

Public Summary of Confidential deliverable D4.6 Preliminary design of the mainline smart grids

What is MERLIN?

MERLIN is a collaborative project funded under the European Commission's 7th Framework Programme on Research and Development. MERLIN started on 1st October 2012 and will last 36 months.

MERLIN's main aim and purpose is to investigate and demonstrate the viability of an integrated management system to achieve a more sustainable and optimised energy usage in European electric mainline railway systems.

What are the issues at stake?

Energy management is a key issue for railway systems and this situation will continue to be prominent for the foreseeable future. Multiple operational scenarios add complexity to the development of suitable and appropriate energy management solutions. Moreover, existing assessment tools lack an integrated approach, and tend to omit the variation in emission levels, energy usage and associated costs resulting from differing traffic peaks.

Given that the railway system is a complex and interconnected system, a single supplier, operator or infrastructure manager (as large as they may be) cannot

tackle the energy management issue for the entire network alone. Hence, only through a collaborative approach such as **MERLIN** can effective solutions for this issue be developed. Appropriately, the **MERLIN** consortium brings together the key rail stakeholders from across Europe.

What are MERLIN's main achievements?

- Proposals for technical recommendations (UIC/UNIFE TecRec) on Specification and verification of energy and power consumptions of railway systems and on Energy and power related information protocols at operational level;
- Future business models & recommendations (smart energy management, cost saving);
- Optimised solutions for current and future business models;
- Reference architecture and interfaces related to a strategic support tool and operational energy management tool which supports real time suggestions to network actors.

Public summary:

WARNING: *This document is a synthesis of a confidential document. Access to the full content of the deliverable is restricted to the members of the MERLIN consortium and to the European Commission's services.*

Introduction

D4.6 "Preliminary design of the mainline smart grids" deals with the scenario 1 define in MERLIN project. This scenario concerns a French high speed mainline between Paris and Lyon, with a 25 kV 50 Hz power supply.

Objectives

The final aim for SNCF is to increase the capacity of the line, from 13 to 16 trains per hour per way.

One of the difficulties is the power system weakness in some places: roughly in the Morvan's hills, halfway between Paris and Lyon.

SNCF Réseau wants to improve the line capacity with minimum investments in the power system. This means to optimise the use of the energy on the railway network and to smooth power needs during peak hours.

Solutions

It was demonstrated in MERLIN that this goal could be reached by a better management of available energy. Two types of solutions were studied, which consist in getting a smooth power demand:

- At software level: traffic optimisation.
Solution #1: timetable is designed offline to be less energy consuming and to avoid simultaneous power peaks.
Solution #2: real operation brings unexpected conflicts into the timetable that will be mitigated in order to reduce energy impact. The traffic regulation using an ATS (Automatic Train Supervision) can be implemented, suggesting speed profile modifications. For example, significant energy reduction is obtained when avoiding braking, stops and accelerations.
- At hardware level: hybrid substation.
Solution #3: integration of intelligent energy storage and/or alternative energy sources (such as renewables) rather than building a new substation. For example, energy stored during the night can be re-injected into the railway power system during rush hours. The storage system is then added to a conventional existing substation, leading to a hybrid power substation.

Conclusion

These solutions have to be applied sequentially in order to maximize energy benefits. Timetable adjustment, offline, then traffic issues solving, online, is the first step to optimize power system sizing. Then, if "software" solutions are not enough, the railway power system "hardware" can be optimised, in a second step.

More information

To know more on the MERLIN project, please visit <http://www.merlin-rail.eu>.