

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

Contract: IEE/08/690
Dissemination Level: PU

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

ECORails

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Acronym:

ECORailS

Title:

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

Distribution:

| Partic N° | Participant name | Participant short name | Country code |
|------------------|---|-------------------------------|---------------------|
| CO | TSB Innovation Agency Berlin GmbH FAV – Transport Technology Systems Network | TSB FAV | DE |
| CB 2 | Senate Department for Urban Development | SenStadt | DE |
| CB 3 | Pro Rail Alliance | ApS | DE |
| CB 4 | KCW GmbH | KCW | DE |
| CB 5 | Berlin University of Technology | TUB | DE |
| CB 6 | Trafikstyrelsen | TSY | DK |
| CB 7 | Transportforskningsgruppen I Borlänge AB | TFK | SE |
| CB 8 | Province administration of Brescia | PoB | IT |
| CB 9 | Università Commerciale "L. Bocconi" | CBO | IT |
| CB 10 | Università di Roma "La Sapienza" | ULS | IT |
| CB 11 | Integral Consulting RD | IRD | RO |
| CB 12 | Universitatea POLITEHNICA din Timisoara | PUT | RO |
| CB 13 | CFR Timisoara – National Society of Railway Transport | CFR | RO |
| CB 14 | Budapest University of Technology and Economics | BME | HU |
| CB 15 | A.L.O.T. Sacrl Agenzia della Lombardia Orientale per I Trasporti e la Logistica | ALOT | IT |

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7.1. Introduction

During the ECORailS pilot applications, the four test sites formulated awarding texts by integrating energy efficiency and environmental criteria into awarding documents which have already been used or could be used in a PTA's or TOC's day-by-day job. Such awarding texts are concrete examples of how the ECORailS Guidelines can be implemented in real life when local expectations need to be matched with general strategies. From the legal point of view, they were formulated in the framework of usual awarding procedures for the countries and PTAs involved in ECORailS.

Therefore, according to the different starting points and local conditions and expectations, the awarding texts, reported in the present document, can be used by interested PTAs and TOCs as useful **text modules to develop new awarding documents** compliant with the approach supported by ECORailS. They are plausible texts that are feasible within the actual EU legal framework.

Each text module was developed with reference to concrete site conditions: the following tables help the reader in selecting the texts which more fit his expectations.

| Present status of EE/ENV criteria before using ECORailS Guidelines | Text modules | | | |
|--|--------------|--------|---------|-----------|
| | Lombardy | Berlin | Øresund | Timișoara |
| No use of EE/ENV criteria in the awarding procedures | | | ☑ | ☑ |
| Pilot use of some EE/ENV criteria in the awarding of services | | ☑ | | |
| Pilot use of some EE/ENV criteria in the awarding of rolling stock | ☑ | | | |
| Pilot use of EE/ENV technologies / policies not in awarding procedures | ☑ | ☑ | ☑ | ☑ |
| Availability of on-board energy meters | | ☑ | ☑ | ☑ |

TABLE 1: TEST SITES SITUATION REGARDING THE PRESENT USE OF EE/ENV CRITERIA

| Regulatory framework | Text modules | | | |
|--|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| | Lombardy | Berlin | Øresund | Timișoara |
| Direct awarding of services | <input checked="" type="checkbox"/> | | | <input checked="" type="checkbox"/> |
| Competitive tendering of services | | | <input checked="" type="checkbox"/> | |
| Competitive tendering of new rolling stock | <input checked="" type="checkbox"/> | | | <input checked="" type="checkbox"/> |
| Competitive tendering of services, including the rolling stock | | <input checked="" type="checkbox"/> | | |
| Energy provision by the Infrastructure Manager | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

TABLE 2: TEST SITES SITUATION REGARDING THE REGULATORY FRAMEWORK WITHIN WHICH THE TEXT MODULES CAN BE USED

| Awarding instruments | Text modules | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| | Lombardy | Berlin | Øresund | Timișoara |
| Public Service Contract | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | |
| Tender specifications for services | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | |
| Tender specifications for new rolling stock | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |
| Preparatory agreements and plans | <input checked="" type="checkbox"/> | | | |
| Regulations for the Infrastructure managers | <input checked="" type="checkbox"/> | | | |

TABLE 3: TEST SITES SITUATION REGARDING THE AWARDING INSTRUMENTS TO WHICH THE TEXT MODULES ARE APPLICABLE

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| Main clauses in the awarding documents | Text modules | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| | Lombardy | Berlin | Øresund | Timișoara |
| Measurement, reporting and monitoring of energy consumption | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Energy efficiency incentives (bonus/malus) | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | |
| Compensation payments taking into account EE/ENV criteria | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | |
| LCC-driven procurement of rolling stock | | | | <input checked="" type="checkbox"/> |
| Awarding criteria | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Liability of rolling stock manufacturers | <input checked="" type="checkbox"/> | | | <input checked="" type="checkbox"/> |
| Training of personnel (energy-efficient driving) | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Parked trains prescriptions | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Pricing of electric energy for traction | <input checked="" type="checkbox"/> | | | |
| Operational measures on the side of the IM | <input checked="" type="checkbox"/> | | | |

