

MAC[®] & MAR[®]

Magaldi Ash Cooler & Recycling Systems

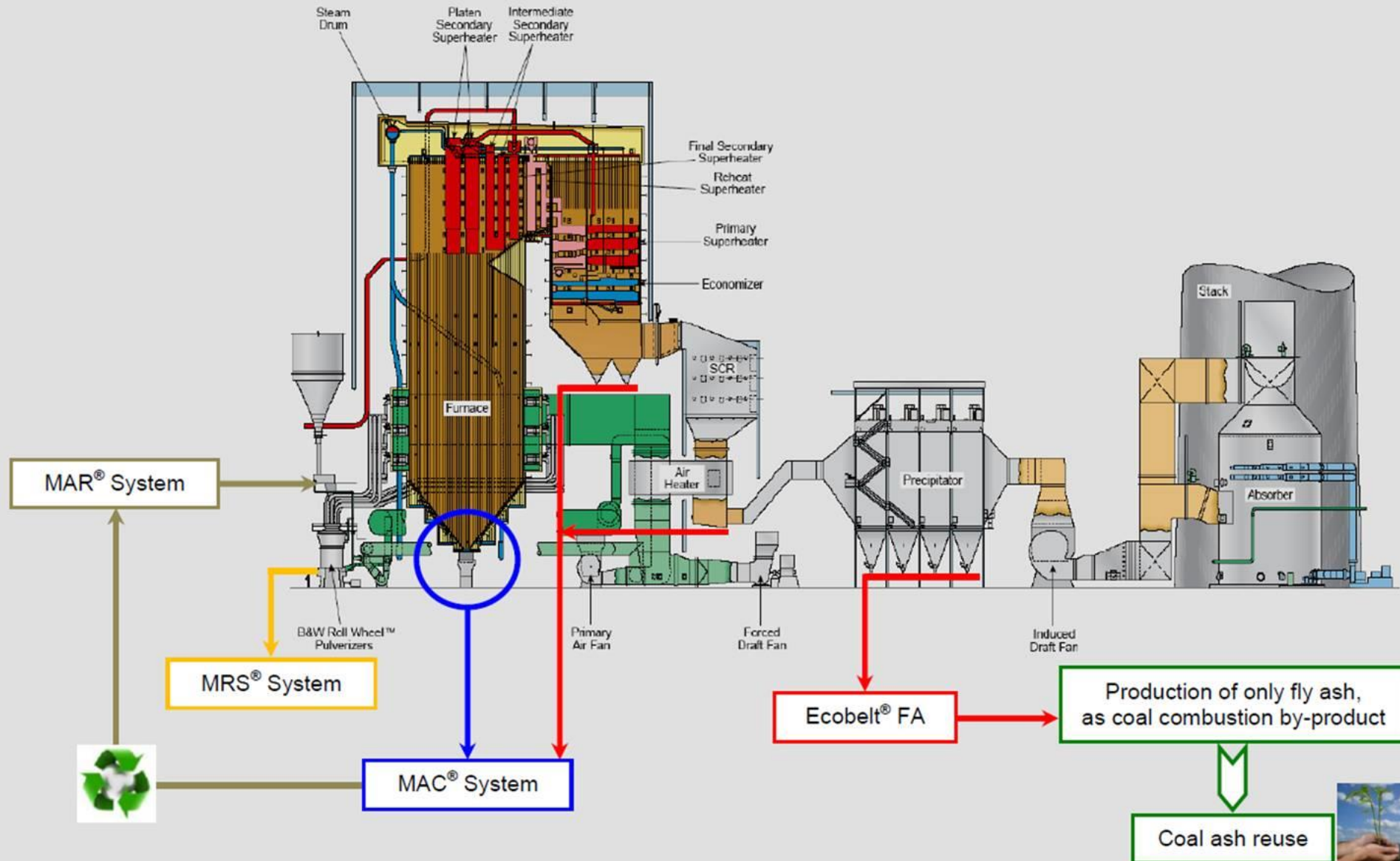


Dry Bottom Ash Extraction and Recycling



Mechanical Handling of Ash

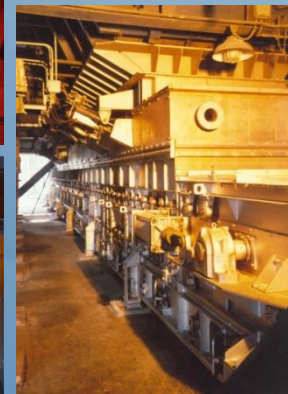
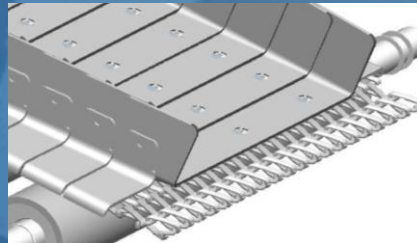
Solutions for Power Plants burning Solid Fuels



