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## ECORails

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



# **Deliverable 17: Validation report including tests and recommendations**

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**Title:**

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

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## Summary

The present deliverable is structured to provide a full description of results achieved within ECORailS based on the Final Version of the Guidelines. Work Package 5 aims at analysing and validating project works and to prove that the project objectives have been fulfilled. The WP has an input-output oriented approach by gathering all relevant information that may lead directly or indirectly to the proof of fulfilment of the project results and providing recommendations after the validation. In addition to the compulsory ECORailS defined objectives, due to the project special aims and structure, WP5 also takes into consideration the needs of the users which represent real life requirements.

The Deliverable is structured in a linear manner and aims to present the works undertaken in the project by analysing the final Version of the Guidelines alongside the improvements made in the Final version compared to the Test Version of the Guidelines.

The method used to gather feedback from the users was the WP5 questionnaire which aimed to gather users' points of view regarding the performance of the test version of the Guidelines as it resulted from the tests and disseminations. The analysis is useful because it shown the involvement of the users in the project and heir commitment to help the project by providing their opinion which ultimately lead to the improvement of the final version of the Guidelines.

Chapter three represents the main part of the deliverable which presents the improvements the Guidelines were subjected to in their Final Version taking in to consideration the recommendations and comments made by the users, and project partners within D16 and D14. Overall the aim is to asses the overall performance of the final version of the Guidelines in relation to the project objectives.

## 1. Introduction

This document presents the status of the ECORailS project's results. On the basis of the validation, WP5 will provide an outline of recommendations for the implementation of the Guidelines and suggestions for its further use.

The validation process covers the period of the Guidelines progress after the tests' end and until the release of the final version of the Guidelines. Following the validation process, WP5 aims at providing a set of conclusions and recommendations in order to put into application a high performance Guidelines, useful as a decision support for the decision makers in PTAs, TOCs, IMs – for an energetically and ecological efficient awarding process for rolling stock and regional railway transport services.

The current aim of this deliverable is to highlight the status of the final Version of the Guidelines in relation with the project's objectives. The main sources which used in this deliverable to determine the improvements done to the final version of the Guidelines and its status are:

- D16 – Results analysis report which refers to the test Version of the Guidelines, the Questionnaires filled in by the users which refer to the test Version of the Guidelines and
- D14 – Report on Pilot Applications which also refers to the Test Version of the Guidelines.

The approach of this deliverable is to present the Guidelines as it was perceived by the user, by the test participants and by the WP5 partners and highlight the improvements done until the release of the Final Version of the Guidelines. The goal of this deliverable is to highlight how the recommendations made in the above sources were incorporated and assess the status of the Guidelines in relation to the project's objectives as well as to recommend future uses of the Guidelines.

### **The basic documents on which the analysis report is built:**

Annex 1 to Contract IEE/08/690/SI2.528422 – Description of the Action

D14 - Report on Pilot Applications

D15 - Validation Strategy

D16 - Results analysis report

Questionnaires from users

### **The role of WP5 (“Evaluation and Validation”) in the project**

WP5 participates in the project activities of WP2, WP3, WP4 and WP6 by collecting information from these WPs to make the necessary proposals from the validation perspective, as well as to create the data basis and the know-how underlying the validation strategy elaboration.

Based on qualitative criteria for assessing the Guidelines performance (enhancement of environmental awarding, integration into the awarding process), the indicators and the set of criteria have to be applied according to the implementation of the Guidelines in other European regions alongside suggestions on the further development of the Guidelines including future promotion strategies.

### **Internal Work Cycle of the document (elaboration – partner feedback - completion)**

With a view to pursuing the accomplishment of project objectives and of internal correlation, all the proposals and deliverables from the other WPs are analysed from the perspective of WP5.

There has been, and still exists a continuous and efficient dialogue between WP5 and the other WPs so that all materials are elaborated according to the general and specific project objectives (the three levels). Based on the results and conclusions obtained during the tests from WP4 – in the 4 locations, WP5 elaborated a synthesis of recommendations for the further use of the Guidelines, which is the object of the present deliverable.

## 2. Questionnaire results

During the projects development, constant interaction with the users and stakeholders took place in order to gather their opinion and needs regarding the project's goals, methodology and issues still needed to be approached in the project in order for the Guidelines to be fully usable as a tool for the inclusion of energy efficiency and environmental criteria in the awarding of rail vehicles and services. While the users were involved in various stages and tiers of the project, most of the interactions were made

The peak of Project-user interactions were achieved during the User Platforms and during the Site Working Group and Site Stakeholder Group Meetings. Within these meetings the users were asked to fill-in questionnaires, which, in some cases took the form of interviews in which case the users commented on each question and gave their overall impression concerning the topics of the questionnaires. Users from each test region were asked to fill in questionnaires to have a clear picture of the users' opinion concerning the Test Version of the Guidelines. It is however noteworthy to mention that the questionnaires refer to the test version of the Guidelines. The final Version of the guidelines was improved taking onto consideration all user feedback and recommendation received including the ones received via the questionnaires which led to the development of an improved final version of the Guidelines responding to the users' needs and benefits.

