



Modern Coal Fired Power Plants for Electric Generation

“We are passionate about innovation and technology leadership”

Steve Moorman
*Manager -Business Development
Advanced Technology*

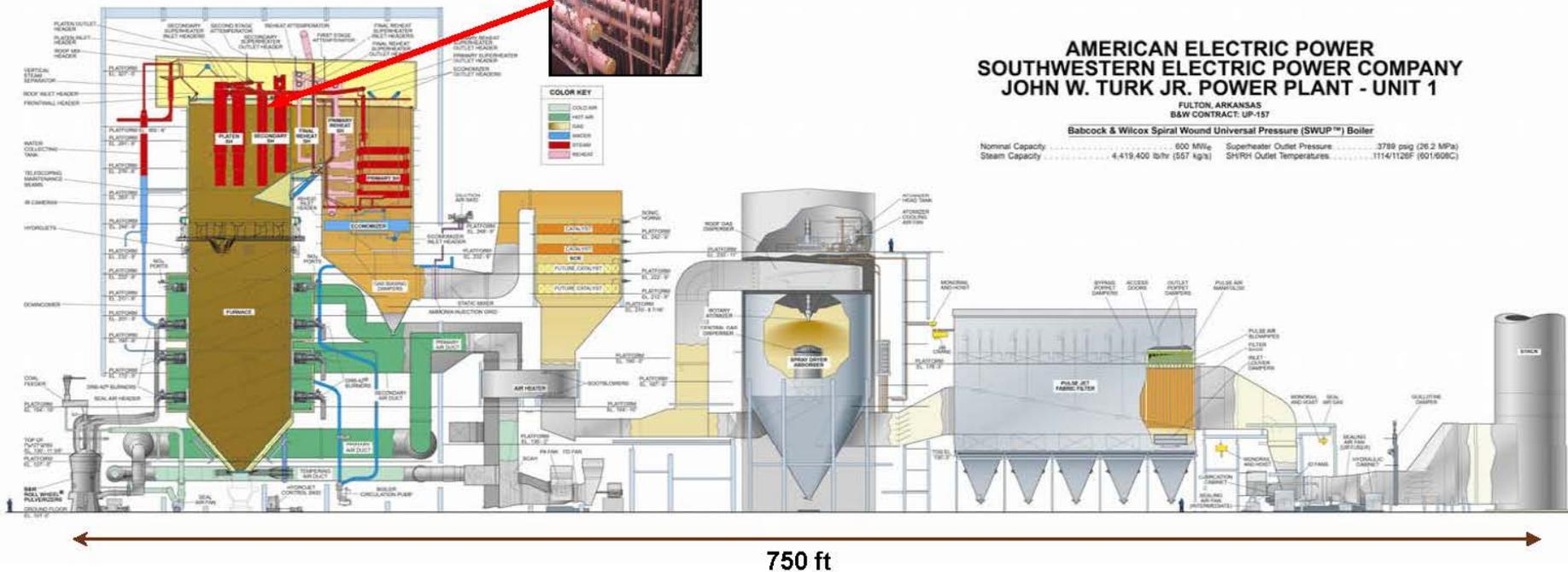


The Importance of Electricity to Economic Development

- **The success of any economy relies heavily on the ability to generate and deliver reliable, low cost electricity.**
- **Coal has provided a stable and low cost source of energy for electricity generation here in the US for over 100 years. Coal is now playing a major role in electrification of many developing countries.**
- **Over the last 50 years we have developed and deployed technologies here in the US that have improved power plant efficiency and reduced emissions of particulates, SO_x, NO_x and Hg from coal plants to a small fraction of what was emitted back in the 1960's and we did it at a reasonable cost. As their economies grow developing countries around the world are beginning to do the same.**
- **The US has been a major contributor to development and deployment of electric generation technologies around the world. These primarily include natural gas fired combustion turbines, coal fired steam turbine-generator systems, air quality control systems and nuclear power.**