MAC[®] System

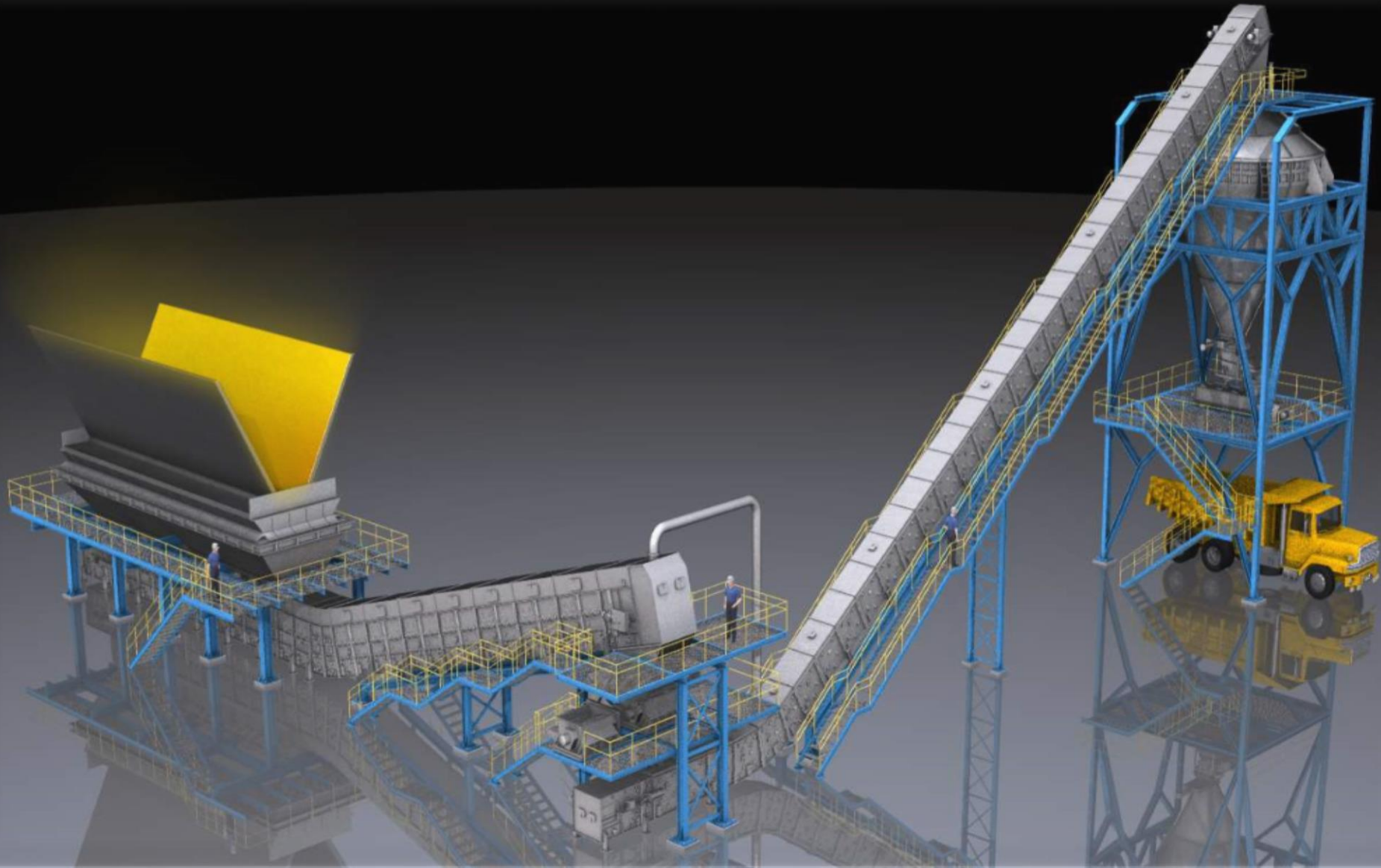
Magaldi Ash Cooler since 1985

The MAC[®] is a system for “dry” extraction, air cooling and mechanical handling of bottom ash from pulverized coal-fired boilers



MAC[®] System

Typical Configuration



MAC[®] System

Main Features

The MAC^β System for a Natural Environment Protection

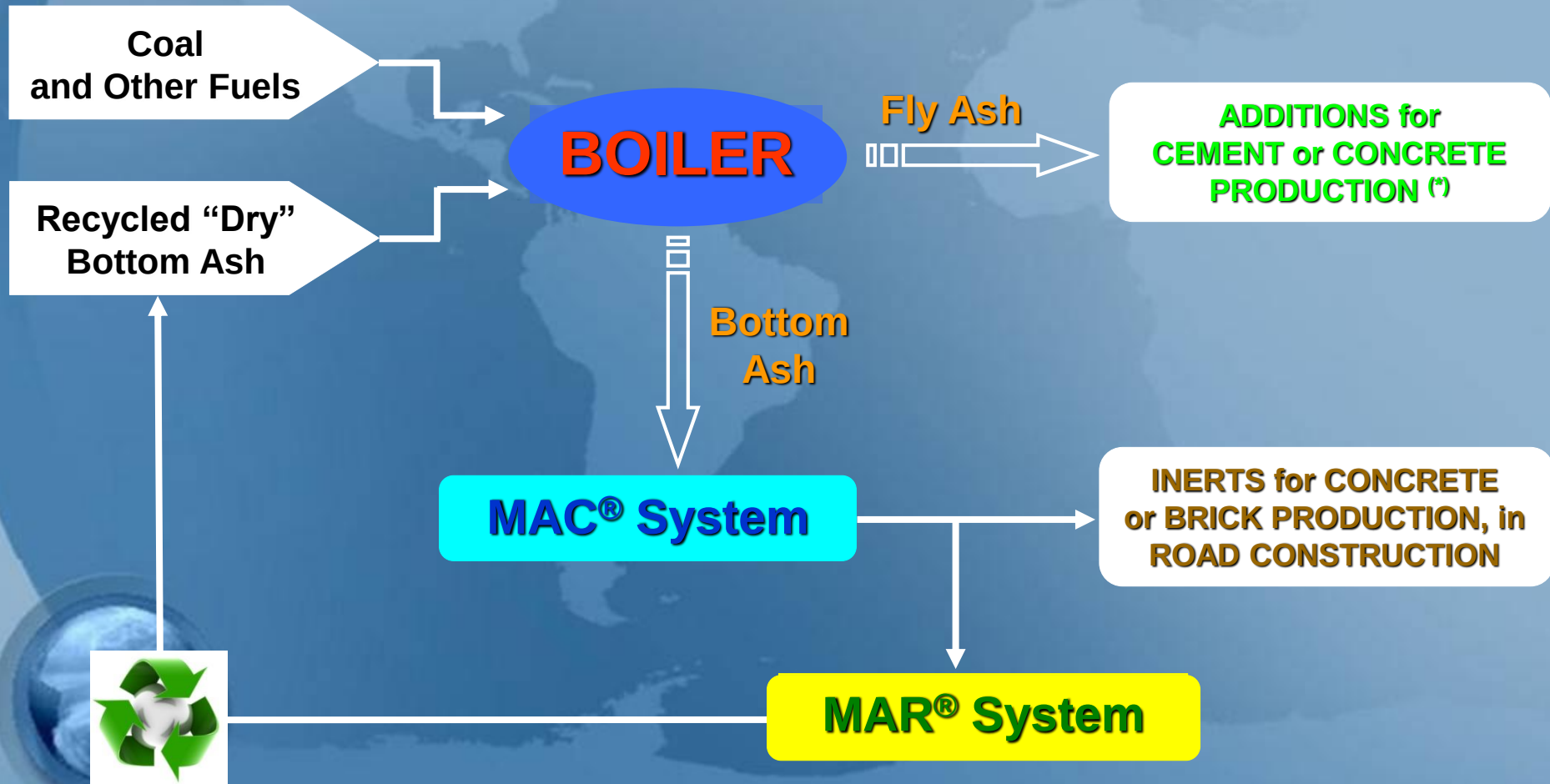
- ☀ Zero water usage. No need for waste water treatment, pumps, piping, dewatering bins. Simplification of bottom ash removal.
- ☀ Damage-tolerant design of conveyors, based on the Magaldi Superbelt[®] technology, ensuring continuous ash removal, low wear, low power demand, long service-life, low O&M costs, safe operation, high system dependability.
- ☀ Boiler efficiency increase, due to recovery of energy from unburned fuel in bottom ash, ash sensible heat and flame radiation through boiler throat. Coal consumption savings and CO₂ emission reduction.
- ☀ Improved quality of bottom ash (dry and low-carbon). Maximum potential for valuable ash marketing.
- ☀ Effective environmental risk mitigation. No need for bottom ash storage ponds.



