

How to improve regenerative energy utilization in subway systems?

Maximizing regenerative energy utilization is an important way to reduce substation energy consumption in subway systems. Timetable optimization and energy storage systems are two main ways to improve regenerative energy utilization, but they were studied separately in the past.

How regenerative energy storage systems can reduce substation energy consumption?

For example, Wayside Energy Storage Systems (WESSs) can store the surplus regenerative energy temporarily and deliver it back to accelerate trains in the same Electricity Supply Interval (ESI) when needed. Thus, Substation Energy Consumption (SEC) can be reduced.

Can timetable optimization optimize regenerative energy utilization in a subway system?

An integration of timetable optimization and WESS is proposed to maximize regenerative energy utilization, thus to minimize substation energy consumption in a subway system.

Why should a subway timetable be optimized?

An optimized timetable can improve regenerative energy utilization between traction and braking trains, hence reduce substation energy consumption in a subway system. In addition, the cost of timetable optimization is relatively low.

Does WESS reduce substation energy consumption?

Experimental results indicate that substation energy consumption is effectively reduced by using WESS together with a correspondingly optimized timetable. Note that substation energy consumption becomes lower when the total size of WESS is larger, and timetable optimization further reduces it.

What are Pareto optimal solutions for the experimental subway line?

A set of Pareto optimal solutions is obtained for the experimental subway line--based on which, decision makers can make a sensible trade-off between energy conservation and WESS investment accordingly to their preferences.

Review of Energy Storage Systems in Regenerative Braking Energy Recovery in DC Electrified Urban Railway Systems: Converter Topologies, Control Methods & Future Prospects September 2021 DOI: 10. ...

Installing a ground-based super capacitor energy storage system in the subway will effectively recover the regenerative braking energy of the train, reduce the energy ...

For the application in a storage for a geothermal power plant, a maximum operation temperature of 165 °C was defined. The temperature is 15 K above the melting temperature and used for the aging experiments. ... Furthermore, components for latent thermal energy storage systems are developed including

macroencapsulated PCM and immersed heat ...

In this paper, the subway traction drive system (STDS) is established to simulate the braking deceleration condition of subway. The STDS is composed of the DC traction network and the traction motor. The DC traction network is a 24-pulse rectifier, and the traction motor is a three-phase asynchronous motor. The control strategy is the slip frequency vector ...

Nowadays, the energy storage systems based on lithium-ion batteries, fuel cells (FCs) and super capacitors (SCs) are playing a key role in several applications such as power generation, electric vehicles, computers, house-hold, ...

ESS are commonly connected to the grid via power electronics converters that enable fast and flexible control. This important control feature allows ESS to be applicable to various grid applications, such as voltage and frequency support, transmission and distribution deferral, load leveling, and peak shaving [22], [23], [24], [25]. Apart from above utility-scale ...

This paper aims to study how to mix energy feedback and ground energy storage technologies to achieve efficient collection and utilization of subway energy during operation. The research ...

optimized, based on the application of the energy storage. The power rating of a flywheel depends on. ... MRL provides rail subway service connecting downtown to San Fernando Valley through.

Keywords: Subway system, traction application, energy management, train timetable optimization, energy storage device Journal of Control System and its Recent Developments Open Journal Systems. ... Li S., Gao Y. Energy-Efficient Train Timetable Optimization in the Subway System with Energy Storage Devices. IEEE Transactions on Intelligent ...

The simulation results showed that the scheme was feasible and available to provide reference for the application of vibration energy storage system for subway track. Mechanical structure diagram ...

With the rapid development of urban rail transit, power consumption has increased significantly. In 2021, the total electric energy consumption of China's urban rail transit reached 22.8 billion kWh, with a year-on-year increase of 6.9 % [1, 2]. Reducing the traction energy consumption of urban rail transit is critical for society to achieve energy conservation ...

The authors have conducted a survey on power system applications based on FESS and have discussed high power applications of energy storage technologies. 34-36 Authors have also explained the high-speed FESS control of space applications. 37 Many authors have focused on the evolutionary part of the motor and generator for FESS.

Benefiting from the dual function of energy-saving and voltage balance, OESD is being sought after by

researchers . Recently, many energy storage-related technologies have been studied, such as flywheels, supercapacitors, hybrid energy storage systems, which can be divided into stationary energy storage devices (SESD) and OESD. Different ...

Energy Storage and Applications is an international, peer-reviewed, open access journal on energy storage technologies and their applications, published quarterly online by MDPI. Open Access -- free for readers, with article processing charges (APC) ...

The energy storage unit in the supply network is a lithium-ion battery equipped with DC-to-DC converter with battery charge-discharge loop controller. Energy flows are controlled by ...

All In One Energy Storage System; Lithium Battery Energy Storage Cabinet; Lead Acid Battery Series ... we will explore the advantages of lead-acid batteries in subway systems and examine their various applications. Advantages. High Energy Density: High energy density, or the ability to store more energy in a smaller volume, is a feature of lead ...

