

# **DryFinishing™ to Improve Efficiency and Lower Emissions 5+ Years of Commercial Operations**

---

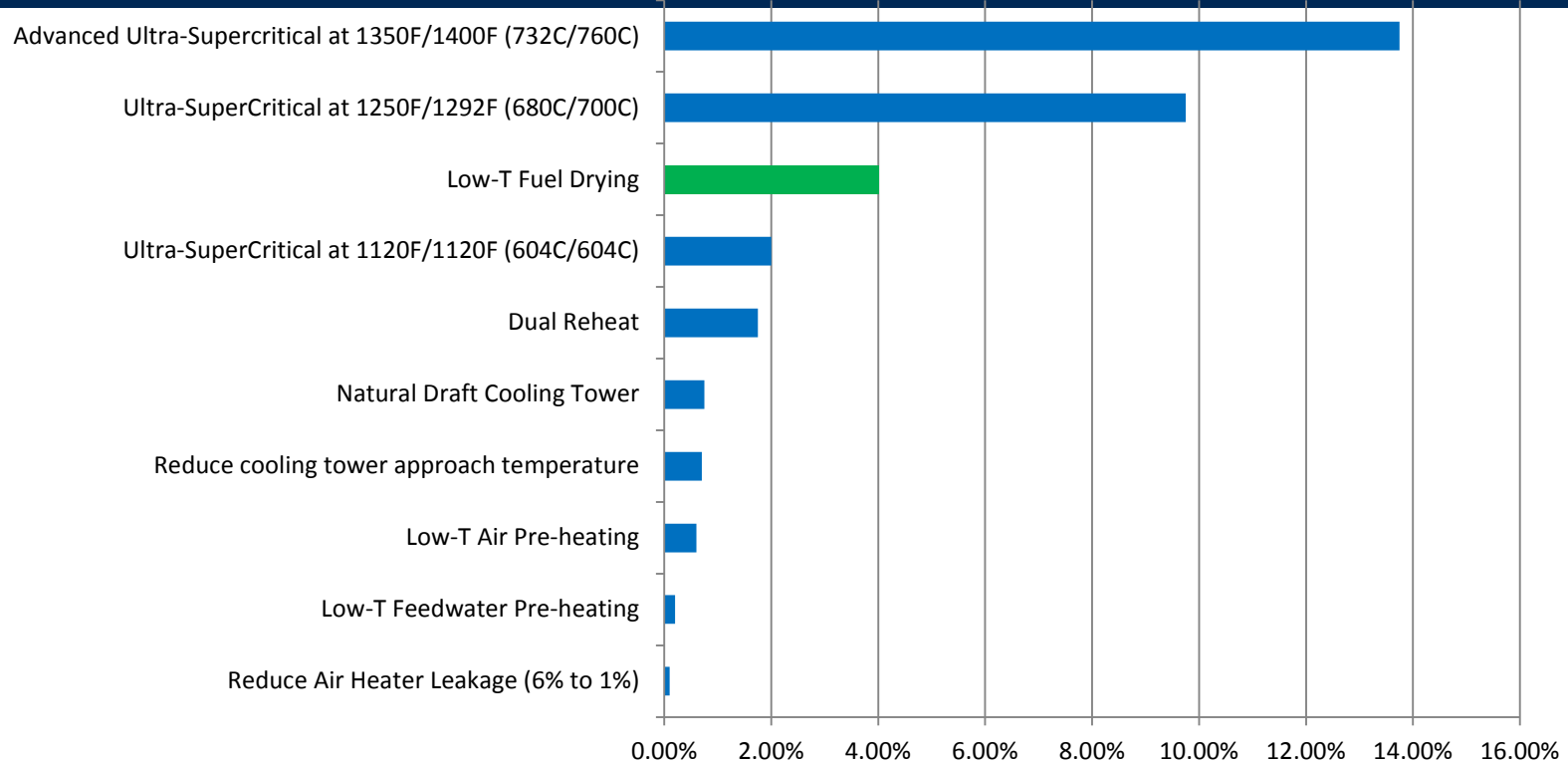
**Gregory L. Ridderbusch**  
August 2015

# Great River Energy

- Generation & Transmission cooperative
- 28 member cooperatives in MN
- Serving 655,000 homes & businesses
- 880 employees
- \$1 Billion revenue
- \$4 Billion total assets
- Investment grade debt
- 2,800+ MW of generation
- 4,500+ miles of transmission lines



