

Renewing of Aging Power Plant

**Lowest Emitting, Highest Efficiency Steam Plant
Enwave Energy – Pearl Street Steam Plant**

2011 IDEA/CDEA Conference and Trade Show

June 26-28, 2011

Enwave Energy Corporation

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History Pearl Street Steam Plant (PSSP) - Plant

- PSSP was constructed in three phases in the 1960
- There are 8 boilers, 100,000 pph each
- Plant name plate capacity of 800,000 pph
- Boiler output of 650,000 pph due to stack restriction
- Insignificant condensate return
- Plant steam usage of 18%

History Pearl Street Steam Plant (PSSP) - Boilers

- There are two type of boilers 'O' and 'D'
- 5 'O' type boilers: John Inglis Co
 - 3 boilers with 79 % efficiency
 - 2 boilers with 84 % with economizers
 - Double burners
 - 120 ppm of NOx
- 3 'D' type boilers: B&W
 - 80 % efficiency
 - Single burner
 - 75 ppm of NOx



Urban Setting of the PSSP

- In 1960 office building east
- In 1980 New office adjacent
- In 2000 Condominium 40 m
- New Air Emission Regulation updated regulation O.Reg 419/05 Grandfathering to be phased out by 2020

More stringent point source air emissions regulations



Solutions Considered

- Relocate Pearl Steam Plan
- Increasing the height of the stack
- Updating the combustion technology