TABLE 4: TEST SITES SITUATION REGARDING THE MAIN CLAUSES INCLUDED IN THE AWARDING INSTRUMENTS

| Main technologies in the awarding documents | Text modules | | | |
|--|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| | Lombardy | Berlin | Øresund | Timișoara |
| Control of comfort functions in parked trains | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Energy-efficient driving | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Vehicle concepts | <input checked="" type="checkbox"/> | | | <input checked="" type="checkbox"/> |
| Diesel engine | | | | <input checked="" type="checkbox"/> |
| Braking energy recovery | | | | <input checked="" type="checkbox"/> |
| Fuel / energy consumption measuring and recording system | <input checked="" type="checkbox"/> | | | <input checked="" type="checkbox"/> |
| Train Control and Management System | | | | <input checked="" type="checkbox"/> |
| Maintenance and Diagnostics Software | | | | <input checked="" type="checkbox"/> |
| Optimisation of the heating/air-conditioning/ventilation system (HVAC) | | | | <input checked="" type="checkbox"/> |
| Optimisation of lighting | | | | <input checked="" type="checkbox"/> |
| Optimisation of doors' actuation control | | | | <input checked="" type="checkbox"/> |

TABLE 5: TEST SITES SITUATION REGARDING THE MAIN TECHNOLOGIES INCLUDED IN THE AWARDING INSTRUMENTS

7.1.1. How to use the text modules

A PTA or a TOC wishing to use the present text modules to develop its own awarding documents can follow these steps:

- clearly decide on the objective and the goals of your awarding procedure;
- understand the local legal, regulatory and technical frameworks and constraints that can be in place;
- identify the local starting point regarding the EE/ENV criteria, the available finances and what is feasible;
- compare the above outlined picture with the conditions that are suited to the text modules included in the present document: tables 1-5 can be useful;
- select, for each topic, relevant text modules for you. They are only examples that should be partially or fully followed according to the local conditions. When more text modules are available for the same topic, they could be useful by giving you a wider selection of alternatives;
- write your own awarding text: this will benefit the range of examples provided by ECORails, but their compliance with national and regional regulations should be checked locally.

7.2. Lombardia Region (Italy)

The pilot application Lombardy developed a Memorandum of Understanding between the PTA, the TOC and the Infrastructure Manager, in which it was agreed that the regional railway company can make significant use of the EE/ENV criteria. The implementation instrument of the agreement is a plan that has to be jointly prepared by the Region and the TOC. This plan contains clear targets and deadlines, referring to short, intermediate and final steps. For each step, the main contractual text modules have been outlined for insertion into the public service contract.

This approach is included in this report as an example for the countries where EE/ENV criteria are not yet used in the awarding of regional rail services and there is the political willingness to progressively adopt them.

The text module – called “Memorandum of Understanding Between Regione Lombardia, Direzione Generale Infrastrutture e Mobilità (the PTA), and TRENORD S.r.l. (the TOC) and (for specific issues) FERROVIENORD S.p.a. (the regional Infrastructure Manager) – Actions to monitor energy consumption, improving energy efficiency and reducing emissions of regional rail services in Region Lombardy” – is presented here according to its main parts:

- The agreement and its operating plan
- Actions which involve the Infrastructure Managers
- Monitoring of energy consumption
- Incentives
- Compensation Payment
- Clauses to be applied to the provision of rolling stock

7.2.1. The agreement and its operating plan

Article 1 – Energy Efficiency and Environmental Impact of Regional Rail Service

1. Region Lombardy (hereinafter the PTA), TRENORD (hereinafter the TOC), and FERROVIENORD (hereinafter the regional IM) within its jurisdiction, foster regional rail service’s technological evolution, pursuing energy efficiency targets and noise and environmental emissions’ containment, aiming to increase the already significant role played by regional rail service for sustainable development in Lombardy.
2. The PTA, the TOC and the regional IM undertake, by means of the present agreement, to follow targets on energy efficiency and noise and environmental emissions’ containment:
 - a. at least 5% by the implementation of monitoring, personnel training and efficiency management;
 - b. at least a further 5% by the introduction of new rolling stock into service;
 - c. at least 15% for the complete service period, by 2020, by innovative technologies implemented in addition to management measures.

The targets listed above will be detailed by the operating plan in article 2, according to the available funding.

Article 2 – Operational Plan

1. The TOC, supported by the regional IM within its jurisdiction, commits itself to submit to the PTA, within six months after signing this Protocol, an Operational Plan of activities aimed at progressively achieving the objectives and meeting the deadlines set out in article 1.
2. The Operational Plan contains measures which are consistent with the Guidelines delivered by the ECORailS project under the program "Intelligent Energy Europe", listed below and detailed in the following points:
 - a. Introduction of environmental and energy consumption indicators in the monitoring system of the Service Contract (hereinafter PSC) to be refined and detailed afterwards following the improvement of available meters and techniques more advanced.
 - b. Set up Partnerships with the IMs, manufacturers of rolling stock and other relevant stakeholders, aimed at achieving more effective energy saving and reducing the negative environmental impact.
 - c. Installation of equipment for measuring energy consumption on newly acquired rolling stock. The equipment has to conform to the specifications adopted or under adoption by international standardization and certification bodies.
 - d. Implementation of a measuring equipment plan for rolling stock already in service, defining a minimum number of rolling stock vehicles that is typical for the different series in service today. These vehicles will be employed to measure the energy consumption both when not in service, in standard operational conditions, and when in service, on a rotation basis on different lines. The plan will specify available sources of financing.
 - e. Commitment to adopt, in upcoming procedures for purchasing rolling stock, specifications of requirements and evaluation criteria for tenders that promote energy efficiency and the reduction of noise and pollutant emissions.
 - f. Commitment to define actions for improving both energy efficiency and noise as well as pollutant emissions. These actions are to be implemented during the main scheduled maintenance of the following newer series of rolling stock: ...*(vehicle classes to be given)*
 - g. Implementation of functional training courses addressed to personnel in charge of service, maintenance and infrastructures. The training, which will be supported by the PTA training programs, will deal with best practice and operational measures, for example driving techniques that optimise energy consumption. As a result of the training, the TOC commits itself to putting the acquired measures into day-by-day practice and to monitor their impact on the energy consumption.
3. The operational plan will become part of the PSC.
4. The operational program will specify 3 steps of implementation:
 - a. Preparation step, which aims to supply the regional rail service with the basic tools, data and know-how that is necessary in order to start concrete actions of reducing energy consumption and emissions.
 - b. Kick-off step, during which the monitoring system, acquisition criteria, provision of rolling stock and cooperation with the IMs will be in operation. Energy consumption targets will be set and monitored, starting from a panel of selected lines.
 - c. Trimming step, that foresees the application of incentive tools extended to all regional rail services, as well as standard energy consumption targets and costs will be in use.