The data collected in this project can be utilized to properly design, integrate and operate energy storage systems in the NYCT Subway system, leading to reduced energy usage, reduced greenhouse gas emissions, reduced energy costs, and increased infrastructure capacity.

4.1.1-3 Energy Storage Device Model 20 4.1.2-1 Full Stop Motion Model Data 21 4.1.2-2 Partial Deceleration Motion Model Data 23 4.1.3-1 Model of Energy Storage with Lithium Ion Cells 25 4.1.3-2 Model of Energy Storage with EDLC Ultracapacitor Cells 27 5.1-1 Peak Charging Capability of Energy Storage Devices 30

Jin and co-workers reported that an integrated energy "harvesting-storage" devices, especially photocharging devices that can simultaneously achieve the functions of photoelectric energy conversion and electrochemical energy storage, had attracted enormous attention to serve as sustainable and portable distributed power sources . This device ...

Request PDF | A novel wind energy harvesting system with hybrid mechanism for self-powered applications in subway tunnels | With the rapid development of urban rail transit, the safety maintenance ...

The system designed in this paper can convert the wind energy of the subway tunnel into electrical energy to achieve energy storage and application. This chapter analyzes three aspects: electromagnetic power generation analysis, piezoelectric power generation analysis, and simulation analysis.

3 REAL APPLICATIONS OF ONBOARD ENERGY STORAGE SYSTEMS. Rail transport has experienced significant improvements in energy efficiency and GHG emissions reductions, equating to more than a 20% change in each over the past 20 years . Manufacturers have increasingly employed multimodal vehicles with onboard storage devices as a feasible ...

Hybrid energy storage technology, which consists of lithium-ion batteries (LiB) and super capacitors (SC), is an effective way to ensure the safety of power supply and realize ...

As an efficient urban transportation mode, subway has been developing rapidly in China, which provides convenience for people to travel and also produces certain vibration pollution. ... The simulation results showed that the scheme was feasible and available to provide reference for the application of vibration energy storage system for subway ...

An inversion-based control of the ESS is deduced from the Energetic Macroscopic Representation of the entire system, which enables the energy recovery to be maximal and secure the supercapacitor in real time for different track configurations. In this paper, a new energy storage system (ESS) is developed for an innovative subway without supply rail ...

DOI: 10.1016/j.jrtpm.2018.03.003 Corpus ID: 264257712; Energy saving in metro systems: Simultaneous optimization of stationary energy storage systems and speed profiles @article{Ahmadi2018EnergySI, title={Energy saving in metro systems: Simultaneous optimization of stationary energy storage systems and speed profiles}, author={Saeed Ahmadi and Ali ...

Overview of current development in electrical energy storage technologies and the application potential in power system operation. Applied Energy 137: 511-536. Article Google Scholar Fengbing, Li. 2015. Control and Optimization of Hybrid Energy Storage Systems Containing Lithium-ion Batteries and Super-Capacitors. Chongqing: Chongqing ...

The energy consumption in the built environment represents one of the major contributors of carbon emissions to the atmosphere. This leads to the need for a transition in the building sector and the introduction of policies that pursue high efficiency in residential and non-residential buildings with an increasing share of renewables.

This paper investigates a train timetable problem in a subway system, which is equipped with a series of energy storage devices at stations, and a nonlinear integer programming model is formulated to maximize the utilization of regenerative braking energy. In subway systems, electrical trains can generate considerable regenerative braking energy ...

With this consideration, this paper particularly investigates a train timetable problem in a subway system, which is equipped with a series of energy storage devices at ...

The simulation results show that the supercapacitor bank based on power, capacity and discharge depth can meet the requirement of braking energy recovery for subway vehicles and the economic evaluation of the project shows that the project will achieve good social and economic benefits. The on-board supercapacitor energy storage system for subway ...

2.6 Hybrid energy-storage systems. The key idea of a hybrid energy-storage system (HESS) is that

heterogeneous ESSes have complementary characteristics, especially in terms of the power density and the energy density . The hybridization synergizes the strengths of each ESS to provide better performance rather than using a single type of ESS.

In this paper, the feasibility of using stationary super-capacitors to store the metro network regenerative braking energy is investigated. In order to estimate the required energy storage system (ESS), a very simple model for metro network is developed. Using the model of metro network for a particular station, a new approach is proposed to find an ...

Energy storage research is inherently interdisciplinary, bridging the gap between engineering, materials and chemical science and engineering, economics, policy and regulatory studies, and grid applications in either a regulated or market environment.

In subway systems, kinetic energy can be converted into electrical one by using regenerative braking systems. ... Very promising are energy storage applications in propulsion systems of diesel ...

The on-board supercapacitor energy storage system for subway vehicles is used to absorb vehicles braking energy. Because operating voltage, maximum braking current and discharge depth of supercapacitor have a great influence on its rational configuration, there are theoretical optimum values based on the analysis of vehicle regenerative braking theory, whose ...

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