Oxyfuel Capture in 30 MW_{th} CFB Boiler

Challenges & lessons learned

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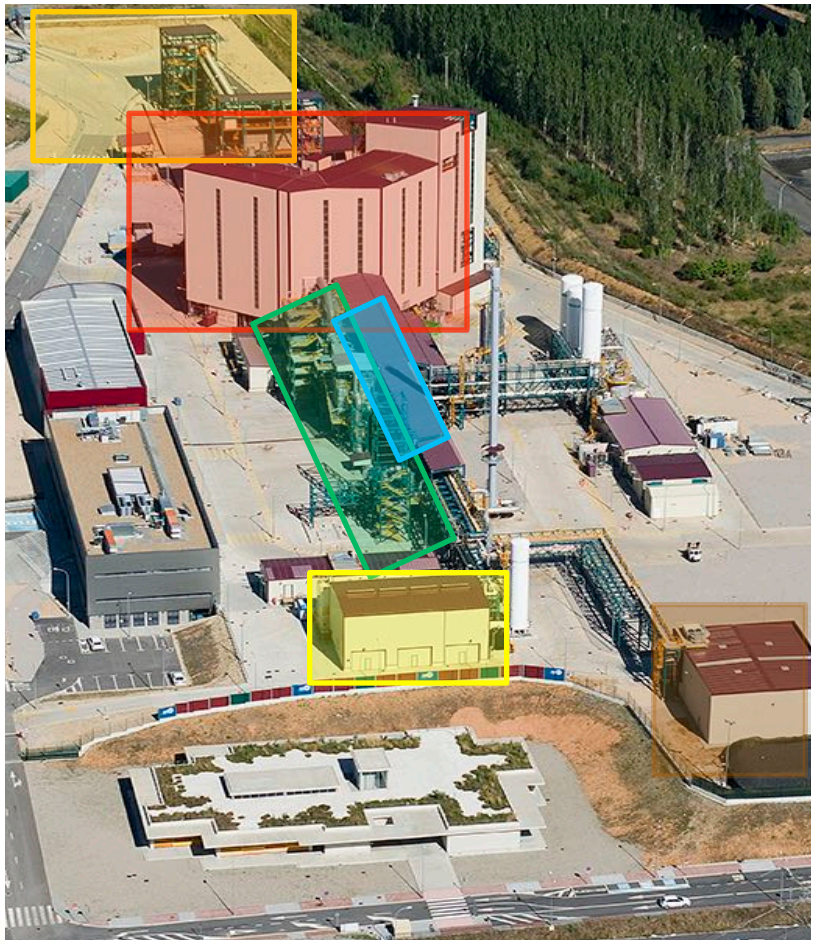
Lay out