The first two steps will be completed within *(DD.MM.YYYY)*

7.2.2. Actions which involve the Infrastructure Managers

Article 3 – Coordination with Infrastructure Managers

1. Coordination initiatives to be implemented between the PTA, the TOC and the regional and national IMs will address the following priority issues:
 - a. Energy consumption measurement and implementation of technologies for energy saving.
 - b. Pricing of electric energy for traction.
 - c. Design of train paths.
 - d. Energy-mix analysis.
2. IMs will support trial runs for energy consumption measurement in standard operational conditions when the trains are not in service. They also will make available data collected from sub-stations to be compared to the data collected by the TOC on board. TOC and IMs will cooperate to test technologies for the recovery and re-use of braking energy and other innovations developed through research. Data gathered will be used in a shared way aiming to build an evaluating system for the overall energy performance of the regional rail service.
3. The PTA, when implementing European and national legislation on access to rail infrastructure, undertakes to upgrade the pricing rules about the electricity supplied to TOCs on the infrastructure licensed to the regional IM. The new rule will charge the TOCs for electricity according to the real consumption of each train path. To determine consumption, both standard consumption data – pre-defined for every type of rolling stock and service profile – or actual data collected by the on board energy meters can be adopted. The choice of data sources will depend on meters availability and monitoring system progress.
4. The PTA and the regional IM will make available to the national IM and to the national Ministry of Infrastructures and Transportation their experience and knowledge gained on the regional railway infrastructure for the purposes of reviewing the energy charging policy on the national infrastructure.
5. The PTA will foster the analysis of energy sources purchased by IMs on the energy market. Strategies to promote the use of sources with the lowest CO₂ emissions will be developed referring to best international practices.
6. The PTA will foster cooperation with the IMs aimed at optimising energy consumption, also during design of train paths and traffic control, to be obtained by:
 - a. Prevention of traffic conflicts and other delay or stop causes.
 - b. Improved planning of travelling times that avoids delays and speed reductions.
 - c. Thorough application of infrastructure maintenance plans to avoid the prescription of speed reductions.
 - d. Gradual upgrade of the infrastructure, aimed at removing the causes of speed reductions.

7.2.3. Monitoring of energy consumption

Article 4 – Monitoring System

1. An energy and environmental performance monitoring system is added to the present PSC between the PTA and the TOC. It will be designed according to the criteria described in the following paragraphs.
2. Fuel and Energy consumption are measured:
 - a. “Not in service” carrying out trial runs on standard operating conditions. These operating conditions have to replicate the main service profiles (suburban, regional and fast regional) and the main features of Lombardy lines, in terms of layout and gradient, in standard driving conditions. The “not in service” surveys will be held for all major series of rolling stock and train compositions, aiming to establish a reference baseline. Surveys will be repeated several times to deal with all relevant weather and environmental conditions in the year. The repetition in subsequent years will allow the consolidation of the baseline and test the condition of rolling stock.
 - b. “In service”, dependent on availability of energy meters and databases. Until energy meters are available on all traction units, data will be collected in samples. To do this, the equipped rolling stock will circulate by turns on different lines. The analysis of the data collected in service aims firstly to assess the actual driving conditions compared with the optimal ones, and secondly how much the traffic irregularities and the load factor influence energy consumption.
3. Energy consumption data gathered in service and not in service will be completed by other background data already available in the monitoring system or that will be added later, identified by reference to guidelines issued by the major international institutions and research projects. They will allow the gradual activation of incentives, avoiding in the meantime any degradation of service caused by promoting energy saving. The main background data to be collected deal with:
 - rolling stock specifications (weight, capacity, auxiliaries, traction braking and transmission systems, ...);
 - regularity of service;
 - load factor;
 - operating speed;
 - stopover time (planned or not);
 - speed restrictions;
 - weather conditions.
4. Where allowed by the measurement systems, energy consumption related to traction will be recorded separately from that for the auxiliaries. Both when measured in service and not in service, energy consumption data have to be allocated to each run and, if possible, to each stop.
5. The data collected in the baseline have to be organized in a way to enable summaries to be made according to lines, time or kind of service and the preparation of assessments and standard values.
6. Using the data collected in the baseline, the following indicators, as foreseen in the ECORailS Guidelines, will be calculated:
 - KPI1: kWh/gross tonne*km
 - KPI2: kWh/seat*km
 - KPI4: kWh/passenger*km
 - KPI5: kWh (or %) consumed not in service
 - KPI6: kWh (or %) recovered

The above listed indicators will be part of an incentive system (see article n.5).

7. Noise Emission data will be collected in sample, covering all main classes of rolling stock operating in Lombardy, taking into consideration the following measurement conditions:
 - a. Departing train.
 - b. Running train.
 - c. Braking train.
 - d. Stationary train.

For the methods of data collection, refer to the regulations, if any, and best practices.
8. The PTA and the TOC undertake to use the data collected on energy consumption and noise emission to define specifications when purchasing new rolling stock for the Lombardy regional rail service.

