# Panel 2
# Electric Regional Rail Services

# Innovative Rolling Stock Technologies

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# Overview

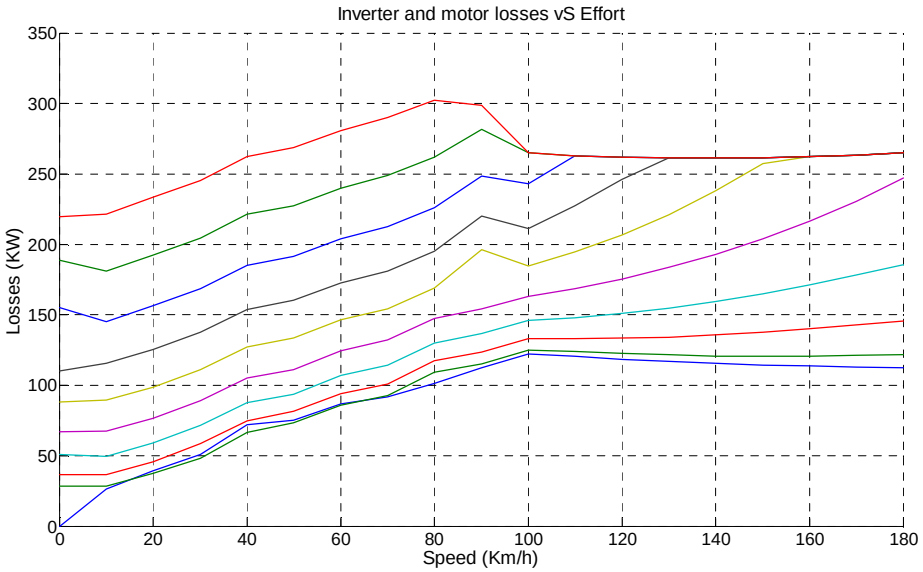
- Characteristics of Regional Rail Transport
- Main achievements
- Conclusions and Outlook

# Characteristics of Regional Rail Transport

- A growing market segment in terms of production (in pkm and tkm) as well as energy consumption.
- Results from Railenergy simulations are for 15kV 16.7 Hz AC, but valid results have been derived also for 25kV 50Hz AC, and for DC as done by technology potential assessments within the Railenergy project.
- Multiple stops in short intervals, typically (in average) in the range of 4 to 15 km of distance between stops.
- Continuous acceleration and deceleration of the rolling stock between the stops, with high acceleration rates and power demand.

# Main achievements
# Reduction of Traction Chain Losses

- High losses in inverters and traction motors during coasting and for low levels of traction effort (cruising): up to 50% of losses that occur at full power!
- Managing motor flux according to operating conditions (line voltage, speed, required effort) it is possible to reduce such losses.



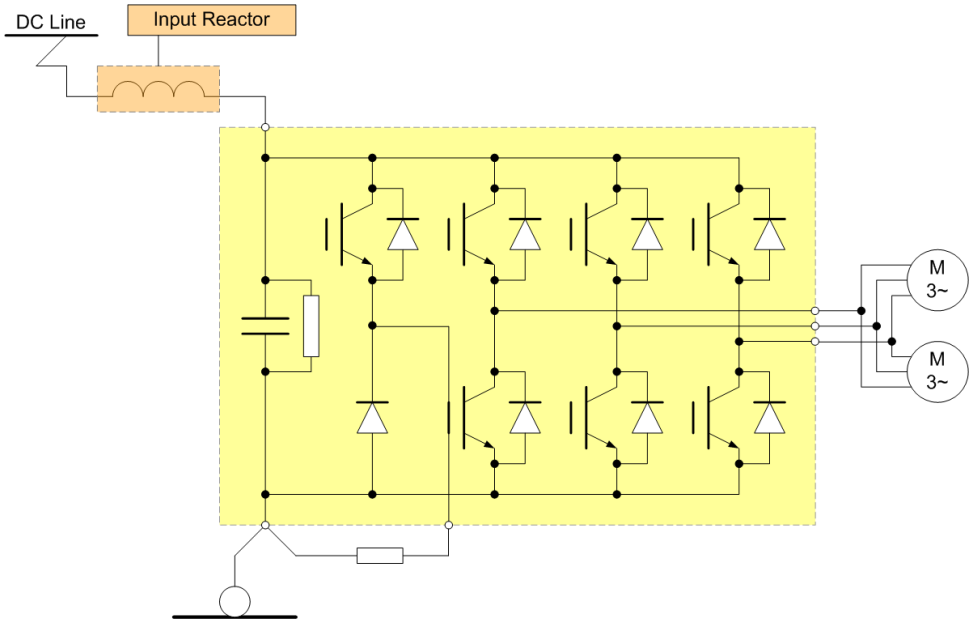

- Saving potential up to 3%, independent on power supply type, influenced by the percentage of coasting.
- Only software changes. Very promising for upgrading and for new vehicles.

