DP CleanTech
Clean energy, natural solutions

Advanced straw-fired power plant

(Corn and wheat straw)

Guzhen Anhui Province, China

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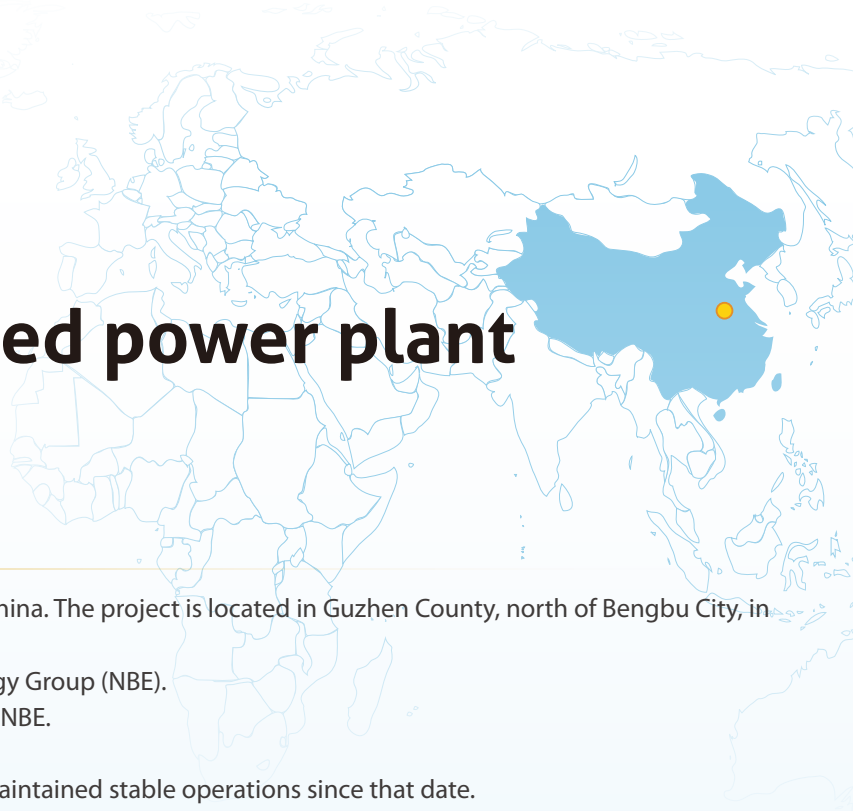

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Introduction

- Guzhen is DP CleanTech's 25th biomass power plant in China. The project is located in Guzhen County, north of Bengbu City, in the north of Anhui province.
- The Guzhen power plant is owned by National Bio Energy Group (NBE).
- Guzhen is the 25th project delivered by DP CleanTech to NBE.
- It is the 1st NBE project in Anhui province.
- It commenced operations in December 2010 and has maintained stable operations since that date.
- From 2011 - 2018, the average annual availability of Guzhen was around 7,500 hours. In 2017, total power output reached 230 million KWh.
- The plant has been instrumental in promoting the local rural economy and consumes agricultural straws. It has helped the local government improve energy infrastructure, protect the environment, and has greatly increased local farmers' income.
- The plant occupies a total of approximately 12 hectares. The fuel stockyard of Guzhen occupies more than 50% of this land.
- In 2014 Guzhen consumed approximately 300,000 tons of agricultural straws. Majority of which is corn straw, plus some wheat straw and bark etc.
- The local Anhui government has provided extra funds for straw utilization to encourage plants to take more straw types of fuel.

The 30 MWe plant at Guzhen is one of the most advanced biomass plants in China; it consumes at least 250,000 tons of agricultural residue (corn and wheat straw, plus other types of fuels) and generates 2x108 kWh of clean electricity every year. Based on normal production, wheat cultivation in Guzhen is ~1 million units (approximately 66, 667 hectares). The ratio of grain and straw outputs is 1:1. It indicates that more than 500,000 tons of straw produced annually. Based on local official's input, around 200,000 tons are collected.

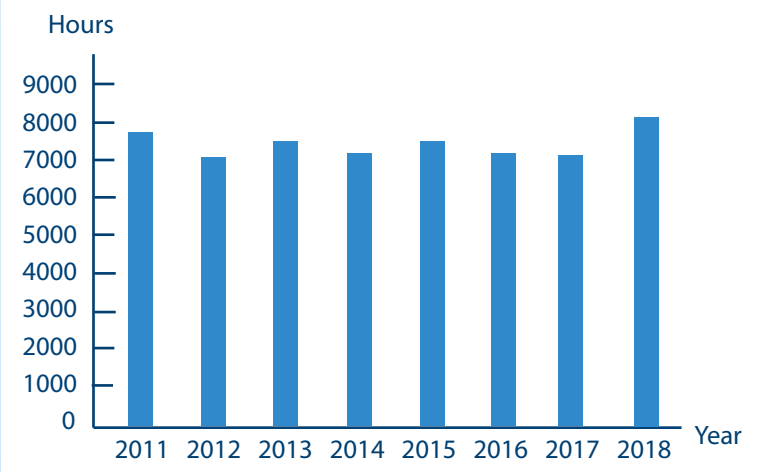
The plant is based on DP's High Pressure High Temperature technology, which enables very high boiler efficiency (91%). In addition, the plant's design and use of high-quality materials guarantee high reliability and resistance against corrosion and fouling.

