

Supporting Industry in Transitioning to a Sustainable, Decarbonized World

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Siemens Energy
Fields of Actions

Leading the energy transformation

Decarbonized Heat &
Industrial Processes



Energy Storage



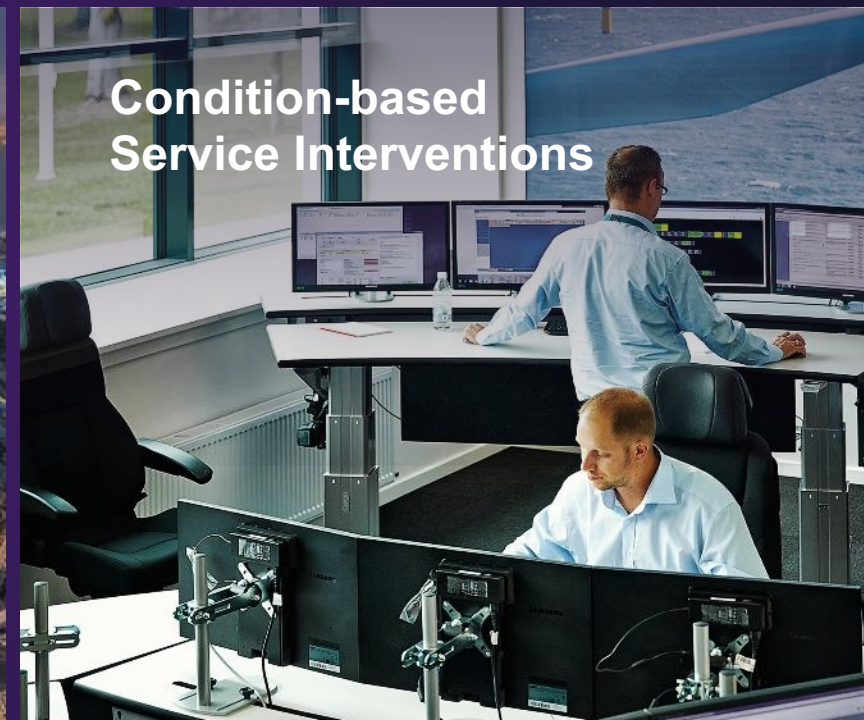
Power-to-X



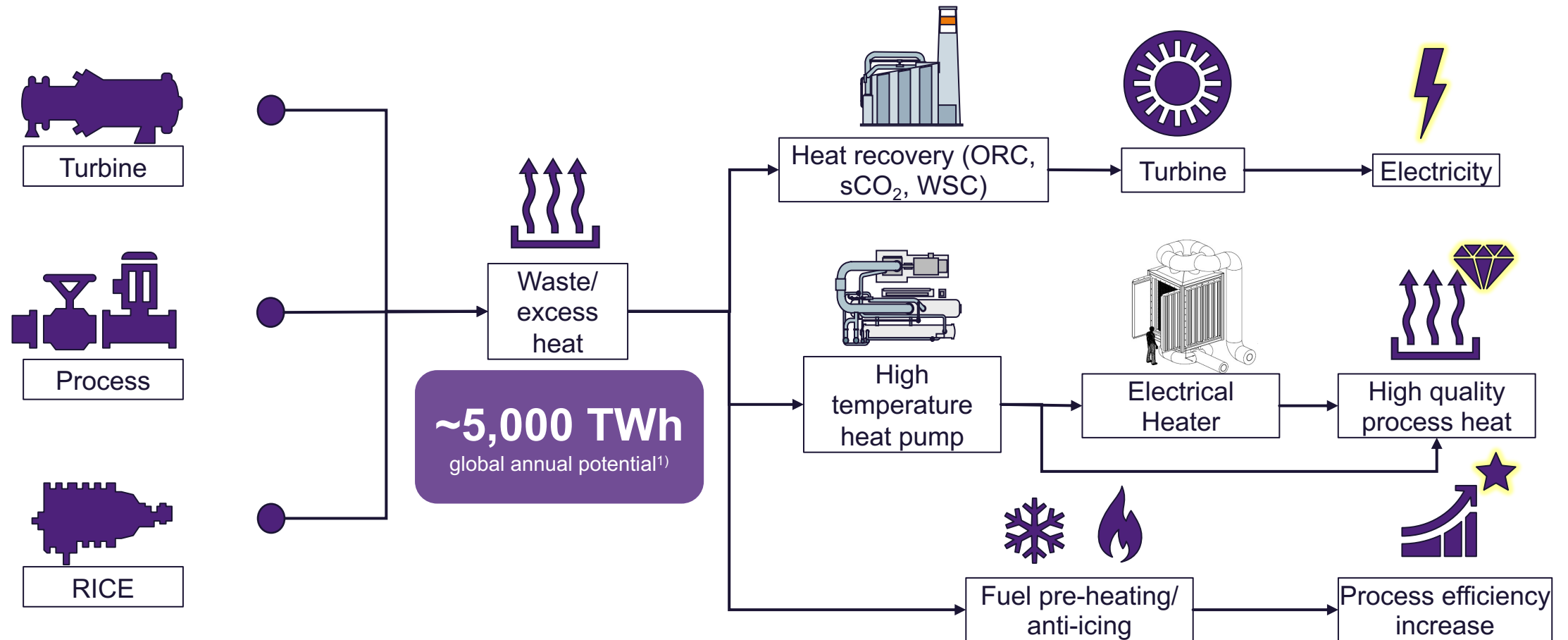
Resilient Grids
and Reliability



Condition-based
Service Interventions

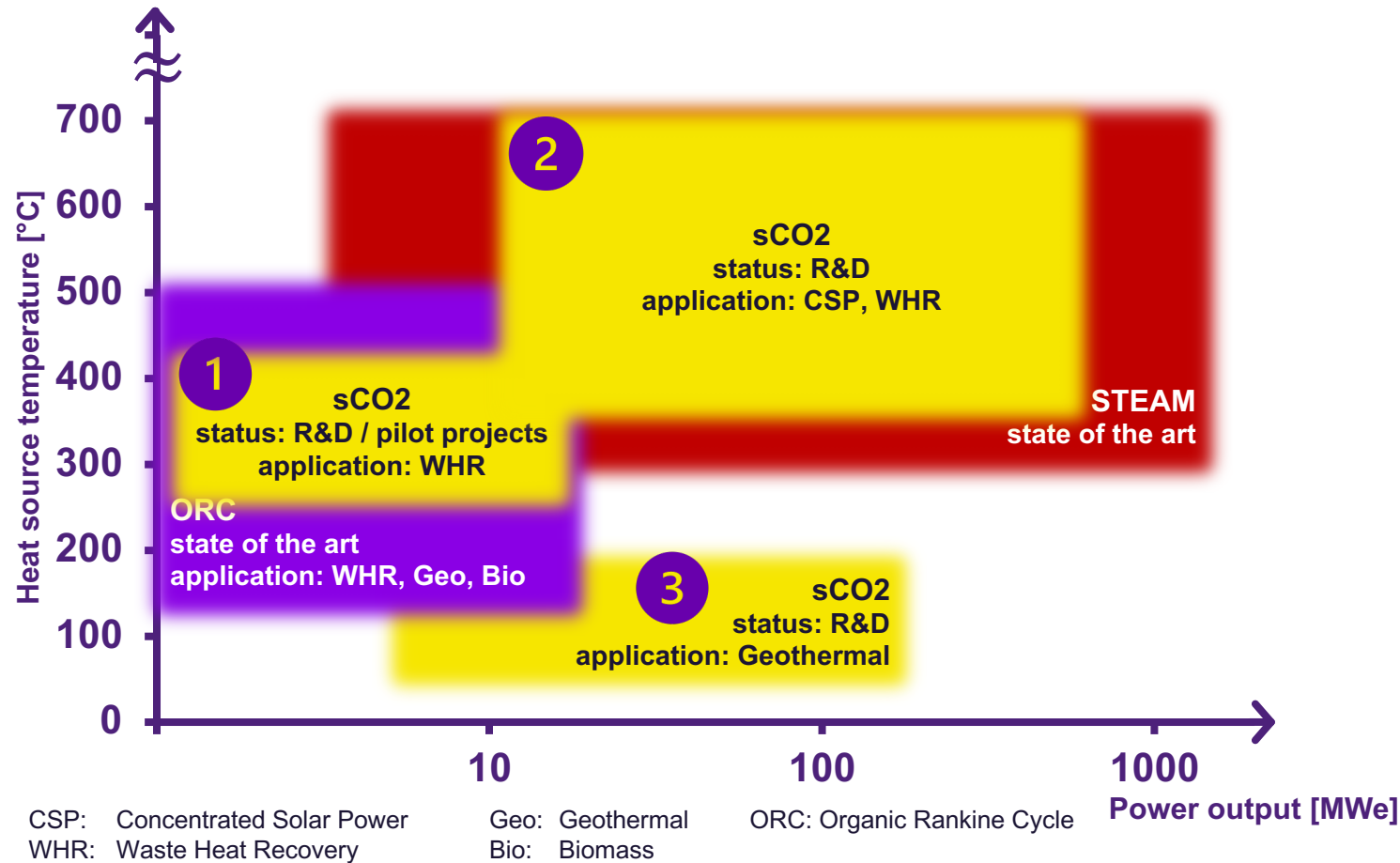


Waste Heat Recovery for Improved Efficiency and Environmental Sustainability



