Thermal power plant flue gas waste heat storage peak load regulation

What is a heat pipe flue gas waste heat utilization system?
A heat pipe flue gas waste heat utilization system is installed in front of the inlet of the electrostatic precipitator of a boiler to heat the condensate of the steam turbine. In order to understand the performance characteristics of the system, the performance evaluation of flue gas waste heat utilization and transformation is carried out.

Can exhaust flue gas be used to improve thermal power plant efficiency?
The exhaust flue gas will be emitted to the atmosphere. But we can use the heat energy of the waste gasto improve the efficiency of the thermal power plant. But if the temperature of the exhaust gas drops low will lead to the formation of the acids which will reduce the efficiency of the boiler[2,3].

How a thermal power plant works?
That the heat of the flue gas is used in the condensate system. That one of the low pressure heater (LPH) is replaced by the flue gas heater. So the efficiency of the thermal power plant will be improved and the energy used by the power plant will be reduced. The thermal power stations are used to generate electricity for a long time.

What are the performance characteristics of flue gas waste heat exchanger?
In order to understand the performance characteristics of the system, the performance evaluation of flue gas waste heat utilization and transformation is carried out. When the load is 310 MW ~ 325 MW, the average flue gas temperature drop of the heat pipe heat exchanger is 26.3 °C.

Why is tail flue gas a problem in coal-fired power station boilers?
There is a common problem that the waste heat of tail flue gas is directly discharged into the atmosphere without utilizationin large coal-fired power station boilers. The flue gas emission of boiler will not only increase the energy loss of thermal power,but also cause damage and pollution to the environment .

Does flue gas save energy?
Therefore,the waste heat recovery and utilization of flue gas is of great practical significance for saving energy,reducing consumption and improving the economy of units for large-scale coal-fired power plant boilers .

The exhaust flue gas (80 to 130°C) in the thermal power plant is often released into the atmosphere as waste heat. This waste heat can be utilized as a form of heat source for the ...

The fast peak-load regulation capability of CFPP is the key. According to the available literature, the lowest load rate of thermal power plants is about 30 % [1] and the fastest load change rate is about 4.5 %/min [2].However, some components of traditional steam Rankine cycle power plants, such as condensers, have

large thermal inertia due to their large size and ...

Key words: flue gas waste heat recovery, energy storage technology, compressed air energy storage, thermal energy storage, air preheater, carbon neutrality, heat pump CLC ...

The results show that the molten salt heat storage auxiliary peak shaving system improves the flexibility of coal-fired units and can effectively regulate unit output; The combination of high-temperature molten salt and low-temperature molten salt heat storage effectively overcomes the problem of limited working temperature of a single type of ...

The part of the heat is equal to the 40 percent of heating load. The return water conventionally has a high temperature, so the flue gas waste heat is difficult to recover. Based on the situation, this paper introduced the technique of flue gas waste heat recovery in gas cogeneration based on absorption heat-exchange.

In addition to the above measures to improve the thermal efficiency of the power plant, the waste heat recovery from boiler exhaust flue gas is also regarded as an effective method [12].Currently, the low-temperature economizer (LTE) thermal system is widely used for the waste heat recovery of the boiler, in which the waste heat of the exhaust flue gas is ...

The waste heat utilization of flue gas is always an important issue in coal-fired power plants. The waste heat is usually used in carbon capture, heating feed water, and preheating air for energy saving [11-16]. Utilizing the waste heat of flue gas to pyrolyze solid waste has so far been rarely reported.

research work focuses on tapping the unused heat energy from the flue gas in a 270 MW thermal power plant and using the same for refrigeration purpose for the large cooling ...

The increasing grid-connected generation of renewable energy, sets higher requirements on the regulation and digestion capacity of the grid [5].Due to the uncontrollable characteristics of intermittent fluctuation and seasonality of renewable energy such as solar energy and wind energy [6], in order not to waste such clean energy with zero resource cost, ...

The scheme of coal-fired power plants coupled with a molten salt energy storage system is a promising way to improve the flexibility of coal-fired power plants. The flue gas molten salt heat exchanger is a key component to capture thermal energy from flue gas.

In the thermal power plant, the temperature of exhaust flue gas is usually 130-150 °C, and the exhaust heat loss usually accounts for 50%-80% of the total heat losses of the boiler [22]. ... Improving denitrification efficiency of supercritical unit for peak load regulation by changing feed water temperature has become a focus of thermal ...

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Wojcik and Wang [5] proposed the operation plan of 375MW subcritical fuel power plant with integrated thermal storage system, this paper puts forward the reservoir heat and heat release scheme of different locations in the whole ...

So, a new integrated system combining flexible energy storage and waste heat recovery in the CFPP is presented. The scheme consists of a double-effect absorption heat pump (D-AHP) with an integrated thermal electricity storage system (IT-ESS). Waste heat from flue gas is recovered by D-AHP, while IT-ESS is responsible for peak shaving.