First Ultra Supercritical Steam Electric Plant in the U.S. – 700 MW

Typical size = 350 to 1000MW for PC Designs

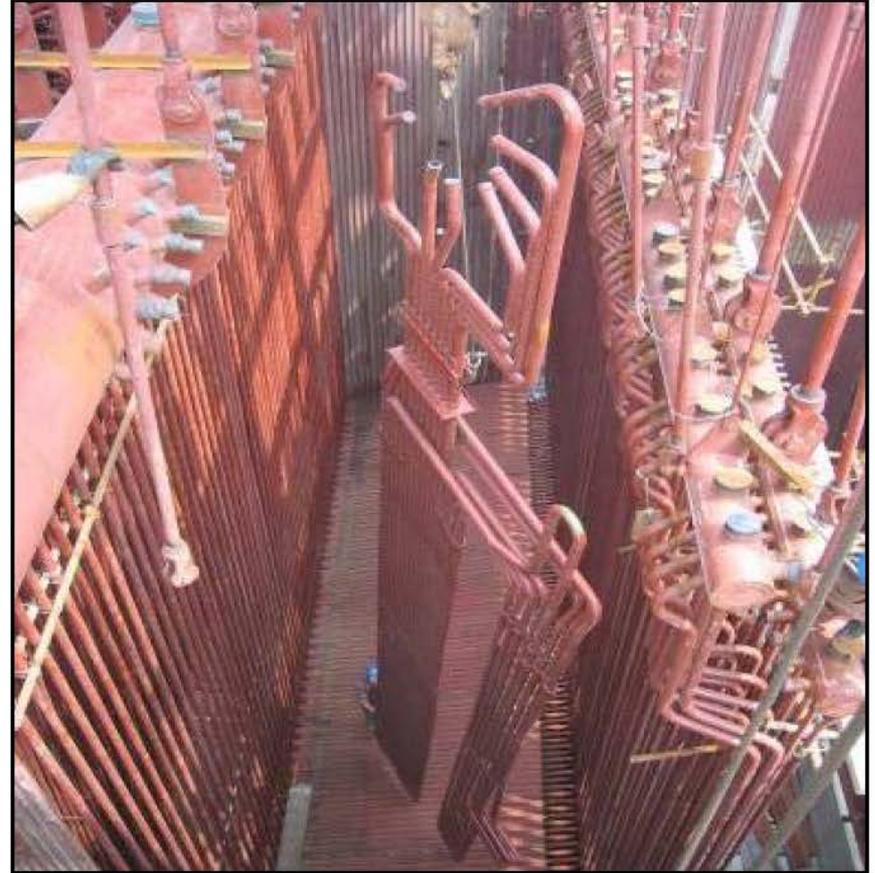


8,500 tons coal /day consumed, (77 train car loads/day @110 tons/car)
30,000 tons/yr SO₂ produced - 750 tons emitted with 98% SO₂ removal
4,600,000 tons/yr CO₂ emitted - 460,000 tons emitted with 90% CO₂ capture