Fuel Preparation system

Combustion island / gasifier

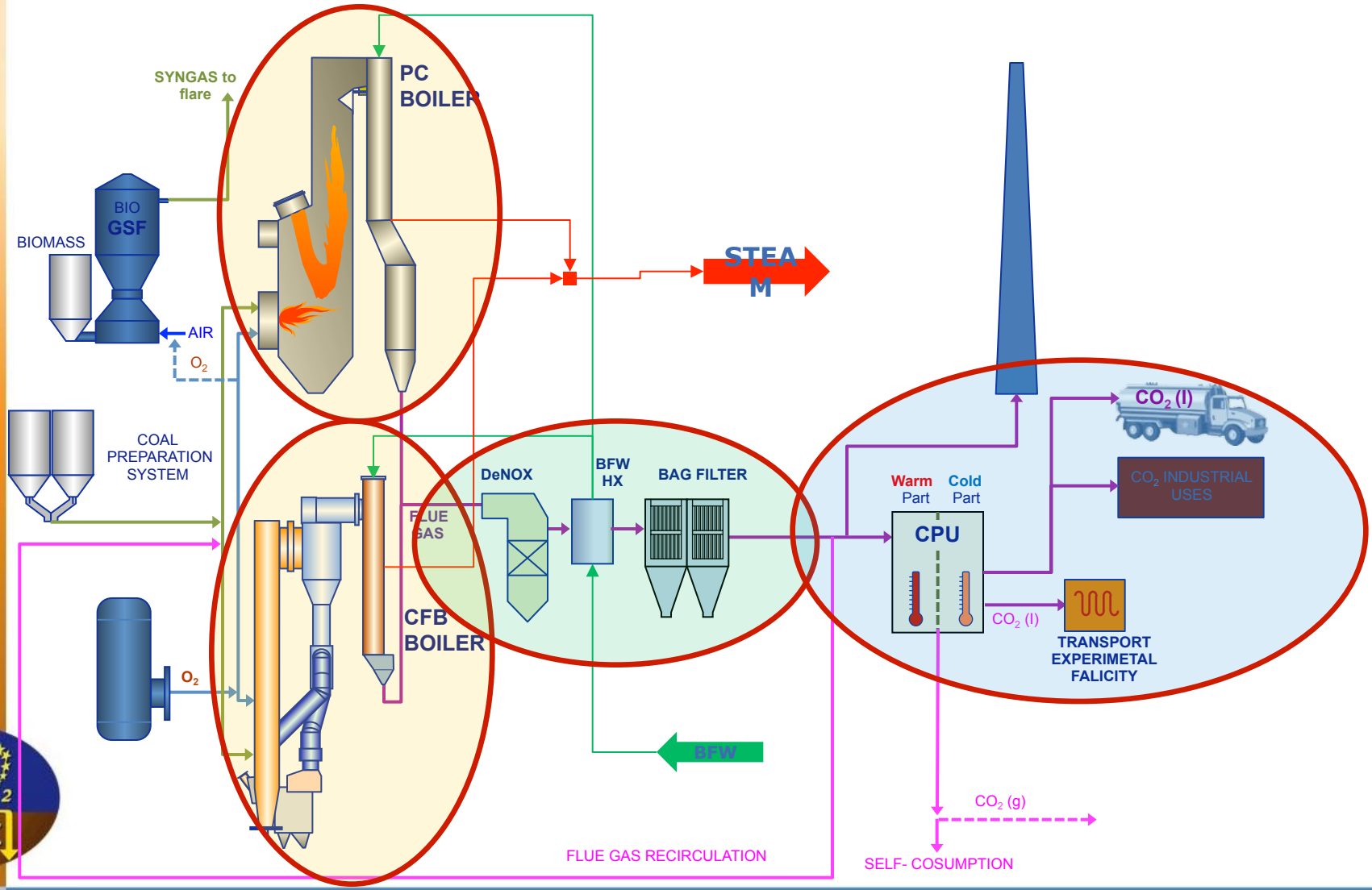
Depu train

Oxid prep

CPU

Transport rig

Schematic PFD



Fuel preparation system

- **Different fuels**
- Crusher 15 t/h
- Mill 5 t/h

PC boiler

- **20MW$_{th}$**; 3.4 t/h pulverised coal
- 4 burners

CFB boiler

- **30MW$_{th}$**; 5. 5 t/h crushed coal
- DeNO$_x$ and DeSO$_x$ in bed

BFB gasifier

- **3MW$_{th}$**
- Bubbling fluidised bed
- 15 t/d biomass

Flue gas cleaning system

- Cyclon
- DeNO$_x$ (SCR)
- Design flow rate: 23.215 Nm^3/h

Compression & Purification Unit (CPU)

- Inlet flow rate: 4500 Nm^3/h
- CO_2 captured: 11 t/d
- Purity of CO_2: > 99% v

Transport experimental facility

- 3000 meters piping length
- 2” pipe diameter
- Operating pressure 80 to 110 bar
- Operating temperature 10°C to 31°C

Rear-view-mirror

- **OXY-CFB** technology **validation** with different fuels
- **More than 3.500 h of operation**
- Load **follow-up capabilities** (CFB & CPU)
- Boiler **repowered** in **oxy-mode** (from 16 MWth to 30 MWth)

