

Supercritical CO₂
Power Cycles
Symposium

Albannie CAGNAC

EDF R&D

albannie.cagnac-1@edf.fr



AIMS OF R&D



Improve EDF Group performance

in all of its current ventures and enable customers to benefit.



Prepare the energy scenarios of the future


by working on disruptive technologies.



Carry out **research for external commissioning bodies** within the framework of partnerships or orders.



EDF R&D in Figures



**MORE THEN 1800
EMPLOYEES IN
FRANCE AND 225
OUTSIDE**



**160
RESEARCHERS-
TEACHERS**

**156 PHD
STUDENTS**



9 centres
en France et à l'étranger

**40
nationalités**



**MORE THAN 300
ACADEMIC AND
INDUSTRIAL
PARTNERSHIPS**



**70 TEST, MEASUREMENT
AND SIMULATION
PLATFORMS**



2100 PATENTS



**11 petaflops of
computing capacity**

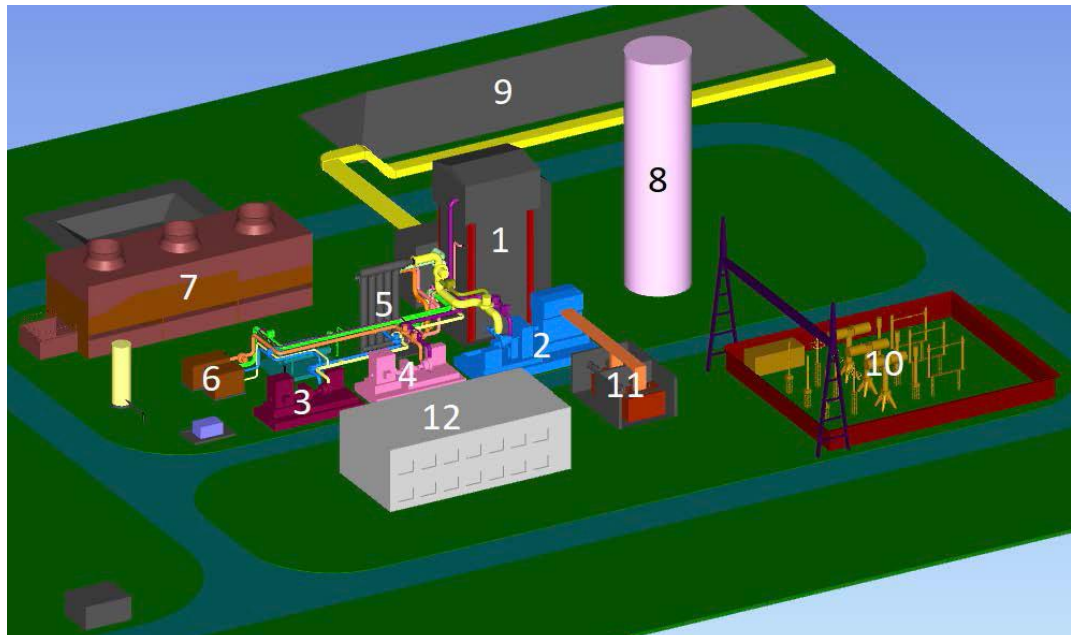
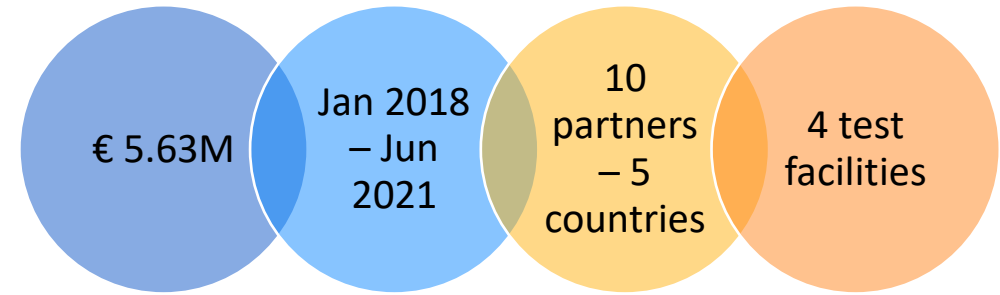


