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ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

Flexible Generation

PUMP-HEAT

Performance Untapped Modulation for Power and Heat via Energy Accumulation Technologies

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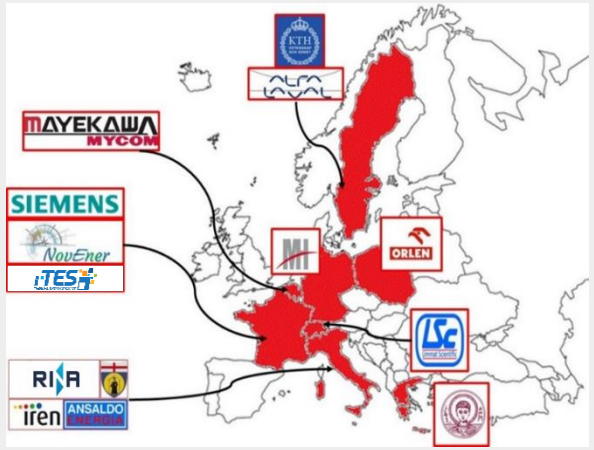
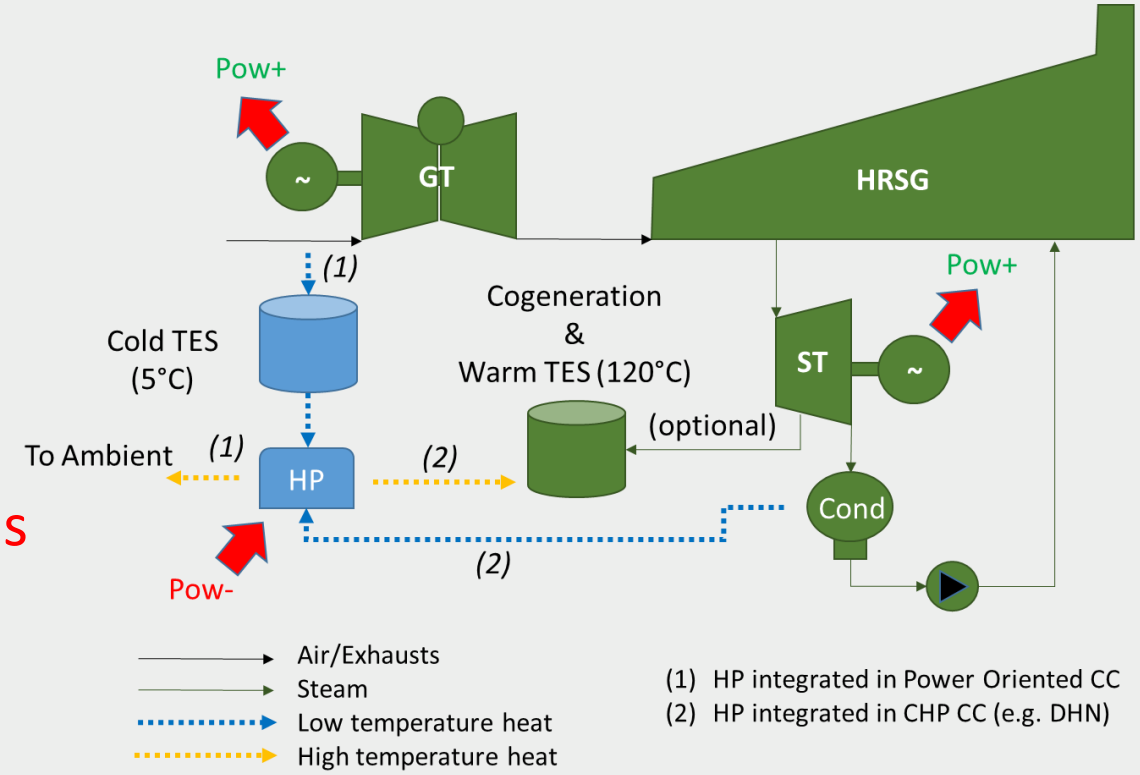
https://www.pumpheat.eu/

Short presentation of the project

PUMP HEAT





14 Partners from 8 countries, 6 M€ for 36 months

Overarching objectives:

- Heat Pump (HP) as a *smart electrical load*
- HP may allow Combined Cycle (CC) to sell grid services also when the CC is off
- HP will impact on the Gas Turbine inlet air improving its performance
- HP can produce useful heat for District Heat Network
- HP will also increase the CC average annual efficiency

Key exploitable results addressing energy system integration

PUMP-HEAT KERs:

1 Pump-Heat combined cycle layout

2 Innovative turbo expander

3 Electrical market targeted predictive control system

4 Cold Phase Change Material for Thermal Storage

5 Data drive/Physics based simulation environment

6 High performing and fast cycling heat exchangers

7 Fast response high performance HP

8 Warm Phase Change Material for Thermal Storage

Quantifiable results and benefits available;

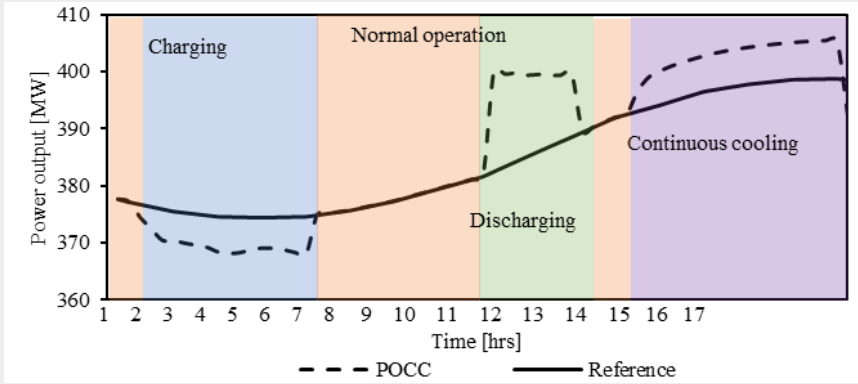
1 Combined Cycle layouts that enables up to **3%** of annual **reduction** of **OPEX**

