Sulzer Chemtech – Moving Ahead

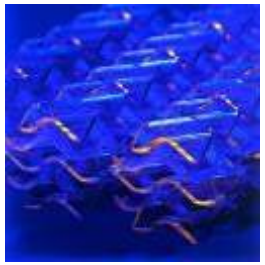
Static mixers for flue gas treatment applications

SULZER

Sulzer Chemtech

S. Hirschberg | 2011

Sulzer Chemtech: Leading in static mixing technology

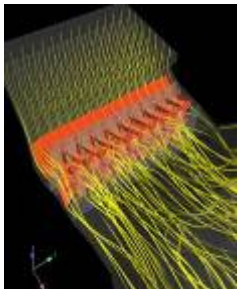


1970 Invention of Static Mixing Technology (SMV-Mixer)

1980 Introduction of SMX

1985 First SMR Reactor

1990 First PS-production plant



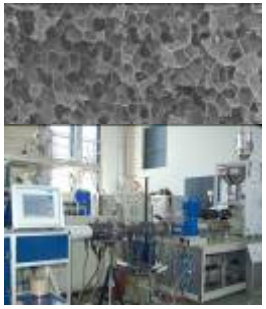
1995 CFD-simulation

2002 First CompaX

- More then 50 applied patents
- More then 40 years experience
- More then 100'000 references worldwide

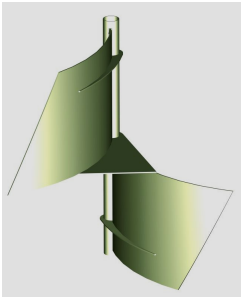
2009 Introduction of SMX plus

2008 First sold PLA production plant



2007 Introduction Optifoam Extrusion

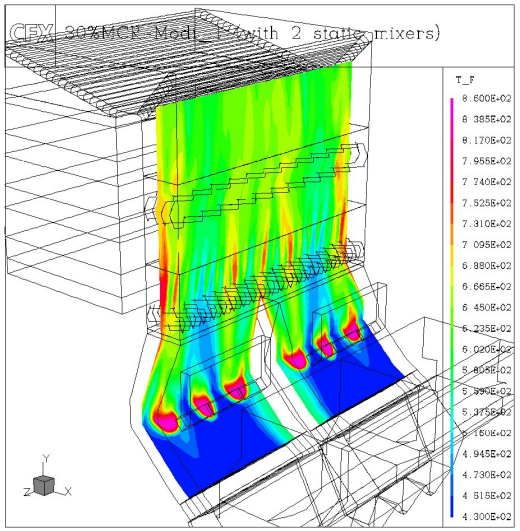
2006 First EPS-production plant



2004 First Contour

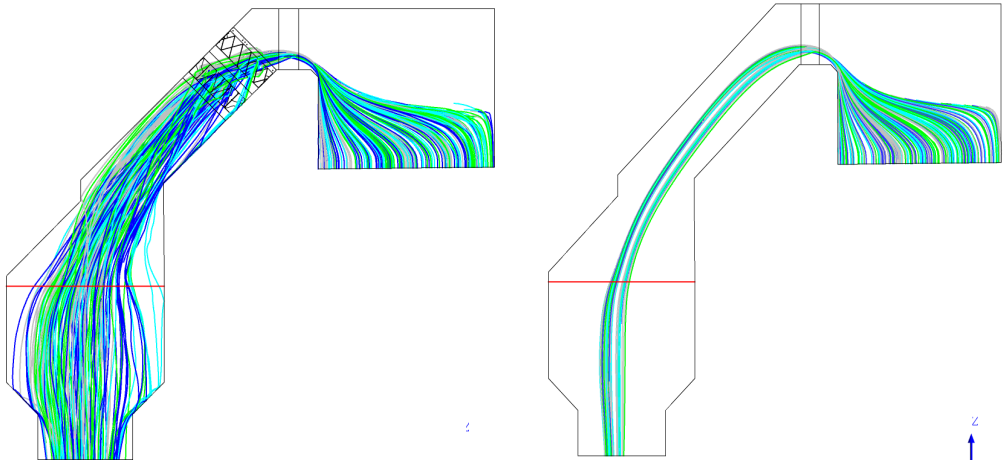
With Sulzer static mixing technology, you can …