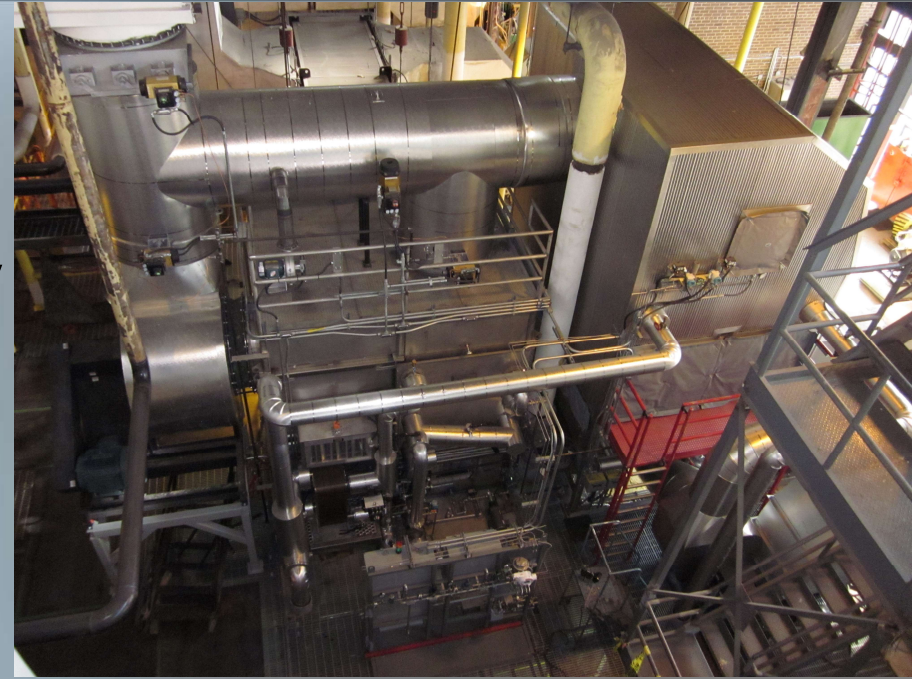


Selecting the Write Solution

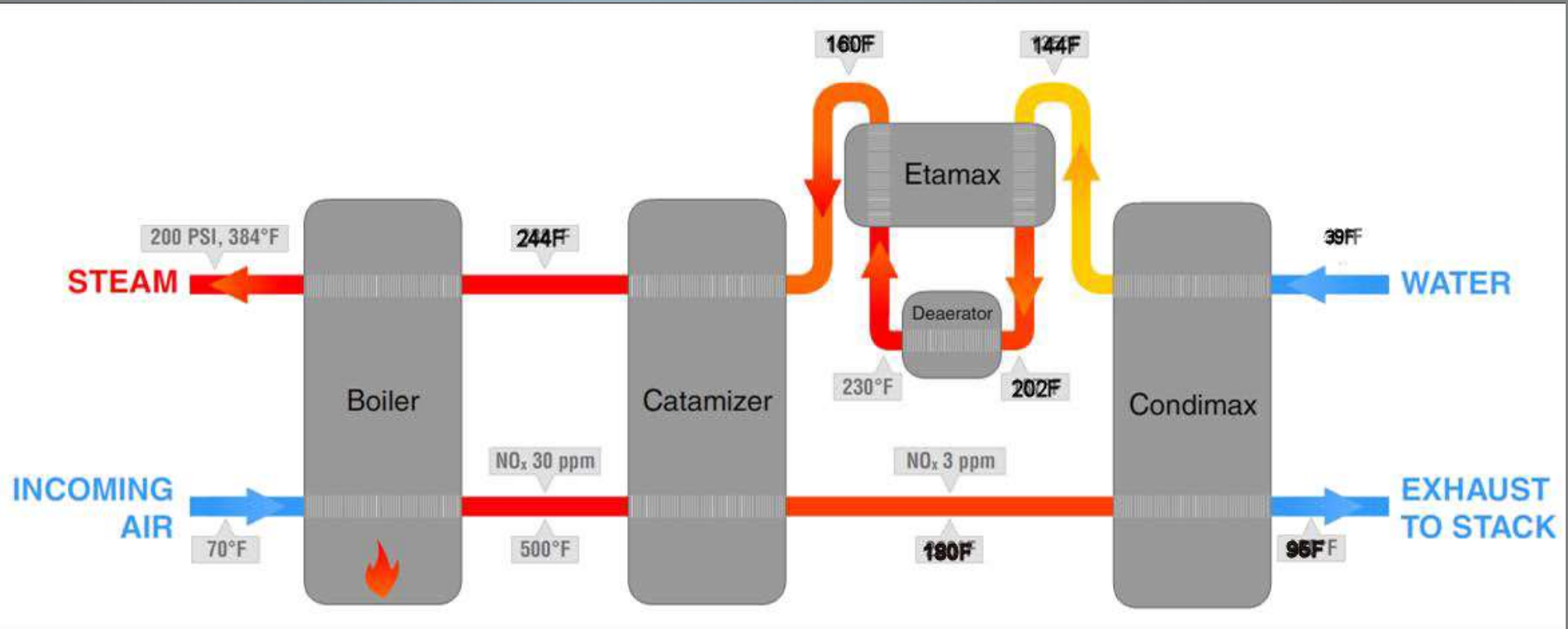
- The award was based on three criteria
 - Emissions Compliance Regulation NOx < 5ppm
 - Emissions Compliance + Maintain Plant Capacity of 650,000 pph
 - Emissions Compliance + Increased Capacity + Improved Efficiency greater than 84%

