

HAMON RESEARCH-COTTRELL, INC.



Isogo Plant

REACT™
Regenerative Activated Coke Technology



REACT™

Advanced Multi-Pollutant Control

ReACT™ (Regenerative Activated Coke Technology) is an advanced multipollutant technology that achieves simultaneous capture of SO_x, NO_x and mercury in one vessel.

The process was first developed in the 1970s in Germany, was subsequently advanced and commercialized in Japan where ReACT™ has been implemented at three large scale coal-fired power plants and at several steel mill and refinery applications:

- The J-Power 2 x 600 MW Isogo plant is among the world's lowest emissions coal fired power plant.
- EPRI demonstration testing at Valmy station yielded results confirming the Isogo operation.

Hamon Research Cottrell offers ReACT™ under a license agreement from J-Power Entech.

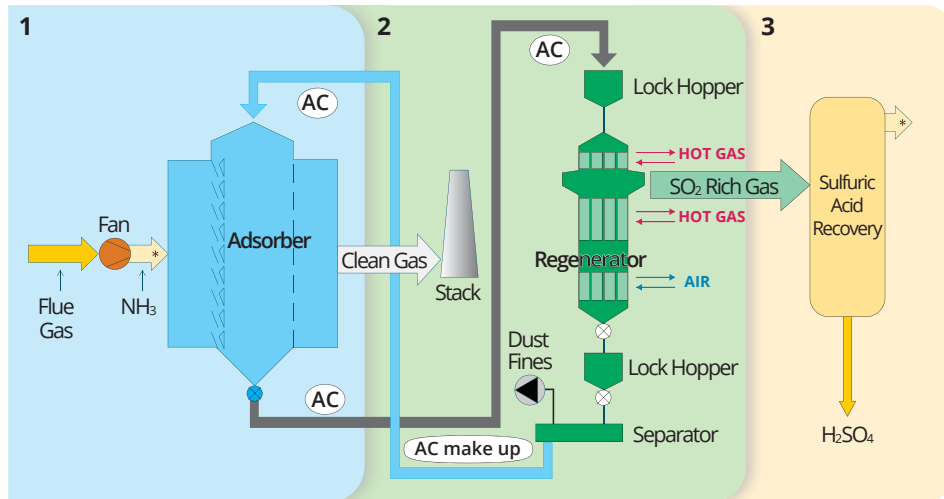
TYPICAL PERFORMANCE AT J-POWER ISOGO (SINCE 2002):

Pollutants	Emissions Permit	Operating Results		
		Efficiency	Inlet Concentration	Outlet Concentration
SO _x	10 ppm (0.025 lb/MMbtu)	>98%	<410ppm <0.85 lb/MMbtu	<1 ppm <0.002 lb/MMBtu
NO _x	13 ppm (0.02 lb/MMbtu)	10% to 50%	<20ppm 0.03 lb/MMbtu	<7ppm <0.011 lb/MMbtu
Particulate	5 mg/Nm ³ (0.004 lb/MMbtu)	>95% (>99.9% w/ESPs)	<100mg/Nm ³ <0.1 lb/MMbtu	<3mg/Nm ³ <0.002 lb/MMbtu (w/ backend ESP)
Hg	-	>90%	2.5 ug/Nm ³	<0.25ug/Nm ³

BENEFITS OF REACT™

- **By-Product Revenue** - Sulfuric acid is the world's number one commodity chemical with a market value of \$50-\$200 per ton. Instead of producing disposal gypsum or flyash/gypsum waste, ReACT™ produces saleable by-product.
- **Avoided Disposal Costs** - For every ton of SO₂ controlled in conventional FGD, about three tons of solid waste is generated. More if flyash is part of the FGD waste stream.
- **Near Zero Water Use** - ReACT™ uses minimal water, in significant contrast to FGD systems. For a 500 MW plant, a WFGD system would require 275,000,000 gallons per year while ReACT™ would use near zero.
- **Minimal Plant Modifications** - ReACT™ can flow to the existing stacks with no change in liner materials. ReACT™ is located downstream of existing equipment and does not necessitate modifications to upstream equipment.
- **NO_x Performance Options** - ReACT™ systems may be designed for a range of NO_x reduction options - from co-benefit levels of 30% through alternative designs reaching 80%.

THREE STAGE PROCESS



1) Adsorption - In the adsorber, flue gas and ammonia pass through a slowly moving bed of activated coke. The activated coke adsorbs SO_x and mercury at high efficiency and reduces NO_x as a co-benefit.

Activated Coke (AC) is produced from coal and activated by steam. It has high mechanical strength against abrasion and crushing and high specific surface area for adsorption.

2) Regeneration - AC with adsorbed SO_x and mercury is conveyed to the regenerator. Here, sulfuric acid or ammonium salts in the AC are thermally desorbed and decomposed to form a sulfur-rich gas steam for by-product recovery by thermal desorption.

After desorption the AC is cooled and passed through a vibrating screen to remove undersized particles. Replacement AC is added to the system, and the regenerated AC returns to the adsorber for use.

3) By-product recovery - The sulfur-rich gas from the regenerator is converted into a marketable sulfuric acid.

Activated Coke



Regenerated AC



FIRST U.S. COMMERCIAL INSTALLATION

Hamon Research-Cottrell has received the contract for the engineering, procurement and installation of a ReACT™ system at the 321-megawatt net Wisconsin Public Service Weston Power Plant, Unit 3.

The ReACT™ system will reduce plant SO₂ emissions by more than 90%, mercury by 90% or more, and provide additional co-benefit NO_x reduction, while producing approximately 50 MTD of industrial grade sulfuric acid for the market.

The project is scheduled to start up in Spring 2015.



ReACT adsorber roll feeders

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Hamon Research-Cottrell is part of the worldwide Hamon Group and is a major provider of air pollution control technology. HR-C serves the North American market from its main office in Somerville, NJ.

Hamon Research-Cottrell provides innovative clean air technologies to a wide array of industries including power generation, pulp & paper, petrochemical, chemical, glass, cement, steel, food, and pharmaceuticals. Hamon Research-Cottrell is a worldwide leading supplier of:

- Electrostatic Precipitators
- Fabric Filters
- ReACT™ multi-pollutant control technology
- Dry and Wet Flue Gas Desulfurization Systems
- DeNOx Systems (Selective Non-Catalytic Reduction - SNCR)
- Urea to Ammonia (U2A®) Systems
- ExxonMobil Wet Gas Scrubbers

Hamon Research-Cottrell provides solutions and project services that include new and retrofit equipment, engineering and fabrication, parts and aftermarket support, field services, trouble-shooting, fluid dynamics and specialty consulting.

INTEGRATED SOLUTIONS FOR A CLEAN ENVIRONMENT

The Hamon Group is a global source for engineering and contracting.

Its activities include the design, the manufacturing of critical components, the installation and the after-sale services of cooling systems, process heat exchangers, air pollution control (APC) systems, HRSG's and chimneys.

