 21 bn euros per year – the case for German companies



In Germany, 49% of process heat demand (226 TWh/a) can be conserved, representing 33% of total industrial energy use.

- The level of economic output remains the same.
- $\frac{2}{3}$  of all saving potentials pay off in less than three years.
- 101 TWh/a are attributed to (re-)using excess heat, heat recovery and integration.
- This is an overall value. The individual savings potential of each company can vary greatly - depending in particular on temperature levels, processes and measures already implemented.

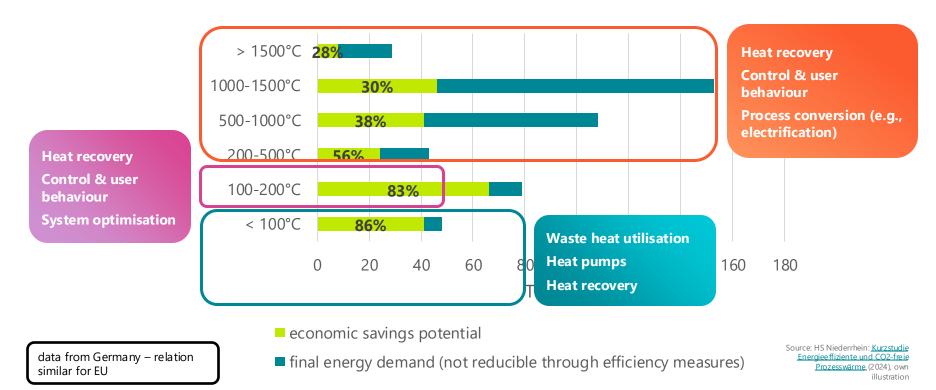
#### What is excess heat?

It is thermal energy generated as byproduct of most manufactering processes, service provisions, waste disposal or energy conversion.

Photo: Heat image of two pipes, Getty Images



### **Getting there through efficiency measures**

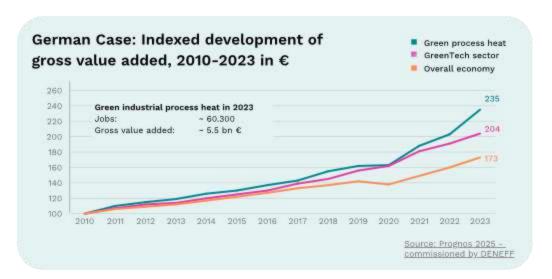




# Opportunity for European manufacturers: Enormous market potential for energy efficient and climate neutral process heat – and independence!



**Strong growth & great potential:** Gross value added and employment are rising much **more dynamically than in the economy** as a whole. Decarbonisation can increase the market volume for European manufacturers by a **factor of 22**. Up to **1 million jobs** (in the efficient and clean process heat industry in Germany alone) are possible by 2050.



**Value creation:** Installation and consulting services dominate – growth in heat pumps even more dynamic.

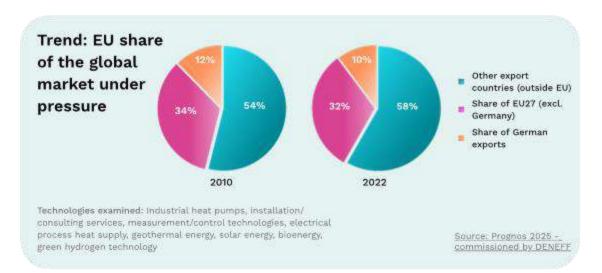
**Industry comparison:** Process heat industry already on a par with wind and solar industries.



# Growth potential is not enough; we need to strategically secure our competitiveness.



International competition: EU exports grow by 7% per annum. Although the EU holds >40% of the global market, it has been losing export share since 2010.





#### We must act:

The trauma experienced in the solar industry must not be repeated: Industrial policy initiatives are needed to secure and leverage the competitiveness of the efficient and clean process heat industry.

Learn more in the prognos study



### MPG Mendener Präzisionsrohr GmbH exploit their excess heat MPC potential through internal warm water grid and heat pumps.





#### **MPG Mendener** Präzisionsrohr GmbH

Metal processing Industry

**Products** Heat exchanger tubes made from

various copper alloys

145 **Employees** 

Revenue, in € 41 million

#### **Final Energy Demand in GWh/a**



Process Heat Others



#### **Process heat: Current usage**



Degreasing basin, pipe drying, heating Hot water network at 70°C, continuous annealing furnaces from 600°C to 950°C



Our efficient decarbonisation strategy



#### How we use waste heat efficiently

- Waste heat utilization from the cooling circuits of the foundry, press and pipe mill using heat pumps
- Waste heat utilization from compressors



#### How we electrify the process heat delivered by natural gas

- Electrification of the continuous annealing furnaces
- Installation of heat pumps to decarbonise the hot water network