MAR[®] System

Magaldi Ash Recycling back to Boiler

The MAR^β System is an innovative system to recycle “Dry” Bottom Ash in the combustion chamber of PCF boilers in order to turn it into fly ash.

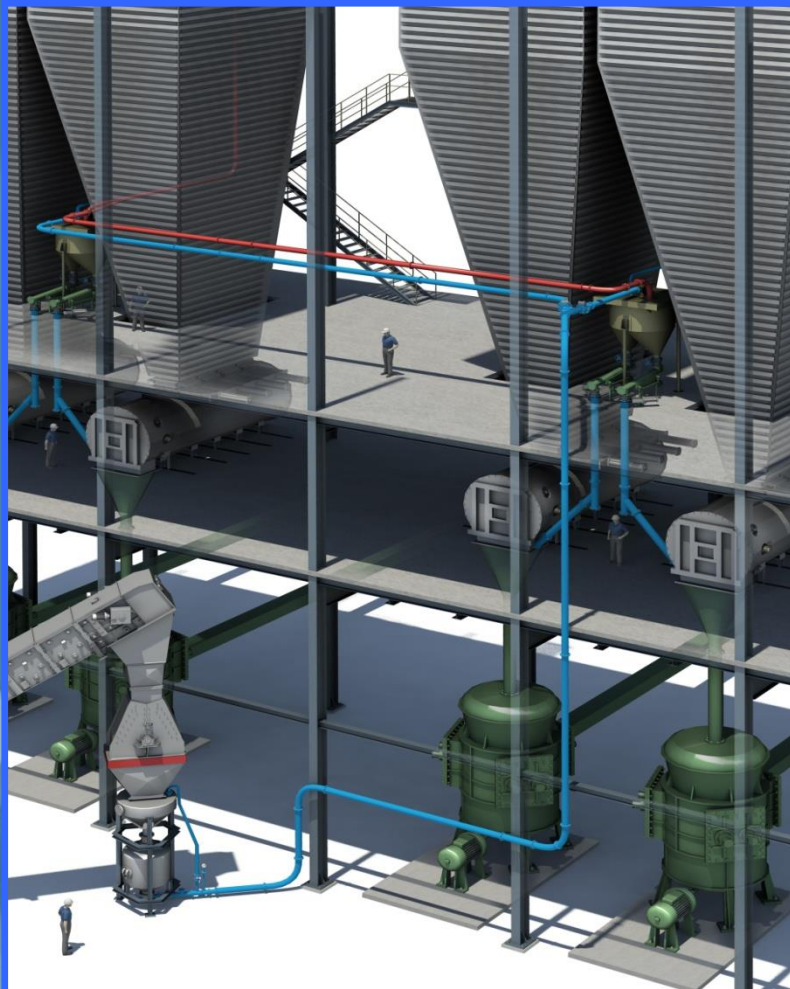


(*) In compliance with EN 197-1:2011 (cement) and EN 450-1:2012 (concrete)