Project Outline

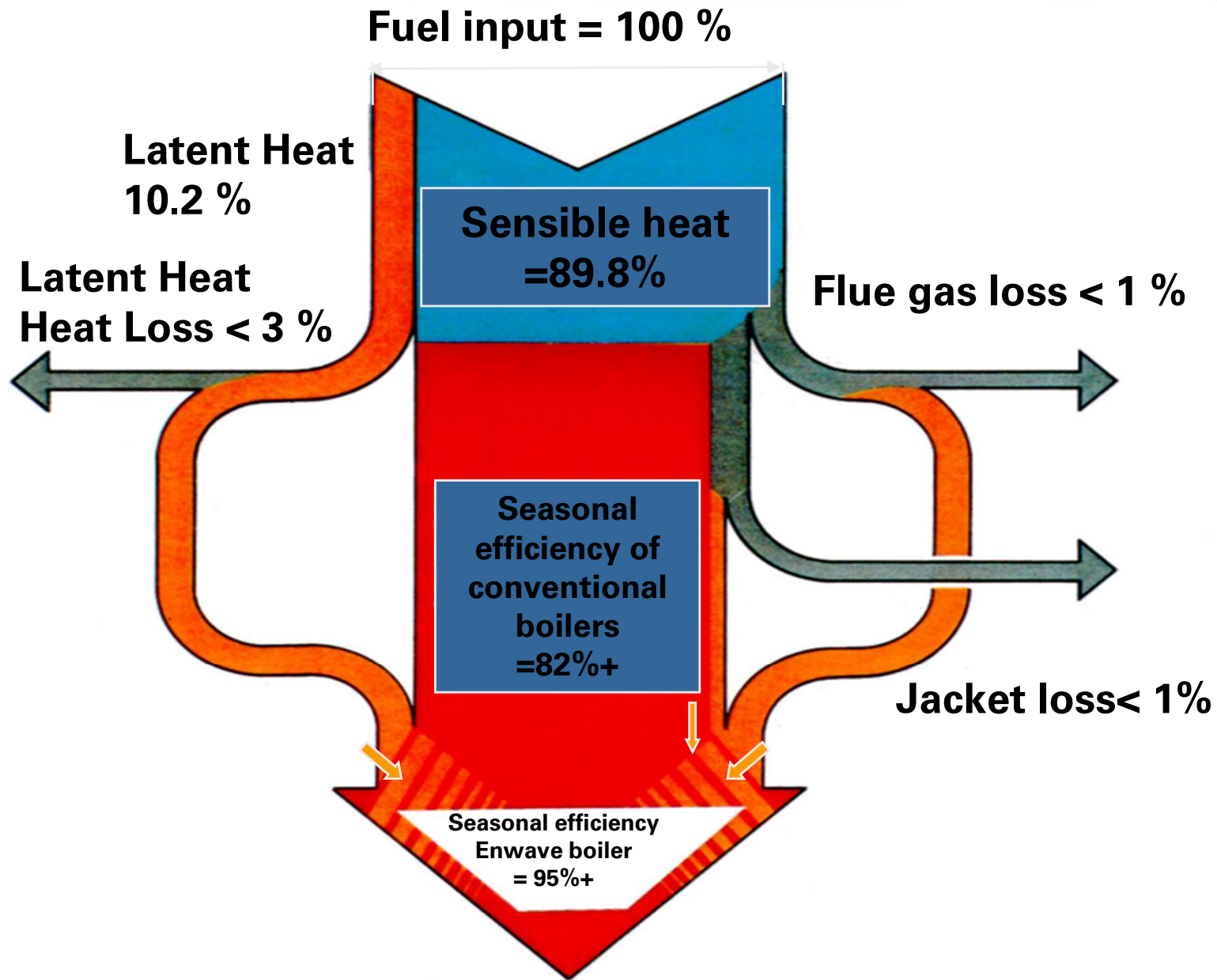
- Two Stage NOx reduction
 - CompuNOx – 25ppm NOx
 - Low Excess Air – Higher Efficiency
 - FGR from breach
 - Selective Catalytic Reduction
 - Less than 3ppm NOx
- Heat Recovery
 - High Efficiency Economizer
 - 165F water in, 240F out. 2%O2 500Fin, 180F out
 - CondiMax Condensing Heat Exchanger
 - 39F 100% makeup water in, 142F out. 2%O2 180Fin, 90F out
 - 15.5gpm of water from flue gas @100klb/hour boiler load
 - Reduce the Visible Plume
 - EtaMax Recuperator Feedwater to Makeup water heat exchanger
 - 230F feedwater in, 165F out 142F makeup water in, 202F out



