



## ***Boiler Upgrades Save Money & Energy: Cargill Krefeld***

Cargill is an international producer and marketer of food, agricultural, financial and industrial products and services headquartered in the United States. Cargill Krefeld is a wet corn mill that produces starches, sweeteners, and other corn derived products in Krefeld, Germany that was purchased by Cargill in 2002.

As an active partner in the U.S. EPA's ENERGY STAR program, Cargill has earned ENERGY STAR certification for four of its U.S. wet corn mills and has set goals to improve energy efficiency and greenhouse gas intensity by 5% within 5 years on a global basis.

Because wet corn milling is an energy intensive process with high thermal and electrical demands, the Krefeld mill was originally designed with large coal boilers linked to a counter-pressure extraction steam turbine used to produce electricity. A fuel oil combined heat & power (CHP) system was added later as the mill's production expanded. By the early 2000s, higher fuel costs combined with deteriorating fuel quality made the fuel oil CHP unit costly to operate. Additionally, the plant's coal boilers, now almost 50 years old, required new environmental controls in order to meet stricter emission standards.

After considering the full cost of using coal (retrofitting emission controls plus ash disposal), rising fuel oil costs and CHP incentives (KWK Gesetz, Germany's Act on the Conservation, Modernization and Development of Combined Heat and Power), Cargill replaced the mill's coal boilers with a natural gas fired CHP system and retrofitted the fuel oil CHP units to run on natural gas (over 20 MW electricity). To maximize efficiency, the mill established new steam parameters that to enable the use of a more efficient counter-pressure extraction turbine for increased electricity production. By installing an exhaust gas recirculation unit, the mill was able to reduce NO<sub>x</sub> levels well below legal limits. The mill also optimized waste heat from the CHP units to use in process drying applications.

### **Savings:**

- ✓ Improved overall efficiency through investment in a natural gas CHP system.
- ✓ Lowered overall fuel costs.
- ✓ 30% reduction in direct CO<sub>2</sub> emissions (natural gas vs. coal/fuel oil).
- ✓ Reduction of indirect CO<sub>2</sub> emissions from CHP (steam turbine vs. grid electricity).
- ✓ Reduced NO<sub>x</sub> and SO<sub>x</sub> emissions and lowered control costs.

### **Additional Benefits:**

- ✓ Eliminated costs associated with disposal of coal and oil ash.
- ✓ No longer rely on urea to control NO<sub>x</sub> emissions.
- ✓ Less corrosive flue gases have reduced fouling and enabled better optimization of heat exchangers resulting in lower maintenance costs and improved efficiency.
- ✓ Revenue generated by the sale of electricity produced by the CHP units.