VATTENFALL ENERGY AWARD

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THERMOECONOMIC ANALYSIS AND OPTIMISATION
OF
AIR-BASED BOTTOMING CYCLES
FOR
WATER-FREE HYBRID SOLAR GAS-TURBINE POWER PLANTS

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MJ211X DEGREE PROJECT IN THERMAL ENGINEERING

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KTH - SCHOOL OF INDUSTRIAL ENGINEERING AND MANAGEMENT

ENERGY TECHNOLOGY DEPARTMENT

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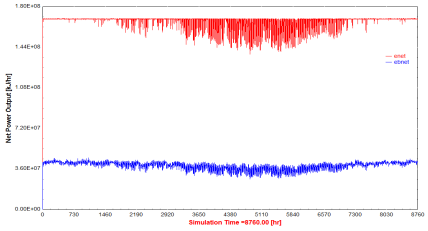
WHY ?

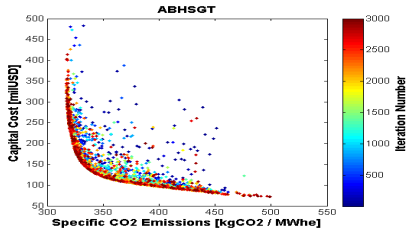
- Need for alternatives for the sustainable generation of electricity
- Concentrated Solar Power (CSP): one the most promising technologies
- Suitable locations: high solar insolation and water scarcity
- Problem: CSP conventionally based on steam turbine cycles, consuming high amounts of water
- Novel concept: water-free and highly efficient
- **Hybrid solar gas-turbine power plant with an air-intercooled and recuperated gas-turbine bottoming cycle**

HOW ?

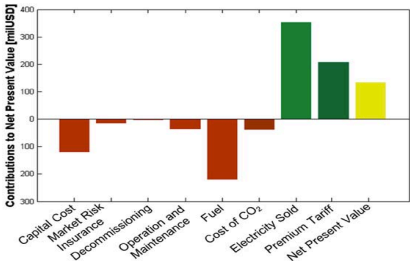
- Dynamic modeling of the novel power plant concept
- Simulation of yearly transient operation



- Thermoeconomic and environmental analysis
- Multi-objective optimisation



- Sustainability-oriented selection of the optimal design
- Detailed design analysis and sensitivity analysis



WHAT ?

- Promising solar concept for electricity production in water-scarce areas
- Performance improved by the integration of the bottoming-cycle
- Reduced levelized cost of the electricity generated
- CO_2 emissions: -33% compared to an equivalent gas-fired power plant
- Water consumption: 100 times lower than conventional CSP plants
- Overall thermodynamic efficiency: +7%
- *Further information available in the MSc thesis report*