Simplified Process Diagram



ENWAVE BOILER HEAT FLOW

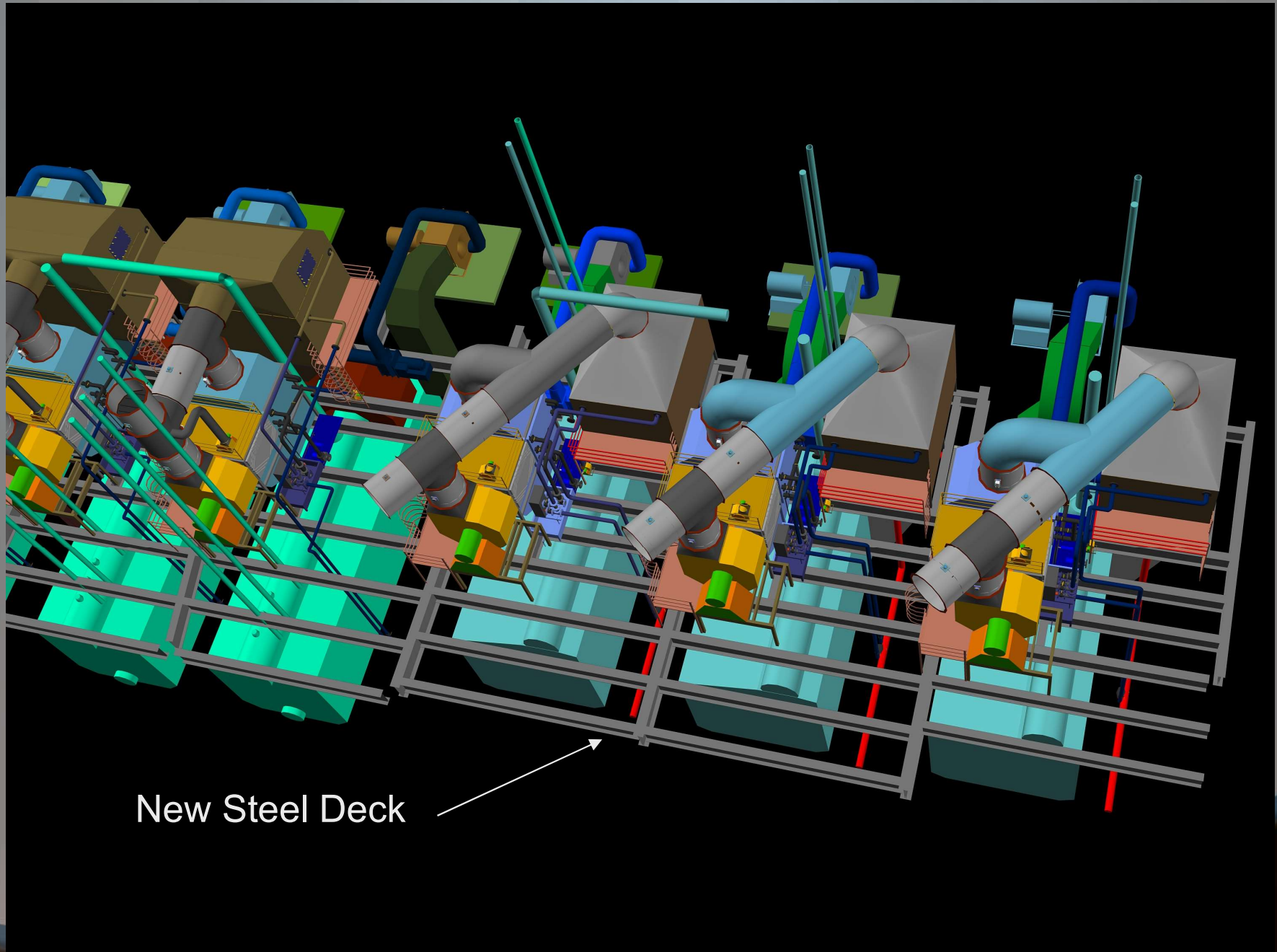


Challenge





How to Accommodate Equipment



New Steel Deck

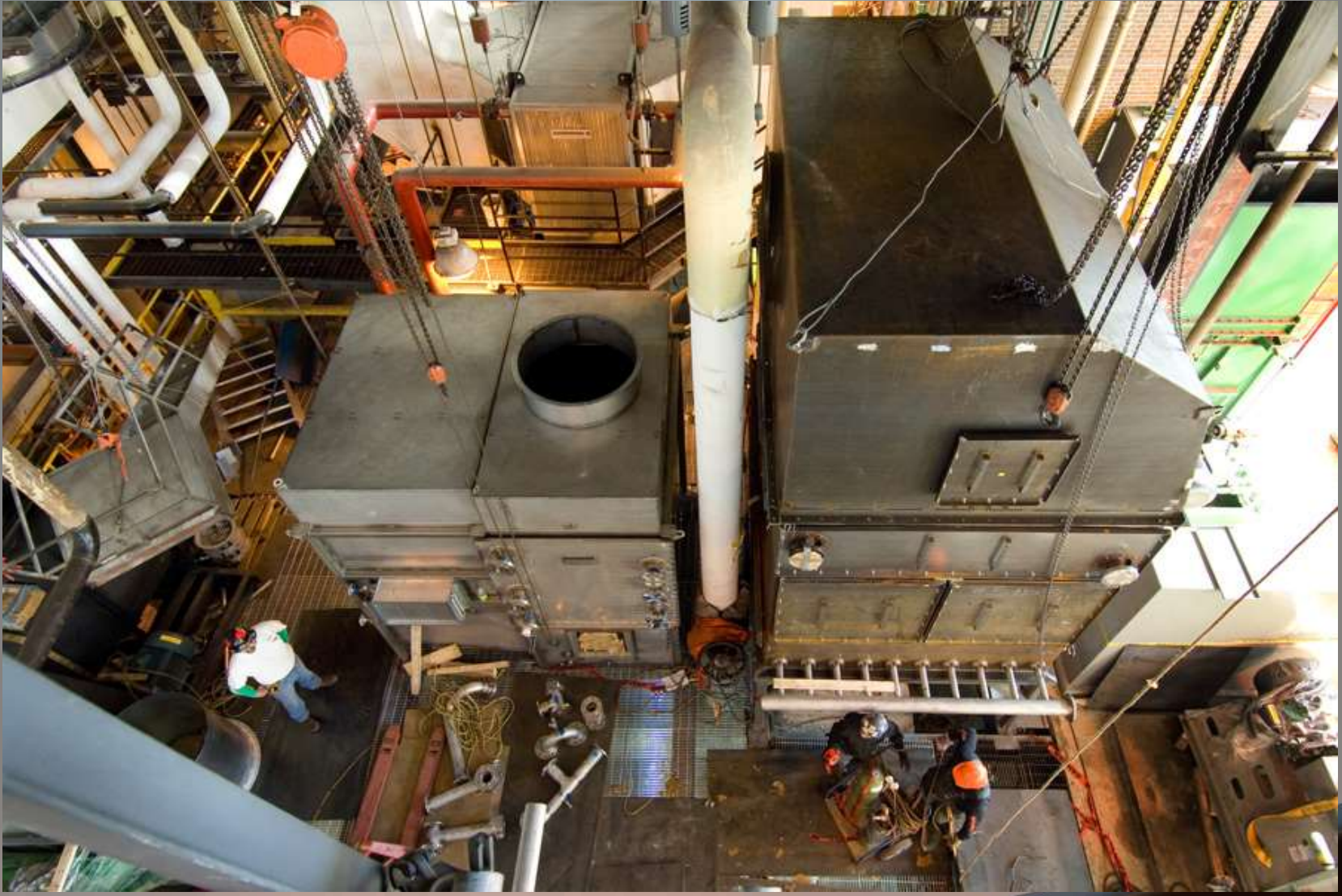


