

Reinhold Environmental Ltd.



2007 NOx Round Table & Expo
Presentation

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Combustion Strategies for NOx Control

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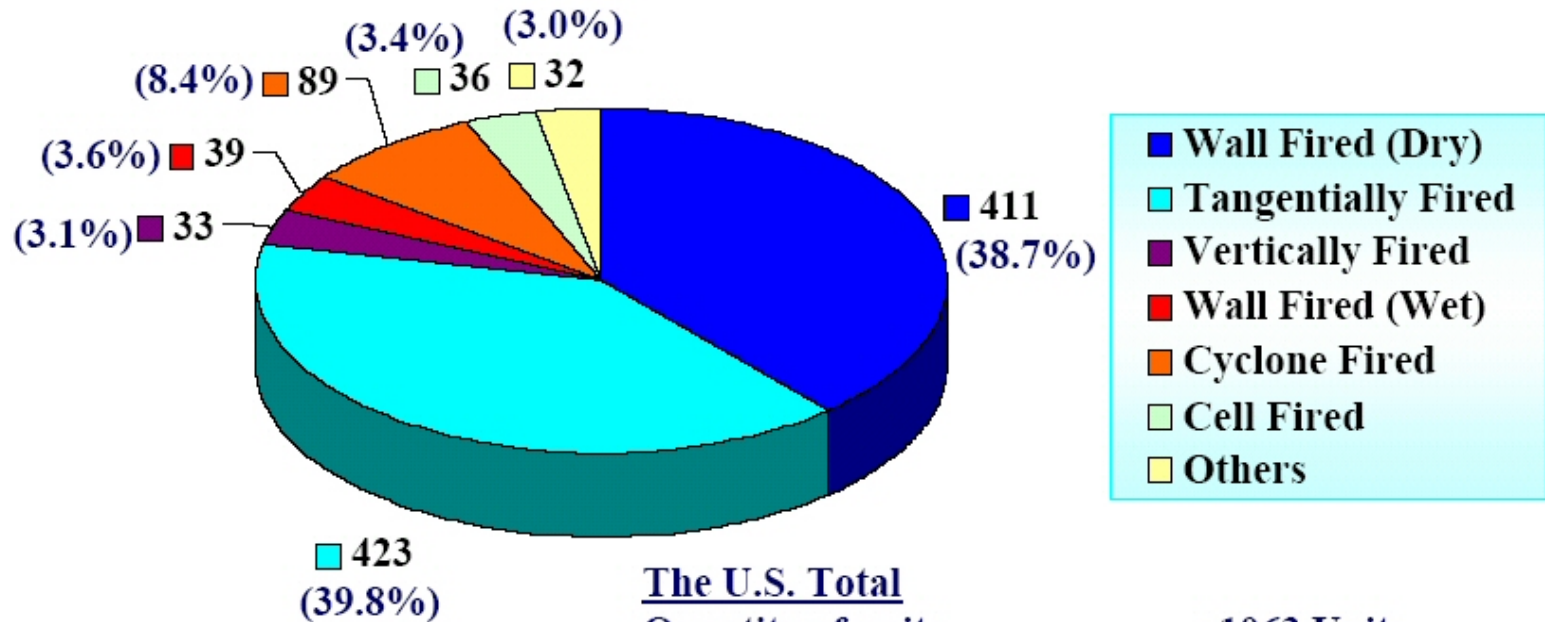
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Reaction Engineering International

Firing Configurations



The U.S. Total

Quantity of units : 1063 Units
Electric Generating Capacity : 327 GWe
NOx Emission : 5,996,000 ton/year

Source : DOE Fossil Energy – Low NOx Clean Technology Burners (1990)



Combustion-Based NO_x Control

- **Fuel Switching** (nitrogen content, volatility, nitrogen release rate, heat release)
- **Air Staging** (low NO_x Burners, overfire air, biasing)
- **Fuel Staging** (reburn)
- **Tempering** (flue gas recirculation, water/steam injection, air preheat reduction)
- **Oxygen Co-firing** (targeted injection, nitrogen minimization, CO₂ recycle)
- **Combustion Control/Optimization** (emissions monitoring, flame monitoring, advanced control)



Fuel Switching

- Most common is switch from hotter burning to cooler burning coal (e.g., bituminous to PRB)
- Can also include opportunity fuels
 - Tires, petcoke, RDF, biomass
- Potential balance of plant impacts
 - Corrosion
 - SO_2/SO_3 and Hg emissions
 - Carbon in fly ash (LOI)
 - Slagging
 - Firing rate, heat balance
 - Fuel Handling



NOx Control Technologies

Technology	NOx Reduction	Cost, \$/Ton NOx Removed	Potential BOP Impacts
Burner Modifications	10-30%	100-200	CO, LOI, slagging
Low NOx Burners	30-50%	200-400	CO, LOI, slagging, corrosion
Staging / Overfire Air	30-50%	400-1000	CO, LOI, slagging, corrosion
Fuel Reburn	20-30% FLGR, 30-60% conventional	500-2000 (strong fuel dependence)	CO, LOI, heat balance
Oxygen Enhancement	30-50% beyond OFA (want SR<0.8)	500-1000	Heat balance, efficiency
Controls / Optimization	0-30%	<100-300	Efficiency

