sCO2-flex

sCO2-flex Final Event

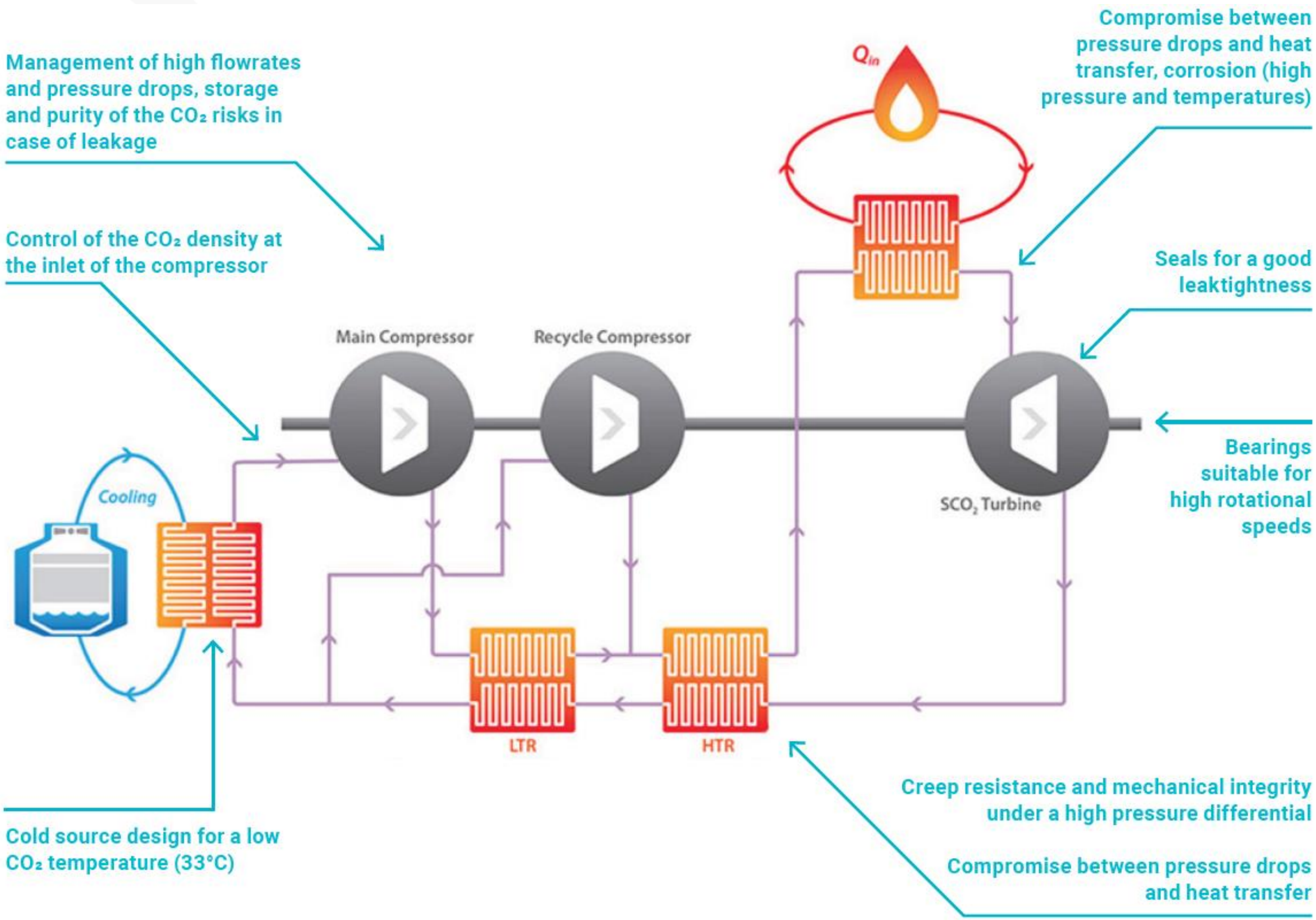
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 764690-

Supercritical CO2 cycle for FLEXible power plant

Our aim: develop and validate a design of a 25MWe Brayton cycle using supercritical CO2 that will enable an increase in the operational flexibility”

