Public Summary of

D4.1 DETAILED ARCHITECTURE OF REM SYSTEM

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 railwaysystemsand 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.

Sustainable and intelligent management of energy for smarter railway systems in Europe: An integrated optimization approach

D4.1 "Detailed Architecture of REM-S" intends to present and illustrate a detailed reference architecture specification of a holistic railway energy management system in terms of new smart grid structures, new management strategies and new controllable components, like new intelligent devices for energy management at infrastructure grid level or at vehicle level. The system is named as REM-S.

The CEN-CENELEC-ETSI Smart Grid Coordination Group offers a reference and support for smart grids use case design with an architectural approach, called SGAM (Smart Grid Architecture Model). Thus, taking the base of the SGAM, the railway energy optimisation use case has been adapted to it. The SGAM is a three dimensional model, with five interoperability layers and a two dimensional smart grid planes.

The main aim of the deliverable is presenting the detailed architecture of the Operational Railway Energy Manager System (REM-S) and its matching to the SGAM. The following layers of the SGAM were used to describe the REM-S detailed reference architecture:

- Business Layer, including:
  o Business objectives: Energy, Power and Cost optimisation;
  o Participant organisations and actors in the business activities;
  o High level functions to achieve the objectives, and;
  o Services for implementing the functions by interaction with actors.
- Function Layer, including:
  o Function layer structure of the primary functions (detailed functions from the point of view of the implementation, detailed enough to be mapped onto a specific architecture);
  o Division of functions by different operational modes: Day Ahead Operation (DAO), Minutes Ahead Operation (MAO) and Real Time Operation (RTO), and;
  o Allocation of functions in SGAM's Zones-Domains plane.
- Components Layer, including:
  o The specification of components involved in REM-S, and;
  o Classification in generic or specific REM-S components.
- Information Layer, including:
  o The information exchange between the source actors and the destination actors, and;
  o The sequence diagram of the information flow.
- Communication Layer, including:
  o Protocols, standards and mechanisms for the interoperable exchange of information between components, and;
  o Communication profile (infrastructure needed for the transmission) and application profile (syntactic and semantic sense to the transmission).

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