

Coal Power as seen by Conventional Wisdom ...

Coal + Air \longrightarrow **Energy + Ash + CO₂**





AIT CleanCem co-production process

IN-BOILER BENEFICIATION OF COAL ASH INTO A HIGH PERFORMANCE CEMENT SUBSTITUTE

Presented by:

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Coal Power as seen by AIT: the epitome of co-production

Coal + Air + AIT Technology → **Energy + Cement + CO₂**



Coal Ash: a global Environmental catastrophe

Ash is piling up ...

India: ~170 million tons / year

USA: ~130 million tons / year

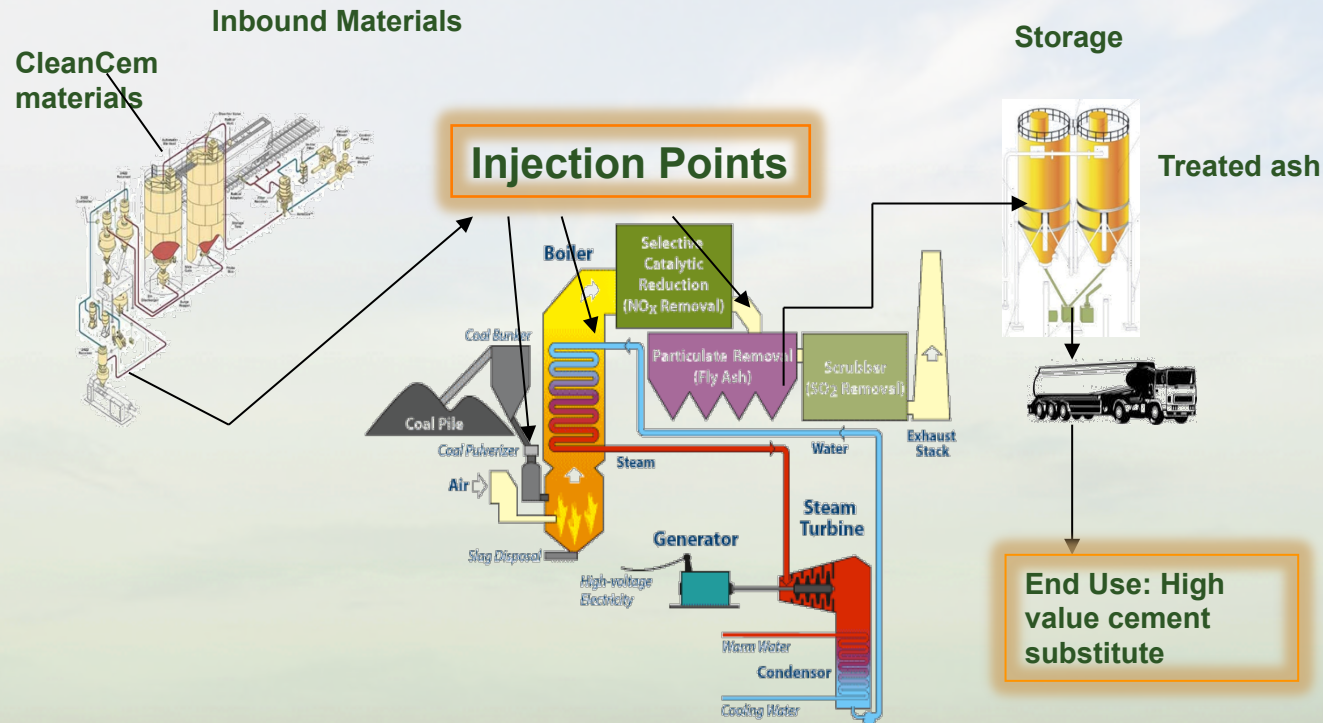
China: ~400 million tons / year



AIT Solution: a novel process that eliminates waste ash, creates low cost cement



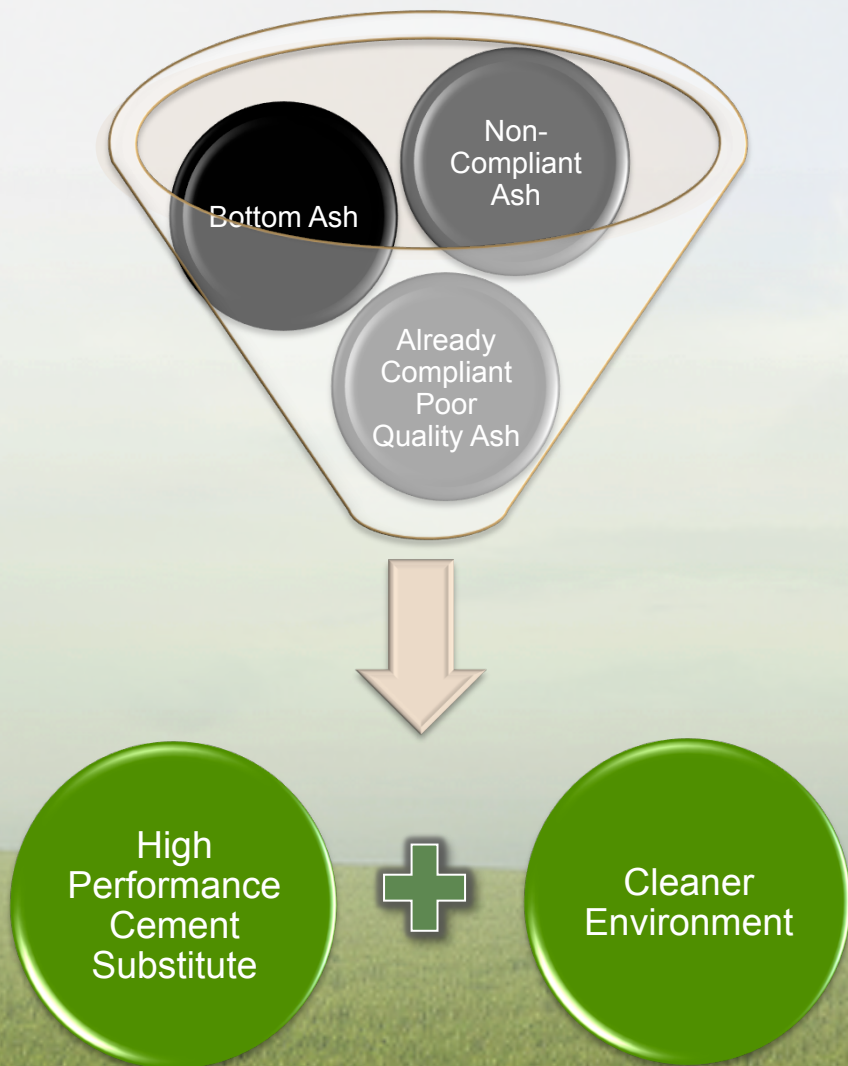
The CleanCem process at the Coal Fired Power Plant



