Metro line energy storage

What are the benefits of storing energy in Metro stations?
In turn the stored energy could power upon demand selected stationary electrical loads in Metro stations of a non-safety critical character (such as lighting,ventilation,pumps,etc.) leading to very significant energy savings and to a corresponding reduction of greenhouse gases.

Can stationary ESS save regenerative energy in a metro network?
In Refs. ,,,,stationary ESS has been applied to save the regenerative energy in a metro network. Stationary ESS has been proposed for voltage regulation of weak points in Ref. . But,the driving cycle and characteristic of the studied metro system has not been throughly explained.

Can a stationary super-capacitor save regenerative braking energy in a metro line?
Razieh nejati fard, stationary super-capacitor energy storage system to save regenerative braking energy in a metro line Energy Convers. Manag., 56 (2012), pp. 206 - 214

How much energy does a metro station use?
A typical Athens Metro station stationary electrical loads consumption has been experimentally measured to be of the order of 2000 kWh/dayhence the HESS energy could cover most of these loads,as long as they are not of a safety critical nature (e.g. tunnel ventilation).

Can a hybrid energy storage system smooth out DC traction network power fluctuations?
A hybrid energy storage system has also been reported aiming to smooth out DC traction network power fluctuations, due to moving trains. In this context, a variable gain K iterative learning control (K-ILC) is proposed to balance the DC regulated voltage characteristics and thus lead to optimal lifetime of the battery storage system.

The methods proposed for maximizing the recovered energy are presented together with their theoretical analysis and results show that the system performance is significantly improved when reversible substations or energy storage are in operation. Growing concerns about environmental issues dictate the necessity for improving the energy efficiency ...

High electric energy consumption is one of the main challenges of metro systems, which the operators deal with. Among several energy saving methods, this paper focuses on the simultaneous application of speed profile optimization and energy storage systems, to efficiently utilize regenerative braking energy. With this approach, a substantial reduction in energy was ...

Leoutsakos G., Sarris, K., Kyriazidis, D.: Hybrid energy storage system for the utilization of regenerative braking energy in metro stations--energy measurements on board two trains and in three rectifier substations. Attiko Metro - MetroHESS Deliverable Report 2.2 - rev2, WP2 (2020) Google Scholar

It should be noted that the model of the entire line is not considered. Besides, the aim is to minimize the operation cost. Fernández-Rodríguez et al. [27] evaluated the energy performances of an Italian metro line and a Spanish metro line, and also examined the capacity to charge EVs with detailed simulations. The authors concluded that a ...

This simulation tool is used to study the most convenient ESS alternative for the case of a Brussels metro line. When compared with a conventional metro line, the total energy consumption reduction achieved with stationary ESS varies in function of the traffic conditions, ESS size and ESS distribution along the line.

This paper presents an analysis on using an on-board energy storage device (ESD) for enhancing braking energy re-use in electrified railway transportation. A simulation model was developed in the programming language C++ to help with the sizing of the ESD. The simulation model based on the mathematical description has been proposed for a train ...

Energy storage systems, on-board the train or in the track-side, can be implemented to avoid this situation and maximise regenerated energy usage. The main technologies that have been applied in railways, the modelling of these energy storage systems and its control are discussed in this chapter. ... This metro line comprises 18 stations across ...