Flexible transformation of thermal power storage

The paper presents a model algorithm for a global transformation of conventional thermal power plants to thermal storage power plants (TSPP). TSPP are thermal power stations that provide highly flexible and at the same time renewable power. The idea behind such transformation is to conserve the firm capacity of the existing thermal power plant ...

The paper presents a model algorithm for a global transformation of conventional thermal power plants to thermal storage power plants (TSPP). TSPP are thermal power stations that provide highly flexible and at the same time renewable power.

1) In the flexible transformation technology of thermal power plants, the methods of increasing the heating capacity of the unit can effectively reduce the forced output of the unit and improve the power plant low-load operation flexibility, but it will reduce the peak load capacity of the unit during the peak load and face the loss of peak ...

[1] Li J, Zhu P W, Wang H and Qiu X L 2021 Flexible transformation technology of thermal power units based on high temperature molten salt heat storage and its application prospect Southern energy construction 8 63-70 Google Scholar [2] Li Y, Sun D L, Wang M Q and Qin T 2021 Multi-stage joint decision-making method for flexible transformation of thermal ...

Trojan et al. [4] proposed a scheme to improve the thermal power unit flexibility by installing the hot water storage tank.Richter et al. [5] analyzed the effect of adding a heat storage tank to the load regulation capability of thermal power units.Yuan et al. [6] attempted to improve the operating flexibility through additional electrode immersion boiler.

The paper presents a cost comparison of thermal storage power plants (TSPP) with various conventional power plants. TSPP require less fuel and can better fulfill the demand of variable and intermittent residual loads through providing a much higher flexibility with their intrinsic heat storage system, also called Carnot Battery.

Secondly, after achieving grid saturation with VRE, the residual load gaps must be covered and grid stability must be secured by highly flexible thermal power stations that generate dispatchable renewable electricity (DRE) without using fossil fuels. Thermal Storage Power Plants (TSPP) that integrate solar- and bioenergy are proposed for that ...

Therefore, this paper establishes a cost analysis model for the flexibility transformation of thermal power plants in Jiangxi Province, verifies the economic benefits of the flexibility transformation ...

Based on the basic data in 2020, two different planning cases are set up: 1. synergistic planning for wind

power, PV, thermal power, and hydrogen storage without considering the flexibility transformation of thermal power units; 2. synergistic planning for wind power, PV, thermal power, and hydrogen storage with consideration of the flexibility ...

The paper at hand presents a new approach to achieve 100 % renewable power supply introducing Thermal Storage Power Plants (TSPP) that integrate firm power capacity from biofuels with variable renewable electricity converted to flexible power via integrated thermal energy storage.

Study of supercritical power plant integration with high temperature thermal energy storage for flexible operation. Journal of Energy Storage (2018) ... By enabling each agent to become a power supply agent, a typology transformation from centralized to distributed energy prosumers was proposed, with an intermediate step-by-step transition from ...

It is necessary to satisfy the flexible requirements of solar heat storage systems to provide efficient heating and constant-temperature domestic hot water at different periods. A novel heat storage tank with both stratified and mixing functions is proposed, which can realize the integration of stable stratification and rapid mixing modes. In this research, a three ...

Improving the flexibility of conventional power plants is one key challenge for the transformation of the energy system towards a high share of renewable energies in electricity generation. ... flexible power plants enable the integration of more wind and solar power by ... Regarding the heat storage integration into thermal power plants, most ...

With the increasing penetration of wind power in Jiangxi province, the peak shaving pressure of power grid is becoming increasingly prominent, the phenomenon of abandoning wind and limiting power is obvious, and the scale of thermal power flexibility transformation is expanding. Therefore, this paper establishes a cost analysis model for the flexibility transformation of thermal power ...

After applying the carbon capture device in the thermal power plant, the factors affecting the power plant output include additional steam extraction for the reboiler and auxiliary power consumption for the carbon capture device and the CO 2 multi-stage compression system. For the 630 MW coal-fired plant, the largest part of the electricity ...

Under the requirements of low-carbon energy transformation development, thermal power units will complete the transformation from basic power supply to peak load power supply. This ...

