DP CleanTech
Creating value from waste

Advanced straw-fired power plant

(Cotton straw & forestry waste)

Dangshan Anhui Province, China

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Introduction

- Dangshan Biomass power plant is the 1st project by DP CleanTech for Everbright International Co., Ltd. (a HK listed company). It is located in Dangshan Economic Development zone, Anhui province and covers an area of 20 hectares.
- The plant is owned by China Everbright International, with a total investment of about US$ 92.96M.
- It was put into operation in 2011. The construction for WtE project (1st phase with 300 tons/daily waste consumption) was started in 2014, and was connected to the grid on 6th April, 2016.
- The plant has been instrumental in promoting the local rural economy by making good use of agricultural residues. It has helped the local government improve energy structure, protect the environment, and has greatly increased local farmers' income whilst making significant contributions to a low carbon conomy.
- The company has put in place several community initiatives, including a school, to enhance rural development.
- 2016 annual availability was 8,148 hours, internal consumption was 6.98%, and electricity generated was 240Mkwh.
- 2017 1st half availability was 4,100 hours.

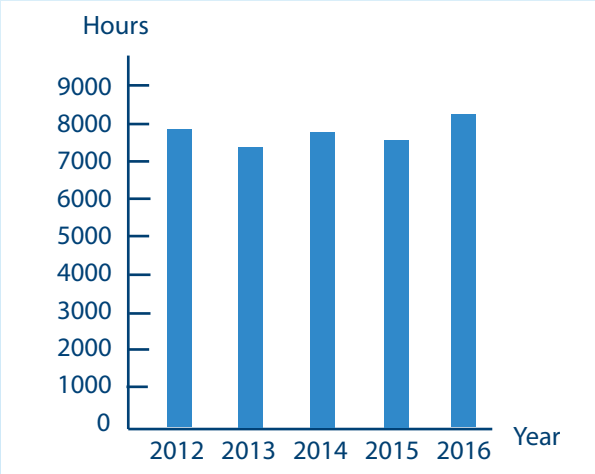
Performance Data

The 30 MWe plant at Dangshan is one of the most advanced biomass plants in China; it consumes 250,000 tons of agricultural & forestry residue (including 80,000 tons of fruit tree branches mixed with a small quantity of wheat straw) . Everbright's minimum annual goal for power production is 200,000,000kWh, which is equivalent to 6,666 hours full load operation. In fact, the plant is capable of producing at least 240,000,000kWh/a, with 8,000 hours full load operation. The plant consists of a High Pressure High Temperature vibrating grate boiler and a condensed steam turbine. This combination of technology enables a very high overall plant efficiency (33%). In addition, the superior design and manufactured quality of the equipment ensures high reliability, and corrosion & fouling resistance.

Design Data

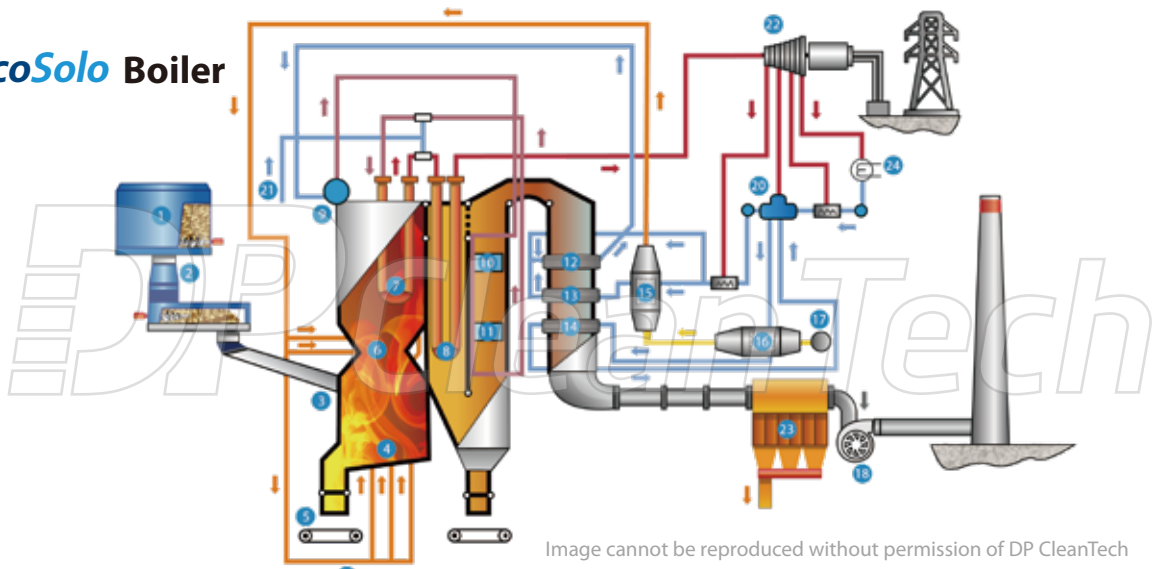
Fuel	Cotton Straw, Forestry Residues
Fuel Consumption	25tph
Plant Efficiency	>33%
Boiler Efficiency	>91%
Annual Operation Hours	>8000h
Main Steam Flow	130t/h
Main Steam Pressure	92 bar
Main Steam Temp	540 °C
Parasitic Load	8%