Major Boiler Components - Sections



Top Side view of Pendant sections

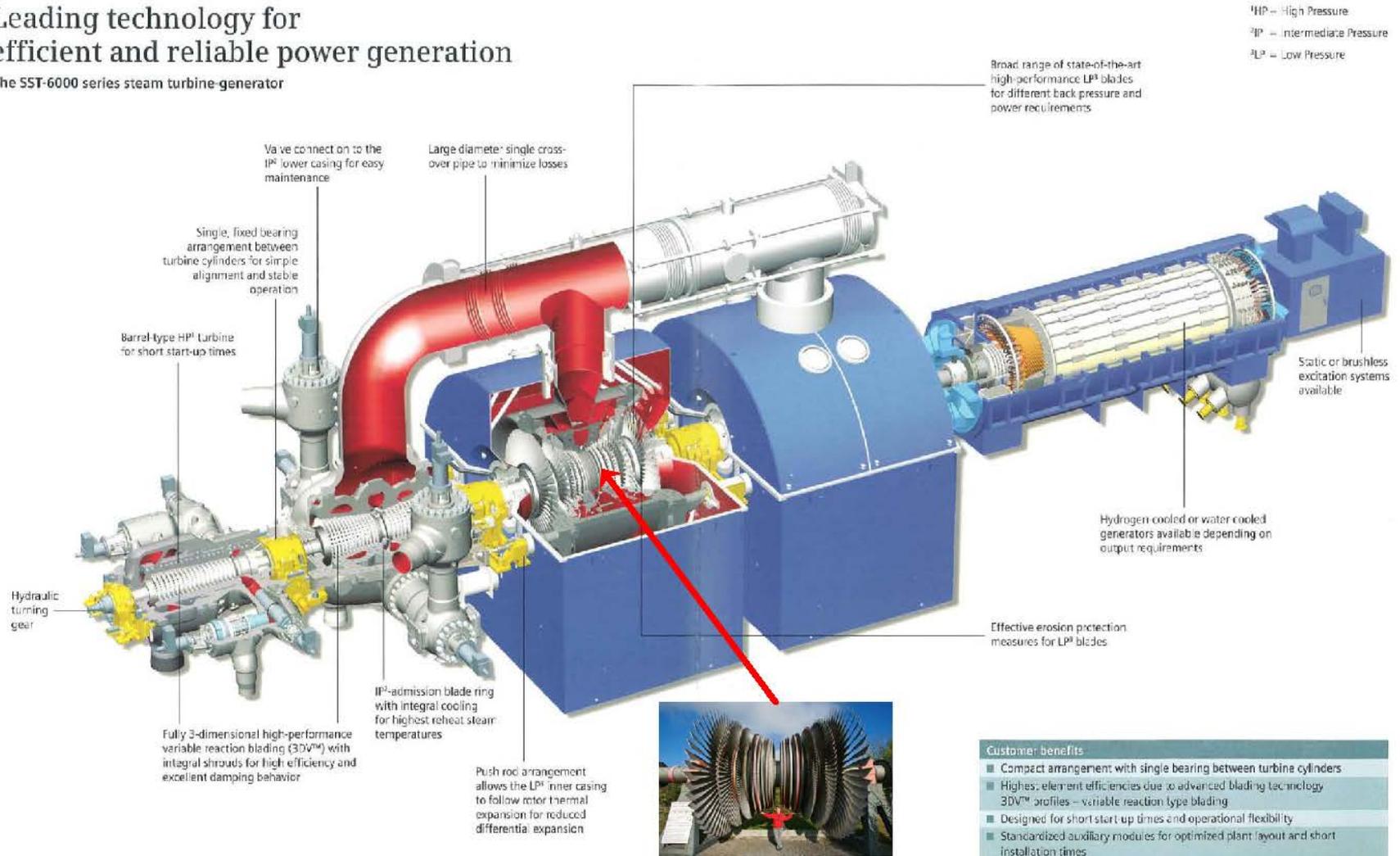


Reheater outlet section

Steam Turbine - Generator

Leading technology for efficient and reliable power generation

The SST-6000 series steam turbine-generator



- Customer benefits**
- Compact arrangement with single bearing between turbine cylinders
 - Highest element efficiencies due to advanced blading technology 3DV™ profiles – variable reaction type blading
 - Designed for short start-up times and operational flexibility
 - Standardized auxiliary modules for optimized plant layout and short installation times
 - High availability and reduced maintenance costs with 10 year major inspection intervals
 - Proven designs for applications in subcritical and supercritical steam and combined cycle power plants