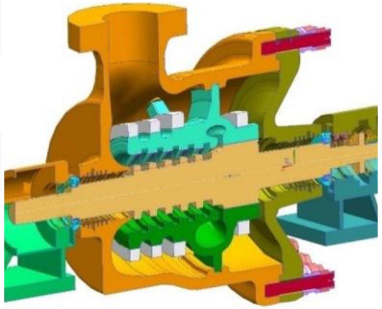
sCO2-Flex: Our consortium

Main challenges



Main equipments development

Turbine



Mechanical design

5 stages

88,4% isentropic efficiency

Compressor

5.4MW prototype

Dry Gas Seal (DGS) system

From 100% to 20% load

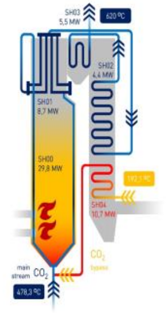
Test campaign

Heat exchangers

Several prototypes: PCHE/ PFHE

Pressure test: 1200bars

Boiler

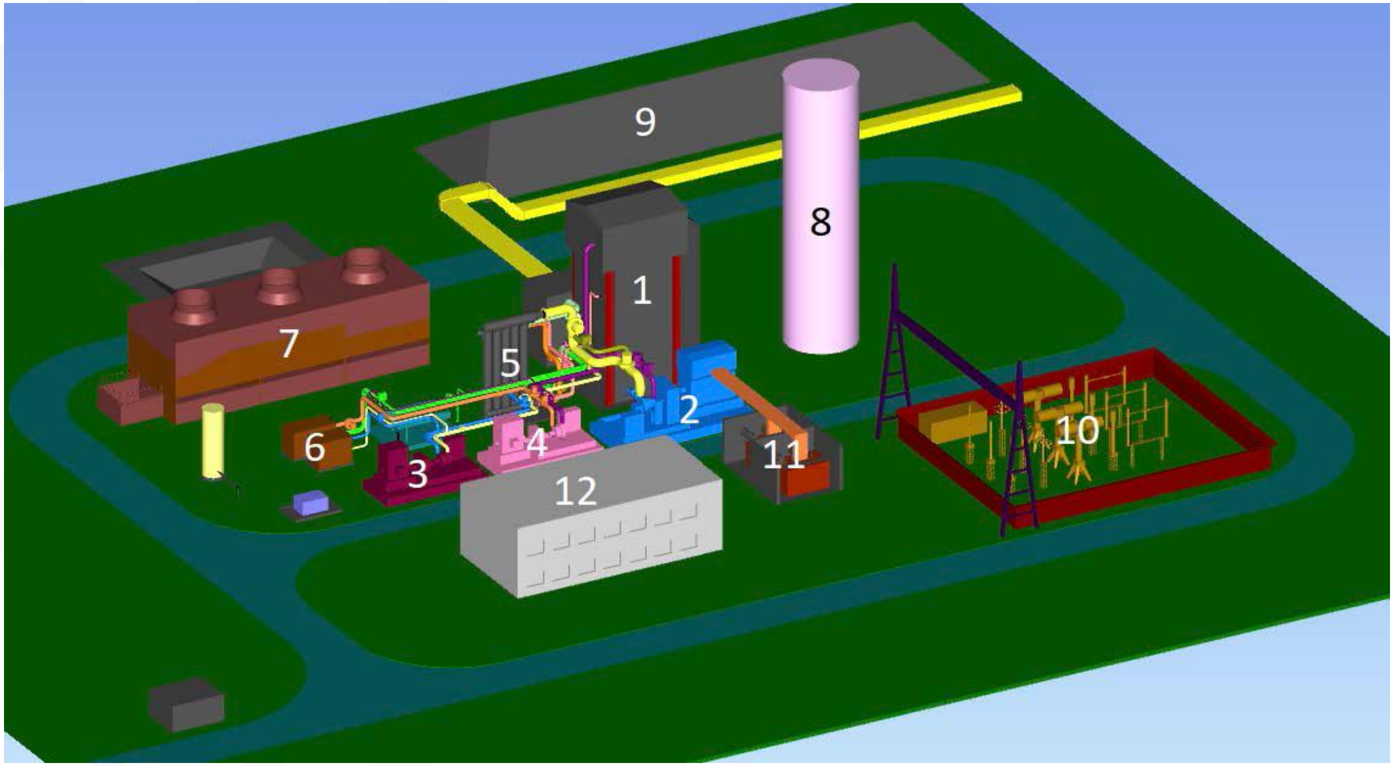


Hot CO_2 T°: 620°C

Thermal load: 59 MW

Efficiency: 92.5 %

Engineering Design



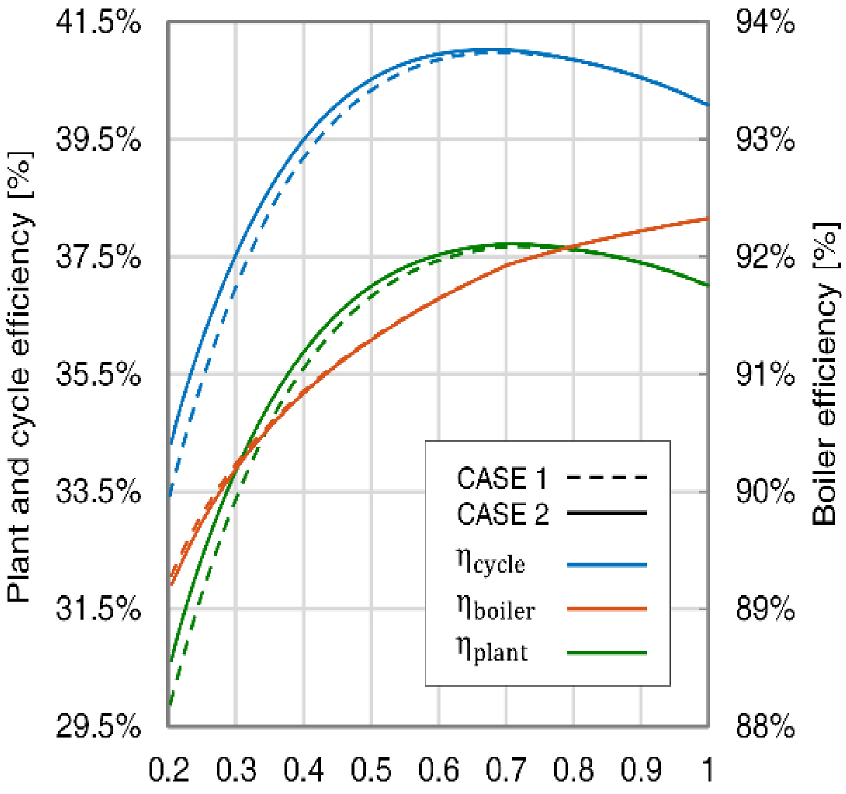
1: boiler house,
2: turbine,
3: main compressor,
4: secondary compressor,