MAR® System

Main Features

The MAR^β System to Turn Bottom Ash into Fly Ash

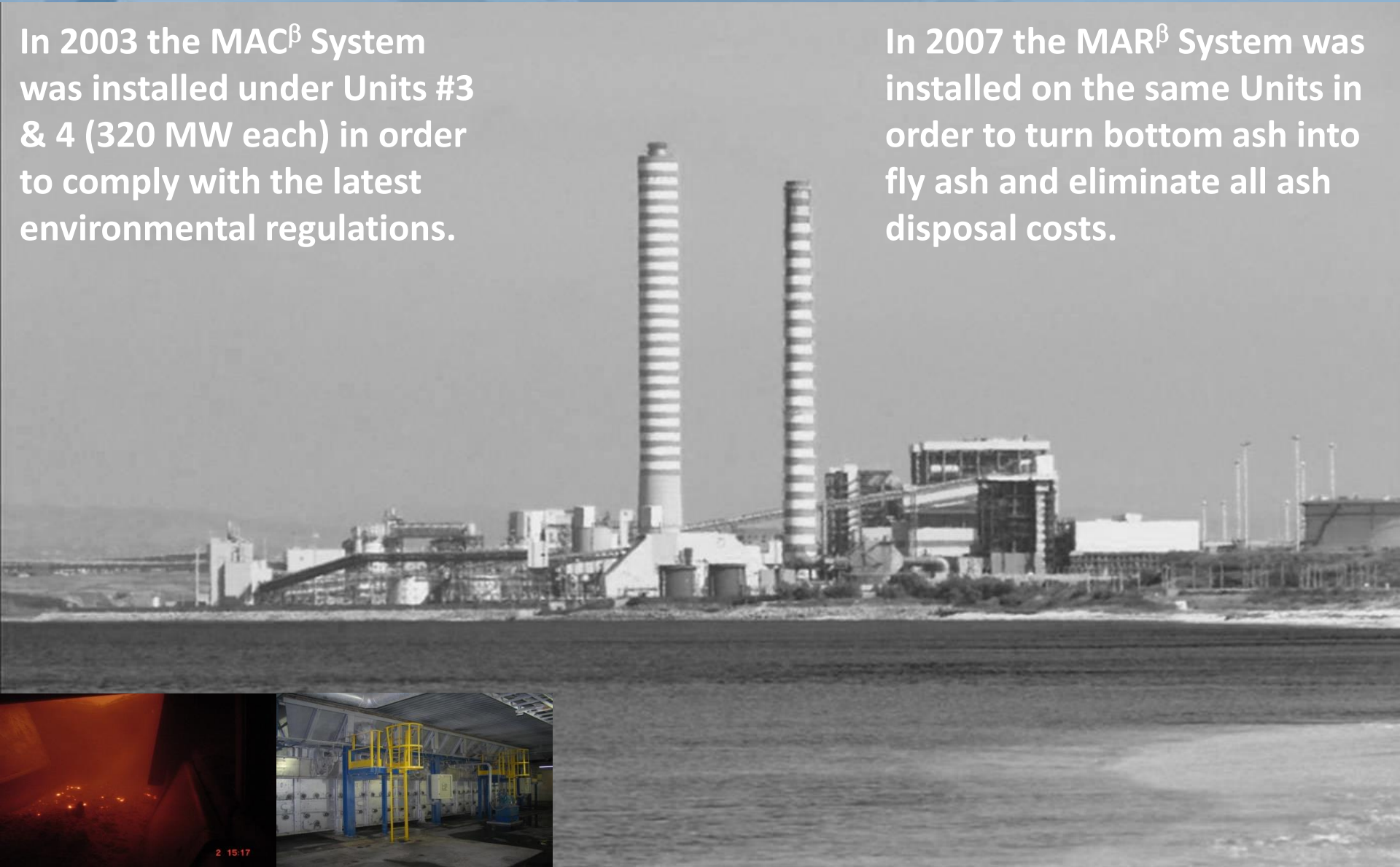


- ☀ Conversion of all bottom ash (waste) into saleable fly ash.
- ☀ Complete elimination of costs associated with bottom ash disposal or dedicated slurry system to a bottom ash pond.
- ☀ LOI content reduction in fly ash due to the dilution effect of dry bottom ash (~8% reduction on average).
- ☀ Fly ash in compliance with international standards: i.e. EN 197-1 (cement) and EN 450-1 (concrete) in the EU.
- ☀ Environment respect: mixing fly ash with cement, CO₂ emissions decrease. Around 0.9 tons of CO₂ are generated from the production of a ton of Portland cement.

Dry Bottom Ash Extraction and Recycling Project Experience

In 2003 the MAC^β System was installed under Units #3 & 4 (320 MW each) in order to comply with the latest environmental regulations.

In 2007 the MAR^β System was installed on the same Units in order to turn bottom ash into fly ash and eliminate all ash disposal costs.



Dry Bottom Ash Extraction and Recycling

Project Experience: Design Data

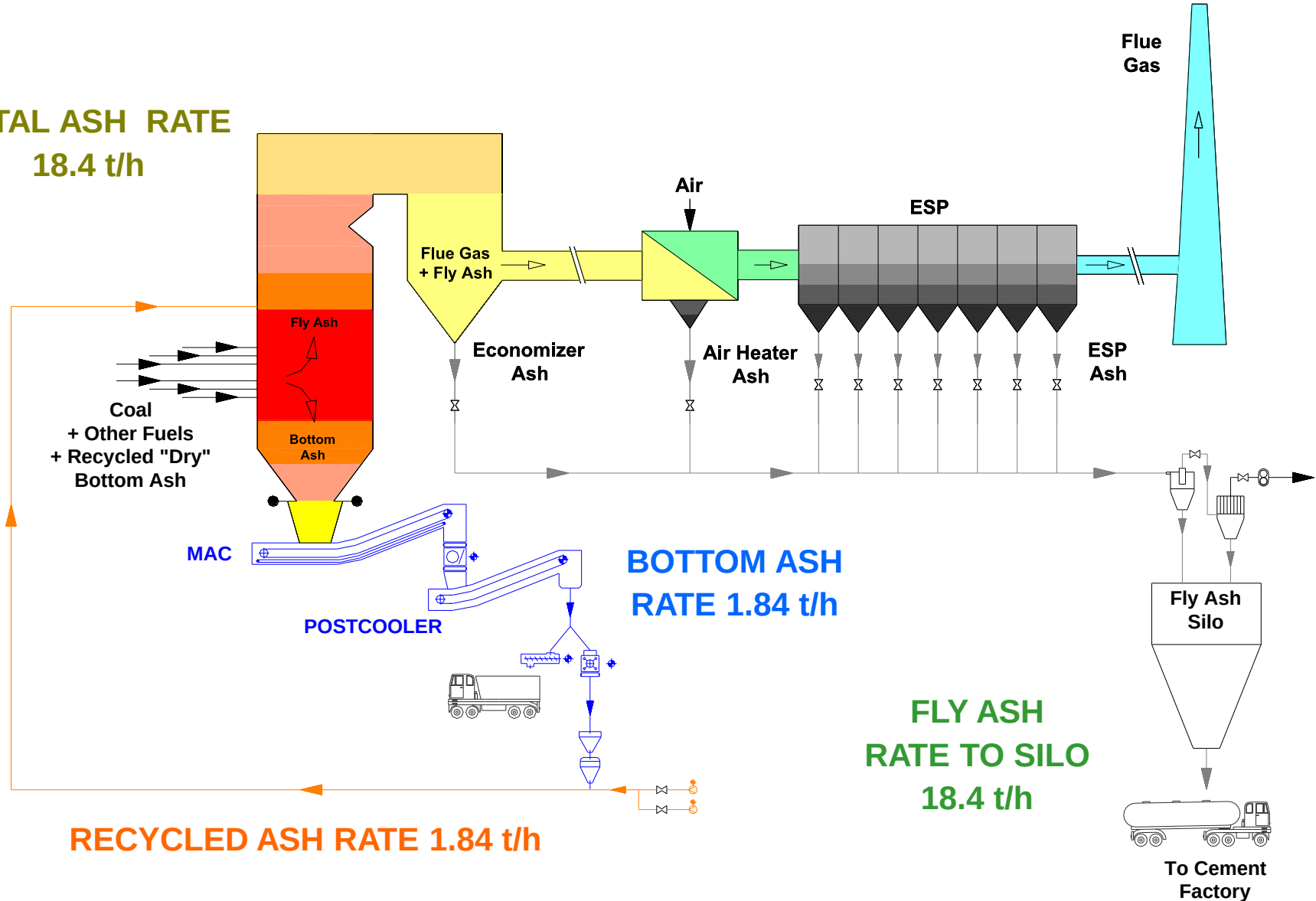
Boiler load	320 MW
Total combustion air	1,200 t/h <i>(approximately)</i>
Fuel characteristics	Imported coal with a high heating value equal to 6,000 kcal/kg and an ash content up to 16%.
Coal rate	115 t/h @BMCR
Total ash production	18.4 t/h <i>(design value)</i>
Bottom ash production	1.84 t/h <i>(normal)</i> 6.0 t/h <i>(during boiler sootblowing)</i>
Type of coal pulverizers	Bowl type - Raymond XRP783
Number of coal pulverizers	6 <i>(1 in stand-by)</i>
Coal rate per pulverizer	23 t/h <i>(normal)</i> 32 t/h <i>(max)</i>
Number of coal pulverizers for bottom ash recycling	4
Bottom ash rate per pulverizer	0.46 t/h
Pulverizer rate increase	2.0% approx.



