



Integrated biomass & MSW power plant Mixed biomass fuel (Straw & forestry waste)

Lingbi Anhui Province, China



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Introduction

The Lingbi project is China's 1st integrated biomass direct combustion and municipal solid waste (MSW) combustion project; and the 5th biomass project investment made by China's leading environment protection group EverBright International (EB) using DP's solution. As the first project in EB's "urban-rural" initiative, it is owned and operated by EB, and entered commercial operation in May 2017, setting a precedent for the industry in China. EB selected DP's most advanced 130tph High Temperature High Pressure and Water Cooled Vibrating Grate biomass solution for this project.

The land area of Lingbi project is 20 hectares, about 2 hours' drive from Xuzhou City, Anhui Province. Total investment of the integrated project is 570 million RMB, of which 320 million RMB is for biomass. The daily disposal capacity of WtE is 400t/d, equipped with a 9MW turbine. Such colocation provides a more efficient use of land; and reduces the cost of infrastructure, logistics and operations.



Design Specifications

Fuel	Cotton, Fruit Tree and Poplar Tree Fragments; Wheat, Corn, Cotton and Bean Straw; Rice Husk
Fuel Consumption	32.8 tph
Plant Efficiency	>33%
Boiler Efficiency	91%
Annual Operation Hours	>8000 h/y
Main Steam Flow	130 tph
Main Steam Pressure	92 bar
Main Steam Temp	540°C
Internal Consumption	<8%
Annual Fuel Consumption Volume	> 300,000 tons

DP's biomass technology is proven to be the most efficient available, and combined with the highest manufacturing and quality standards, DP biomass combustion plants are both reliable and performance guaranteed. The plant can consume up to 250,000 tons of biomass fuel and 170,000 tons of MSW, generating 2.5x10⁸ kWh of clean electricity every year. Sales of agricultural waste for biomass fuel will bring approximately 80 million RMB additional income to local farmers.

The NO_x emissions from Lingbi are lower than 100Mg/M³, which reaches the emission standard set by the local government.

The plant officially connected to the grid and started commercial operation in May 2017. In the second half of 2017, the plant consumed 80,000 tons of straw, and an agreement was subsequently signed with the local government to guarantee consumption of at least 150,000 tons per year. From May 2017 to May 2018, the plant has generated 2.2x10⁸ kWh electricity in total with more than 7600 hours of annual availability.