A decision-making evaluation index system for the flexibility transformation of coal-fired thermal power units under the demand of deep peak shaving is established and targeted "one machine, one policy" recommendations were put forward. According to China"s economic green ecological sustainability development requirement, the energy reform of China ...

Flexible transformation of thermal power storage

The phased objectives, difficulties, and challenges of building a new power system were analyzed, along with the problems encountered in the flexible transformation of thermal power units at the present stage. Combined with thermal power operation data, the technical ways of configuring energy storage equipment for thermal power units were ...

thermal power units and carrying out flexibility transformation of thermal power units [3,4]. On the energy demand side, with the development of energy storage technology and

In this paper, a multi-timescale coordinated planning model considering flexible regulation of coal power to support wind and solar storage is established, and the investment decision model is ...

606 FAN ET AL. FIGURE 1 Schematic diagram of thermal power unit peaking process. where H is the planning period, d is the discount rate; c g is the flexibility transformation cost per unit capacity of thermal power units;S g 1 is the set of flexibility transforma-tion thermal power units; N g is the depreciation life of the transformation investment; Pmin g 0 and P min g 1,i

As much wind power is connected to the power system, the accommodation of the wind power in the power grids becomes a huge challenge to the operation model of China"s power system. Releasing and improving the flexibility of the power system will be necessary and important to enable the accommodation of power generated with renewable energy sources, ...

The paper presents a cost comparison of thermal storage power plants (TSPP) with various conventional power plants. TSPP require less fuel and can better fulfill the demand of variable and ...

Most of the power conversion system in a thermal power plant uses water as the working fluid. To become more flexible thermal power plants, an energy storage system (ESS) can be used for storing thermal and mechanical energies of the vaporized water. i.e. steam, when the demand from the grid is not as high or RE generates enough power for the grid.

A thermal storage unit, which consists of electric heater, thermal storage tank and storage steam generator is needed to absorb surplus PV-power and deliver it later on demand. A gas turbine and a heat recovery steam generator are optionally installed to cover loads that exceed the capacity of the steam turbine, if necessary.

DOI: 10.1016/j.apenergy.2020.114608 Corpus ID: 213808649; Enhancing the operational flexibility of thermal power plants by coupling high-temperature power-to-gas @article{Sun2020EnhancingTO, title={Enhancing the operational flexibility of thermal power plants by coupling high-temperature power-to-gas}, author={Yang Sun and Ligang Wang and ...

In order to provide more grid space for the renewable energy power, the traditional coal-fired power unit

should be operated flexibility, especially achieved the deep peak shaving capacity. In this paper, a new scheme using the reheat steam extraction is proposed to further reduce the load far below 50% rated power. Two flexible operation modes of increasing ...

Improving the deep peak shaving capacity of conventional thermal power units and conducting flexible transformations of thermal power units are considered effective strategies to support the ...

Finally, the cost recovery of flexible transformation of thermal power units is obtained through example calculation, in order to provide ideas for the decision-making of flexible transformation of thermal power units, improve the peak adjustment capacity of power grid under high proportion of new energy, and solve the key problems and ...

The flexible transformation of thermal power units is an effective strategy to address the previously mentioned challenges; however, the factors influencing the diffusion of this technology merit further investigation, yet they have been seldom examined by scholars. ... the conversion of coal-fired power plants into thermal storage facilities ...

1. Introduction. Flexibility transformation of coal-fired power plants is critical for renewable energy consumption. In September 2020, China promised to reach peak carbon emissions before 2030 and achieve carbon neutralization before 2060 (Xi, 2020a).Moreover, the proportion of non-fossil energy in primary energy consumption will be approximately 25% in ...

This scheme is the best flexible peak shaving transformation plan for the unit studied in this article, which can recover the initial investment within five years and meet the requirements of technical transformation difficulty. ... The thermal performance of the coupled thermal power-thermal storage system is evaluated in this paper using the ...

Thermal Storage Power Plants (TSPP) as defined in Section 2 of this paper seem to be well-suited to cover the residual load with renewable energy and to reduce curtailment of excess power. They must be understood as highly flexible thermal power plants rather than as simple storage devices.

The flexibility transformation of thermal power units faces challenges such as insufficient peak regulation capacity, high operation costs, slow load response, high operation energy ...