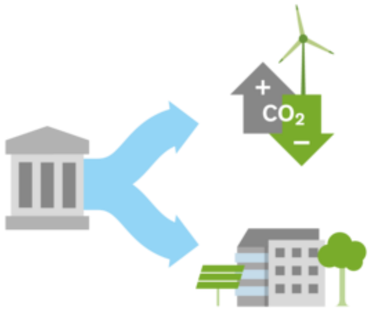

Use of waste heat potential and flexibility elements to speed up decarbonisation in Austrian thermal spas

ISEC 3rd International Sustainable Energy Conference 2024

Carina Seidnitzer-Gallien, Roman Stelzer

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VORZEIGEREGION ENERGIE

Boundary conditions

Key facts

- 38 thermal baths in Austria
- Hydrogeothermal energy
- Emissions up to 50,000 tCO_2
- High usage of fossil fuels

Overall Target

- Decarbonisation of thermal baths with high share of renewables and efficiency measures

Challenges

- High Energy Consumption
- Continous Heating Requirements
- Limited Space Requirements
- Balancing Sustainability with Visitor Comfort
- Cost Consideration
- Regulatory and permitting effects

GEO.MAT …linking research with implementation

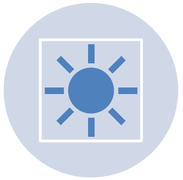
Project aims to create carbon-neutral thermal baths by optimizing geothermal energy utilization

Using untapped waste heat potentials (geothermal splashing water, climate cold, other sources)

Implementation of specialized heat pump concept to enhance efficiency

Deployment of targeted efficiency improvement measures to further optimize energy demand

Integration into intelligent energy management system (MPC & DPC) for consumption reduction



