Panel 1 – Energy Efficiency Management

The Railenergy approach to system modelling, simulation and evaluation – First results

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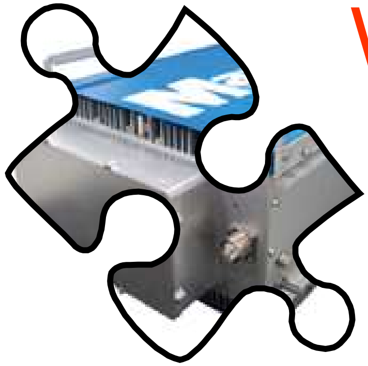
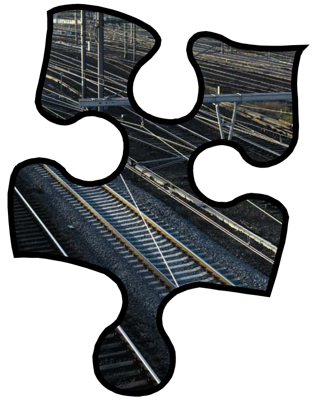
Macroplan

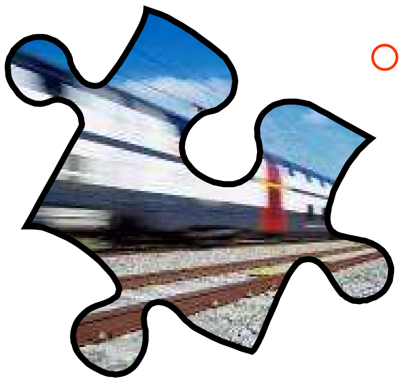
Why “holistic methodology”?



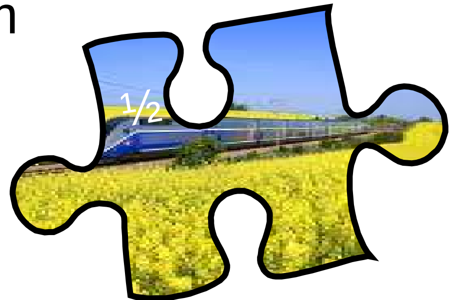
- Saving energy in railways is not one “silver bullet” solution
- Only way to improve is to corporate within the supply chain (infrastructure, operator, supplier)



- Railway operators need a business case for their total (re-)investments in their fleet and operations
- Modular concepts is good for standardization but risk to sub-optimize single components

