



## **Intermediate results**

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**ECORails Workshop  
Brussels**

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## Presentation overview

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- About the Railenergy project
- Our simulation and evaluation concept
- First simulation results
- Strategic assessment reports
- Railenergy Decision Support Tool (Calculator)
- The new UIC/UNIFE TecRec 100\_001: “Specification and verification of energy consumption for railway rolling stock”

# Railenergy

## Railenergy Partnership



## Project data

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- Integrated Project co-funded by the EU Commission DG Research under the 6th Framework Programme
- 27 partners across the EU
- Project start: 01 September 2006
- Duration: 4 years
- Budget: €14.7M (€8M EC grant)
- 7 subprojects, 26 work packages
- Project coordinator: UNIFE

## Railenergy targets and objectives (2005)

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**Climate  
Change  
Challenge**

**Rising Energy  
Costs and  
Transport Demand**

**Energy  
Security and  
Independency**

**Railenergy objective:**  
**Cutting the energy consumption** in the railway system in order to stay **economically competitive** and act socially responsible towards the **environment**

**Project's Target:** a possible **6%** reduction of the specific energy consumption of the rail system by **2020**

## Railenergy targets and objectives (2005)

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- Railenergy targets **and objectives**

**Projects' Target:** an overall **6%** reduction of the specific energy consumption of the rail system by **2020**

**HOW ?**

Addressing the Energy Efficiency of the Railway System as a whole

Investigating and validating solutions:

- introduction of innovative traction technologies, components and layouts
- development of rolling stock, operation and infrastructure management strategies

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 & CO<sub>2</sub> 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**
- **Decision Support Tool**
- **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**



## Simulation & evaluation concept

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The Railenergy is evaluating the performance of promising technologies and operational in four main steps:

1. Performing simulations of pre-selected use cases
2. Aligning the commercial multi train simulators using one common simulation input database format
3. Measuring the resulting energy consumption using agreed Key Performance Indicators (KPI)
4. Extrapolating and transferring results to increase coverage and usability of Railenergy simulations



## Demonstration scenarios & use cases

Railenergy Technology Matrix	Demonstration scenes and use cases											
	DS 1		DS 2				DS 3					
	1.1	1.2	2.1 A		2.1 B	2.1C	2.2	3.1	3.2	3.3	3.4	3.5
Rail service type	High speed		Intercity		Freight	Mixed intercity & freight		Regional			Intercity	
Country	France	Germany	Austria			Italy		France	Sweden	Netherlands		United King-dom
Energy supply type	25 kV AC 50 Hz	15 kV AC 16.7 Hz	15 kV AC 16.7 Hz			3 kV DC		Diesel	15kV AC 16.7 Hz	1.5 kV DC		Diesel
Rolling stock configuration	EMU	EMU	Loco	EMU	Loco	Loco / EMU	Loco	DMU	EMU	EMU		DMU

# Railenergy



<u>Railway domain</u>	<u>Technologies and measures</u>
<b>Management</b>	Eco-driving
	Parked train management
<b>Infrastructure</b>	DC Reversible substation
	Real-time power management
	2x 1.5 kV DC Traction system
	Asymmetrical system
	Parallel substation
	Reduced line impedances
	Increased line voltage (4kV)
<b>Onboard components</b>	Trackside energy storage unit
	On-board energy storage technologies
<b>Onboard traction</b>	Re-use of waste heat
	Superconducting transformers and inductances for railway traction
	Medium frequency energy distribution
<b>Onboard optimization</b>	Innovative hybrid diesel electric propulsion
	New control tech. to reduce converter energy consumption during coasting
	Active filtering tech. to reduce Input passive filter (reactors) losses
	Reuse of converters energy loss
	Medium voltage loads management

## Commercial multi-train simulators used

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- Sidytrac
  - Elbas
  - ECOtranz (diesel only)
  - Fabel
  - MOTORS
- Siemens
  - Alstom
  - Bombardier
  - Enotrac
  - Sciroidea



