



Development of High Efficiency CFB Technology to Provide Flexible Air/Oxy Operation for Power Plant with CCS

The project aims to develop and demonstrate a power plant concept that allows flexible high-efficiency air-firing of fossil fuels with biomass and oxygen-firing with carbon capture which provides the potential for an almost 100% reduction in CO₂. The use of the Circulating Fluidized Bed (CFB) technology will allow the utilization of indigenous coals and biomass with Carbon Capture and Storage (CCS) thus addressing the needs for climate change mitigation, security of supply and reduction of dependence on imported coals.

Objective

This project combines the CFB's intrinsic advantages (fuel flexibility and low emissions) with oxygen-firing for carbon capture and storage. In oxygen-firing systems the fuel is burned in a mixture of pure O₂ and recirculated flue gas instead of air. The absence of air nitrogen produces a flue gas stream with a high concentration of CO₂, making it much easier to separate the CO₂. CFB technology appears to be ideally suited to oxygen-firing combustion. The overall result of this project will be a power plant design based on the air/oxy flexible CFB concept, ready for demonstration of high efficiency large utility-scale power plant with CCS burning a large variety of indigenous and imported coals from lignite to anthracite as well as co-firing biomass. Demonstration tests with different coals at a first-of-its-kind 30 MW_{th} air-oxygen-flexible CFB pilot facility and validation tests at the world's first and largest supercritical once through CFB (460 MWe Lagisza in Poland) are essential elements in the project to ensure the efficient, reliable and safe design of the commercial scale air/oxy flexible CFB power plant.