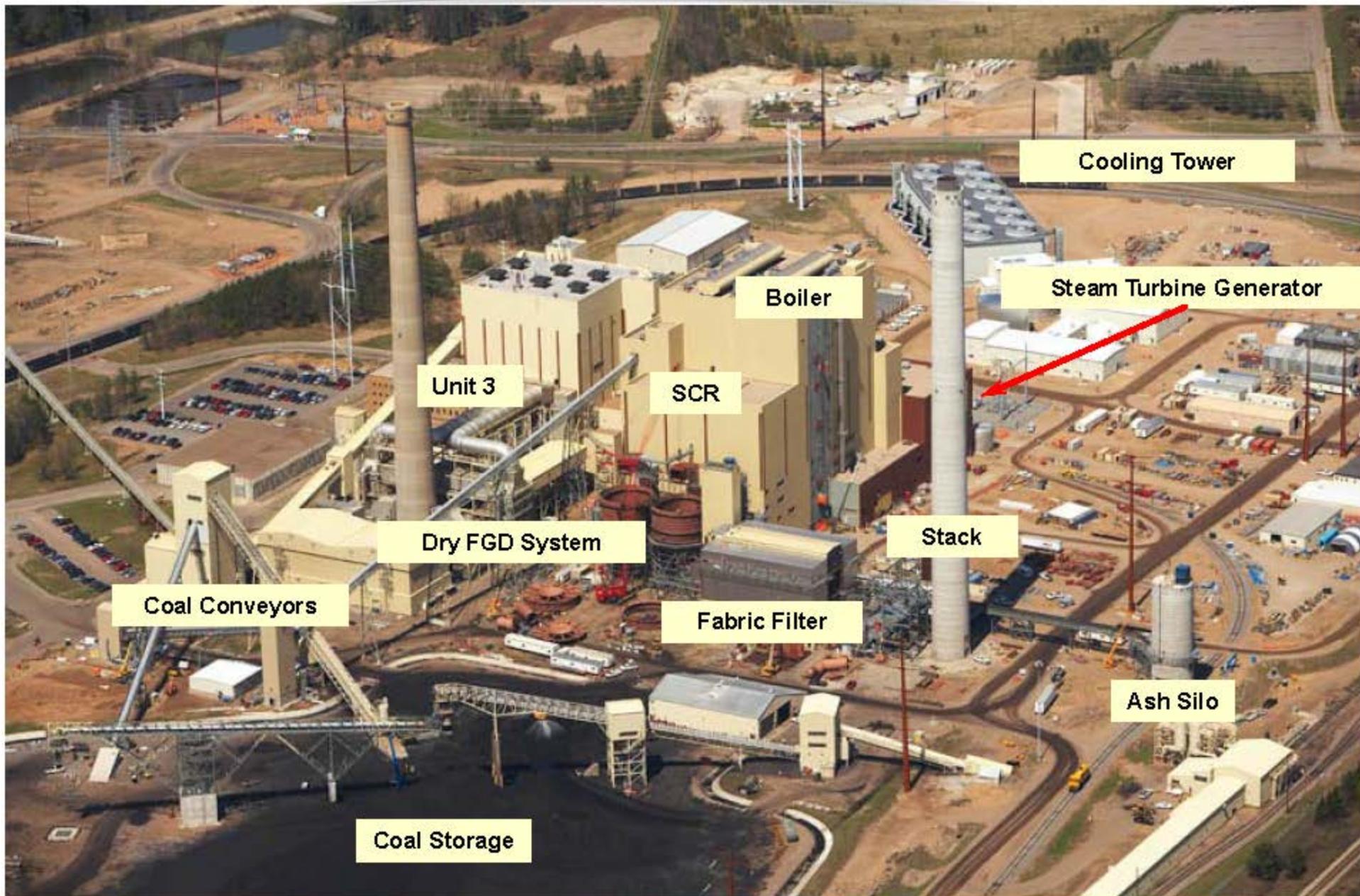
Steam Turbine - Low Pressure Rotor



Steam Turbine - Generator







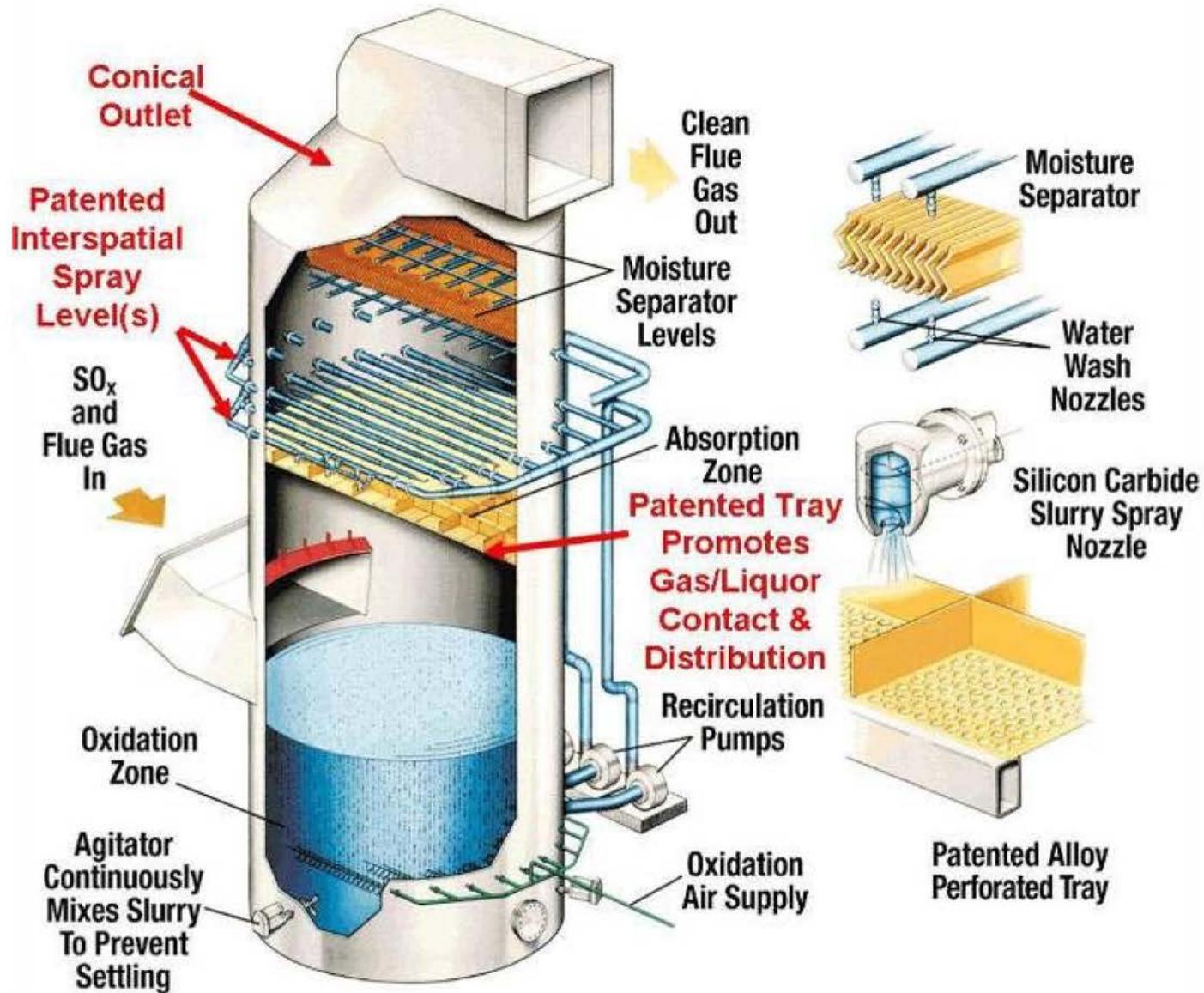
Public Service of New Mexico, San Juan 1-4