# Heat Rate Improvement Technology Comparison



Source: EPRI

# Point of view ... efficiency first!

---

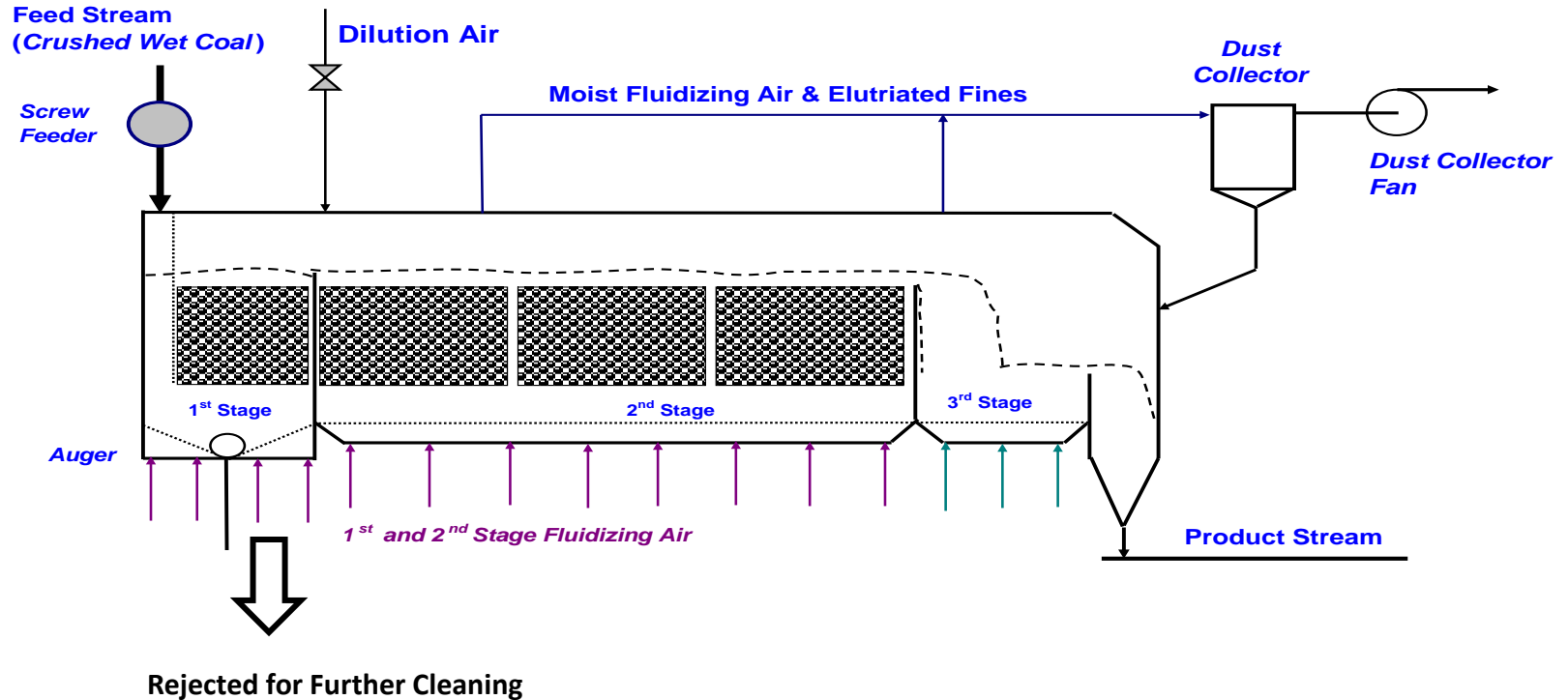
- ▶ Before considering carbon capture, leverage efficiency with investments that lower cost and improve carbon intensity
  - Turbine upgrades
  - Combined heat and power
  - Low temperature drying

# What is DryFining™ fuel enhancement?

- DryFining is a technology utilizing waste heat and mechanical separation for drying and refining low-rank coal
- DryFining can benefit a large portion of US and world coal-fired plants
- DryFining benefits
  - Cost effective
  - Significant reductions in pollutants
  - Improved plant efficiency
  - Lower CO<sub>2</sub> intensity for power



# Coal Dryers



# Coal Creek Station DryFining Retrofit

- ▶ DOE Clean Coal Power Initiative
- ▶ Engineering and construction from 2006-2009
- ▶ Construction performed without additional outage time
- ▶ Both units retrofitted simultaneously



