

of 1500 V DC traction substation, renewable energy sources and battery energy storage. The energy management strategy is proposed based on multi agent system. The system meets the requirements of self-adaptation and autonomy. Perez et al. in [5] analyze the stability aspects including power balance and voltage level in a DC microgrid including ...

The recovery of regenerative braking energy has attracted much attention of researchers. At present, the use methods for re-braking energy mainly include energy consumption type, energy feedback type, energy storage type [3], [4], [5], energy storage + energy feedback type [6]. The energy consumption type has low cost, but it will cause ...

With the optimal sizing of the HESS, the traction substation can achieve 8.69% annual saving of demand charge and recycle 52.33% of the RBE. The results also show that a traction substation equipped with the HESS yields higher economic benefit than the energy storage systems equipped with only a battery or a supercapacitor.

This paper introduces the concept of fault-tolerant control (FTC) of a multi-string battery energy storage system (BESS) in the dynamic reduction system of a traction substation load (DROPT). The major task of such a system is to reduce the maximum demand for contracted peak power, averaged for 15 min. The proposed concept, based on a multi-task control ...

The fundamentals of traction power substation, distribution system and overhead contact system design, construction and operation; Traction power load flow simulation methods, input requirements and available software for AC and DC traction power systems ... Traction power wayside energy storage systems, substation grounding and substation ...

This paper presents a conception of 3 kV DC traction power system based on distribution sources, as an alternative to traditional traction substation. The system consists of supplying modules (SM) installed along the electrified railway line, the distance between adjacent SMs are much shorter, than between traditional traction substations in 3 kV system. Each SM ...

The energy storage system is an alternative because it not only deals with regenerative braking energy but also smooths drastic fluctuation of load power profile and optimizes energy management. ... Unlike the traditional traction power supply system which enables the electrified railway traction substation to be connected to power grid in a ...

These expansive railway power facilities, which cover vast areas, result in increased maintenance and management costs while affecting the power supply to traction substations (TSs). Herein, we investigated the

load leveling ...

Abstract: Co-phase traction power supply system provides the insights for solving the existing power quality and electrical sectioning issues in high-speed railways, and the flexible control of co-phase traction substation (CTSS) with the integration of photovoltaic (PV) and hybrid energy storage system (HESS) attracts widespread attention. However, the strong ...

Voltage variations of substation auxiliaries and the recorded case of a short-term ac failure are shown qualitatively and quantitatively. To improve the quality of power supply to essential auxiliary consumers of the combined traction substation, a technical solution based on a hybrid energy storage is proposed.

A novel topology of railway traction substation integrated power optimization controller (POC), hybrid energy storage system (HESS) and photovoltaic (PV) generation system is studied in this paper. The railway station energy management strategy is divided into high-level and low-level, in which high-level optimizes energy flow of substation, and the low-level controls power ...

In the upper level control layer, the energy management model is established with the objective of minimizing the daily electricity charge in the traction substation, and the constraint of negative sequence, and the reference power command for hybrid energy storage system and co-phase traction power supply system are generated.

Hitachi Energy offers traction substations for DC and AC applications containing all the switchgear and control equipment, including fault analysis equipment. ... network management systems, energy recuperation and energy storage systems as well as a broad range of system studies and dynamic traction power supply simulations based on powerful ...

In the power supply system of urban rail transit, the main substations are connected to the power network and transform 110 kV AC to 35 kV AC. The medium voltage cables connect the main substations, traction substations, and step-down substations. In traction substations, BCDs convert energy between the 35 kV AC and the 1500 V DC side.

One part is the loss of traction energy provided by the substation for this train on the line when the current braking train B becomes ... Yang ZP, Zhao ZW, Lin F (2021) Two-stage synthetic optimization of supercapacitor-based energy storage systems, traction power parameters and train operation in urban rail transit. IEEE Trans Veh Technol 70 ...

The integration of hybrid energy storage systems (HESS) in alternating current (AC) electrified railway systems is attracting widespread interest. However, little attention has been paid to the interaction of optimal size and daily dispatch of HESS within the entire project period. ... a novel bi-level model of railway traction substation ...

Abstract: Flexible traction substation (FTSS) integrates PVs, energy storage systems (ESSs), and railway

power flow controllers (RPFCs) into the existing split-phase traction substation. It is a vital solution in advancing electric railways towards a low-carbon, efficient, and grid-friendly future. To improve the techno-economic performance of FTSSs, this paper proposes a sizing method to ...

Moreover, advancements in battery storage technology have led to investigations into the integration of energy storage systems with traction substations. Energy storage can help balance power supply and demand, support the integration of renewable energy sources, and provide backup power during emergencies.

The structure of a typical traction substation with energy storage system (ESS) is shown in Fig. 1. With the operation of the railway power conditioner (RPC), it is possible to achieve a bidirectional flow of energy between the left and right feeding sections.

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