The questionnaire was developed according to the structure of the project and specific needs to interact with users permanently. It was the responsibility of Work Package 5 to analyse user needs and include them in the validation process alongside the project objectives established in Annex I of the Grant Agreement.

The first concept of the questionnaire was elaborate in D15 – Validation Strategy and at the time included only the technical part of the questionnaire (scoring method and validation thresholds). The actual questions were elaborated and fine tuned during the course of the project in order to ensure the maximum effectiveness.

The questions were elaborated and structured in such a way that they cover the project performance indicators and create a broad picture in terms of the achievement of the objectives as seen by the users. For the validation of the answers, 75 % of the maximum score was used as a High Quality threshold which signifies that topics which scored above this threshold are considered by the users as very well approached in the project with excellent results achieved and improvements to these issues are not necessary. The 50 % threshold is designed to highlight that the issue over this threshold but under the 75 % threshold is seen as positive by the users but it still has potential for improvement. In general such issues are sufficient in terms of content but still need a better format or structure. Issues failing to achieve 50 % of the score would need to be seriously approached in order to be included in final version of the Guidelines.

The positive threshold (50 %) is represented by any score above the value "0".

The users from the four test areas were asked to answer to questions concerning the project's performance indicators. Due to the quantitative scoring scale developed within WP5 we were able to aggregate the answers provided by the users in each test site without the need for interpretation of local circumstances. This allows for an objective analysis of the answers and to draw an overall conclusion concerning the project's performance indicators. Our goal is to define the opinion of the users' regarding the overall project performance not only on a regional level.

It is noteworthy however that the questionnaires reflect the users' opinions only regarding the test version of the guidelines, the final version incorporates improvements in all the areas marked by the users as improvable.

According to the project objectives we have grouped the questions in to three categories (quantitative performance indicators, manageability of the Guidelines and dissemination) which will be analysed distinctively.

### **Quantitative performance indicators**

The questions concerning the quantitative performance indicators were designed to obtain information concerning the perception of the users regarding the quantitative targets of the project.

The questions addressed all project performance indicators which include the comparison with the current awarding, current rolling stock and a system wide projection for 2020. Due to the importance of the quantitative performance indicators, the questionnaire aimed to directly assess the users' perception regarding the quantitative targets reached during the tests based on the test version of the Guidelines. In this aspect, we have received a number of 14 answers to question 1 and question 2 and 15 answers to questions 3-6.

The aggregated answers for these questions have all passed the positive threshold which signifies that users have a good perception concerning the achievement of the quantitative performance indicators. Solid positive answers were given to question 1-4 (concerning with the comparison with currently used rolling stock and current awarding) which signifies, from a user point of view that the project has achieved its targets. The projections for 2020 have also received positive score but less than the previous questions mainly due to the fact that the overall system wide evolution in terms of energy efficiency is highly dependent of other factors that are out of the scope of the ECORailS project, factors such as technological restrictions, shifts in transport market share, shifts in transport volume also.

The graph below shows the distribution of scores received by each question referring to quantitative performance indicators corroborated with the results obtained in the test sites.

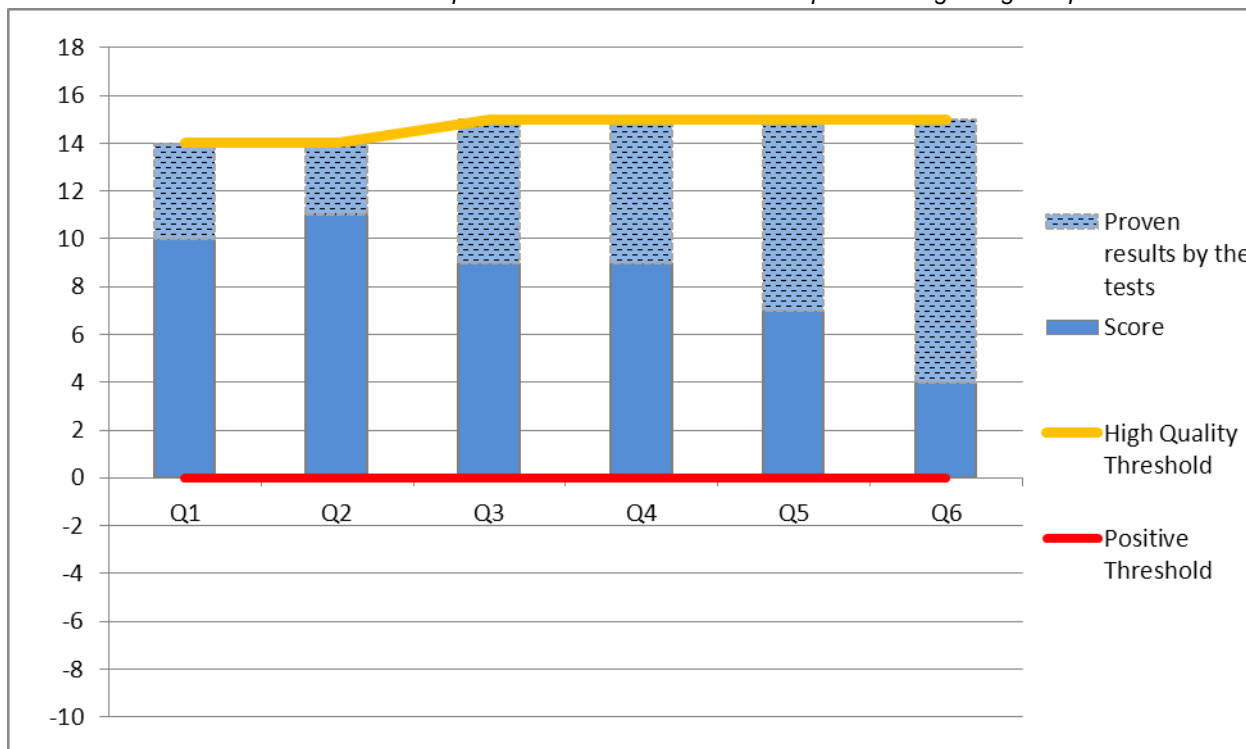
The graph indicates the overall performance achieved by the issues which the questions approached. The tests clearly show the results achieved via calculations and estimations and therefore represent a reliable basis for the validation of results.

