

CIUDEN Development Centre on Oxycombustion Technologies

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Introduction

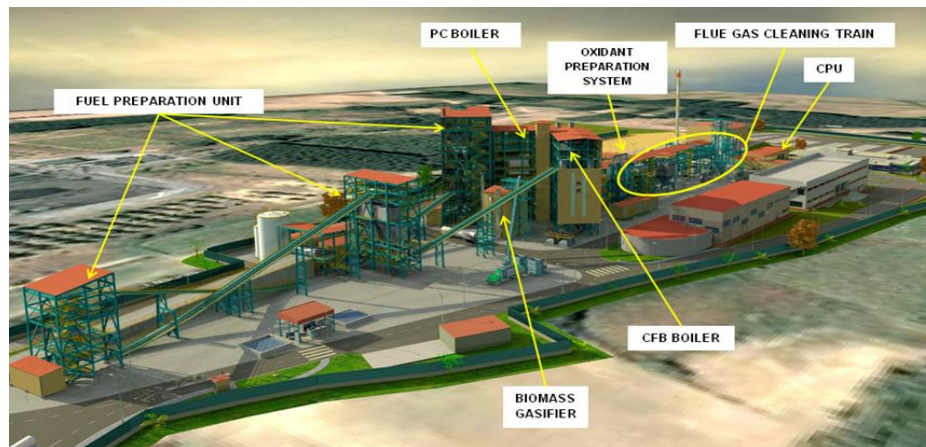
CIUDEN is a non-profit organization created by the Spanish Government in 2006, conceived to promote economic and social development in Spain by carrying out projects and activities related to energy and environment. CIUDEN has a complete program focused on the development of CCT and CCS, including the construction and operation of various facilities.

This paper includes the description of CIUDEN's Development Centre for CO₂ Capture Technologies. This is the only installation in the world with two large pilot boilers capable of burning a wide range of coals, biomass and pet coke under conventional combustion and oxycombustion conditions. The hot commissioning of some of the units of the Centre started in the first quarter 2011.

Technical description of the combustion island and preliminary results are presented in this paper.

CIUDEN Development Centre for CO₂ Capture Technologies

This Centre includes a fuel preparation unit, a 20 MW_{th} Pulverized Coal boiler (PC), a 30 MW_{th} Circulating Fluidized Bed boiler (CFB), a 3 MW_{th} biomass gasifier, a flue gas cleaning train, a CO₂ processing unit and a CO₂ transport rig.



1. CIUDEN PC boiler is a 20MW_{th} unit designed to applied clean coal technologies for different types of fuels (anthracite, bituminous, sub-bituminous, pet coke/anthracite mixture). The boiler allows the operation under both conventional mode (air as oxidant) and oxy combustion mode. The boiler is also designed to operate up to 25% of its thermal power provided by biomass.

The PC boiler is a vertical membrane water-tube type with square (4.5x4.5 m) cross section furnace, natural circulation and balanced draft by forced and induced draft fans. The main design parameters of the experimental PC boiler are the following:

Design fuel:	El Bierzo Anthracite	Steam pressure:	30 bar
Steam flow:	20 – 30 t/h	Steam temperature:	420 °C
Feed water temperature:	170 °C	Combustion air/oxidant temp:	80 °C - 350 °C

The in-furnace gas temperature is controlled depending on the type of coal/oxidant and the type of burner. This is achieved by using removable refractory bricks in the lower combustion zone of the furnace.

2. CIUDEN 30 MWth CFB boiler is a natural circulation, balanced draft, circulating fluidized bed boiler, designed to operate either under air or a mixture of Flue Gas Recirculated (FGR) and oxygen as oxidant. The mayor components of the boiler are combustion chamber, solids separator, loop seal and INTREX™ superheater located in a separate fluidized bed chamber.

Main features of the CFB boiler are included in the table below:

Furnace dimensions (m):	20x2.8x1.65	Maximum steam flow:	47.5 t/h
Superheated steam temperature:	250 °C	Superheated steam pressure:	30 bar
Feed water temperature:	170 °C	Outlet boiler flue gases temp:	350-425 °C
Max Thermal power: 15 MWth conventional (air) mode, 30 MWth oxycombustion mode			

Foster Wheeler is the technological provider of the Flexi-Burn® Circulating Fluidized Bed unit in CIUDEN's Centre. Commissioning of the CFB boiler is intended for July 2011.

Results are expected to significantly contribute to demonstrate the feasibility of the oxycombustion technology, particularly valuable as technical support for the OXYCFB300 Compostilla Project which aims to validate this technology at demo scale.

3. Oxidant Preparation System. Oxidant streams required for oxycombustion are prepared by mixing oxygen and FGR in order to control the combustion temperature. A variety of formulations for the oxidant streams are considered in test plans.

In order to reach partial or total oxycombustion conditions in the boiler, flue gases are recirculated and mixed with oxygen. There are two recirculation streams: FGR1 taken downstream from the desulphurisation unit, and FGR2 taken upstream from the desulphurisation unit.

4. Flue gas cleaning train comprised by: Cyclone System, Selective Catalytic Reduction (SCR) unit, bag filter, and wet Flue Gas Desulfurization (FGD).

5. CO₂ Processing Unit, designed in order to obtain a scaled-up unit where CO₂ is generated under proper conditions to be eventually transported and stored. Heavy metals, such as mercury, and acid contaminants are to be removed.

6. Biomass Gasifier, consisting on a 3 MWth bubbling fluidized bed gasifier for testing innovating ways of using sustainable biomass.