Dry Bottom Ash Extraction and Recycling

Project Experience: Ash Mass Balance

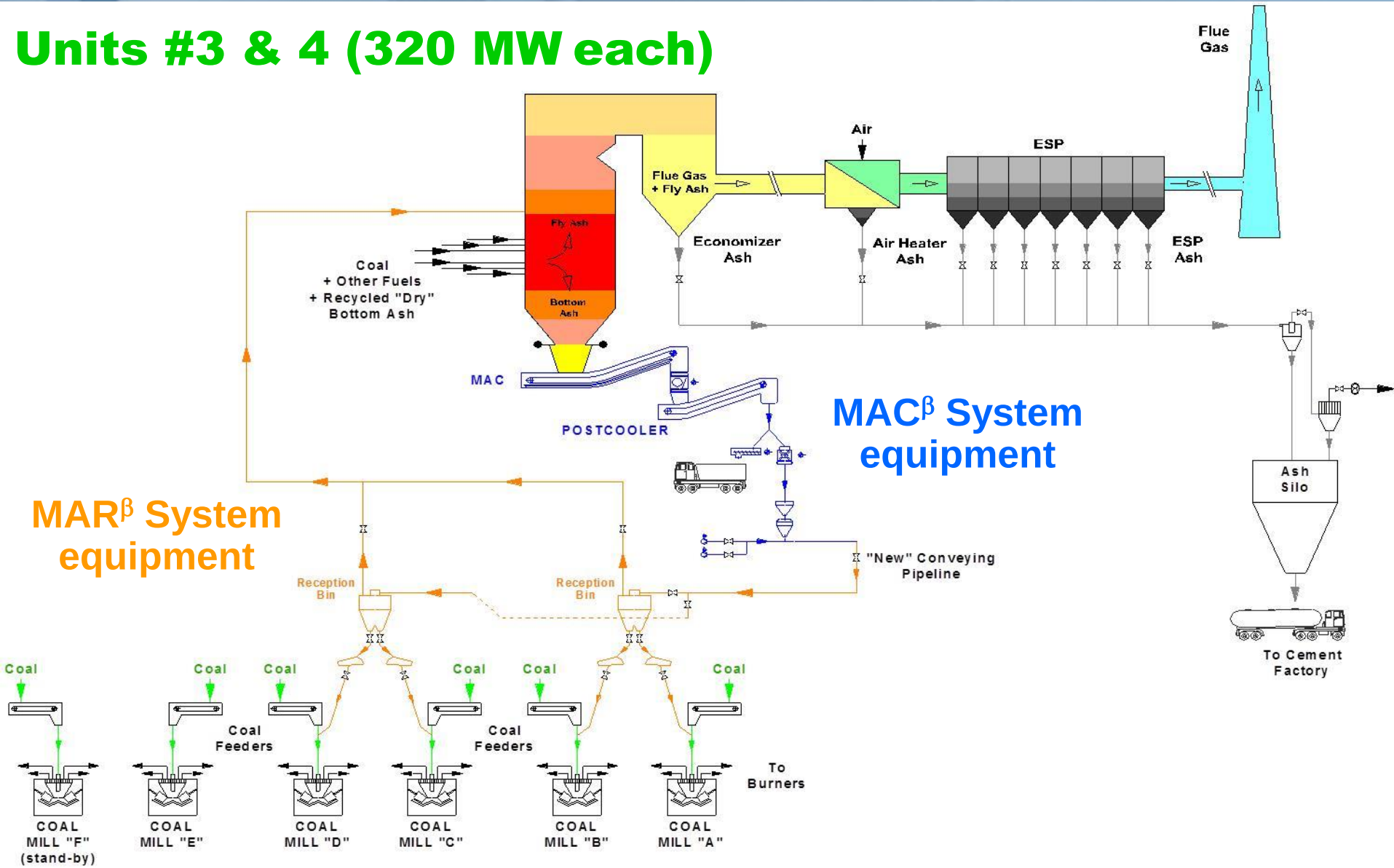
TOTAL ASH RATE
18.4 t/h



Dry Bottom Ash Extraction and Recycling

Project Experience: Flow-diagram

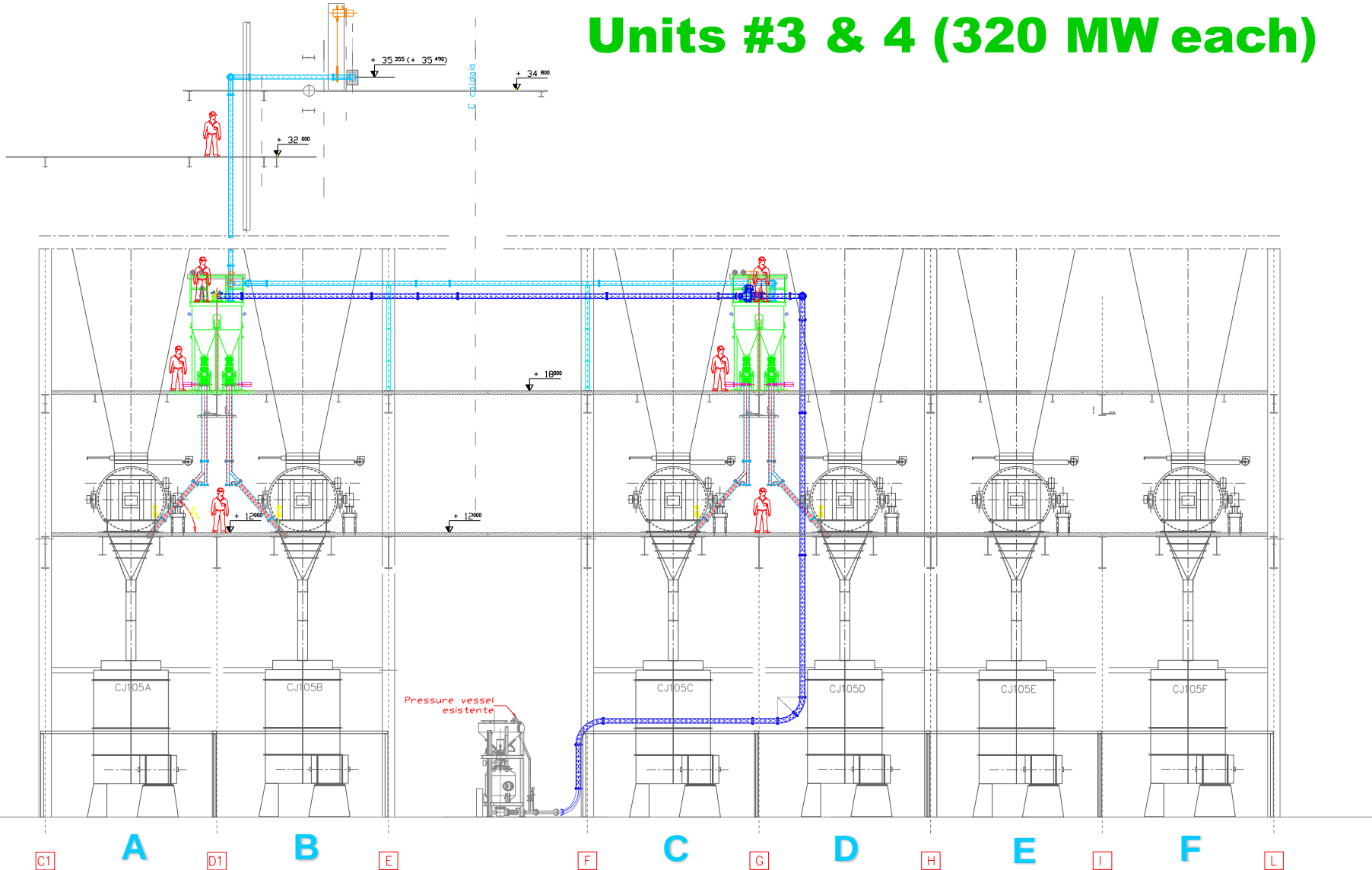
Units #3 & 4 (320 MW each)



