

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



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

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

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1. Executive summary

Work package 3 aims at analysing awarding procedures and their legal and economic frameworks and describing how to include energy efficiency and environment-friendly (EE/EF) criteria in the awarding of services and rolling stock in a legally secure way. Work Package 3 has an input-oriented objective (state-of-the-art and future developments of legal norms and awarding procedures) as well as a process-related objective (compilation of the technical – technological, economical and legal – inputs into a Europe-wide applicable, legally-secure guideline).

The present Deliverable is structured as a complement to D10 and as a compilation of the final contributions from Work package 3 to the final guide line version (D22). This means that the results presented in D9 and D10 will not be repeated in this version besides from the background information in chapter 3 about European legal framework.

To summarize the main results from the three deliverables a short sector from the earlier deliverables will follow in the summary together with the new parts that have been added in D11.

To be in compliance with European legislation, awarding of regional railway services can be done through *competitive tendering* or through a *direct awarding* procedure. In a *competitive tendering* procedure the competent authority (PTA) may evaluate the offers of a number of interested Train Operating Companies (TOCs). Within a *direct awarding* procedure, the PTA may award the transport services to a public service operator without entering a competitive tendering procedure. The use of direct awarding is an optional exception for rail services (other than metro and tram) while for other passenger transport modes this is only allowed under special circumstances. National legislation can still prohibit the use of direct awarding of rail services.

When the railway service has been awarded, a Public Service Contract (PSC) between the responsible authority and the TOC has to be established. The PSC is the legally binding act that confirms the agreement between the two contractors and in which the competent authority requires the public service operator to comply with quality standards and technical specifications. The PSC must be in accordance to national law, but the actual standards and requirements may be stricter, e.g. in terms of environmental effects, than required by national or European legislations.

The ECORailS User Platform agreed upon the statement that it is legally secure to implement EE/EF criteria in the awarding of services and rolling stock. However it was stated that being too specific regarding technologies to be implemented should be avoided since it could impose a risk for discrimination.

The inclusion of EE/EF criteria in awarding can from the PTA point of view be included either in 1) the Public Service Contract or, 2) in the case of PTA owning the vehicles, in the awarding of vehicles. Depending on how and what to award, EE/EF criteria can be included either as strict **Requirement** (the TOC/Manufacturer is required to fulfill the specified criteria), as **Bonus/Malus** (during the contract period, the TOC can be awarded with a bonus if they manage to fulfill the specified criteria or provide penalties for non-compliance to the criteria included in the contract) or used as **weight in the evaluation of tenders** (together with other parameters like price and quality). Requirements, bonus/malus, weights, how to monitor its compliance and penalties for non-compliance must be described both in the PSC and in the awarding documents. Requirements are recommended to be used for minimal standards that are not too far reaching or innovative while bonus/malus systems and weights for evaluation of tenders are recommended for implementing more advanced ecological standards in order to go further.

2. Introduction and project framework

2.1. WP3 activities and D11 aims

Work package 3 aims at analysing awarding procedures and their legal and economic frameworks. The WP has an input-oriented objective (state-of-the-art and future developments of legal norms and awarding procedures) as well as a process-related objective (compilation of the technical – technological, economical and legal – inputs into an Europe-wide applicable, legally-secure guideline). Work package 3 is to:

- Give an overview of the legal situation today and anticipated changes on the European level and in the participating countries providing a basis for the guidelines. Therefore the legal situation of setting standards in awarding and negotiating processes will be analysed both on European and national level;
- Describe the different economic situations and starting points in the participating countries including the market access and key actors;
- Describe the chances but also the risks that go along with the use of ecological standards in awarding procedures;
- Describe the different possibilities of integrating ecological standards in awarding documents and point out critical issues and requirements for the successful formulation of awarding texts;
- Compile the task results into the technical draft and later technical chapter of the final guidelines version.

The present Deliverable (D11) is structured as a complement to D10 and as a compilation of the final contributions from Work package 3 to the final guide line version (D22). This means that the results presented in D9 and D10 not will be repeated in this deliverable besides from the background information in chapter 3 about European legal framework.

The earlier deliverables D9 and D10 was structured as an updated version of each other and the previous deliverable (D10) also includes comments from the ECORailS consortium and the second ECORailS User Platform. All three deliverables includes project results from the following WP3 tasks:

1. Good practice examples of awarding involving environmental standards
2. Legal framework on the European level
3. Legal frameworks in the participating countries and regions
4. Economic frameworks concerning passenger rail services
5. Chances, risks and risk handling concerning ecological standards in awarding
6. Options of integrating ecological standards in award procedures.

The previous deliverable (D10) also includes a catalogue consisting of how steps describing how to include energy efficiency and environmental indicators, technologies and operational measures into the awarding procedure. The catalogue was the main input for the guideline version that was tested at the four test-sites.

The main issue for WP3 in the last stage of the project has been to discuss different suggestions with WP6 for the final version of the Guideline. This work/discussion is difficult to describe in a deliverable. Therefore D11 is a kind of a conclusion of the former deliverables (D9 and D10) with parts that are important as a base for the Guideline together with new parts and parts that the project chosen to put in D11 and not in the Guideline.

The deliverable has been coordinated by TFK. Input for this deliverable has also been provided by KCW, TSB FAV, ApS, TUB, TSY, PoB, CBO, ULS, PUT and BME.

3. European legal framework

3.1. European law relevant for awarding and tendering

3.1.1. Primary legislation

Currently the Treaty of Lisbon is the relevant Treaty of the European Community. The Treaty came into force 1st of December 2009.

Basically the principles of the European Treaty have to be observed at awarding procedures. This applies for awarding of regional rail transport as well.

The main principles of the European Treaty are:

- Non-discrimination;
- Proportionality;
- Transparency;
- Equal treatment.

The European procurement directives or the minimum standards for awarding expressed in the regulation (EC) No. 1370/2007 follow these principles. This means that the principles of the European legislation can be used for interpretation or for the closure of regulatory gaps.

3.1.2. Secondary legislation

European legislation for railways

The goal of the common transport policy is to remove obstacles at the borders between Member States so as to facilitate the free movement of persons and goods. To that end its prime objectives are to complete the internal market for transport, ensure sustainable development, manage funding programs and develop international cooperation. It is also concerned with laying down the conditions under which non-resident carriers may operate transport services within a Member State.

The main focus of European railway policy is the opening of the transport market, interoperability and harmonisation of safety requirements of the national networks and the development of (trans-European) networks.

The instruments of the Commission to realise their objectives are:

- Legislation;
- Compilation and provision of data and knowledge;
- Exchange of 'best or good practice'-examples;
- Development of guidelines;
- Encouragement of innovations in the field of science and research;
- Harmonisation of standards [e.g. TSI (Technical Specifications of Interoperability)].

Concrete legislative measures are derived from Green- and White Papers, which are summaries of different discussion levels and give basic orientation for the transport sector and which are further substantiated to directives, regulations and decisions.