## Agreed Key Performance Indicators

### Energy performance on railway system level

#### ➤ KPIs for the operation of rolling stock

- KPI 1: Final Energy consumption per traction effort (kWh/gross tkm)
- KPI 2: Final Energy consumption per offered traffic (kWh/seat km)
- KPI 3: Primary Energy consumption per traffic output (KJ/Pkm~tkm)
- KPI 4: Final Energy consumption per traffic output (kWh/Pkm~tkm)
- KPI 5: Share of energy consumption for parked trains (%)
- KPI 6: Systemwide realised energy recuperation rate (%)

#### ➤ KPI for the operation of railway infrastructure

- KPI 7: Efficiency of the railway distribution grid (%)



## Technology Potential Tables (TPT)

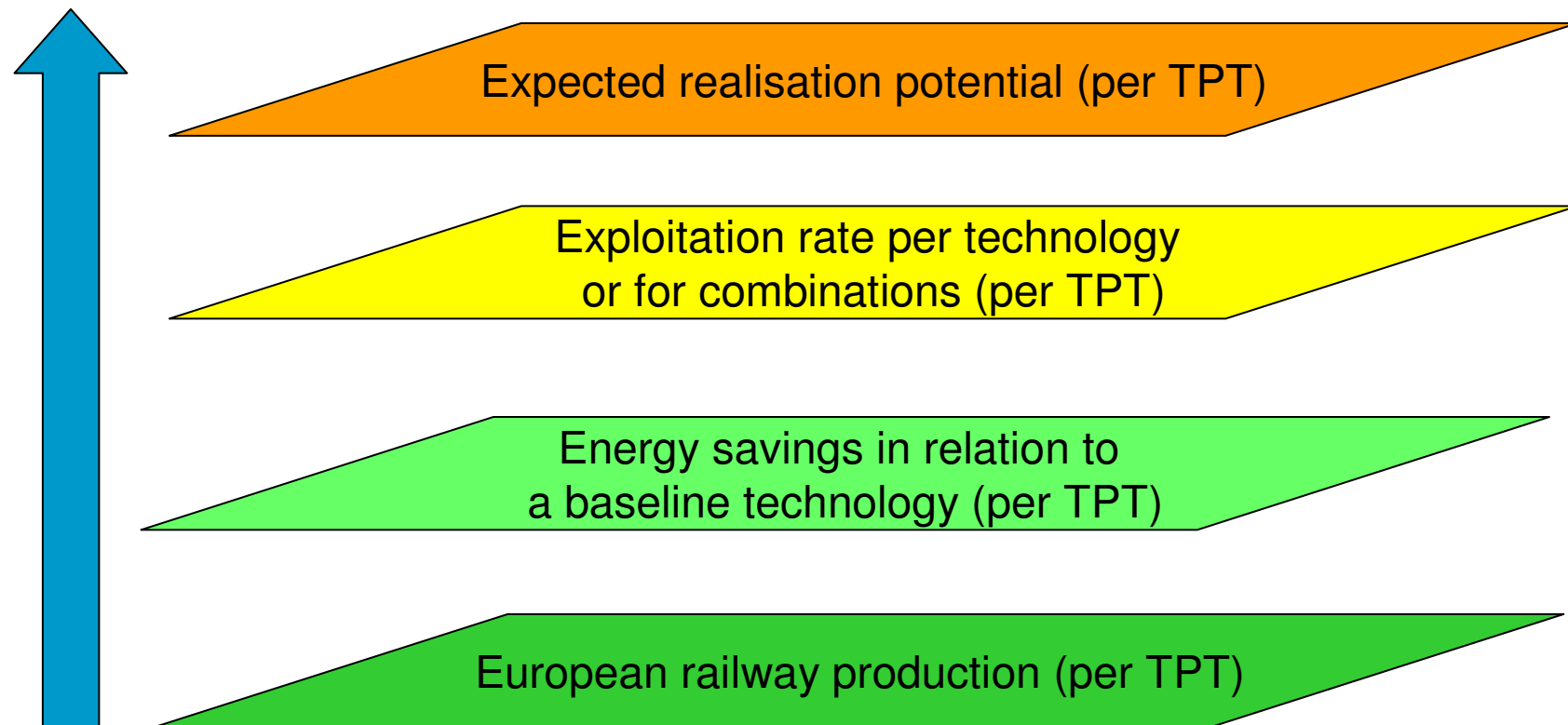
- A TPT table is created for each Railenergy technology to extrapolate simulation results from use cases to a general European situation taking into account the actual technology baseline.
- These values will apply for all relevant combinations of energy supply and service types.
- The TPT tables can always be updated with latest knowledge and represent a transparent structured approach

