Capacity configuration of high-speed railway energy storage system

How does capacity configuration affect the economic operation of energy storage system?
As the foundation of the energy storage system,capacity configuration is directly relatedto the economic operation of the energy storage system. This paper establishes a multi-objective optimization model with the lowest equivalent annual value and the highest monthly income for the high-speed railway hybrid energy storage system (HESS).

What is China's high-speed railway construction?
China's high-speed railway construction has achieved a significant breakthrough and distinguished achievement . In China, the mileage of railways in service reached 131,000 km in 2018, of which 29,000 km are high-speed lines. Meanwhile, it should be noted that the energy consumption of the railway system is high.

How traction power fluctuations affect high-speed railway system (HSRs)?
Traction power fluctuations have economic and environmental effectson high-speed railway system (HSRS). The combination of energy storage system (ESS) and HSRS shows a promising potential for utilization of regenerative braking energy and peak shaving and valley filling.

How much energy does the railway system use in China?
In China,the mileage of railways in service reached 131,000 km in 2018,of which 29,000 km are high-speed lines. Meanwhile,it should be noted that the energy consumption of the railway system is high. The statistics indicated that the total energy consumption in 2018 was equivalent to 16.2 million tonsof standard coal .

What is hybrid energy storage system (Hess)?
The hybrid energy storage system (HESS) is composed of different energy storage media with high power density and high energy density,such as batteries,capacitors,etc. [3].

Can a hybrid energy storage system be used for traction substations?
The combination of energy storage system (ESS) and HSRS shows a promising potential for utilization of regenerative braking energy and peak shaving and valley filling. This paper studies a hybrid energy storage system (HESS) for traction substation(TS) which integrates super-capacitor (SC) and vanadium redox battery (VRB).

Collaborative operation scenarios between IESs resulted in a 22.96 % reduction in total operational costs and an 80.11 % decrease in CDE. Zhang et al. [14] found that the cost of a hybrid hydrogen-battery energy storage system is 22.85 % and 20.65 % lower than pure battery and pure hydrogen energy storage systems, respectively. To address the ...

To solve the problem of slow capacity configuration due to the large scale of traction power supply systems, Pang Tao et al. [15] proposed a capacity configuration method for rail transit energy storage systems based on

NSGA-II and a ...

High-speed railway has the advantages of fast speed and large transportation volume, but it is also accompanied by huge power consumption. The development of energy storage technology provides new ideas for solving this problem. As the foundation of the energy...

As shown in Fig. 9, a photovoltaic and hybrid energy storage structure is added to the traditional high-speed railway power supply system. Energy flow is achieved by a two-way DC/DC converter and RPC, and the RPC introduced also has a certain inhibitory effect on the quality of the traction power supply system.

High-speed railway has the advantages of fast speed and large transportation volume, but it is also accompanied by huge power consumption. The development of energy storage technology provides new ...

Hydrogen energy has the characteristics of high energy storage density, long storage time, and pollution-free. ... Probability method was used to analyze the random variables which affected the performance of the system. The wind speed and solar radiation intensity were often taken as input variables to solve the capacity for meeting the actual ...

This article summarizes the existing configuration methods for capacity optimization of traction transformer. Then under the conditions of energy storage and new energy access to traction power supply system, the three aspects are described as follows.

LUO Jiaming, WEI Xiaoguang, GAO Shibin, HUANG Tao, LI Duo. Summary and Outlook of Capacity Configuration and Energy Management Technology of High-speed Railway Energy Storage System[J]. Proceedings of the CSEE, 2022, 42(19): 7028-7050. DOI: 10.13334/j.0258-8013.pcsee.211526

The combination of energy storage system (ESS) and HSRS shows a promising potential for utilization of regenerative braking energy and peak shaving and valley filling. This ...

Aiming at the randomness and intermittent characteristics of renewable energy power generation, a capacity optimization method of a hybrid energy storage system is proposed to ensure the economical and reliable operation of wind and solar power supply systems. The optimization method takes the minimum life cycle cost of the hybrid energy storage system as the ...

This paper systematically discussed the current research status of high-speed railway energy storage system capacity configuration and energy management, summarized the key technical issues of high-speed railway energy storage system, and provided corresponding reference for high-speed railway energy storage system engineering.

