

**ECORails –  
Energy efficiency and environmental criteria in the awarding of regional rail transport  
vehicles and services**

# ECORails

## **Deliverable 23: Training Module for the Guidelines Annex 09 Part 3/Issue 08 – Evaluating and monitoring operations**

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# Evaluating and monitoring operations

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## Rationale for monitoring operations

- Relevant if services are awarded (rolling stock from PTA or TOC)
- Prerequisite for
  - Political reporting about the environmental effects of the railways
  - Better calculation of reference values for future contracts
  - Identifying potentials for improvement (joint effort by PTA, TOC and Infrastructure Manager)

## Rationale for monitoring operations

- Basis for incentives
  - Motivate the TOC to apply all feasible operational measures in order to save energy
  - Even modernisation may be induced in certain cases
  - Bonus/malus would be related to the performance compared to the reference value
  - Methods for monitoring to be defined in tender and contract documents



The real performance of the operator should be monitored

- TOC (or manufacturer) should keep to its promises.
- PTA gets important information about energy consumption and energy costs which is helpful for future awarding and long-term strategic planning.
- Requirements and pre-conditions for monitoring must be announced in tenders and confirmed in contracts.
- Necessary equipment and resources must be required and calculated.
- Malperformance may lead to →penalties.
- Very good performance may lead to bonus payment.

## How to include in award procedure

- 1) Analyse the data situation
- 2) Define the requested exactness and other parameters of the monitoring system
- 3) Decide whether to use an incentive system
- 4) Describe the relevant line(s) as concrete service profiles according to the standardised methodology
- 5) Calculate the reference level; make test runs with rolling stock if necessary

## How to include in award procedure

- 6) Integrate data and assumptions about the energy consumption of comfort functions
- 7) Define the values for bonus/malus
- 8) Use definitions from monitoring clauses for punctuality, if applicable (relevant in case of unstable operation conditions)
- 9) Analyse, whether the combination of criteria for the evaluation of rolling stock and the incentives based on the monitoring, is viable
- 10) Integrate text modules and documents in the tender documents

## Related actions

- Define comfort parameters
  - Interior design
  - heating
  - air condition
- Require energy meters or monitoring devices for fuel consumption

## Relevant indicators

- **kWh / passenger km:**  
 Main overall objective but within award procedures, measures for improved occupancy and improved EE should clearly be separated from each other.
- **kWh / seat km:**  
 Most relevant indicator; applicable for awarding services and procurement of vehicles; applicable for assessment of MUs, loco-hauled trains (as a whole) and for comparing MUs with loco-hauled trains
- **kWh per train km:**  
 Technical basis (in terms of measurement) for calculating kWh per seat km; in certain (very few) cases helpful to simplify the process when used as such
- **kWh per gross tonne km:**  
 the most relevant indicator for the assessment of locomotives

## Performance Indicators – challenges and restraints

- Clear definition of train configuration and interior design
- Service profiles to be clearly defined
- Clear definition of secondary conditions
- Technology for monitoring the energy consumption required (e.g. energy meters)
- Comfort functions for passengers to be analysed separately
- Parked train modes to be analysed separately



## Bidders need information about (a.o.)

- Infrastructure: longitudinal profile, speed profile, curves, tunnels, electric power supply system
- Operational requirements: propulsion system (diesel/electric), timetable, pay load, regenerative braking, comfort functions (in-service)
- Environmental (ambient) conditions: ambient temperature, humidity, intensity of sunlight, average head wind
- Simulations of bidders and manufacturers should be carefully examined, because methodological inconsistencies could lead to wrong assessments!

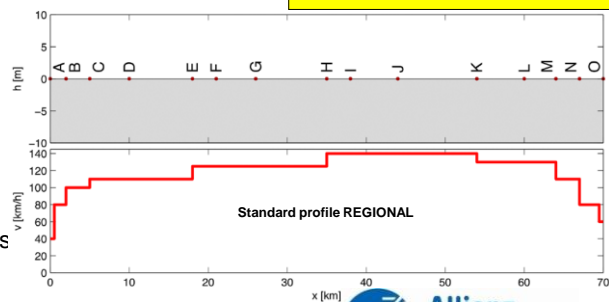
## Relevant service profiles

The PTA (or TOC) may define a specific service profile which

- is representative for the own network;
- can easily be used for testing.
- Relevant parameters need to be described:

- Infrastructure
- Diesel fuel specifications
- Operational requirements
- Environmental (ambient) conditions

Most relevant reference:  
UIC/UNIFE  
TEC REC 100 001



## Main challenges

- (1) Calculating the reference value
- (2) Unstable infrastructure and operation conditions
- (3) Improved infrastructure and operation conditions
- (4) Incentives for low energy consumption must not outweigh penalties for bad punctuality.
- (5) Changes of energy supply and energy market conditions

## Instruments

(1) Requirement:

“The TOC must accept a monitoring system for the traction energy consumption and provide the necessary equipment and database.”

