



European Rail Research Advisory Council

ERRAC ROADMAP FACT SHEET

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The Greening of Surface Transport

- WP01 -

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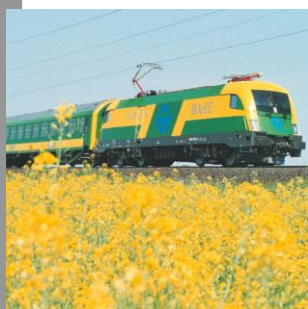
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Rail transport has the capability to play a key role in a sustainable transport system by offering efficient services with low environmental impact, and these strengths need to be articulated in the political decision-making process. Through the use of mechanisms such as fairer pricing and the internalising of external costs, modal shift to rail, and innovative co-modality concepts become more achievable and offer sustainable solutions for the various challenges in the transport sector.



Today's energy and environmental research places high emphasis on energy efficiency, environmental impact, alternative energy sources to be prepared for the reduced availability and finally disappearing of fossil fuels. The work carried out in the WP1 provides scope to explore more radical, environmentally friendly and innovative technologies that can prepare for the step change required for the medium-term future and meanwhile can stimulate radical technology changes and foster creative thinking. Energy resources are getting scarce and legislation on emissions is getting stricter. Even though the railway is the most energy-efficient and green transport mode, research is needed on energy efficiency and eco-design to further improve the performance of rail.



Noise and vibration have to be considered in a system and holistic approach to reduce emissions and external perceived noise levels. A lot has been done but the research efforts should go on: reducing noise from individual sources (freight trains, noise, emission reductions from diesel engines on trains, etc.), technologies for active noise and vibration control. Software tools will assist the development of methods to reduce noise at source, to derive technologies and to enhance system assessment and decision-making processes.



Becoming greener means that we will also consider the overall railway life cycle and especially elimination of materials with a negative environmental impact, measures like closed cycle waste management systems for a high level of recycling, historical legacy of existing infrastructure (creosote sleepers), greener land use, pollution from the rail sources (chemical treatment against shrubberies) and the emissions of electromagnetic waves.

WORKING METHOD

Over the duration of the ERRAC Roadmap project (three years) the work package will produce at least three different roadmaps:

- Energy Roadmap for the European Railway sector,
- Noise and vibration Roadmap, and
- Roadmap on other environmental issues.

These roadmaps will help the European railway industry/sector to focus on the most promising research activities, especially research funded through the European Framework Program (FP), FP7, FP8 and the following.

The ERRAC Roadmap WP1 activities are supported by UIC and UNIFE.

Objective of WP01

To ensure that the railway mode will remain a green transport mode by defining the necessary research activities to carry out at the European level.

ENERGY ROADMAP

Energy consumption for passenger and freight transport has significantly increased together with transport demand in the last decades putting heavy pressure on fossil fuel resources as well as increasing the emission of industrial greenhouse gases. Railways are very energy efficient compared to other modes of motorised transport mainly due to lower rolling and air resistance combined with a controlled driving pattern. In order to stay economically competitive and act socially responsible towards the environment, railways must continue increasing their energy efficiency.

Targets and Goals of Research

Climate protection

- By 2030 the European Railways will reduce their specific average CO₂ emissions from train operation by 50% compared to base year 1990; measured per passenger-km (passenger service) and gross-tonne-km (freight service).
- In addition, by 2030 the European railways will not exceed the total CO₂ emission level from train operation in absolute terms even with the projected traffic growth compared to base year 1990.
- The European railways will strive towards carbon-free train operation by 2050 and provide society with a climate neutral transport alternative.

Energy efficiency

- By 2030 the European railways will reduce their specific final energy consumption from train operation by 30% compared to the base year 1990; measured per passenger-km (passenger service) and gross-tonne-km (freight service)
- The European railways will strive towards having their specific final energy consumption from train operation by 2050 compared to the base year 1990; measured per passenger-km (passenger service) and gross-tonne-km (freight service).

Exhaust emissions: Nitrogen oxides and Particulate Matter (PM₁₀)

- In addition, by 2030 the European railways will reduce their total exhaust emissions of NO_x and PM₁₀ by 40% in absolute terms even with projected traffic growth compared to base year 2005.
- The Europe railways will strive towards zero emissions of nitrogen oxides (NO_x) and particulate matter (PM₁₀) from non-electric trains by 2050.