7.2.4. Incentives

Article 5 – Incentives

1. The Operational Plan mentioned in article 2, and the PSC between PTA and TOC will gradually introduce incentives by following the criteria described below.
2. During the implementation of the Operational Plan, the PTA will support the TOC and encourage the achievement of the planned actions by activating available instruments from time to time, including financial help.
3. PTA will grant a share of the penalties resulting from the PSC, in default of possible forms of TOC's corporate self-financing or other sources available, to the installation of the initial minimum provision of energy meters.
4. Once available, data provided by the monitoring system will allow the definition of the baseline and possible targets for improvement. No later than ... years (*to be agreed by TOC and PTA*) after signing this agreement, the TOC will report to the PTA on projects for energy efficiency and emission reduction, with reference to specific lines or classes of rolling stock.
5. For each line or class of rolling stock that is the subject of the projects referred to in paragraph 4, a target to reduce electricity or fuel consumption and CO₂ and noise emissions will be defined, to be achieved in the 12 months after the implementation of the project and to be maintained or improved in subsequent years.
6. 80% of the achieved savings from paragraph 5 will be channeled, without any reduction to compensation established in the PSC, to ensure the Operational Plan until its completion, starting with the completion of the installation of energy meters.
7. The new rolling stock, which during tender will be subject to the clause referred in article 7, will be subject to the following special regime. When the period covered by the manufacturer's warranty ends, the TOC will be required to maintain for the vehicle's whole working life the same maximum energy consumption that was agreed for the warranty. Therefore, with regards to the mileage of this rolling stock, the PTA will not recognize higher energy costs per kilometer or a penalty will be applied.
8. The PTA reserves the right, in case of a revision or increase of the PSC compensation, to require lower energy consumption as target for the TOC. For this purpose, the contractual compensation can be adjusted by less than the total increase in energy costs in the period.

7.2.5. Compensation Payment

Article 6 – Compensation Payment

1. Once the trimming step of the Operational Plan is reached, the PSC compensation for the part dealing with energy costs may be determined in a standardised way by applying:
 - a. To each class of rolling stock and service profile, standard energy consumption established by the monitoring system. Consumption standards will be developed taking into account the tests carried out to define optimal operations 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 the PTA on the basis of market trends and sources of primary production.
2. Incentives can be confirmed, such as those foreseen in article 5.
3. The selection by the IMs of energy providers that use renewable sources will be stimulated.

7.2.6. Clauses to be applied to the provision of rolling stock

Article 7 – Purchase of rolling stock

1. When purchasing new rolling stock, the PTA and the TOC will require the installation of energy meters compliant with the international norms and standards.
2. The PTA and the TOC commit themselves to require and/or to reward in the call for tenders new rolling stock capable of achieving greater energy efficiency, even in the auxiliaries, and the reduction of CO₂ emissions and noise.
3. The usual Reliability, Availability, Maintainability (RAM) clause in contracts for the purchase of new rolling stock will be upgraded by asking the manufacturers to add an energy consumption index, with reference to the infrastructure and service profiles of the tendered rolling stock. A description of the infrastructure and of the service profile will be in the tender specification document. The RAM+C indexes offered by the competitors will be evaluated when awarding the tender. The contract with the winning manufacturer will require the checking of real energy consumption for all delivered vehicles. The manufactures must be fined in the case of lasting differences after a 24 months service.
4. For the purpose of encouraging technological innovation, in the evaluation of tenders the energy saving features of the rolling stock will be favored by higher scoring than their influence on the full cost of the tendered vehicles.

7.3. Berlin-Brandenburg (Germany)

The current structure of the awarding texts in the Berlin-Brandenburg site should be added with the following text modules, covering the following issues:

- energy efficiency related way of determining the reimbursement for energy consumption;
- awarding criteria and public service contract rules including energy efficiency in the competitive tendering for regional rail services;
- inclusion of the control of comfort functions in parked trains in the current awarding procedure;
- inclusion of energy efficient driving in the current awarding procedure.

7.3.1. How to determine 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 at 1.61 Euros per train-kilometre. This amount includes all the energy consumption of the vehicle (incl. comfort functions). This amount is the initial basis for indexing the reimbursed costs for energy consumption.

7.3.2. Energy consumption as criterion for the awarding

Text module for the Awarding Text:

1. The maximum energy consumption of an offered vehicle on the respective network must not exceed 12.75 kWh per train-kilometre (excluding comfort functions). If lower values are offered, it will lead to a better weighting for the bid. The PTA will provide a detailed profile of the network in the technical specifications in order to enable the potential bidders to calculate their offers accurately.

Text module for the Public Service Contract:

1. Before starting operations, the TOC has to prove the offered values for energy consumption with a test run on the network. The test run has to be done with at least one vehicle from the offered type series.
2. If the test run identifies higher values, the franchise payments will be cut by the amount that the TOC was better weighted in the awarding phase. In addition, there will also be a reduction of another 10 cents per train-kilometre.
3. If the TOC did not offer its own values for energy consumption, the franchise payments will be cut by 16.1 cent per train kilometre (equivalent to 10 percent of the reimbursement for energy costs). Furthermore, the TOC has to develop a concept for achieving compliance with the maximum consumption values as soon as possible, in full agreement with the PTA.
4. If the TOC can prove compliance with the maximum values, the reduction of the payments will be suspended. The reduction can also be suspended if the TOC uses replacement vehicles that meet the requirements regarding energy consumption and quality standards.

7.3.3. Parked train modus

Text module for the Awarding Text:

1. In its offer, the bidder must provide a detailed concept showing how it intends to use the parked train modus of the vehicles to save energy.

Text module for the Public Service Contract:

1. The TOC must produce an annual report showing how its parked train concept is being implemented.

7.3.4. Energy efficient driving

Text module for the Awarding Text:

1. The bidder must provide a concept for the regular training of drivers, particularly with regards to energy-saving driving methods. The PTA attaches a short overview of educational content to the technical specifications. Minimum requirements must be defined (basic principles, particular features of the track or vehicle etc.)