It is noteworthy that that all questions passed the positive threshold, which signifies that the users were content with the results achieved by the project but there is still potential to improve.

All the necessary changes were done in the final version of the Guidelines which insures and a good representation of the quantitative performance indicators.



Graph 1 Distribution of scores of the questions regarding the quantitative indicators



### Manageability

Unlike the quantitative performance indicators, the Guidelines' manageability can only be assessed via qualitative indicators. In essence the users expressed their opinion by answering the respective questions trying to match the impression the Guidelines gave them when reading them or using during the Pilot Applications with their experience and knowledge, being experts / decision makers / opinion leaders in the field of regional passenger rail.

In terms of manageability, the questions addressed issues regarding the flexibility of the guidelines, the efficiency of introducing energy efficiency and environmental criteria in the awarding of rail vehicles and services, acceptability and EU wide applicability.

All aggregate answers received for each question have passed the positive threshold which signifies that the users perceive the guidelines as being manageable. This is highly relevant for the final validation of the Guidelines due to the fact that the users see the test version of the Guidelines as manageable signifies that the Final version of the Guidelines has to be improved only in terms of form and structure rather than in terms of content.

All questions related to manageability have passed the positive threshold which shows that the users left positive feedback regarding the Guidelines and that the final version of the Guidelines can be improved in order to reach its full potential.

The questionnaire indicates a high interest of the users for an EU wide applicable set of Guidelines and the respective question received a very high score. The potential of the Guidelines received a high score which signifies that the Guidelines have convinced that they have the potential to become a useful instrument useable on EU level.

Slightly smaller scores were obtained by questions concerning the acceptability of the Guidelines. The result is still positive but the score is lower than the other manageability categories included in the questionnaire. This can be explained by the fact that the Guidelines have some degree of novelty and in spite of the fact that tests in the four areas were performed; there is still reluctance to use a new product especially one that addresses a major issue in the field of awarding of rail vehicles and services.

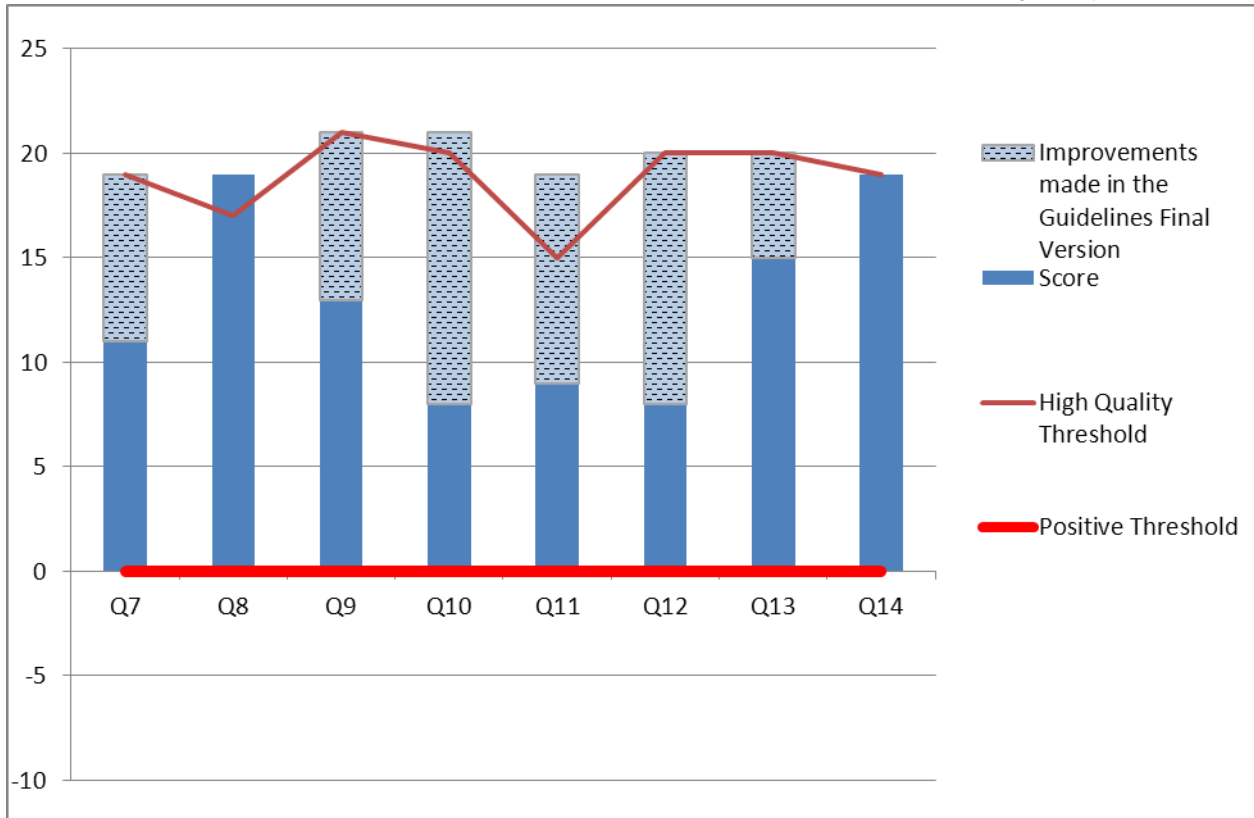
In terms of flexibility of the Guidelines there is good indication that the users regard the Guidelines as being flexible. The score obtained by the specific question was positive and high compared to other manageability related questions which stands for a good indicator of the performance of the Guidelines regarding this issue.