AIT's quality controlled process converts a coal-fired plant into a manufacturing plant for a value added cement substitute

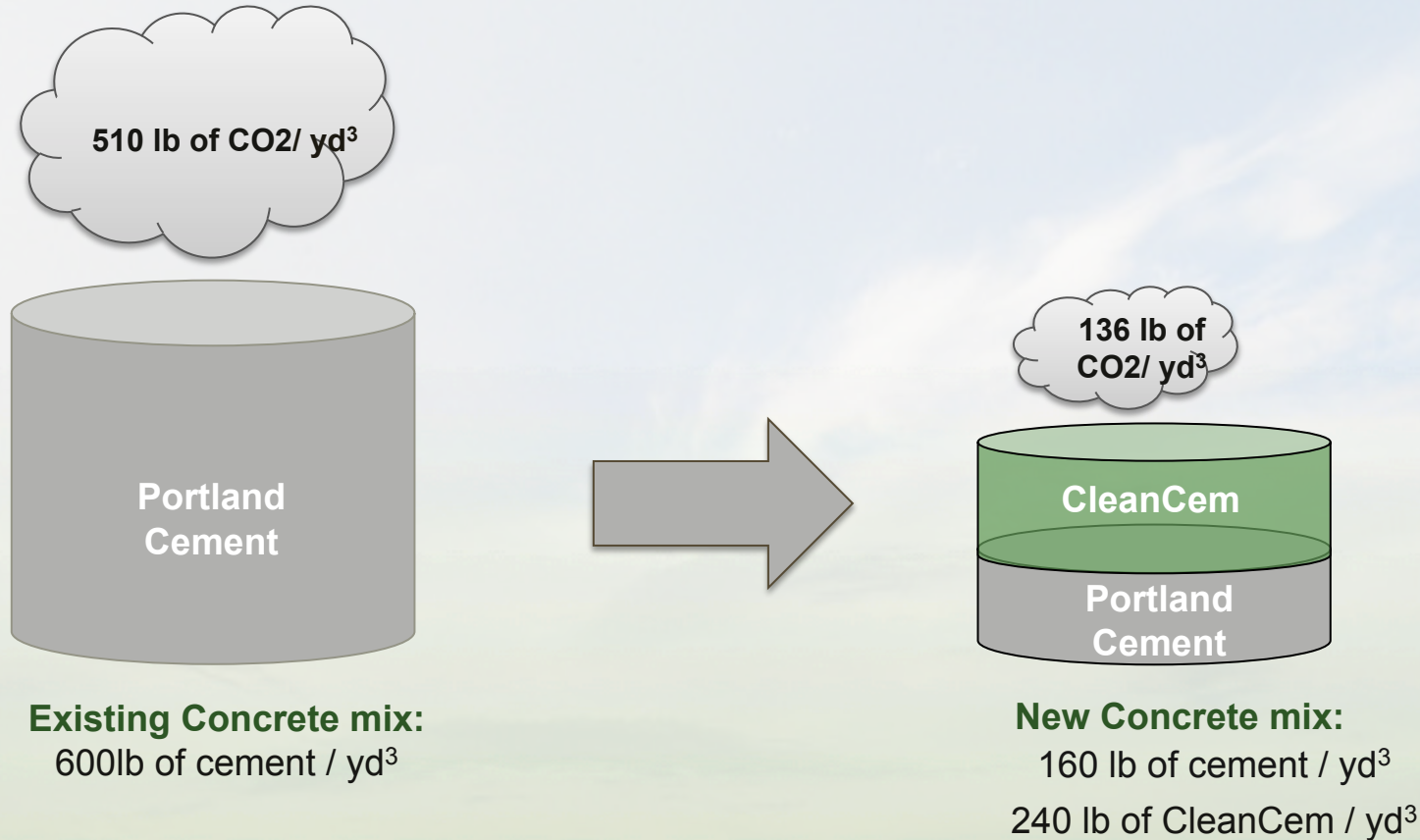
The Value of AIT's CleanCem process

CleanCem creates a cost-saving green building material, which avoids CO2 emissions and eliminates a substantial environmental liability.



- **Less Ash Waste disposal & storage**
- **Less CO2 emissions**
- **High Value Cement Replacement**
- **LOI reduction**

CO₂ Emissions: huge potential to reduce emissions



IMAGINE ... If all Concrete was made with CleanCem this would mean:

1.85 billion tons less CO₂ emissions every year (like taking half of the world's cars off the road)

What's important in the CleanCem process

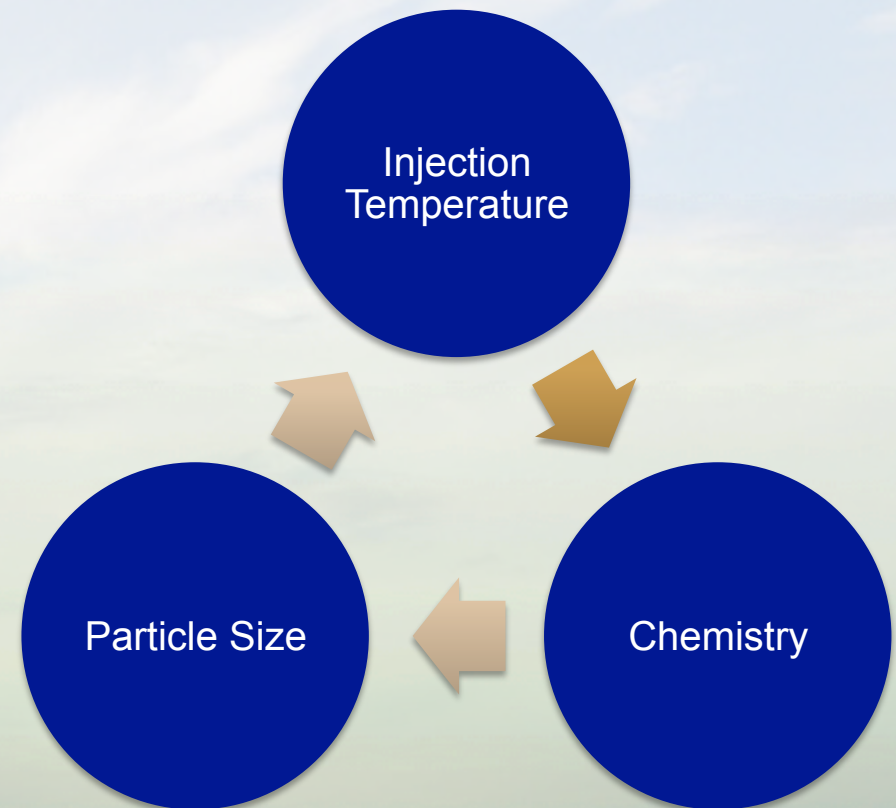
Variables: Each Coal source / boiler combination will have different for adjustments in:

- Raw material selection / dosages
- Injection points (temperature)
- Raw material particle sizes



End Product: Controlled production of high performance cement substitute:

- Target specific performance attributes (**strength, durability, LOI**)
- Control **consistency** of end material



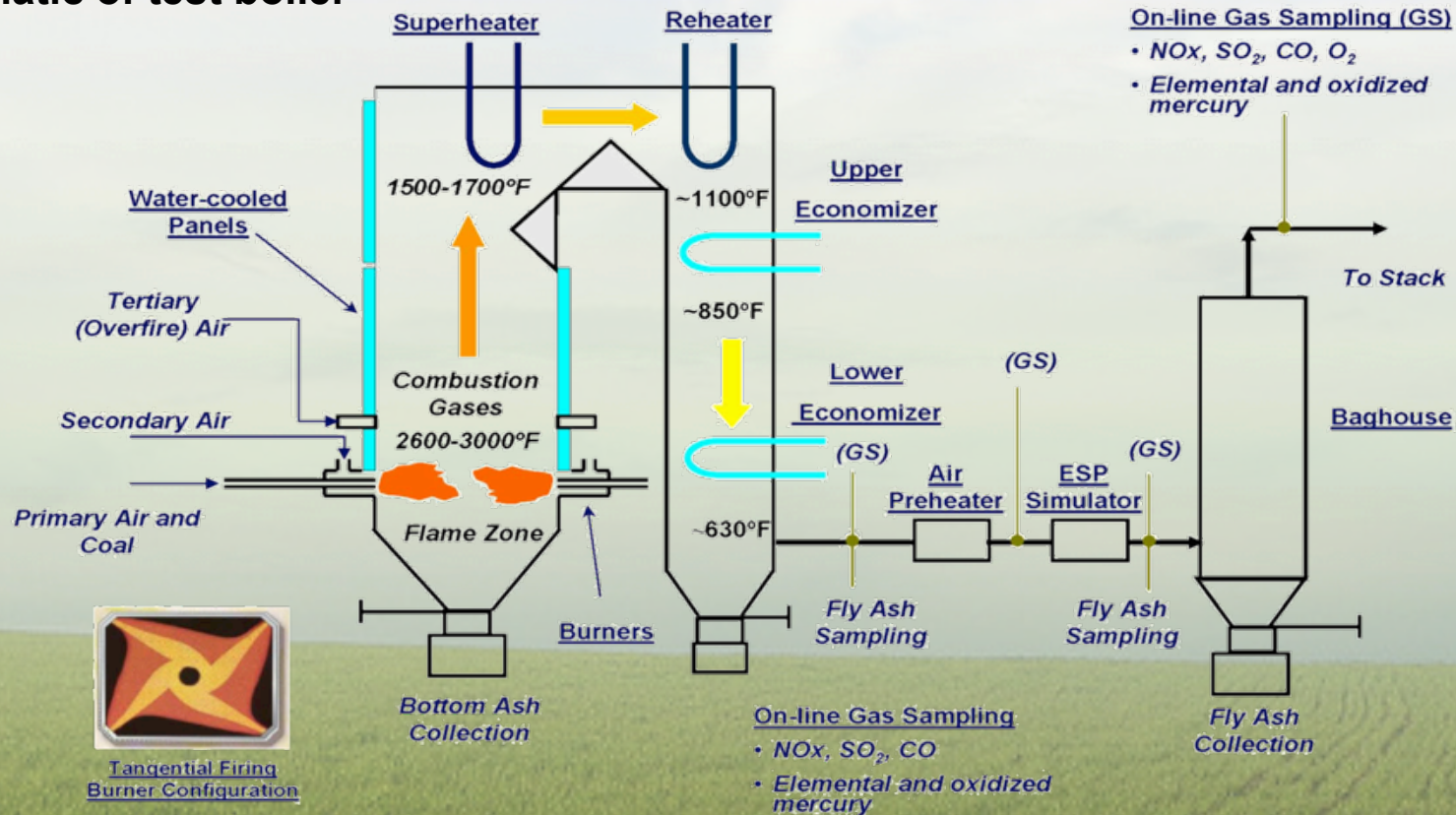
Case Study 1: ash reactivity enhancement

Objective: more reactive ash – improve compressive strength at substitution rates up to 60%

Boiler type: PCC, tangentially fired

Coal types tested: PRB (Eagle Butte) and bituminous (Illinois – Triad)