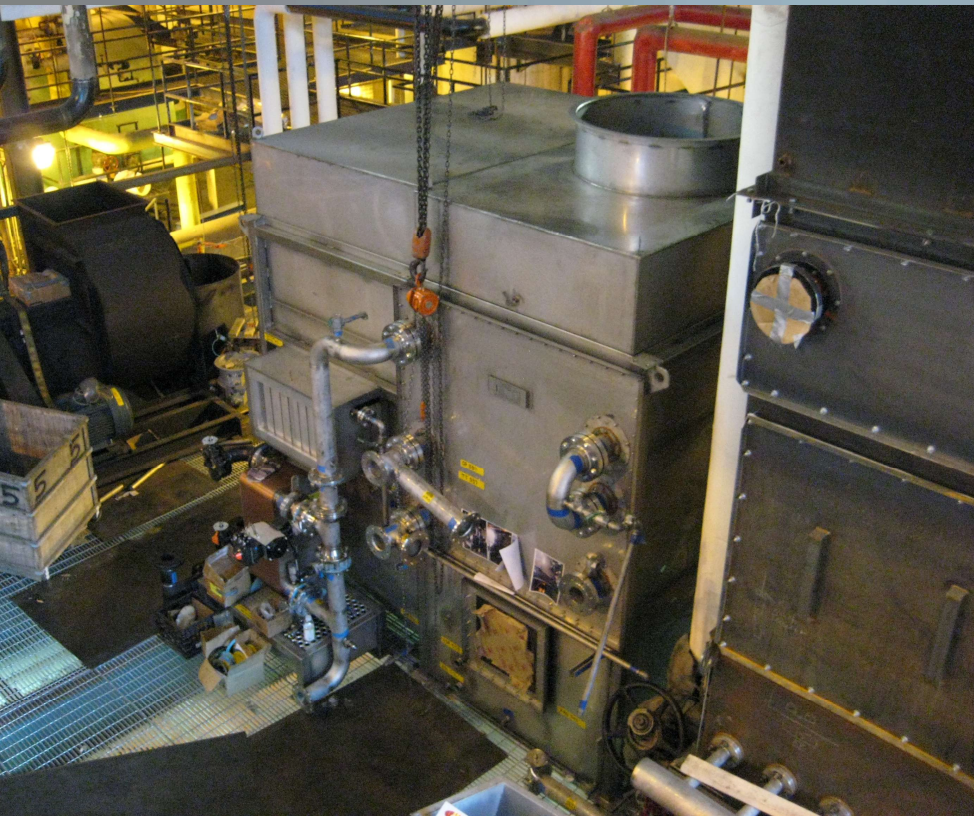
CataMizer

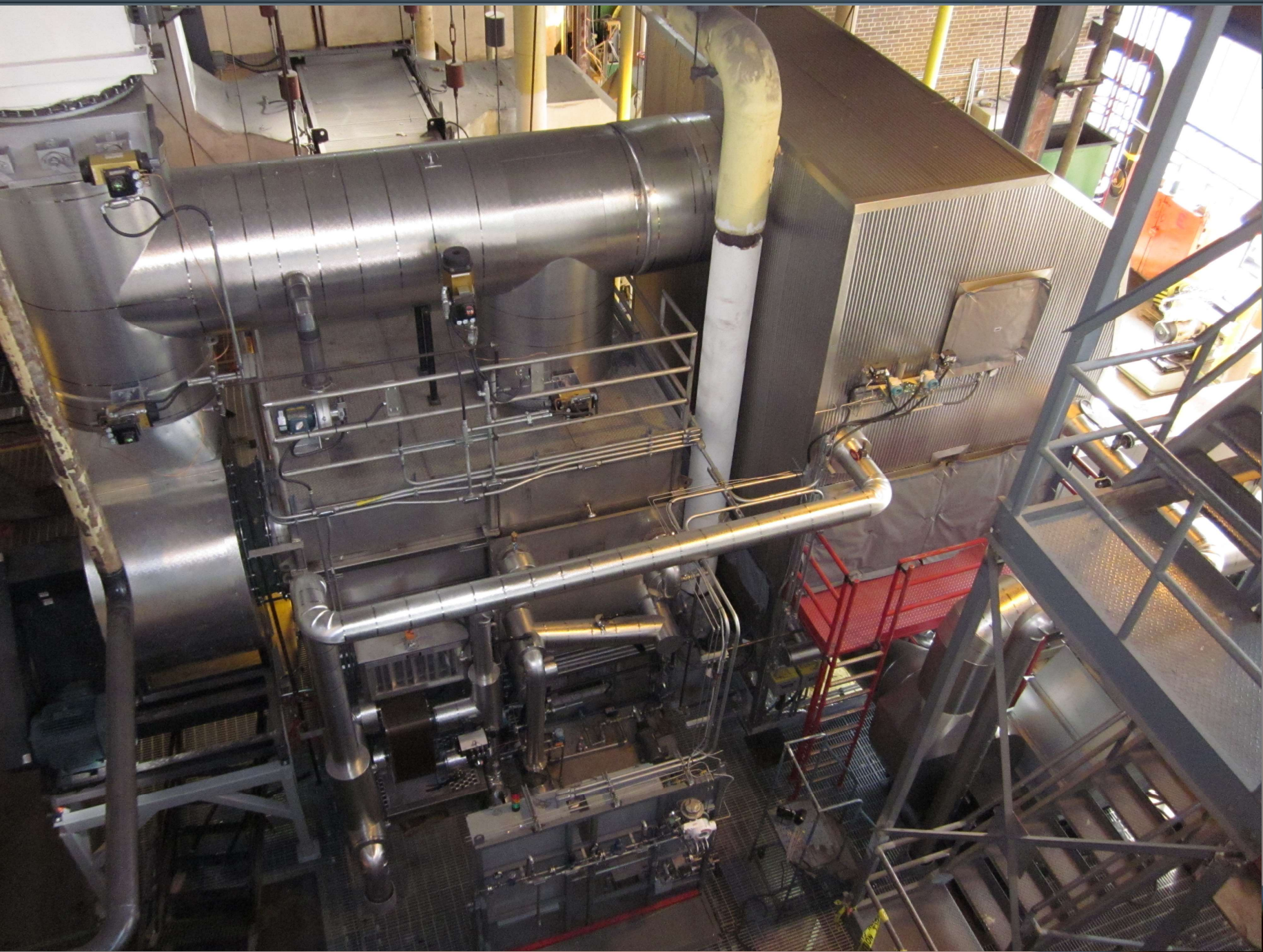
- Economizer, Catalyst and NH₃ Injection



Plant Remained in Operation







Environmental Benefits

- Reduce CO₂ production by 15,300 metric tonnes or approximately 22%
- Reduce NO_x production by 21 metric tonnes or approximately 91%
- Reduce fuel usage by 14%
- 10% of boiler H₂O recovery from flue gas
- Reduced noise pollution to 55 DB