The efficiency of the Guidelines to support the elaboration of an awarding procedure received mixed answers. The questions which aimed to determine whether the Guidelines are efficient in the introduction of energy efficiency and environmental criteria in the awarding of rail vehicles scored very high and above the high quality threshold. This signifies that the Guidelines fully cover the before mentioned manageability issue. In terms of awarding of services however, the score is positive but lower which signifies that improvements are necessary to cover topics just as good as in the case of vehicle awarding. The other two questions received average positive scores which led to improvements in the final version of the Guidelines to cover better aspects concerning the scoring method and awarding documentation.

It is noteworthy to mention that the questions regarding manageability have a greater variability in the number of answers compared to questions concerning dissemination and quantitative indicators. The range of answers ranged from as low as 15 answers to as high as 21 answers.

The graph below shows the distribution of scores received by questions referring to the manageability of the Guidelines corroborated with the improvements made in the Final Version. The graph indicates the overall performance achieved by the issues approached via the questionnaire. The improvements were made in the final version based on the users' opinions, feedback and also comments made by the project partners.

Graph 2 Distribution of scores of the questions related to the manageability of the Guidelines



**Dissemination**

Dissemination is an important element and main objective of the ECORailS project. It is for that reason that two dissemination related questions were included in the questionnaire. It is noteworthy to mention that even though the users were involved as much as possible in the project works, they would still interact with the project via the project partners, fact which involved quality dissemination. In essence, all scores obtained by questions concerning quantitative performance indicators and manageability also contain an unquantifiable contribution from dissemination activities. The questions concerned the dissemination of information through the website and through the Users platform. Both questions received positive high scores which signifies the users were content with the level of involvement if the project and viewed the information as clear and useful. The high scores obtained by the dissemination activities signify that important issues concerning the project were excellently covered.

### 3. Results Presentation

#### 3.1 First Level performance indicators

##### 3.1.1 Energy efficiency and CO<sub>2</sub> emissions quantitative indicators

###### Øresund

The Øresund test is performed as a simulated tendering process covering phase A *Preparation* phase B *Elaboration*, according to the guideline's definition of a tendering process. The goal of the test has been to determine, whether the guideline can be used in connection with the overall tendering process used in Trafikstyrelsen, Denmark. More specifically, the tendering documents used for last tendering process in connection with the cross border traffic across the Øresund have been used for the test. It has also been tested whether the energy efficiency and CO<sub>2</sub>-reduction targets set out in the ECORailS project could be met when using the guideline.

The Guidelines has been tested when selecting the types of technology to be used, as well as to determine how to implement the use of the desired technology. The choice of technologies merely serves to determine the feasibility of these technologies in the Øresund rail services, and on the basis hereof to evaluate the energy saving potential in the current rail services.

The base line and the energy consumption for the Øresund traffic on the Danish side is presented in a calculation report. The purpose of the report is to identify realistic saving measures and calculate the overall energy saving and CO<sub>2</sub> reduction potentials that could result from such measures. This result is then used for predicting to which extent the ECORailS guideline could possibly support Trafikstyrelsen in setting energy or environmental requirements in future invitation to tenders for regional rail traffic and how to evaluate such tenders. This last part is more an indirect indication of the impacts from setting environmental requirements and having a joint European guideline.