Schematic of test boiler

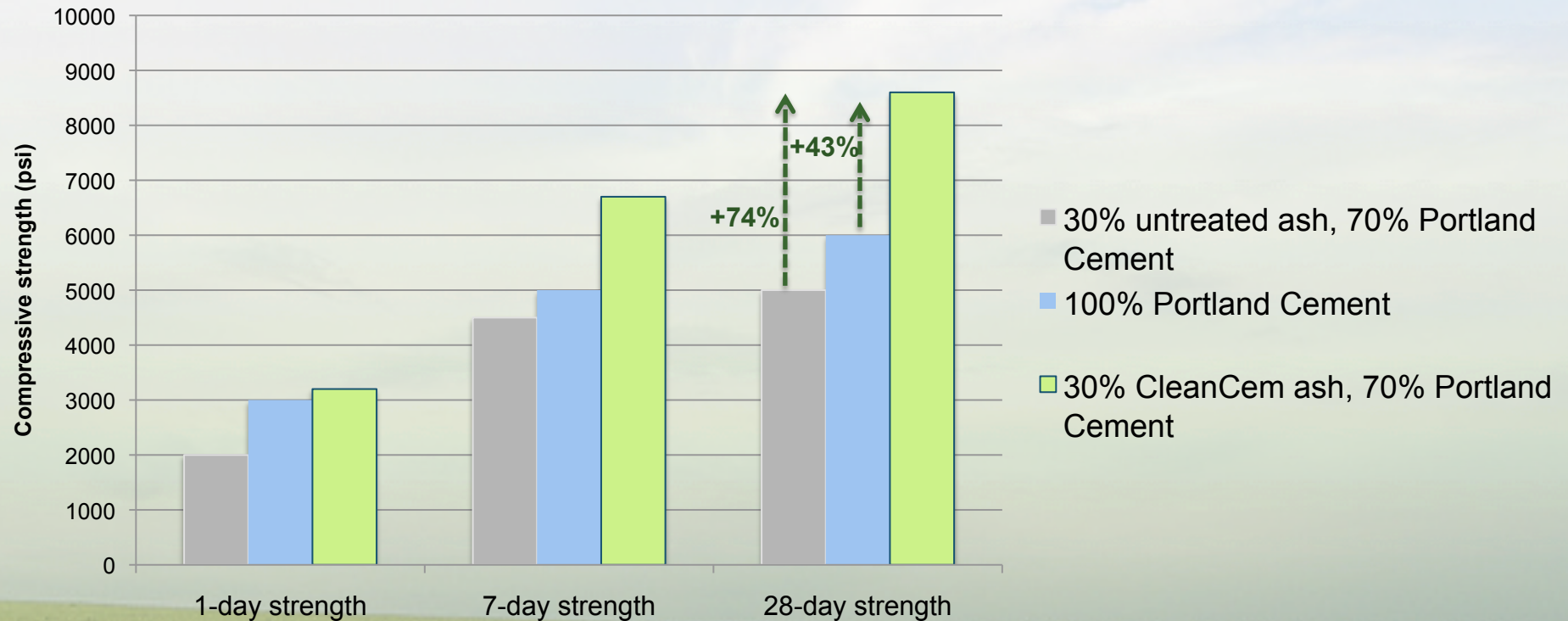


Our modified ash product: superior compressive strength at 30% replacement ...



Strength development of mortar with **30%** CleanCem binder vs. untreated ash and pure Cement

Compressive Strength CleanCem treated ash at 30% substitution



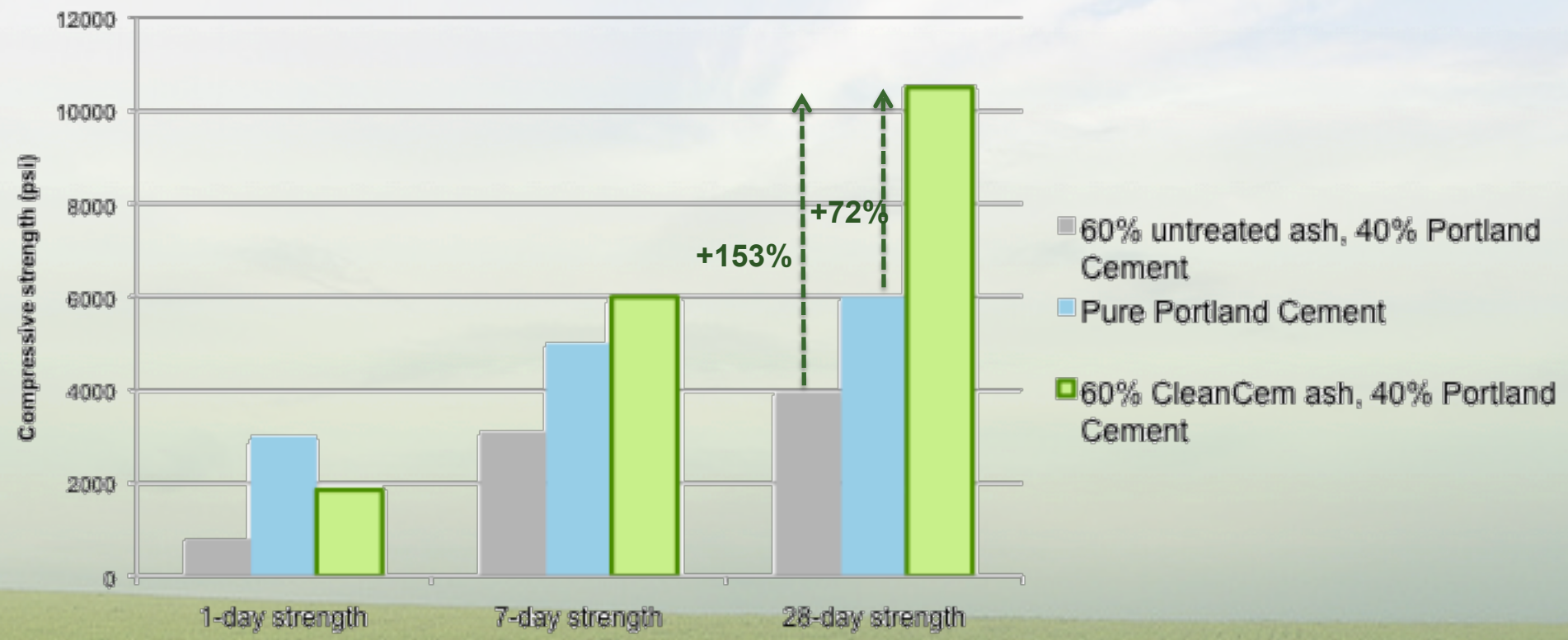
Proper additive selection and process can drastically improve strength properties of fly ash in a 30% substitution mix

Performance results: CleanCem has superior compressive strength at 60% replacement ...



Strength development of mortar with **60%**CleanCem binder vs. untreated ash and pure Cement