Essential legislation in the field of railways at present:

- Regulation (EC) No 1370/2007- substantial level of transposition in Member States necessary,
- Directive 2001/14/EC – only basic regulation concerning network access, crucial level of transposition in Member States necessary,
- TSI (Technical Specifications of Interoperability) - several harmonized standards [e.g. Commission Decision 2006/66/EC concerning the technical specification for interoperability relating to the subsystem 'rolling stock - noise' of the trans-European conventional rail system – high level of concretization of the regulation.]

Further existing regulations regarding environmental aspects can be found in the COMMISSION STAFF WORKING DOCUMENT *accompanying the COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Greening Transport* {COM(2008) 433 final}. With this Communication the Commission emphasises the protection of the environment in the transportation sector.

As a general rule for the policy area of transport, the particular negotiation process of the organs of the Community (i.e. especially the Commission, which intends to protect and develop the Common Market and the individual policies for further integration, whereas the Member States intend to protect their right of subsidiarity) is crucial to the assessment of the influence of the Community, universal statements are not possible in the end.

Relevant legal framework for the award of transportation services (regional rail transport)

The relevant legal framework for the award of transportation services in regional rail passenger transport – i.e. basically “how” to award – in the EC found expression in

- the European secondary legislation regarding the financing and awarding of public passenger transport services by rail and by road (Regulation (EC) No 1370/2007),
- the European secondary legislation regarding public procurement (Directive 2004/17/EC – Utilities Directive and Directive 2004/18/EC - Services Directive = European procurement directives),
- the European primary legislation, here, the basic principles of the Treaty establishing the European Community (EEC),
- national (regional and/or local, if any) provisions regarding the awarding of public transportation services, especially resulting from transposition or concretization of European secondary legislation,
- existing jurisdiction, primarily of the European Court of Justice (ECJ),
- the interpretation of European Community Law by the Commission Interpretative Communication on the Community law applicable to contract awards not or not fully subject to the provisions of the Public Procurement Directives (2006/C 179/02).

The succeeding explanations focus solely on European legislation. Transpositions in national law and concretizations remain out of consideration.

a. Regulation on public passenger transport services by rail and by road (Regulation (EC) No 1370/2007)

The „Regulation of the European Parliament and of the Council on public passenger transport services by rail and by road” has its legal basis in the guidelines of the Treaty establishing the European Community (EEC) regarding the common transport policy (Art. 91 EEC-Treaty) and the common competition policy (Art. 109 EEC-Treaty) and replaces the predecessor rules Regulation No (EEC) 1191/1996 and Regulation (EEC) No 1107/1970. The regulation intends to raise the efficiency and attractiveness of public regional passenger transport. For the first time, the regulation includes provisions which regulate the allowable financing and the awarding of public services in the sector of passenger land transport in the European Union on an area-wide basis. The directive comes into force on 03.12.2009. Considering the awarding of services in regional rail transport the regulation rules in Art. 5 par. 1 that the procedure has to be executed according to the guidelines of the regulation. However, the depth of control is quite small. Art. 5 par. 3 specifies merely that:

“The procedure adopted for competitive tendering shall be open to all operators, shall be fair and shall observe the principles of transparency and non-discrimination.”

As long as the provisions of the European procurement directives (see No. 2) are applied in awarding procedures, the provisions are observed automatically. On the other hand, the wide guidelines of the regulation offer a far greater scope for the Public Transport Authorities (PTA) considering the design of the awarding procedure compared to the stricter European procurement directives. At the same time PTAs are able to procure transportation services in regional rail passenger transport by direct awarding as long as national legislation does not forbid. In this case the maximum contract period is reduced from 15 to 10 years. A prolongation up to 50% with regard to longer amortisation periods is possible.

Generally, the regulation applies to the Member States directly without legislative transposition. However, a large room to manoeuvre remains. Those wide scopes, e.g. regarding the awarding procedures or possible restrictions of direct awarding through national legislation, are a manifestation of the general principle of subsidiarity according to Art 5 EEC-Treaty. This article rules that the European Community takes action only in those areas (also by legislative means) if and as far as it is not possible to the achieve aims of the considered measures by the Member States themselves.

Considering the subject of the service contracts in regional rail transport to be awarded (the „what“) the regulation contains only compulsory statements on how the contract has to be specified regarding financing especially to avoid overcompensation. The regulation allows in Art. 4 par. 6 explicitly the inclusion of environmental criteria into the contract:

“Where competent authorities, in accordance with national law, require public service operators to comply with certain quality standards, these standards shall be included in the tender documents and in the public service contracts.”

b. European procurement directives (Directive 2004/17/EC – Utilities Directive and Directive 2004/18/EC - Services Directive = European procurement directives)

Objective of the European procurement directives is to guarantee a transparent and non-discriminatory public procurement ensuring of the fundamental freedom of the Community on the basis of a common competition policy and the regulations of the Single Market (Art. 53, 62 und 114 EEC-Treaty). Contrary to Regulation (EC) Nr. 1370/2007 the awarding procedure is regulated in great detail. However, attention should be paid to the fact that the European

awarding procedures apply only for contracts in the sense of those directives. Unlike with the Regulation (EC) No 1370/2007, the awarding of concessions is not included. A concession guarantees a right, for instance of an operator of a public service, to offer a specified service for a specified period of time to customers. The concessionaire also bears the economic risk of the customer relations, e.g. by generating revenues through compensation for services rendered. Generally, the concessionaire receives no payments for the provision of services from the licensor, the public administration. The following aspects are relevant for the awarding of regional rail passenger transport:

- For the most part, application of the directives is not compulsory: According to category 18, rail services are non-priority services (Art. 21),
- The Regulation (EC) No 1370/2007 governs the awarding of public service contracts (including concessions) in regional rail transport starting 03.12.2009.

As far as the guidelines of the European procurement directives serve as a rule for awarding procedures, also the (far less strict) specifications of the Regulation (EC) No 1370/2007 are met (see above in section 1). Opposite to Regulation (EC) No 1370/2007 transposition of the European procurement directives into national law in the sense of a standardization of national legislation has to be achieved in 2006.

There are no statements with regard to the subject of the service to be awarded. On the other hand, the directives basically allow freedom of manoeuvre for the contracting authority to specify the subject of the award, e.g. considering energy-efficiency or pollution. In general, the requirements have to be non-discriminatory. For example, the specification of a particular pollution filter (in the sense of a specific producer) would not be allowed. However, the specification of a maximum level of pollution or cleaning method would be permitted, even if these limits were stricter than required by European or national regulations of emission limits.

The establishment of specific environmental evaluation criteria for the appraisal of the offers is possible. The procurement directives define that the environmental standards

- can be associated with the subject of the contract,
- do not admit unlimited scope of action for the public authority,
- have to be mentioned explicitly in the contract notice and the tender documents,
- have to be consistent with the basic principles of EU-legislation.

At an earlier stage of bid assessment it is also feasible to assess the reliability of the bidder and, if necessary, to exclude bidders, e.g. because of registered violation against environmental law or the lack of expertise with regard to the implementation of environment management systems (EMAS¹).