# Main achievements
# Medium Voltage Loads Management

- Efficient Cooling System's MV loads management (fans, pumps…) allows to reduce:
  - Energy consumption when maximum cooling performances are not requested (during stops in the stations, favourable climatic conditions)
  - Environmental impact (noise, dust hoisting, clogging for snow presence)
- Saving potentials up to 4%, independent on power supply type.
- Influenced by the frequency of power demand for cooling of traction components.
- Highly promising for new vehicles and for refurbishment requiring software changes only.

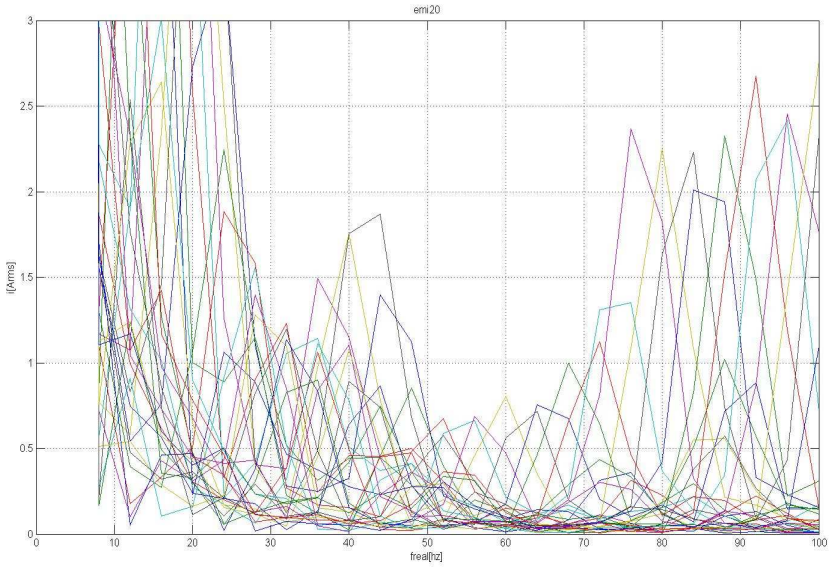
| Water Temperature Range / Train Speed | Loads Configuration | Loads Absorbed Power KW |
|---|---|---|
| TH2O ≥ 60°C<br>v > 5 Km/h | Couple fans MAX SPEED<br>Pump 50 Hz | 9.19 |
| 58°C ≤ TH2O < 60°C<br>v > 5 Km/h | Couple fans HALF SPEED<br>Pump 50 Hz | 3.95 |
| TH2O < 58°C<br>v > 5 Km/h | Couple fans HALF SPEED<br>Pump 40 Hz | 2.39 |
| TH2O ≥ 60°C<br>v ≤ 5 Km/h | Couple fans HALF SPEED<br>Pump 50 Hz | 3.95 |
| 58°C ≤ TH2O < 60°C<br>v ≤ 5 Km/h | 1 Fan HALF SPEED<br>Pump 50 Hz | 3.57 |
| TH2O < 58°C<br>v ≤ 5 Km/h | 1 Fan HALF SPEED<br>Pump 40 Hz | 2.01 |

# Main achievements
# Active Filtering




- Promising for DC Traction
- Saving potentials up to 1.5%
- Applicable for new vehicle, lead to a reduction in losses, size and weight of input reactors.

- Propulsion systems produce harmonic currents that can interfere with signaling system.
- Traction converters can be used as active filters, by means of dedicated algorithms for harmonic reduction.



# Conclusions & Outlook

- Energy saving for rolling stocks can be achieved not only using new hardware technologies but also through a smart on-board energy management.
- Such "quick win" solutions are very promising for new vehicles and for refurbishments as well.
- Mainly software-based solutions with low investment costs and short payback time.

| | |
|---|---|
| **Rail service type** | Regional |
| **Energy supply type** | Electric |
| **Rolling stock configuration** | EMU/Loco |
| Converter control to reduce traction chain losses | **1 - 3%** |
| Active filtering to reduce Input passive filter losses (only DC traction) | **0.5 - 1.5%** |
| MV Loads management | **2 - 4%** |
| Combination of Converter control to reduce traction chain losses and MV Loads management | **3 - 7%** |

Thank you very much for your attention!

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