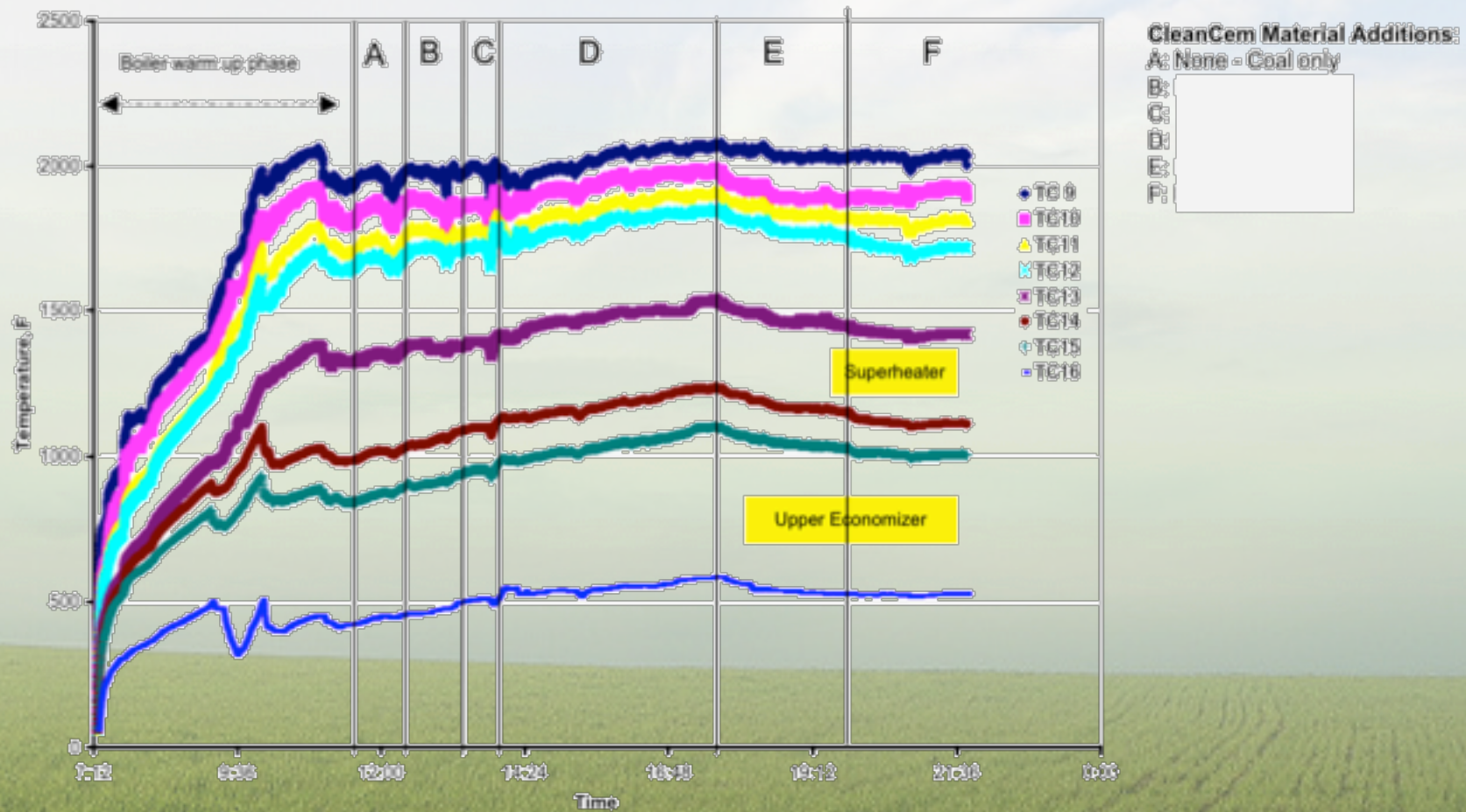
Compressive Strength CleanCem treated ash at 60% substitution



Boiler efficiency is not affected

In solid fuel combustion processes, boiler efficiency is not affected: boiler temperatures stay constant at equal coal input as CleanCem materials are added in the process

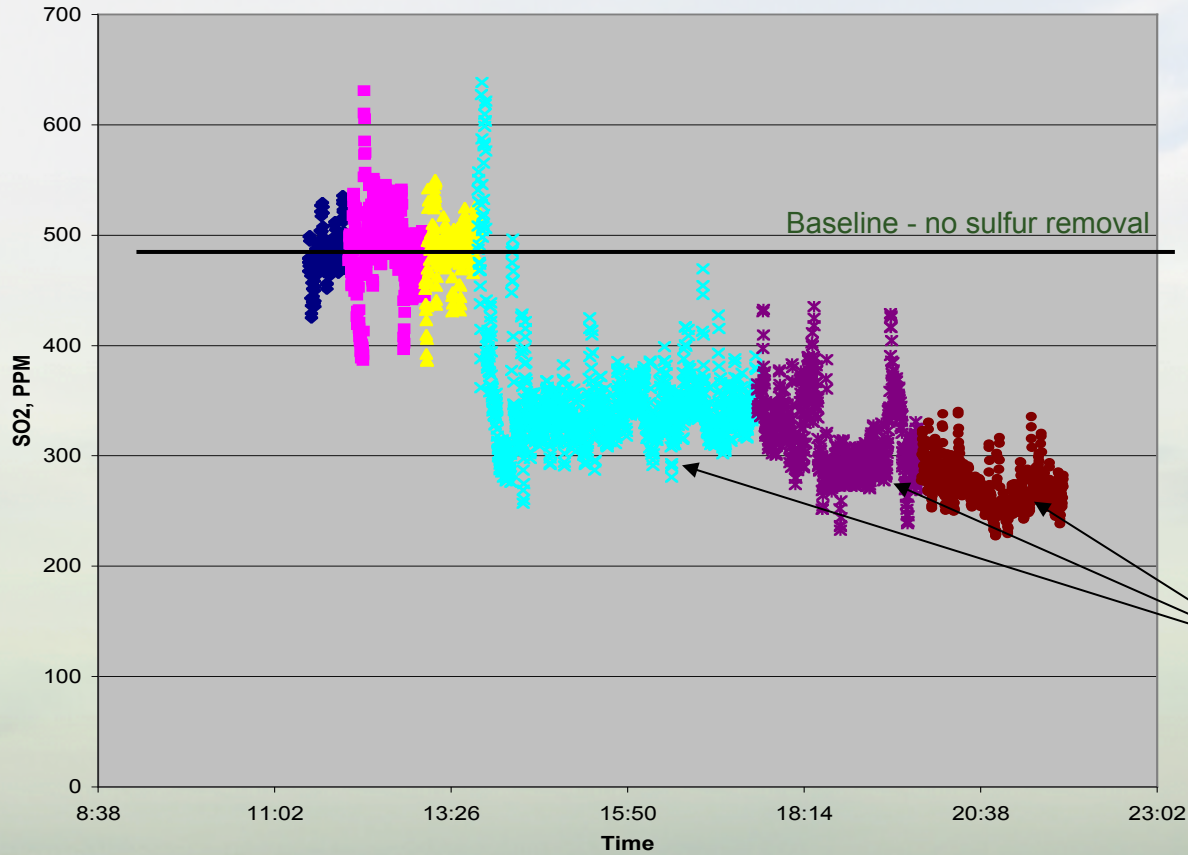
Boiler temperatures measured at different stages during material addition