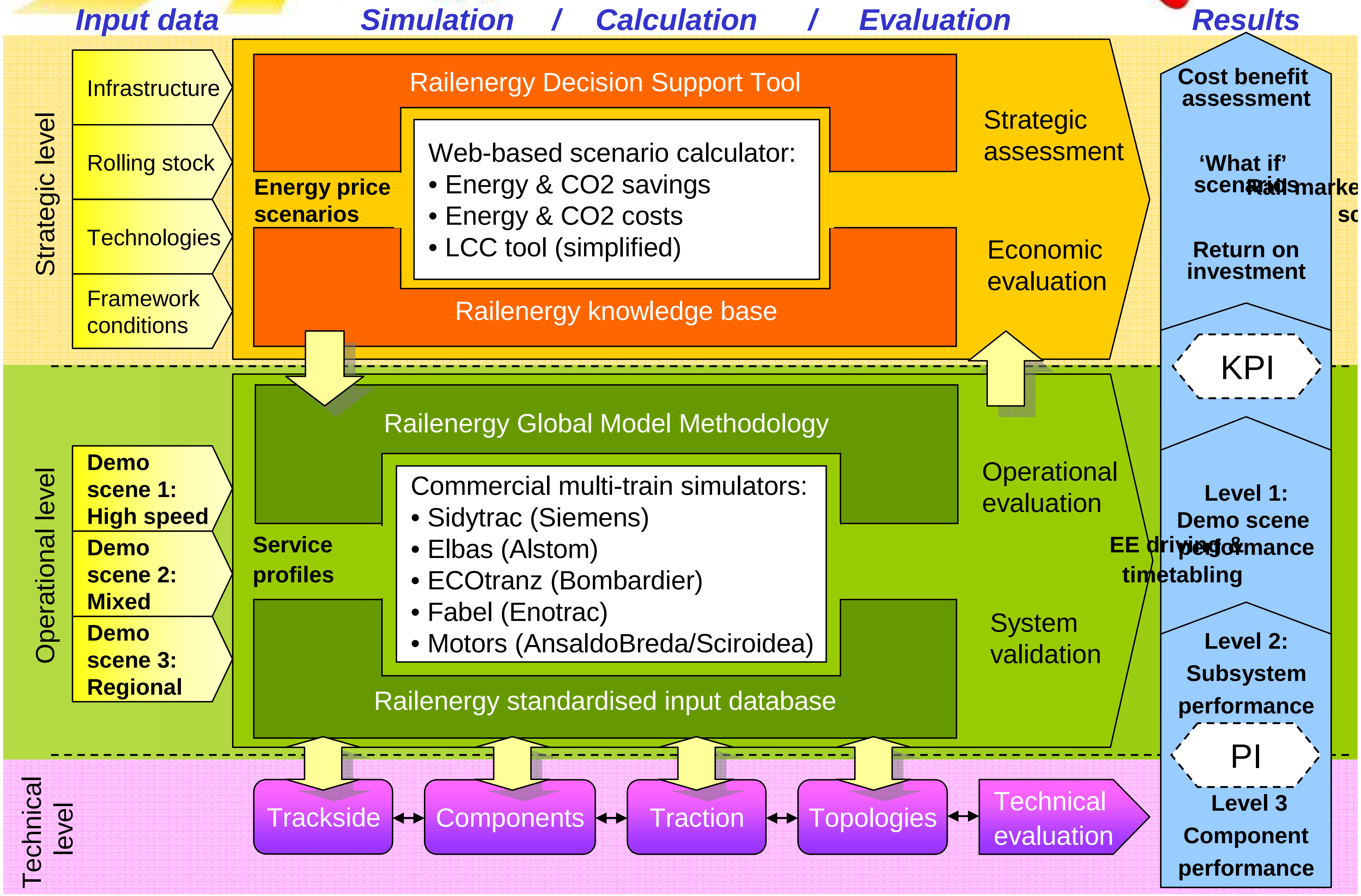


- Energy consumption and possible savings have to be measured on system level to make sense



Railenergy Work Flow

Energy Efficiency Days 2009



Railenergy

Energy Efficiency Days 2009

		IM	RU	Starting Station	Border Station	Country	Rolling stock used on this line
Demo scene 1 International route with high speed traffic	**Use case 1.1**	RFF/SNCF (UIC)	SNCF (UIC)	Paris	Forbach / Sarrebruck	France	ICE 3
	Use case 1.2	DB Netz (UIC)	DB AG (UIC)	Forbach / Sarrebruck	Frankfurt	Germany	ICE 3

		IM	RU	Starting Station	Border Station	Country	Rolling stock used on this line
Demo scene 2 International route with mixed traffic	**Use case 2.1 A**	ÖBB (UIC)	RCA	Kufstein	Brenner	Austria	1216
		ÖBB	RCA	Kufstein	Brenner	Austria	4024 ICE 4011
	Use case 2.1 B	ÖBB (UIC)	RCA	Kufstein	Brenner	Austria	1216
	Use case 2.2	RFI	Trenitalia / Trenitalia Cargo	Verona	Brennero	Italy	E 405

		IM	RU	Starting Station	End Station	Country	Rolling stock used on this line
Demo scene 3 Regional routes with passenger traffic	**Use case 3.1**	RFF/SNCF (UIC)	Eurolum (Veolia Transport)	Paimpol	Guingamp	France	SNCF to confirm
				Guingamp	Carhaix		
	Use case 3.2	BV	SL	Upplands Väsby	Södertälje	Sweden	Alstom Coradia Lirex (X60)
	Use case 3.3	ProRail	NS	Utrecht	Zwolle	Netherlands	ICM-III + ICM-IV
	Use case 3.4	Pro Rail	NS/Lloyd Register	Rotterdam	Groningen	Netherlands	ICM-III + ICM-IV
	Use case 3.5	Network Rail	ATOC	London	Sheffield	UK	222 (4 car)