**Estimated investment volume:** 3,1 Mio. €





# Covestro issued an energy efficiency portfolio and follows a cascade putting energy efficiency first.





#### Covestro

**Industry** Chemical Industry

**Products** High-quality polymer

materials

Employees 17.500

Revenue, in € 14.2 billion



#### **Process heat: Current usage**

#### **☆** Application and temperature level

50 - 150 °C Preheating & trace heating of processes

100 - 250 °C Thermal separation/concentration/drying (mainly)

150 - 400 °C Chemical reactions

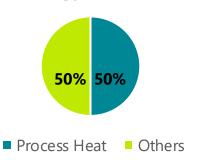


#### Our efficient decarbonisation strategy

#### Cascade:

- Tap energy efficiency potential
- 2. Integrate excess heat
- 3. Electrify process heat where possible
- 4. Use biomass, hydrogen, CCU/CCS and others

#### **Final Energy Demand in %**





## How we utilise process heat efficiently

- Process optimisation and innovative production processes
- Heat integration / transfer of excess waste heat to third parties
- Digitalization / Al
- Mechanical vapor recompression / heat pump



## How we decarbonise the required process heat

- P Electrification with electricity from renewable energies, e.g. electrode boilers / heat storage in combination with PPAs
- Use of biomass / hydrogen
- CCU/S
- others



### Politics has to act now: Implement Energy Efficiency First principle and tackle barriers of process heat decarbonisation.









• Make electrification efficient and affordable – Reduce electricity prices (target ratio: electricity to gas <2:1), but only when coupled with strong efficiency policies to avoid a subsidy spiral. Link subsidies to effective energy-saving measures.



Strengthen EU industry, unlock markets and tackle delayed grid access – ramp up funding (incl. for SMEs), ease loan access, and introduce derisking mechanisms, boost R&D and lead markets for decarbonised commodities. Enable expansion of electricity grid connections for companies in a timely manner



 Mandate waste heat and cold recovery – Make waste heat recovery mandatory for major emitters and integrate reuse into heat planning, Modernise networks, enable low-temperature reuse, and align planning with industrial transformation.



• Enable Energy Efficiency as a Service - Remove barriers for ESCOs, create fair, stable market conditions, strengthen frameworks for district heating, mandate heat mapping at lower thresholds, and standardise technical interfaces. Promote social contracting.



# As normal as these products are, their efficient and fossil-free production should be too.







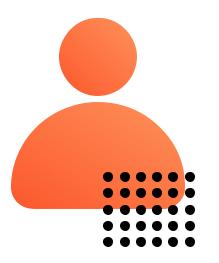
Let us make our industry fit for future!

Photo from left to right: <u>Hümâ H. Yardım</u>, <u>Ahmadreza Rezaie</u>, <u>Eugene Chystiakov</u>; <u>Unsplash</u>



# Thank you!

We look forward to your questions and suggestions. Get in touch with us!





phone: +49 (0) 179 14 95 76 4

mail: <a href="mailto:christian.noll@deneff.org">christian.noll@deneff.org</a>

www.deneff.org

# The right technology for any situation: Thermal energy harvesting







### "Watt's Next: a shift to an electric and efficient net zero industry"

Piero Colonna, Professor, Deft University of Technology









# Thermal Energy Harvesting: the right technology for any situation

Prof. Piero Colonna
Professor, Delft University of Technology and
KCORC member.

Watt's Next: the shift to an electric and efficient net zero industry

October 15th, 2025, Webinar

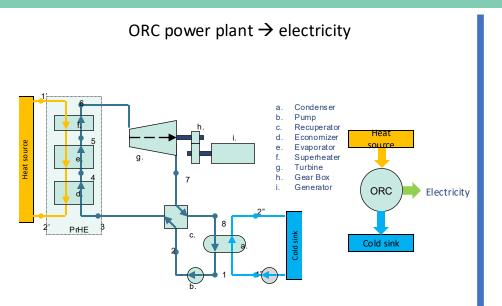


## Content

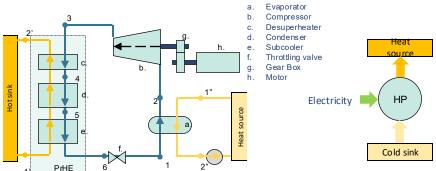
- ✓ Mature technologies: how do they work?
- ✓ Wasted thermal energy: potential, industrial sectors, amount and temperature levels
- ✓ When using one or the other?
- ✓ What is needed? An interesting example...