20 joint laboratories

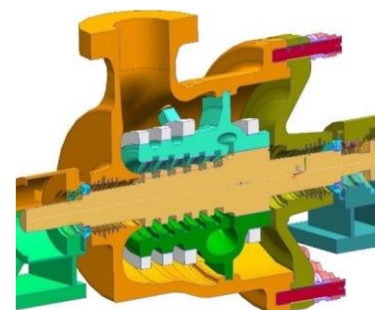
SCO2 projects – sCO2-flex - Coordination

Main Objective

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



Turbine



Mechanical design
5 stages
88,4% isentropic efficiency

Compressor



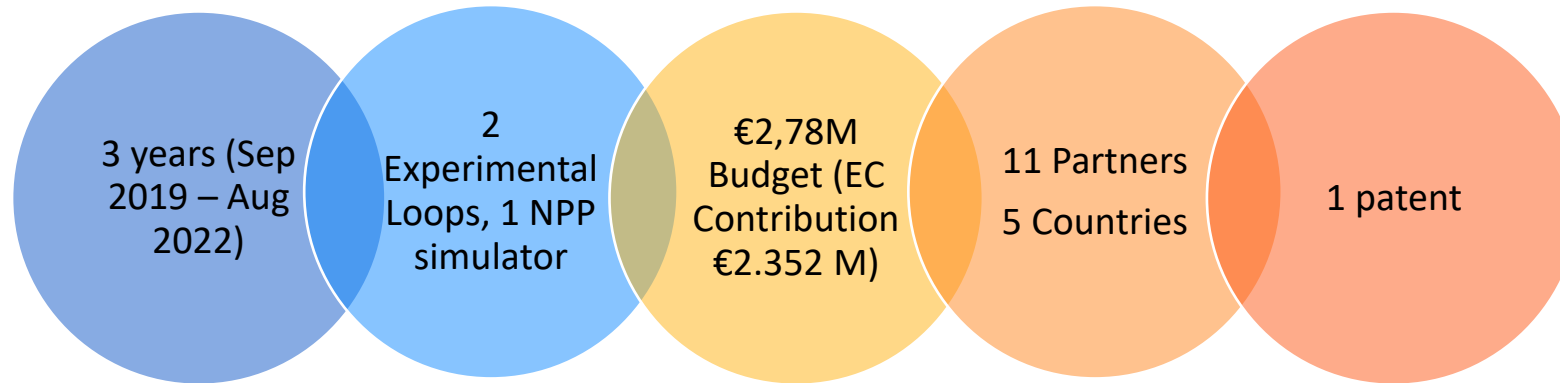
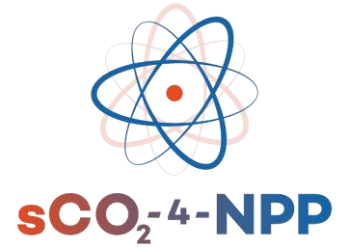
5.4MW prototype
Dry Gas Seal (DGS) system
From 100% to 20% load
Test campaign