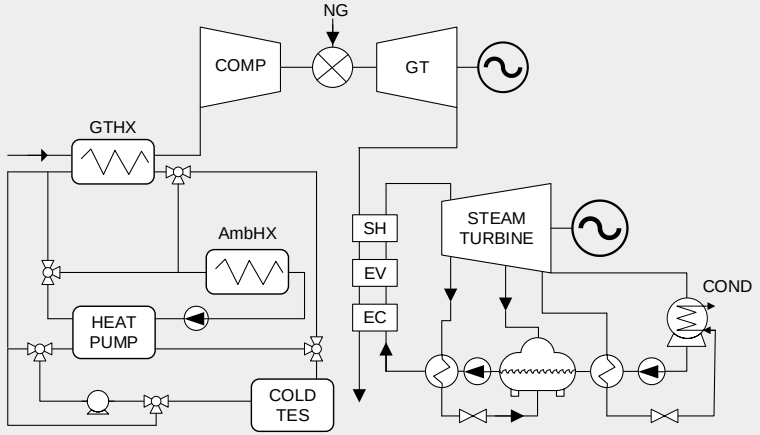
2 Combined Cycle minimum load and part load **efficiencies** enhanced up to **15% in summer/10% in winter**

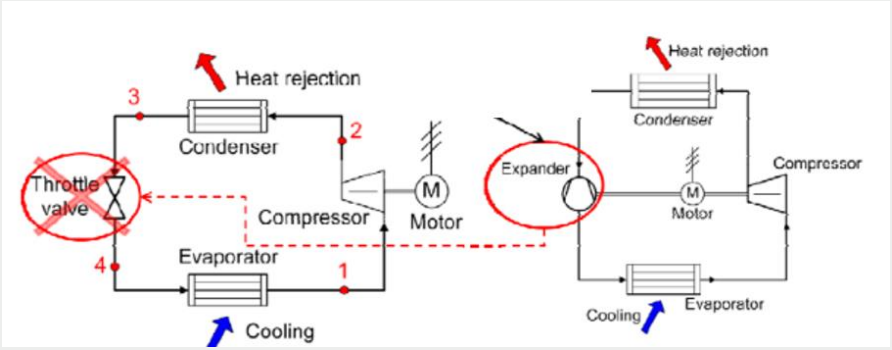
3 The reduction of the start-ups and heavy ramp-ups, due by HP and CC integration, allows a **saving** of up to **40000 Sm3 of Natural Gas** per start-up (for a 400 MW CC)

Key exploitable results addressing energy system integration

KER 1 - **Innovative plant layout for combined cycle** plant integrating a fast cycle heat pump and thermal energy storage to increase part-load efficiency, reduce the minimum environmental load and increase power ramp rates, enhancing the flexibility







KER 2 - **Innovative two-phase turboexpander for high efficient Heat Pumps** will be developed from laboratory to demonstration. This turboexpander will be substituting the HP lamination valve, promising compactness, efficiency and cost effectiveness.

Lessons learned and barriers to innovation deployment

Lessons learned from the project thanks to experimental activities

- Solutions to untap combined cycle flexibility in cogenerative applications
- Safety and authorization procedures for large heat pumps in power plants

Università di Genova

1) Validation Site
UNIGE LABs

iren

2) Demonstration Site,
IREN, Moncalieri
Power Plant

Barriers (regulation, technologies, budget,…):

Butane HP, ATEX regulation, Winter period, Phase Change Material usage, ….

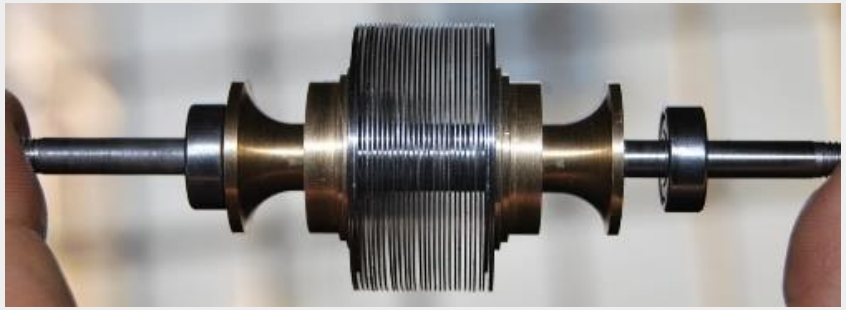
Deployment prospects of the most promising solutions

Innovative two-phase turboexpander for high efficient Heat Pumps

SIT Technologies Srl: SPIN-OFF, **UNIGE Linked Third Party**

TESLA Turboexpander: Boundary layer or **BLADLESS turbo expander** (such as Tesla, patented in 1913, but poorly developed from a scientific and technological point of view)

- **No negative scale effects for smaller sizes**
- **High flexibility (air, natural gas, organic fluids..)**
- **High reliability/low maintenance costs**
- **Affordable performance**
- **Reduced cost**



Needs for future R&I activities coming out of the project

Other results: Validation Site UNIGE LABs

The water flow skid system

The heat pump

Thermal Energy Storage

Microturbine T100 and inlet heat exchanger

Future R&I activities:

Validation site proof of concept and addition of TESLA turbine within Heat Pump

From TRL 2 to TRL 6

Needs for future R&I activities coming out of the project

Dissemination Event:

SUPEHR Conference

SUPEHR'19

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Supporting European projects

turboreflex – power plant technology upgrades · PUMP HEAT · sCO2flex

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