# Two very similar technologies



# Heat pump $\rightarrow$ heat upgrade (from low T to high T)





#### Chemicals 11.7% Iron and steel 16.4% Non-ferrous metals 0.3% Non-metallic minerals 27.3% Paper and printing 9.9% Refineries 34.4% DE ES UK NL SE BE Available energy, TJ/yr Industrial sites RO EL 200 100 300 400

# Where in EU



**Industrial sectors** 

# Potential per sector (EU)

	Temperature range of waste heat [℃]								
% of usable wasted thermal energy < 20% < 50% > 50%	<100	100-200	200-300	300-400	400–500	200-600	600-1000	>1000	TWh/y
Iron and Steel									73.0
Non-metallic minerals									91.2
Clinker*					c 90				
Glass*						5			
Non-ferrous metals (Primary aluminum*)									32.3
Chemical and petrochemical									141.7
Pulp, paper and printing*									125.5
Others						7.			263.0
Refinery*									
Food and beverages						6			115.2
Gas and diesel engines						1).			2013.5



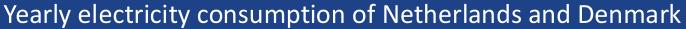
# Waste Heat Recovery Potential in Europe (ORC)

Temperature level	Theoretical Potential	Technical Potential	Installable Capacity
<100 °C	882 TWh <sub>th</sub>	32.2 TWh <sub>el</sub>	$4.0~\mathrm{Gw_{el}}$
100-200 °C	60.5 TWh <sub>th</sub>	2.8 TWh <sub>el</sub>	$0.3~\mathrm{GW_{el}}$
200-500 °C	334.7 TWh <sub>th</sub>	68.5 TWh <sub>el</sub>	$8.6~\mathrm{GW_{el}}$
>500 °C	97.2 TWh <sub>th</sub>	47.2 TWh <sub>el</sub>	5.9 GW <sub>el</sub>
Total	882 TWh <sub>th</sub>	150 TWh <sub>el</sub>	18.8 GW <sub>el</sub>





VERY cautious

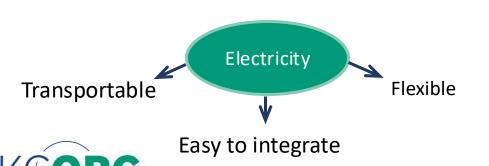




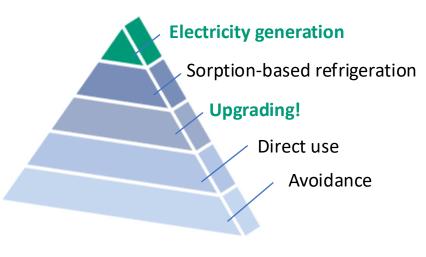
# Waste Heat from energy Intensive Industry

#### Sources (examples):

- (Petro) chemical processes
- Materials production (metal, cement, glass...)
- Mechanical drives (GT, ICE engines)
- Incinerators (waste, fuel residues or biomass)



#### **Utilization opportunities**



# Temperatures and capacity

#### **Heat Pumps** (+ steam compression)

- Cold water, air, warm water...
- From 0 °C to 200 250 °C (steam)
- From 100 kW $_{th}$  to 50+ MW $_{th}$

#### **ORC** power plants

- Warm water, hot gases,...
- From 120 °C to 500+ °C
- From 100 kW<sub>el</sub> to 50+ MW<sub>th</sub>



# Advantages

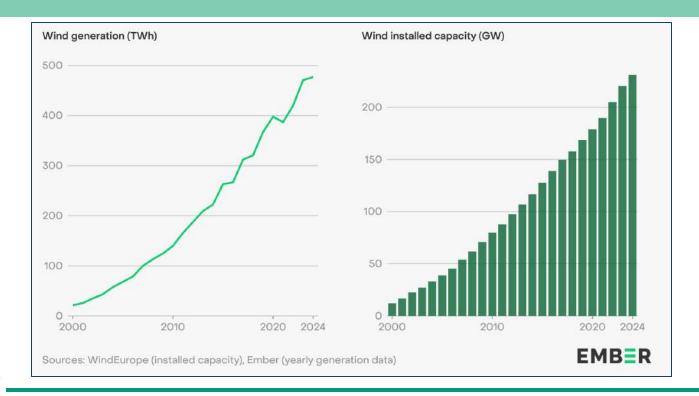
- √ Thermal-source-indifferent
- ✓ Efficient
- ✓ Proven
- √ Can be cost-effective
- ✓ Flexible (tailored working fluid):
  - T<sub>source</sub> level
  - Wide capacity range:
     10's kW 10's MW (single unit)

- ✓ Modular
- √ Waterless cooling (air cooling)
- ✓ Fully hermetic, no make-up water
- ✓ Small footprint
- ✓ Full automation
- ✓ Grid services
- ✓ Location: industrial environment (public acceptance + grid connection)

