Conclusions
Workshop Energy Efficiency and CO$_2$

Overview

• Introduction – Henning Schwarz
• Energy and CO2 performance of the rail sector and further reduction strategies – Raimondo Orsini
• The Railenergy Project – Mads Bergendorff
• Technical Recommendations – Enno Wiebe

西班牙高速列车：能源效率在运行 – José Antonio Jimenez
Discussed targets 2030 & vision 2050

Climate Protection

• **Target 2030**
  - Reduction of specific CO2 emissions from train operation by 50% compared to base year 1990; measured per passenger-km (passenger service) and gross tonne-km (freight service).
  - not exceeding total CO2 emission from train operation in absolute terms even with projected traffic growth compared to base year 1990.

• **Vision 2050**
  - European railways will strive towards carbon-free train operation by 2050
Discussed targets 2030 and vision 2050

Energy Efficiency

• **Target 2030**
  • Reduction of specific final energy consumption from train operation by 30% compared to the base year 1990

• **Vision 2050**
  • European railways will strive towards *halving* 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).
CO2 performance of European Rail

- Specific CO2 emissions 1990-2007: Passengers: -11%  Freight: -35%
- Specific CO2 emissions 1990-2020: Passengers: -38%  Freight: -54%
- Specific CO2 emissions 1990-2030: Passengers: -47%  Freight: -63%

Specific CO2 emissions

- Specific passenger CO2 emissions
- Specific freight CO2 emissions

Specific passenger CO2 emissions sector target
Specific freight CO2 emissions sector target

-30% sector target

-11%  -35%  -38%  -54%  -47%  -63%
The suggested targets for 2030 are feasible!

2030 scenario:
• 50% electricity from non-fossil fuels (from UE forecast)
• 80% passenger traffic and 90% freight with electric traction
• 20% load factor improvement
• 5% energy saving with eco-driving and fleet renewal
• 20% biodiesel blend
Smart and efficient energy solutions for railways

How to measure & analyse energy in railway systems?
• Common simulation methodology
• First UIC/UNIFE TecRec (100_001)

How to define, browse & collect energy data?
• Railenergy KPIs
• UIC energy & CO₂ database

How to benchmark energy performance?
• Railenergy performance baseline
• Ranking of saving potentials
• Technology Assessment Reports

How to compare & prioritise different measures?
• Cost-benefit & effectiveness
  • Railenergy Calculator
  • Market readiness

How to save energy costs?
• LCC screening
  • In/out of service view

How to plan strategically your fleet procurement & refurbishment?
• Strategic Assessment Reports
  • Practical check lists for professionals

Railenergy toolkit
What is a TecRec?

- UIC/UNIFE standard designed to be used within the European region (voluntary standard)
- primary field of application is the European rolling stock domain and all associated interfaces with other subsystems

> Acceleration of and better influence over the European standardisation process
> All TecRecs are public documents and free of charge
TecRecs

- TecRec 100_001 Specification and verification of energy consumption for railway rolling stock”
- framework that will enable to generate comparable energy performance values for trains and locomotives on a common basis
- support benchmarking and improvement of the energy efficiency of rail vehicles
- Tec Rec to be transformed to a EuroNorm, via CEN/CENELEC
Spanish high speed trains. Energy efficiency in operation: driving designs based on simulation

José Antonio Jiménez-Redondo, Ph D. & MBA
Products Design Director
Once the simulation model has been fixed, a lot of computer calculations were developed using different time margins in order to choose the final ecodriving design.
The average of energy savings is about 21% at Madrid - Zaragoza section. (Madrid-Barcelona HSL)

### Madrid - Zaragoza Section

<table>
<thead>
<tr>
<th>Route</th>
<th>Time</th>
<th>Non-guided</th>
<th>Ecodriving</th>
<th>Difference</th>
<th>%</th>
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<td>350</td>
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<td>3800</td>
<td>1200</td>
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### Zaragoza - Madrid Section

<table>
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<th>Time</th>
<th>Non-guided</th>
<th>Ecodriving</th>
<th>Difference</th>
<th>%</th>
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<tr>
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**Similar results have been obtained in other HSL:**

- Madrid – Sevilla
- Madrid - Málaga