The results indicate that, to achieve efficient load regulation from 0% to 100% for a 1000 MWe S-CO 2 CFPP, the priority configuration for thermal energy storage is CO 2 TES, followed by flue gas TES and electrical heating TES, with powers of 285.17 MWth, 342.80 MWth, and 329.95 MWth, respectively. The overall heat storage/release ratio is 3. ...

Some experts have researched the application of carbon capture devices in coal-fired power plants. Ju et al. [7] found that under full decarbonization conditions, the power generation efficiency of the plant decreased by approximately 11.2 %; on average, for every 10 % increase in decarbonization capacity, the power generation efficiency of the plant decreased ...

The ORC subsystem absorbs the waste heat of the cooling medium and the remaining flue gas waste heat, resulting in a net power output of 699.45 kW. Through the combined use of the two subsystems to utilize the waste heat of the ICE, the power output increases by 2,029.59 compared to the original ICE unit, corresponding to a 9.52 % increase in ...

The primary metrics for gauging the operational flexibility of thermal power plants include start-up time, minimum load, and power ramp rate. Taler et al. [7] significantly shorten the start-up time by ensuring the optimum mass flow rate and fuel consumption. Ji et al. [8] shortened the start-up time by approximately 150 min through the particle swarm optimization of start-up ...

with a bottoming organic Rankine cycle for power plant flue gas waste heat recovery in a process facility is investigated. Using 1,1,1,3,3-pentafluoropropane (R245fa) as ...

The combined-heat-and-power (CHP) plants play a central role in many heat-intensive energy systems, contributing for example about 10% electricity and 70% district heat in Sweden. ... A third possibility is to store heat in a seasonal thermal storage (hot water), to be able to use the heat for peak load during the winter. Increased summer heat ...

It can be seen that when the load is 310 MW ~ 325 MW, the flue gas pressure drop is 67 Pa ~ 146 Pa, with an average of about 107 Pa. Ignoring the flow velocity difference between the inlet and outlet of the heat exchanger, according to the flue gas resistance of 146 Pa at 325 MW, the estimated flue gas resistance is about

151 Pa at full ...

This paper presents a low carbon district heating system that features a low return water temperature, use of low grade waste heat as the main heat source, long distance heat transmission with a large temperature difference, distributed peak heating load addition by natural gas and heat-power decoupling with heat pump and thermal storage.

The development of large-scale, low-cost, and high-efficiency energy storage technology is imperative for the establishment of a novel power system based on renewable energy sources [3].The continuous penetration of renewable energy has challenged the stability of the power grid, necessitating thermal power units to expand their operating range by reducing ...

A thermal storage scheme using molten salt to store heat from main steam and high temperature flue gas was presented. Results showed that the minimum power output of the CFPP decreased from 30 % to 14.51 %, and the equivalent round-trip efficiency of ...

The energy system in the EU requires today as well as towards 2030 to 2050 significant amounts of thermal power plants in combination with the continuously increasing share of Renewables Energy Sources (RES) to assure the grid stability and to secure electricity supply as well as to provide heat. The operation of the conventional fleet should be harmonised with ...

At present, ultra-supercritical power plant is the most advanced technology, which can achieve ultra-low pollutant emissions and greatly improve the energy efficiency of power plant. In this paper, the key factors affecting the energy efficiency of thermal power unit are analyzed. Moreover, the way in which these factors affect the energy efficiency of thermal ...

WHP systems are designed for a nominal operating point (i.e. design-point), which usually corresponds to the highest thermal power available from the waste heat source [8].At design-point the conversion efficiency of the WHP system is maximum because all components work at rated conditions; however when fluctuations of the thermal power occur, the WHP ...

The Chinese government requires that the CFPP should participate in deep peak load regulation with the ability of rapid start and stop, large-scale load regulation, rapid power changing, and thermoelectric decoupling in the future [5]. ... Thermo-economic optimization of the thermal energy storage system extracting heat from the reheat steam ...

To date, a lot of research has been conducted on the flexible operation and peak-shaving ability of gas turbine-based systems. Inlet air heating (IAH) technology is gradually gaining attention as a favorable means of load regulation. Liu et al. [10] proposed a heating system that used the waste heat of exhaust gas to heat the compressor inlet ...

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To improve the energy utilization efficiency and electricity regulation range of thermal power plants, Wu et al. [27] proposed a new type of peak shaving synergy system with waste heat recovery (hereinafter referred to as the synergy system). Without building new coal-fired power plants, waste heat from exhausted steam is recovered for heating.

This implies that, on a national level, CFPPs are still the primary providers of peak shaving services [10]. Thermal power plant operators have implemented various measures to deal with power grid load regulation requirements, such as reducing the low load and off-design operating time [11]. Steam temperatures can fluctuate when the generation ...

Example:21 MW condensing cum extraction turbine has inlet steam flow 120 TPH at 88 kg/cm2g pressure and 520 0C temperature, it has two extraction first, at 16 kg/cm2g pressure and temperature 280 0C at flow 25 ...

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