- Increase NOx conversion of your SCR system
- Optimize the amount of catalyst necessary
- Reduce ammonia slip
- Achieve good DeNOx performance at all loads
- Homogenize temperature (hot bypass stream, filters, stack, …)
- Reduce operation expenses
- Increase catalyst life time
- Enhance filter efficiency
- Reduce service work



Temperature homogenization with Sulzer static mixers

Physical flow model with Sulzer Contour™ mixers



Dust homogenization with Sulzer SMV™ mixers

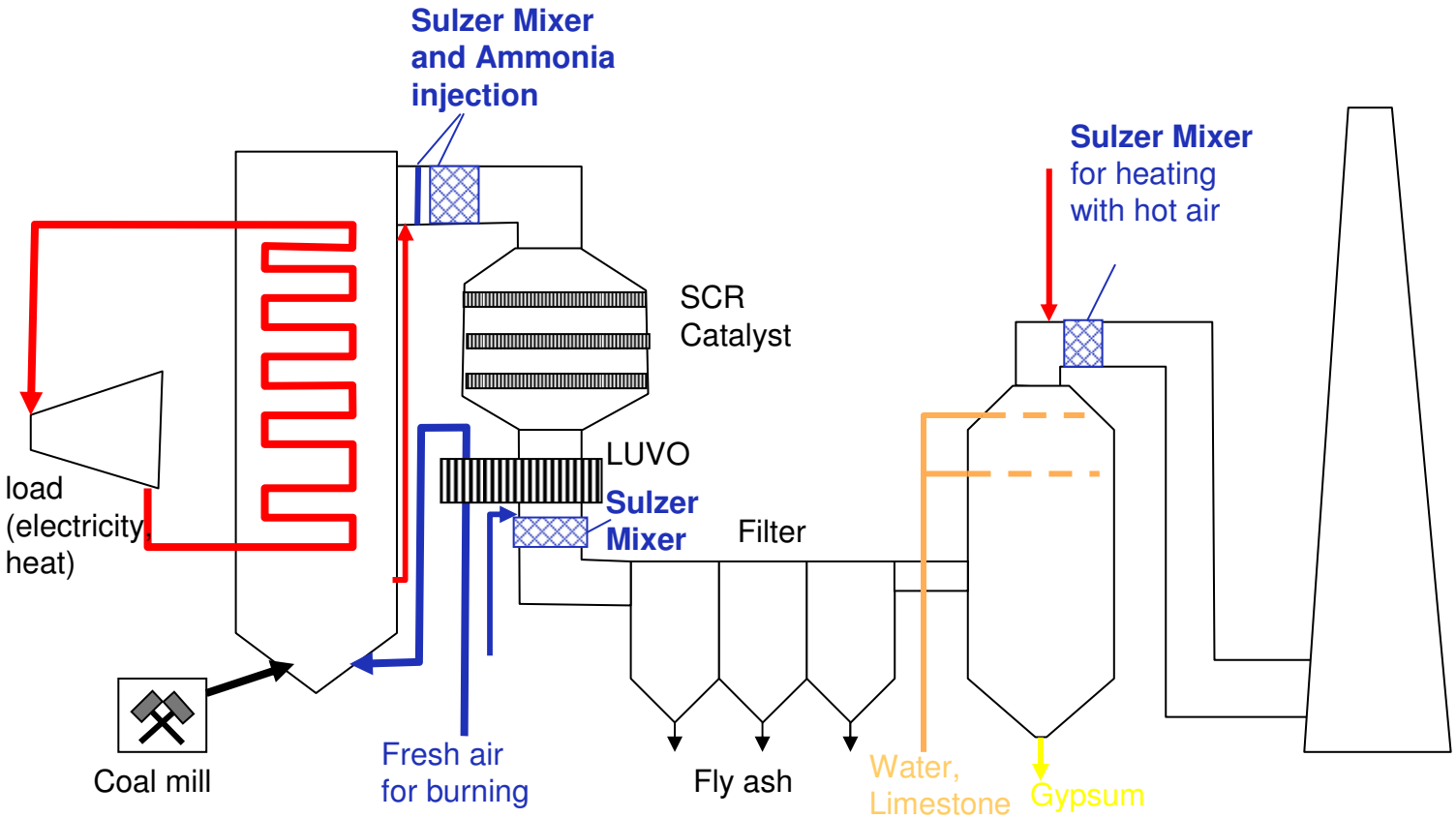
Sulzer products and services

- Static mixers for different installation sizes
  - Round ducts: **Sulzer CompaX™, Sulzer SMI™, Sulzer SMV™**
  - Rectangular ducts: **Sulzer Contour™, Sulzer SMV™**
- Ammonia Injection grids optimized for the static mixer to be used
- Wear protection coating for mixers and duct internals for operation with difficult dust
- CFD analysis and optimization of duct with AIG, mixers, turning vanes, flow rectifiers is part of the solution provided
- Physical flow modeling
- Development of static mixer configurations for equalization of dust distribution over the catalyst surface using CFD
  - For increase of catalyst life time
  - For prevention of fine dust clogging parts of the catalyst
- General analysis of large gas ducts for potential of pressure drop reductions as a service
- Performance guarantees

