Worldwide Pollution Control Association

WPCA-Entergy

"Increasing Energy Efficiency of Existing Units" Seminar

January 22, 2014

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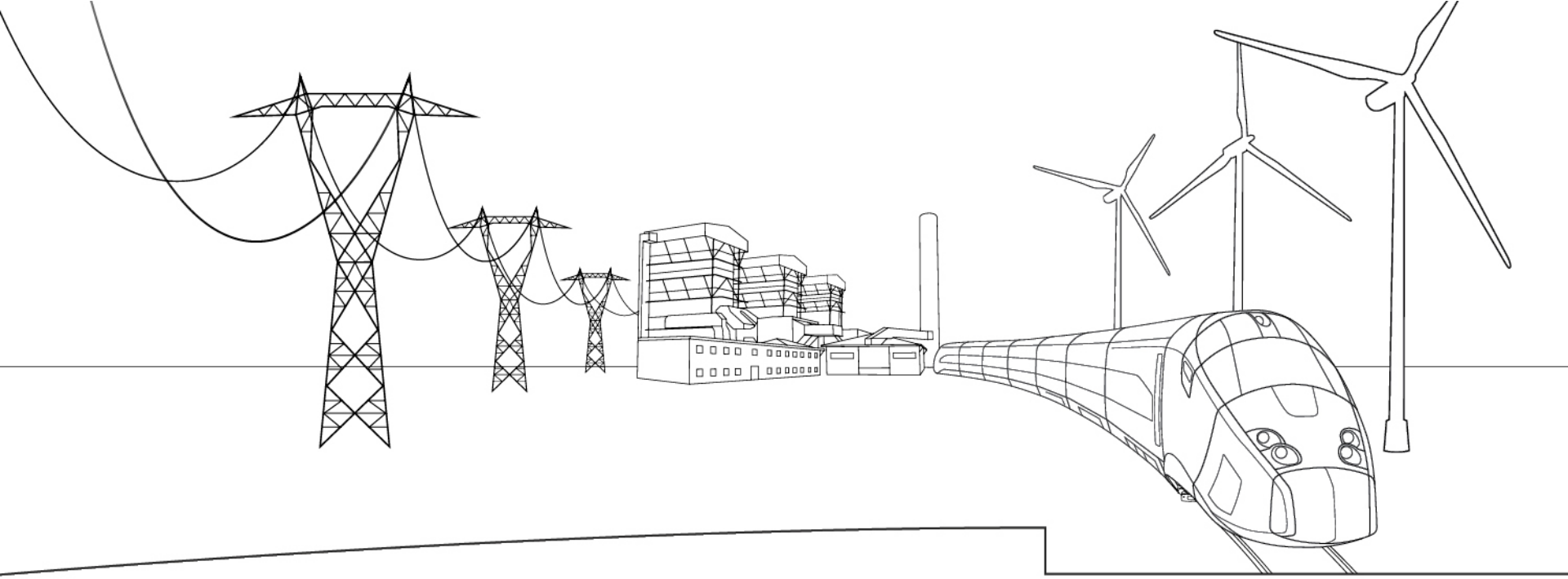

Approaches to Improve Air Preheater Thermal Efficiency

Louis Bondurant

Alstom Air Preheater

January 22, 2014

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Shaping the future

LGOT R&D Program
(Low Gas Outlet Temperature)

- Objective of the LGOT Program
  - Develop the design of the Ljungstrom® air preheater for operation at gas outlet temperatures down to 220°F (105°C) on coal fired boiler applications.
- The Potential Benefits of LGOT
  - Significant reduction in “Dry Gas Loss” a key metric in unit heat rate
  - Reduced volumetric flow rates for downstream FGD, CO2 capture, etc.
  - ESP can benefit from reductions in both volumetric flow and fly ash resistivity
- Potential Issues for LGOT
  - Enhanced risk of air preheater acid dew point fouling problems
  - Added potential for low temperature corrosion from halogen acids near the H_2O dew point.