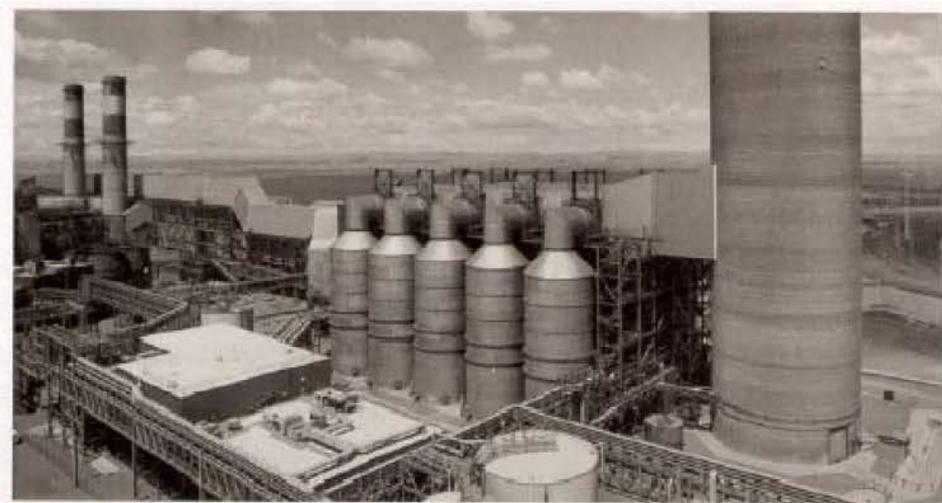
Wet Scrubber System for SO₂ Removal



B&W Wet FGD Absorber



SO₂ Scrubber evolution



Wet FGD Tower

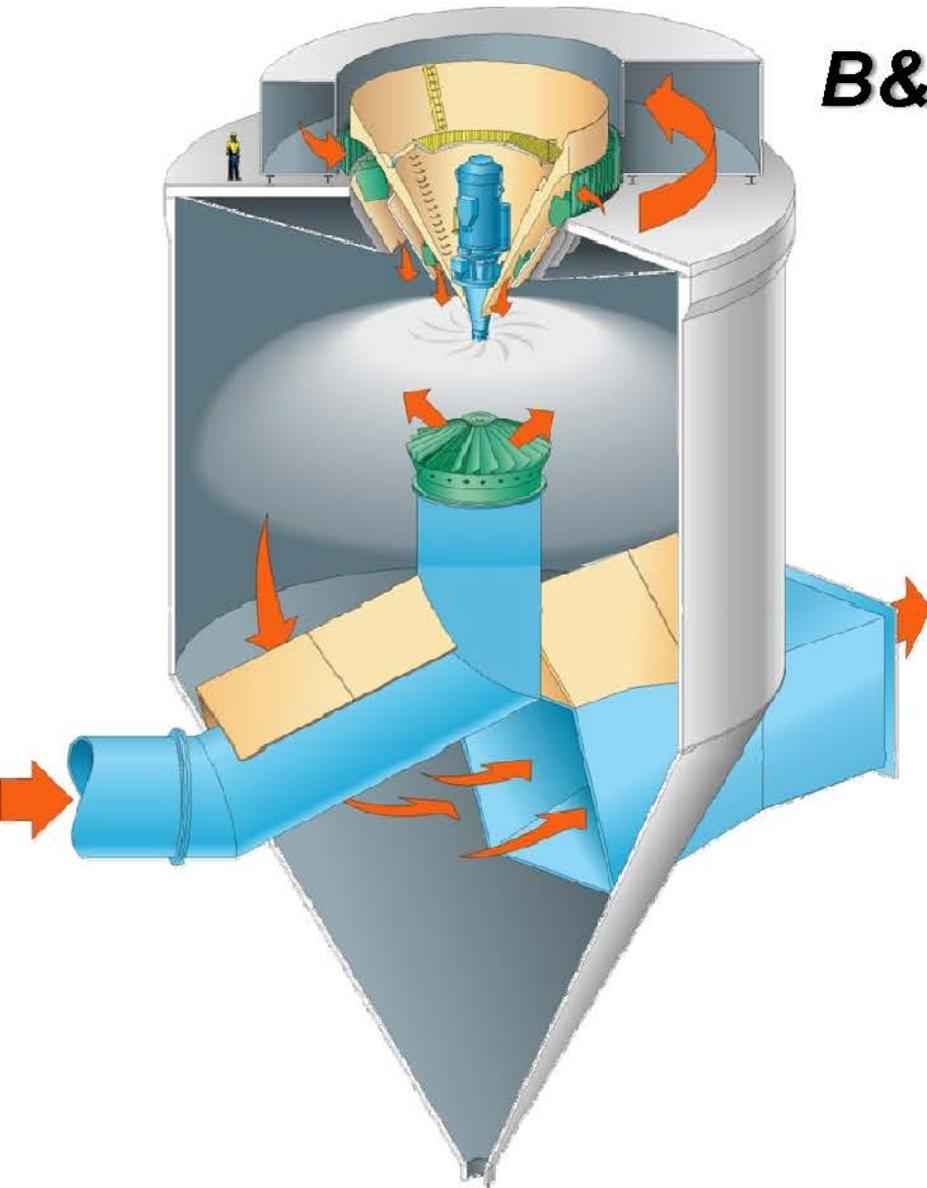