Text module for the Public Service Contract:

1. The TOC has to provide proof that every train driver has received training in energy-saving driving every year/every two years.

7.4. Øresund (Denmark)

The following tendering documents describing the Øresund train service may be improved with EE/ENV criteria:

- Rolling stock (Bilag 3 Rullende materiel);
- Staff (Bilag 6 Personale);
- Incentive schemes (Bilag 8 Incitamentsordninger);
- Reporting (Bilag 12 Rapportering);
- Description of the tender (awarding criteria and assessment) (Tilbudsgrundlag).

7.4.1. Rolling stock

The tendering document should contain the requirement to the operator to describe which steps he would take to ensure energy efficient use of the rolling stock (in and out of service). This description should be used by the PTA to evaluate the offers, and thus be included in the overall evaluation scheme.

Proposed text (part of chapter regarding what the TOC should describe as part of the offer):

1. The tender must describe what measures will ensure energy efficient use of the rolling stock.

7.4.2. Staff

Proposed text (part of chapter regarding what the TOC should describe as part of the offer):

1. The tender can describe how training, energy awareness campaigns etc. could support energy efficient operation.

7.4.3. Incentive schemes

Registration and monitoring of energy consumption should be made on a monthly basis. Separate registration and monitoring should be made for energy consumption in service and out of service.

A bonus/malus scheme should be set-up to encourage the operator to optimise his energy performance. Break even is the baseline energy consumption per train set km, alternatively per seat km. The bonus/malus scheme should follow the principles of the other bonus/malus schemes in use at the test site (for instance regularity) to ensure transparency and manageability in the contract period.

Proposed text:

1. The payment is to be adjusted based on the TOC’s energy consumption for running the service. The energy consumption is to be measured and reported on a monthly basis.
2. The adjustment is fixed in the table below:

| 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 % |

7.4.4. Reporting

The existing energy consumption monitoring scheme in Øresund provides the necessary information and manageability for contractual follow-up. One additional reporting feature requiring the operator to report the energy consumption directly to the PTA should be added to the requirements. The energy consumption used for parked trains (when not using the pantograph) should be extracted and revised separately by the operator before reporting to the PTA.

Proposed text (as part of a list of reporting duties from the TOC):

1. Energy consumption (average kWh/train km), to be reported monthly.

7.4.5. Description of the tender (awarding criteria and assessment)

The weighting of energy efficiency is to be included in description of the tender. The overall weighting scheme in use in the Øresund test site consists of three elements:

- Price (50 %)
- Quality (30 %)
- Deliverability (20 %)

Energy efficiency should be covered by “quality”, which then also covers quality of traffic, rolling stock (organisation of maintenance), stations (maintenance and operations), distribution and passenger services.

Energy efficiency would appear alongside other qualitative requirements, but without any significant weighing in the overall assessment of a bid. However, the bidder would have to describe his solution, and this description would be part of the contract. The operator would then have a specific contractual obligation to fulfil.

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

Contract: IEE/08/690

Dissemination Level: PU

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Proposed text (part of description of quality requirements):

Energy efficient use of the rolling stock (10 % of the quality element):

- 50 %: measures to support energy efficient use of rolling stock “in-service”
- 50 %: measures to support energy efficient use of rolling stock “out of service”

7.5. Timișoara region (Romania)

The Pilot Application of Timișoara developed awarding documentation, based on the ECORailS Guidelines, to be used to procure new rolling stock (10 DMU and 10 EMU).

The awarding text deals with ten technologies and measures from among those collected and mentioned in the ECORailS project reports. Following the “awarding to the most economically advantageous tender” criterion (EU Directive 2004/17), the text module specifies the main conditions and targets required by the end user (a PTA or a TOC), while the tenderer is free to offer the technical concepts and solutions for best meeting them.

The document provides draft example and is a guide to developing documentation that accords to the new ECORailS concepts. It refers particularly to the best way of drafting the requirements with the aim of enhancing the products in terms of EE/ENV criteria. For this reason, a series of requirements or details related to the user’s preferences are not mentioned at all, or mentioned only very briefly. The present Specifications refer to the procurement of multiple-unit trains, but many of the modalities proposed, as well as the related explanations or foot notes can be applied to other types of procurements aimed at reducing energy consumption, emissions and operating costs.

The Timișoara text module is composed of:

“Specifications for the Procurement of 10 DMUs and 10 EMU” (document no. W42-02 annexed to the ECORailS Deliverable 14) with the following Technical Sheets as Annexes:

1. “TECHICAL SHEET no. 01 - EE and Env features of DMU”, annex no. W42-03-01 to the Specifications;
2. “TECHNICAL SHEET no. 02 - EE and Env features of Diesel Engine for DMU” , annex no. W42-03-02 to the Specifications;
3. “TECHNICAL SHEET no. 03 - EE and Env features of Electrical Transmission” , annex no. W42-03-03 to the Specifications;
4. “TECHNICAL SHEET 04 Pneumatic installation and braking for DMU”, annex no. W42-03-04 to the Specifications;
5. “TECHNICAL SHEET no.09-Life cycle costs for DMU”, annex no. W42-03-09 to the Specifications;
6. “TECHNICAL SHEET no. 11 - Operation and testing conditions for rolling stock”, annex no. W41-01-02-21 to the Specifications.

The key procurement specifications are reported in the following paragraphs, while the full document and annexes can be downloaded from the ECORailS web site.

7.5.1. DMU Configuration

Text module for the awarding text:

The conditions for rolling stock application and testing are described according to Annex 1 - Technical Parameters, leaving the multiple unit train configuration up to the tenderers.