The "out of service" load profile for ER and ET has been determined in corporation with the maintenance engineers at DSBFirst Helgoland. The values represent conservative estimates for the saving potentials which mean that savings could be higher in reality. The very high parked train hours for ER are due to the fact that these train sets mainly serve as rush hour traffic capacity. In agreement with the maintenance engineers at DSBFirst Helgoland, two scenarios for parking have been developed: Low and High. At the moment the High scenario is closer to reality than the Low.

The energy saving measures for both train types can be divided into technical measures (upgrading the hardware e.g. components) and operational measures like eco-driving, parked train management and intelligent on-board energy management through different procedures, settings or software changes. Due to the relatively short period for contracting (7 years) no technical modifications have been considered even though this should not be neglected. The following operational measures should be considered for the kind of service and rolling stock in question:

Measure	Saving potential	Comment
Eco-driving level 2 (on-board device)	8 %	In service only, ready for implementation
Parked train management	18-47 %	Out of service only

Total potential savings for the Kystbanen traffic assuming “low parking” scenario and conservative estimates applied:

PER YEAR	Present	Alternative	Savings
In service (GWh)	41.1	37.8	3.3
Saving (%)	8 %		
Out of service (GWh)	12.6	8.9	3.6
Saving (%)	29 %		
Total (GWh)	53.6	46.8	6.9
Total saving (%)	12.9 %		
Total energy costs savings	7.1 million DKR		

The CO<sub>2</sub> savings are similar since no change in electricity mix is foreseen.

The results confirm some simple observations:

- The saving potential for out of service is much higher for ER than for ET due to the longer stand still as the ER mainly serves as rush hour capacity,
- The impressive 8 % energy saving from GreenSpeed will in this case not be the prime driver for cost reduction; the parked trains have simply a too high share to neglect,

The saving potentials from out of service are depending on the assumptions/observations of the actual routines at the workshop; further attention should be given here and re-confirmation from the workshop would improve the reliability of the saving potential. Especially the hours for each mode as well as the installed power would benefit from a re-confirmation. The results finally confirm that it would be feasible even in the short term to save more than 10 % of energy within the current contracted traffic for the Danish part of Øresund. The long term goal of 15 % could be reachable but probably only by adding some technical measures for which additional investment costs could be needed.

In terms of environmental impact, CO<sub>2</sub> emission reductions are similar to the ones for energy consumption due to the fact that there is no foreseen change in electricity mix.

The results finally confirm that it would be feasible even in the short term to save more than 10 % of energy within the current contracted traffic for the Danish part of Øresund compared to both currently used rolling stock and current awarding. On the long terms however, 15 % system wide energy efficiency and CO<sub>2</sub> reductions could be reachable but probably only by adding some technical measures for which additional investment costs could be needed.

### Timisoara

Within the Timisoara site, a large number of measurements and statistics were made related to train current service on various routes and in various operating conditions (electrified/non-electrified tracks, different modes of configuration of DMU/EMU, different weather conditions winter/summer, parking, different number of passengers etc.). The data was collected from the ECORailS catalogue of technologies and operational measures, examples of tenders, norms, and technical documentations from suppliers or specialised literature from other related projects (Railenergy, Prosper, Event, Repid, Ravel etc.)

Also, actual line tests were performed with the existing rolling stock, by measuring and registering the fuel or energy consumption under various operating conditions, different driving styles, for various train configurations and by making additional calculations in order to define and quantify some parameters

The calculations made in order to achieve the results were made based on real data and extra care was dedicated to ensure that the results would be consistent and correct.

The Guidelines were helpful in identifying the right performance indicators needed for the tests and also provided a description of technologies and operational measures which were assessed in the Timisoara test site. The test version of the Guidelines stood at the base of the Timisoara test site, and even though some improvements were considered necessary during the test execution, these improvements were included in the final version of the Guidelines which now contains the recommendations of the Timisoara site in terms of quantitative performance indicators.

Due to the test specifics of the Timisoara region (division by components) we have identified the potential for energy saving on all technologies used in the site taking in to consideration the site specific baseline and local conditions.

Below are ten components used in the Timisoara test site and their assessment in terms on fuel consumption.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
1	Variable and optimised configuration of DMUs	6.0 %	145 %	18.0 %	21.0 %	73.0 %	30.0 %

The optimised configuration established according to the awarding documentation was compared against the ones from current awarding and respectively, from the currently used rolling stock. For each variant, theoretical calculations were made for the chosen test line and compared with statistical data for the real consumption of different trains from the same line. From these calculations, it clearly resulted the importance of reducing the weight, and respectively, of the possibility of composing the DMUs as suitable as possible for the real traffic demand (no. of passengers).