Leveraging thermal capacities through peak shaving and load shifting

Replacing fossil fuels with biomass and other renewables

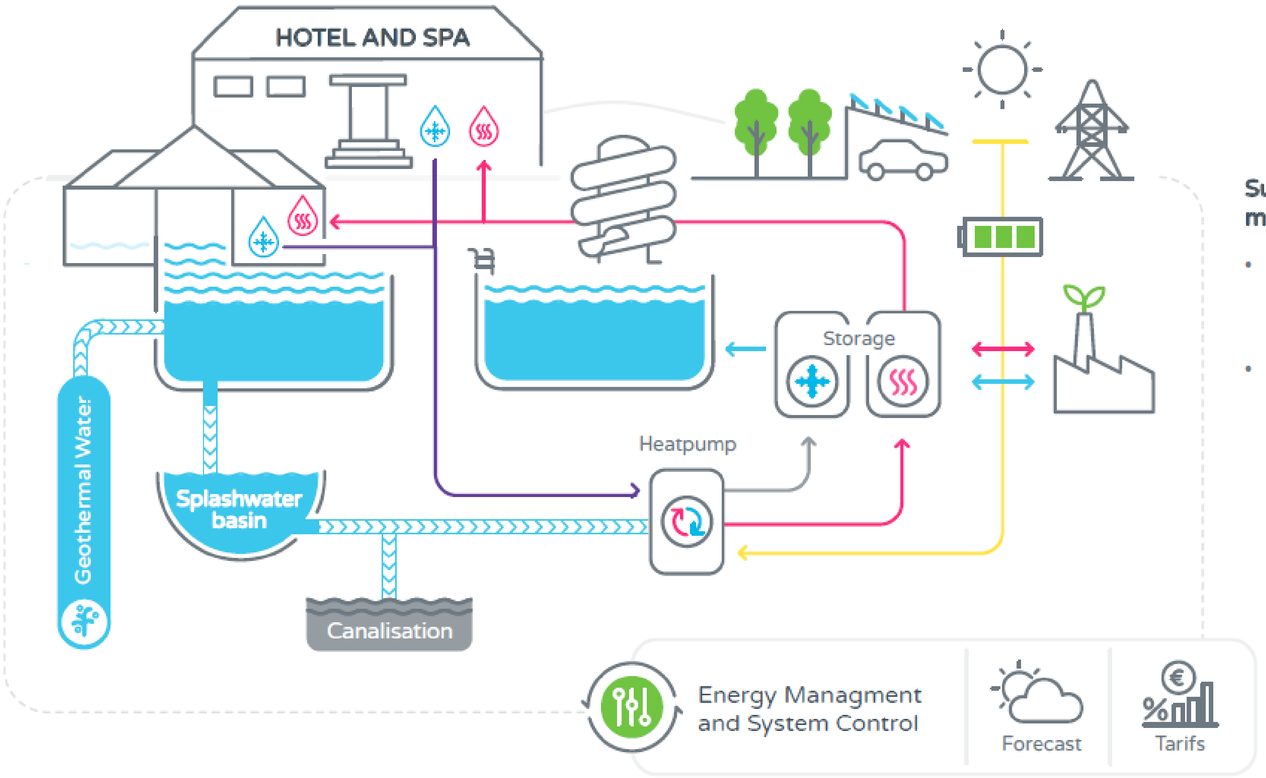
GEO.MAT …decarbonized thermal baths

Enhancing Efficiency

- Multi-dimensional waste heat utilization of splashing water, chilled water of refigeration and ventilation systems
- Seamless heating and cooling integration with heat pumps across temperature ranges

Demonstrator projects:

- Sonnentherme Lutzmannsburg
- H2O Thermal Spa Bad Waltersdorf