Siemens Energy has several solutions for generating power and quality heat without incremental emissions

Different technologies exist to convert heat into power...



...sCO2-based cycles with potential benefits...

- Higher efficiency (up to 4%pts¹) compared to water/steam
- High fluid energy density leads to smaller turbines and footprint
- Potentially lower LCOE (up to -25%) compared to water/steam
- Non-hazardous fluid (non-flammable/toxic)

...but need for commercialization

1) Depending on heat source and heat sink temperature



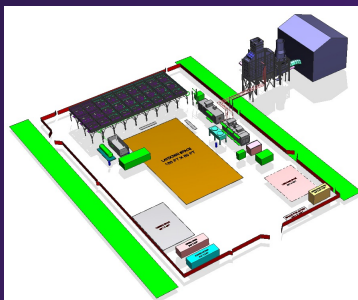
Unit Scaling
10 MW range



Turbine Configuration
Single Stage
Radial Design



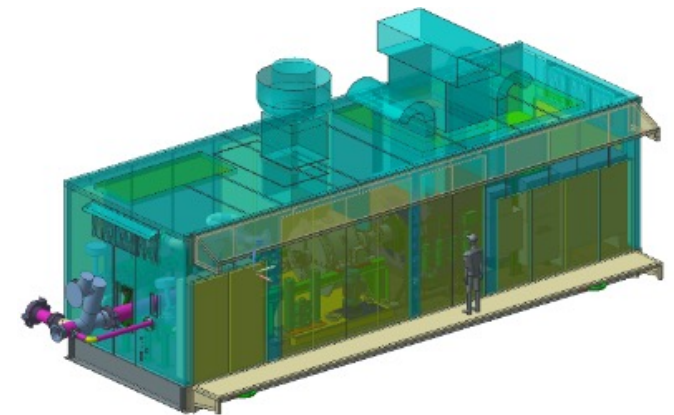
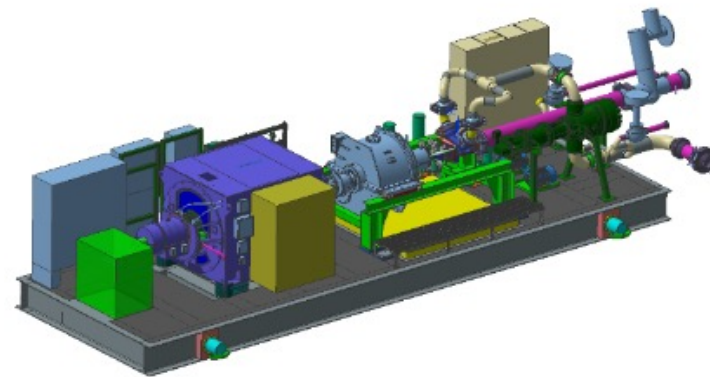
Pilot Project
TC Energy
Compressor
Station

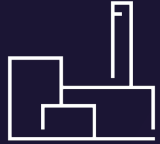


Integrated Solution for Oil & Gas Applications with Strategic Partner Echogen Power Systems

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- **Factory testing** completed up to 3.1 MW
- **FEED studies** developed with major O&G companies
- **Pilot Project** with TC Energy: Phase 1 “Engineering” completed, BUT project not proceeding at this time with Phase 2 “Construction & Operation” due to project cost increases