Recital 5 of Directive 2004/18/EC shows the prominent position of environmental aspects in the directive:

“This Directive therefore clarifies how the contracting authorities may contribute to the protection of the environment and the promotion of sustainable development, whilst ensuring the possibility of obtaining the best value for money for their contracts.”

¹ Regulation (EC) No 761/2001 of the European Parliament and of the Council of 19 March 2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme (EMAS).

Recital 29 describes the freedom of the public authority with regard to the subject of the contract (the „how“):

“Contracting authorities that wish to define environmental requirements for the technical specifications of a given contract may lay down the environmental characteristics, such as a given production method, and/or specific environmental effects of product groups or services. They can use, but are not obliged to use appropriate specifications that are defined in eco-labels, such as the European Eco-label, (multi-)national eco-labels or any other eco-label providing the requirements for the label are drawn up and adopted on the basis of scientific information using a procedure in which stakeholders, such as government bodies, consumers, manufacturers, distributors and environmental organizations can participate, and providing the label is accessible and available to all interested parties. Contracting authorities should, whenever possible, lay down technical specifications so as to take into account accessibility criteria for people with disabilities or design for all users.”

Finally, Art. 27 par. 1 of the Directive RL 2004/18/EC specifies further responsibilities with regard to environmental aspects:

“A contracting authority may state in the contract documents, or be obliged by a Member State so to state, the body or bodies from which a candidate or tenderer may obtain the appropriate information on the obligations relating to taxes, to environmental protection, to the employment protection provisions and to the working conditions which are in force in the Member State, region or locality in which the works are to be carried out or services are to be provided and which shall be applicable to the works carried out on site or to the services provided during the performance of the contract.”

The European lawmaker underlines by the guidelines mentioned above the high relevance of environmental protection for the Community. The guidelines express the obligation to incorporate environmental aspects in the definition and execution of common policy and measures (especially to promote sustainable development) stated in Art. 11 EEC-Treaty.

3.2. European legislation in the areas environment and energy-efficiency

As illustrated above, Community Law contains different requirements on “how” to award. The subject of the awarding is left to the discretion of the contracting authority. The contracting authority has to define, describe and procure the services needed. In principle, the Community does not regulate by law the subject of the provisions. This is prohibited explicitly by the EEC-Treaty and would violate the basic principle of subsidiarity. It is possible, though, that the Community develops and discusses their own positions and applies pressure and influences social debates by their actions respectively. This becomes apparent in the above mentioned possibilities of the Member States to focus on environmental aspects in their procurement activities, for instance the environmental guidelines with regard to awarding procedures. Eventually, the Community has a broad field of activity concerning environmental and railway policy. This is mostly done by the Commission.

The Community pursues the following goals with regard to the common environmental policy according to Art. 191 par. 1 EEC-Treaty:

- The conservation and protection of the environment and the improvement of its policy;
- The protection of human health;
- The sustainable and rational use of natural resources;

- The promotion of measures to solve environmental problems on a regional or international level.

The environmental policy of the Community is targeted according to Art. 191 par. 2 subsection 1 page 1 EEC-Treaty on a high level of protection, considering the different circumstances of the individual regions of the Community, i.e. their productivity as well.

The environmental policy is based on three guiding principles (Art. 191 par. 2 subsection 1 page 2 EEC-Treaty):

- Precautionary Principle;
- Abatement of environmental impairments prior at their source;
- Polluter-Pays-Principle.

To achieve their goals, the Community applies Environmental Action Programs which determine the basic targets of the common environmental policy, taking into account the guiding principles. Different legislative measures, i.e. directives and regulations (currently 668) result from those Environmental Action Programs. Examples:

- Directive 2004/26 on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery
- Directive 2002/49/EC relating to the assessment and management of environmental noise
- Directive 2008/50/EC on ambient air quality and cleaner air for Europe
- Directive 2003/4/EC on public access to environmental information
- Regulation (EC) No 761/2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme (EMAS II)
- Directive 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-using products (Ecodesign-Directive – the directive does explicitly not apply to means of transport for persons or goods, Art. 1 par. 3).

However, the Member States play usually a crucial part in the implementation of the guidelines of the Community, regardless of the character of the guidelines as regulation or directive. The Member States are responsible for the financing and implementation of the environmental policy according to Art. 192 par. 4 EEC-Treaty. The virtual influence of the Community becomes apparent: To implement the common goals of environmental policy the Commission can and may take up topics legislatively, notably if a disparity in law-making threatens to thwart those goals or leads to a distortion of competition. Occasionally, the framework established by this legislation can be very detailed. The Member States are responsible for the further transposition, financing and monitoring according to the subsidiarity principle. In particular cases, legislation by the Community has immediate effects on the EU-citizens, e.g. the so-called light bulb ban². It is not possible to tell abstractly, when exactly legislative actions of the Community show indirect or direct consequences to the EU-citizens. Rather, it is the result of a negotiation process where the organs of the Community, especially the Commission, intend to protect and develop the Common Market and the individual policies for further integration, whereas the Member States intend to protect their right of subsidiarity. Attention has to be paid to the fact that “energy-efficiency” is not an independent policy field of the EC but rather part of the common environmental policy of the Community. Additional (indirect) instruments of the Commission (in order to apply political pressure) in the area of environment and railways are for example:

² Regulation (EC) No 244/2009 with regard to ecodesign requirements for non-directional household lamps (as a consequence of the Ecodesign-Directive).

- Compilation and provision of data;
- Compilation and dissemination of knowledge;
- Exchange of „best-practice“ examples;
- Development of guidelines (see „Buying Green! - Handbook on green public procurement“ or the European Commission Green Public Procurement (GPP) Training Toolkit for example);
- Support of innovative activities in the area of science and research;
- Easing of harmonisation of standards;
- Easing of the promotion of projects by the Member States or individual promotion respectively.

3.2.1. Directives for non-road mobile machinery (NRMM)

Altogether 4 directives regarding NRMM are in force:

- Directive 97/68/EC
- Directive 2002/88/EC
- Directive 2004/26/EC
- Directive 2006/105/EC

The main purpose of the NRMM-directive is to define the maximum exhaust emission respectively the definition of limit values for different non-road mobile machineries. The amount of the values depends on the kind of engine used in the respective vehicle. The definition of NRMM includes all vehicles for passenger transport or transport of goods with an internal combustion engine. Road vehicles are not scope of the directive. Beside separation into vehicle classes there is a development of exhaust emission values. This means that the maximum values are lowered by time in order to force the manufacturers to advance their engine technologies. One of the reasons for the directive is to define standards in order to keep the non-road modes of transport eco-friendly. The directive also defines the test methodologies. In case of railway vehicles a NRSC-the test cycle has to be applied. The limit values presented in the table below apply to new railway vehicles (DMUs or locomotives), but also to new engines replacing older engines in existing vehicles.

