UIC WORKSHOP ON ENERGY EFFICIENCY OF FUTURE TRAINS

*Infrastructure for energy efficiency:*

Innovation technologies towards energy efficiency

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Rome, 4-10-2017
RFI, a company of Ferrovie dello Stato Group, has been established on July 1st 2001, at the conclusion of a restructuring process of the whole Group.

RFI is the company responsible for the management and maintenance of the rail infrastructure.

RFI manages the control and safety systems connected with train operations, defines the criteria for the use of the network and enters into contracts with railway companies for the access to the rail infrastructure.
RFI: National railway infrastructure

... a big network

Network: 16,742 km
Double track: 7,536 km
Single track: 9,206 km

Power supplied lines: 11,932 km (71%)

Tunnels and bridges: 1,980 km
Stations: 2,260

Signalling technologies:
- SSC – SCMT: 16,742 km
- ERTMS: 671 km
- GSM-R: 9,000 km

Power Supply system:
- 3 kV DC for conventional lines
- 25 kV AC for high speed lines

~ 1,000 km High Speed
~ 950 km City network
~ 2,900 km Basic performance
~ 3,900 km Medium performance
~ 7,950 km Low traffic line
RFI projects towards energy efficiency

RFI is involved in the research and the development of the following projects in the energy efficiency field:

- On-board energy measurements;
- On-board energy efficiency: implementation of the eco-driving technique, realized by optimization algorithms.
- Energy recovery and voltage control systems in ESSs.
RFI is involved in MyRails project that aims to develop the metrological infrastructure for accurate measurement of energy exchange and for reliable system monitoring, which underpins the implementation of an energy efficiency management of the European DC and AC railway, in order to reduce the $CO_2$ railway transport emissions by 50% by 2030. Moreover, an error of 5% on 36.5 TWh, the energy consumption of the European railway system, equates to around 110 M€ savings.
RFI on-going energy efficiency projects

- Project presently being developed in Italy:

  ERTMS High Density

  Test of a DAS prototype

  ERTMS level 2 on city railway network with ATO (Automatic Train Operation)

  on a regional train (in co-operation with Trenitalia) – Driver Auxiliary System

  Integrated with ERTMS

  External supporting device

The **main advantages** are:

- punctuality improvement;
- carbon footprint reduction;
- energy costs decrease.
**Speed profiles**

**Current speed profile:**

- ETCS MRSP
- Speed profile

**Final goal:**

- ETCS MRSP
- Optimizes speed for energy saving
Energy recovery and voltage control systems in ESSs

The energy recovery and voltage control system is an innovative system designed for the 3 kV DC power supply system.

The main advantages are the following:

- Regulation of the contact line voltage and the increase of the operational advantages;
- Improvement of the energy saving by recovering the rolling-stock braking energy.

The innovative ESSs are composed by:

- Supply transformer for interconnection of HV and MV supply systems;
- AC/DC converter for the power conversion and for the voltage control in the DC railway system;
- DC/DC converter for conversion of rolling-stock braking electrical energy;
- Energy storage device.
The **main characteristics** of the components are:

- The **AC/DC converter** in active rectifier mode behaves as a traditional converter and shall provide maximum 10MW overload capability.

- The **DC/DC converter** is bidirectional in order to store the rolling-stock braking electrical energy and reuse it into 3 kV DC line.

The energy storage device consists of a supercapacitors bank and it is connected directly with the contact line.

The supercapacitors are designed to handle the power peaks caused by the rolling-stock braking and to store the related energy.

This energy will be given back to the rolling-stock during the traction phase.
Energy recovery and voltage control systems in ESSs

The transformation unit and the recovery energy unit are not performing at the same time.
Thank you for your attention