If the vehicles are used on more than one line/network, the monitoring system should allow for analysing the energy consumption per every train and day.

In other cases more aggregated data might be sufficient.

## Monitoring of operations

### GUIDELINES

- Direct indicator = kWh/seatkm
- Side-conditions relevant
- Network profile relevant
- Service profile:
  - Standard
  - Real
- Energy meters specified and required
- Comfort functions aside

“The TOC must accept a monitoring system for the traction energy consumption and provide the necessary equipment and database.”

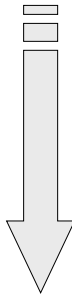
### AGREEMENT RL-TN

- Plan to install energy meters:
  - priority to “sample” vehicles
  - mandatory for new purchase
  - fitting during planned maintenance
- Energy consumption monitored together with side-conditions:
  - train specifications
  - regularity of service
  - load factor
  - operating speed
  - stopover time (planned or not)
  - speed restrictions
  - weather conditions
- Use of the ECORails KPIs:
  - KPI1: kWh/Ton\*km
  - KPI2: kWh/seat\*km
  - KPI4: kWh/passenger\*km
  - KPI5: kWh (or%) consumed off-duty
  - KPI6: kWh (or%) recovered



## Different approaches for incentives

### Beginner



### Advanced

- ↓ first result is to make the TOC aware of the energy consumption
- ↓ if a TOC does not benefit of flat energy rates, it is an incentive itself to save energy
- ↓ a bonus/malus scheme can share this benefit between the TOC and the PTA
- ↓ a starting incentive scheme can give a bonus when consumption is under the baseline:
  - by leaving a share of the saved cost to the TOC
  - or
  - by paying an addition to the subsidy
- ↓ when the database is consolidated and the saving potentials of main technologies acknowledged, a target of energy consumption is fixed:
  - ⇒ the energy cost share of the subsidy is paid depending on this target energy consumption
  - ⇒ periodic update of the target

## Incentives to save energy

### GUIDELINES

- Calculation of a reference value
- Be aware of unstable infrastructure and operation conditions
- Careful decision of targets and thresholds
- Periodic revision of values
- Balanced incentive with other penalties (punctuality)
- Bonus/malus values take into account relevance of energy prices for the TOC and contract value

### AGREEMENT RL-TN

- During kick-off 80% of the savings will be set aside to finance investments for increasing the energy efficiency; the remaining 20% will be kept by the TOC
- After kick-off:
  - standard energy consumption elaborated by monitoring system
  - standard energy cost to pay the subsidy

## Text module: payment of subsidy

### Article 6 – Compensation Payment

1. Once reached the Trimming step of the Operational Plan, the PSC compensation for the part dealing with energy costs, may be standard determined by applying:
  - a. To each class of rolling stock and service profile, standard energy consumption elaborated by monitoring system. Consumption standards will be developed taking into account the tests carried out to define the optimal operation and a reasonable deviation due to real conditions during the year.
  - b. To each kWh or liter of fuel of standard consumption, standard Energy costs will be defined by RL on the basis of market trends and sources of primary production.
2. Incentives can be confirmed, as those foreseen in article 5.
3. The selection by the IMs of energy providers which use renewable sources will be stimulated.

## Text module: incentive

Bonus/malus level	Average energy consumption (kWh/train*km)		Bonus/malus: Share of payment, half-yearly
	From	To	
Bonus level 2		6,18	+2 %
Bonus level 1	6,19	6,53	+1 %
Neutral	6,54	7,21	No adjustment
Malus level 1	7,22	7,56	- 1 %
Malus level 2	7,57		- 2 %

## Text module: Reimbursement for energy consumption

### Text module for the Awarding Text and Public Service Contracts:

1. The bidder's/TOC's costs for energy consumption are reimbursed in the amount of 1.61 € per train kilometre. The value implies any energy consumption of the vehicle (incl. comfort functions). This value is the initial basis for indexing the reimbursed costs for energy consumption.

### Remarks

- The TOC's compensation for its energy consumption is usually indexed and will regularly be adapted according to official statistical data.
- This issue was included in the test awarding in order to avoid over-compensation and to strengthen the TOC's economic concern to save energy.
- These *standard costs* for energy consumption are based on the total energy consumption of the vehicle, that means including comfort functions.

## Contact

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