Supervisory Intelligent energy managment & system control

- Ensuring optimal thermal bath performance for all seasons and changing visitors demand
- Using of Model based and data driven predictive control strategies

Key parameters Demo Sonnentherme

Location:

- Lutzmannsburg, east Austria

Geothermal:

- Maximum flow rate: 18 m³/h
- Operating temperature: 32°C

Additional heat source:

- Gas consumption of around 1.67 million m³ per year
- Annual emissions for heating: over 4,200 tCO_2

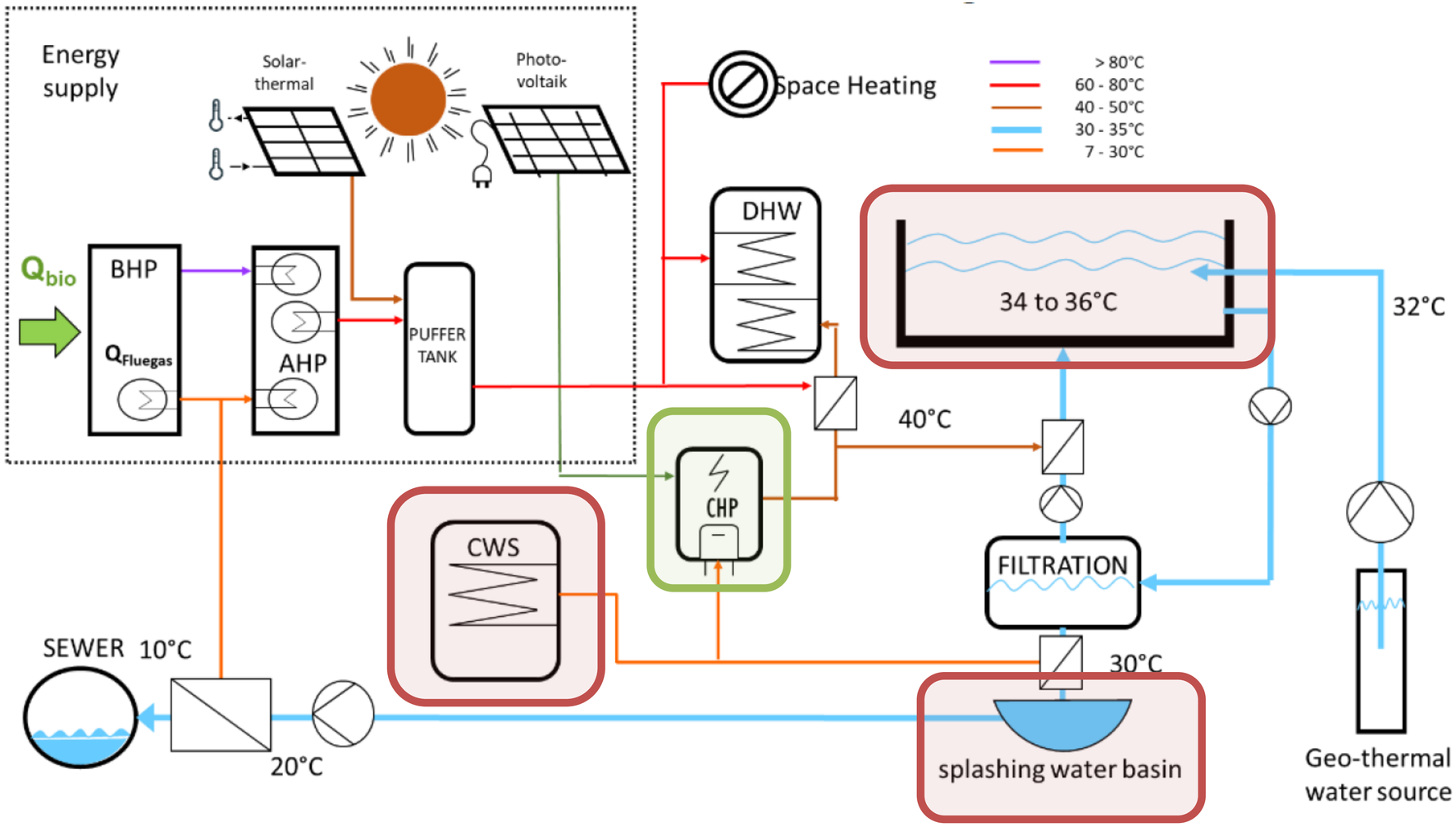
Pool water volume:

- Approximately 2,200 m³
- 24 Indoor and outdoor pools
- 18 slides with 900m length

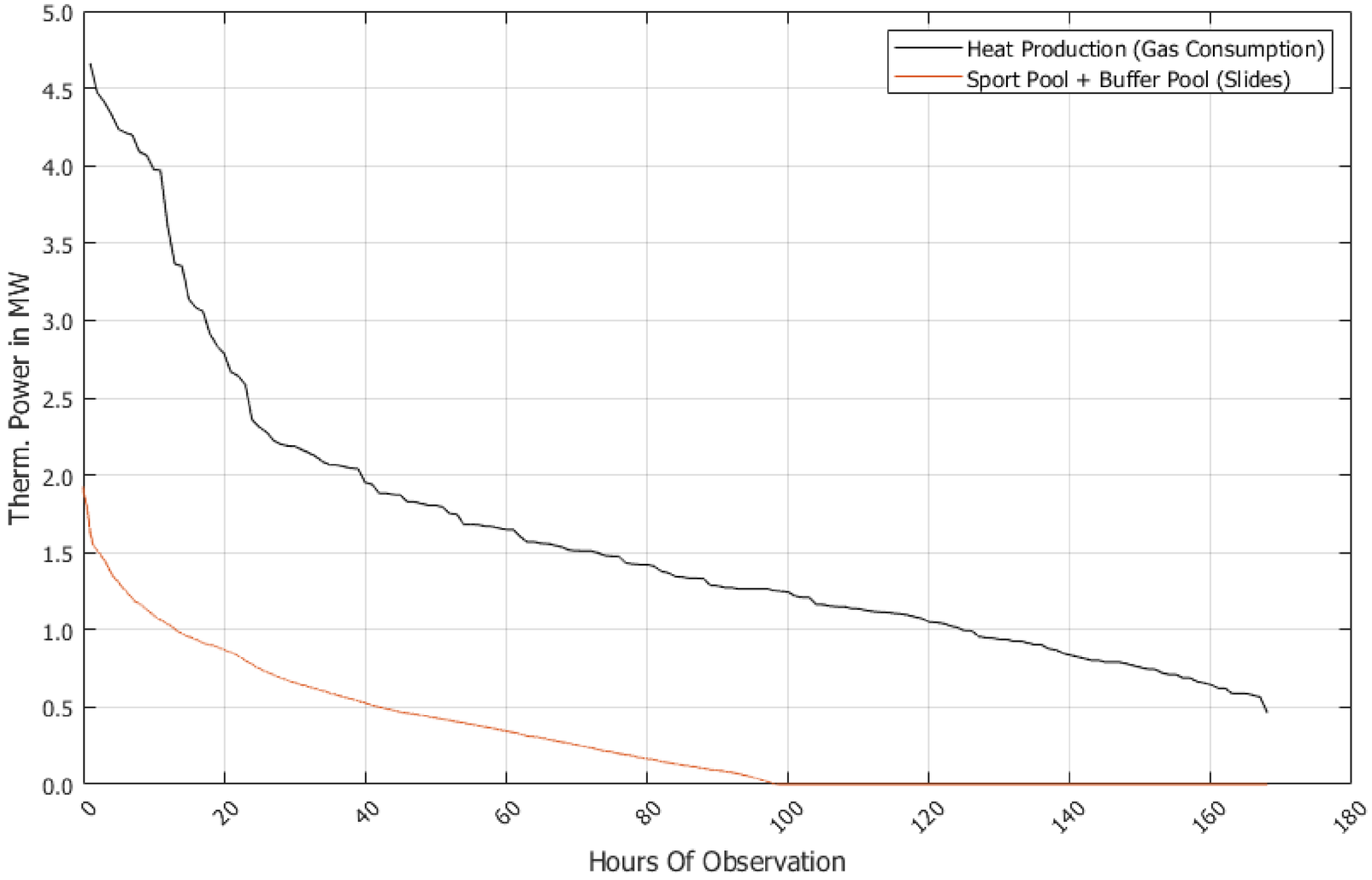
Potential sources of waste heat:

- Waste heat from pool operation
- Waste heat from chiller

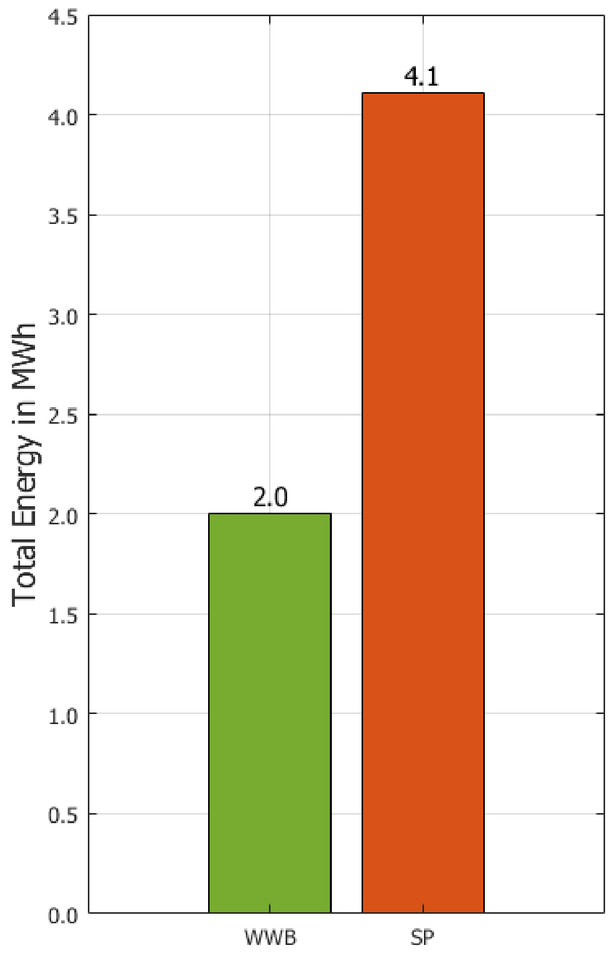
CO2-free thermal spa: first steps



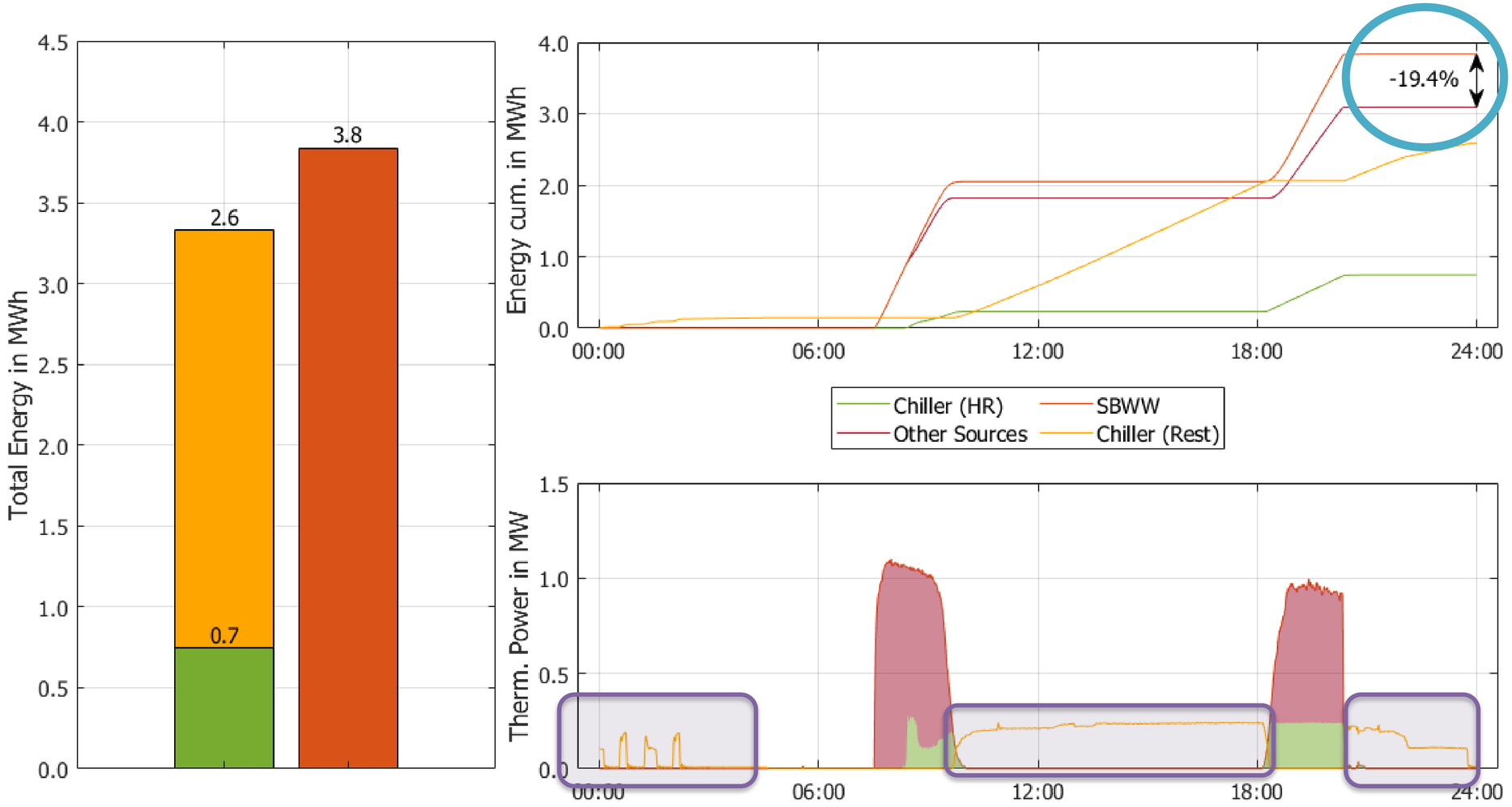
Results potential study: overview



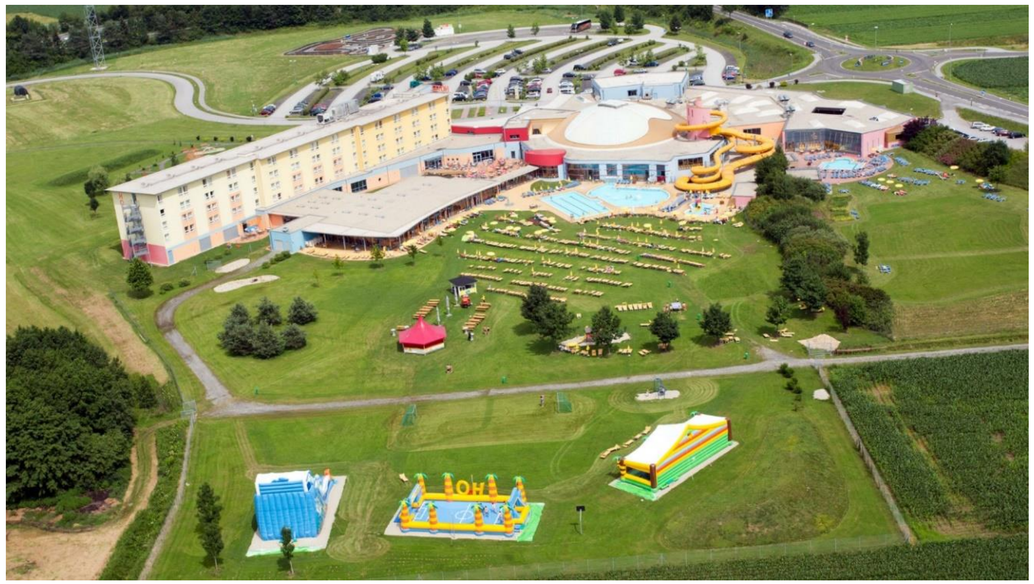
Results potential study: Waste water utilization



Results potential study: Heat recovery



Key parameters demo H2O Holtherme



Location:

- Bad Waltersdorf, southeast Austria

Geothermal well:

- Depth: 498 meters
- Production: 9 m³/h at 32°C

Connection to local district heating network

Annual heat demand:

- 6.4 GWh

Annual electricity demand:

- 3.4 GWh

Potential sources of waste heat:

- Thermal wastewater
- Chilled water refrigeration and ventilation
- Drinking water cooling