Railenergy technologies	Example: Reversible DC substation				
Network / Service type	suburban	regional	intercity	high-speed	freight mainline
DC 1.5 kV					
DC 3 kV	← -10,0%	-3,5%	-5,0%		→ -2,0%
AC 15 kV 16 2/3Hz					
AC 25 kV 50 Hz					
Not electrified (diesel)					

DC Traction	Simulated values are marked in green			
Railenergy Technology Potential Table				
Energy supply type / Service type	suburban	regional	intercity	freight mainline
DC 1.5 kV and 3 kV				
Reversible DC substation	-10,0%	-6,9%	-5,0%	-2,0%
Real time management	-6,0%	-2,0%	-1,0%	
2x 1.5 kV DC Traction System	-3,3%	-3,3%	-3,3%	-3,3%
Reduced line impedance	-3,0%	-4,0%		-4,0%
Trackside Energy Storage Unit	-5,0%	-5,0%	-5,0%	-5,0%
On-board energy storage technology	10,0%	6,0%	3,0%	
New control tech. to reduce converter energy consumption during vehicle coasting	-3,5%	1,2% (loco), 3,5% (EMU)	1,0%	
Active filtering tech. to reduce Input passive filter (reactors) losses	-1,0%	-1,0%	-1,0%	
Reuse of converters energy loss	-0,5%	-0,5%	-0,5%	
MV Loads management	-0,5%	-0,5%	-0,5%	
Eco-driving	-15,0%	-10,0%	-9,6%	
Parked train management	-3%-8%	-3%-8%	-3%-8%	



## Strategic assessment approach





# Structuring of Strategic Assessment Reports

Railenergy technologies					
Network / Service type	suburban	regional	intercity	high-speed	freight mainline
DC 1.5 kV	1. DC EMU	2A. DC EMU/Loco	3. AC EMU & Loco (including DC mode)	2B. DC Loco	
DC 3 kV					
AC 15 kV 16 2/3Hz	4. AC EMU	5A. AC EMU/Loco		5B. AC Loco	
AC 25 kV 50 Hz					
Not electrified (diesel)	6. DMU	7A. DMU/Loco		7B. Diesel Loco	



## Strategic Assessment Reports

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### **European situation today for the actual railway segment**

- Two approaches: New procurement vs. refurbishment projects

### **Assessment Methodology**

#### **Technical Performance**

- Simulation and evaluation results (Technology Potentials)
- Technology assessment reports including time to market

#### **Economic Performance**

- LCC calculations

#### **Strategic Assessment**

- Pro's and cons' of implementation
- Three scenarios (ambition levels)

#### **Recommendations**

- Saving potentials for this railway segment
- Promising measures and combinations - ranked
- Main trends for this railway segment exploitation actions



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Railenergy  
Decision Support Tool  
(Calculator)



## Decision Support Tool/Calculator

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### What is the Railenergy Decision Support Tool/Calculator?

- Web-based screening tool to assist the rail industry to align their energy calculations and common understanding
- A "business to business" tool based on a uniform calculation methodology
- Analysis & prediction of energy savings, CO<sub>2</sub> emissions and LCC of saving strategies

### What is the tool NOT?

- The Railenergy Calculator is NOT a comparison tool between modes like Ecotransit and Ecopassenger.