Applications of static mixing technology in thermal power stations

SULZER

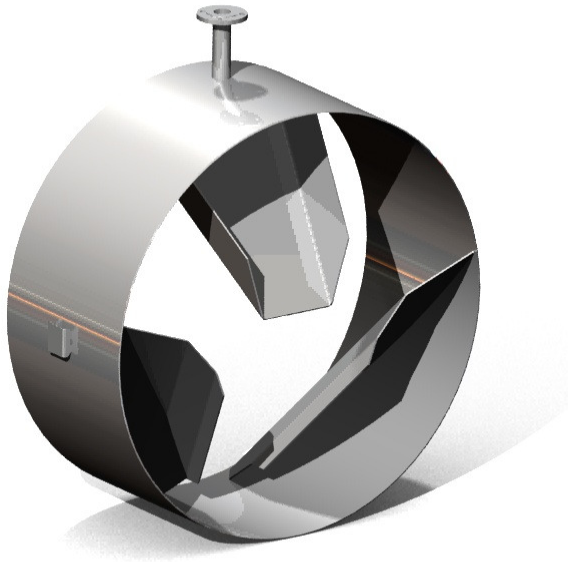
Sulzer Chemtech

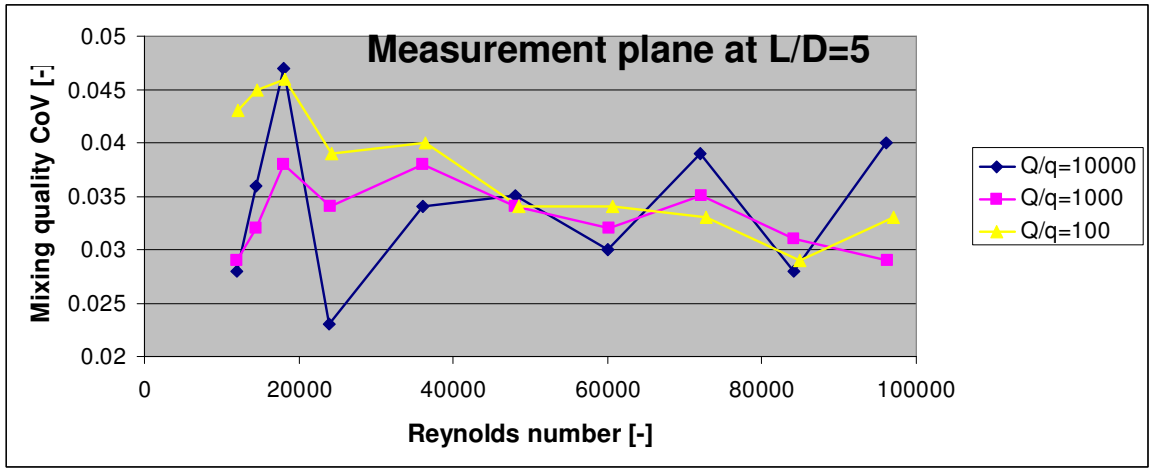


Sketch of a flue gas cleaning system with high dust SCR

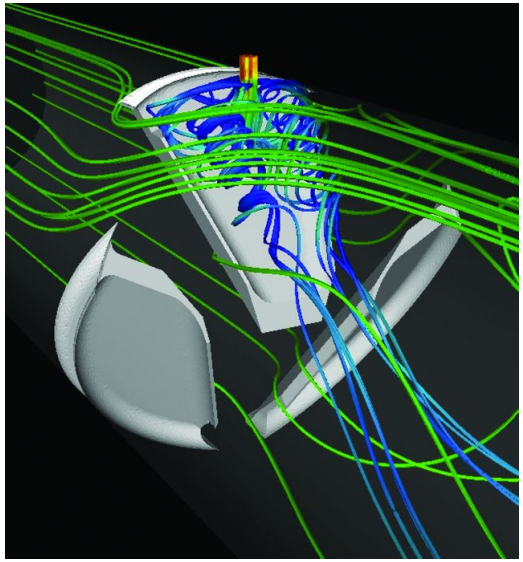
Sulzer CompaX™ Mixer

- Ideal for dosing of small additiv streams into turbulent main streams for round ducts
- Optimized geometry
- Works well for all mixing ratios between 1:10 down to 1:100000 and below
- No separate ammonia injection grid (AIG) necessary
- Homogeneous distribution after 3-5 diameters of the tube
- Low pressure drop



