

Features and Operational Results of South Korea's First 1000 MW Class Coal-Fired Ultra-supercritical Boilers - Korea East-West Power Co. Ltd. Dangjin Thermal Power Plant Units No. 9 and No. 10 -



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In South Korea, power demand is steadily increasing in response to economic growth. As the construction of new power plants is planned in the country, developments in the field have been attempted one after another, such as increasing the power generation output of the units and improving their steam conditions. Amid such a trend, Dangjin Thermal Power Plant Units No. 9 and No. 10 of Korea East-West Power Co., Ltd. were planned as the first large-capacity 1,000 MW class ultra-supercritical boilers in South Korea, and have continued stable commercial operation since the commencement of operations in 2016.

1. Introduction

As the domestic electric power market has seen sluggish growth, we targeted overseas sales of our high capacity ultra-supercritical boiler technology cultivated through the power plant market in Japan, and received an order for South Korea's first 1000 MW class coal-fired ultra-supercritical boilers for Dangjin Thermal Power Plant Units No. 9 and No. 10 in 2010. This means that our company's numerous achievements and technological capabilities are highly evaluated. This paper presents the features of the Dangjin Units No. 9 and No. 10 boilers that commenced commercial operations in 2016, as well as an overview of the applied technology.

2. Overview of boiler design

2.1 Overview

Table 1 shows the planned specifications of the boiler. The steam conditions are equivalent to the latest power plants in the domestic power generation market, and the boiler was planned to be used in a highly-efficient plant. The specifications reflect a design that allows for 50% mixed firing using bituminous coal and subbituminous coal as the fuel.

Table 1 Planned specifications of boiler

Item	Dangjin Power Plant	
	Unit No. 9	Unit No. 10
Boiler type	Ultra-supercritical variable pressure reheat-type once-through boiler	
Output	1,020MW	
Steam flow	3,033t/h	
Steam condition	25.4MPa(g) / 603°C / 603°C	
Fuel	Bituminous coal and subbituminous coal mixed firing	
Operation start	July 2016	September 2016

2.2 Major features

Figure 1 shows the boiler side view. The boiler's design adopts the latest technologies of large-capacity ultra-supercritical boilers cultivated in the domestic power plant market, and has the following features.

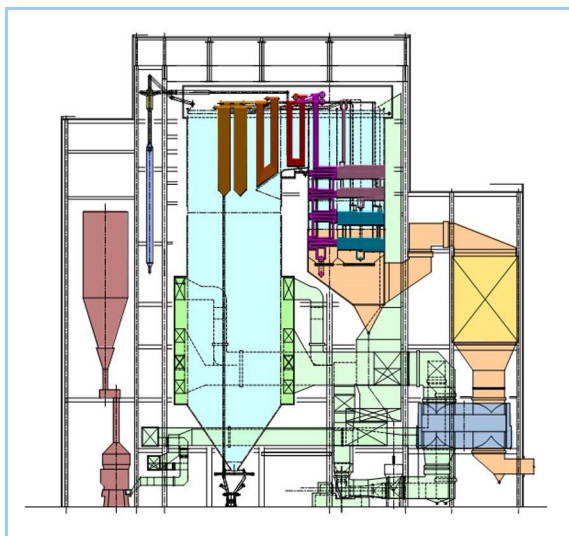


Figure 1 Boiler side view

(1) Subbituminous coal mixed firing

The characteristics of subbituminous coal are that it has a larger amount of moisture, a lower calorific value, and a higher ash adhesion property than bituminous coal. As measures against the high ash adhesion property, a sufficient furnace size is secured, the shape and the pitch of the heating surface are optimized, as is the arrangement of the soot blower.

(2) Adoption of spiral water wall structure

The boiler employs a combination of a spiral water wall structure and the opposed firing method that has been proven in many domestic and overseas large-capacity boilers. This realizes a design with a reduced fluid temperature unbalance at the furnace outlet.

(3) Adoption of large-capacity pulverizer

Since subbituminous coal has a lower calorific value, coal consumption is increased in comparison with that of bituminous coal. However, this boiler adopts a large-capacity pulverizer with a capacity 1.5 times larger than conventional pulverizers to be able to handle the increased coal consumption using the same number of pulverizers and type as existing technology.

(4) Adoption of low NO_x burner

This boiler adopts the NR3 burner, which is a low NO_x burner with many achievements including its use in the latest domestic plants, to reduce the environmental burden. This NR3 burner enhances the flame stabilizing property to promote in-flame NO_x reduction, and also enables the reduction of unburned carbon content, which normally impedes NO_x reduction.

3. Operational results

As a result of commissioning, it was verified that this boiler is capable of stable operation in which the steam temperature characteristics, combustion characteristics, etc., achieved the planned values even when subbituminous coal is used as fuel. In terms of the combustion performance, NO_x and unburned carbon content were extremely low and good results were obtained. For the boiler performance, it was confirmed that planned boiler efficiency was achieved. This indicates our high technological strength and reliability in ultra-supercritical boilers that are designed to make the use of subbituminous coal possible.

4. Future development

The boilers for Dangjin Thermal Power Plant Units No. 9 and No. 10 are South Korea's first 1000 MW class coal-fired ultra-supercritical boilers that were adopted due to our highly-evaluated technology and reliability. During commissioning, the high boiler performance was confirmed and fully satisfied the customer's expectations. This boiler will be a model plant for next generation of large-capacity 1000 MW class ultra-supercritical boilers that are planned not only in South Korea, but also elsewhere in Southeast Asia. Reflecting the operational results of this boiler, we will continue to supply even more reliable boilers.