## Decision Support Tool/Calculator

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### When should the Decision Support Tool/Calculator be used?

- For preparing and supporting railway management investment decisions for energy efficiency solutions during new procurement and upgrade/refurbishment

### Who will be the likely users of the Decision Support Tool/Calculator?

- Technical, procurement, strategy and management personnel from:
  - Railway operators, leasing companies and infrastructure managers
  - Railway manufacturers (system integrators and sub-suppliers)
  - Rail traffic authorities & agencies for rail service procurement
  - Consultants and academia supporting the industry players



**1** Start

**2** Scope and targets

**3** Current setup

Yearly traffic production

Out of service consumption

**4** Energy saving potentials

**5** Energy mix and CO2

**6** Energy and CO2 results

**7** Economic framework

Life cycle costs

**8** Economic results

**9** Sensitivity analysis

START

**General information**

Welcome to the Railenergy calculator! This is....

You can fill in some basic information about yourself first in order to save and redo the inquiry. Short explanation here....Read our FAQ or help file or???? Happy inquiring!

**Create new inquiry**

My name:

Company:

My inquiry name: \*

Date:

[go to step 2](#)

**Open examples and your saved inquiries**

Example / Name	Energy supply type	Service type	Date
Example_a			03.04.2009
Example_abc			03.04.2009
Example_ab			03.04.2009
My personal inquiry xyz			24.06.2010

**Login**

email address

password

[sign in](#)

> password forgotten?

