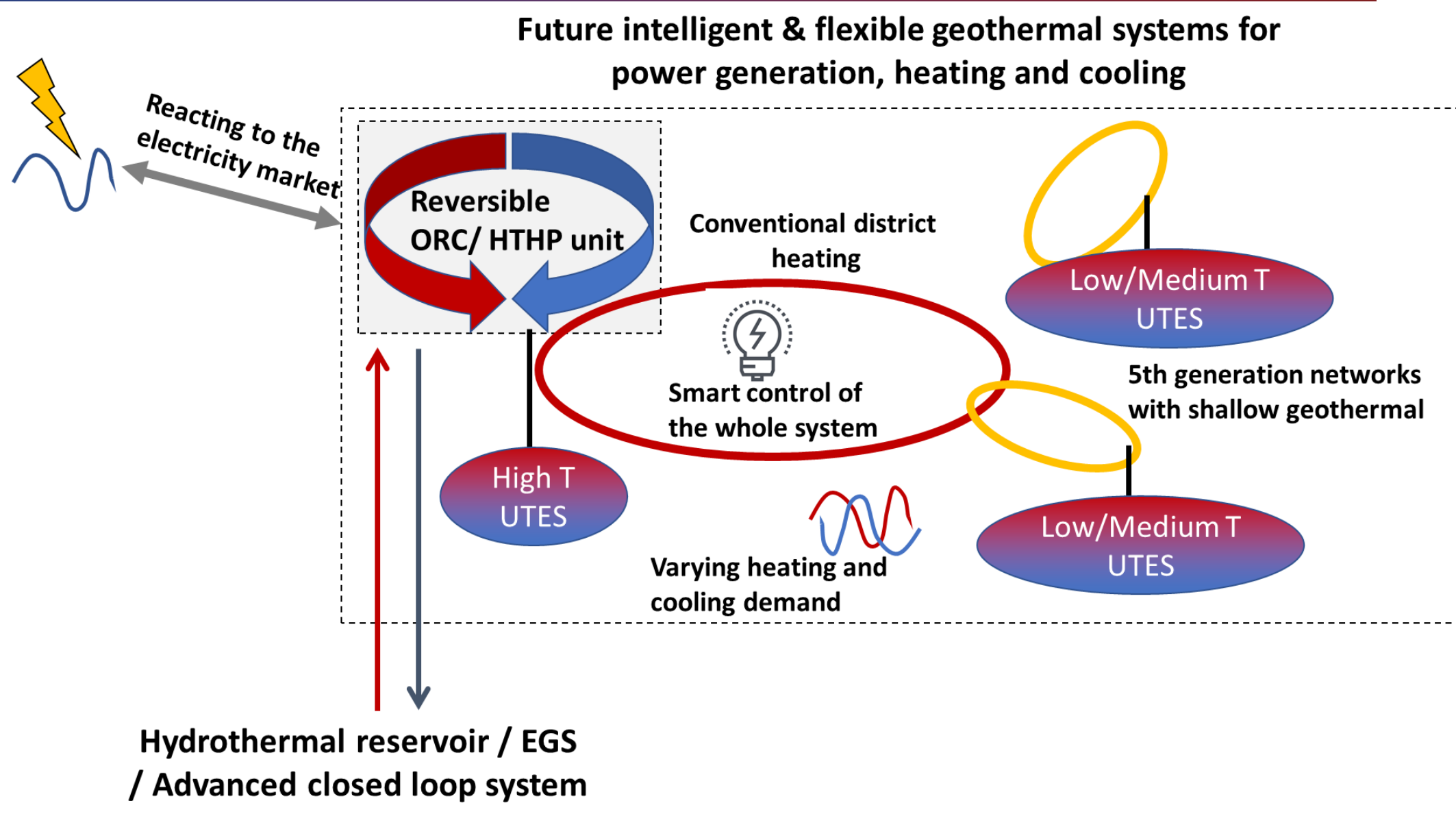


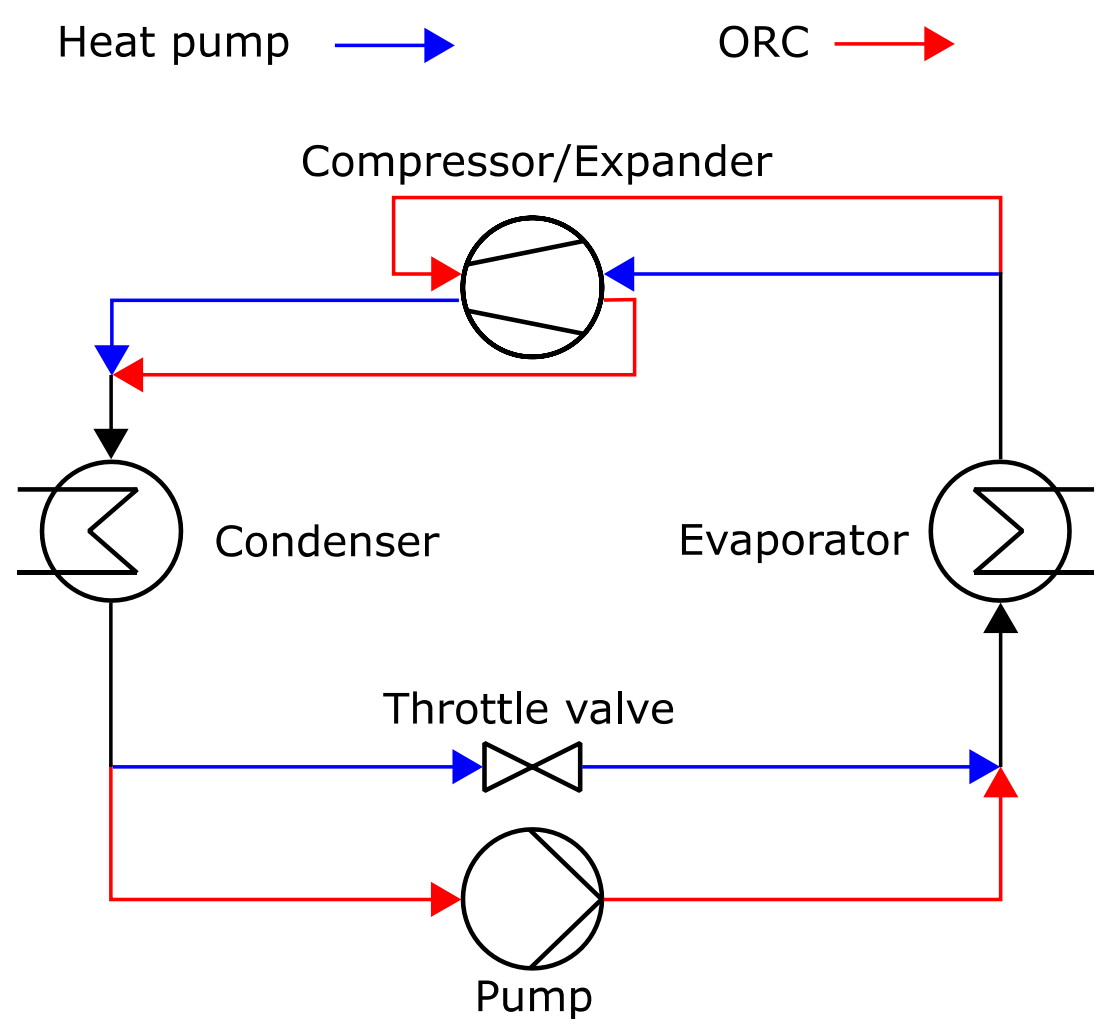
Future smart & flexible geothermal systems