Vehicle category	Stage	CO	HC	NOx	Particles
Railcars / DMUs	IIIa (2006)	3,5	4,0		0,20
Railcars / DMUs	IIIb (2012)	3,5	0,19	2,0	0,025
Locos (130 kW < P < 560 kW)	IIIa (2007)	3,5	4,0		0,2
Locos (560 kW < P < 2.000 kW)	IIIa (2009)	3,5	0,5	6,0	0,2
Locos (P > 2.000 kW)	IIIa (2009)	3,5	0,4	7,4	0,2
Locos (P > 130 kW)	IIIb (2012)	3,5	4,0		0,025

Table 1 Emission levels for rail vehicles as defined in the NRMM-directive³

³ Source: directive 2004/26/EC; p. 15 et sqq.

3.2.2. TSI Noise (2006/66/EC)

The so-called TSI Noise (Technical Specification for interoperability relating to the subsystem ‘rolling stock – noise’ of the trans-European conventional rail system) came into force in June 2006. All TSI are in accordance with the directive 2001/17/EC [resp. revised version 2008/57/EC] which is the basis for the TSI-development. The TSI Noise regulates noise-emission limits for rail vehicles on the trans-European conventional rail network. Also the relevant test procedures are defined within the TSI. Usually networks for regional rail services are not part of the trans-European conventional rail network. But article 1 paragraph 4 of the directive 2008/57/EC announces that the scope of the TSI may be extended in the future. Thus also networks for regional rail service could be scope of TSI Noise eventually which is already the case in some member states.

With regards to the content the TSI Noise sets noise emission limits for rail vehicles for freight transport and passenger transport. Concerning passenger transport, locomotives, multiple units and coaches are mentioned. In the field of passenger vehicles the noise emission values apply only to new vehicles. In case of refurbishment the TSI just requires that the noise emission after modernisation is not higher than before. It is not required to modernise existing vehicles in order to fulfil the values for new rolling stock.

Type of value [dB (A)]	DMU	EMU	Diesel loco	Electric loco
Pass-by noise (80 km/h)	82	81	85	85
Starting noise	83/85 </> 500kW	82	86/89 </> 2.000kW	82/85 </> 4.500kW
Stationary noise	73	68	75	75

Table 2 Noise emission limits for rail vehicles for passenger services⁴

The pass-by noise has to be measured at 80 km/h and at maximum speed and then re-calculated to 80 km/h. Both values must fulfil the required limits given in the chart above. In the case of noise it is essential that the requirements in terms of measuring, definition of noise values and track conditions are respected. Noise values which are measured according to previous national regulations may deviate significantly from values measured according to TSI Noise standards.

3.2.3. Jurisdiction for interpretation of Common Law

Especially the European Court of Justice (ECJ) emphasised the permissibility of environmental assessment criteria in awarding, as long as they are non-discriminatory and they are associated with the subject of the contract (see ECJ on the legal matter C-513/99 - *Concordia Bus* and ECJ on the legal matter C-448/01 – *Wienstrom*). The jurisdiction of EJC leads to the guidelines of the European procurement directives⁴ as described above.

3.2.4. Summary – European legal framework

The Community is able to realise the aims of the EC Treaty in a legislative way through having an instrument for operations in the political fields of transport and environment. The range of the legislation is the result of the negotiations between all involved parties. General assignments of task and competence as “commission = guardian of the contracts and the development of integration” and “member state = guardian over the subsidiarity” are only

⁴ Source: TSI Noise (2006/66/EC); table 3 et sqq.

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qualified arrangements for highlighting the area of conflict regarding the interests, not for describing the effects of legislation processes. In the range of awarding services through the public authorities the legislative enactment of the EC Treaty describes “how” to get the award rather than the “what”. Although it is possible for the Community to ban or to regulate certain products, methods etc., the awarding authority on site can make its own decision within these parameters. Thus, as long as vehicles with certain emissions or specific technologies are not prohibited, the awarding authority is able and allowed to provide services using vehicles that incorporate these technologies. Furthermore the Community is not restricted to implement incentives for TOCs within the common law.

4. Contracting and awarding processes with EE/ENV issues

4.1. Application to different types of awarding procedures

A PTA which wants to award services or the procurement of rolling stock can choose between four basic types of award procedures:

- (1) Competitive tendering;
- (2) Competitive tendering including a negotiation phase after the pre-qualification of bidders;
- (3) In-house provision by a TOC which is owned by the regional administration or government itself;
- (4) Direct awarding to another operator, usually the national or "incumbent" railway company⁵.

All these award procedures are allowed by EU law, although restrictions apply in certain cases. Additional restrictions may apply within national legal frameworks.

The application of EE/ENV criteria is feasible in all these procedures. With regard to EE/ENV criteria no special preference shall be given to one of these procedures and PTAs may decide about procedure types in line with other strategic considerations.

However, some pros and cons for the procedure types can be given in terms of the application of EE/ENV criteria:

	Competitive tendering (1) & (2)	Direct awarding (3) & (4)
Pro	<ul style="list-style-type: none"> • Functional approach • Open for ideas of bidders • Problems with one criterion may be outweighed by good result with other criterion. 	<ul style="list-style-type: none"> • Results may better fit to specific situation. • Flexibility, to certain extent even after signing the contract • Innovations with mid- or long-term implementation time are feasible.
Contra	<ul style="list-style-type: none"> • Certain inflexibility • Results difficult to forecast • Restricted timeframe 	<ul style="list-style-type: none"> • Result depends on bargaining power of PTA. • External (better) ideas may be ignored.

Table 4-1: Pros and Cons of types of awarding

In case of competitive tenders all criteria for the evaluation and award decision have to be described in the awarding documents. Also the procedures for verification, monitoring and the application of incentive schemes must be announced in advance. In all types of awarding, the service or procurement contract must fix the agreed standards and comprise

⁵ Direct awarding to an external manufacturer in case of procuring vehicles is not compliant to EU law.

clauses which define procedures for verification, monitoring and (if relevant) the application of penalties and bonus/malus schemes.

The main phases of awarding projects and the basic considerations about the selection and inclusion are independent from the type of awarding. Differences in the definition of criteria which are due to the type of awarding will be given in the technical parts of chapter 5.

4.2. Reference model of awarding

There are different “cultures” of awarding in the participating countries. For example the time the bidders have to respond to an invitation to tender (ITT) varies between three months and 1.5 years. Although these different procedures may have their own unique benefits, it is possible to successfully include environmental criteria within all approaches and time frames applied, provided that the ITT (or direct contract) is elaborated based on a sufficient analysis of options and potentials.

These Guidelines therefore follow a reference model of approach agreed by the PTAs which participate in the ECORailS project. All award projects, being for services or for the procurement of rolling stock, can be structured into seven phases, according to the chart and the descriptions below. The following sub-chapters provide an overview for the use of EE/ENV criteria in the different awarding phases by way of diagrams and short descriptions. This model can easily be used by each procurement authority in Europe.

Although these Guidelines should encourage all PTAs to start directly with the inclusion of EE/ENV criteria into their actual awarding projects, it is advisable to consider strategic issues in order to achieve a successful mid- and long-term environment-related innovation process. This is indicated by the “roof” of the following chart.

