European Rail Infrastructure Managers

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EIM Position Paper on Energy Meters on Electric trains

associated member

candidate member

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Contents

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EIM Position Paper on Energy Metering, Saving and Billing

Summary

- Data from energy meters on trains will be of benefit to European railways, as it can be used for energy reduction management and to enable accurate billing.
- Standardisation on data exchange should facilitate technical innovation, the optimisation of installation and operational costs and should also facilitate the introduction of tools optimising the energy efficiency of trains in an international context.
- European regulation is needed for cross acceptance of the metrological verification and the methods to guaranty the metrological performance.
- If an electric unit is fitted with an energy measuring system, it should comply with the requirements of a European standard. The location function shall be implemented.
- The Technical Specifications on Interoperability for Locomotives and Passenger Carriages and Energy subsystems should mandate the use of data coming from standard meters for billing where fitted.
- The data transmission for energy billing should conform to the UIC-leaflet 930.
- European regulation should give evidence on the intended way to combine deregulation in energy and railway markets.

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1. Introduction:

In this paper EIM discusses:

- The benefits of on-board energy measurement;
- The benefits of standardising on-board meters;
- The data collection, exchange and billing;
- The energy savings;
- The energy purchasing; and
- Recommended actions for the European Regulatory Framework.

2. The benefits of on-board measurement

Electrical energy for trains is traditionally measured at bulk supply points and not on individual traction units. By using this method the total estimated consumption for the railway operation is recorded but it is not possible to accurately apportion the energy consumed by an individual railway undertaking. It is even more difficult to determine the amount of energy used by a particular train on a particular traction unit or journey. It is normal to estimate energy consumption per user based on a set of theoretical train characteristics with an assumed standard driving technique.

Energy measurement on an individual train will enable accurate apportionment to each particular traction unit or journey. This is an essential task to each infrastructure manager. Without energy measurement benefits of energy savings can't be allocated to the correct railway undertaking.

Data from the energy meters are necessary input for railway undertakings in their energy management work. Train driving technique has a significant affect on the energy consumed for trains operating over the same route with the same stopping patterns. By using accurate energy data, railway undertakings can optimise driving technique, climate control and parking mode. It is documented that this delivers improvement in energy efficiency of at least 10%. Knowing how much energy is used and being billed accurately provides an incentive to railway undertakings to reduce energy consumption.

Energy meters are also a necessity if railway undertakings are to enter the energy market as eligible consumers and the Third Party Access-principle is to be implemented regarding electric energy to trains.

3. The benefits of standard on-board meters

Standardisation enables trains to be fitted with a single metering system, thus avoiding the use of multiple meters to suit the needs of the user. This will require a common specification for accuracy, time, date and positioning data.

The measured data for billing shall consist of 5 minutes time series with consumed and regenerated energy together with a recording of the position. The recording of time and position is necessary for energy saving purposes and also to make it possible to use this

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data for commercial procurement and payment. It might be necessary to use shorter time periods for e.g. data used for energy savings and loss calculation.

CR Energy TSI already has defined the requirement that data coming from on-board energy meters shall be accepted for billing in each member state. In addition the TSI also states that the on-board energy metering equipment can be used for billing purposes. Regulation should be adjusted so that this ambiguity disappears. Trains equipped with an energy meter intended for energy billing shall fulfil the essential requirements described in the CR LOC&PAS TSI. Any infrastructure manager shall be able to use the data coming from a standard energy meter in conformance with the CR LOC&PAS TSI.

Currently both the conventional rail TSIs and the high speed TSIs have requirement for on-board metering, however they differ. This should be resolved during a process of merging and revising the TSIs.

The principle of cross acceptance of metrological verification and methods to guaranty the metrological performance must be implemented in railway regulation (Directive or TSI) or by the Measurement Instrument Directive. Sensors and energy meters accepted in one member state by a laboratory that can give a metrological certification, must be accepted in all member states. Also the acceptance conditions must be uniform in all member states.

The EN 50463 will define the general requirements, the measuring of the energy consumption, the compiling of these data with date, time and location, the communication to ground and the conformity assessment. The standard should describe functions and not specific solutions in order not to hinder future technical innovations or limit the market on energy metering equipments. The standard should facilitate e.g. the use of digital communication between sensor, energy meter and other on board equipment by proposing some preferred solutions. This would increase the accuracy of the energy measurement and can save installation and operational costs.