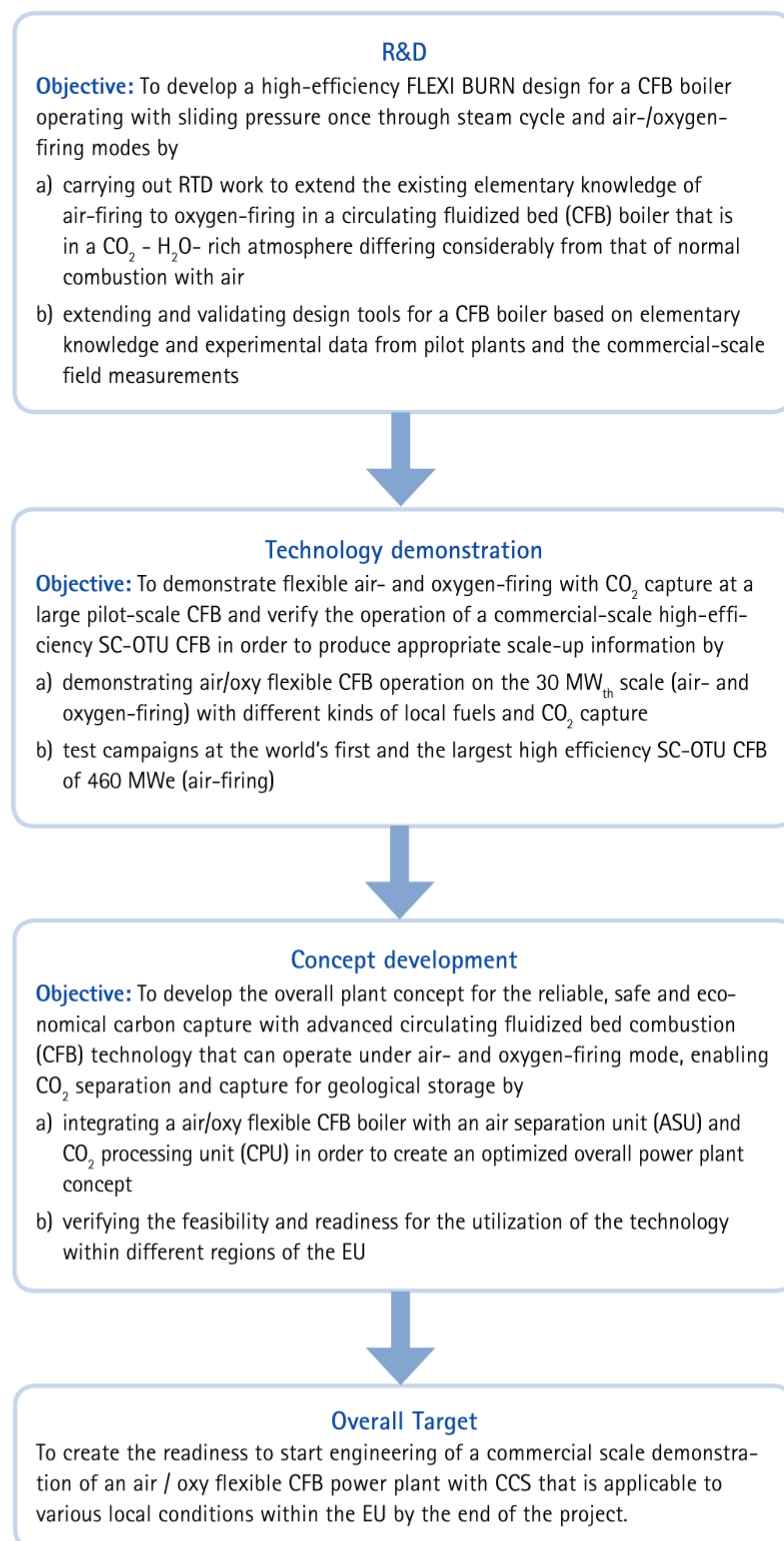
Novelty

The primary novelty of the proposed technology is in the full utilisation of all of the new CFB design and process advancements when merging a CFB boiler with a supercritical once through steam cycle and air separation unit together with CO₂ capture unit for CCS. This encourages utilities to take the new technology, which has the built-in capability for CCS, into use and to decommission old, inefficient and highly polluting capacity with lower efficiency and worse emission performance. In air-firing, the higher efficiency has a direct impact on CO₂ emissions due to the reduced consumption of fuel. In addition, by substituting 20% of the coal input with renewable fuels CO₂ emissions can further be reduced by 15-20%. Furthermore, the air/oxy flexible CFB concept is capable of CCS whenever the CO₂ storage is available. At a power plant with full CCS capability, the air/oxy flexible CFB concept serves as a risk mitigation tool that enables power generation during temporary outages of the CO₂ transport and storage facilities. Such features are expected to facilitate investment decisions for highly capital-intensive CCS power plant projects.

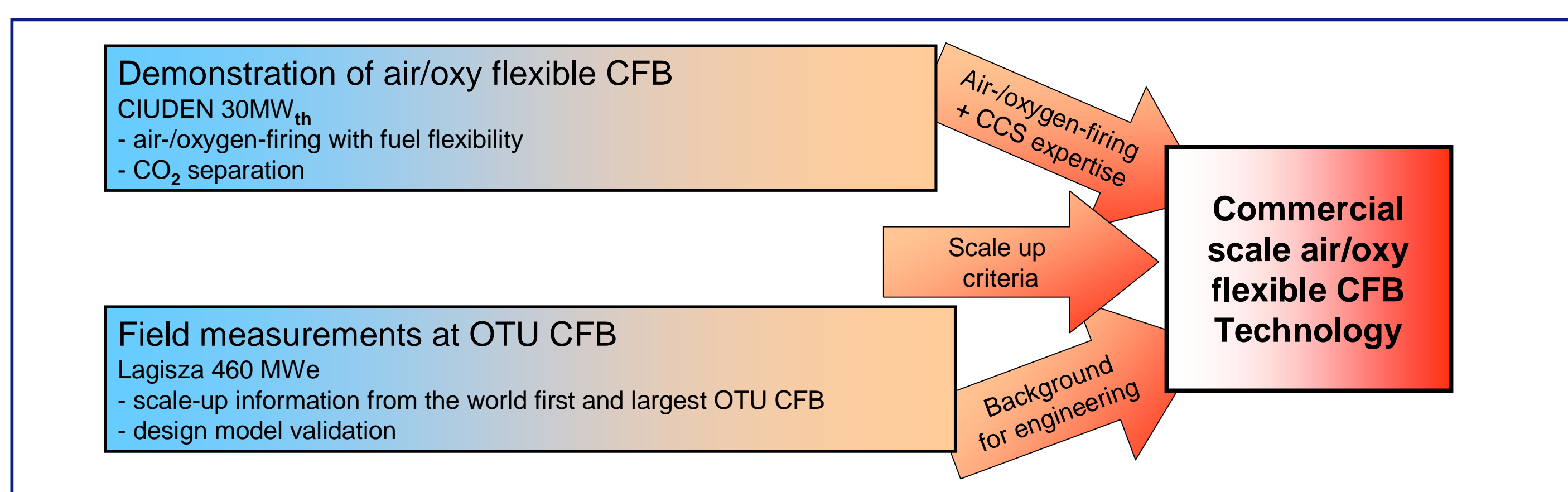


CIUDEN CCS large scale test Platform which is close to Compostilla Power station.

MAIN ELEMENTS AND THE KEY OBJECTIVES OF THE PROJECT



- THE AIR/OXY FLEXIBLE CFB CONCEPT HAS A SET OF IMPORTANT ADVANTAGES:**
- Fuel flexibility in order to decrease dependency on imported coals and in order to improve power plant economics especially with CCS operation
 - Operational flexibility in order to apply air-firing and oxygen-firing with CO₂ capture
 - Lower NO_x production due to reduced and more uniform furnace temperature profiles, and lower SO_x concentration in flue gases due to in-furnace capture, thus reducing the need for downstream flue gas cleaning
 - New methods to control power plant with air separation unit (ASU) and CO₂ capture
 - Overall concept for phased transition into CCS technology with minimised risks through high efficiency air-oxy flexible CFB combustion
 - Lower specific CO₂ emissions from the reduced consumption of fuel due to the intrinsic high efficiency of the technology. In addition, by substituting e.g. 20% of coal input with renewable fuels, CO₂ emissions can further be reduced by 15-20%.
 - Provides utilities an attractive alternative to take into use the new technology and decommission old capacity with lower efficiency and poorer emission performance



Development and demonstration on multiple scales - Principle of demonstration steps towards air/oxy flexible CFB concept.

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