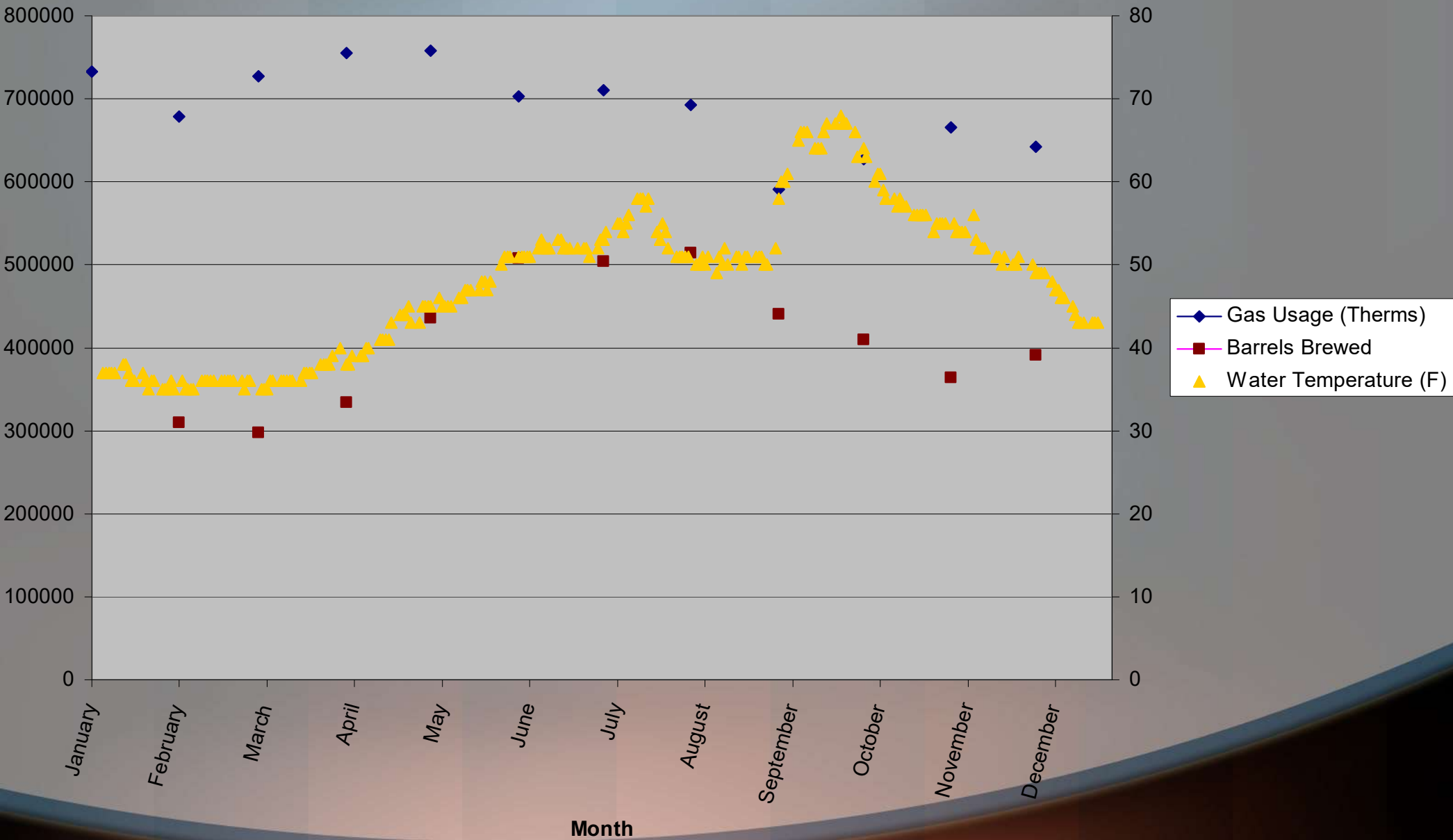


Conclusions

- Greater than 25 years additional service life
- Repeatable combustion control
- Efficiency up to 97%
- NOx below 3 ppm capability
- SCR for NOx trimming
- 200,000 PPH additional capacity
- Condensate recovery
- Nearly Invisible Plume



2009 Monthly Usage



QUESTIONS