Modularization for Field Construction

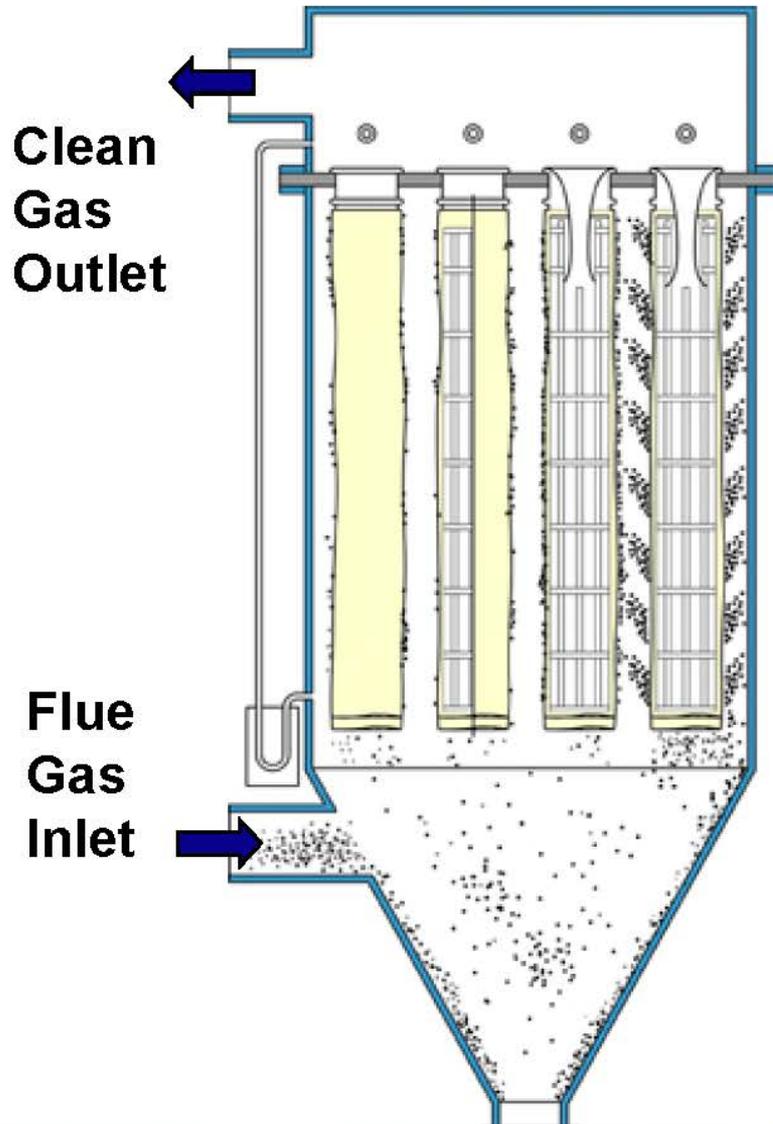
- **Field Labor Cost Savings**
- **Improved Product Quality**
- **Shorter Installation Schedule**
- **Enhance Site Safety**