Unit Scaling
2-100 MW

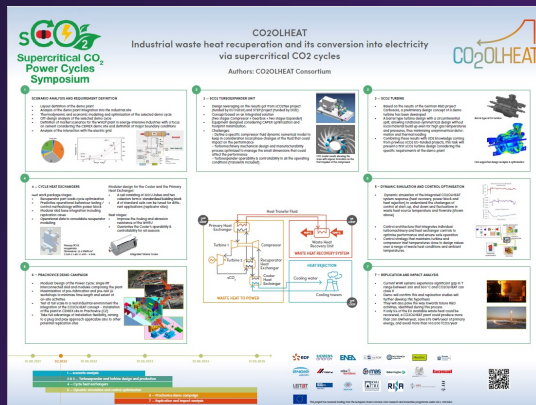


Turbine Performance
Up to 92%



Go-to-market
2025

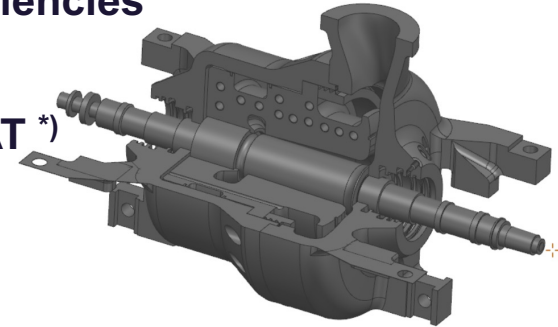
Conference
Poster



Large-Scale Industrial Waste Heat Recuperation with axial sCO₂ Turbine

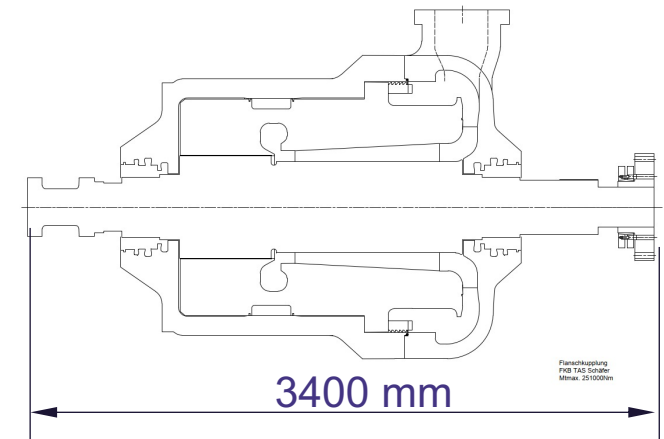
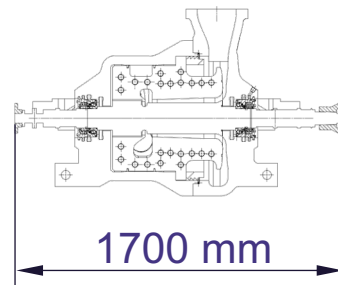


- Adapting barrel-type turbine design for high gas temperatures and pressures, leading to **high efficiencies**
- Realization and validation of **2 MW demo application** within EU funded project **CO2OLHEAT** *)
- Design **scalable to large power output** for different types of applications

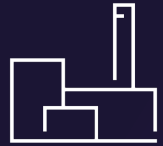


2 MW Demo sCO₂ turbine

Upscaled 50 MW sCO₂ turbine



*) This project has received funding from the European Union's Horizon 2020 research and innovation programme under GA n. 101022831



Solution Scaling
20-500 MW



Performance
**Strong natural
circulation**



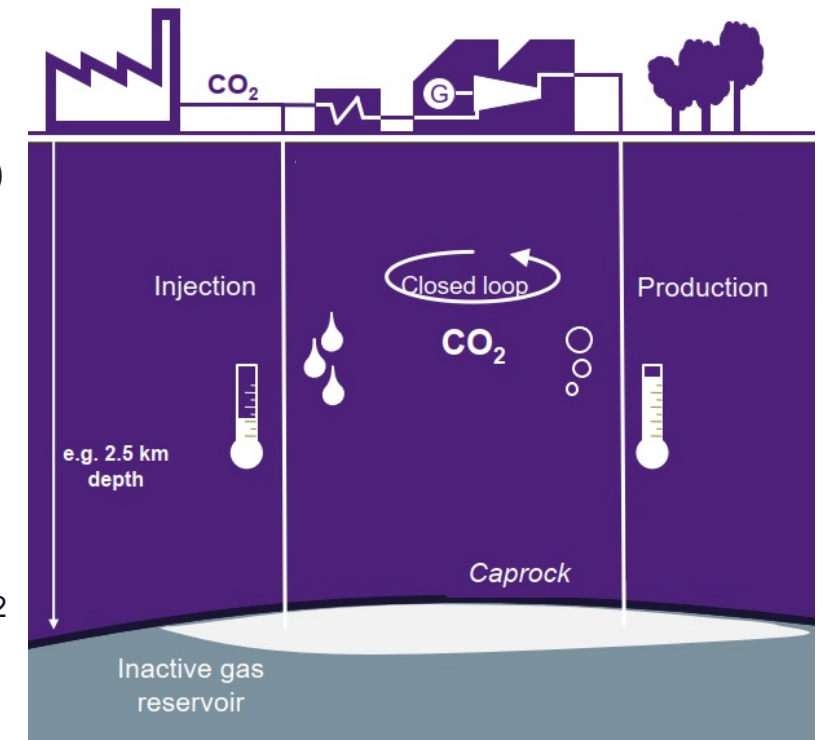
Go-to-market
2026

NextGen Geothermal Power (NGP)