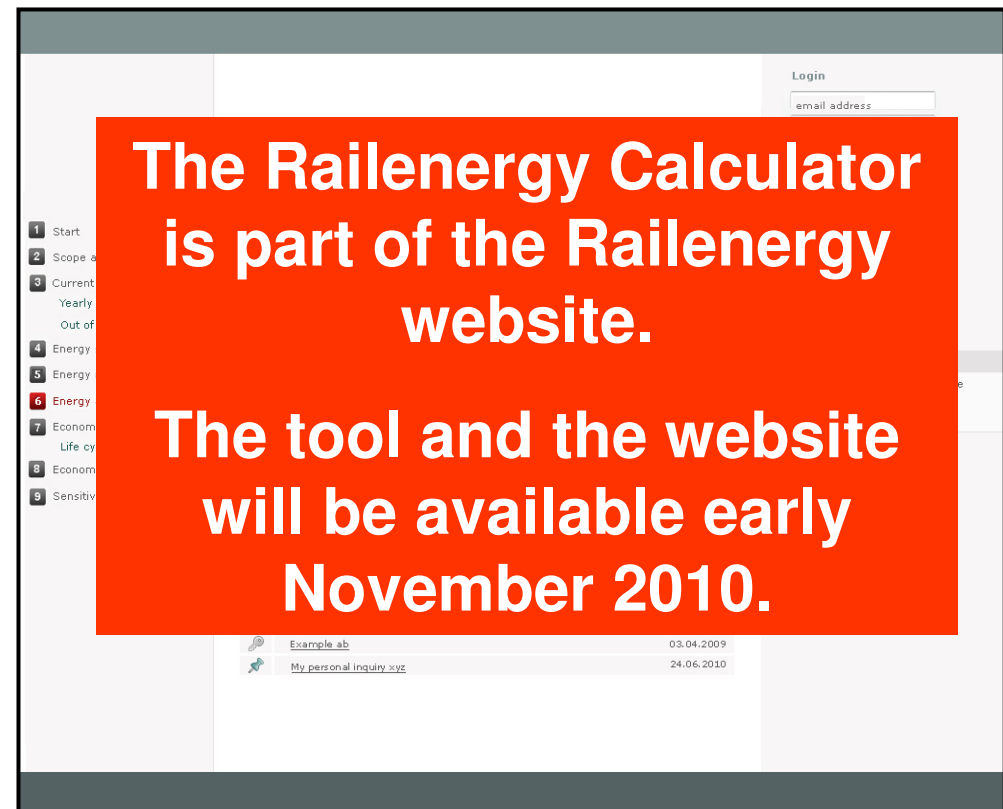
> register now

you can save your inquiry anytime later in the calculation process



## Decision Support Tool/Calculator

- Step 1: Start
- Step 2: Scope and targets
- Step 3: Current setup
- Step 4: Energy saving potentials
- Step 5: Energy mix and CO2
- Step 6: Energy and CO2 results
- Step 7: Economic framework(LCC)
- Step 8: Economic results
- Step 9: Sensitivity analysis