Bench-Scale Test Apparatus

Fouling Test Apparatus

Simulated gas flow included controlled amounts of

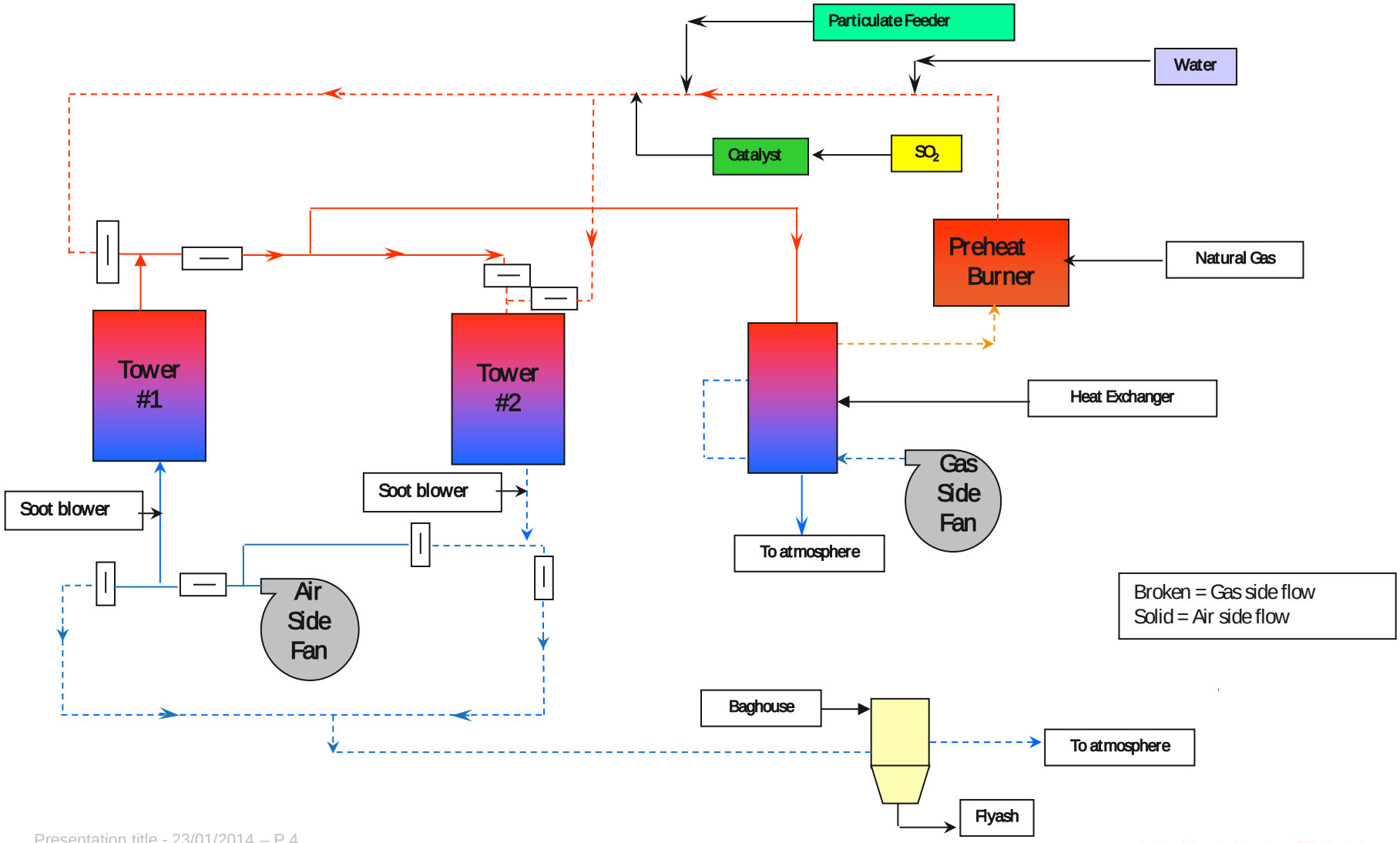
- SO3
- Water vapor
- Solid particulate

Cleaning cycle

- Duration of tests mimicked typical sootblowing interval
- Translational movement in the path of the cleaning nozzle mimicked rotor rotation
- Tube removal required in order to clean