5: low- and high-temperature recuperators,
6: CO2 inventory management tanks,
7: heat sink,
8: stack,
9: fuel storage area,
10: electrical substation,
11: transformers,
12: electrical & administration building

Reduced Footprint, very compact design

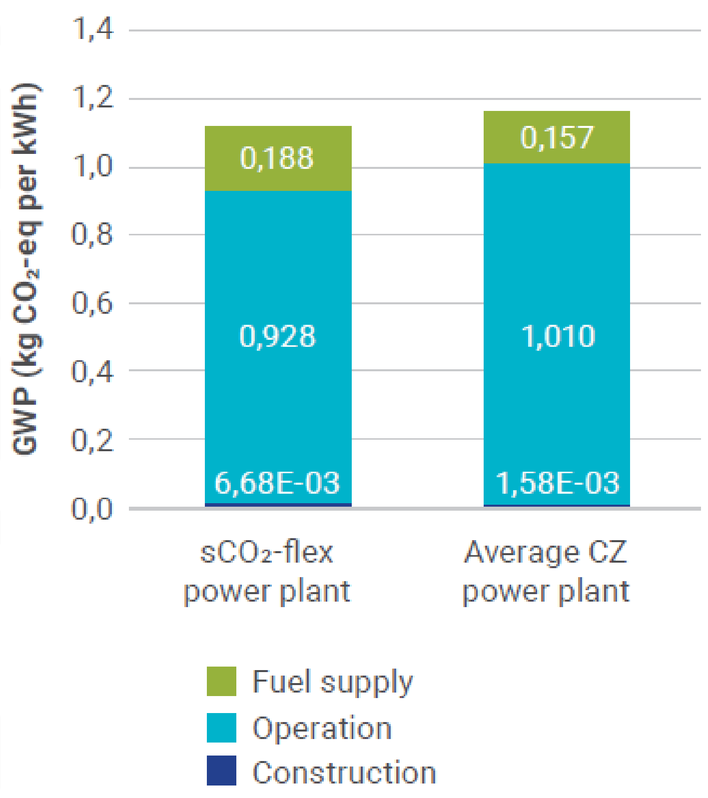
Plant Operation

Off-design and dynamic Performance:

- Several operating strategies tested
- Sliding pressure for turbomachinery
- Variable speed fans for heat rejection unit (HRU)
- Working fluid inventory can be varied to set the cycle minimum pressure
- 5%/min load reduction
- Compatible with primary frequency control on the grid