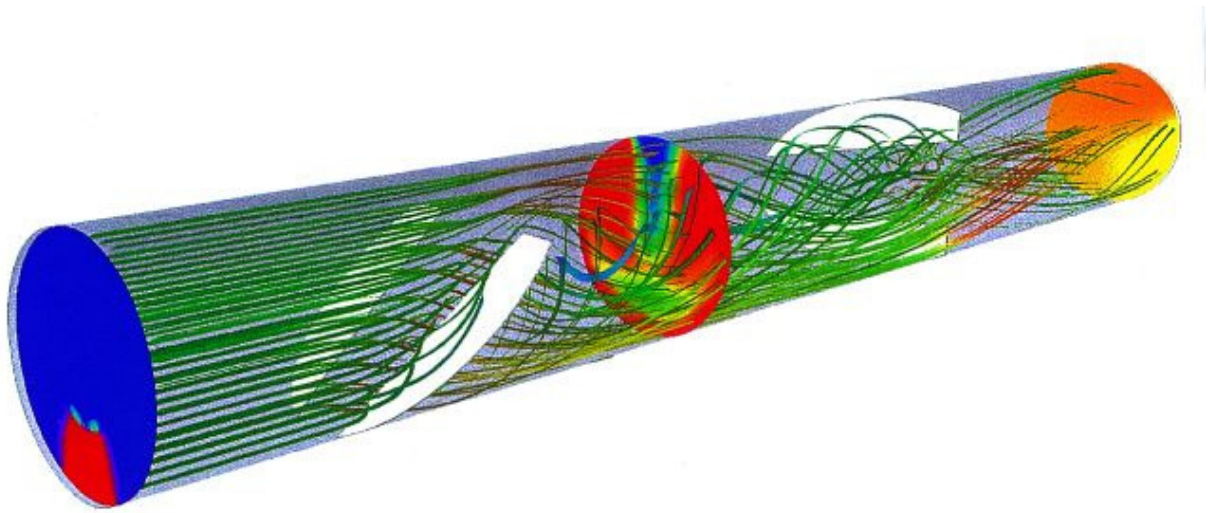


Resultats of experiments performed by BHR



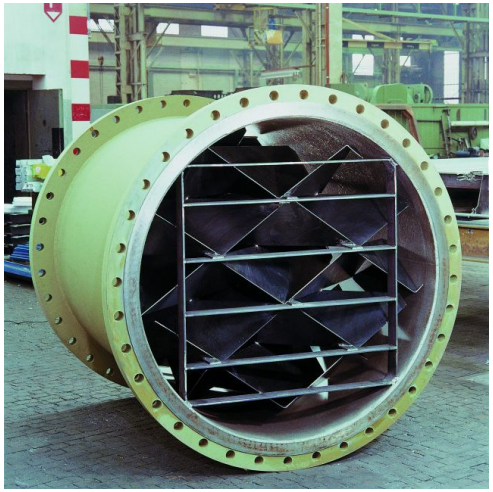
Sulzer SMI™ Mixer

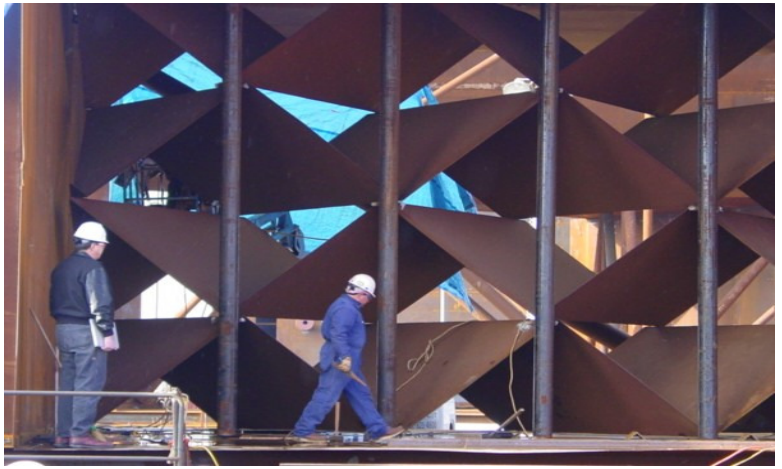
- Intense mixing of streams down to homogeneities below 1% RMS if needed
- Admixing of small additive streams
- Simple oprtimized ammonia injection lance
- Very good homogeneity 5 – 8 tube diameters downstream of the mixer inlet
- Low surface area, widely open flow cross sections
- Low pressure drop



Sulzer SMV™ gas mixer

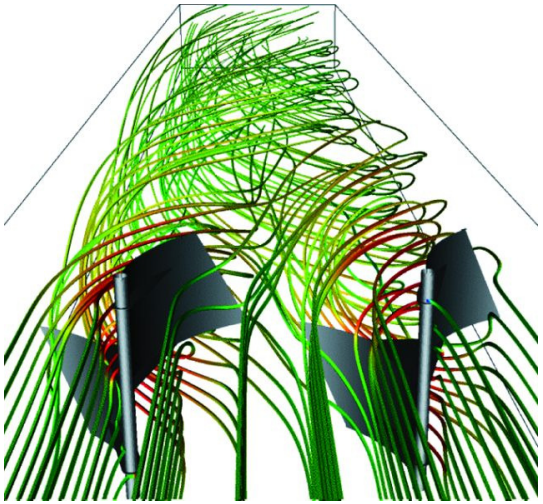
- Proven mixer technology
- Used in first large DeNOx applications realized in Germany in the 1980‘s. Many recent US references
- Compact design
- Very short mixing length possible with specially adapted ammonia injection grid (AIG)