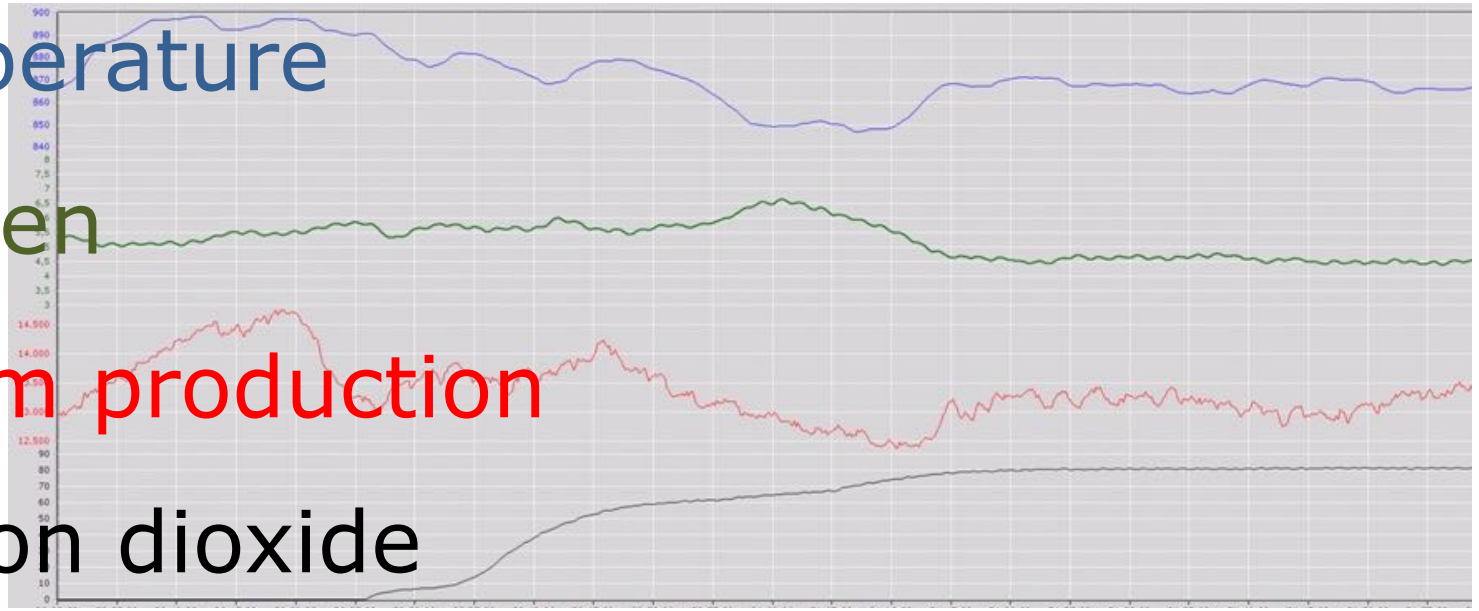
Air-Oxy transitions

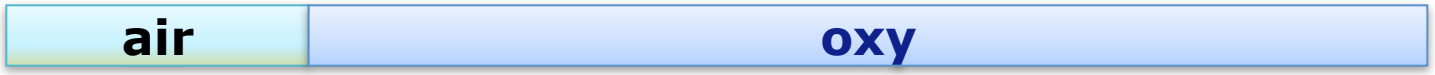
temperature

oxygen

steam production

carbon dioxide

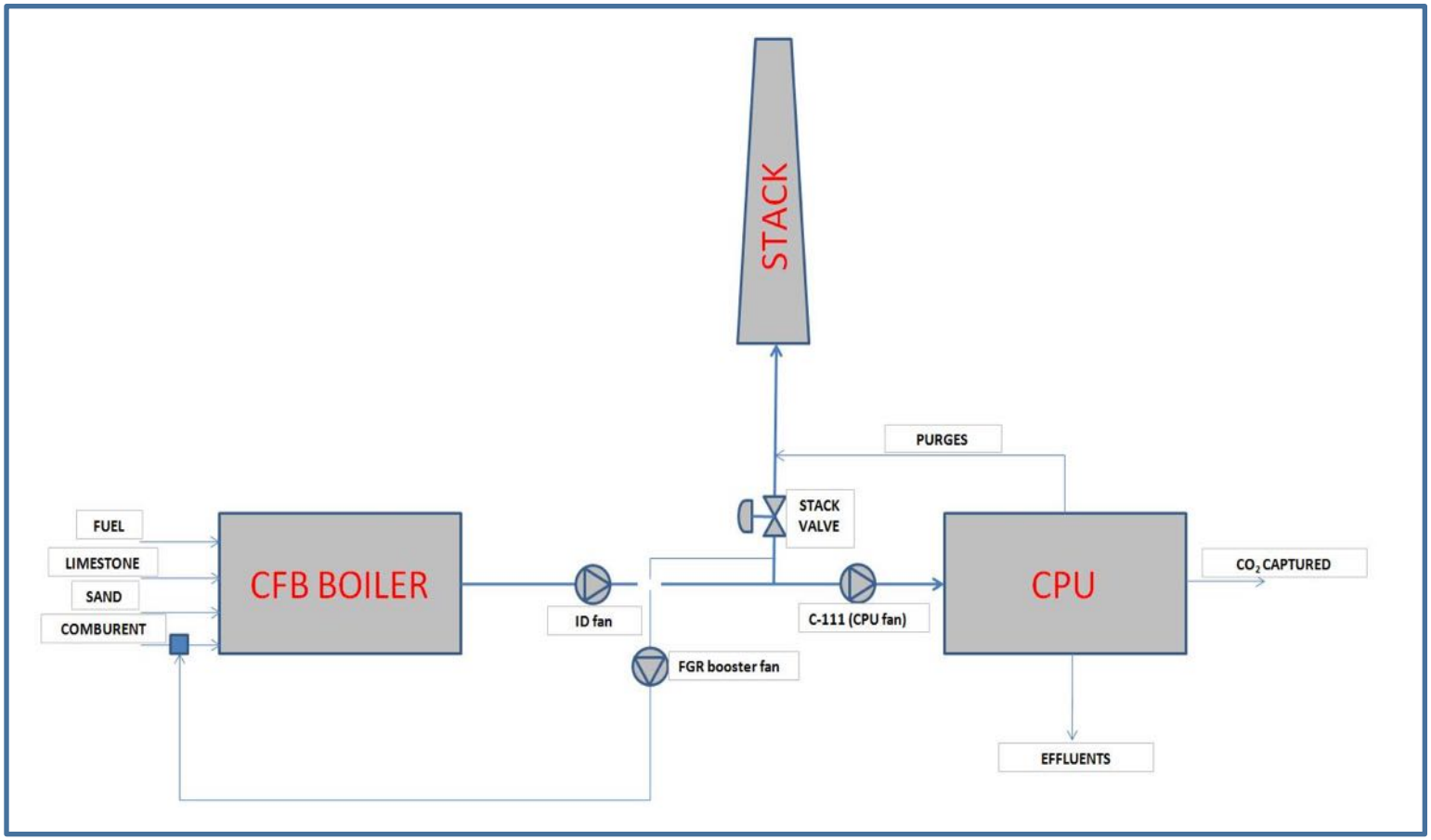




