Energy metering – SBB situation and expectations

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Energy settlement and billing
Energy consumption rates per train type are established based on reference measurements:

<table>
<thead>
<tr>
<th>Train type</th>
<th>I-Prix</th>
<th>Vehicles with regenerative braking</th>
<th>Vehicles without regenerative braking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>InterCity/EuroCity</td>
<td>0.0029</td>
<td>0.0033</td>
</tr>
<tr>
<td>2</td>
<td>Fast train/InterRegio</td>
<td>0.0029</td>
<td>0.0033</td>
</tr>
<tr>
<td>3</td>
<td>Regional train</td>
<td>0.0049</td>
<td>0.0071</td>
</tr>
<tr>
<td>4</td>
<td>S-Bahn</td>
<td>0.0049</td>
<td>0.0071</td>
</tr>
<tr>
<td>5</td>
<td>RegioExpress</td>
<td>0.0029</td>
<td>0.0033</td>
</tr>
<tr>
<td>6</td>
<td>Long-distance freight train</td>
<td>0.0028</td>
<td>0.0033</td>
</tr>
<tr>
<td>8</td>
<td>“Tractor-hauled” freight train</td>
<td>0.0043</td>
<td>0.0050</td>
</tr>
<tr>
<td>9</td>
<td>Light engine(s)</td>
<td>0.0050</td>
<td>0.0057</td>
</tr>
<tr>
<td>10</td>
<td>Empty passenger stock train</td>
<td>0.0039</td>
<td>0.0045</td>
</tr>
</tbody>
</table>

Train-path kilometres are taken from the SBB planning systems with current data up to approximately one hour before train run.

Energy consumption for additional services such as shunting is billed based on flat rates.

Energy settlement and billing situation at SBB today.
SBB’s energy saving target:

20% by 2025

- Energy saving programme
- RUs will invest in energy efficiency if they can save money
- Billing of exact energy consumption establishes immediate link between energy efficiency and cost savings
- Plus: data for analysis and proof of effectiveness of energy measures is available

Reasons for introducing metering at SBB
### Vehicle factors
- 33 vehicle types
- Various primary voltages (AC and DC)
- Various on-board power supplies (24V, 36V, 110V)
- Various transformer types or none
- Various antenna types, partly already several on the roof
- Partly existing on-board communication system including GPS.
- Very low availability of vehicles due to very high operating grade

### Success factors
- No impact on passengers
- One proven product
- Small / modular solution
- No need for intervention in vehicle construction or electrics
- Simple installation and maintenance
- Least possible interfaces for minimizing difficulty of vehicle re-approval
- Just-in-time-availability of vehicles for installation

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**Challenges regarding the introduction**
Expectations towards products and suppliers – the SBB wish list

Supplier
- Basic understanding of railway business and customer needs and restrictions as a minimum
- Overall concept for energy efficiency
- Monitoring of new developments and proactive development of solutions
- Involvement in further development of standard

Product
- Small product or modular solution: “one fits all”
- Quick installation and removal
- Maintenance-free, highly available and reliable, long lifetime
- No need for calibration
- Remote diagnostics and remote software upgrade possible
- Cross acceptance assured by compliance to standards
- Standard, non-proprietary interface between DCS and EMS
- Additional usability for energy controlling and energy efficiency measures
- Reasonable prices
Thank you for asking!