- Mixing process already starts within the mixer
- Low pressure drop
- Standard design includes 2 mixers
- Well suited for dust distribution
- Erosion protection by coating critical parts of the mixer as an option

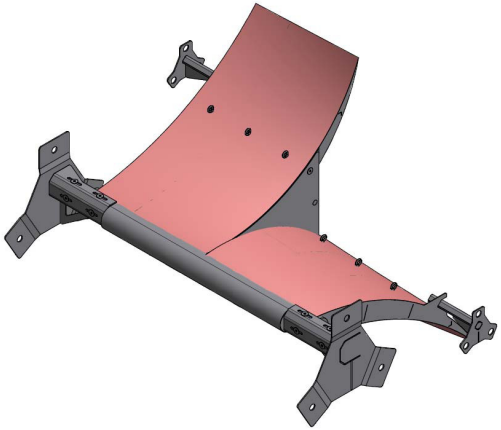


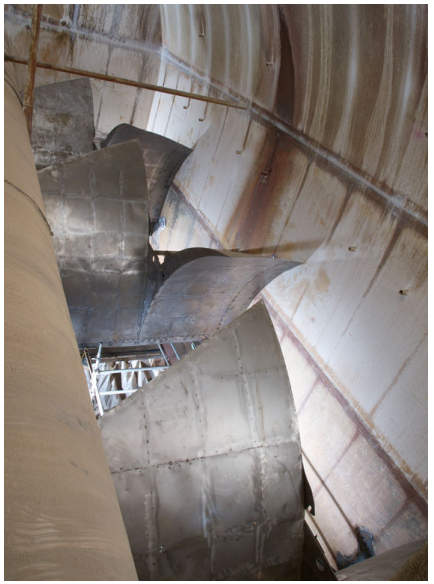


Sulzer Contour™ mixer

- New mixer with optimized streamlined design (no flow detachment)
- Extremely low pressure drop
- Very good homogeneity possible (below 1% RMS if required)
- Very short mixing length possible
- Cross flow mixing over large distances
- Customizable to the mixing problem at hand
- Ideal for applications both with liquid atomized NH4OH or vaporized dosing
- Erosion protection through coating as an option
- Low weight
- On site assembly from a number of compact parts for installation in existing flue gas ducts