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
2	Performant diesel engine	2.6 %	13.5 %	8.0 %	5.0 %	15.4 %	12.0 %

The importance of choosing the diesel traction engine, since it is the main fuel consumer from the DMU, is great. The calculations were made based on the comparison of data for all types of diesel engines analysed and of prognosis, as well as taking into consideration the real statistical data, on the long term, measured in operation on the test line. However, in the offers' evaluation, this criterion will count less because thanks to the evolution of the technological field, of legal requirements and of competition, the modern engines became similar in terms of technical performances.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
3	Braking energy recovery and usage for auxiliary services	2.0 %	10.0 %	6.0 %	2.0 %	10.0 %	6.0 %

The calculations were conducted taking into consideration the energy consumed at braking, the duration of braking within a journey, the recovery rate, the power of auxiliary services and their possibility of using the recovered energy.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
4	Storage of recovered braking energy and re-use for start-up	21.0 %	30.0 %	25.0 %	21.0 %	30.0 %	26.0 %

The calculations were conducted taking into consideration the energy consumed at braking, the duration of braking and the recovery rate. In this case, through energy storage, the stored energy could be completely re-used. This solution will be preferred to the technology no. 3, and will be adopted if the supplementary costs are not exaggerated. In this case, for the total estimation, only the chosen technology will be considered.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
5	Train control and management system TCMS	0.0 %	50.0 %	20.0 %	0.0 %	50.0 %	20.0 %

The evaluation was realised by estimating the effects of different functions and proposed amenities, based on experiences and data from the real exploitation of such functions, correlated with data from the specialised literature, best practice examples, data from manufacturers, etc. The differences can be big dependent on the extent to which and the manner in which the requirements from the Specification will be realised.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
6	Systems for optimised control of equipment	20.0 %	60.0 %	25.0 %	20.0 %	60.0 %	30.0 %

The evaluation was realised by estimating the effects of different functions and proposed amenities, based on experiences and data from the real exploitation of such functions, correlated with

data from the specialised literature, best practice examples, data from manufacturers, etc. The differences can be big dependent on the extent to which and the manner in which the requirements from the Specification will be realised.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
7	Assistance for optimised driving	0.0 %	25.0 %	14.0 %	0.0 %	25.0 %	14.0 %

Real tests were conducted, in different conditions and under different optimised driving styles, based on theoretical considerations and on data from previous tests. The data obtained were compared against statistical data, measured during one year's time, on the same test line. Through the on-board computer assistance, the permanent comparison of consumptions and the granting of bonuses/penalties dependant on savings or supplementary consumption, the efficiency of this technology will be even greater.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
8	Measuring and recording of fuel consumption	1.0 %	3.0 %	5.0 %	2.0 %	9.0 %	5.0 %

This technology will be a mandatory requirement because no savings measure can be efficient if its effect is not verified and permanently monitored. Through consumption monitoring and measures for the reduction of additional consumptions (resolving of technical defects or bonuses/penalties) great savings can be obtained. The effects were computed based on some experimental data obtained from operation, as well as from the specialised literature.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
9	Control system for comfort functions in parked trains	0.0 %	8.0 %	5.0 %	4.0 %	12.0 %	10.0 %

The calculations were realised by summing up the consumptions of parked trains, correlated with the climatic conditions, the exploitation or comfort conditions, and the reduction possibilities for each consumption type of parked trains.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
10	Optimised HVAC system	0.0 %	4.0 %	3.0 %	3.0 %	9.0 %	7.0 %



The calculations were conducted by summing up the consumption of each of these services, correlated with the climatic conditions, the exploitation or comfort requirements, and the reduction possibilities for each consumption type, at the same time observing the impositions foreseen by the comfort norms.

	Analysis criterion	Current awarding (without ECORailS) >5 %			b) Currently used rolling stock >10 %		
		pessimist	optimist	probable	pessimist	optimist	probable
11	Analysis of LCC	0.0 %	30.0 %	15.0 %	8.0 %	35.0 %	21.0 %

According to the statistics, for a DMU transporting passengers, the investment costs represent 23 % compared to 77 % assimilated operational costs on a LCC basis (out of which, approximately 46 % represent the costs with energy consumption and approximately 31 % are maintenance costs). The calculations were computed based on statistical data from the specialised literature, as well as on operation data from the Timisoara regional. The values can be obtained and exceeded if a performant management is in place and also by the existence of a will to monitor/analyse and permanently intervene for the reduction of LCC.

Almost all of the technologies analysed can bring about greater economies than the targets of ECORailS. Taking into consideration the factors that could reduce these savings: the weight of each technology, some overlapping conditions, etc., the resulted total is superior to those established by the ECORailS targets. The only necessary condition is the decision to apply the ECORailS methodology and of rigorously following-up the adherence to the recommended procedures. Overall the rounded up probable level for energy efficiency and CO<sub>2</sub> emission saving resulted in the Timisoara test was 10,5 % compared to current awarding and 15,6 % compared to current rolling stock. In terms of the system wide energy efficiency by 2020 we considered several influencing factors whose targets were sent within official documents and strategies on a national level. Among the factors we considered the increase in volume of activity measured on passenger-km, the increase incapacity measured in seats and shift in market share (road to rail) measured in percentages. The predicted evolution for all these factors and the potential energy efficiency resulted in the Timisoara tests lead to a possible potential for energy saving of up to 27,56 %.

## Berlin

The Berlin-Brandenburg pilot application is designed to review present awarding documents developed for competitive tender. Test versions of the Guidelines have been presented to the Site Working Group (SWG) and to the Stakeholder Site Group (SSG) at every step of their development, with the SWG/SSG functioning as a sounding board to check for completeness, conciseness and reliability of content.