# DryFining for 600 MW (500 TPH)



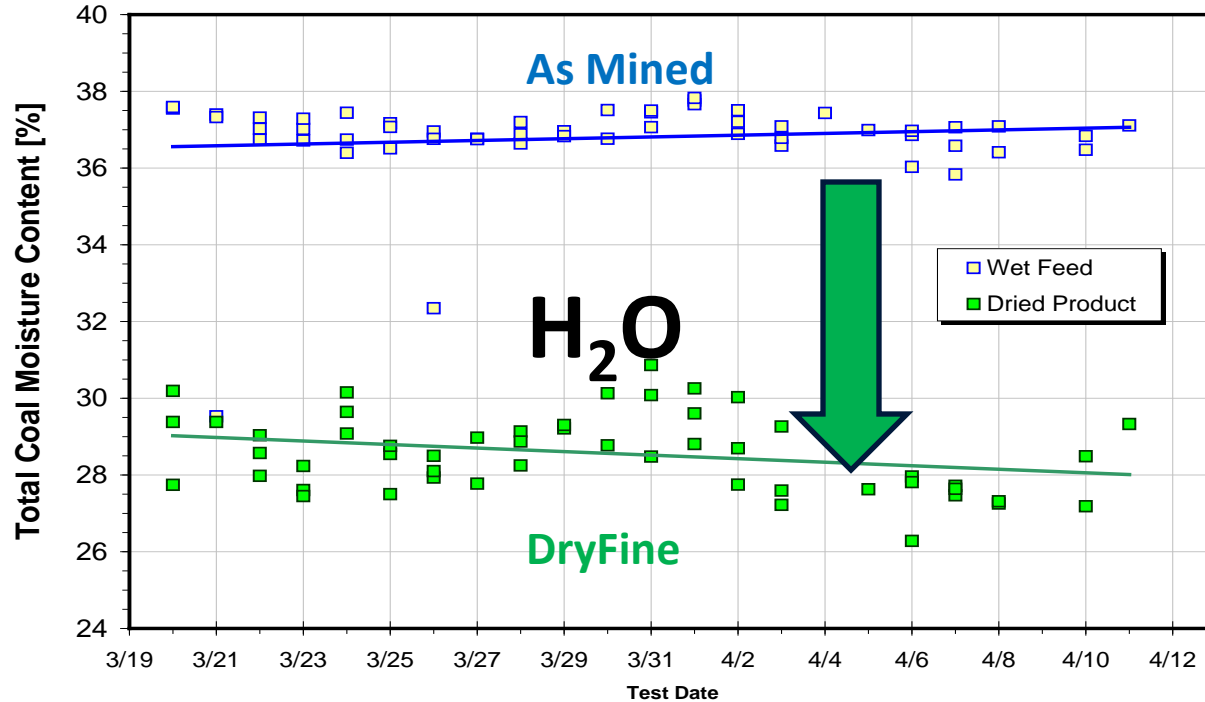


# Dust Collectors for 600 MW

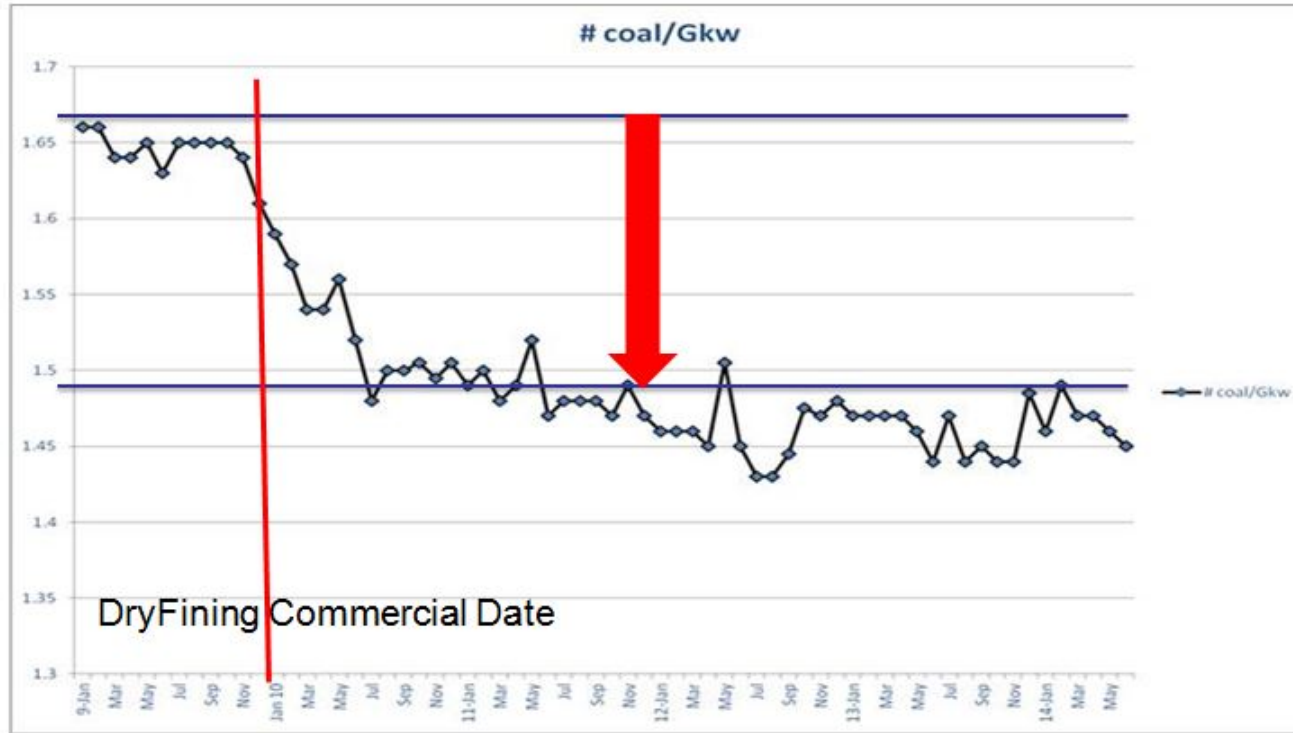