Soot Blowing Simulator

Pilot Scale Test Apparatus



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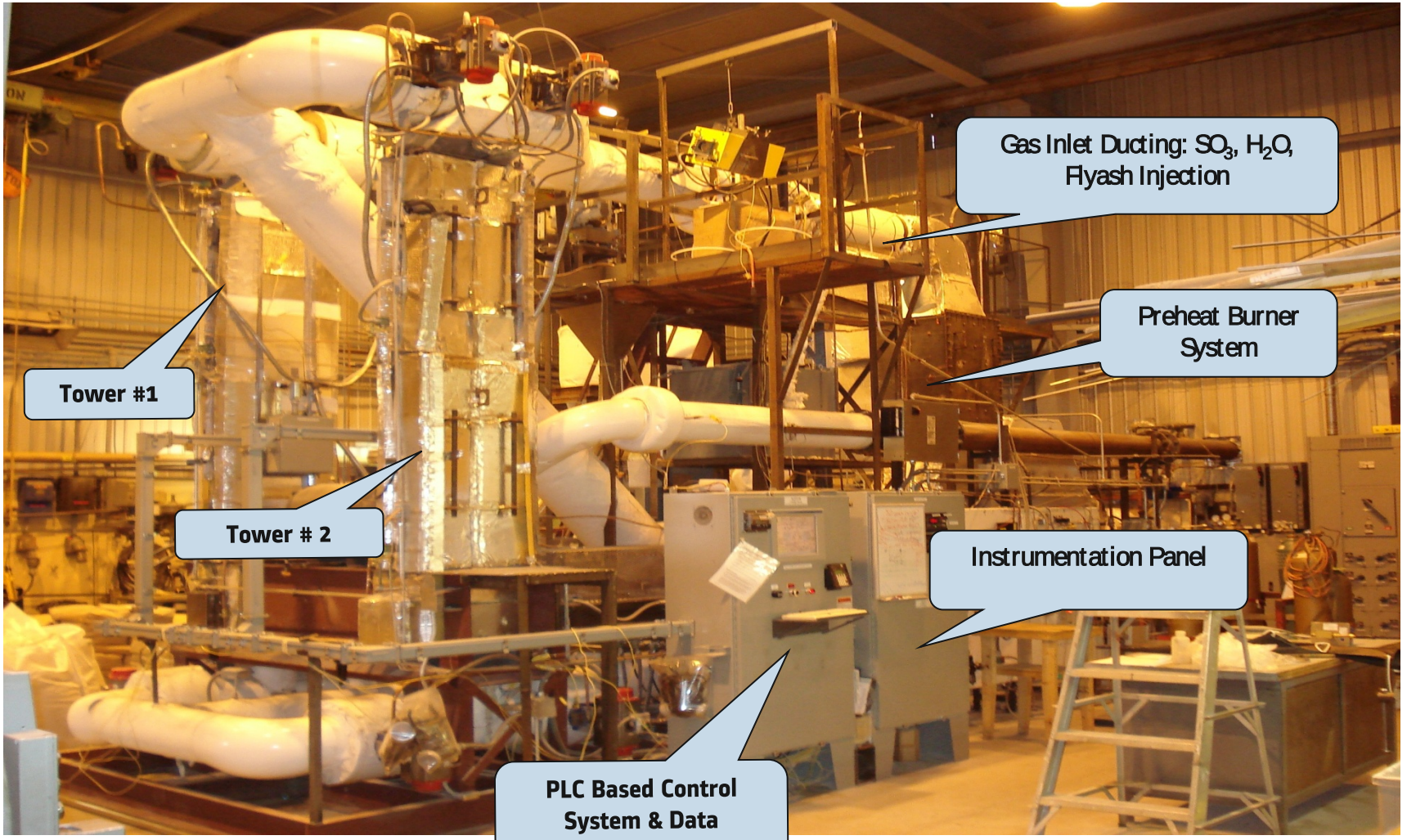
Pilot Scale Test Apparatus