Performance Data

Design Data

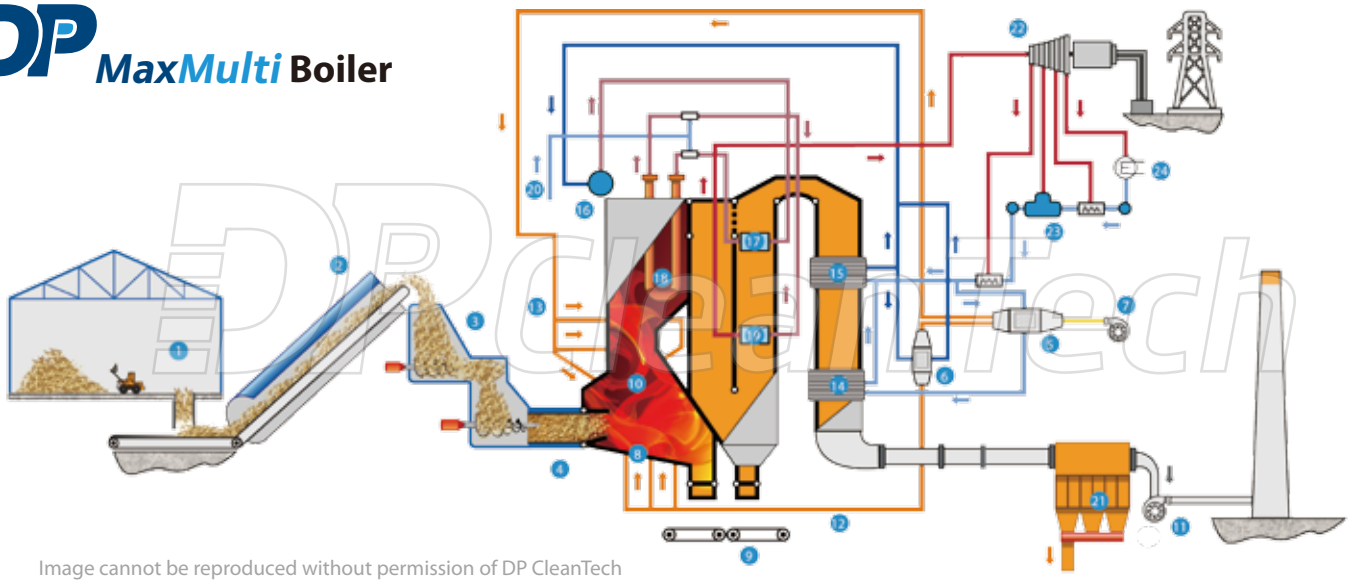
Fuel	Corn Straw, Wheat Straw and cotton straw (up to 60%)
Fuel Consumption	25tph
Plant Efficiency	>33%
Boiler Efficiency	>88%
Annual Operation Hours	>8000h
Main Steam Flow	130t/h
Main Steam Pressure	92 bar
Main Steam Temp	540 °C
Internal Consumption	10%

Full Load Operation Hours



The plant consumes 250,000 tons of agricultural and forestry residues each year, sourced from the surrounding area.

DP MaxMulti Boiler



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

Key Technologies

The Fuel Feeding System is one of DP's advanced European core technologies which was introduced to clients in China. The stoker and water cooling duct fuel feeding system is specialized for soft straw with the ability to handle 50% hard straw and provides improved combustion efficiency. The automated system is highly stable and easy to operate, and includes specialized safety systems to prevent fuel fires, self-burning and jamming, as well as a water supply to extinguish fires.

Water-Cooled Vibrating Grate

The grate 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 use with over 60 biomass fuels as well as Refuse Derived Fuels. The grate vibrates periodically during combustion, to help ensure full burnout. An automated timing system for fuel combustion optimises combustion and prevents slagging on the grate segments.

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HTHP Boiler

High levels of efficiency, superior durability and safety mechanisms are key features of DP products. The HTHP boiler is supported from the bottom, with precise placement of the centre of gravity and the guiding devices ensuring a uniform expansion in all dimensions. In the event of earthquakes or other shocks, any horizontal force that may affect the boiler is dissipated away from the boiler itself to the main and auxiliary frames, and from there to the foundations preventing damage to the boiler and ensuring safety standards.

External Air Preheater - DP proprietary technology

Biomass fuels are significantly different from coal in terms of chemical composition. Biomass fuels have higher chlorine and alkali metals, and lower sulfur - a combination which is highly corrosive for heating surfaces. The Air Preheater and Flue Gas Cooler system increases the cold air temperature to ~180°C using feed water. At the same time, the feed water temperature is reduced from ~210°C to ~90°C after the Air Preheater. The 90°C water goes into the end part of the Flue Gas Cooler and is heated to ~210°C, which in turn cools down the flue gas temperature to 130°C. This proprietary technology reduces the flue gas temperature to improve the efficiency of the boiler. Meanwhile low temperature corrosion is reduced as the cold end average temperature 【(130+90) /2=110°C】 is higher than dew temperature.

DP's patented technology locates the APH outside the flue gas duct and prevents contact between flue gas and cold air, whilst heating cold air with feed water. This unique arrangement prevents abrasion, low temperature corrosion and ash blockages within the APH.

Superheaters #3 and #4

DP's Superheaters are designed to have strong resistance to corrosion and coking through the use of special structures (vertical tube panels, coarse pitch) and the use of high grade materials (ASME SA-213TP347H, stainless steel, extra thickness pipes). The superheater structures and materials avoid high temperature oxidation on the steam side, and greatly reduce coking and high temperature corrosion on the flue gas side.