<u>Main phases at PTA in a typical award project:</u>		<u>Main associated actions at PTA:</u>	
Competitive Awarding	Direct Awarding / In-house provision	Competitive Awarding	Direct Awarding / In-house provision
A. Preparation		A. Definition of the award project: decision on award procedure; identification of needs, options, targets and priorities; draft selection of criteria	
B. Elaboration		B. Elaboration of ITT / (direct) contract text, including selection and detailed definition of criteria; planning of phases D-G; publication of tender documents	
C. Response to tender	C. + D. + E. Negotiation	C. Mainly bidding operators to work; PTA to answer bidders' questions	C. + D. + E. Agreement on the contractual clauses and on the economical and technical details of the contract
D. Evaluation and awarding		D. Evaluation, decision and justification; communication of the result	
E. Negotiation (optional; legal restrictions)		E. Further negotiations and specifications	
F. Preparation of contract period		F. Verification of performance with selected operator; finalisation of the contract; preparing of monitoring	
G. Follow up during the contract period		G. Monitoring real performance; application of bonus/malus schemes	

Table 4-2: Reference model of awarding

It is obvious that in phase B (“Elaboration”) the necessities of phases D to G must be considered in advance and targets need to be defined. Only criteria should be selected which can clearly and legally sound be defined, evaluated and monitored. This is especially valid in case of competitive awarding. In case of direct awarding and in-house provision phases C to G can be merged as the formalised tendering process is replaced by direct contact and negotiations between the PTA and the train operating company (TOC) or the supplier of rolling stock (manufacturer).

In the following table it is shown which major actions should be considered by the PTA in terms of energy efficiency and further environmental criteria during the seven phases of an awarding project.

	<u>Main awarding phases:</u>	<u>Main associated actions at PTAs:</u>	<u>Actions at PTA concerning energy efficiency and further environmental criteria</u>
A	Preparation	Definition of the award project: decision on award procedure; identification of needs, options, targets and priorities; draft selection of criteria	<ul style="list-style-type: none"> • Analysis of the actual situation (environmental performance, “baseline”) • Identification of main environmental problems • Identification of mandatory and non-mandatory target levels for energy consumption, noise and pollutants • Market analysis (technological potentials, economic and legal restraints, potential bidders) • Draft definition of targets in terms of energy efficiency, noise and pollutants • Draft prioritisation and weighting • Decisions concerning new, refurbished or existing rolling stock
B	Elaboration	Elaboration of ITT / (direct) contract text, including selection and detailed definition of criteria; planning of phases D-G; publication of tender documents	<ul style="list-style-type: none"> • Analysis whether and how the criteria can be evaluated, validated and monitored • Clear definition of EE/ENV criteria (requirements, target values, performance specifications, penalties, incentives...) • Selection of relevant technologies/requirements • Requirements regarding LCC&CBA; elaboration of a form to permit the easy comparison of offers • Definition of priorities and weighting against other criteria • Definition of how to monitor the compliance • Draw up of contract including the conditions for monitoring, verification and fulfilment of the EE/ENV criteria
C	Response to tender / quote request	Mainly bidding operators to work; PTA to answer bidders' questions	<ul style="list-style-type: none"> • Response to bidders' questions for clarifications; forwarding the information to the other bidders. • Receipt of offers

D	Evaluation and awarding	Evaluation, decision and justification; communication of the result	<ul style="list-style-type: none"> • Evaluation of offers in terms of EE/ENV criteria • Assessment whether the selected offer is realistic and reliable in terms of energetic and environmental performance
E	Negotiations	Further negotiations and specifications	<ul style="list-style-type: none"> • Further negotiations and specifications
F	Preparation of contract period	Verification of performance with selected operator; finalisation of the contract; preparing of monitoring	<ul style="list-style-type: none"> • Verification of environmental performance (especially of vehicles) as far as it is possible and appropriate before starting the operation • Test runs for the verification of energy consumption • Definition of more detailed specifications if necessary • Detailed definition (if necessary) of incentive or bonus / penalty regimes according to the performance offered by the bidder
G	Follow up during the contract period	Monitoring real performance; application of bonus/malus schemes	<ul style="list-style-type: none"> • Monitoring of real-life energy consumption / environmental performance (application of bonus/penalty if necessary) • Verification and monitoring of operational measures • Verification measures as in phase F if further procurement or refurbishment is foreseen during the contract period • Verification and monitoring if environmental performance is affected by maintenance or vehicle quality • Identification and overcoming of obstacles for better environmental performance (in co-operation with the bidder when appropriate)

Table 4-3: EE/ENV related activities of the PTA within the phases of awarding

4.3. How to include EE/ENV criteria

In the technical sense there are mainly four ways of using criteria:

- (1) Requirements
- (2) Weighting and scoring
- (3) Penalties if a defined quality is not realised during the contract duration
- (4) Incentives (bonus/malus) for good performance or improvements during the contract duration

Requirements are criteria that the TOC or manufacturer needs to fulfill as minimum standards in order to be qualified for the contract. The fulfillment must be verified and monitored. Bidders who breach the minimum standards will face sanctions which need to be fixed in the service contract in advance.

In case of long contract durations, requirements that apply at a fixed time, later during the contract period, may also be defined.

Experience shows that the requirement of ecological standards, which exceed the current regulations is generally accepted by the bidders. Also the better assessment of those bids with ambitious environmental standards in the bid evaluation is commonly accepted, if the tender documents give a clear and calculable picture on the assessment criteria and reflect, to a reasonable extent, availability, reliability and costs of the respective technologies. It is, however, not realistic to *require* technological or energy efficiency standards in awarding procedures, which are not yet certain to be available on the market at reasonable prices and reliability. This could lead to the withdrawal of a tender and thus to considerable political, economical or legal problems. Therefore, the PTA has to differentiate between the minimum standards and advanced ecological standards.

Weighting and scoring: Offers may be evaluated according to several categories and sub-categories. Tender responses with advanced ecological standards, compared to the mandatory requirements, may receive a high scoring in the category "EE/ENV". If the categories are weighted e.g. 70 % (lowest price/compensation), 15 % (EE/ENV) and 15 % (other quality features), good results in terms of EE/ENV may lead to the best overall scoring, even if the bidder does not offer the lowest price.⁶

The offered ecological standards have to be monitored as well. The preferred options, to which additional scores will be given, and the weighting system must be announced in advance.

There are mainly two types of criteria to be considered for a weighting or scoring scheme:

- (1) Features which are either offered or not.
- (2) Improved performance values; in this case the bidder may get the more scores the better the offered performance values are. The evaluation could be done with mathematical functions or the definition of quality classes which represent certain ranges of values.

⁶ The scoring in the category "Lowest price" should be proportionate in order to limit the additional expenses for the PTA.

The weight of such quality criteria should depend on the PTA's priorities, availability on the market, and inherent incentives for the bidder. Technical details should be given by the bidder in the offer in order to allow the "anomalous offer check" before the tender is awarded. The standards which the PTA and the successful bidder have agreed upon must be monitored, and the bidder will face sanctions if the offered standards are not met.