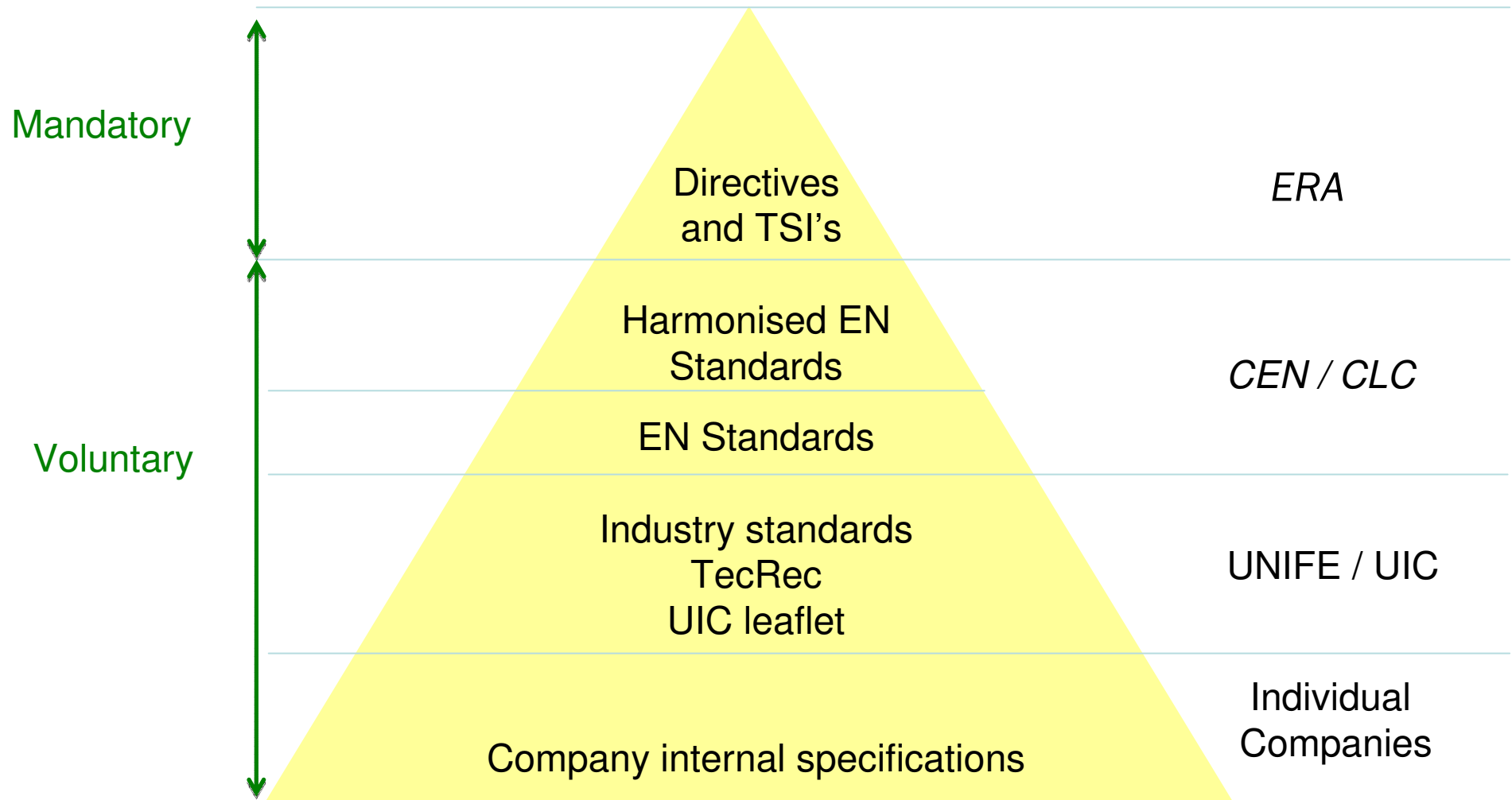




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## Specification and verification of energy consumption for railway rolling stock





## Contribution to Standardisation: TecRec

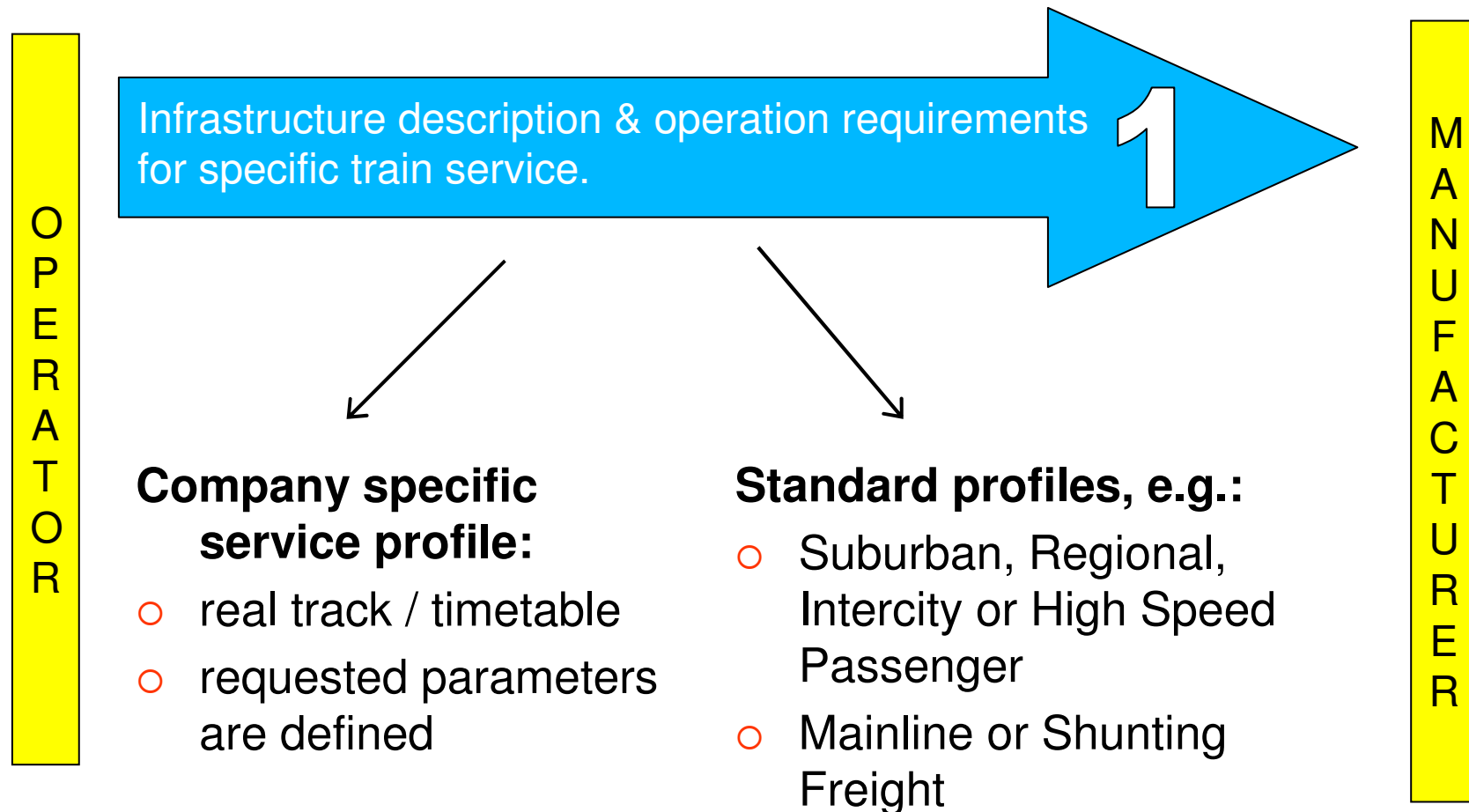
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- A Technical Recommendation (TecRec) is a UIC/UNIFE standard of which the primary field of application will be the European rolling stock domain and its interfaces with other subsystems and is the preferred solution by both partners
- Freely available at [www.tecrec-rail.org](http://www.tecrec-rail.org)
- Railenergy TecRec's:
  - TecRec 100\_2 "Specification and verification of energy consumption for railway rolling stock"
  - TecRec "Reversible DC Substation" - *in progress*