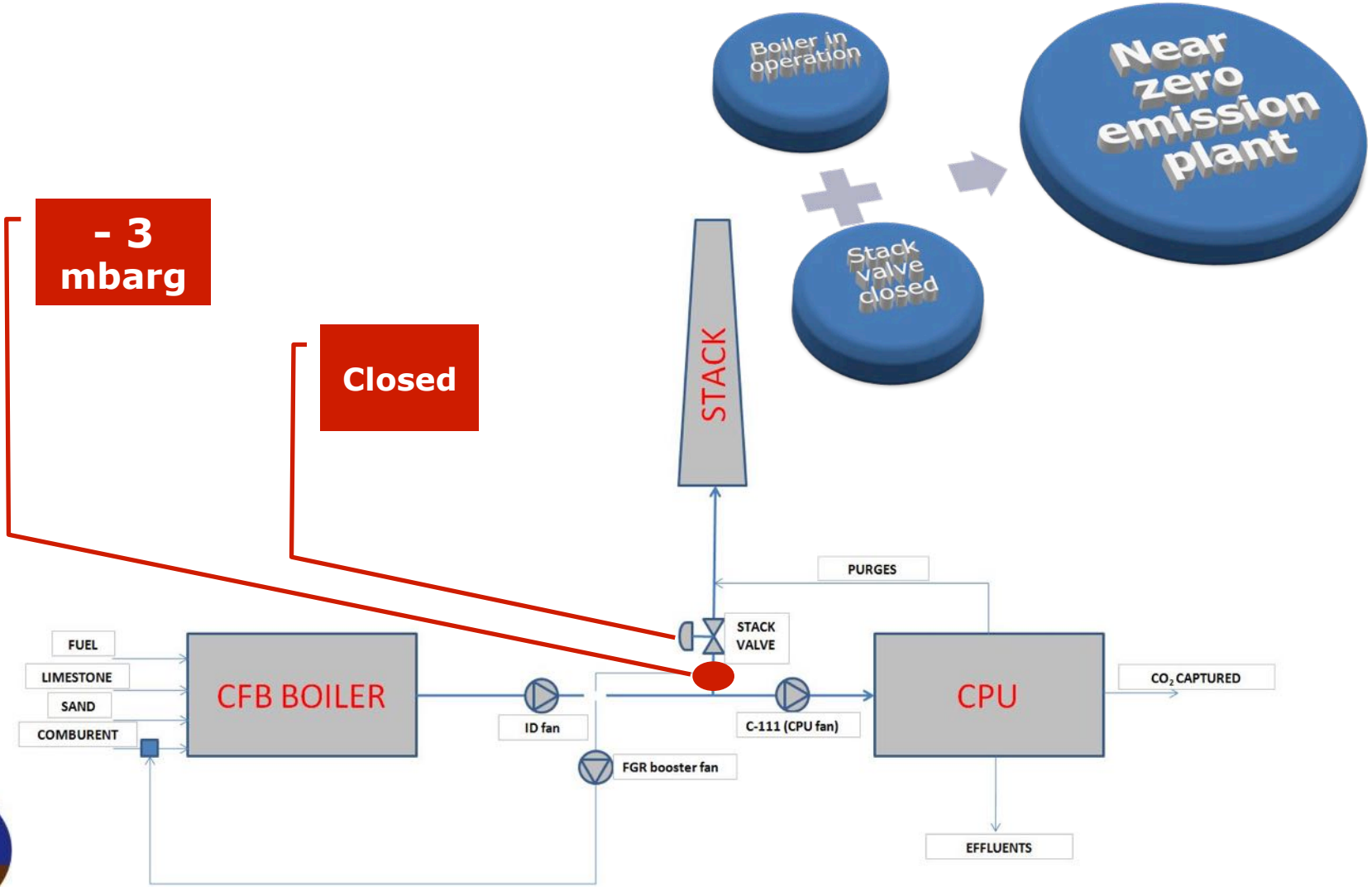
Operation aspects

CHALLENGES - IMPACTS OBSERVED		
Infiltrations	O_2 concentration - Increases CO_2 concentration - Decreases	• A loss of capture efficiency (N_2 concentration increases)
Leakages	External Acidic condensations - depositions	• Damages in the installation • Health and Safety issues
Temperature losses	Acidic condensations Corrosion	• Blockages in solids transport lines • Damages in the installations