Regarding the benefits of on-board measurement and the already available level of standardisation, infrastructure manage should already promote energy meters to be installed on-board rolling stock.

As standardisation is not completely formalised (CR LOC&PAS TSI expected in 2011, EN 50463 expected in 2012), infrastructure manager should publish some intermediate requirements for on-board metering and data collection to cover this gap. These requirements shall be based on RISC-approved version of CR LOC&PAS TSI, the most recent draft of EN 50463 and the previously published UIC-leaflet 930.

4. Data collection, exchange and settlement

As of yet, there is no requirement for a data collection and settlement system to be used, created or to form part of the railway infrastructure. However, recognising the benefit of energy measurement, and how it is likely to be used, it is obvious that systems will have to be created to capture and analyse the large volume of data involved.

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The infrastructure manager shall be able to attribute the consumption to the correct railway undertaking. In an interoperable railway market, the only solution is likely to be the use of a settlement system able to use data coming from on board energy measuring systems.

The transfer of data from data collection systems to settlement systems and in between settlement systems is already standardized by UIC-leaflet 930. This enables the effective and accurate distribution of energy data for the benefit of railway undertakings and infrastructure managers.

A settlement system should be designed to support the varying requirements of the electricity suppliers and the commercial contracts in place across the member states of Europe without impacting the operation of the railway. A settlement system should also be designed to provide acceptably accurate apportionment of electricity to railway undertakings and infrastructure managers without invoking complicated legislative requirements.

The only requirement is that a system shall be able to receive data from a standard train mounted energy meter or the standardized exchange format of the UIC-leaflet 930. The data coming from these settlement systems are the basis for invoicing the energy consumption.

The functioning of these systems used for data collection, exchange and settlement should be certified by an independent entity to guarantee the quality of the processes and the integrity of the data throughout the processes.

5. Energy saving

The data exchange for billing is already standardised. But the data should also be used by the railway undertaking or traction unit owner for energy savings.

EN 50463 should define a protocol usable to collect data from on-board to ground also for energy saving purposes. This will make it possible to collect energy data directly from on-board.

Several cases have documented that eco-driving is a significant method for saving energy. A handset advising the driver how he should drive according to the planned schedule could further exploit the eco-driving potential for the railway undertakings. The schedule can be revised in real time by traffic control. It should be possible to transmit the planned and corrected schedule on a standardised way from infrastructure manager on ground to the on-board tool. This will help to avoid unneeded stops due to dense traffic and help running at a homogeneous speed.

6. Energy purchasing

The railway undertakings are the end users of electricity. According to the Electricity Directive each end user should have the right to choose its electricity supplier. This must also be possible for railway undertakings operating trains receiving electricity by the contact lines. The European Court of Justice has confirmed this principle of third party access.

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This third party access should be implemented by railway regulation. The railway infrastructure manager must get excluded from most other obligations to distribution system operators in electricity market. The contact line should be regarded as one grid, independent on how this grid is connected to the public transmission and distribution system operators.

Railway regulators are regarded as the competent bodies to approve e.g. the tariffs of the infrastructure manager. The European Railway Agency should make a request to all National Safety Authorities to adjust local regulations in such a way that third party access becomes possible. The transposition of the third package (directive 2009/72/EC) to local laws can be the initiator to make this possible.

For smaller railway undertakings the possibility to buy electricity at the infrastructure manager at a non-profit, open and non-discriminatory basis is a big advantage. Railway regulation (directive and/or TSI) should make this a right for each railway undertaking.

7. Conclusion

Train mounted traction energy measurement will be beneficial to European railways because data can be used for energy reduction management and to enable accurate billing or apportionment.

European regulation should enforce cross acceptance of the metrological verification and the methods to guarantee the metrological performance.

All energy meters producing data suitable for energy billing shall comply with the same requirements stated in the Rolling Stock TSI's referring to a European standard. EIM recommends to IMs to publish some intermediate requirements already to facilitate the installation of on-board EMS in the period from now till summer 2012 (publication of EN 50463).

All data shall be transferred on ground using the protocols defined in UIC-leaflet 930. It will be beneficial to the railway and electricity supply industry if the settlement system is certified to a European standard.

Standardisation on data exchange should facilitate technical innovations, helping to reduce installation and operational costs and to improve the energy efficiency of trains in an international context.

European regulation should make the usage of data coming from interoperable on-board Energy Measuring Systems mandatory and should also give evidence on the how electricity market and railway market should get integrated.

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