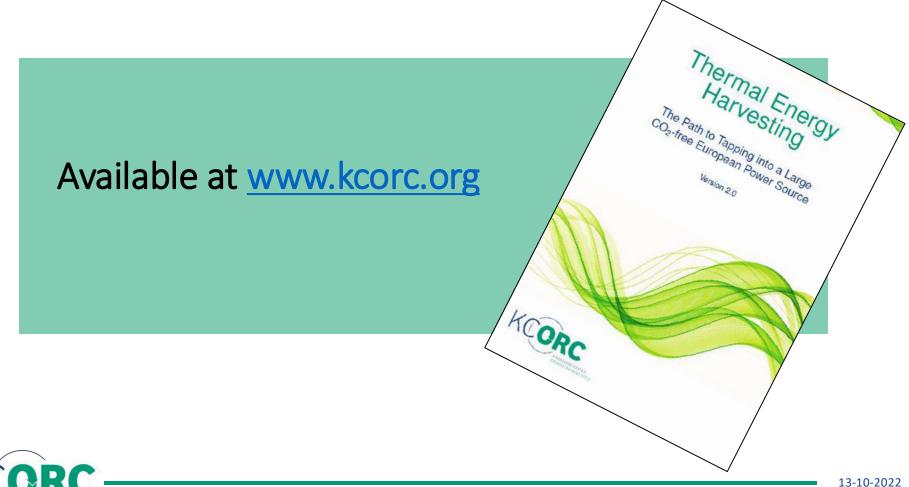


# What made this possible? Same with thermal energy harvesting?

ORGANIC RANKINE CYCLE







Case study 1, Heat Pumps, practical industrial implementation







## "Watt's Next: a shift to an electric and efficient net zero industry"

**Laura Alonso**, Senior researcher and project coordinator, Tecnalia, PUSH2HEAT EU project









Case study 1: Heat pumps, practical industrial implementation

**Speaker: Laura Alonso Date: 15<sup>th</sup> October 2025** 







# PUSH2HEAT OUTLINE & OBJECTIVES

#### **TECHNOLOGY RELATED OBJECTIVES:**

Optimization of four heat upgrade technologies

#### MARKET/BUSINESS RELATED OBJECTIVES:

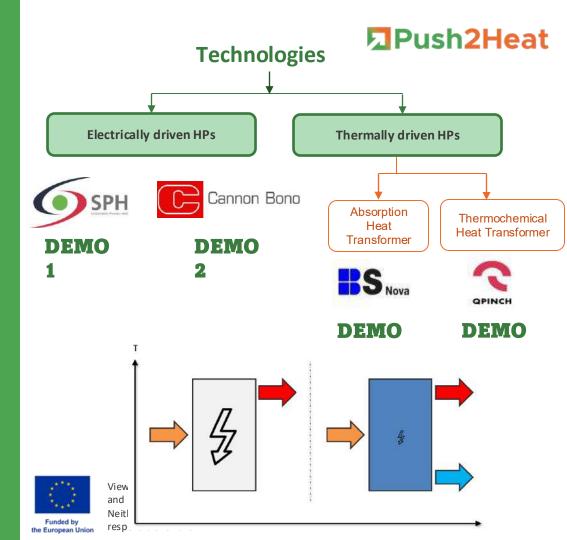
Pushing forward the market potential, new business models and actions towards technologies market deployment

# Demonstration of four full-scale pilot plants in different industrial applications:

- Waste heat → 40-90 °C
- Heat supply  $\rightarrow$  100-160 °C
- System size:  $0.5 \rightarrow 1 \text{ MW}$

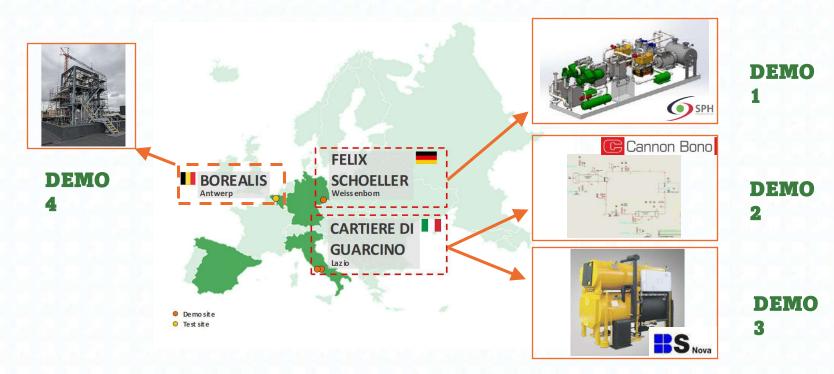


# PUSH2HEAT TECHNOLOGIES AND DEMO SITES





#### **PUSH2HEAT Demo Sites**





# DEMO 1 – HTHP WITH PISTON COMPRESSOR IN THE PAPER INDUSTRY









#### **DEMO 1: Paper industry**

# Felix Schoeller GmbH & Co. KG (Germany)

	<u> </u>
Location	Weissenborn, Germany
Sector	Paper industry
Plant owner	Felix Schoeller GmbH & Co. KG
Technology	HTHP with reciprocating piston compressor (by SPH)