- Future geothermal systems will combine several technologies, such as high-temperature Underground thermal energy storage (UTES) and fifth-generation networks (5GDHC)
- Increasing demand to provide reliable flexibility by renewable energy sources also for geothermal energy
- FlexGeo will develop advanced system designs, technologies and operational strategies to maximize the flexibility and efficiency of future geothermal systems

The reversible ORC / HTHP technology

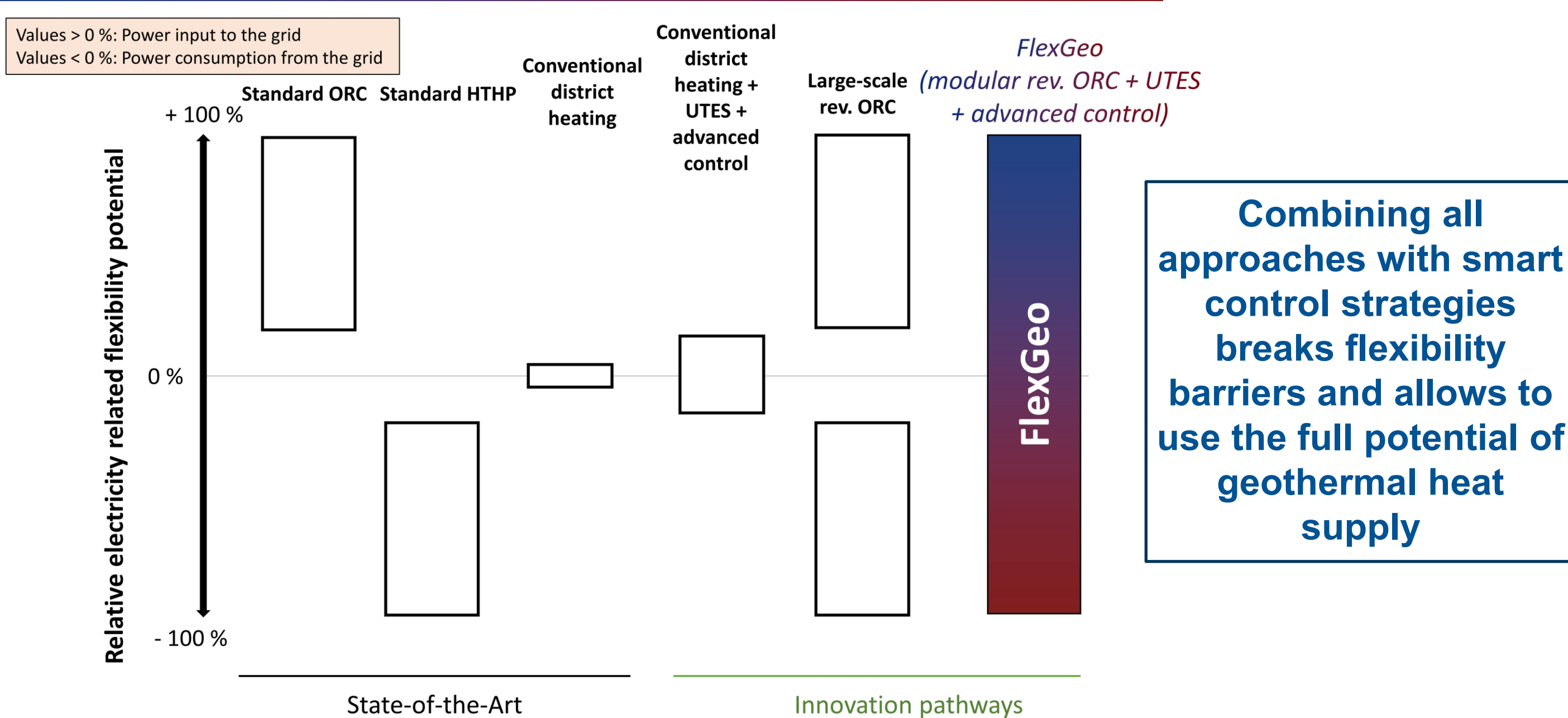
Combination of a heat engine (ORC) and a heat pump (HTHP) in one plant, using similarities of the required components and working fluids:



Advantages and challenges:

- + Increase in plant utilisation and flexibility
- + Reduced CAPEX and footprint compared to separate plants
- Additional complexity in piping and lubrication
- Efficiency decreases in some components due to reversible use

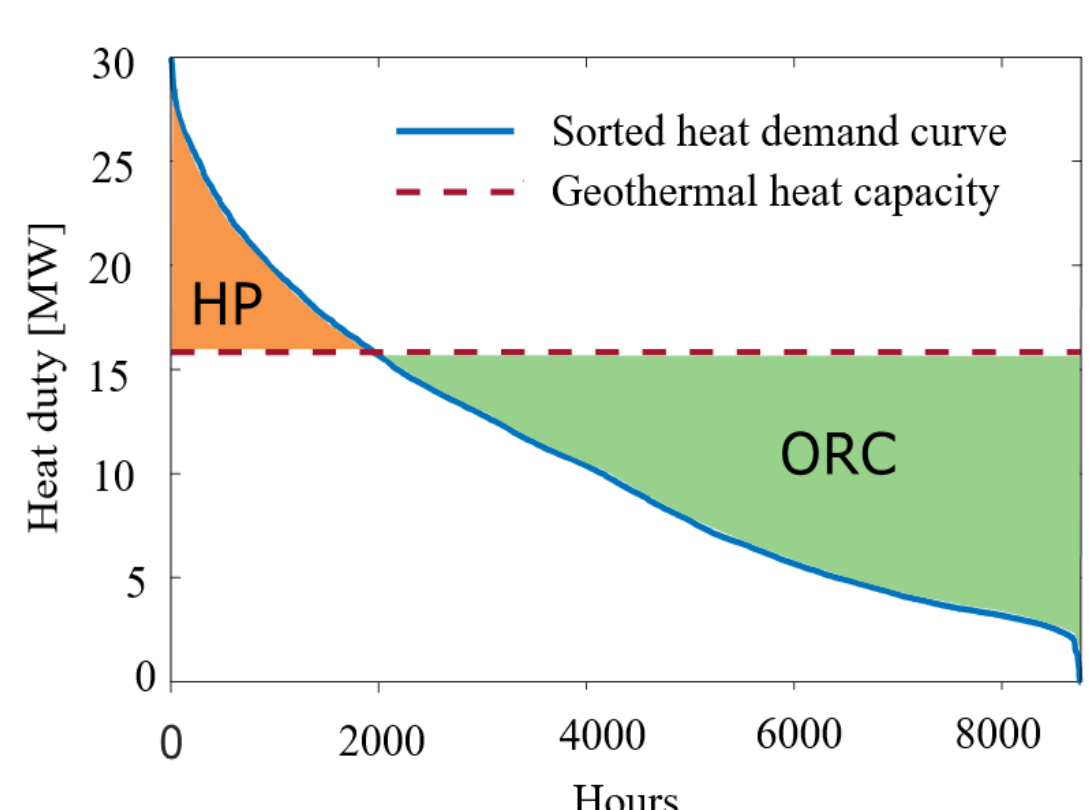
Groundbreaking flexibility enhancement



- The reversible modular ORC approach exhibits an operational range of twice its nominal capacity
- By implementing advanced control strategies, a switch between both maximal operational modes should be achieved in less than 3 minutes