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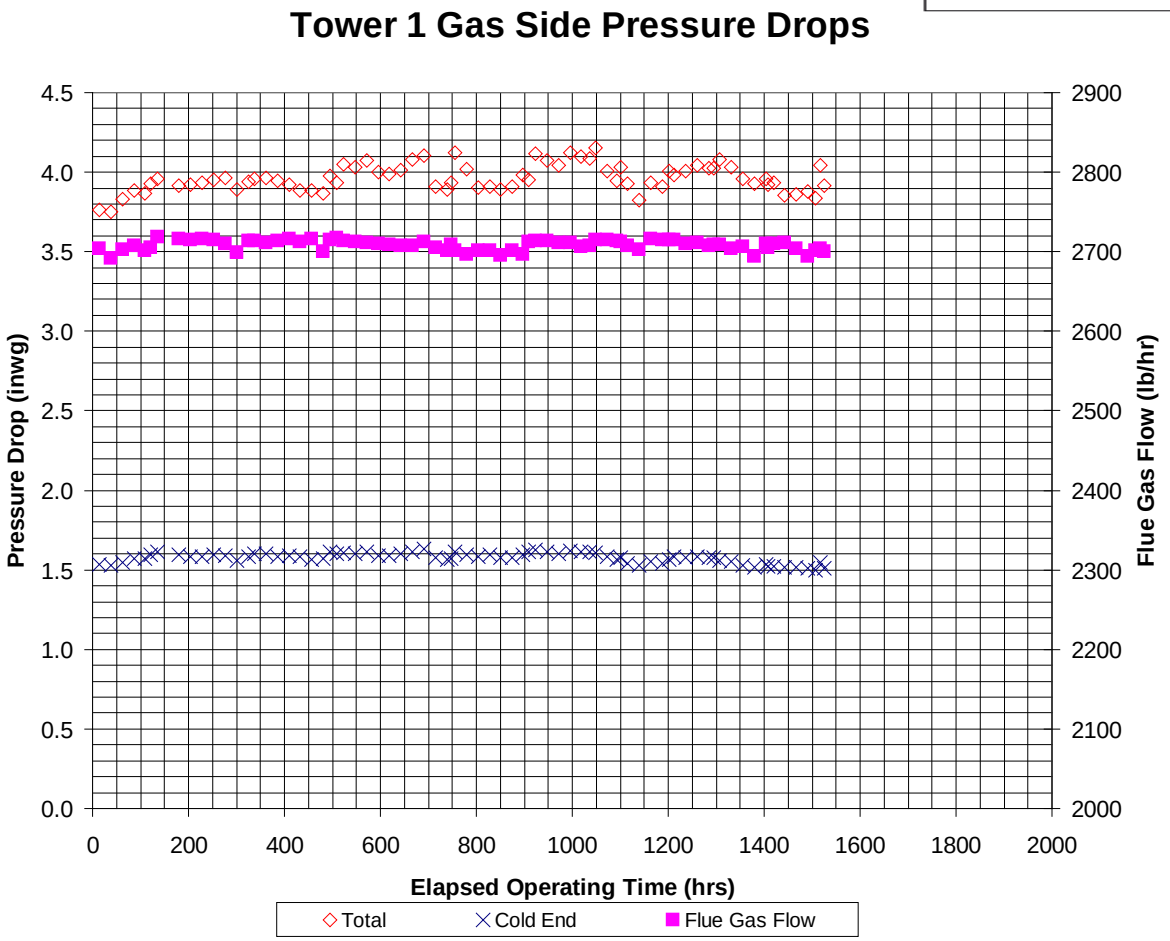
Simulated URS SBS Injection™ Technology
Full Mitigation (5ppmv SO_3 + Na_2SO_4 By-Product)



Stable Pressure Drop Response for ~ 2 Months

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Simulated URS SBS Injection™ Technology
Full Mitigation (5ppmv SO_3 + Na_2SO_4 By-Product)

No Significant Deposit Thickness Was Found

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Conclusions from Pilot Scale Testing
Simulated URS SBS Injection™ Technology

With SO_3 levels reduced to 5 ppmv …

- Cold layer pressure drop did not increase
- No significant deposit thickness was found

With SO_3 levels at 10 ppmv …

- Rapid increases in cold layer pressure drop occurred
- Significant sodium bi-sulfate deposit was found

Note: Sodium based SO_3 mitigation must reduce SO_3 concentrations to 5 ppmv or less entering the air preheater

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RGOT Vs LGOT Operation
(Reduced Gas Outlet Temperature)

- Simple modifications to an existing air heater typically cannot achieve a 220˚F gas outlet temperature

- An increase in airflow can provide a significant reduction in gas temperature. Co-benefit, if this this incremental hot air can be used elsewhere in the plant.

