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Technical Assistance for Better Air Quality by Transposing the Large Combustion Plants Directive (TR2010/0327.04-01/001)

EuralEnergy
New cogeneration plant
Design Experience

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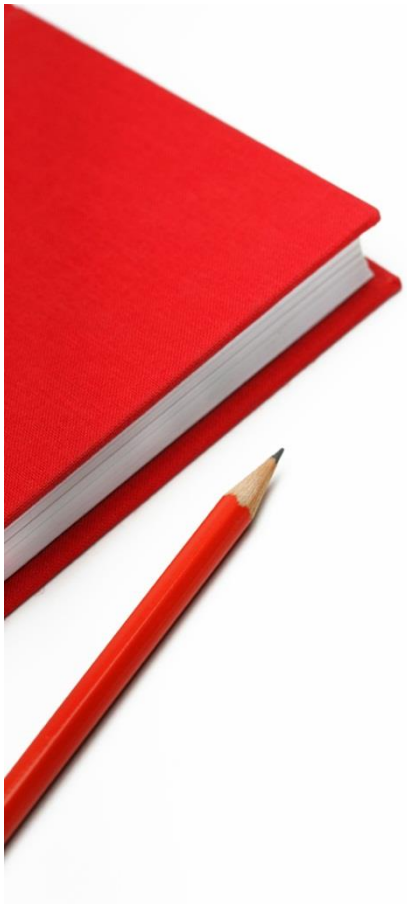
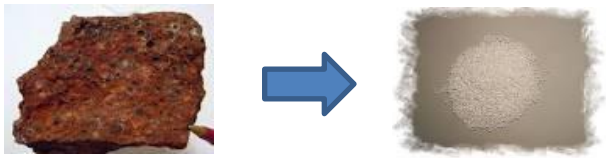
Agenda

- Introduction
- Scope of AmecFW work
- Feasibility Study – Technical features
- Basic Design – Technical features
- Evolution of the Emission Regulation
- Impact of new Emission Limits on the Technical Design of the Plant
- Comparison Summary between the existing Oil boilers and the new CFB
- Economic Estimate and Schedule



Introduction

- Eurallumina:
  - Company producing alumina (approx. 3,200 t/day) from bauxite
    - Recently acquired by RUSAL



  - Alumina production is an energy intensive process, requiring:
    - 280 t/h steam, originally produced by Oil Boilers
    - 30 MWe electric power, originally imported from the grid
  - Plant shut down in 2009. Necessary actions to restart operations are aimed at:
    - Reducing energy costs
    - Guaranteeing feedstock supply at low price
    - Introducing new technologies
- EuralEnergy (created in 2013):
  - New Cogeneration Plant supplying steam and power to Eurallumina plant

Introduction

- EuralEnergy New Cogeneration Plant

New coal **CFB boiler** + New backpressure **steam turbine** + Existing oil boilers (emergency only)

Stable coal supply from nearby Enel plant

- **Steam** to Eurallumina
- **Power** to Eurallumina
- **Excess power** exported to grid

- Benefits:
  - ✓ Energy production at competitive price
  - ✓ Reduction of pollutant emissions
  - ✓ Employment increase in the region

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Plot area

No additional plot area required for coal storage

Scope of work (AmecFW)

- Feasibility study (Power Division)
  - Technology comparison (CFB vs PC boiler)
  - Steam cycle and steam turbine configuration definition
  - Cost Estimate ± 30%
- Basic Design (Power Division)
  - Technical documentation preparation
  - Duty Specification for quotation (main equipment) to support a ± 15% estimate
  - Support to EuralEnergy (techno-economic data) to ask for a soft loan financing scheme
- Support for permitting (Environmental Division)
  - Plant construction: Environmental Impact Assessment (including final project design, pollutants dispersion, noise and landscape conservation studies)
  - Plant operation: Environmental authorizations (AIA)

Technical features – Feasibility Study

- The techno-economic analysis proved that the CFB boiler is preferred to the PC.