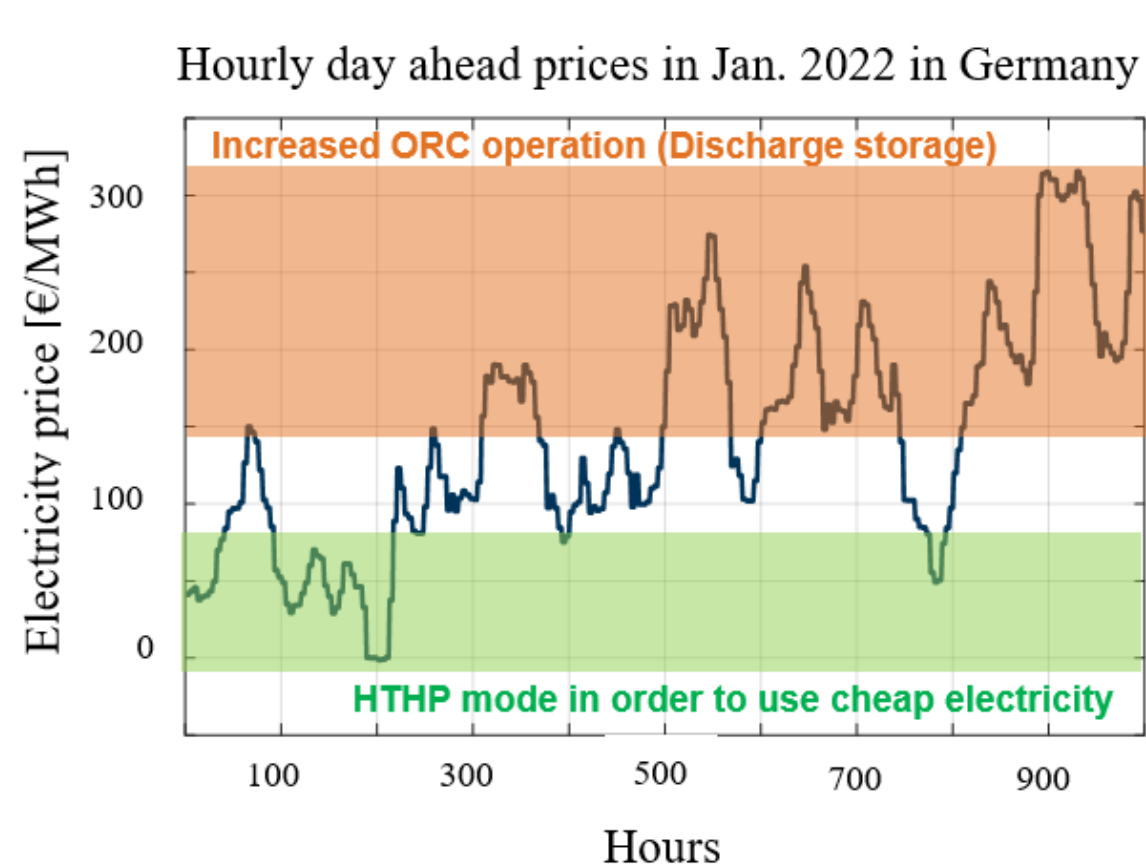
The potential operational strategies of the rev. ORC

Heat demand driven operational mode



- During winter, the heat pump mode is used to provide additional heat by cooling down the geothermal brine further, substituting oil or gas peak demand boilers
- During times with low heating demand, power is generated by the ORC mode
- While stand-alone ORC or HTHP systems might not be economically due to low operational hours, the reversible systems runs most hours of the year, which significantly improves the economic performance