#### **DEMO 1 – HUT integration and technology**

#### HIGH TEMPERATURE HEAT PUMP WITH RECIPROCATING PISTON COMPRESSORS

LOW

**PRESSURE** 

STEAM

**HEAT FROM** 

POWER



\* Expected values

1180 kW 123°C 1800 kg/h

SPH (1)

VAPOR COMPRESSION HEAT PUMP WITH RECIPROCATING COMPRESSOR



#### **TECHNOLOGY FACTSHEET:**

Factsheet thermboost-1.pdf





690 kW

130 m3/h

46°C

# DEMO 2 – HTHP WITH SCREW COMPRESSOR IN THE PAPER INDUSTRY











# **DEMO 2: paper industry**Cartiere di Guarcino (Italy)

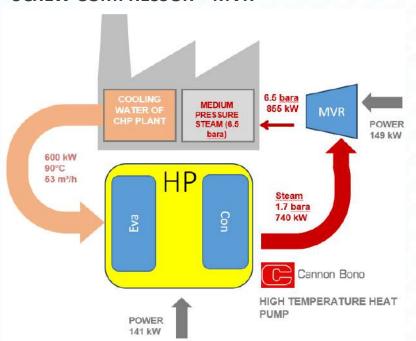
Location	Lazio, Italy
Sector	Paper industry - CHP plant
Plant owner	Cartiere di Guarcino
Technology	HTHP (by CANNON BONO) + MVR





# **DEMO 2 – HUT integration and technology**

### HIGH TEMPERATURE HEAT PUMP WITH SCREW COMPRESSOR + MVR





COPel (HTHP / System)	5/3
Op. hours (h/y)	7000
PE savings (MWh/y)	3487
CO2 savings (tCO2/y)	707

<sup>\*</sup> Expected values

#### TECHNOLOGY FACTSHEET:

Heat-Upgrading-technologies-HUT.jpg (1414×2000)



# DEMO 3 – AHT IN THE PAPER INDUSTRY











#### **DEMO 3: paper industry**

Cuartiere di Guarcino (Italy)

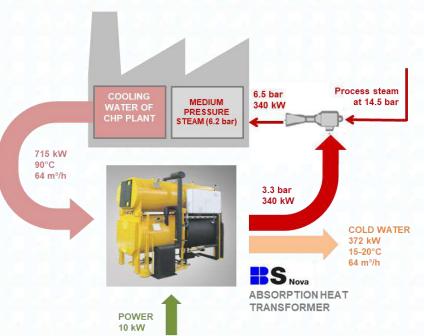
Location	Lazio, Italy
Sector	Paper industry - CHP plant
Plant owner	Cuartiere di Guarcino
Technology	Absorption Heat Transformer (AHT) (by BS-NOVA) Working fluid: H2O/LiBr





#### **DEMO 3 – HUT integration and technology**

### ABSORPTION HEAT TRANSFORMER + STEAM GENERATION AND UPGRADE



COP (Thermal/electric)	0,48 / 35
Op. hours (h/y)	7000
PE savings (MWh/y)	2800
CO2 savings (tCO2/y)	500









# DEMO 4 – THT IN THE CHEMICAL INDUSTRY







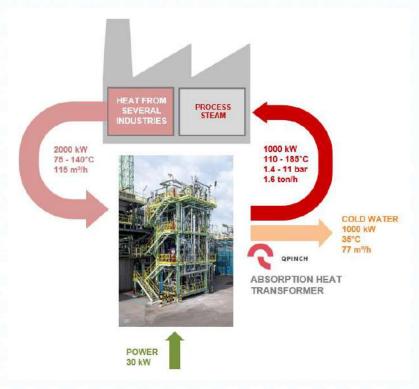
# **DEMO 4: chemical industry**Borealis Antwerp (Belgium)

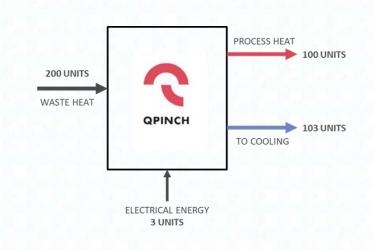
Location	Antwerp (Belgium)
Sector	Chemical industry (LDPE plant)
Plant owner	Borealis
Technology	Thermochemical Heat Transformer (by Qpinch)