	PC	CFB	Δ (PC-CFB)
CAPEX (M€)	103.3	95.3	+8.0
OPEX (M€/y)			-0.7

The extra capital expenditure has a Pay-back time of 11 years (too high to select the PC boiler)

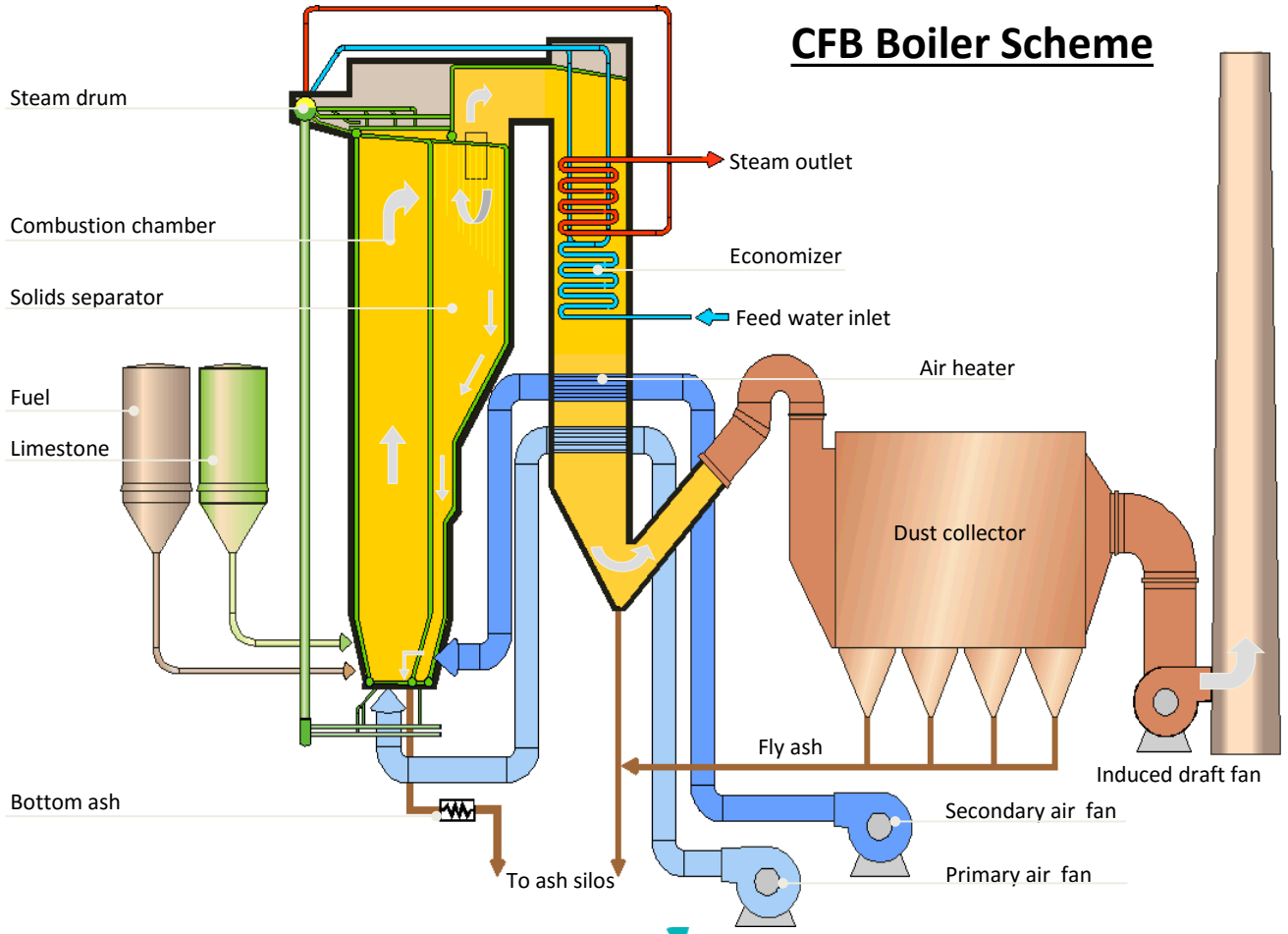
- Steam cycle configuration

EuralEnergy selected a simple steam cycle configuration, excluding more efficient and expensive solutions (e.g. higher Steam Turbine admission pressure) aimed at:

- Minimizing CAPEX
- Optimizing EE export to the grid

Technical features – Basic Design

CFB Boiler Scheme



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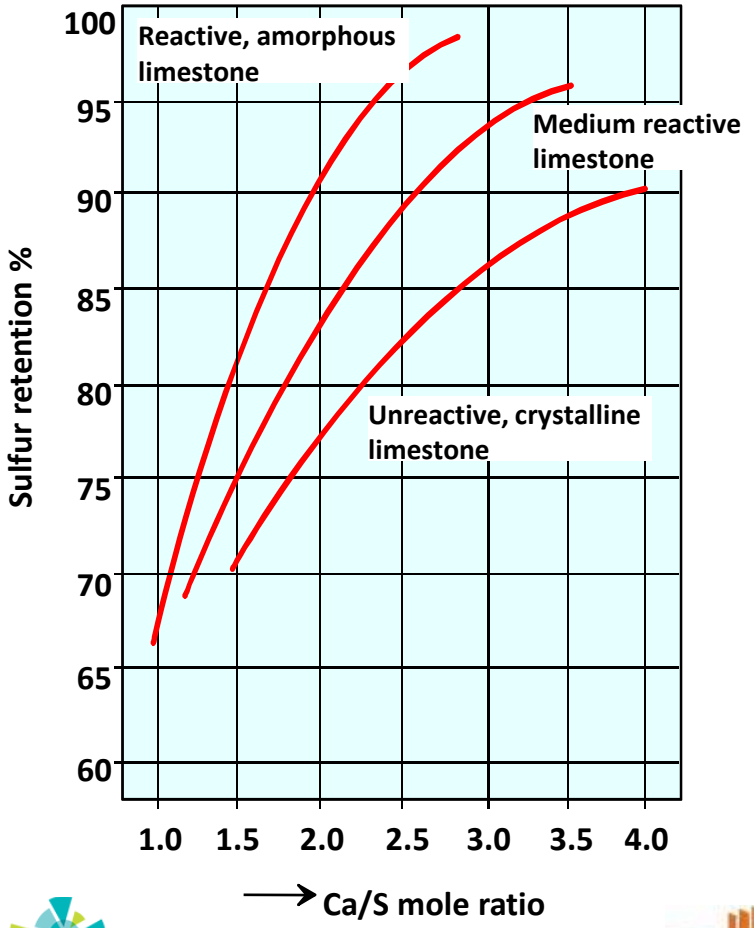
Technical features – Basic Design

Sulfur Retention vs. Ca/S Mole Ratio

For example only – Not a design guideline



Evolution of the emissions regulation

- Emission limits for the main pollutants from coal-fired boiler in new plants:

	DM 12/7/1990	Dlgs 152/06	EU 2010/75	Dlgs 46/14
SOx	1700	200	200	**100**
NOx	650	200	200	**100**
Particulate (PM)	50	30	20	**20**

Emissions in mg/Nm^3, dry @ 6% O2

Plant Basic Design

- The gaseous emission limits require the adoption of advanced technologies, with high removal efficiency of SOx, NOx, Particulate.
- The plant shall be designed and realized considering the new emission limits set by the Dlgs 46/14 .

Impact of the new emission limits

- The Basic Design has been developed in collaboration with AmecFW GPG, targeted to the current emission limit regulations (March 2014):
  - SOx: 200 mg/Nm3, dry @ 6% O2 → Fluid Bed, with Ca/S ratio = 3.5
  - NOx: 200 mg/Nm3, dry @ 6% O2 → SNCR (TBC)
  - Particulate: 20 mg/Nm3, dry @ 6% O2 → Bagfilter
  - Ammonia slip: 5 mg/Nm3 (BAT for SNCR applications)

- Two possible CFB configurations:
  - 2 passes
  - 3 passes with ammonia killer catalyst