Dry Bottom Ash Extraction and Recycling

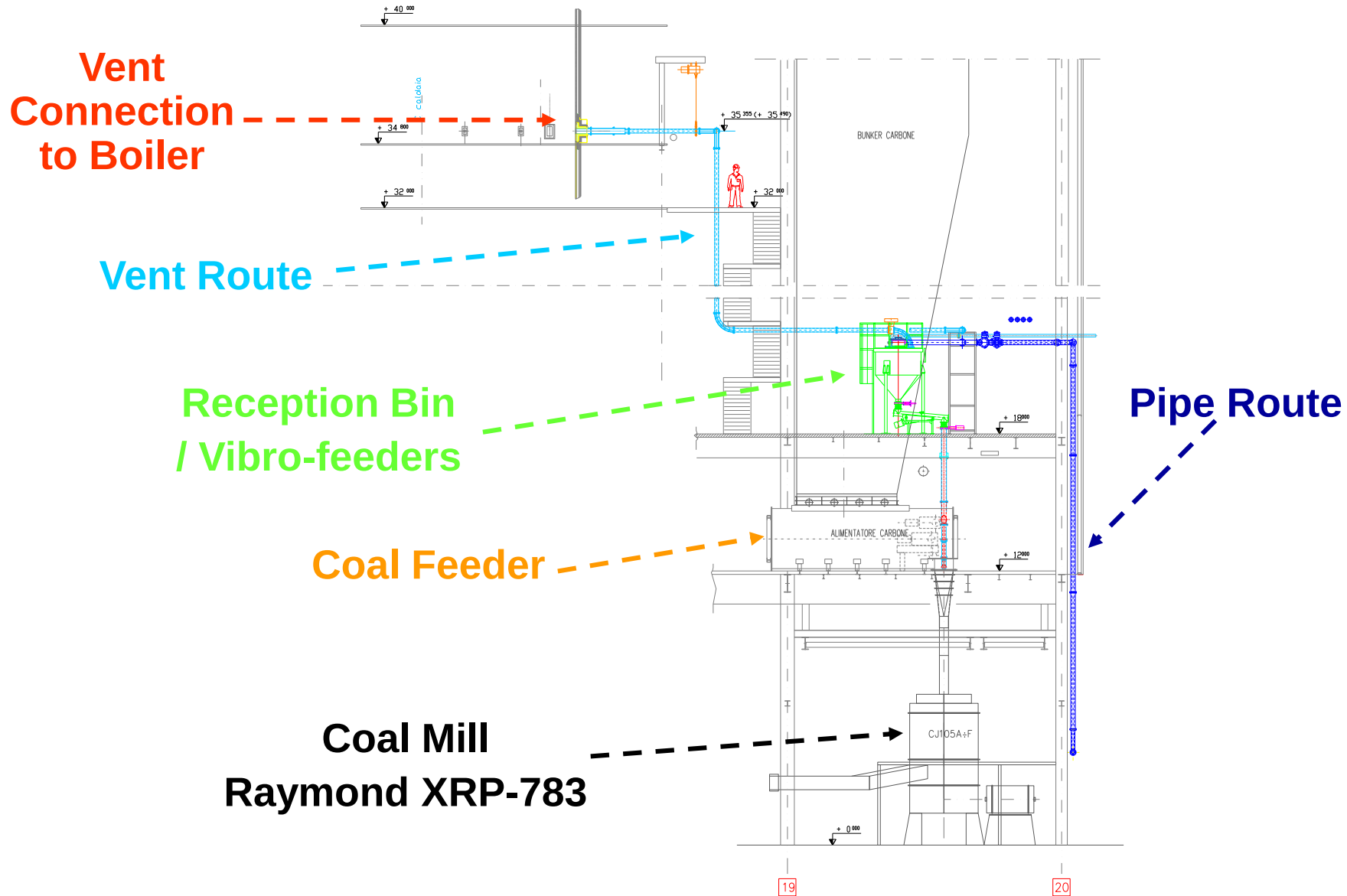
Project Experience: Front View

Units #3 & 4 (320 MW each)