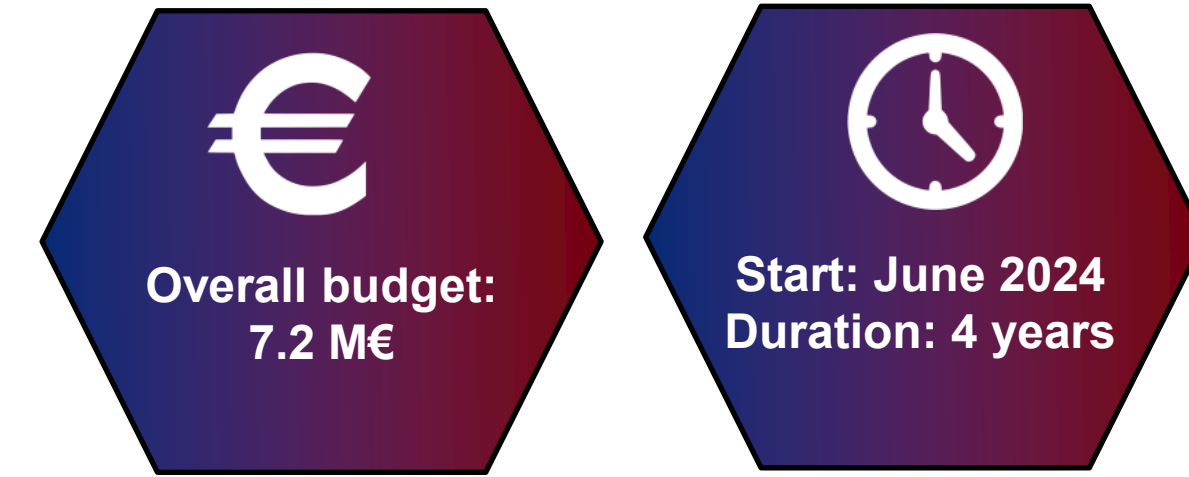
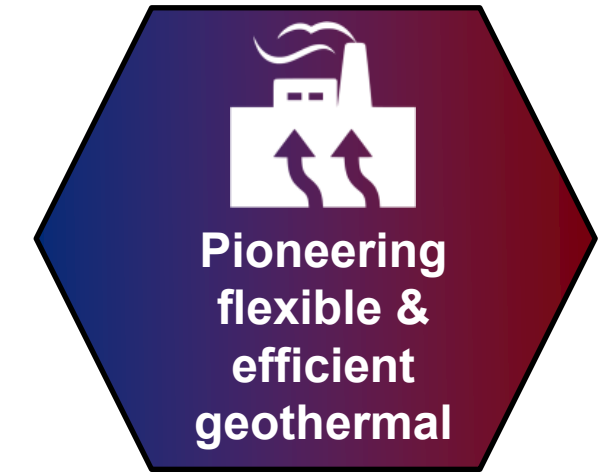
Electricity price driven operational mode



- Combining the rev. ORC with a storage systems allows reacting to the electricity price
- The thermal storage system might be either a smaller surface installation or a seasonal Aquifer UTES system

Key highlights & Objectives

- Demonstrating a geothermal reversible ORC system on a TRL 7 level
- Developing and demonstrating advanced control strategies
- Optimizing the design & operation of innovative district heating and cooling systems with UTES
- Developing optimal system designs for future geothermal systems across Europe
- Enabling a high system replicability & fast market update



Paving the way for market entry

- From the beginning of the project, two novel test rigs at TUM and ULIEGE will collect long-term operational data. The gathered experience will be used for the optimal design of the demonstrator.
- A 200 kW_{el} demonstrator will be installed at a real district heating network at the TUM campus in Garching, Germany
- Since the demonstrator has already the capacity of future potential modular reversible ORC systems, the market entry of this technology might occur directly after the project end

Two rev. ORC test rigs (TUM + Uni Liège)