The tenderers shall come up with optimum configuration versions with a view to reducing energy consumption, harmful emissions and LCC, by providing solutions aimed at:

- reducing overall weight and the weight as related to the number of seats;
- the possibility of configuring the train according to the foreseen number of passengers.

The tenderers shall fill in the Technical Data Sheet in Annex 2 – DMU Technical Characteristics, which contains all the important parameters, according to various DMU loading degrees, inclusively.

All the data provided shall be verified during the trials on a test line.

The offer shall confirm the compliance to the provisions under the latest norms / recommendations referring to the passengers' present demands, ECORailS criteria, operation prescriptions, the end user's trade objectives, traffic safety, fire prevention, passenger safety, interoperability, utilization of allowed materials, ecologic and ergonomic design, facilities for disabled / low mobility people etc. while describing the concrete modality in which these requirements were actually met with state-of-the-art standards.

7.5.2. Diesel engine

Text module for the awarding text:

The offer documentation shall account for the diesel engine choice so as to best meet the state of the art technical and reliability requirements, as well as the lowest values for:

- fuel and oil consumption;
- emissions, according to stage IIIB as per the EU Directive 2004/26/EC – NRMM, EU Directive 2010/26/EU, UIC 330, UIC 345, UIC 624;
- noise levels, according to EU Directives and regulations, especially TSI Noise;
- Life Cycle Costs (LCC);
- start-up at low temperatures;
- high reliability indicators, as resulted from similar applications.

The engine specific documentation shall include the technical characteristics (proven through tests), optimum energy consumption diagrams, list of the documents to be provided (Engine Instruction Book, Operation and Maintenance Manual, Service Manual, Test Bulletins, diagnosis and maintenance software, List of consumables and wear parts, Spare Parts Catalogue, references from on-site applications etc.), as well as any other documents or documentation which may contribute to a better offer evaluation, and to a better and more efficient operation and maintenance, respectively. The offer will refer also to connected equipments and installations.

In order to permit a uniform filling-in of the necessary data and for an easy comparison and evaluation of offers, the tenderer will fill-in Annex 2 – DMU Technical Characteristics, and will also supply the values of the life cycle costs following a model similar to the one under Annex 5 – LCC.

All the data supplied shall be verified through acceptance tests and track tests.

The mandatory engine-related technical data shall be required (maximum energy consumption, harmful emissions, noise level etc.), but the offers shall be evaluated mainly on general vehicle parameters, which will include the engine characteristics, also correlated with other parameters, so that the evaluation may at best mirror the benefits with the present vehicle performance.

7.5.3. Braking energy recovery

Two issues are required under this point:

- a) Regenerative braking and use of regenerated energy for supplying the auxiliaries:

Text module for the awarding text:

The tenderer shall specify whether this optional requirement is met, and if so, the design solutions, the degree of energy regeneration to be reached (in % and in kWh, respectively), as well as how the regenerated energy may be used.

The tenderer shall fill-in the Technical Sheet under Annex 4 – Braking.

The data in the technical data sheet shall be proven by the acceptance tests.

b) Storage of the energy regenerated at braking and its use at the next DMU start up:

Text module for the awarding text:

The energy shall be stored in super-capacitors fitted on top of the DMU.

If this optional feature is offered, the following shall be specified: design solutions, regeneration degree to be reached (in % and kWh, respectively) and how the regenerated energy can be used.

The characteristics of the storing devices (volume, weight, location, efficiency, additional operations and costs – procurement costs, maintenance costs, LCC – etc.) shall be specified.

The tenderer shall fill-in the Technical Sheet under Annex 4 – Braking.

The data in the technical data sheet shall be verified by the acceptance tests.

According to the data filled-in in the Technical Sheet, a comparison can be made between the offers, as well as between the ratio investments-maintenance costs to the benefits related to lower energy consumption, harmful emissions and life cycle costs. When the contract is concluded one of these braking energy recovery solutions will or will not be foreseen.

7.5.4. Fuel / energy consumption measuring and recording system

Text module for the awarding text:

The fuel system must allow for total fuel consumption measuring.

The energy system shall measure and record the energy consumption as received from the supply system, and shall also record the regenerated energy.

All data recording shall be in correlation with the date and moment of energy consumption, as well as with other related parameters.

The system shall comply with the provisions under EN 50483-2 clause 2, homologated for rolling stock and metrologically certified.

The system shall be vandalism and mistuning proof.

The system has to allow for the possibility of transferring the recorded data so that they may be copied and analysed using the maintenance software (in the depot), either by real-time transmission (on line), or by copying them on to a stick or a memory card.

Requiring such data, as mentioned in the text box above, allows the identification of those responsible for the energy consumption (the driver, the mechanic in charge of performing and checking the adjustments, the mechanic in charge of maintenance, parking, etc), while also automatically setting up the incentive measures (penalties / awards).

7.5.5. Train Control and Management System - TCMS

Text module for the awarding text:

DMU shall be provided with a TCMS system with dynamic self-configuration according to the (variable) train configuration in order to allow for the train coupling / uncoupling and multiple control.

The system requirements will be reported to existing norms and the user's requests.

The information system shall perform the following main functions:

- communicate with the other controllers in the configuration of the various equipment items in order to copy and monitor the data of interest necessary for commands, decision making / display / depot data base;
- in case of multiple control, control and monitor both its own and the other units;
- allow the TCMS data be periodically copied by an authorized operator on to a stick or personal memory card;
- transfer, on demand or as an optional solution, all the necessary data to a control centre in real time from the on-board controller;
- allow the implementation of specific requirements related to costs and emissions reduction in operation;
- ensure that the software is user friendly and can be further improved in service, including for the technical assistance necessary for the end user.

The provisions from the above text box have a tremendous potential in reducing operational and maintenance costs. That will depend in a decisive way on:

- the way of setting forth the requirements addressed to the developer;
- the way of meeting these requirements and the correlation between TCMS and the maintenance software;
- the end user's actual and permanent involvement in exploiting this potential.