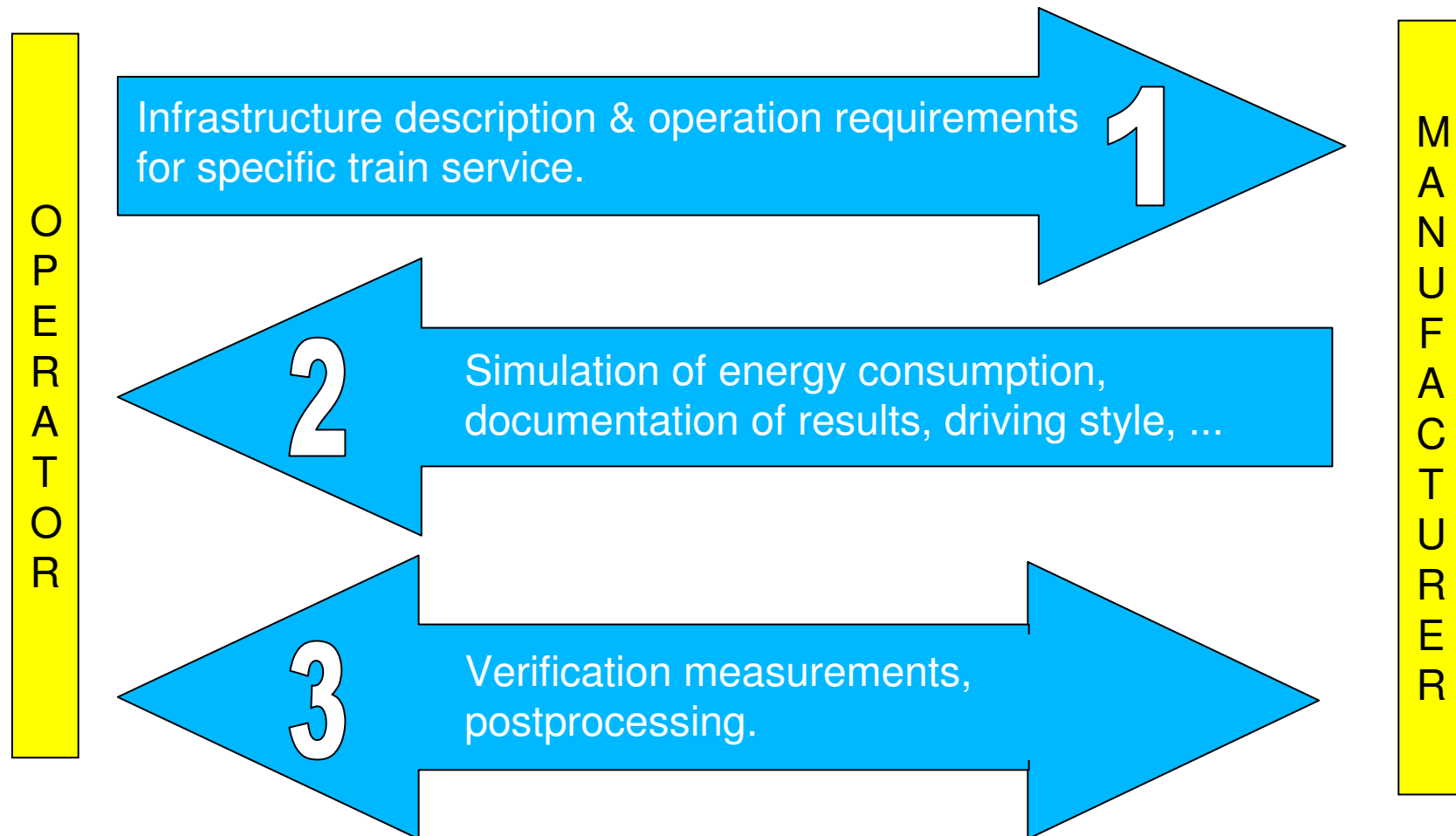
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## Specification and verification of energy consumption for railway rolling stock