B&W Spray Dryer Absorber



Pulse Jet Fabric Filter

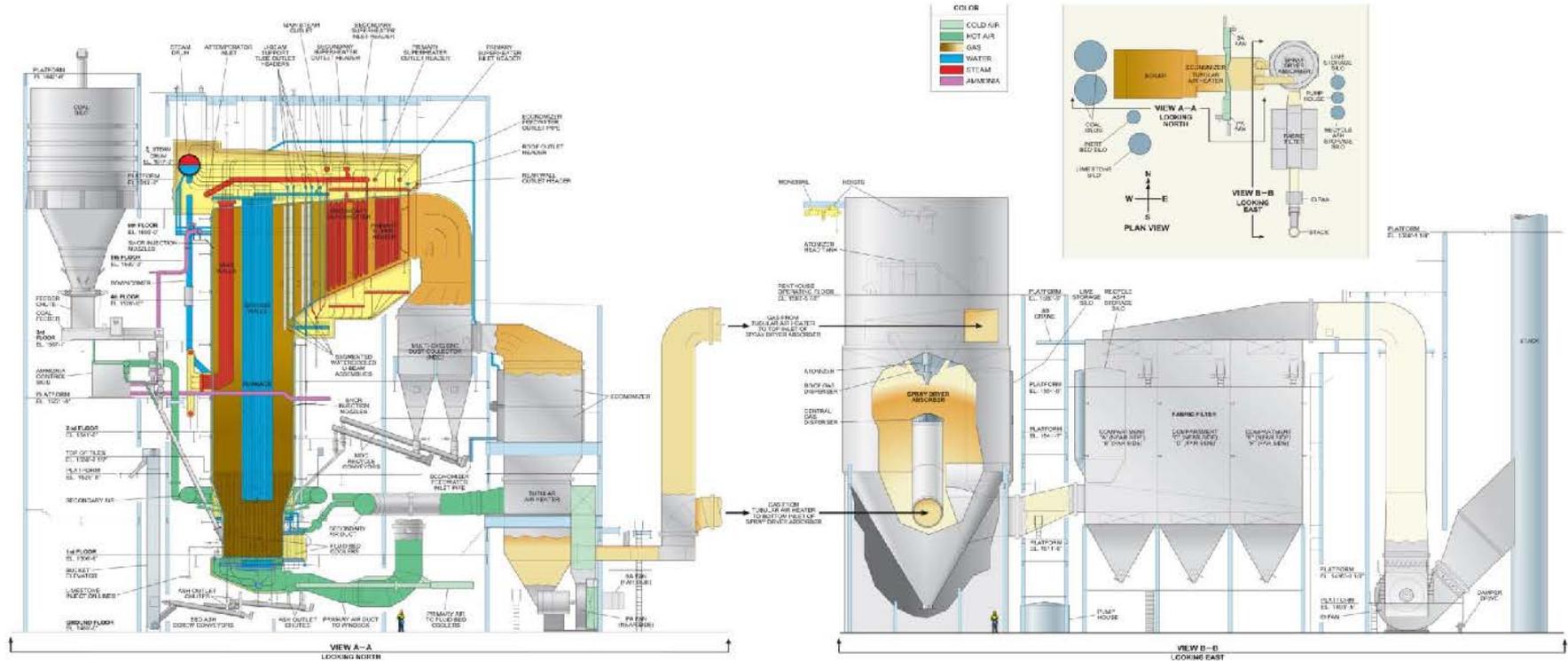


Plenum – Bag and Cage Installation



Circulating Fluidized Bed Boilers

- **Lower Quality Fuels - 15 to 350 MW**
- **Lower Base SO₂ and NO_x Emissions than PC**



