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

From 2009-09-01 to 2013-02-28

Objective

This project combines the CFB’s intrinsic advantages (fuel flexibility and low emissions) with oxygen-firing for carbon capture and storage (CCS). 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 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 CFB technology will allow the utilization of indigenous coals and biomass with CCS thus addressing the needs for security of supply, reduction of imported coals dependency and addressing the climate change issue.

The overall result of this project will be a power plant design based on the FLEXI BURN 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 MWth 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 FLEXI BURN power plant.

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 decommission old, inefficient and high polluting capacity with lower efficiency and emission performance. In air-firing, the high efficiency has a direct impact on CO2 emissions due to reduced consumption of fuel. In addition, by substituting 20% of coal input with renewables, CO2 emission can further be reduced by 15-20%. Furthermore, the FLEXI BURN CFB concept is capable of CCS whenever the CO2 storage is available. At a power plant with full CCS capability, the FLEXI BURN 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.
Coordinator
TEKNOLOGIAN TUTKIMUSKESKUS VTT
TEKNIKANTIE 4 A
02044 VTT ESPOO
Finland
See on map

Activity type: Research Organisations

Administrative contact: Antti Tourunen
Tel.: +358405542887
Fax: +358207222597
Contact the organisation

Participants
ENDESA GENERACION SA
AV DE LA BORBOLLA 5
41004 SEVILLA
Spain
See on map

Activity type: Private for-profit entities (excluding Higher or Secondary Education Establishments)

Administrative contact: Juan Carlos Ballesteros
Tel.: +34 912131221
Fax: +34 912130998
Contact the organisation

FUNDACION CIUDAD DE LA ENERGIA
AVENIDA DEL PRESIDENTE RODRIGUEZ ZAPATERO SN
24492 PONFERRADA
Spain
See on map

Activity type: Research Organisations

Administrative contact: Marta Vivaracho
Tel.: +34 987 456 323
Fax: +34 987 419 570
Contact the organisation
SUMITOMO SHI FW ENERGIA OY  
METSANEIDONKUJA 8  
02131 ESPOO  
Finland  
See on map

**Activity type:** Private for-profit entities (excluding Higher or Secondary Education Establishments)

**Administrative contact:** Arto Hotta  
Tel.: +358103937288  
Fax: +358103937689  
Contact the organisation

EDP - GESTAO DA PRODUCAO DE ENERGIASA  
AVENIDA 24 DE JULHO N 12  
1249 300 LISBON  
Portugal  
See on map

**Activity type:** Private for-profit entities (excluding Higher or Secondary Education Establishments)

**Administrative contact:** José Manuel Moreira Ascensão  
Tel.: +351220012348  
Fax: +351220012236  
Contact the organisation

Tauron Wytwarzanie S.A. Oddzial Elektrownia Lagisza  
Lwowska  
Katowice  
Poland  
See on map

**Administrative contact:** Szymon Jagodzik  
Tel.: +48327742960  
Fax: +48327742987  
Contact the organisation

PRAXAIR NV  
METROPOOLSTRAAT  
SCHOTEN  
Belgium  
See on map

**Administrative contact:** Frederic Bonte  
Tel.: +32 14 250 476  
Fax: +32 14 250 475  
Contact the organisation
ADAPTIVE PREDICTIVE EXPERT CONTROL ADEX SL
Plaza Valle de la Jarosa 77
28035 MADRID
Spain
See on map

Activity type: Private for-profit entities (excluding Higher or Secondary Education Establishments)

Administrative contact: Kenneth Slaven
Tel.: +34 913327792
Fax: +34 913053184
Contact the organisation

UNIVERSIDAD DE ZARAGOZA
CALLE PEDRO CERBUNA 12
50009 ZARAGOZA
Spain
See on map

Activity type: Higher or Secondary Education Establishments

Administrative contact: Oscar Lopez
Tel.: +34976761000
Fax: +34976761048
Contact the organisation

LAPPEENRANNAN-LAHDEN TEKNILLINEN YLIOPISTO LUT
SKINNARILANKATU 34
53850 LAPPEENRANTA
Finland
See on map

Activity type: Higher or Secondary Education Establishments

Administrative contact: Timo Hyppänen
Tel.: +358 40 580 3180
Fax: +358 5 621 6399
Contact the organisation

POLITECHNIKA CZESTOCHOWSKA
UL. DABROWSKIEGO 69
42 201 CZESTOCHOWA
Poland
See on map

Activity type: Higher or Secondary Education Establishments

Administrative contact: Katarzyna Malmur
Tel.: +48 600385483
Fax: +48 34 3250933
Contact the organisation
FOSTER WHEELER ENERGIA SL
GABRIEL GARCIA MARQUEZ 2
28232 LAS ROZAS DE MADRID
Spain

Activity type: Private for-profit entities (excluding Higher or Secondary Education Establishments)

Administrative contact: Jon López Díaz
Tel.: +34 913362845
Fax: +34 913362965
Contact the organisation

"ASOCIACION DE LA INVESTIGACION Y COOPERACION INDUSTRIAL DE ANDALUCIA ""F. DE PAULA ROJAS""
CAMINO DE LOS DESCUBRIMIENTOS S/N ESCUELA SUPERIOR DE INGENI
41092 SEVILLA
Spain

Activity type: Research Organisations

Administrative contact: Carlos Bordons
Tel.: +34954461718
Fax: +34954461775
Contact the organisation

Last updated on 2019-07-16
Retrieved on 2019-08-28

Permalink: https://cordis.europa.eu/project/rcn/94480_en.html
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