Incentives and/or penalties are rather commonly used today in service contracts and usually include criteria like punctuality, growth in number of passengers etc. The argument for including incentives or penalties is to promote (or prevent) a certain behaviour. A penalty is applied if a bidder does not keep to an agreed standard during the contract period. A bonus/malus scheme is applied as an incentive for the TOC in order to improve the actual performance during the contract period and usually refers to an agreed level of performance.

Incentives for good performance or improvements during the contract duration can be used if the TOC has different options to improve e.g. the energetic performance. The conditions for the incentive scheme (or an integrated bonus/malus scheme) need to be announced or agreed upon in advance.

Penalties and bonus/malus levels need to be proportionate. The typical evaluation period would be one year (timetable period). Penalty and bonus/malus levels may vary during the contract period if defined so in advance. The actual performance may be negatively affected by conditions which are out of the scope of the PTA and the TOC, e.g. bad infrastructure conditions, disturbance in operation caused by the infrastructure manager (IM) or force majeure. The risk of such influences should be shared by the PTA and the TOC in an appropriate way.

An incentive scheme may also be used to encourage investments by the TOC during the contract period like e.g. procurement of new vehicles or refurbishment of the existing fleet.

The four ways of using EE/ENV criteria mentioned above should be considered for each single criterion. A combination of these tools is also possibly (e.g. requirements for minimum standard and weighting for additional measures).

It is recommended to screen which standards and technologies are available at the time of starting the awarding project. In general use a combination of binding requirements and incentives. The criteria and targets to be included need to be simple to verify, monitor and report. There should be room for own suggestions of the bidders regarding how to get better environmental performances. However, these suggestions have to be transparent and traceable for the PTA. In case of technologies the recommended approach is to specify the technology functionally (e.g. efficiency of energy storage or necessary functions of parked train control systems) and not proprietary solutions or products. The latter could even cause major legal problems while the functional approach is viable in almost all cases.

4.3.1. Phase A – Preparation

Phase A is the definition phase of a specific award project. Lines or networks to be awarded will be defined. Service concept, quality standards and the duration of the contract must be preliminary decided. For the following steps or issues EE/ENV criteria should be considered (including draft decisions):

- Identification of lines or networks; definition of lots:

Rationale: Main aspects for the definition of lines, networks and lots should be the needs of passengers, existing contracts, existing rolling stock and the need for renewal, infrastructure situation, the existence and ability of interested TOC. Nevertheless, environmental aspects should be considered, e.g.:

(1) Energy efficiency: Do the defined lots allow for sufficiently homogeneous occupancies (without too much operational efforts by way e.g. of strengthening or shortening of trains); also relevant: homogeneous rolling stock, or homogeneous technology, or other economies of scale can force to different lots each with different EE/ENV standards

(2) Noise: If the invention of silent rolling stock is possible only partially or step-by-step – are the lots defined in a way that the new fleet can be concentrated on the lines which have the most serious noise problems;

(3) Pollutants: analogously to noise.

In any case a certain level of flexibility should be allowed for modification of services during the contract duration.

- Timetable and service concepts

Rationale: Also the timetable and service concepts should mainly respect the passengers' needs e.g. in terms of travel time and good direct or corresponding connections. However, spare time in the timetable should provide better options for punctuality and energy-efficient driving, and thus furthermore promote the use of public transport. 2 % spare time between stations is usually sufficient for eco-driving.

Beside defining EE/ENV criteria in awarding rail services or procuring rolling stock is the preparing of the timetable and service concept the most feasible way of fulfilling goals of energy saving. PTA should keep this in mind when they start with the awarding process.

- Identification of main environmental problems

Rationale: Although the focus should be on energy efficiency and CO₂ emissions, noise and pollutants (the latter in case of diesel operation) should not be neglected. If the region faces serious noise or air quality problems along the lines in question, the respective criteria should get a relatively high relevance in the awarding process.

- Analysis of energy prices, charging and supply system

Rationale: If the traction energy is not charged according to real consumption, it should be checked whether this regime can be changed for the contract which is being prepared. Additionally: are there options for the procurement of "green" energy?

- Analysis of the actual situation in terms of energy consumption and CO₂ emissions

Rationale: The analysis of the actual situation in terms of energy consumption is essential for the estimations of savings which can be achieved by operational measures or new rolling stock. If no sufficient data are available, a measurement campaign should be considered. Alternatively, estimations based on the current train configurations and traction technologies could be helpful.

- Draft definition of targets in terms of energy efficiency

Rationale: Based on the as-is analysis and additional analysis of available technologies and feasible operational measures, a first estimation of the saving potential during for the next contract period can be made. Thus a target can be defined and used as a preferred “good solution” or reference in tender or contract documents.

- Analysis of the actual situation in terms of pollutants; draft definition of targets for avoiding pollutants

Rationale: The emission standards of existing diesel engines or DMUs should be analysed. Depending on the air quality in the respective area it should be decided whether pollutant emissions should be addressed in the awarding project and which standard (e.g. Stage IIIb, Stage IIIa, or UIC II) should be required as minimum or rewarded. New engines for existing tractive units or particle filters may be an option.

- Analysis of the actual situation in terms of noise; draft definition of targets for avoiding noise

Rationale: It should be checked whether measured emission values of the existing rolling stock are available. If not, information of the norms which are fulfilled (e.g. TSI noise or national regulations) can be helpful. Be aware that values given in dB (A) cannot easily be compared if definitions and measurement conditions are not harmonised. The analyse can show whether existing noise problems can be solved by modernisation or procurement of new rolling stock or whether more ambitious noise limits than required by TSI Noise should be aimed at in the present awarding.

- Decisions concerning new, refurbished or existing rolling stock

Rationale: The fleet strategy should be concretised with respect to the current awarding project and the relevance of EE/ENV considerations. It should be decided whether e.g. new or refurbished material will be required or encouraged or whether it will be up to the bidders to decide which generation of rolling stock to offer.

- Vehicle concept and comfort for passengers

Rationale: Conceptual decisions about the vehicles and the comfort standards should be reviewed with respect to environmental effects. It is a prominent question whether the train configurations can easily be adapted to the actual demand. Articulated MUs, double-deck trains and MUs in general have advantages compared to conventional MUs, single-deck trains or loco-hauled trains, but these advantages may be outweighed by specific conditions, sub-optimal design or the higher flexibility of loco-hauled trains. In case of awarding services, the PTA may require a specific fleet concept (e.g. multiple units instead of loco-hauled trains) or leave the decision to the bidding TOC.

- Locations for parked trains and maintenance facilities

Rationale: Noise and pollutants at stabling or maintenance facilities may cause disturbance to the neighbourhood. Timetable concept, infrastructure situation and the bidders' maintenance concepts should be reviewed with respect to this problem.

- Availability of loan programmes or specific public funds

Rationale: In some Member States special loan programmes are offered for environment-friendly or highly innovative investments. These may be used by PTAs or the TOCs in certain situations. Using such loan programmes in combination with competitive tendering is feasible if loans are offered to all potential bidders. Also EU funds may be available in specific cases.

Phase A comprises merely concept decisions while phase B is dedicated to the elaboration of the actual tender or contract texts.