Full Load Operation Hours



The plant consumes 250,000 tons of agricultural and forestry residues each year.

EcoSolo Boiler



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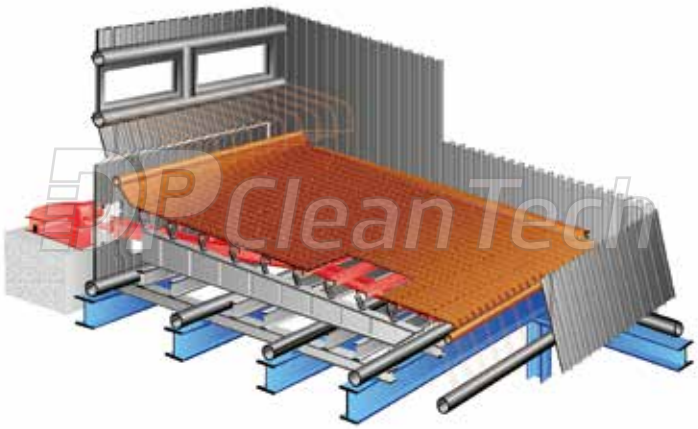
1. Wood chip silo
2. Dosing silo
3. Spreader
4. Vibrating grate
5. Slag conveyor
6. Combustion chamber
7. Superheater 3
8. Superheater 4
9. Steam drum
10. Superheater 1
11. Superheater 2
12. Economizer
13. High pressure flue gas cooler
14. Low pressure flue gas cooler
15. High pressure air preheater
16. Low pressure air preheater
17. FD fan
18. ID fan
19. Preheated combustion air
20. Deaerator
21. Water for atemperators
22. Turbine
23. Bag filter
24. Condenser

Key Technology

The Fuel Feeding system is one of DP CleanTech's core technologies. The technology is based on DPCT's experience with European projects. DPCT was the first to introduce this most advanced biomass fuel feeding system to China. For the Dangshan project, the spreader feeding system was selected, as it is both specialized for hard straw and tailored to handle 20% soft straw. The automatic control system is easy to operate and highly stable and includes specific safety systems to protect from fuel firing-burning and jamming, together with a water supply to extinguish fires.

Water-Cooled Vibrating Grate

The WCVG is another feature unique to DP CleanTech. Originally from Denmark, this system was designed for the efficient combustion of biomass fuels. The grate vibrates periodically during biomass combustion, thus ensuring full burnout and controlling fuel combustion time in order to prevent slagging on the grate segments.



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Boiler

High efficiency and durability are key features of DP CleanTech's products, and the design of the boiler and the materials used are fundamental to ensuring long term performance. The boiler itself 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. In addition, the boiler is designed to resist earthquakes. 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. The boiler is manufactured using high grade materials to resist corrosion and extend life cycle.

External Air Preheater and Proprietary Technology for Handling Corrosive Fuels

Biomass fuels are significantly different from coal, having a higher content of chlorine and alkali metals, and lower sulfur content – all of which can heavily corrode heating surfaces. DP CleanTech uses proven, proprietary technology to reduce flue gas temperature and prevent low temperature corrosion. In essence, using a patented combination of an external Air Preheater and recirculated feedwater, the temperatures of flue gas can be regulated to maximize the efficiency of the boiler. At the same time, low temperature corrosion is reduced because the cold end average temperature【(130+90)/2=110℃】is higher than dew point. Using DP's patented system for the Air Preheater also avoids problems of ash blockage and abrasion of the Air Preheater.

Superheaters #3, #4

DP CleanTech's Superheaters are specifically engineered to resist the common problems of corrosion and coking through both the structural design and the use of high grade materials. The structure consists of vertical tube panels and ASME SA-213TP347H extra thick pipe stainless steel materials, which together help to avoid high temperature oxidation (steam side); and to significantly reduce coking and high temperature corrosion (flue gas side).