# Moisture Reduction

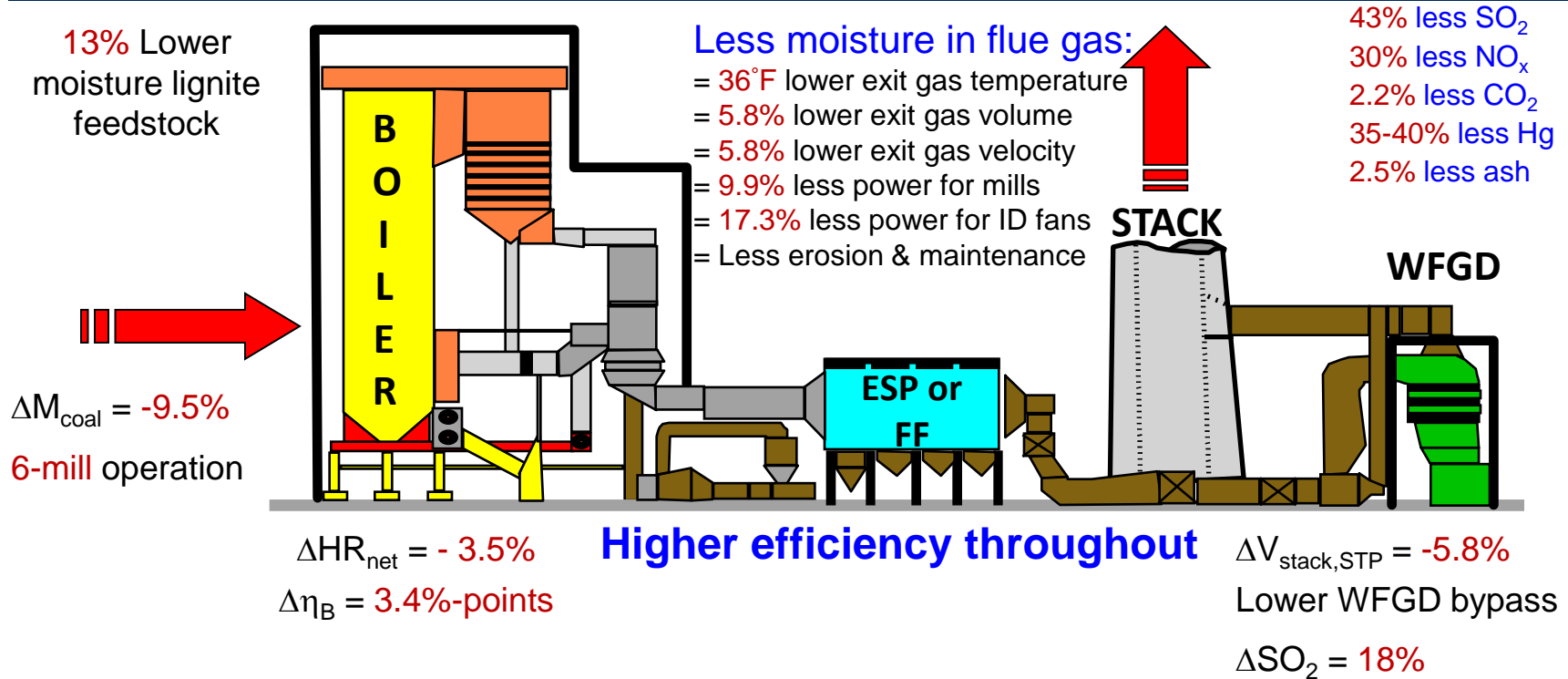
Prototype Coal Dryer Performance: March to April, 2006