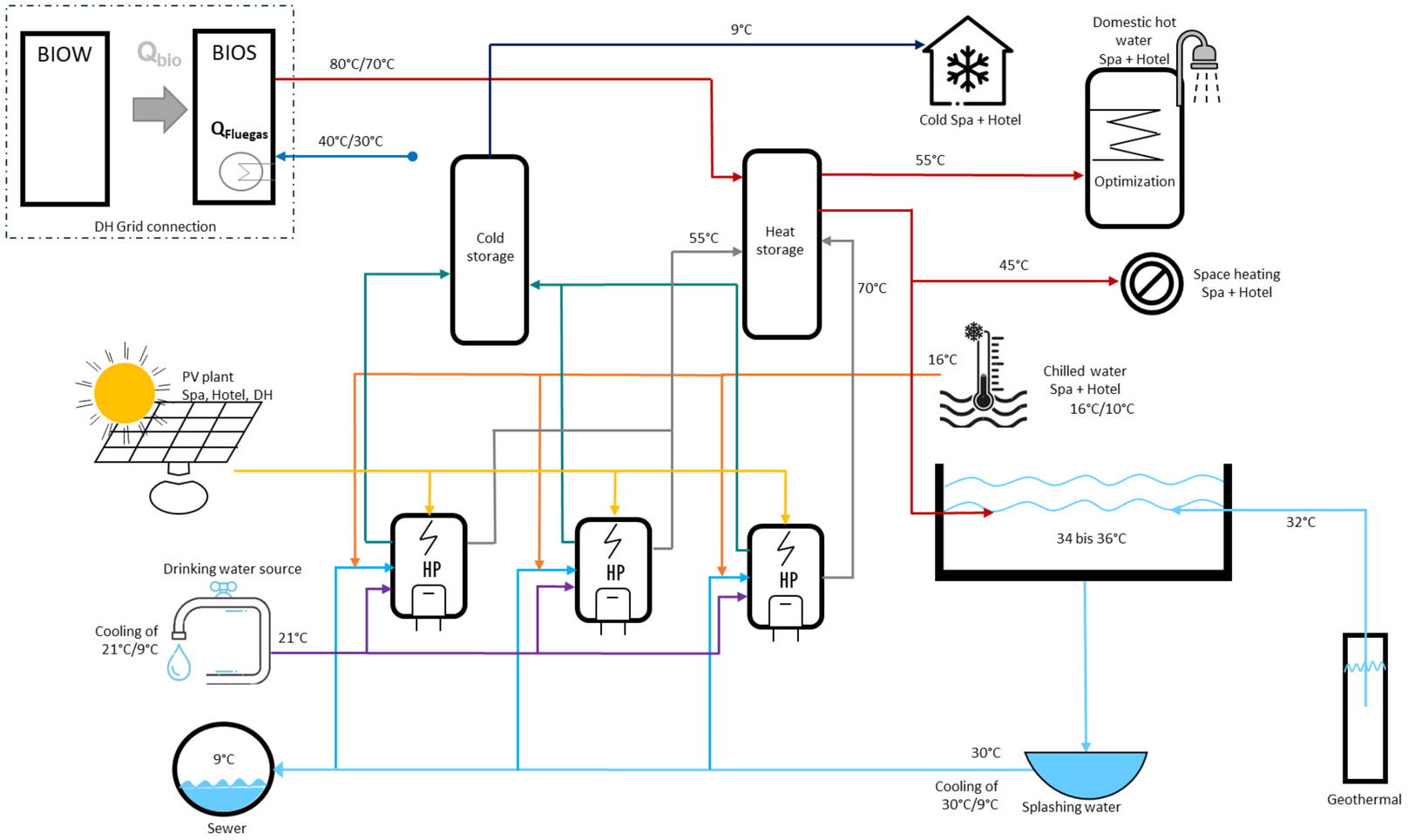
Concept Design & Innovation Measures

Demo H2O Hoteltherme

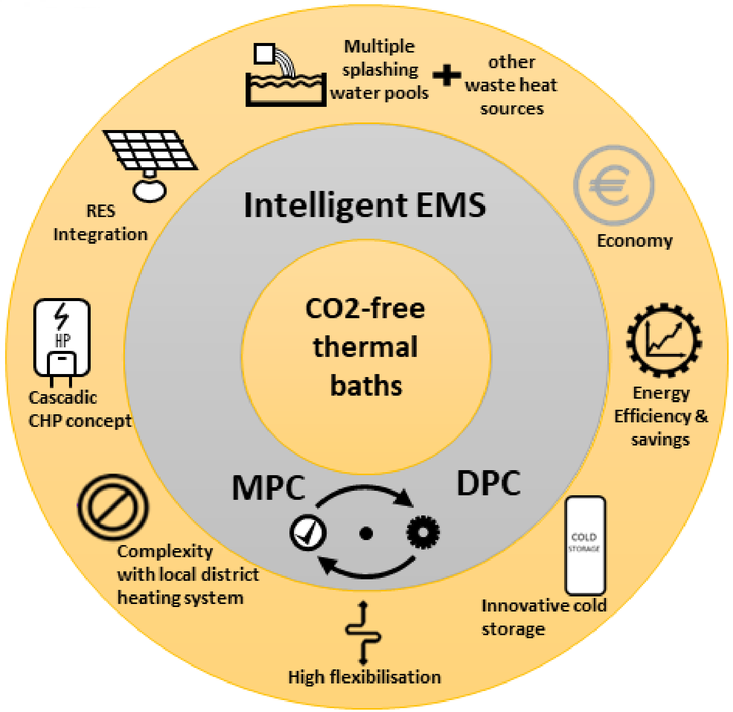
1. Multi-dimensional waste heat utilisation from the thermal spa (splashing water, waste heat of chillers and ventilation) for optimised cascading operation of the heat pumps
2. Energy optimisation cascade thermal spa and hotel (DHW heating, ventilation systems, heat recovery, exergetic loss minimisation) to achieve a high degree of self-sufficiency
3. Bidirectional waste heat utilisation and efficiency increase for both connected district heating plants, district cooling between local heating grid and thermal spa
4. Cascading heat pump system for utilising multidimensional waste heat sources with the aim of conserving biomass resources and increasing the efficiency of the heating plants in summer and transitional operation
5. Innovative intelligent energy management with the use of Model Predictive Control (MPC) for optimised storage management of the heating and cooling supply