Priority areas

- System view

We consider that the higher and more efficient savings of energy will be ensured by considering the consumption of energy in the overall railway system, and also considering all the interactions between the different sub-systems. The better efficiency will be reached by managing the different parts of the railway system and their interactions between all of them. We have shared the following statements:

- Necessary monitoring about consumption energy in the railway system
- More and more re-use of kinetic energy
- Managing the electrified system by implementing concepts of smart grid networks (multiplication of the energy sources). Storing energy will be strongly developed

- Rolling Stock

Electric propulsion is already very environmentally friendly due to very efficient electric motors and the fact that eco-energy can be used. Significant improvements can be achieved only with breakthrough ideas. Nevertheless, the control of exhaust emissions (e.g. particulate generation and different exhaust gases) and the necessary reduction of dependence on fossil fuels were deeply examined. Hybridisation of energy, i.e. mixing and managing various sources of energy and storing installation, for the diesel and the 100% electrified mode, is a way of improvement for the rolling stock.

- *Lighter rolling stock, especially for the urban and suburban passenger operations*
- *More compact, lighter, and more efficient equipment*
- *Full recovery of braking energy*
- *More intelligent management of auxiliaries*
- *Consideration of the next generation of power semi-conductor (efficiency, lighter components)*

- Infrastructure

It was considered how energy is lost in the infrastructure, the rolling stock, in the interfaces of the system and how these losses could be saved and how energy could be temporarily stored to maximise the global efficiency. The fields of development are the following:

- *Development of smart grids concepts, based on economical potential assessment*
- *Minimising the losses in the electric railway infrastructure, especially in DC systems by considering catenary, increased voltage, etc*
- *Consideration of infrastructure sections without catenaries in electrified system*
- *Feeding of kinetic energy to the public grid*
- *Storing of energy in the infrastructure*

- Railway operation

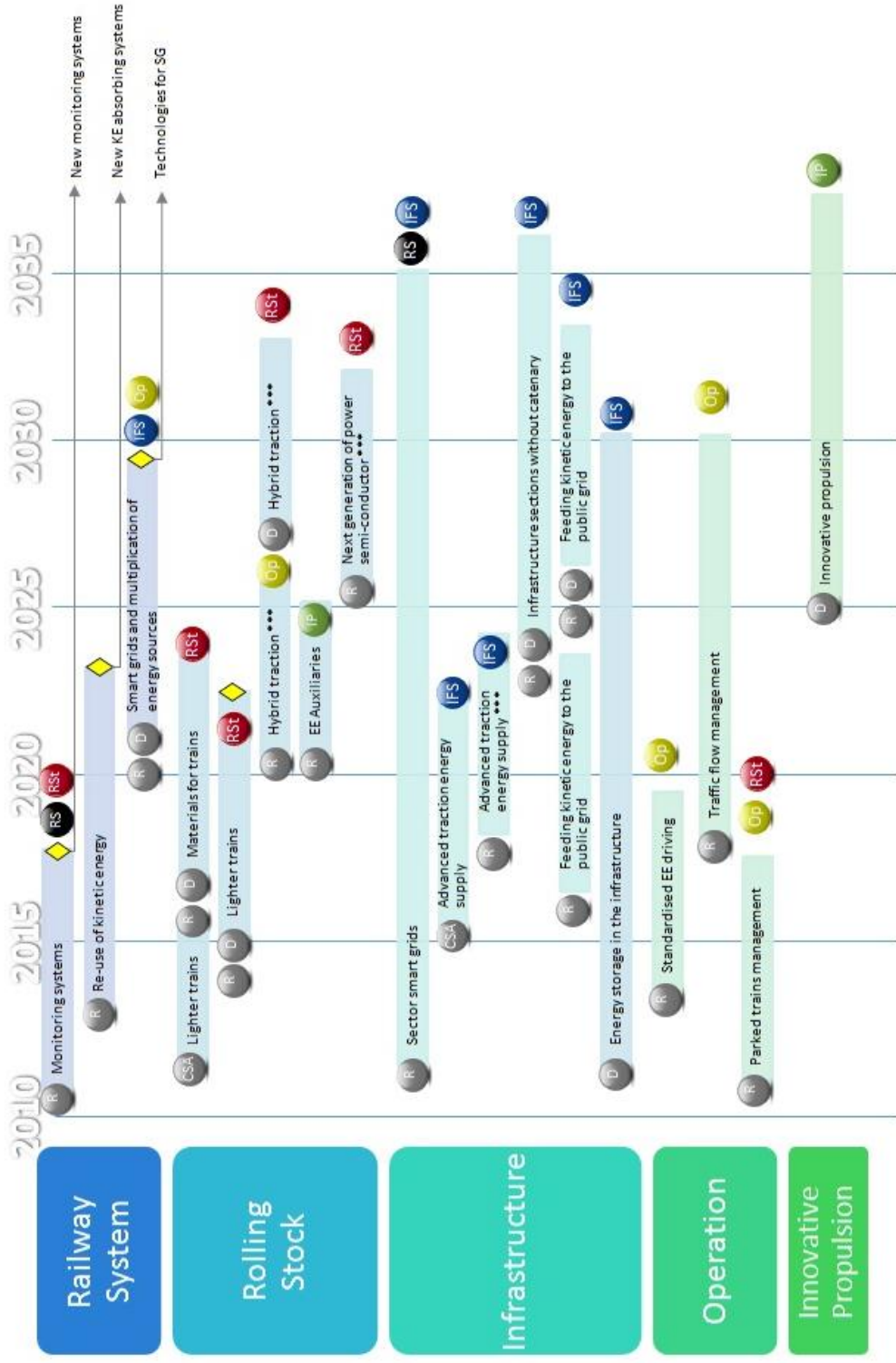
Different approaches exist to smoothen the traffic flow like traffic flow management, longer trains, double stack wagons or removing bottlenecks by adding a third track (which is not always possible especially in densely populated urban areas). Optimizing energy use can be achieved by improved route planning, optimised timetabling, fully implemented eco-driving or by paying more attention to parked trains management. In the Energy Roadmap, the group has investigated the following fields in more depth:

- *Management of Operations / Traffic Flow Management*
- *Parked Trains Management*

- Hydrogen and fuel cells

The application of the fuel cell in the European railway market is not foreseen before 2050.

ERRAC ENERGY ROADMAP



NOISE AND VIBRATION ROADMAP

Noise and Vibrations have been identified major challenges for the European railway system with the sector constantly increasing its transport volume. Shifting more transport to rail and increasing the market share of the sector can only be achieved with sustainable noise and vibration mitigation measures. This affects on the hand the infrastructure and on the other hand the rolling stock causing the vibration transmitted by the rail/wheel interaction.

The sector is aiming at proving better solutions to achieve noise mitigation from all sources and to preserve quiet areas. In order to reach the sector's target, various research projects were previously launched, nevertheless, there are still some areas to examine in the future to reach the target of silent rails. These research topics are described below:

- Keeping the acoustic performance of the system (train and infrastructure) throughout its whole life through monitoring, maintenance with implementation of technical solutions,
- Looking after a necessary new breakthrough in noise reduction to decrease noise by 5-10 dB through research activities on rolling noise, aerodynamic noise, tonal noise, traction noise, screech and squeal, etc.
- Ensuring a sustainable sound quality, through fulfillment of noise action plans criteria's, bearable noise level follow-up for the comfort of passengers even if rolling stock becomes lighter!

We will promote demonstrator(s) such as a Silent European Train, a real train where "green" solutions are implemented and tested in operation with low noise and other environmental friendly solutions.

The ERRAC roadmap will describe the way towards reducing the environmental impact of ground-borne vibration while safeguarding the commercial competitiveness of the railway sector. For several areas of concern vibration should be reduced to near or even below the threshold of perception.

The European railways will strive towards noise and vibrations no longer being considered a problem for the railways and its neighbors – meaning that noise and vibration levels are socially and economically acceptable and allow for 24-hour passenger and freight operation by 2050.



Noise barrier



Example of noise mapping (Cologne/ Germany)

Disclaimer

ERRAC-ROADMAP

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ERRAC Roadmaps Fact Sheets

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