**GREAT RIVER ENERGY
SPIRITWOOD STATION
SPIRITWOOD, NORTH DAKOTA**

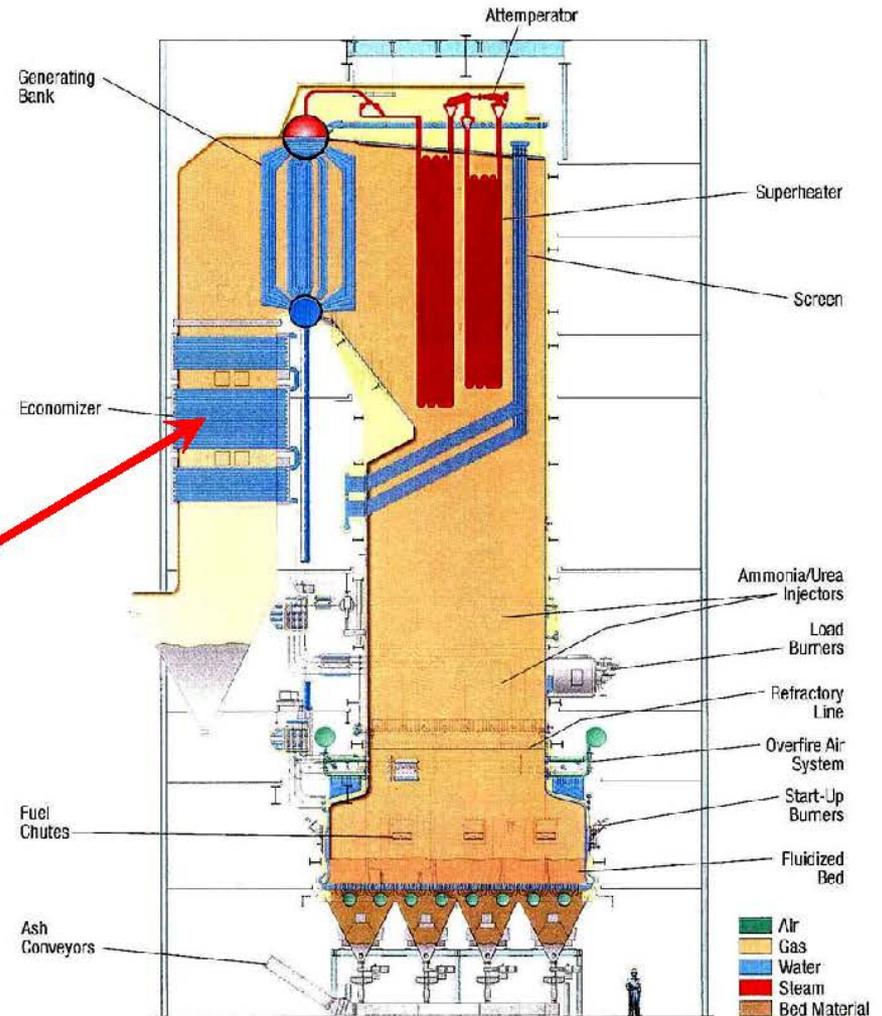
Babcock & Wilcox Circulating Fluidized-Bed Boiler

Steam Flow 895,000 lb/hr (101.4 kg/s)
 Steam Pressure 1780 psig (12.3 MPa)
 Steam Temperature 1006 F (541 C)

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Bubbling Fluidized Bed Boiler

- Low quality coals and biomass
- 10 to 100 MW Capacities





Economic Value of Power Plant Construction 700 MW Steam Electric Plant

- **Boiler - Engineering, Material, Transportation, Project Management - \$200 Million + \$200 Million Installation**
- **Steam Turbine Generator - Engineering, Material, Transportation, Project Management - \$100M + \$10M Installation**
- **SO2 Scrubber - Engineering, Material, Transportation, Project Management - \$70M + \$70M Installation**
- **Fabric Filter - Engineering, Material, Transportation, Project Management - \$20M + 22M Installation**
- **Balance of Plant Equipment - Engineering, Buildings, Steel, Electrical, Piping, Fuel Handling, Waste Handling, Controls, Fire protection, Roads, Cooling Tower - \$900M**
- **Owners cost - Project Development, Financing, Permits, Legal, Project Management, Owners Engineer - \$600M **Total Project cost - \$2.2 Billion****
- **Jobs – 200 Permanent Plant Jobs, 1000 Construction, 500 Engineering, 500 Manufacturing**

Babcock & Wilcox Vølund ApS *Startup 1898*

Esbjerg, Denmark

Offices in Glostrup & Aarhus, Denmark; Subsidiary in Paris, France

Size

- 134,000 ft² (40,903m²)

Employment

- 350

Markets

- Europe
- Far East

Products

- Waste-to-Energy plants
- Biomass combustion plants
- Grate and boiler service
- Power plant services
- Inconel cladding
- CFD (Computerized Fluid Dynamics) analysis
- Automatic combustion control
- Support burners
- Gasification systems



Babcock & Wilcox Beijing Company, Ltd.

Joint Venture 1986

Size

- ▶ **1,175,000 ft² (111,500 m²)**

Manufacturing capacity

- ▶ **2,700,000 man-hours**

Engineering capacity

- ▶ **200,000 man-hours**

Employment

- ▶ **2,250**

Markets

- ▶ **China**
- ▶ **Limited export**

Products

- ▶ **Industrial and utility boilers to 800 MW including MSW, CFB, UP, & RBC**





THERMAX Babcock & Wilcox Energy Solutions

Pune, India Joint Venture 2010



Babcock & Wilcox PGG Operations