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## Specification and verification of energy consumption for railway rolling stock



## Forthcoming Railenergy events 2010

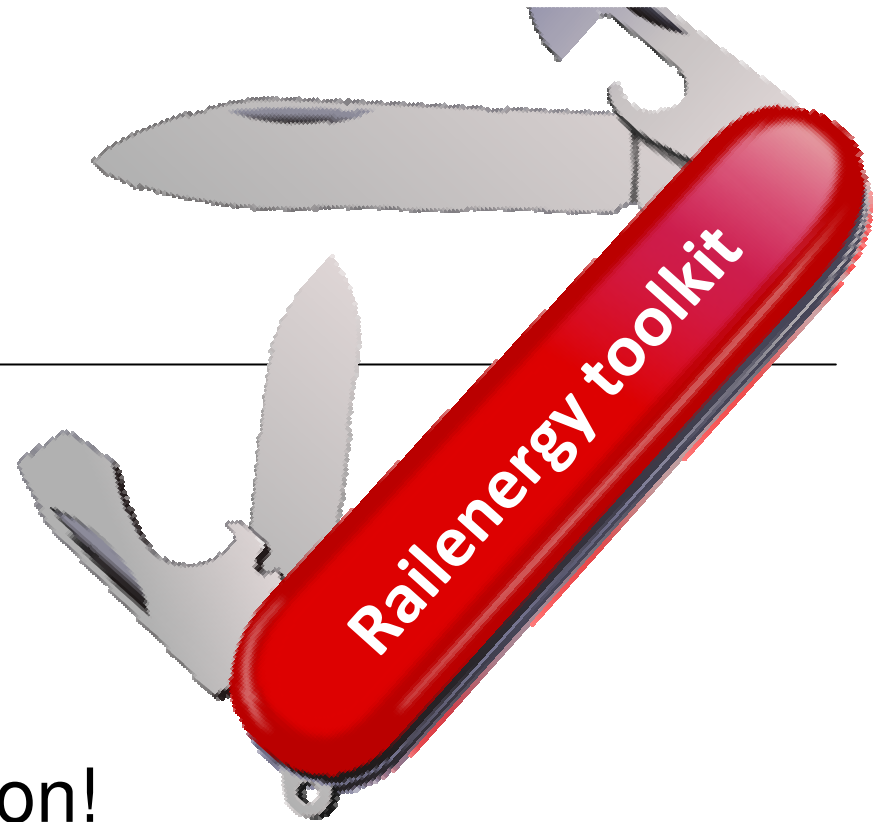
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- September 22-24<sup>th</sup> Presentation at Innotrans (UNIFE stand)
- Early November **Railenergy website launch**
- November 25<sup>th</sup> **Final Conference - open for all (Brussels)**

# Railenergy

So don't forget your...

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Thank you for your attention!

Further questions can be directed to  
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