Demonstrator operated at a real district heating network

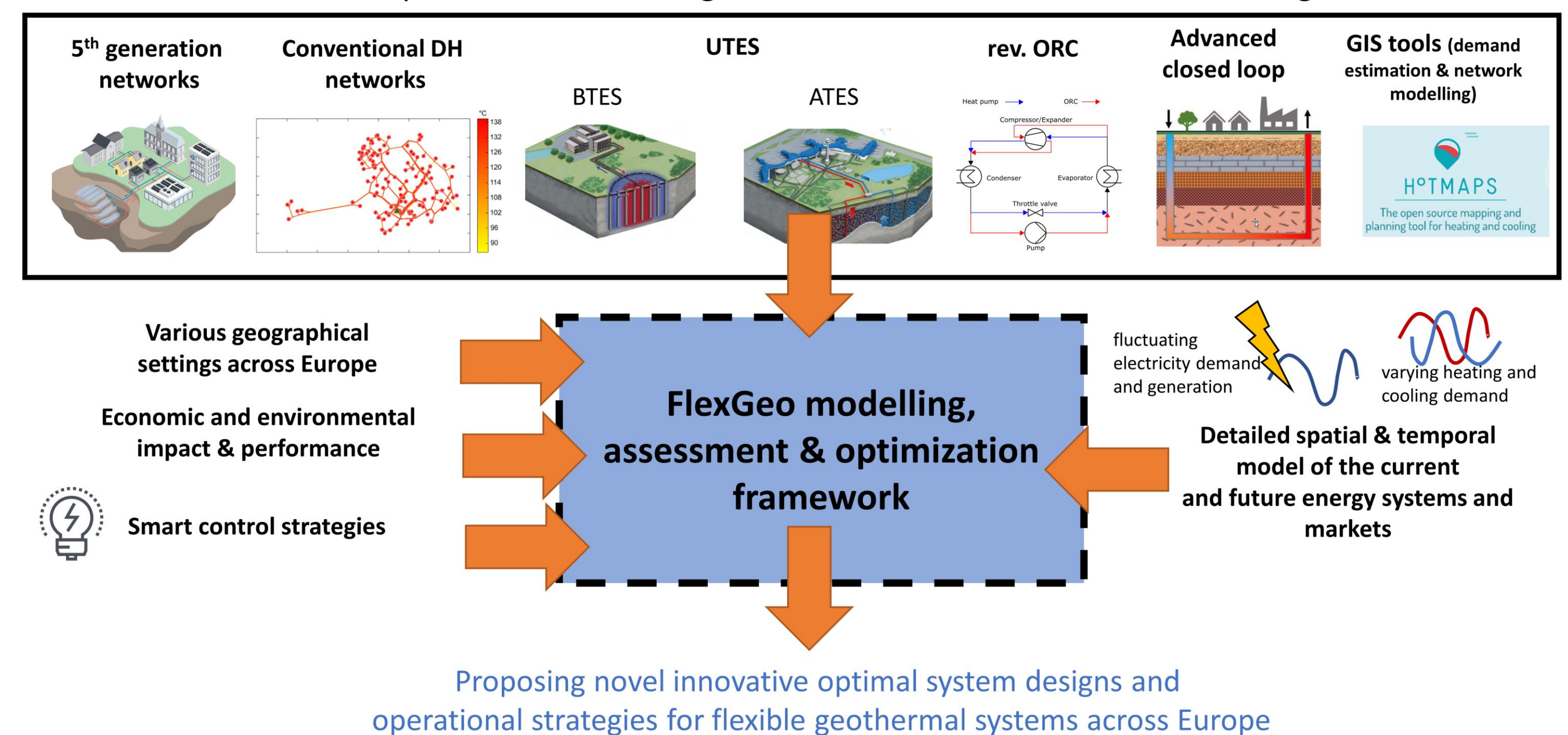


Market entry directly after the project end



The FlexGeo modelling platform

Detailed open-source modelling tools for the different FlexGeo technologies



- Detailed open-source models of the various geothermal technologies will be developed & published
- An integrative modelling framework will be used to identify optimal system designs and operational strategies for future flexible geothermal energy systems
- In-depth assessment of the FlexGeo technology for selected case studies in Europe

Get actively involved & talk to us

- FlexGeo aims at a very active stakeholder interaction by establishing an observer board
- We are seeking several case-studies across Europe to assess the FlexGeo technologies and our modelling toolbox
- Potential travel reimbursement for external stakeholder to participate in project events and workshop
- In addition, several side-events at both the European Geothermal Congress 2025 and the ORC conferences 2025 and 2027 are planned

Register for the project newsletter



Preliminary project website



Meet the FlexGeo members at ECOS 2024



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