Furthermore, the pilot test is designed to identify and minimise potential risks to both PTAs and TOCs regarding:

- market related conditions
- energy prices
- legal requirements

Therefore the Berlin-Brandenburg pilot application consisted of the following three major steps:

### 1. Discussion of Guidelines and Development of EE/ENV criteria

Several Guidelines' test versions have been deeply discussed by the members of the Site Working Group (SWG) and EE/ENV criteria have been developed.

### 2. Test site workshops of the Stakeholder Site Group (SSG)

In order not to hinder the discussion process within the SSG, facing the competitive situation regarding awarding of Regional Railways Transport Passenger Services in the Berlin-Brandenburg region, the starting point was a virtual test case with data and figures nearby real awarding procedures of RegionalExpress lines currently conducted.

The main objectives of the Berlin test site workshops were:

- Consideration of the relevant risks for PTAs and TOCs, resulting from developments during the contract period, as there are
  - o framework conditions rooting in public rail transport demand
  - o energy prices
  - o legal environmental requirements (e.g. ambient noise regulation) and juridical decisions
- Provision of information
  - o For consumption and emission reduction potentials as well as cost estimations
  - o LCC approaches
  - o Further
- Understanding about the interests of the different stakeholders (PTA, TOC, Rail Supply Industry)
- Reality check of the Guidelines test version by the Site SSG acting as a „**Sounding Board**“
  - o Discussion and plausibility check of the developed EE/ENV criteria with the members of the SSG.
  - o Evaluation of the Guidelines' test version (V04 of D 22) by the SSG with the help of questionnaires (8 stakeholders – amongst them 4 participants from PTAs responded to the WP5 questionnaire provided within the last phase of the Guidelines tests.)
  - o Test of the Guidelines in particular for the phases A - Preparation and B - Elaboration regarding comprehensiveness and correctness of contents, perceivability and completeness

### 3. Energy consumption test

Simulation of energy consumption and CO<sub>2</sub> emissions taking into consideration different train configurations which are currently in operation or will be in operation from December 2012 according to the "Stadtbahn network" awarding done in 2009 consisting of a numerical simulation have been done:

- DMU: class 646/946 (GTW 2/6 - Adtranz, Bombardier, Stadler, in operation at Regional-Express line RE 6 going from North-West Brandenburg to Berlin (Wittenberge - Neuruppin - Hennigsdorf - Berlin-Spandau, DMU operated) currently and after December 2012.
- Loco-hauled train: class 143 (LEW Hennigsdorf) without energy recovery with 3 double deck middle coaches (class DBuz 747) and 1 double deck control cab coach (class DAB-buzf 760), currently in operation at Regional-Express line RE 7 going from the Federal State of Saxony-Anhalt via South-West Brandenburg, Berlin-Stadtbahn and Berlin Schönefeld Airport to the southern surrounding hinterland closed-by (Dessau - Bad Belzig - Berlin Stadtbahn - Wünsdorf-Waldstadt, operated with loco hauled trains, electric traction).
- Loco-hauled train: class 182 (Taurus – Siemens) with 3 air-conditioned double deck middle coaches (class DBpz 752), not older than 1998 and 1 double deck control cab coach (class DBpbzf 763), not older than 1998; for comparison with the current situation at line RE 7; with a similar configuration in operation at Regional-Express line RE 1 from December 2012.
- EMU: class 442/443 (Talent 2), Bombardier, three part, five-part, in operation at line RE 7 from December 2012.

Therefore a model which connects the track data like speed limits, curve radius, distance between stations and gradient with vehicle model was build. The simulation was done as suggested in the UIC/UNIFE TecRec 100\_001.

According to the energy consumption tests where currently operated rolling stock was compared with improved rolling stock to be applied with the beginning of the next public service contract (PSC) period, the following results have been obtained:

#### GTW2/6 single traction VBB (550 kW)

- 108 seats
- Traction energy consumption at 25 % seating capacity utilisation: 3.2 kWh/train km (0.97 l/train km)
- Mean value of Energy consumption for comfort functions: 1.5 kWh/train km (0.47 l/train km)

#### Class 143 train set VBB (3540 kW)

- 478 seats
- Traction energy consumption at 25 % seating capacity utilisation: 11.9 kWh/train km
- Mean value of Energy consumption for comfort functions: 0.8 kWh/train km

#### Class 182 train set VBB (6400 kW)

- 478 seats
- Traction energy consumption at 25 % seating capacity utilisation: 9.4 kWh/train km
- Mean value of Energy consumption for comfort functions: 1.5 kWh/train km

#### Class 442 VBB (3030 kW) 5-part vehicle

- 300 seats (273 standing (4 people/m<sup>2</sup>))
- Traction energy consumption at 25 % seating capacity utilisation: 4.6 kWh/train km

- Mean value of Energy consumption for comfort functions: 1.4 kWh/train km

The comparison of the currently operated class 143 train set with the future operated class 182 train set shows that energy savings for

- traction only of about 21 %
- traction and comfort functions of about 14 %

should be possible.