#### **DEMO 4 – HUT integration**







Qpinch\_factsheet.pdf





# MORE INFORMATION

- Visit our website: <a href="https://push2heat.eu/">https://push2heat.eu/</a>
- Follow us on Linkedin (<u>Push2Heat</u>) and X (<u>PUSH2HEAT EU</u>)
- Interested in receiving periodic information on the progress of PUSH2HEAT? Join our Stakeholder Network <a href="here">here</a>





#### HTHPS for electrification of industrial heat

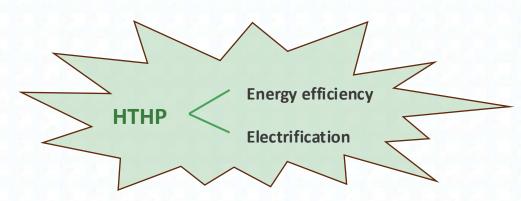
#### **Barriers**

- Grid access for electrification
- Electricity to NG cost ratio
- Investment cost (integration!)
- Need of skilled professionals

#### What can be done?

- Clear, long-term regulatory alignment (EU & national levels)
- Broaden knowledge
- Support demonstration projects
- Sector & process specific approaches → facilitate effective integration
- Subsidies or auctions





## Thank you!

Laura Alonso Researcher in TECNALIA RESEARCH & INNOVATION laura.alonso@tecnalia.com www.push2heat.eu











# Case study 2, ORC, practical industrial implementation







Roberto Bertanzi, Technical product development, Turboden















Roberto Bertanzi – Technical Product Development Coordinator - Turboden S.p.A.

15 ottobre 2025, Brescia

Turboden S.p.A.

#### **ORI MARTIN STEEL MILL**



ORi Martin is a steel mill specialized in the production of alloyed steel.

Its Electric Arc Furnace (EAF) is equipped with a **state-of-the-art energy recovery system**.

This system efficiently recovers energy from two key sources: the **exhaust gas stream** and the **furnace cooling water loop** 

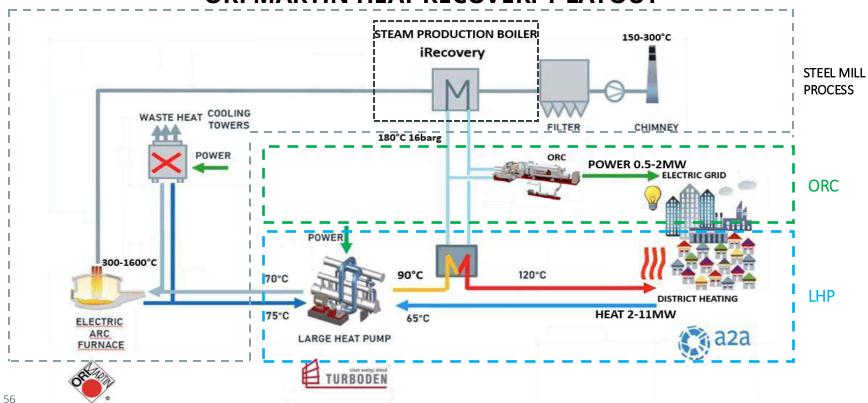








#### **ORI MARTIN HEAT RECOVERFY LAYOUT**





#### STEEL MILL ENERGY MANAGEMENT

#### **PROJECT CONCEPT**

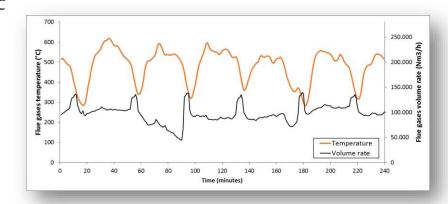
- **WINTER** operation: ONLY HEAT (ORC STOP)
- **SUMMER** operation : ONLY POWER (LHP STOP)
- MID SEASON operation : FLEXIBLE PRODUCION HEAT+POWER (ORC + LHP)

#### **PROJECT CHALLENGES**

- Particles in exhaust gas deposition
- Intermittent operation of the EAF (batch process cycle 1h)
- Planned EAF Maitenances (melting pot changes, etc..)