Concept Design & Innovation Measures

Demo H2O Hoteltherme



Conclusion and Outlook



- Optimization of existing infrastructure, utilization of untapped waste heat sources, integration of renewables
- **Demo Cases** show complexity of approaches to specific needs, leading to high reductions in energy consumption and CO_2 emissions
- **Potential study** demonstrates the high potential for optimization
- Finalization of the **energy system concepts** and preparation for implementation on the demonstrator
- Entail **simulation** and dynamic optimization into predictive model or data control
- Paving the way for **sustainable future** in tourism

GEO.MAT

Efficiency increases of geothermal energy systems with heat pumps

Research Partners

Business partners

Planners & Technology providers

Project Website

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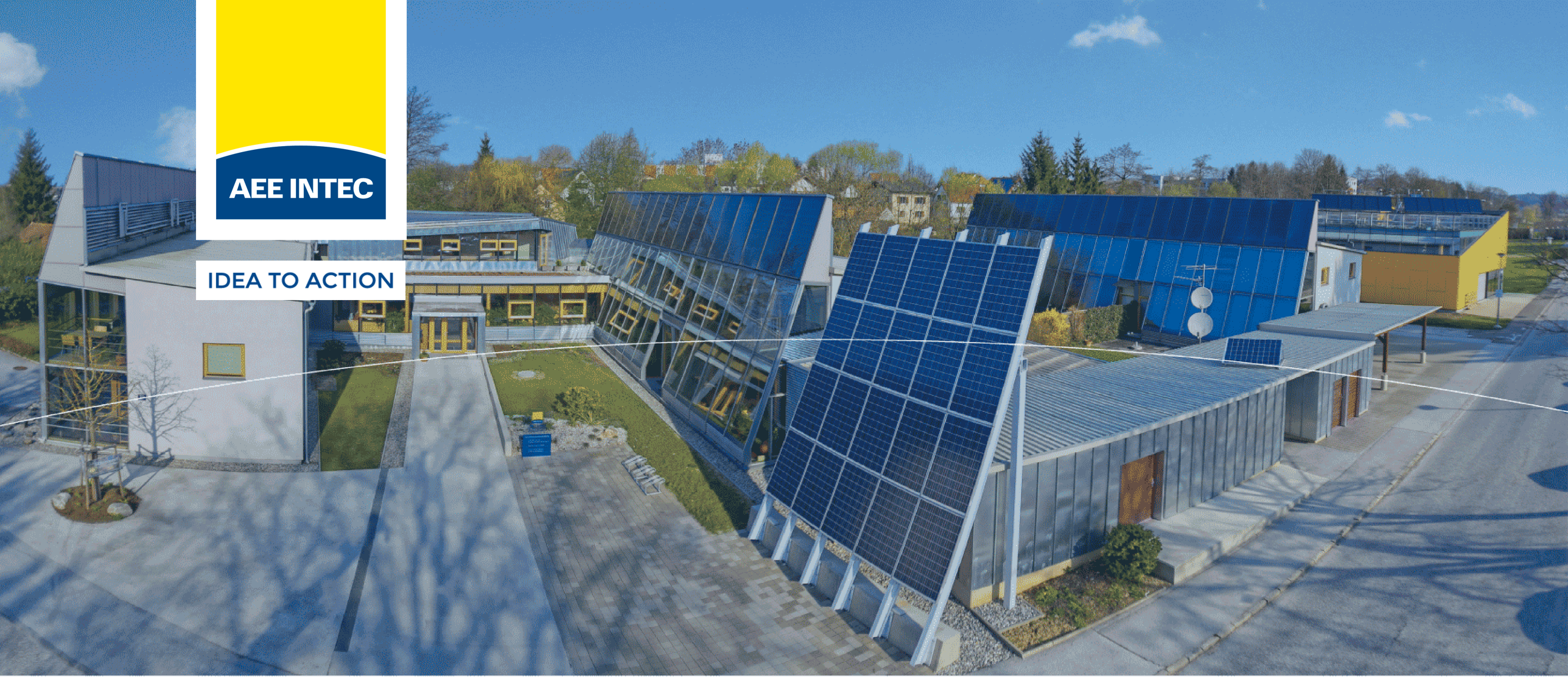
IDEA TO ACTION



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