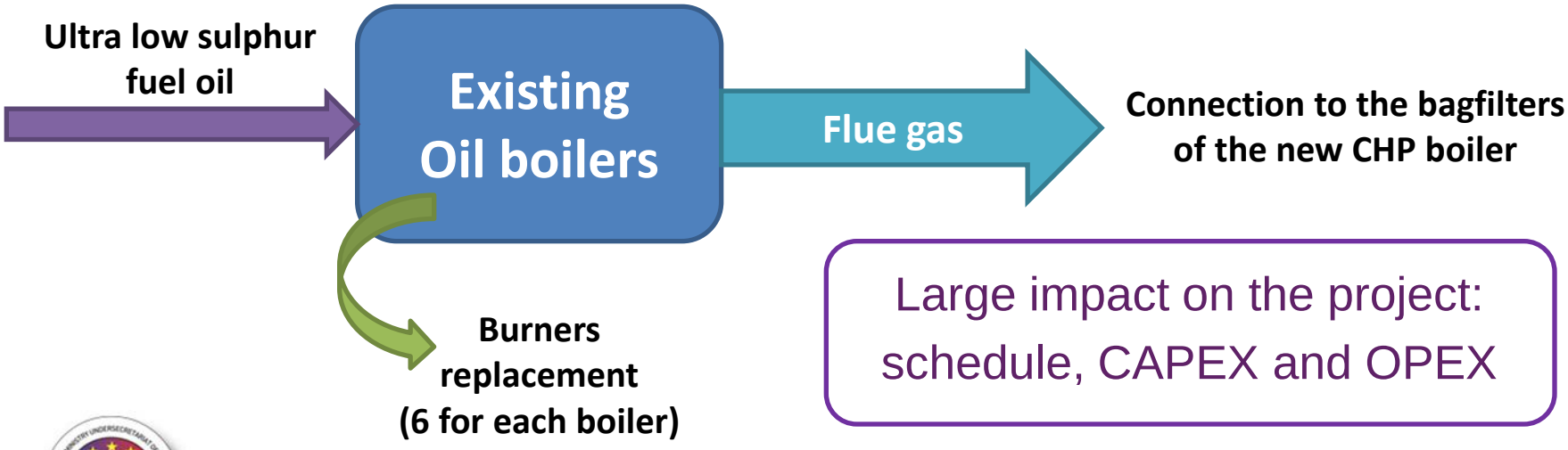
Impact of the new emission limits

- Dlgs 46/2014 (in force from 11° April), receiving EU Directive 2010/75/UE
- Impacts on the CFB boiler of the new cogeneration plant

- SOx: **100 mg/Nm3**, dry @ 6% O2 →
  - Still possible in the Fluid Bed with a Ca/S ratio >= 4 .
  - A combined capture (CFB + dry FGD) may be considered.
- NOx: **100 mg/Nm3**, dry @ 6% O2 →
  - Border-line between SNCR and SCR technology.
  - AmecFW GPG identifies a potential operating issue with SCR (high dust operation).
  - SNCR technology is selected.
  - The 3rd pass on the flue gas path is necessary.

Impact of the new emission limits

- Impacts on the authorization procedures for the existing Oil Boilers (only for emergency operation):
  - SOx: from **1700 mg/Nm3** to **850 mg/Nm3**, dry @ 3% O2
  - NOx: from **650 mg/Nm3** to **450 mg/Nm3**, dry @ 3% O2
  - PM: from **50 mg/Nm3** to **25 mg/Nm3**, dry @ 3% O2



Comparison Summary (Oil vs CFB boilers)

- Technical parameters:

MAXIMUM CAPACITY PARAMETERS	EXISTING OIL BOILERS	NEW CFB BOILER (CHP)
	Ante operam	Post operam
THERMAL POWER (MWth)	240	285
GROSS STEAM PRODUCTION (MM TON/YEAR)	3.2	3.2
GROSS ELECTRIC POWER (MWe)	0	51.5
INTERNAL CONSUMPTION	4.5 (import)	7
EXPORT TO ELECTRIC GRID	--	14
TO EURALLUMINA	--	30
ENERGY EFFICIENCY INDEX	90%	96%
FUEL	OIL	COAL

Comparison Summary (Oil vs CFB boilers)

- Environmental parameters (gaseous pollutants emission):

MAXIMUM CAPACITY PARAMETERS	EXISTING OIL BOILERS	NEW CFB BOILER (CHP)	PERCENT REDUCTION
	Ante operam	Post operam	
SO_2 (TON/YEAR)	3075	320	90%
NO_X (TON/YEAR)	1570	320	80%
PARTICULATE (TON/YEAR)	125	64	49%

Yearly emissions to atmosphere (t/y) in normal operating conditions (8760 hours).

Economic Estimate and Schedule

- **Investment plan for new power station and revamping of existing alumina plant: 185 M€**
- Permitting process under finalization
- Overall project schedule:

- Permitting
- Design
- Construction
- Start-up

36 months

Permit History

2013 - Design activities begin

February 2014. A first release was provided to client.

April 2014: New Decree 46/14

ELV are lower than those in IED Directive

Design activities review.

October 2014 – design final version

March 2015 – permitting procedure (EIA and IPPC) started.


Any
Questions?