7.5.6. Maintenance- and Diagnose Software

Text module for the awarding text:

The maintenance software shall be installed in the user's PC network, it will constitute a data base of data copied from each on-board controller, and will process all these data in order to:

- provide diagnostics data and statistics;
- provide data and statistics related to the driving modality, to energy consumption and operation regimes.

The statistics shall include all the data for all the vehicles in service; however, statistics selected according to various criteria shall be available.

The statistics can be automatically sent, or interconnected to other data bases, at various levels.

The maintenance software is a modern requirement, which should be compulsory in order to allow for optimized efficient operation and maintenance, with important economic effects in terms of reliability in service.

7.5.7. Optimised driving assistance

Text module for the awarding text:

The supplier shall provide detailed instructions with a view to optimized driving styles and the drivers shall be trained accordingly.

The TCMS shall also include software able to offer the driver adequate assistance with a view to economically optimized driving, while also observing the safety conditions and the running times. The supplier shall recommend as economical and efficient as possible a system (or variants) in order to meet this requirement.

Optimised driving shall feature a minimum amount of acceleration, periods of coasting that are as long as possible (inertial running, traction- free) and regenerative braking.

The driver assistance system version shall be selected following an analysis of the offers in terms of the extra procurement costs and the system efficiency.

The key element lending uttermost importance and efficiency to a method is the monitoring of the energy consumption and of energy savings to be reused, referring to each driver, and the bonuses / penalties to be applied according to the results obtained. All that can be recorded on the driver's card (or on a separate form) should also include the technical data referring to the driving modality.

7.5.8. Optimisation of the heating- air conditioning- ventilation system (HVAC)

Text module for the awarding text:

The tenderer shall make sure to provide optimum heat insulation, so that the consumption necessary for air conditioning, heating and ventilation may be minimised.

There shall also be intelligent monitoring and optimising systems, both to provide the necessary comfort, and to optimize the energy consumption according to the outdoor and indoor temperature, air draughts, humidity, air quality, carriages without passengers, etc.

The ventilation of confined spaces shall be made according to the actual demand. The ventilation equipment has to allow for power variation according to an occupancy indicator and the indoor air quality (IAQ).

The traction motor ventilation as well as the other technological ventilation shall make maximum use of technical solutions based on natural ventilation, whilst forced ventilation shall be gradually controlled and adjusted according to heating, their gradient, and demands.

7.5.9. Optimisation of lighting

Text module for the awarding text:

Lighting shall meet the end-user's requirements and the provisions under the specific norm in force regulating the general and local lighting.

Interior materials shall also be selected so as to enhance lighting quality and its necessary energy consumption.

The location and material of the windows shall be selected so as to provide optimum lighting volume and quality.

The tenderer shall use the most efficient lighting systems in terms of efficiency, sight protection, reliability and service life, as well as of environmental quality prescriptions.

Intelligent monitoring and optimisation systems shall also be provided in order both to ensure the necessary comfort, and to optimize energy consumption according to natural lighting, the necessity of general and local lighting as determined by the presence and number of passengers etc.

7.5.10. Optimisation of doors' actuation control

Text module for the awarding text:

The door actuation system shall control and monitor the doors opening and closing so as to ensure safety and protection, while also reducing the compressed air and energy consumption.

7.5.11. Control of comfort functions in parked trains

Text module for the awarding text:

The train at standstill should be supplied at optimum energy consumption according to the necessities (actual temperature at the parking place, local temperatures, light conditions etc.), and according to the specific and operation data in Annex 1 – Technical Parameters and in the rest of the awarding documentation.

Reducing and optimising energy consumption while parked shall meet the following requirements:

- diesel engine heating;
- heating of train at standstill;
- train pre-heating before travel;
- lighting of train at standstill.

The supplier shall provide the necessary instructions and instruments for easy and operative maintenance and cleaning of the trains at standstill, by specifying the required times and the related energy consumption.

The supplier shall indicate the energy saving potential for trains at standstill, reached through constructive measures that reduce the situations / times requiring energy consumption at standstill and / or through the optimized energy consumption control system, and of operation periods.

The supplier may provide optional versions, describing the system, its component parts, the operation modality, the energy consumption for each function, the efficiency in reducing energy consumption and related extra costs.

7.5.12. LCC- driven procurement (whole life cycle costs)

Text module for the awarding text:

The tenderer shall calculate the life cycle costs of the railcar taking into account the operational conditions, the test line conditions and the operating schedule (indicated through Annex 1 – Technical Parameters). The parameters for the acceptance checks and tests are also provided for.

The life cycle costs are to be filled-in by tenderers in conformity with the Technical Sheet under Annex 5 – LCC.

The tenderers shall specify the documentation they will supply, with a view to a proper implementation of their own concept of operation and maintenance, leading to a minimum LCC.

The energy consumption stated in the offer shall be checked by measurements (during the acceptance tests and the trials on the test track – as defined in the procurement documentation and Annex 1 – Technical Parameters). Both the energy consumption in normal operation and their reduction following the application of various technologies (regenerative braking, driver assistance system, systems of reducing energy consumption in service / at standstill etc.) will be verified.

During the guarantee period, and throughout the service life, respectively, periodical checks and analyses shall be foreseen, so that the reduction in energy consumption and costs may be permanently monitored to the benefit of both parties under the contract and in view of a long term partnership.

It is important to include such LCC-driven procurement behaviour not only into the procurement documentation and procedures, but also in the permanent basic activities of the PTAs and TOCs, like the public service contract, because the acquisition cost represents only about 22% of the total life cycle cost.