Heat exchangers



Several prototypes:
PCHE/ PFHE
Pressure test:
1200bars

sCO2 projects – sCO2-4-NPP - Coordination



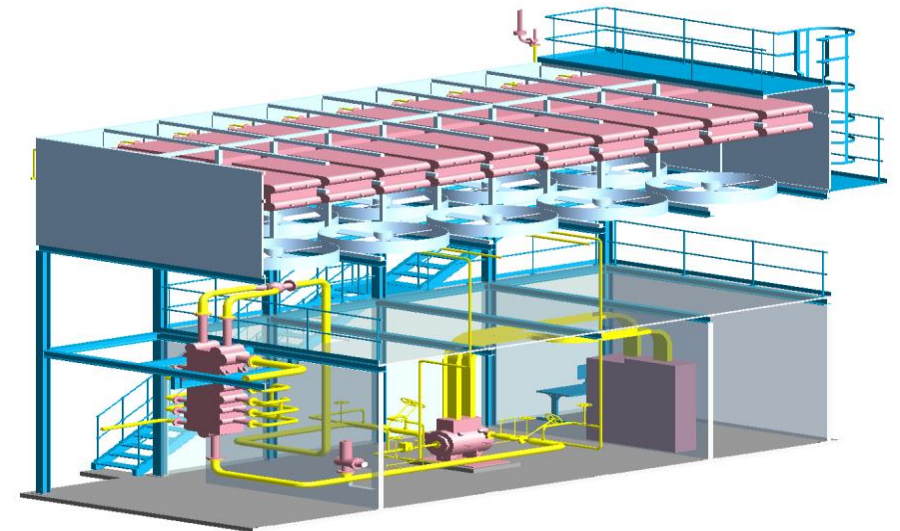
Project Objective

Development of an Innovative sCO₂-Based Heat Removal Technology for an Increased Level of Safety of Nuclear Power Plants

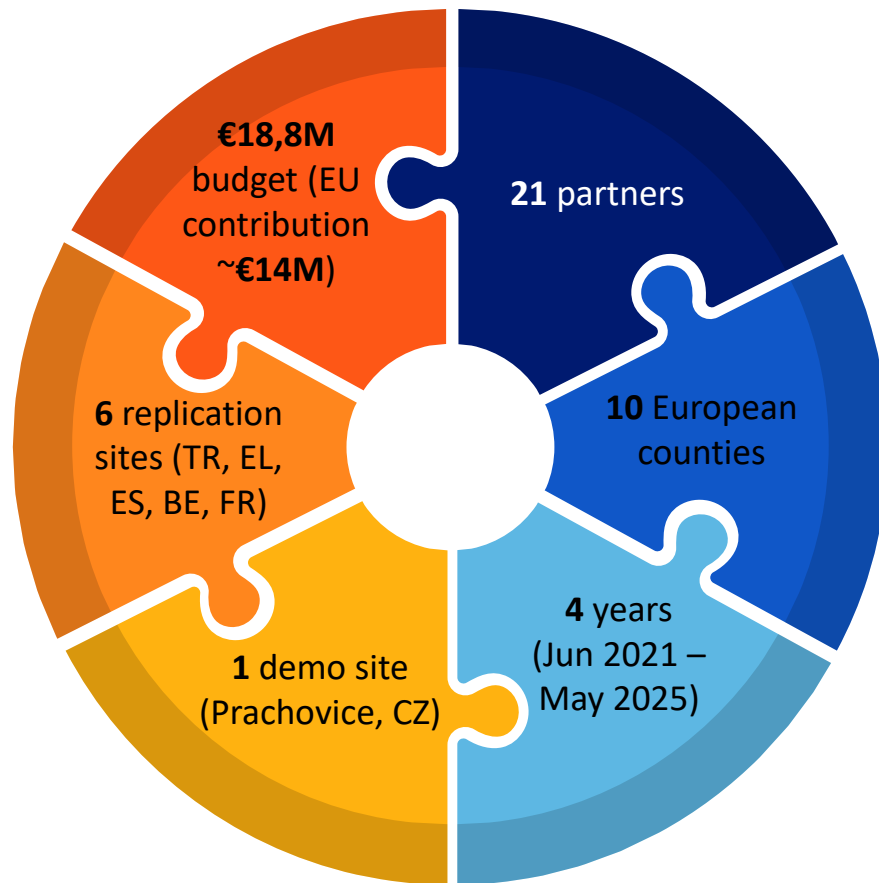
The vision: sCO₂-System

Electricity made out of decay heat / Modular / Self-starting / Self-sustaining

Retrofittable for existing PWR, BWR, ... / Innovative power conversion system for SMR, GEN IV...