SOx control is not affected

Materials added in the process do not harm SOx control

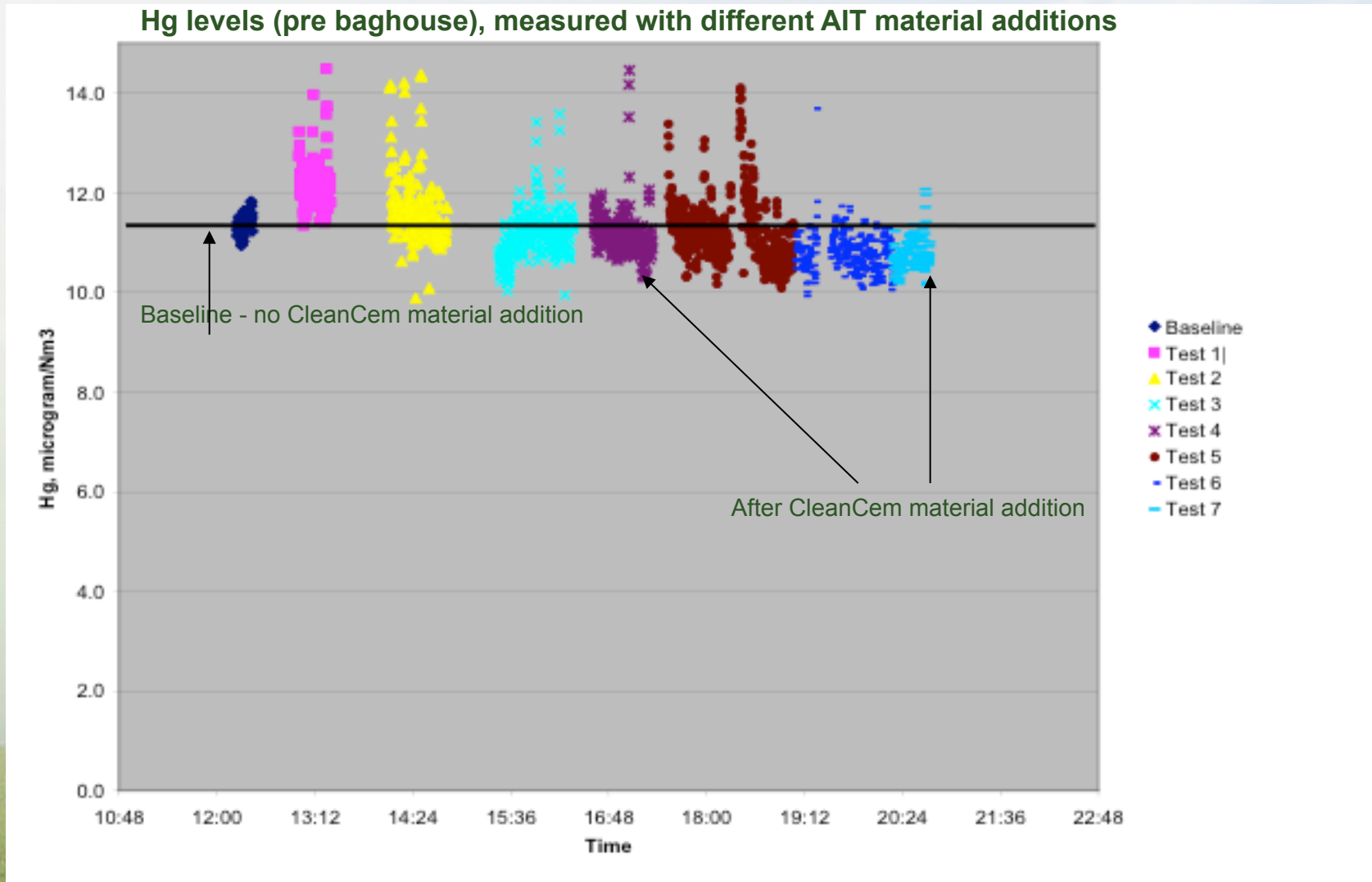
SO2 levels, measured with different AIT material additions