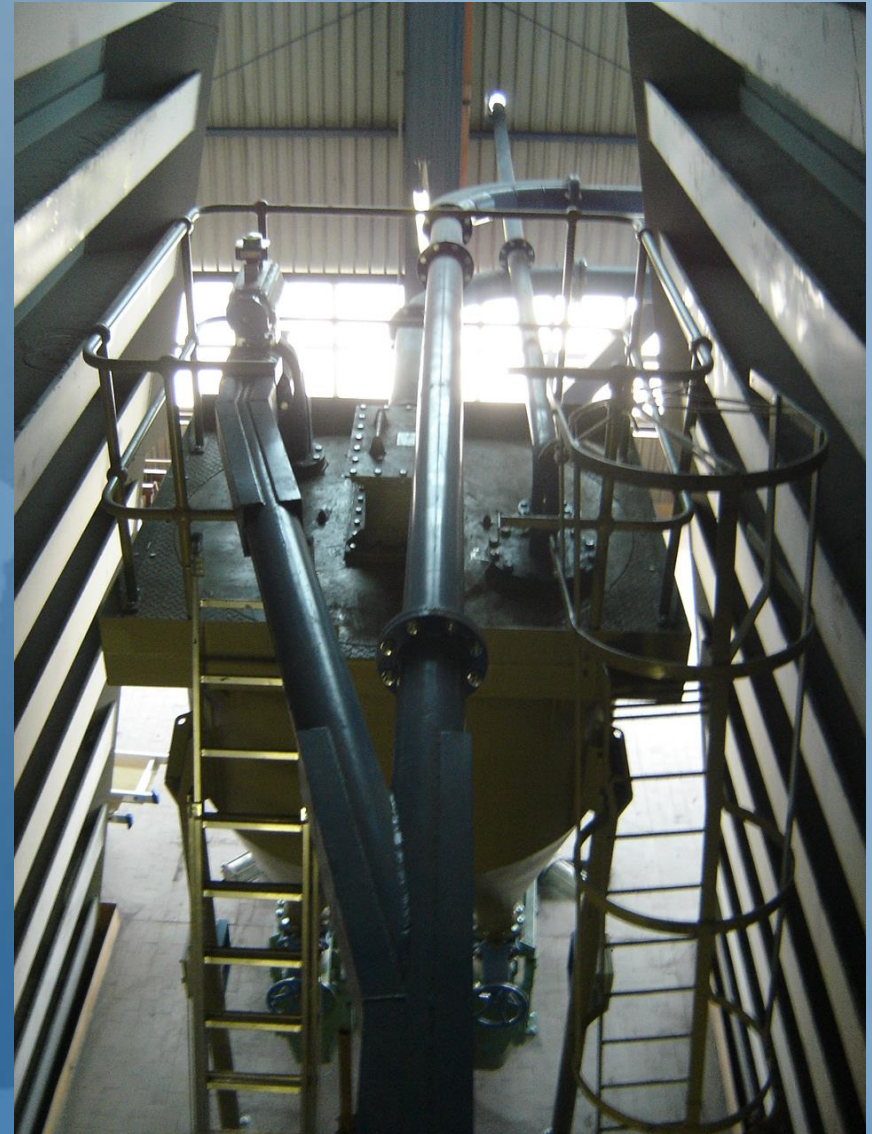
Dry Bottom Ash Extraction and Recycling

Project Experience: Lateral View



Dry Bottom Ash Extraction and Recycling

Project Experience: Ash Reception Bins



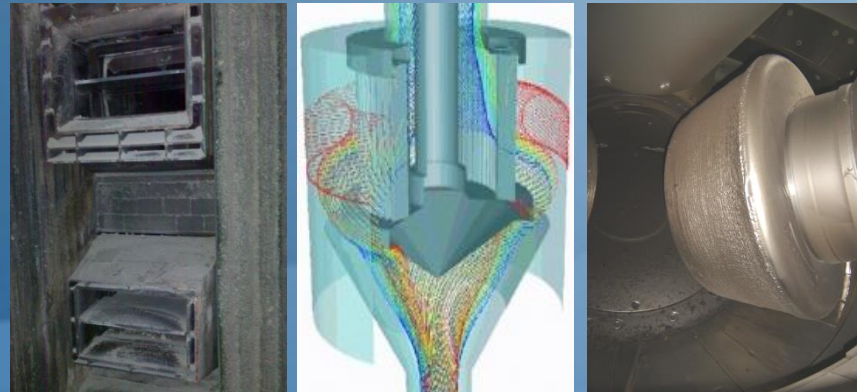
Main Types of Wear

Abrasive Wear is caused by the sliding of hard particles over a surface or between two surfaces:

- Milling equipment

Erosive Wear is associated with the impact of hard particles, carried in a fluid at significant impact velocities, on metallic and other surfaces:

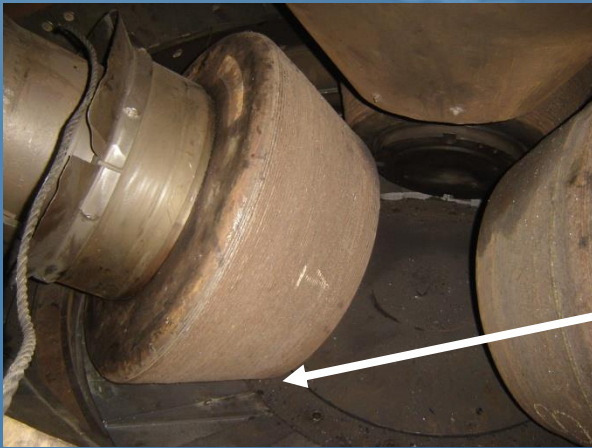
- Coal mill classifier
- Pulverized coal pipeline
- Burner internals



Coal Mill Check –*abrasive wear*-

Dimensional check of grinding rolls and bull ring segments: 700 ÷ 750 hours.

Grinding roll weighing: during the intermediate and final checks.



Grinding roll-to-bowl clearance: 2.5 mm.
Max wear on the radius before replacing:
~ 25 mm.



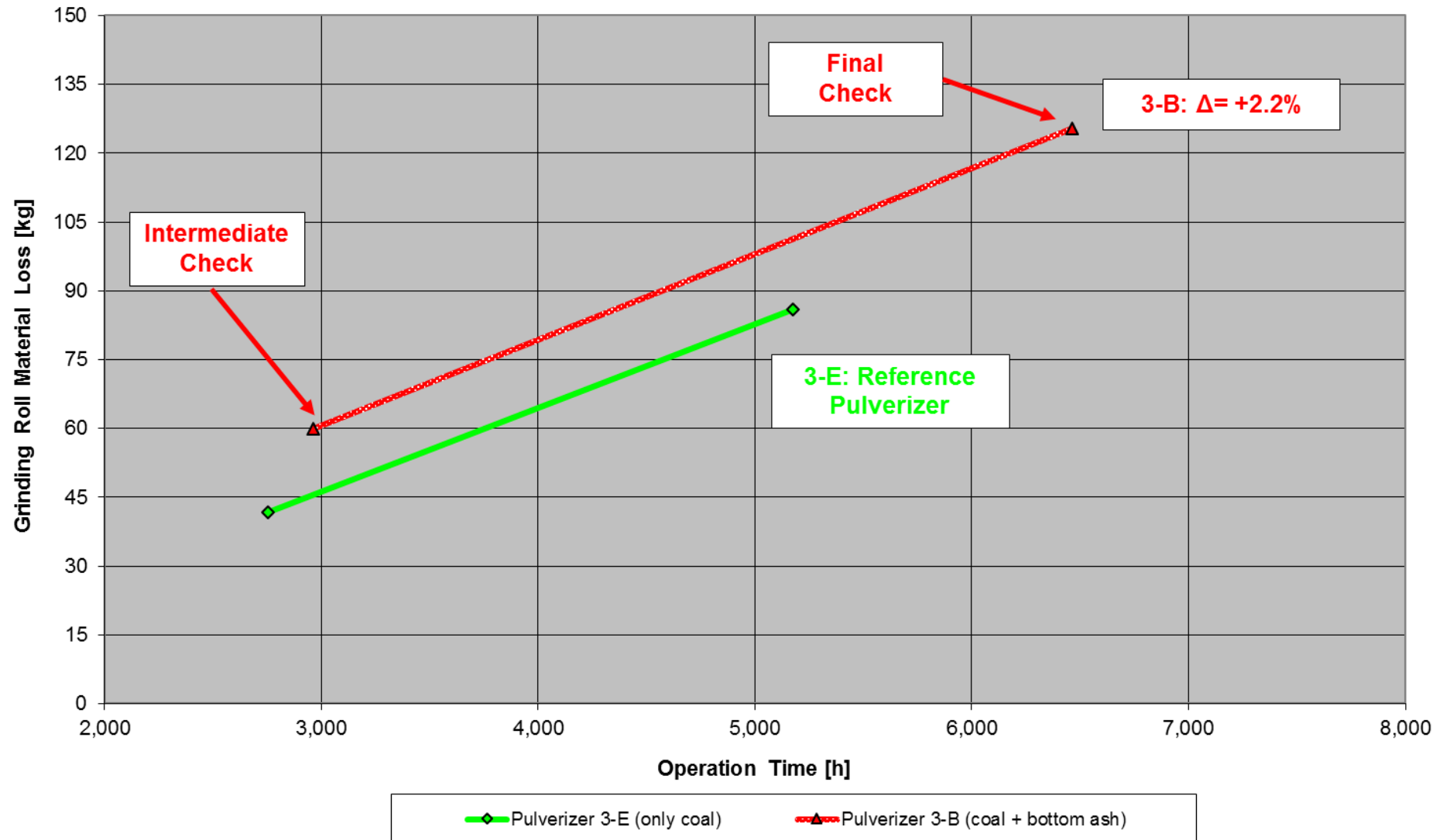
Grinding roll replacement:
5500÷7000 hours on average.