#### **PROJECT KEY FACTORS**

- iRecovcery with Steam drum accumulator (Heat buffer)
- ORC and LHP flexible operation thanks to an integrated software adapting to the steel process
- Automatic start and stop





#### **DESIGN DATA**

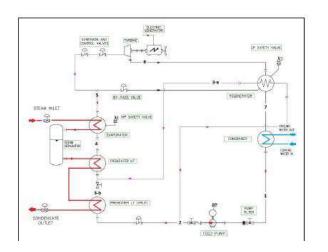
ORC		LHP	
Working fluid: Evaporator pressure – working fluid: Condenser pressure – working fluid: Steam pressure: Steam temperature: Cooling water temperature in: Nominal thermal power input: Nominal gross power output: Gross electric efficiency:	Silicone oil (MM) 7,8 bar 0,18 bar 16 barg 180°C 20°C 10,4 MW 1,88 MW 18,1%	Working fluid: Evaporator pressure – working fluid: Condenser pressure – working fluid: Heat source power: Heat source temperature: Heat sink Thermal Power output: Heat sink Outlet Temperature: Motor power (VFD driven): Compressor speed multiplier: Coefficient of Performance COP:	R1233zd (HFO) 4,4 bar 9,8 bar 3,5 MW 77 °C 4,0 MW 90°C (85-105°C) 485kW 1:5 8,24 (8,6-6,0)

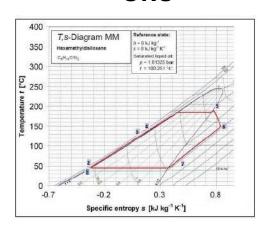


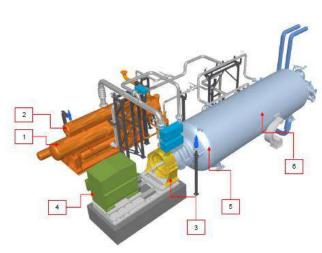
# ORC EXPERIENCE



#### **ORC**





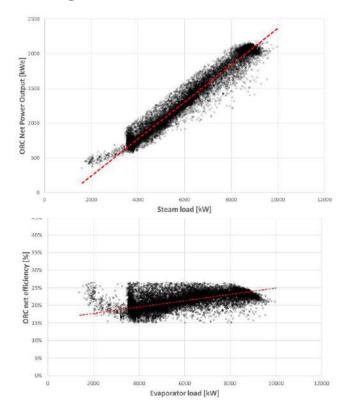


- Operation Flexibility from partial load to full power
- Minimal maintenance
- Low pressure



#### **ORC PERFORMANCE**

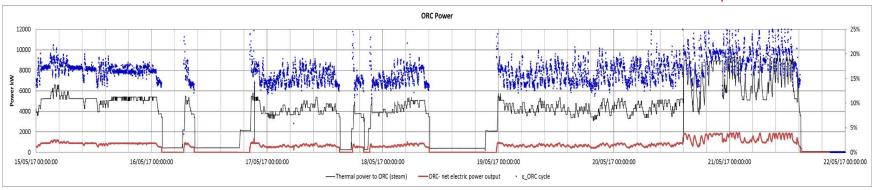
- The ORC (fed by steam) automatically adapts to the steel process intermittent load (from 10% to 100% in a few minutes).
- Startup time < 20min.
- The operation is completely unmanned thanks to the integrated software control.





#### **ORC DATA ANALYSIS**

# Efficiency Thermal power Input Electric Power output



**ORC** in operation since 2017 (about 4000h/y)

- Electric Energy production 4000 MWh/y
- Avoided CO2 emissions ~1000 tonn/y



## LHP EXPERIENCE

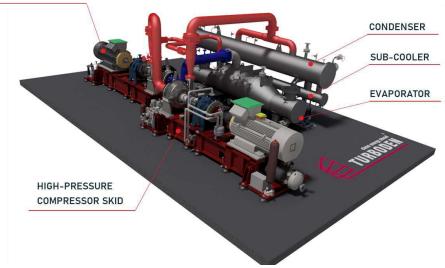






#### **LARGE HEAT PUMP (LHP)**

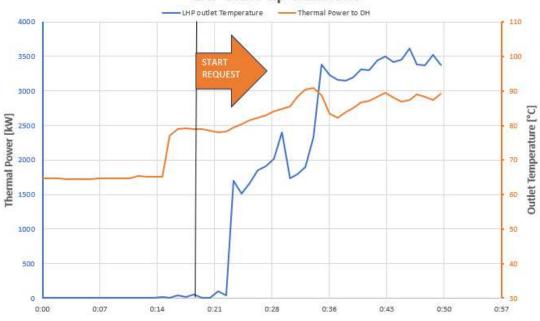
LOW-PRESSURE COMPRESSOR SKID



#### LHP EXAMPLE OPERATING DATA



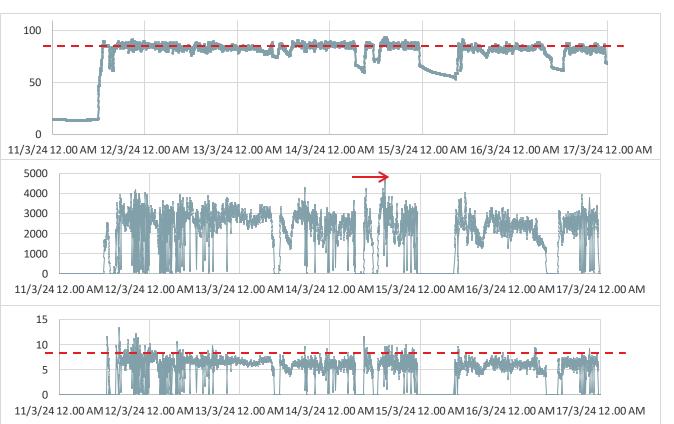
#### LHP start-up transient



- Average Power: 3500kW
- Average temperature: 88°C
- Hot startup time: 9 minutes
- Automatic unmanned operation according to the steel process changes