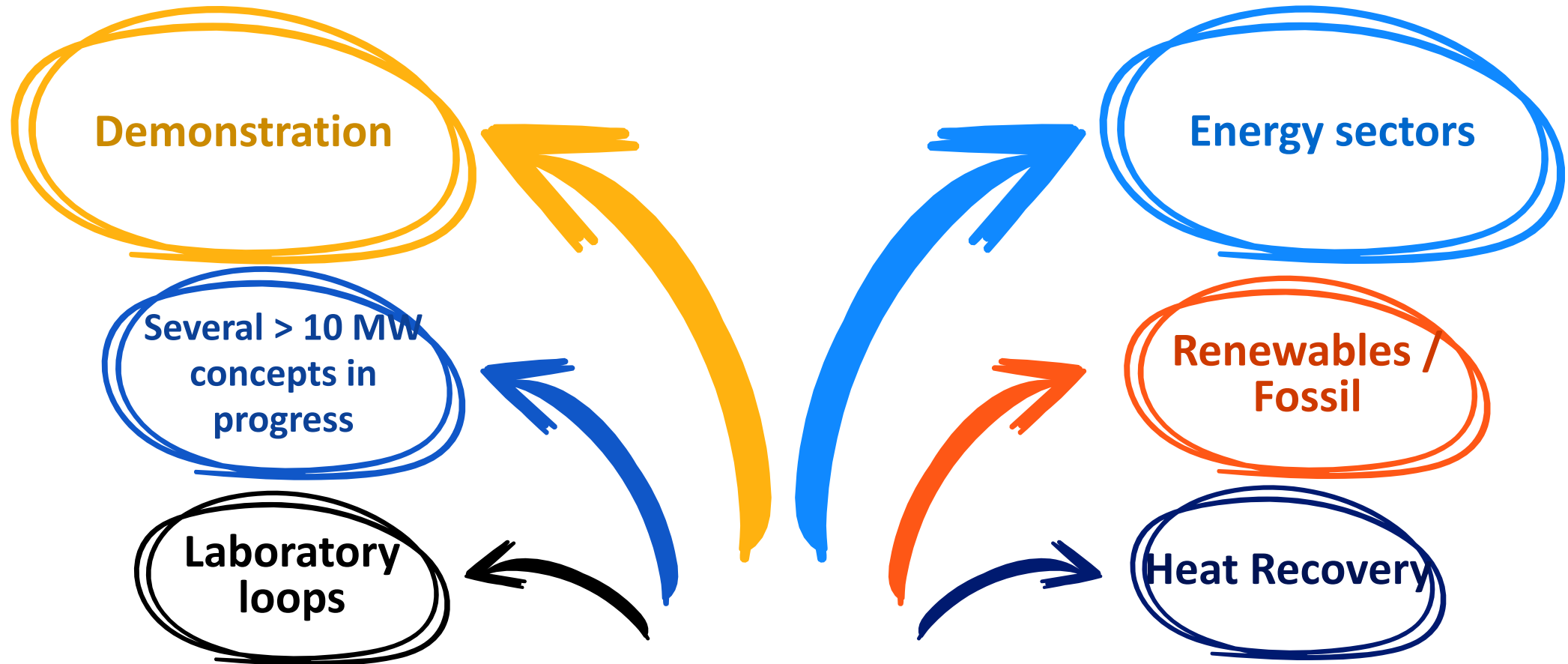


sCO₂ projects – CO₂OLHEAT - partner



- **CO₂OLHEAT** aims to unlock the potential of industrial **waste heat** and **transform it into power** (WH2P) via **supercritical CO₂ cycles (sCO₂)**
- **CO₂OLHEAT** will develop and demonstrate a 2 MW sCO₂ power block able to valorise the unused **waste heat**
- **CO₂OLHEAT** targets WH2P as a key enabler in fostering
 - Resource **efficiency** and the **competitiveness** of the EU's Energy Intensive Industries
 - EU industrial sector **decarbonisation**
- **CO₂OLHEAT** is the first-of-its-kind EU MW scale WH2P sCO₂ plant