Such an objective can be achieved through an advanced and active management that imposes the organization and continuous improvement of the activities related to the operation and maintenance of the rolling stock for passengers transport, based on permanent analyses of costs, energy consumption and emissions with a view to their reduction.

7.5.13. Awarding criteria

The Timișoara text module follows a cost-oriented method of scoring the tenders submitted by the manufacturers, assuming that all the other requirements in the Specifications are mandatory (e.g. if the tenders are not compliant with them, they will be withdrawn).

The proposed maximum 100 points score is awarded as follows: 35 points for the minimum price and 65 points for the parts in the offer determining energy and maintenance costs, respectively, to a larger extent.

The scores were awarded considering the effect of these technologies (their estimated share within the energy and maintenance costs), but also in an attempt to push the tenderers to provide the best solutions, according to the relevance given by the awarding body. The issues subject to scoring are focused especially where the offers can differ more to one another, so that innovation and bigger improvements in saving energy and protecting the environment can be achieved. Less relevance is therefore given to issues which are mandatory or standardised by the industry.

| <u>Text module for the awarding text:</u> | | | |
|---|---|----------------------|--|
| N o | Analysis criteria | Eval. point s | Comments |
| 1 | Variable and optimized DMU configuration | 9 | The maximum score shall be awarded to the offer featuring the best KPI2 [kWh / seat km] filled-in in Technical Data Sheet FT_01-DMU for the running test, consumption calculated for the 3 versions of occupancy (300, 200, 60 seats, namely maximum / average / minimum number of passengers) and of MU configuration, respectively. The other offers shall be awarded lower scores proportionally with the extent to which KPI2 is exceeded. |
| | | 6 | |
| | | 3 | |
| 2 | Performant diesel engine | 0 | The harmful emissions level stage IIIB shall be mandatory. The same with the noise maximum level. The tenderers are interested in providing the best engine, so we propose that no special score points be awarded for the engine. The input of the engine shall be referred to in KPI2 under item no1 (DMU) and in LCC - where the engine consumption and maintenance costs play an important role. |
| 3 | Braking energy recovery and utilization for start-up | 14 | Maximum score shall be awarded for the offer featuring the biggest energy saving [kWh] to be achieved through the system proposed. The data shall be filled-in in the Technical Data Sheets, as per the annexes in the Specifications and shall be checked during the acceptance- and the running tests, respectively. The other offers shall be awarded lower scores, proportionally with the energy saving achieved as compared to the offer with the maximum score. |
| 4 | Assistance for optimized driving | 2 | |
| 9 | Optimized consumption for parked train | 3 | |
| 10 | Optimization of HVAC system (Heating, Air conditioning, Ventilation) | 2 | |
| 11 | Train Control and Management System TCMS | 4 | Score points shall be awarded for totally meeting each optional requirement in the Specifications. These requirements, including the evaluation modality and the maximum score to be awarded, shall be enlarged upon in the Technical Data Sheet. |
| 12 | Measurement and recording of fuel consumption | 0 | Although it is not to be scored, it will be a mandatory requirement according to the Specifications |
| 13 | LCC analysis | 22 | The offer featuring minimum LCCs, according to the technical data sheet FT_09-LCC, annex to the Specifications. The other offers shall be awarded lower scores, in proportion to the extent to which they exceed the costs specified in the offer having been awarded maximum score. |
| 14 | Total DMU price | 35 | The maximum score shall be awarded to the offer with the minimum price. The other offers shall be awarded lower scores, in proportion to the prices. |
| Total | | 100 | |

7.5.14. Progressive steps of the awarding procedure to introduce the EE/Env criteria

At the end of the Timișoara test module a list of useful suggestions is presented to guide the awarding body through all steps of a procurement procedure which follows an approach more oriented to energy saving and the environmental protection:

- According to this approach – which gives less importance to the rebate as awarding criterion – the main conditions and targets required by the end user shall be specified, the tenderer being free to offer the technical concepts and solutions for best meeting them.

- There will be certain mandatory (or minimal) technical conditions, while for the others, the tenderer may propose one or several optional variants which will be evaluated and scored in order to differentiate the offers.
- In order to obtain the desired data and in the view of an easy comparison, the offers will be submitted by using standard forms. By description and by filling-in the requested forms, the tenderer has to justify and quantify his proposals on the basis of the following elements:
 - a) Difference in terms of energy consumption in service [kWh, kWh/Skm, kWh/pkm]
 - b) Differences in terms of emissions [Emissions: g CO₂/pkm, g NO_x/pkm, Noise etc.]
 - c) Life Cycle Costs (LCC) (in the present text module, a 30 years life cycle is considered)
 - d) Technical or utilisation advantages (and the way in which they influence the values above, too)
 - e) Advantages related to reliability in service
 - f) The difference in price (*if any*) that an optional version (equipment / technology etc.) is likely to induce in the total purchase price as compared to the tenderer's standard version.
- The ECORailS Criteria shall play an important role in the evaluation of the tenders, aiming at stimulating the tenderers applications to offer the most competitive technical solutions, technologies and equipment for reducing energy consumption, emissions and operational costs over the entire life cycle.
- The data from the technical sheets are to be verified through acceptance tests, track tests and in operation, according to the provisions from the Technical Specification and from the dedicated norms.
- The Contract shall include provisions for the winning manufacturer's liability in case on non-compliance with the data supplied through the offer.
- The Contract will involve the manufacturer in granting technical assistance and in jointly monitoring/verifying the data collected during the operations, so that his operation/maintenance concept is correctly applied and optimised during operation. By doing so, it will be possible to check the fulfilment of the life cycle costs declared through the offer and to apply a bonus/malus system for the manufacturer, based on the regular comparison of the real costs of operation against the ones from the offer (according to the model of the LCC Technical Sheet under Annex 5).