Boundaries for Railenergy simulations

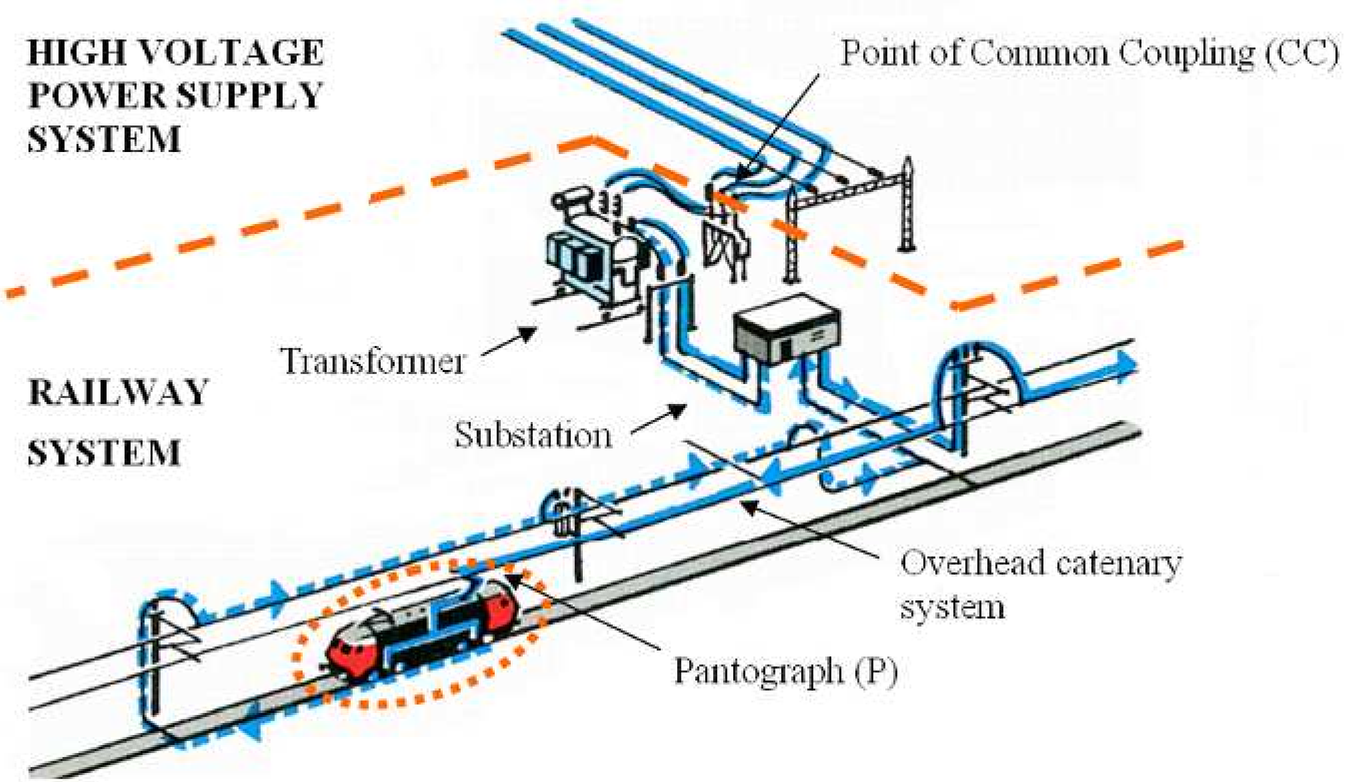


Figure 1: Sketch of system boundaries

What did we do so far?

- Agreement on common simulation methodology and harmonised input data template among simulation teams
- Baseline simulations completed for all demo scenes and use cases in September 2009
- First simulations of new technologies are currently being performed (Autumn 2009)
- Operational evaluation & validation of the baseline simulations are ongoing