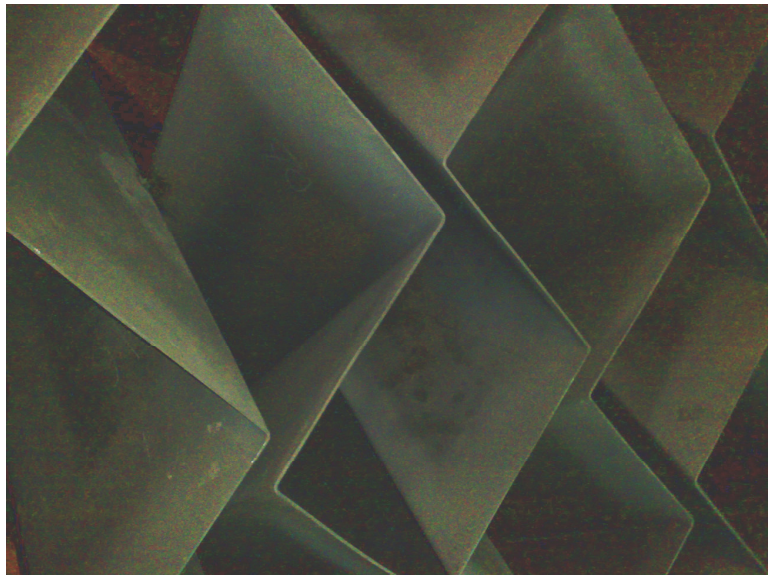






Erosion protection coating

- Thermal spray coating
- Arc wire based coating process
- General coating properties:
  - hard
  - ductile
  - good adhesion to substrate
- Properties of coating developed for this application
  - Hardness > 850 [HV 0,3]
  - Operating temperatures > 550 °C
- Coating can be applied in the workshop (mostly automated) or on site
- Significantly increased service life time for coated surfaces even in severely abrasive environments



References

References since the year 2000

Large scale SCR's utilizing Sulzer Mixer/AIG system

Plant	Engineer	Nr. of Reactors	Year	Plant	Engineer	Nr. of Reactors	Year
AES Cayuga Unit 1	Foster Wheeler	1	2000	TECO Big Bend 3	Sargent ¬ Lundy	1	2005
W.A. Parish Unit 5	Sargent ¬ Lundy	2	2001	Progress Energy Asheville 1 & 2	Worley Parsons	1	2005
W.A. Parish Unit 6	Sargent ¬ Lundy	2	2001	Dallman 4	Foster Wheeler	1	2006
W.A. Parish Unit 7	Sargent ¬ Lundy	2	2001	Elm Road	Hitachi	4	2006
W.A. Parish Unit 8	Sargent ¬ Lundy	2	2001	TECO Big Bend 1 and 2	Sargent ¬ Lundy	2	2006
CP&L Roxboro 1	Foster Wheeler	1	2002	SCE & G Cope	Alstom	1	2006
CP&L Roxboro 3	Foster Wheeler	2	2002	Empire Asbury	Alstom	1	2006
CP&L Mayo Unit 1	Foster Wheeler	2	2002	Springerville 4	Foster Wheeler	1	2006
Owensboro Elmer Smith Unit 1	Sargent ¬ Lundy	1	2002	Trimble County	Hitachi	2	2006
Exelon Mt. Creek Unit 8	Foster Wheeler	1	2002	Seminole	Hitachi	4	2006
Marion Unit 4 - SIPCO	Sargent ¬ Lundy	1	2001	Boswell	Hitachi	1	2007
Consumers Karn 1	Babcock & Wilcox	2	2001	McIntosh 3	Haldor Topsoe	2	2007
Consumers Karn 2	Babcock & Wilcox	2	2001	Longview	Foster Wheeler	2	2007
Consumers Campbell Unit 2	Babcock & Wilcox	2	2001	Hudson	Hitachi	2	2007
AES Petersburg Unit 2	Foster Wheeler	2	2003	Duke Cliffside	Hitachi	2	2007
AES Petersburg Unit 3	Foster Wheeler	2	2003	Mannheim	GKM	1	2008
Muskingum Unit 5	Foster Wheeler	2	2003	Puente Nuevo	Idrecco	1	2008
Consumers Campbell Unit 3	Foster Wheeler	2	2003	Mannheim	GKM	1	2009
Southern Company Gaston Unit 5	Haldor Topsoe	1	2004	BL England	Cormetech	1	2009
Springerville 3	Foster Wheeler	1	2004	Martin Lake	Hitachi	4	2010
AES Deepwater	Foster Wheeler	1	2005	Mannheim	GKM	1	2010
				Sostanj	Alstom	1	2011