#### LHP EXAMPLE OPERATING DATA (7 DAYS)





LHP Water outlet Temperature[°C]

Thermal Power to DH [kW]

C.O.P.



#### **CONCLUSIONS**

The **steel industry** is an energy intensive process with a strong need of **energy efficiency** and **decarbonization**.

ORi Martin (Brescia Italy) implemented the state of the art technologies in heat recovery:

- The Steam Generator, in operation since 2016, supplies thermal power to the Brescia district heating
- The ORC, in operation since 2017, converts the steam power producing up to 2MW power when the heat is not required
- The **LHP**, in operation since 2024, produces up to 4,2MW of thermal power **on top** of the Steam recovered power during the winter season

ORi Martin is a perfect showcase of electrification and decarbonization in the steel industry supported by EU Projects



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# **Questions & Answers**



slido







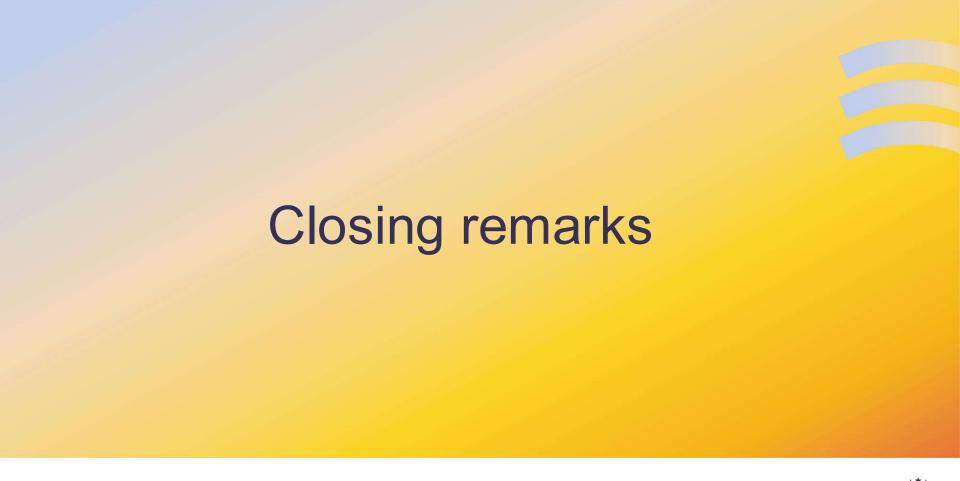
**Gian Luca Agliardi**, Senior associate & innovation program, European Climate Foundation (ECF)

















**Paul Kenny**, Director General, European Heat Pump Association (EHPA)







- When thermodynamics and economics align, the energy transition accelerates.
- Industrial heat pumps are at 1% of their deployment potential today, while the technology potential already reaches 37%.
- DG ENER and Commissioner Jørgensen highlight the opportunity of IHPs and waste heat recovery it's a slow-moving ship, so we must keep up the pressure.
- **EHPA builds bridges** between members and **end-users** in key industries: food & beverage, fibers, plastics, and more.
- 3 new EHPA projects on industrial heat decarbonization are underway.
- Under the Electrification Action Plan, the <u>first EU pilot auction for industrial heat</u> <u>decarbonization</u> has been launched <u>we encourage you to apply and use these fuds</u>, as <u>more funding will follow</u>.







Watt's next: the electric pathway to a competitive, secure industry in Europe









#### Want to know more about EHPA upcoming events?













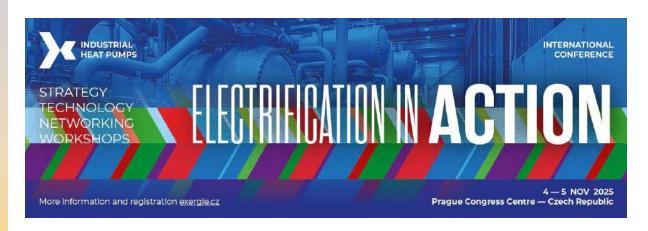


https://ehpa.org/events



#### Industrial Heat Pump PRAGUE









#### More than green: launch of the heat transition colouring book









Thank you for attending!