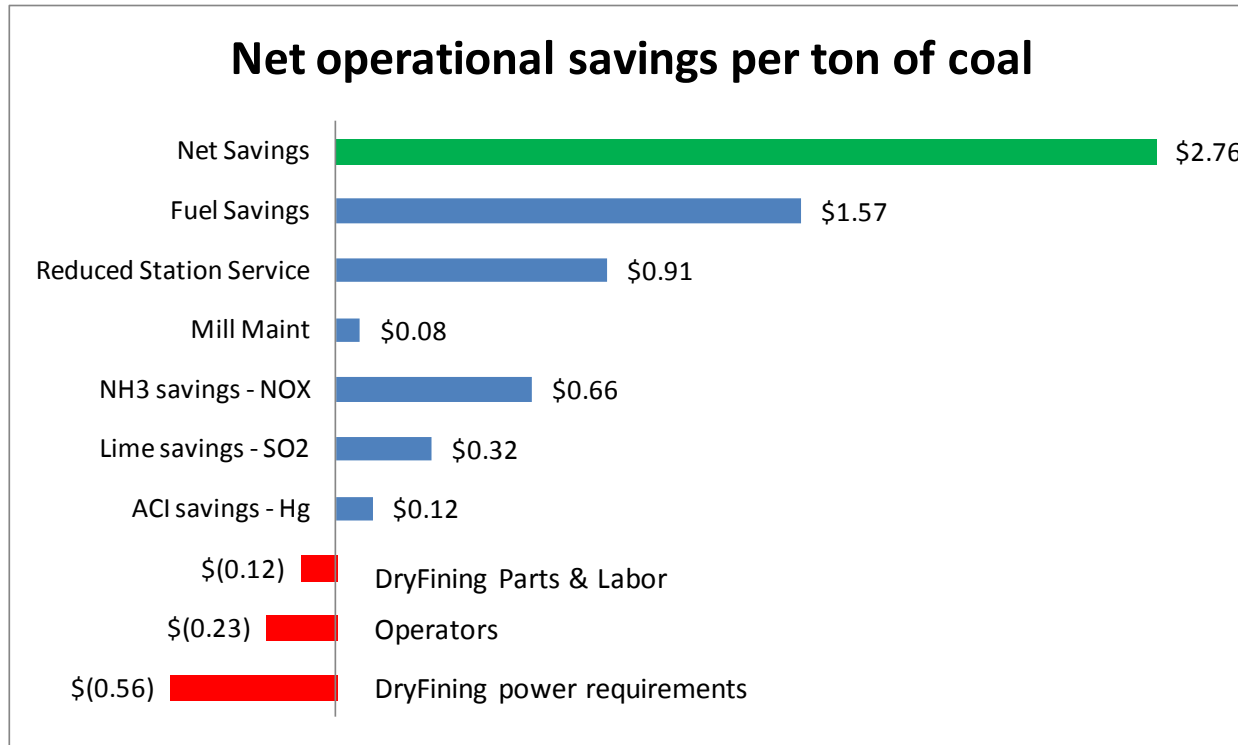
# Reduction in Fuel per MW Produced



# DryFining Performance & Emissions



# DryFinishing Net \$/Ton Savings



# Reference Design (U.S. Equipment Cost)

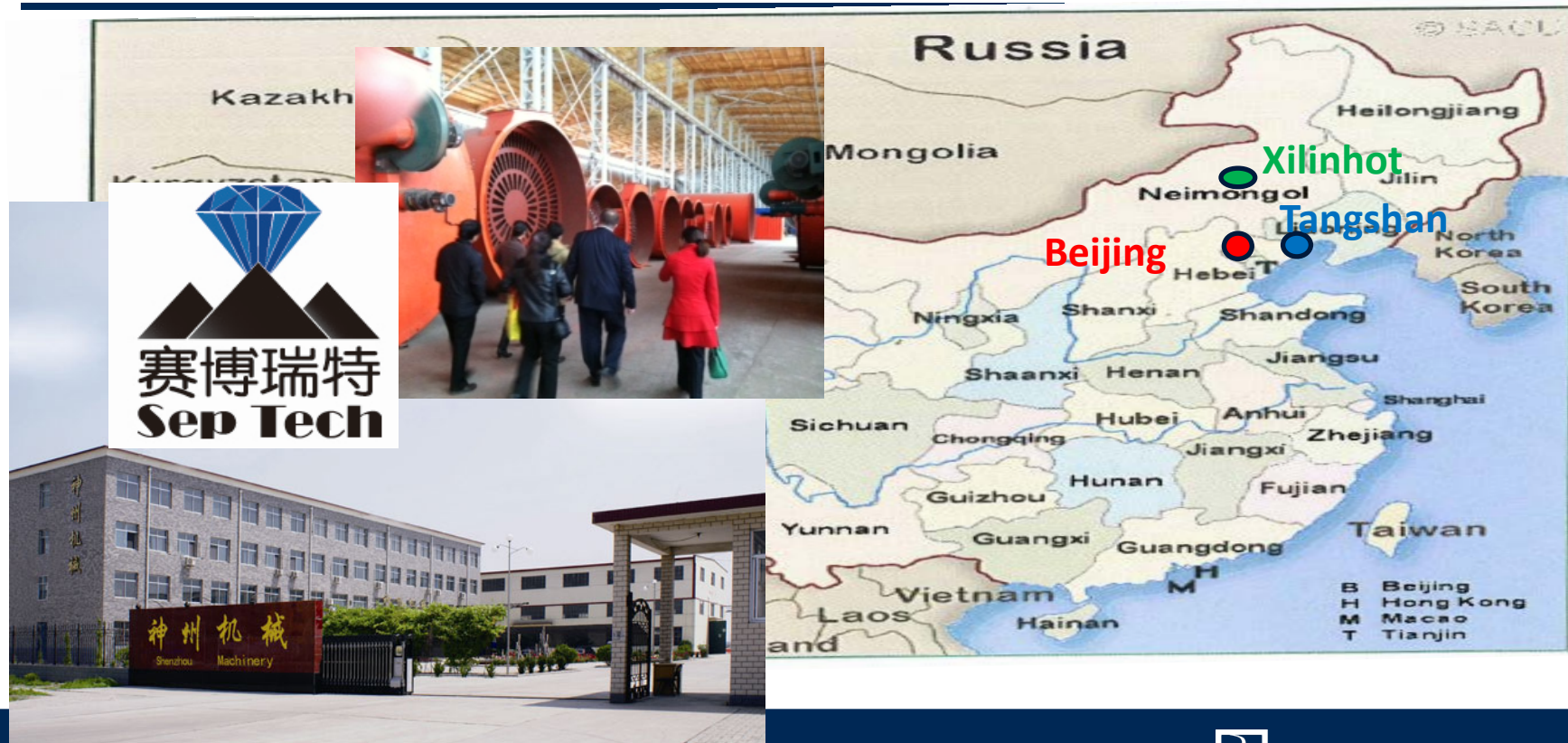
## 2x660 MW (900 TPH with 15 pts H<sub>2</sub>O removal)



Qty	Component	USD
10	DryFining™ fuel enhancement modules	\$25,000,000
10	Fluidizing Air Fans	\$2,500,000
10	Dust Collectors	\$17,500,000
5	Exhaust fans and stack	\$1,250,000
1	External heat exchangers	\$15,000,000
1	Instrumentation & Controls	\$2,000,000
4	Air Jig	<u>\$1,600,000</u>
		\$65,000,000



# TSM is our partner/licensee in China



# Thank you

---

## **Gregory L Ridderbusch**

Vice President, Business Development and Strategy  
gridderbusch@GREnergy.com  
(763) 445-5301

## **Ye Yao**

Senior Engineer, North Dakota Power Generation & Engineering  
yyao@GREnergy.com  
(701) 442-7026