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NGP delivers a CO₂-neutral power plant giving geological storage of CO₂ the opportunity of renewable power generation by:

- **Using emitted CO₂ as working fluid:** provides life cycle for (own) CO₂ emissions
- **Giving depleted reservoirs a second life cycle:** injected CO₂ extracts geothermal heat
- **Providing fully dispatchable renewable power:** geothermal power generation in a closed CO₂ loop supported by strong natural circulation

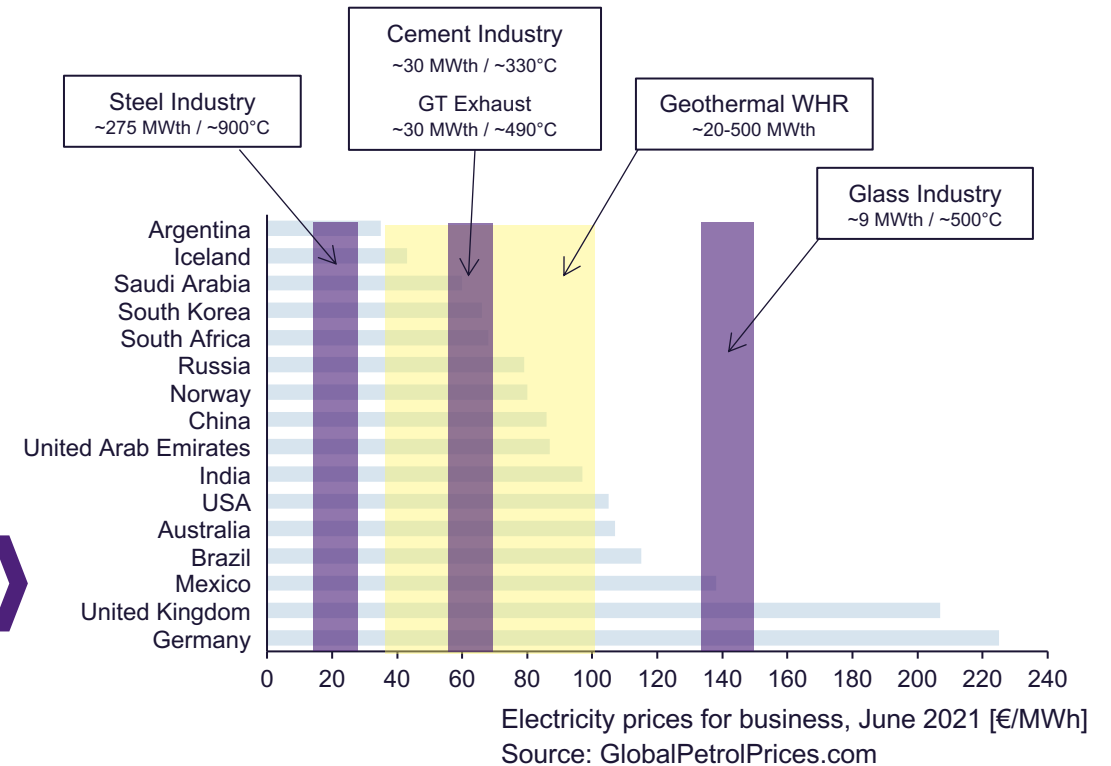


Summary

- Large potential to **reduce CO₂ footprint** of industries by **efficient waste heat recovery concepts**
- sCO₂-based cycles with **clear advantages in size and efficiency**
- Innovative use cases in **CO₂-based geothermal applications**
- sCO₂-based cycles are still **challenged to get past the pilot stage in an economically viable way**, which prevents tapping into the costs scaling potential



Levelized Costs of Electricity of WHR Use Cases [€/MWh]



Siemens Energy continues to invest in sCO₂
and looking for partners to evaluate and realize pilots and demonstration projects

Contact



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