Electrified railway is one of the most energy-efficient and environmentally-friendly transport systems and has

achieved considerable development in recent decades [1].The single-phase 25 kV AC traction power supply system (TPSS) is the core component of electrified railways, which is the major power source for electric locomotives.

As shown in Fig. 9, a photovoltaic and hybrid energy storage structure is added to the traditional high-speed railway power supply system. Energy flow is achieved by a two-way DC/DC converter and RPC, and the ...

Abstract In the context of the "dual carbon" goals, to address issues such as high energy consumption, high costs, and low power quality in the rapid development of electrified railways, this study focused on the China Railways High-Speed 5 Electric Multiple Unit and proposed a mathematical model and capacity optimization method for an on-board energy ...

The Chinese railway industry will be encouraged to reach its high-quality and sustainable development goal by seizing the opportunity presented by the evolution of the high-speed railway traction power supply system in energy supply-side cleaner, energy demand-side electrification, as well as operation control intelligent.

With the development of the high-speed railway, the energy demand for high-speed railway traction power supply systems is increasing rapidly. To further saving energy and reducing consumption, it is necessary to improve the utilization mode of Regenerative Braking Energy (RBE) produced by the braking state in the process of the high-speed rail train operation.

The increasing demand for sustainable and energy-efficient transportation has driven the adoption of energy storage systems (ESS) in high-speed railway networks.

1.1 High-Speed Railway Hybrid Energy Storage System Topology High-speed railway hybrid energy storage systems usually adopt a centralized arrange-ment, and the basic topology of it is shown in Fig. 1. The HESS is placed in the traction substation to collect and use the regenerative braking energy on the two power sup-ply arms [9].

The electricity consumption of urban rail transit increases year by year with its rapid development. The regenerative braking energy generated by the train can be absorbed and reused by the ground energy storage systems, which can effectively reduce the traction energy consumption, so as to achieve the goal of low carbon and energy saving. It is necessary to consider how to ...

This paper systematically discussed the current research status of high-speed railway energy storage system capacity configuration and energy management, summarized the key technical ...

Therefore, this paper proposes an optimal configuration method for the access capacity of wind power generation system (WPGS), photovoltaic power system (PVPS), and hybrid energy storage system ...

Capacity configuration of high-speed railway energy storage system

The energy storage system converts the electric energy into chemical energy for storage, which has a high energy density, but the power density is relatively small and the cycle life is shorter. The energy storage system of the battery can also be used to stabilize the traction network voltage [7].

In this paper, a hybrid energy storage system (HESS) composed of supercapacitors and lithium-ion batteries and its optimal configuration method ...

The configuration of a battery energy storage system (BESS) is intensively dependent upon the characteristics of the renewable energy supply and the loads demand in a hybrid power system (HPS). In this work, a mixed integer nonlinear programming (MINLP) model was proposed to optimize the configuration of the BESS with multiple types of ...

Reference [19,20] studied the use of mobile energy storage systems to reduce railway operating costs and optimize capacity configuration, but the energy storage medium used is single. Reference [[21], [22], [23]] conducted capacity configuration optimization research on HESS for high-speed trains, but its research background is still based on a ...

WITH the increasing scale of high-speed railways, the problem of high energy consumption for high-speed railway (HSR) traction has become increasingly prominent [1], [2].When a locomotive is running downhill in the slope section, the locomotive usually adopts a regenerative braking strategy, and the potential and kinetic energy of the locomotive is ...

Overview and Prospects of Capacity Configuration and Energy Management Technologies for High Speed Railway Energy Storage Systems. 7028; Jiaming;

This paper systematically discussed the current research status of high-speed railway energy storage system capacity configuration and energy management, summarized the key technical issues of high-speed railway energy storage system, and provided

Taking a high-speed railway station in China as an example, this paper analyses the energy storage configuration of high-speed railway power supply system. The traction load curve of high-speed railway is shown in ...

First, the research and application progress of energy storage systems in rail transit transportation is summarized, ... Key words: rail transit, energy storage system, capacity configuration : TM 912 ，. ...

To reduce the investment of HESS and improve economic benefits, we propose a multi-objective capacity configuration optimization model, which takes the series and parallel ...

The echelon utilization of retired batteries in energy storage systems becomes the focus of research. However,

the inability of existing capacity allocation strategies to balance the economy and reliability is an urgent problem. Therefore, a two-stage hybrid energy storage system (HESS) optimal configuration model is proposed in this paper.

Web: https://eastcoastpower.co.za