5. Application of EE/ENV criteria and specifications

5.1 Lifecycle cost and cost benefit analysis

In order to compare the trade-off between investment and operational as well as maintenance costs of different technologies and to find the best solution for a specific use case, all costs that occur during the lifecycle or at least the duration of the respective contract should be considered when selecting technologies or operational measures.

For these calculations two related methodologies with different focus exist. From the PTA's point of view LCC (GL chapter 5.3.1) and CBA (GL chapter 5.3.2) can be used for different purposes. LCC focuses on the costs during the entire lifecycle of a product, e.g. a vehicle. That's why LCC should be used preferably for the procurement of vehicles and for the assessment of components. A CBA on the other hand focuses on the monetary effects of a given use case from the point of view of a specific involved party, e.g. the PTA, during a given period, e.g. the duration of the contract. So it is primarily used for the evaluation of offers for service contracts, but it is also applicable for the procurement of vehicles and the assessment of components to estimate the effects from a specific point of view.

In general lifecycle cost analysis is the calculation of all possible costs of a product during its lifecycle. An LCC analysis increases the cost transparency of a product in comparison to a pure consideration of the purchasing price. Especially for products with a high amount of operational costs, it seems to be essential to include the LCC. A long economic lifetime of a product is an additional argument.

Usually an LCC analysis makes no statement for other values of a single decision, for instance a better ecological performance of a product (e.g. noise and pollutant emissions). But a consideration of LCC can complement other arguments.

Thus LCC can also be the basis for 'non-economical' decisions as the ECORailS-project intends.

Rolling stock and / or rail services procurement shall make allowances for energy savings, emissions and the sum of costs throughout the service life. The purchasing price criterion, often currently made use of, is incomplete and usually misleading for rolling stock with a lifecycle of 25 – 40 years or even longer. Therefore, LCC analyses are an important instrument to improve procurement procedures to the point of a LCC-driven procurement. The major importance of applying this criterion consists in reducing costs, energy consumptions and emissions through a better selection of the product / services to be procured, as well as through their optimisation throughout their operational lifetime.

Due to the long lifetime of rolling stock one-off costs (purchasing price) are partially marginalised by other costs. Increasing operational costs accelerate this effect. As the energy costs for rail services are assumed to rise year on year, their share of the LCC of a rail vehicle will increase. If the PTA is procuring rolling stock itself, a LCC analysis should be obligatory and therefore the relevant calculations and cost elements have to be demanded

from the participating suppliers. For rail services it is not the most suitable instrument. CBA is here more feasible. Nevertheless LCCs are an essential parameter for bidders of rail services.

LCC analyses can be applied for the procurement of rolling stock and - with reservations - for the awarding of rail services as well:

- Procurement of rolling stock by PTA / TOC
- PSC with guaranteed re-use of rolling stock
- PSC without guaranteed re-use, but providing the TOC with essential information regarding operation (e.g. service profile)
- Economic assessment of components.

5.1.1. Methodology

Procurement of rolling stock

The standard case of using LCC methods in the rail sector is the procurement of rolling stock. For analysing the LCC of rolling stock any costs for the vehicles are added up. The total sum of all accrued costs for a specific product is the relevant parameter for comparison purposes with other products. Some of the costs require a look into the future. Thus estimations for their development have to be made.

At the end the net present value (NPV) for the product must be generated. This means that all costs, also the ones in the future, are discounted on the cash value. Only this enables the decision maker to compare different products in relation to their LCC. Therefore these estimates of future cost development (e.g. interest rates) should be included in the tender documents as basis for the calculations of the bidders.

Referring to the performance goals of the ECORails-project (reducing energy consumption or other emission reducing goals) the LCC analysis for different vehicles with the same benefit could be compared.

Mainly the following cost categories form the basis for a LCC analysis:

- Investment costs (one-off costs, purchasing price of the vehicle)
- Capital costs (costs for financing the investment by debt capital, e.g. investment rate)
- Operational costs
- energy costs (for driving and comfort functions)
- costs for additional staff if necessary

Maintenance costs:

- costs for planned and unplanned maintenance (revision, wear and tear etc.)
- refit costs (if applicable)
- Recycling and disposal costs

To sum up the PTA needs a lot of information which is partially present at the PTA's side and partially need to be asked from external experts (see Annex 3 for a list of necessary data). With the help of the requested information the PTA can calculate the LCC on its own.

PSC with guarantee of re-use

If the PTA does not procure the rolling stock, it gains no insight into the LCC. These information are industrial secrets from the TOCs point of view. Thus legal obstacles are most likely. But knowing the LCC from the rolling stock would be essential in case of a guarantee of re-use. In this case the rolling stock has to be calculated with its fair value after the first PSC. The guarantee of re-use is an option for PTAs to guarantee a TOC to use its vehicles in following PSCs, even if the TOC doesn't win these PSCs. Thus financing risks for TOC are lowered significantly.

Contrariwise the TOC needs information and data of the prospective rail service from the PTA in order to calculate their LCC of the required rolling stock. This calculation is included in their bid price. Therefore the PTA has influence on this by providing the potential bidder with general information. Information regarding the specific conditions and the operation modalities (climatic conditions, track condition and characteristics, frequency and ridership of the trains etc.) help the bidders to check or to enhance the products / services they provide as well as their costs according to these conditions.

Even though the PTA has no insight in bidder's LCC calculation, the authority is free to do a sample accounting in order to get an expected value for the rail service. The procedure to do this is quite similar to the one when the PTA is procuring rolling stock itself, even if some of the data are more uncertain.

PSC without guarantee of re-use

If the PTA does not guarantee the TOC to re-use their rolling stock in the following PSC, the calculation basis for the TOC is quite different than with guarantee of re-use. In general, factoring is more complicated for the TOC. Moreover, there is even a risk to find not investor at all due to the missing guarantee of using the rolling stock later in its lifetime. Anyway, even if the PTA refuses a re-use guarantee, the authority has to provide information regarding the service profile in order to augment the calculation basis of the TOC as illustrated in the section before. The difficulty for the TOC is to calculate the costs for the period after the PSC. The capital costs would increase. Thus it is in the PTA's own interest to provide as much data as possible to the TOC. In general, the information basis provided by the PTA to potential bidders should be the same as if the PTA was procuring the rolling stock by itself.

Economic assessment of components

Independently of the ownership of rolling stock, the PTA may try to evaluate the costs for certain components with a consistent benefit. For instance a reduction of energy consumption is possible by many ways. An LCC analysis could determine the incoming costs for the different technologies. This could be the basis for the decision regarding a technology/component. If the costs for components with different impacts are calculated, a cost benefit analysis is preferable. The analysis of LCC as assessment of components could be an economic criterion for the PTA when evaluating the technologies and measurements,

which were selected as relevant for 'ecological regional rail service' during the ECORailS-project (see chapter 5.4).

5.2. Cost benefit analysis (CBA)

In contrast to LCC, the **CBA focuses** on the monetary effects of a given technology or operational measure in comparison to other technologies/operational measures **from the point of view of a specific involved party**, e.g. the PTA, the infrastructure manager or the operator, **during a given period**, i.e. in most cases the duration of the contract.

