Shift2Rail Energy KPI results

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FINE1 WP 4 Leader
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1. Introduction – What is an energy KPI?
2. Future Technologies and Improvements
3. Mapping of Technologies and SPDs
4. KPI results
5. Conclusion
What is an Energy KPI?

Energy KPI quantifies relative savings of the TD innovations compared to the energy baseline.

The Energy KPI summarizes overall savings per SPD, assuming technical improvements reported by the TDs are applied.
Future Technologies and Improvements reported by TDs

TD1.1: independently rotating PM motor-wheel-system ➔ improved gearbox efficiency
TD1.1: Silicon Carbide (SiC) converter (Metro & Tram)
TD 1.3: Carbody mass reduction

Future Technologies and Improvements reported by TDs

30% WEIGHT REDUCTION

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Grant Agreement Number: 730818
**Doors: Concept design**

Composite sandwich base with aluminium extruded profiles.

- Extruded profiles: aluminium.
- Composite part - materials:
  - Core: PET foam.
  - Semipreg Biaxial E-Glass epoxy resin FST
  - Semipreg Biaxial Carbon epoxy resin FST
- Window

26 kg → 19 kg
TD3.9: New substation with double side feeding in 25 kV / 50 Hz AC networks avoids separation sections
## Mapping of Technologies and SPDs

<table>
<thead>
<tr>
<th>SPD</th>
<th>Smart Power Supply</th>
<th>Mass reduction carbody</th>
<th>Mass reduction doors</th>
<th>Mass reduction brakes</th>
<th>Improved line converter (SiC)</th>
<th>Improved motor converter (SiC)</th>
<th>Direct drive with improved gearbox</th>
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<tbody>
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<td>HST300</td>
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Example: KPI improvement for SPD HST300

TD3.9: New substation with double side feeding in 25 kV / 50 Hz AC networks avoids separation sections

![Graph showing speed cycle with and without separation sections](image)

![Bar chart showing energy consumption with and without SS](image)

-2.2%
Example: KPI improvement for SPD HST300

Combined assessment of mass reductions and efficiency improvements – comparison of energy demand
Example: KPI improvement for SPD HST300

Combined assessment of mass reductions and efficiency improvements

- Energy KPI improvement

<table>
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<th>HS300 savings [%]</th>
<th>traction energy (wheel)</th>
<th>total braking energy (wheel)</th>
<th>ED-braking energy (wheel)</th>
<th>braking energy (mech. Brakes)</th>
<th>DC link: traction energy</th>
<th>DC link: recuperated energy</th>
<th>DC link: auxiliary energy</th>
<th>DC link: rheostat braking energy</th>
<th>traction energy at the catenary</th>
<th>recup. energy at the catenary</th>
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Energy savings [%]

17/10/2019

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Summary: KPI results

Improvements of energy KPI between 3.5% (SPD Intercity) and 9.1% (SPD Regional140).

Metro and Tram: SiC converter application improves energy KPI by 1.7% (Metro) and 2.7% (Tram)
Mass reductions lead to significant reduction of brake wear.
What FINE1 achieved:

- **S2R energy expert network was established**, connecting people and topics throughout S2R technological and cross-cutting activities;
- Development of **methodology, process and tool to assess S2R technologies** and their impact on energy demand;
- **Reference scenarios and system platform datasets** (energy baseline) have been defined and distributed in S2R;
- Validation and application of the **OPEUS single train energy simulation tool** for KPI analysis;
- Energy KPI evaluations indicated **energy savings of up to 9%** with future S2R technologies;
Questions and Answers
Thank you for your attention!