- Reduced gas outlet temperature (> 220˚F) can be pursued in lieu of LGOT. Basic benefits retained, implementation cost lowered significantly.

- Reduced potential for corrosion, but need to stay above H_2O dewpoint

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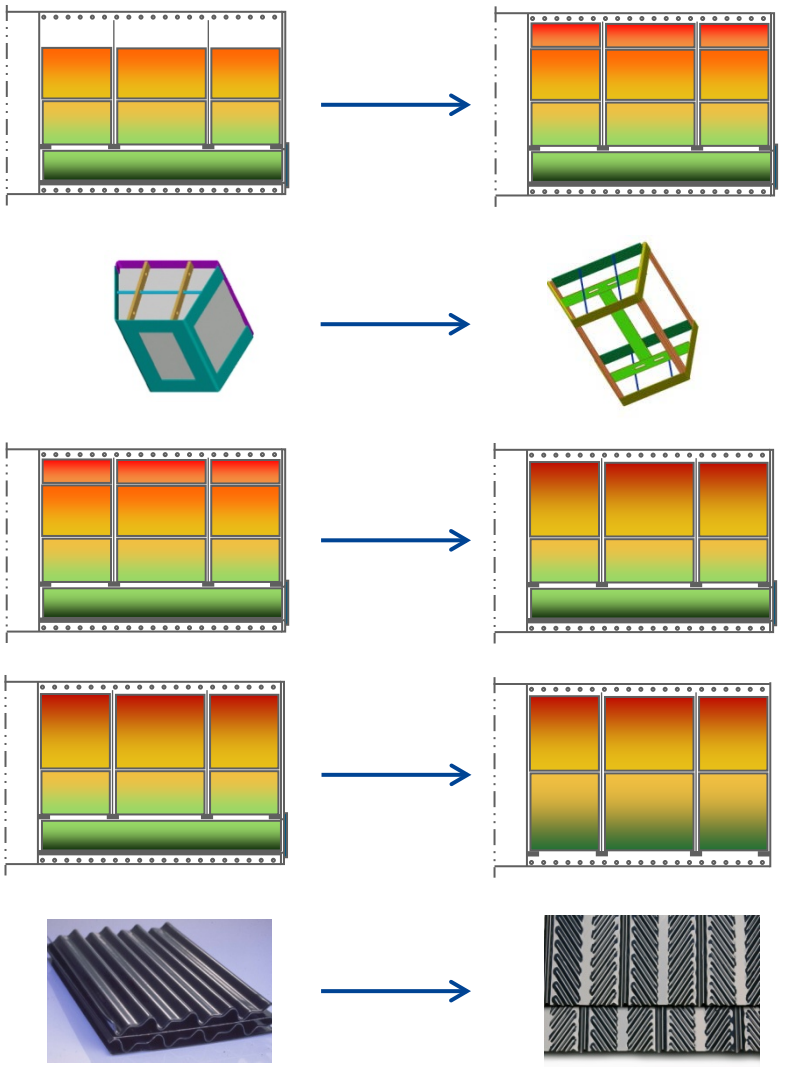
RGOT Operation
Means to Accomplish

- Fill empty voids in APH rotor with additional basket layers
- Utilize special basket designs to maximize useable space for heat transfer surface
- Consolidate shallow basket layers into single deeper layers
- Modify APH rotor to more efficiently support basket layers
- Switch to more efficient types of heat transfer surface



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RGOT Operation
Considerations

- Fuel compatibility
- Thermodynamic limitation
- Available space within the existing APH rotor
- Load bearing limits on rotor bearings, rotor drive and APH structure
- Ability of draft fans to accommodate expected pressure drop levels
- Ability of APH sealing system and structure to operate at higher pressure levels
- Ability to maintain temperature levels above H_2O dew point at all load and ambient conditions