Maturation – EDF's Overview



STRONG DYNAMISM

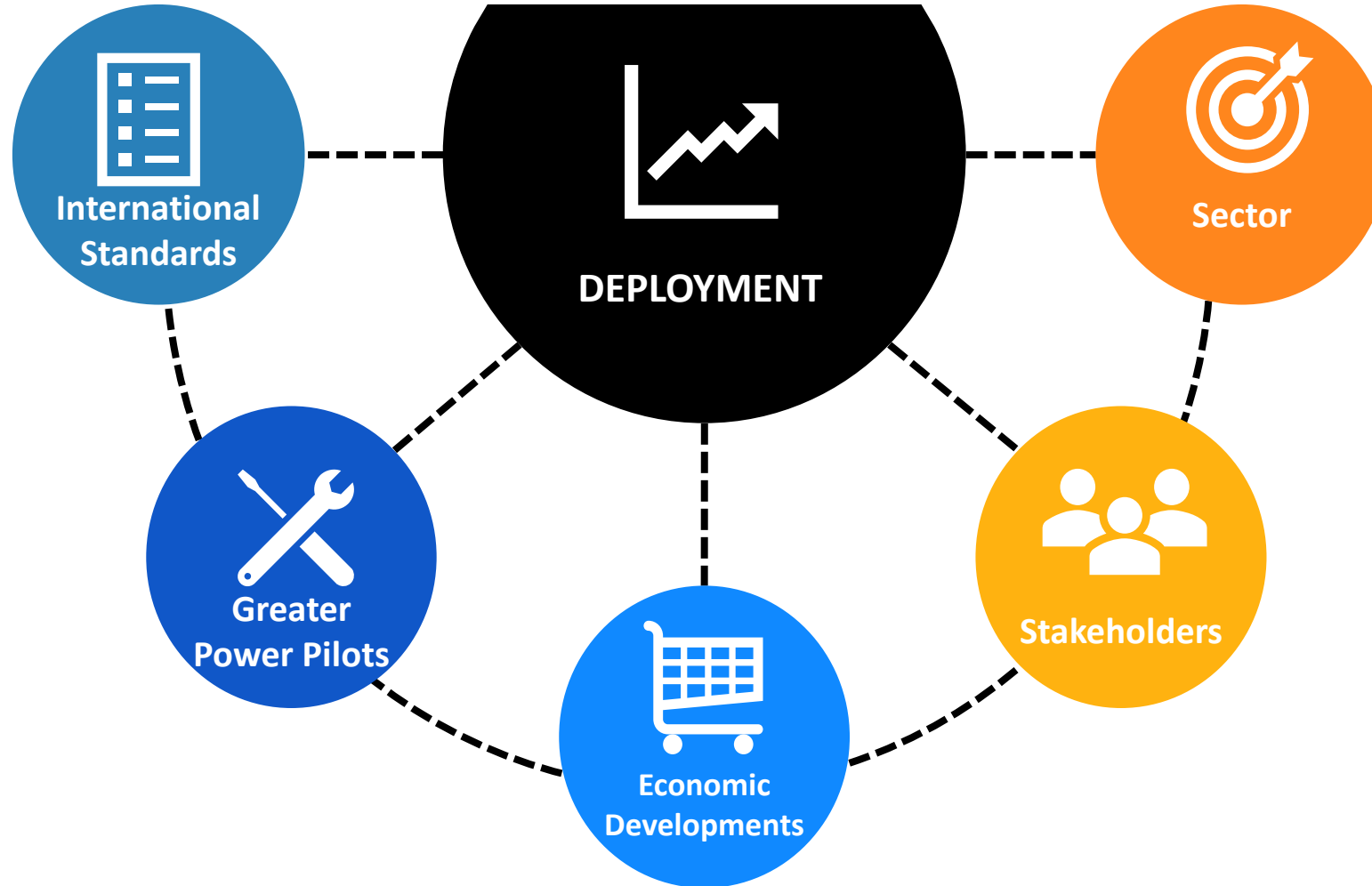
Identified needs

NO DEVELOPMENT WITHOUT REGULATIONS

Reassure on these new cycles
To ensure a good level of security
Set up qualification circuits

ADDRESSING OPERATIONAL ISSUES

Manageability and operability of high power cycles
Demonstrate performance
Addressing issues related to the increasing power of cycles



ONE OR MORE CO2 TECHNOLOGIES

Lead actor or extras
Which type of cycle for which energy sector ?

ALL PLAYERS

What criteria to convince? Cost, performance, ...
Continue the collaboration and discussions

WHICH PLACE IN WHICH ECONOMY

Complexity of the energy ecosystem
Answer questions on possible uses, on flexibility



Thank
You