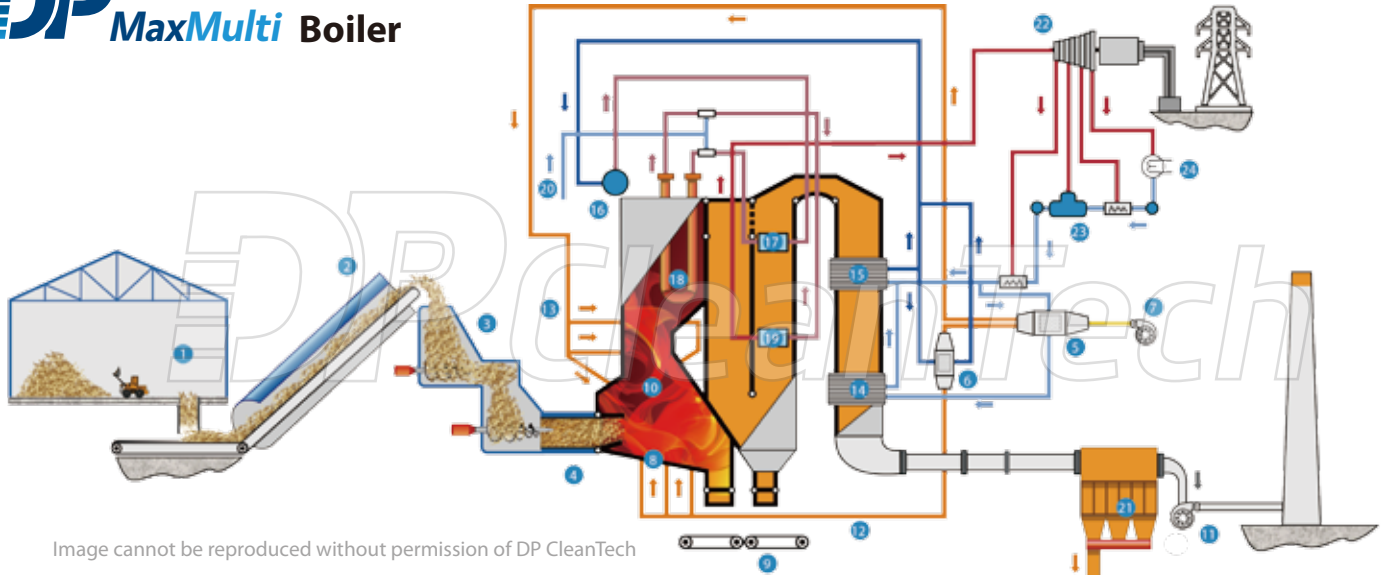


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- | | | | |
|----------------------------------|-----------------------|--------------------|---------------------------|
| 1 Fuel storage | 7 FD fan | 13 Secondary air | 19 Superheater 3 |
| 2 Belt conveyor | 8 Vibrating grate | 14 Flue gas cooler | 20 Water for atemperators |
| 3 Dosing silo | 9 Slag conveyor | 15 Economizer | 21 Bag filter |
| 4 Stoker | 10 Combustion chamber | 16 Steam drum | 22 Turbine |
| 5 Low temperature air preheater | 11 ID fan | 17 Superheater 1 | 23 Deaerator |
| 6 High temperature air preheater | 12 Primary air | 18 Superheater 2 | 24 Condenser |

Proprietary DP Design Benefits

The Fuel Feeding system is an advanced DP technology which was introduced from Europe and adapted for specific fuel conditions in China, which can be variable. The Lingbi plant improves combustion efficiency by using a stoker and water cooling duct fuel feeding system which is specialized for soft straw - but can also handle up to 50% hard straw. The automated system is highly stable and easy to operate, and it includes specialized safety systems to guard fuel against fire, self-burning and jamming, together with a water supply to extinguish fires.



Water-Cooled Vibrating Grate

The system is another highly developed product unique to DP. Originally from Denmark, and already well developed for the combustion of biomass fuels, the Water Cooled-Vibrating Grate system has been further adapted for optimum use in China. The grate vibrates periodically during combustion, to help ensure full burnout. In addition, automated fuel combustion time helps prevent slagging on the grate segments.

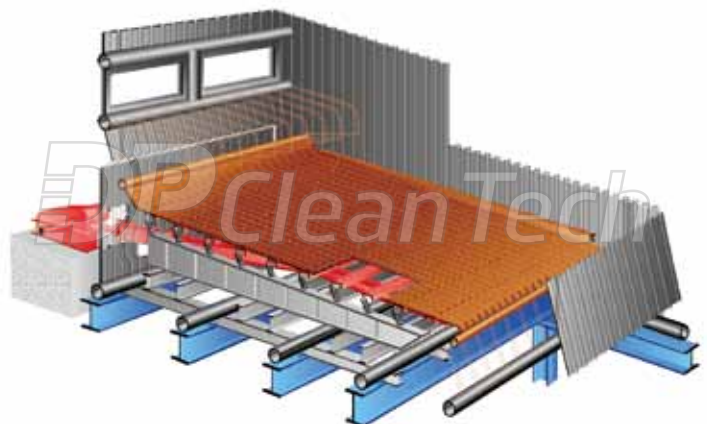


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Boiler

Superior efficiency, durability and quality design are key features of the DP boiler. In terms of design, the boiler is supported from the bottom, the placement of the centre of gravity and guiding devices ensures a uniform expansion in all dimensions, as well as supporting the boiler itself. In addition, the boiler is earthquake resistant, and in the event of seismic activity, any horizontal force that might affect the body of the boiler would be transmitted to its main and auxiliary steel frames, and from there to the foundations, thus preventing damage to the boiler itself.



External Air Preheater

Biomass fuels are considerably different to coal and generally have a higher content of Chlorine and alkali metals, and a lower Sulphur content, which can corrode heating surfaces. DP's patented design technology arranges the APH outside the flue gas duct which has multiple benefits. The proprietary design reduces flue gas temperature which improves the efficiency of the boiler. The Air Preheater and Flue Gas Cooler system can increase the cold air temperature to $\sim 180^{\circ}\text{C}$ using feed water. At the same time, the feed water temperature is reduced from $\sim 210^{\circ}\text{C}$ to $\sim 90^{\circ}\text{C}$ after the Air Preheater. The 90°C water goes into the end part of the Flue Gas Cooler and is heated to $\sim 210^{\circ}\text{C}$, which in turn cools down the flue gas temperature to 130°C . The technology also reduces low temperature corrosion as the cold end average temperature $\left[\frac{130+90}{2} = 110^{\circ}\text{C} \right]$ is higher than dew temperature. Ash blockage and abrasion of the Air Preheater are also minimized.

Superheaters #3, #4

DP Super heaters have strong resistance to corrosion and coking through the use of special structures (vertical tube panels structure, coarse pitch), and high grade materials (ASME material SA-213TP347H, stainless steel, extra pipe thickness). Using these structures and materials avoids high temperature oxidation on the steam side and greatly reduces coking and high temperature corrosion on the flue gas side.