Coal Mill Check

Operation Performance & Results

COAL PULVERIZER - "ABRASIVE" WEAR TREND



Pulverized Coal Line Check –*erosive wear*–



After one year and a half of operation, there has not been any significant difference between the measured wear and the expected one.

It has observed no anomalous wear on the coal mill classifiers and on the boiler burners.



Fly Ash Certification

Reference Standard: EN 450-1:2012

Product Certificate Note

Certificate number	A95/000014
Type	de constancia de las prestaciones 1+ (Reglamento UE 305/2011)
Product	Ceniza Volante para hormigón
Product (English)	Fly ash for concrete
Holder	
Address	(Italia)

☒ Standards applied: 1

Standard EN 450-1:2012

☒ References included: 1

Finura (Categoría)	Finura (Valor declarado %)	Pérdida por calcinación (Categoría)	Densidad de las partículas (Valor declarado kg/m3)
N	19	B	2.200

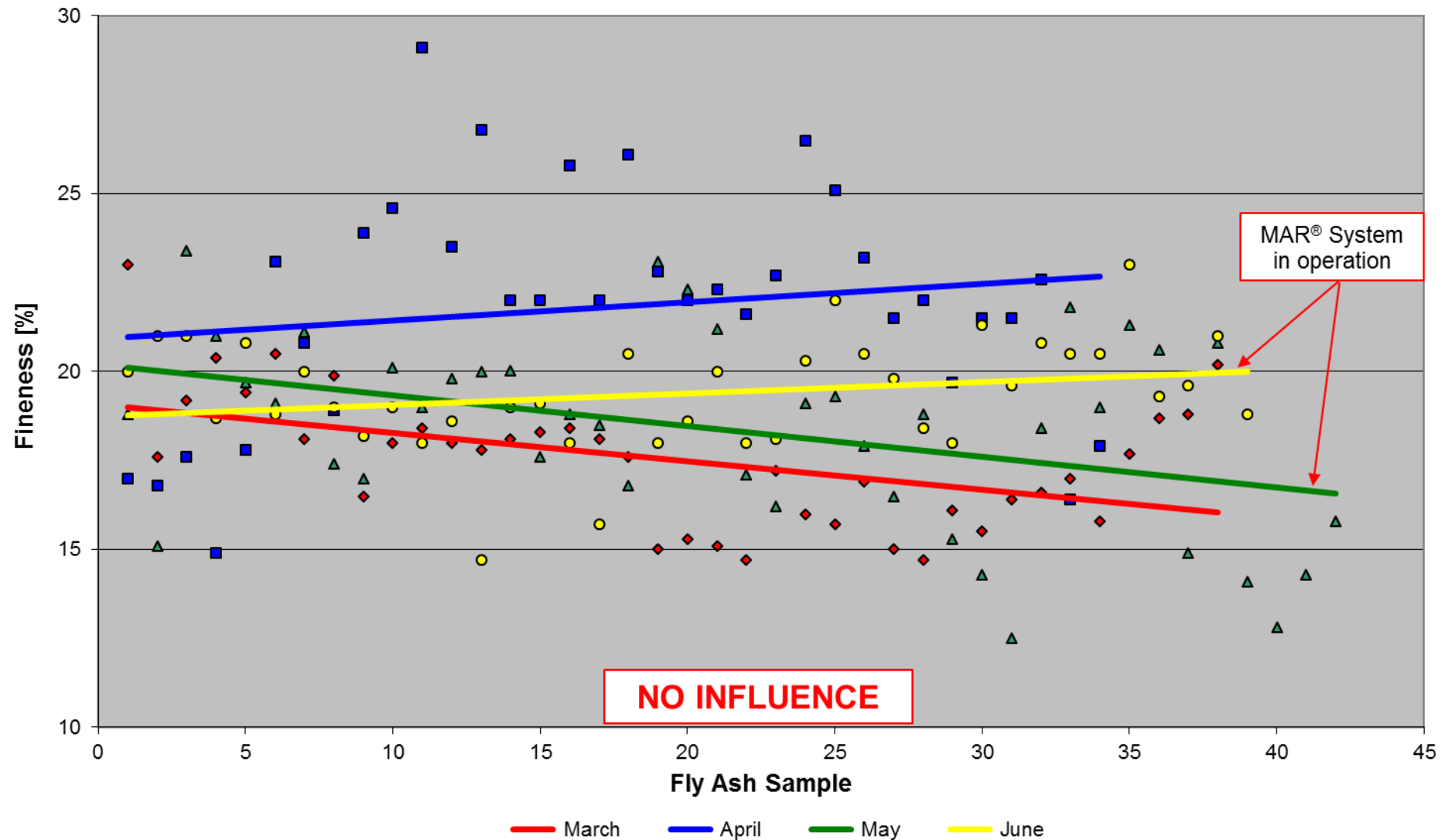
Fineness category "N":
≤ 40% by mass as oversized
particles on a 0.045 mesh sieve

LOI category "B":
< 7.0% by mass

Fly Ash Certification

Monthly Trends

FLY ASH FINENESS - MONTHLY TRENDS



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Thank you for your attention!

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