Benefits Derived from RGOT

- Reduced coal consumption (potentially as much as 3%)
- Significant reduction in activated carbon required for mercury capture
- Enhanced ESP performance (due to fly ash resistivity)
- Reduced O&M costs associated with steam coil air preheaters
- Reduced CO2 emissions resulting from improved boiler efficiency
- Co-benefit if additional hot air can be used elsewhere on site

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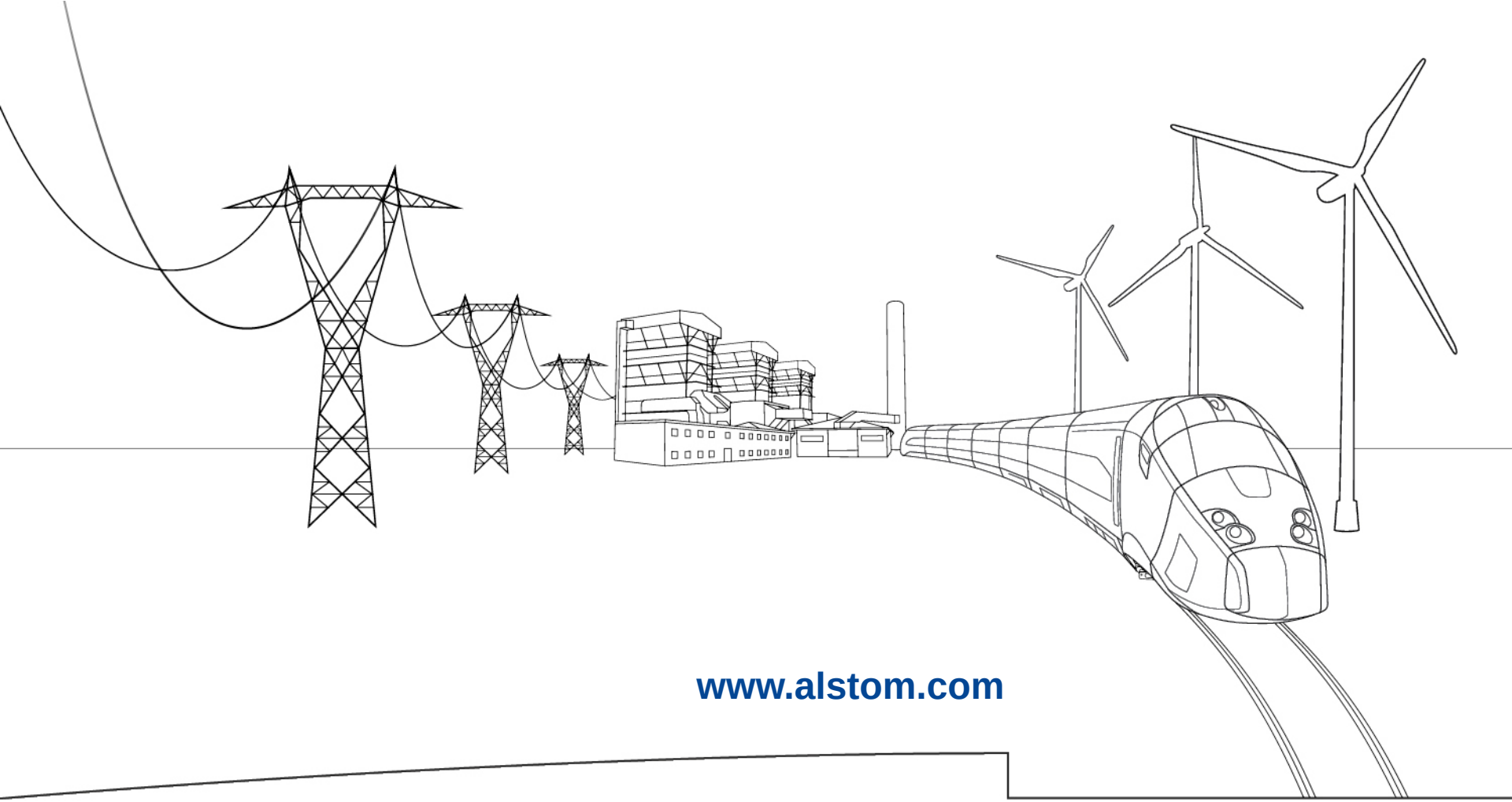

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