CONIFER
INNOVATIVE TOOLS AND CONCEPTS FOR AN INTELLIGENT ELECTRICAL NETWORK APPLIED TO RAILWAYS

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INTRODUCTION

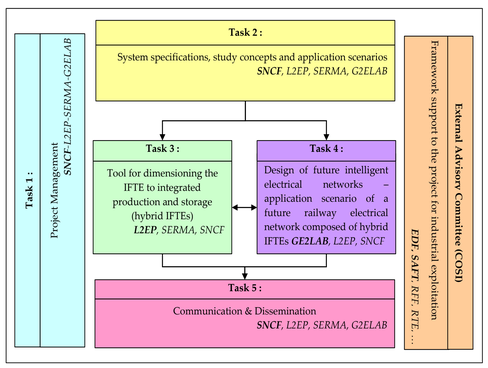
- Near future growth in rail traffic will bring about a growth in energy consumption. The expected increase in energy prices is a risk for the overall energy cost. Changes in the way energy is consumed are needed using intelligent management of railway electrical networks to optimise the system performance.
- The needed technological breakthrough is possible by developing **energy storage capacities, decentralised renewable production, and optimal management of multi-source systems** to be integrated in an intelligent electrical network.
- CONIFER develops **tools for dimensioning and analysis to allow optimal conception of this future railway electrical network using these new means.**

OBJECTIVES

- Advances in skills **concerning the railway network (concept of the Hybrid IFTE: "Railways Fixed Electric Traction Installation")**
  - Integration of storage systems to make use of the kinetic energy of trains
  - Integration of renewable sources in the energy production means for the railway
- Advances in the tools used to conceive the IFTE and the energy management
  - Development and management of multi-source systems and multi-storage to optimise electrical network services
  - Improvement of railway network architecture to increase energy efficiency and to allow "smart-grid" type supervision
  - Development of supervision methodologies for intelligent electrical networks
- Scientific advances through the development of models and algorithms
  - Characterisation and analysis of the real behaviour of technical components
  - Implementation of optimisation tools for complex systems

METHOD

- The project has been organised in 5 inter-connected tasks presented in the following diagram.
- The consortium is composed of the following partners:
  - SNCF (Coordinator)
    - Management of Systems and Engineering Projects
    - Management of Innovation and Research
  - L2EP ("Laboratoire d'Electrotechnique et d'Electronique de Puissance de Lille": Laboratory of Electrical Engineering and Power Electronics in Lille)
    - HEI ("Hautes Etudes d 'Ingénieurs" : School of High Studies in Engineering)
    - AMPT (Arts et Métiers ParisTech)
    - EC Lille (École Centrale)
  - G2ELAB (« Laboratoire Génie Electrique de Grenoble » : Grenoble Electrical Engineering Laboratory)
  - SERMA INGENIERIE (Specialist in systems engineering)
- The project research is receiving funding from the ANR (Agence Nationale de la Recherche: National Research Agency) Framework Programme STOCK-E

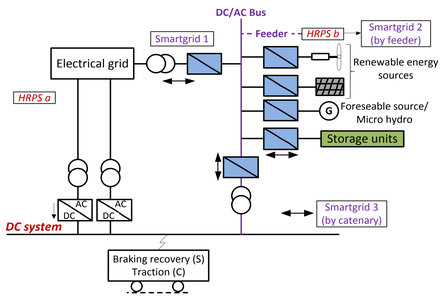


RESULTS

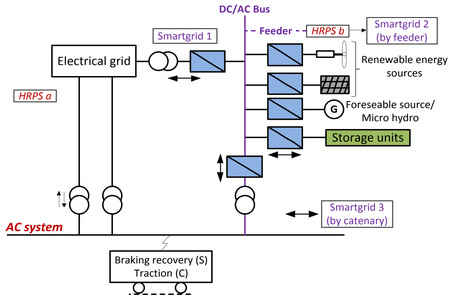
- An **optimal dimensioning tool** for the future IFTE hybrid. This dimensioning will take into account constraints linked to the sub-station (the type of electrification, the interfaces with the Electrical Power Network (RTE), etc.), its application (traffic on the line, power profile requested, etc.), and also the reliability and complementarity of the components envisioned for hybridisation. With the aid of this dimensioning tool, it will be possible to evaluate and compare the impact of the **management chosen from a technical and economic point of view.**
- Future **intelligent electrical railway networks** with a global approach based on a systemic vision. The intelligent character of such a network will be created through a new control architecture and a strategy for the management of a portfolio of production sources and storage constituted of the IFTE hybrids. This energy management will be adaptable and permit the coordination of all these components in order to optimise the exploitation of the railway infrastructure according to different targeted functions (reliability of network, optimised purchase of energy, optimised consumption of the rail line, etc.).

GENERIC ARCHITECTURE FOR THE FUTURE SUB-STATION HYBRID

DC HRPS system 1.5 kV



AC HRPS system 25kV 50Hz AC



CONCLUSION: PROSPECTS AND PERSPECTIVES

SNCF will be the end user of the technologies developed. As a complement to their electrified network dimensioning tools and their railway systems expertise, these new tools will provide experts with a decision-making support pertinent for optimising the supply installations.

The impact of the scientific content of the project:

- A better understanding of energy management methods
- A continuation of the capitalisation on storage systems and their modelling
- A first approach in the design and management of the Smart-Grid
- A new domain of application for optimisation methodologies.

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