After addition of CleanCem materials

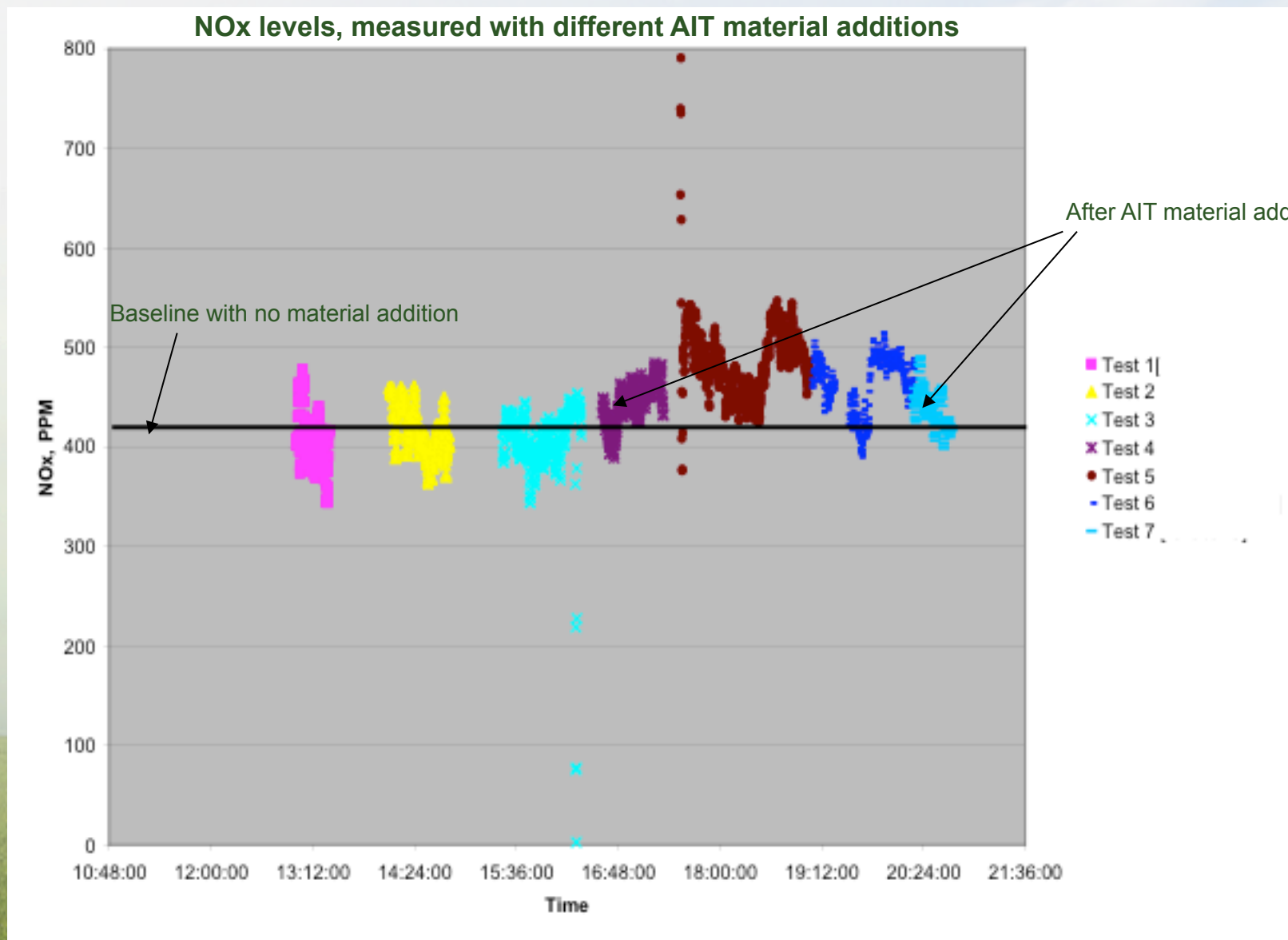
No Negative Impact on Hg control

Materials added in the process are neutral as related to Mercury control



No negative impact on NOx Control

Materials added in the process have a neutral effect on NOx control



Case Study 2: Introduction

Objective: reduce LOI from 7%+ to 4%

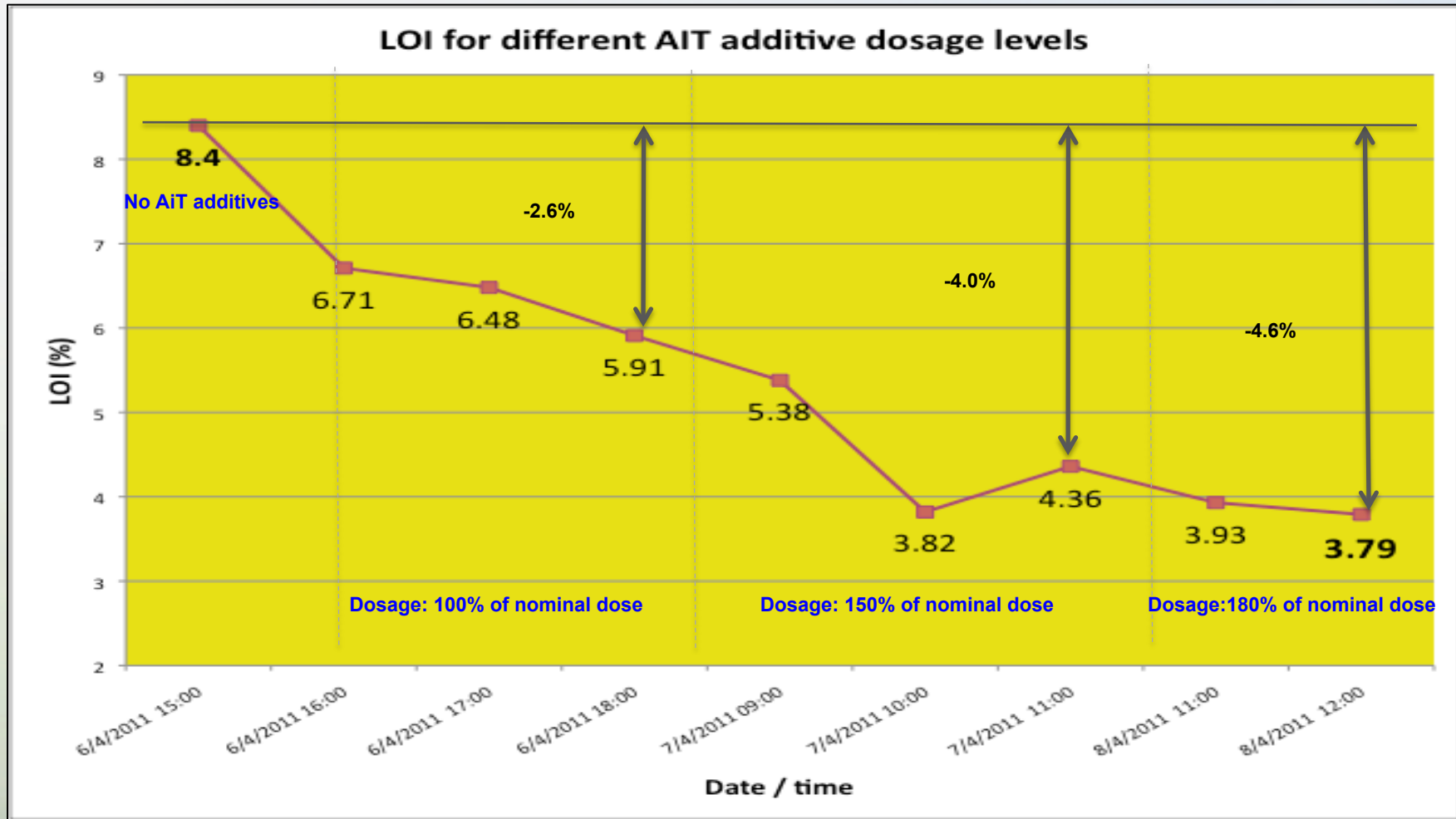
Boiler type: AFBC

Coal types tested: Bituminous (India)

Location: Chhattisgarh, India



Results: Impact of AIT process on LOI



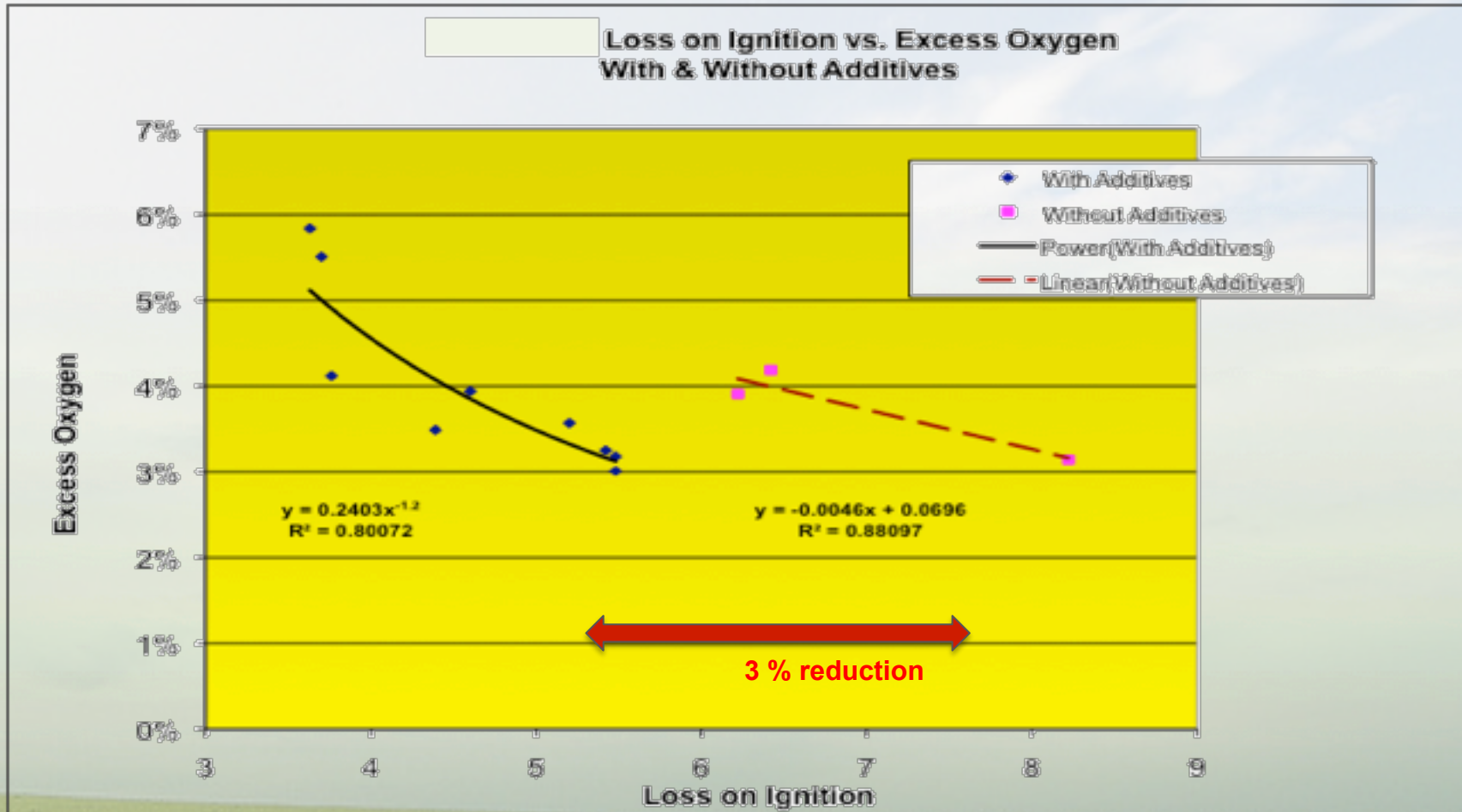
Conclusion:

There is a direct relationship between LOI reduction and AIT material dosage.

The AIT process brought LOI down from 8.4% to 3.79% as dosage of AIT additives gradually increases.

Results: Impact on average LOI at constant oxygen

Impact of AIT Material injection on average LOI isolating Oxygen levels as an independent variable



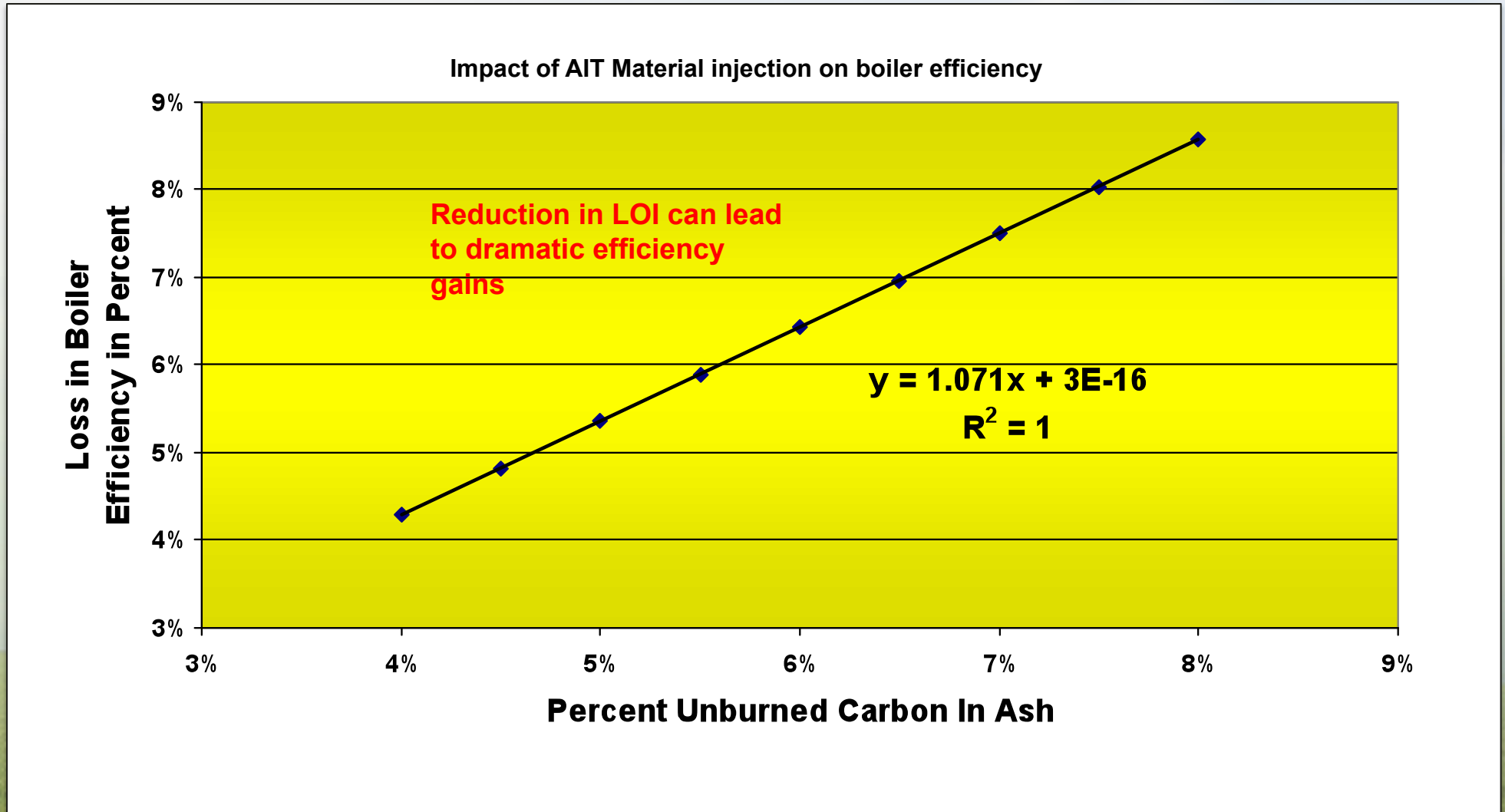
Conclusion:

At constant O₂ levels in the boiler flue gases, the injection of AIT materials at target levels (80% to 150% of nominal dosage) consistently lowers LOI by ~3 percentage points

Boiler Performance: the AIT process improves efficiency



Due to the high ash content of the local coal (46%) unburned carbon in ash has a dramatic impact on boiler efficiency



Conclusion – the AIT CleanCem process can be used to:

- Convert any fly ash into a high value cement substitute
- Contribute to net CO₂ emissions reductions
- Improve SO₂ removal rates
- Reduce LOI and improve boiler efficiency



Thank you !

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