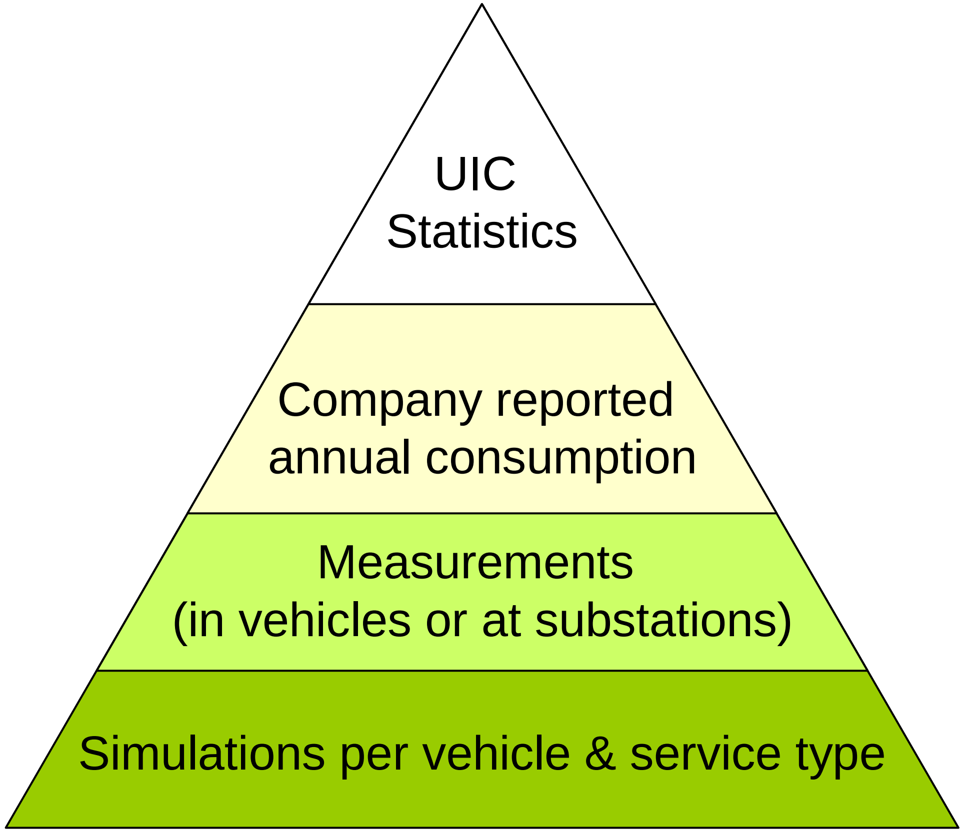
First draft results – baseline simulations

Baseline simulations First draft results	**KP1** kWh/gross tkm	**KP2** kWh/seat tkm	**KP4** kWh/pass km	**KP5** Parked trains (%)	**KP6** Regenerative braking (%)	**KP7** Network efficiency (%)
SIE UC 1.1	**0.054**	**0.051**	**0.068**	**2.40%**	**5.03%**	**97.70%**
ASB+SCID 2.1-A (loco)	**0.033**	**0.046**	**0.091**	**-**	**19.10%**	**96.50%**
ASB+SCID 2.1-A (EMU)	**0.038**	**0.033**	**0.066**	**-**	**21.60%**	**84.00%**
ASB+SCID 2.2 (Mixed)	**0.048**	**-**	**-**	**-**	**1.30%**	**89.90%**
BT UC 3.1 (peak hour)	**0.022**	**0.006**	**0.025**	**-**	**0.00%**	**-**
BT UC 3.1 (off-peak)	**0.018**	**0.0065**	**0.0065**			**-**
BT UC 3.1 (day)	**0.020**	**0.006**	**0.013**	**-**	**0.00%**	**-**
ALS UC 3.2 (off-peak)	**0.071**	**0.040**	**0.158**	**-**	**24.90%**	**98.50%**
ALS UC 3.2 (day)	**0.070**	**0.040**	**0.115**		**25.43%**	**97.84%**
ENO UC 3.3	**0.057**	**0.022**	**0.034**	**12.80%**	**13.90%**	**84.60%**
ENO UC 3.4	**0.045**	**0.018**	**0.023**	**10.10%**	**3.80%**	**88.30%**
ALS UC 3.2 (peak hour)	**0.069**	**0.042**	**0.042**	**4.67%**	**26.30%**	**96.74%**

Simulation findings so far

- The different commercial multi train simulation tools produce comparable and mostly consistent outputs
- A range of commonly agreed assumptions have influenced the achieved simulation results
- Simulation KPI values are lower than real measurements as expected
- Simulation of driving styles are difficult to align with realistic situations due to the lack of complexity
- KPI's for parked trains and regeneration are very sensitive to selection of number of train sets, peak/off peak settings, etc.
- The "Plug & Play" principle for simulation of virtual new components needs further investigation before final conclusions can be drawn

Different applications of Railenergy KPI's



- UIC statistics – total and average of many companies, either per service types or aggregated averages
- Company annual totals typically including "empty runs", to and from workshops, etc. (also estimations)
- Direct measurements for specific lines: out of service (e.g. tests for homologation) or in-service ("from station A to B")
- Simulations using the Railenergy global modelling methodology

Next Steps & Outlook

- Simulations of new technology potentials will be finalised in February 2010
- Validation of the “shared simulation” approach
- Operational evaluation to secure link to reality
- Publication of results via our website throughout Spring 2010
- Economic and strategic evaluation & assessment based on simulation results will take place during Winter 2010 – using the Railenergy Decision Support Tool
- Business cases for technology clusters

Thank you for your attention!