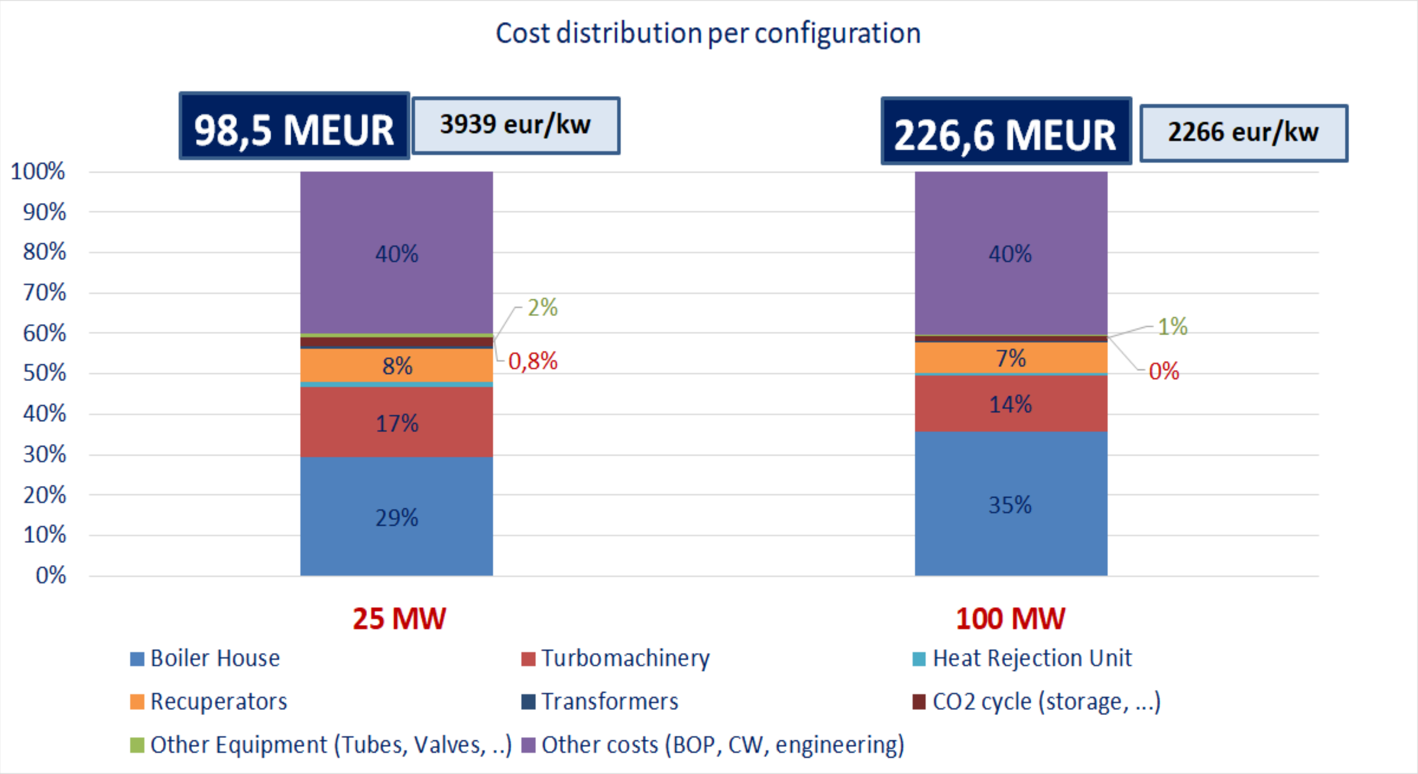


Potentiel environmental impacts



- Environmental Impact
  - 8% less than the reference plant in operation,
  - 4% less overall during its entire life cycle
- Reduced footprint
- Reduced materials for building and main equipment
- Social code of conduct for responsible research in the field of energy

Cost estimates for 25 Mwe cycle



25 Mwe Cycle under 100M€ (as expected) with large margins of reduction

100MWe cycle 2 to 2.5 times higher

Next steps

Equipment improvement is possible

- Turbine and compressor efficency
- Heat Exchangers design

Use for other applications

- Cycle without Boiler, could be used for other applications (CSP, biomass, heat recovery…)
- Study operation and efficiency with different cooler systems

CAGNAC Albannie

Albannie.cagnac-1@edf.fr

EDF Lab Chatou
Département MFEE
6 quai Watier
78400 Chatou

France