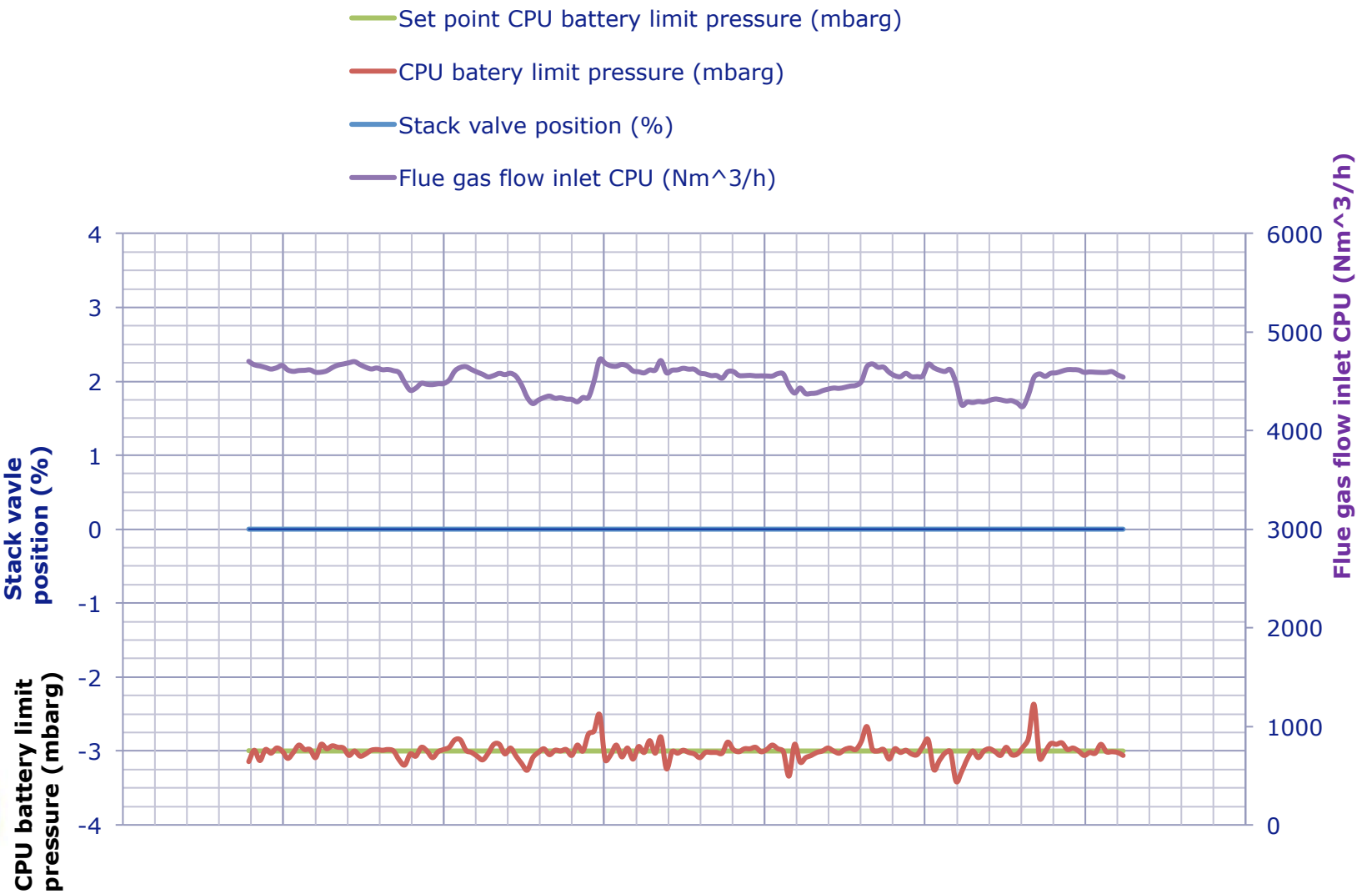
The concept of CFB/CPU integration



Case study (i)


Boiler in operation
Stack valve closed
Near zero emission plant
- 3 mbarg
Closed
STACK
PURGES
STACK VALVE
FUEL
LIMESTONE
SAND
COMBURENT
CFB BOILER
ID fan
FGR booster fan
C-111 (CPU fan)
CPU
CO_2 CAPTURED
EFFLUENTS

Case study (ii)



Comparison between the 1st and 2nd generation performance

Parameter	Effect
General conclusion	~=
Thermal power & furnace heat duty	~2x
Heat duty on back pass	~=
Bottom ash share	↓
Pressure drop in upper furnace (i.e. solids loading)	↑
Temperature profile	=
Combustion efficiency	=
SO_2 emission / capture	~↑ / ~↓
NO_x, N_2O and CO emissions	~=

THANK YOU VERY MUCH FOR YOUR ATTENTION

For further information, please contact
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