The aim of a cost-benefit analysis is the identification of the additional costs and benefits of the analysed technologies and operational measures for the involved parties. Only monetary benefits should be considered in the cost-benefit analysis. These benefits are mostly reduced operation and maintenance costs as well as avoided investment costs (e.g. obsolete sound protection measures for residents, avoided depot extension for additional vehicles due to lower maintenance demand, etc.).

A CBA focuses on the monetary effects of a given use case from the point of view of the PTA during a given period (e.g. the duration of the contract). So it is primarily used for the evaluation of offers for service contracts by means of beforehand estimated costs for the specified service contract. A CBA is – to a lesser degree – also applicable for the procurement of vehicles and the assessment of components to estimate the effects from the point of view of the PTA.

Due to financial restraints regarding the public services the estimation of costs for inclusion of specific requirements with a CBA is an appropriate device to balance the necessary quantity with the desired quality. A PTA can with a CBA mainly carry out evaluations of offers for service contracts as well as comparisons of different scenarios with varying requirements. With a CBA it is also possible for PTAs to identify the most cost-efficient solution for the procurement of vehicles or the assessment of specific components (such as HVAC) as requirements for vehicle procurement or service contracts.

5.2.1 Methodology

The basic principle of a CBA is similar to a LCC-analysis. All relevant costs for the specified service are added up. Additionally the benefits have to be considered - usually subtracted from the costs. Also like a LCC-analysis some of the costs and benefits require estimations for their future development. At the end all costs and benefits are discounted on the cash value to generate the net present value (NPV).

The following cost categories form the basis for a CBA:

- Investment costs (one-off costs, purchasing price of the vehicle)
- Capital costs (costs for financing the investment by debt capital, e.g. investment rate)
- Operational costs
- Energy costs (for driving and comfort functions)
- Costs for additional staff if necessary

Maintenance costs:

- Costs for planned and unplanned maintenance (revision, wear and tear etc.)
- Refit costs (if applicable)

But there are also benefits to consider:

- Ticket revenues
- Secondary revenues (e.g. advertising, maintenance and repair offers)

5.3 Summary (LCC and CBA)

As optimising costs, energy consumptions and emissions throughout the service life respective the complete lifetime of the rolling stock is of crucial importance to the development of a sustainable transport, it is compulsory not only to have it introduced into the award documentation and procedures, but also in the permanent basic activities of the PTAs and TOCs. A permanent update of LCC analyses and CBA could enhance these objectives. It could be realised by:

- elaboration of strategies and policies for the development of a sustainable transport; and
- continuous organisation and enhancement of the rolling stock operation and maintenance activities and of the passenger transports based on the permanent analysis of the costs, energy consumptions and emissions with a view to optimising them.

Both LCC and CBA have their own advantages and disadvantages. LCC is preferable for comparison of rolling stock with a given benefit (performance), usually used when procuring vehicles. In contrast, CBA seems to be more adequate in order to analyse offers for rail services.

5.3.1 Norms

Methods and forms for LCC calculation requirements can be based on the specifications of CEI / EN 60300-3-3 /2005 (Application guide LCC evaluation). Further norms with relevance for LCC analyses are:

- IEC60050-191. International Electrotechnical Vocabulary. Chapter 191: Dependability and quality of service;
- IEC62198. Project risk management – Application guidelines;
- EN61703. Mathematical expressions for reliability, maintainability and maintenance support terms;

5.3.2 Overview of cost categories and list of necessary data

- Investment costs: These costs cover the purchasing price of the vehicle. Usually these costs are one-off costs. In case of different requirements for configuration and performance of the vehicle the purchasing prices can differ, of course. But - as the LCC approach intends - a comparison of purchasing prices for different requirements or solutions would lead to false decision.
- Capital costs: Costs which occur in case of financing the investment by debt capital (e.g. investment rate). In case of financing by equity an interest rate has to be supposed. In order to bear the investment costs the customer has to handle their factoring. In principle this is a must for all customers, but public ones like PTA usually do not have financial difficulties. However, if the public decision maker decides pro public procurement but against public factoring, also the PTA has to manage it otherwise (e.g. by private capital). As investment costs also capital costs are usually known by the customer for the life cycle of the vehicle.
- Operational costs: Besides investment costs, operational costs have the largest impact on the LCC of a vehicle. Operational costs are mainly energy costs (for driving and comfort functions). If a vehicle implies additional staff, these costs should also be considered. Due to increasing energy prices - independent from kind of traction (diesel, electric) - the share of energy costs as part of the LCC increases year by year. The PTA can try to forecast this development by calculating the average development during the last years. Attention has to be paid if one-time factors happened. This could impact the forecast significantly. Not only the energy costs, but also the service profile of the vehicle should be estimated as well as possible. If the mileage of the vehicle changes during its economic lifetime, the operational costs are changing as well. Oftentimes the operational costs (as well as costs for maintenance) are calculated on basis of the manufacturer's data. It must be pointed out that these data are often not in accordance with practical data. Manufacturer tend to be reserved concerning maintenance costs (respectively maintenance rates), but optimistic in case of information regarding energy consumption.
- Maintenance costs: Costs for planned and unplanned maintenance (revision, wear and tear etc.). Also refit costs can occur. In general, the higher the risk of malfunction the higher the costs for maintenance. 'Planned maintenance' is mainly the effort for revision as a minor part of the overall maintenance costs. The major parts are mileage-related or maintenance costs depending on the real operation of the vehicle. Wear and tear of components, periods for replacement of components (e.g. brake blocks, wheels) or additional costs, for instance caused by malicious damage, are mostly the reasons for those costs. The service profile (km per year, track characteristics) has a high influence on those costs. A large part of the important vehicle manufacturers also provide maintenance services. For this reason it can be required that data referring to the costs of the maintenance services should be provided by the manufacturer. If outsourcing of maintenance is an option, this could be an opportunity to optimise costs by cumulating service and vehicle procurement. Most likely this would be a package price. Thus the PTA gets no detailed information regarding the real maintenance costs for the rolling stock. To avoid this, the PTA should ask for separate declarations of the cost elements for vehicle procurement and maintenance services in the bidding documents.
- Recycling and disposal costs: Finally the vehicle and its components have to be disposed or recycled.

5.4 List of necessary data

The following information should be available at the PTA:

- Service profile of the next PSC (ideal case: service profiles for all PSCs during vehicle's operational lifetime)
- Distance profile of the network where the vehicle will be used
- Maintenance effort based on information concerning maintenance provided by manufacturer (see below)
- Measurement of energy consumption (to verify data from manufacturer). Depending on the kind of rolling stock assignment to the chosen TOC, the PTA could be able to get continuous information regarding energy consumption. Therefore the vehicles should be equipped with instruments to measure the energy consumption exactly.

At the manufacturer the PTA should ask for:

- Energy consumption (in detailed form as intended in chapter 5.2.2)
- Revision cycles and other service intervals; overhaul
- Periodic replacement of components; wear parts

Depending on the respective conditions of the PTA, additional information could be useful.