These results have also been checked in terms of plausibility and confirmed by trend by the members of the SSG during the workshop process. Therefore the 10 % goal for improving energy efficiency and reduction of CO<sub>2</sub> emissions compared with existing rolling stock is conceivable.

For the Berlin test case the Guidelines test version V04 of D22 have been evaluated during the workshop process with the stakeholders. Compared to current awarding an achievement of 5 % for improving energy efficiency and reduction of CO<sub>2</sub> emissions is conceivable.

This result is based on the following arguments:

- Answers of the stakeholders to the questionnaires due to the presented and discussed EE/ENV criteria
- Assumption that operational measures (eco-driving, parked-train mode) and timetable optimisation as described in the Guidelines with a potential of at least 5 % will be applied systematically.
- Simulations have shown that there is a significant difference between the Talent 2 and Taurus train configurations in terms of energy efficiency and CO<sub>2</sub> emissions. It should be stated that only the better train configuration will be offered by the TOCs if the EE/ENV criteria become higher weighted in future awarding procedures.

Regarding a system wide achievement of 15 % wide for improving energy efficiency and reduction of CO<sub>2</sub> emissions by 2020 the estimations of the stakeholders are not homogenous.

Taking into consideration the calculation results mentioned which are based on the of the Stadtbahn network awarding procedure with no quantitative requirements of EE/ENV criteria, it is probably to reach the system wide targets by 2020 when including EE/ENV criteria as described in the Guidelines into future awarding procedures.

### **Lombardy**

During the Lombardy Pilot Application the ECORailS Guidelines were used to understand how to improve the present public service contract between Region Lombardy and the TOC called LeNORD (from May 2011 it is taken over by the TOC called TRENORD), which manages the whole regional rail service, thanks to a 6 plus 6 direct awarding (2009 – 2020).

The Pilot Application was done by a Site Working Group (SWG) made by the project partners ALOT and Province of Brescia and by representatives from the Transport Directorate of Region

Lombardy and from the Ferrovie Nord Group (including LeNORD and FERROVIENORD, the Infrastructure Manager).

Energy efficiency and/or environmental requirements are neither part of the present public service contract nor monitored during everyday service, while the approach supported by ECORailS is consistent with the regional energy policy. For these reasons, Region Lombardy and Province of Brescia were very interested in the exploitation of the Guidelines to start with a progressive use of environmental targets and monitoring. Both sections of that document – the Political considerations and the Guideline for the operational level – are therefore relevant in the Italian test site.

For the evaluation of the reachable impacts in terms of Energy efficiency and CO<sub>2</sub> quantitative indicators, the Guidelines and the project database successfully provided the SWG all relevant information. Such an input allowed the SWG to select the measures which are feasible in Lombardy, to understand in a broad way their potentials and how to monitor them, to support the preparation of new contractual clauses. The TRENORD's technical expertise was crucial, as well as the 10 years long use of public service contracts by Lombardy Region.

As today no monitoring of energy consumption is in force in Lombardy, the SWG decided to carry out a demonstrative measurement campaign focused on two lines (Valcamonica diesel line in Brescia and the Milan suburban S3 electric line). This also benefitted from the test installation of an energy meter on a TRENORD train running on the suburban lines. The underneath reported results are therefore able to show that the potential savings described in the Guidelines are reachable in the Lombardy site, but they are not a validation process.

Chapter 5 of the Guidelines explains well how to assess the energy consumption by choosing the right indicator. This helped the design of the analysis, given that the data to collect are the consumed liters of fuel or kWh of electricity. The SWG found that the calculation of all indicators give interesting information. Besides, each indicator can help to rule different perspectives of the relationships between the PTA and the provider of regional rail service: the choice of rolling stock, the awarding of services, and the monitoring of performances.

As regards the CO<sub>2</sub> emissions, less of 20 % of the Italian electricity comes from renewable sources. Even though the Italian energy market is liberalised, electricity is provided by the infrastructure managers on both the national and regional rail networks. The train operating companies therefore can not choose the provider or the sources. For this reason, in the Lombardy Pilot Application the same extent of CO<sub>2</sub> reduction is assumed as the achieved energy savings. The SWG gave importance to the policy – supported by the Guidelines – asking the PTAs to push forward the use of renewable sources: this policy was included in the Pilot Application results by requiring the regional infrastructure manager to include the share of renewable sources in the awarding criteria to select the electricity producer<sup>1</sup>.

The present status of energy consumption for the two test lines, called baseline, has to be mentioned before presenting the achieved reductions of energy consumption and emissions:

- Valcamonica line has diesel traction and the majority of the involved rolling stock was built more than 30 years ago; 2 new diesel-hydraulic DMUs are in service since 2009. All old trains will be replaced within the year 2011 by a homogeneous fleet of diesel-electric DMUs. Such a decision was not influenced by ECORailS, but the Guidelines gave help to understand better its positive impact.

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<sup>1</sup> The same approach is not feasible for the national rail infrastructure, where the infrastructure manager has legal constraints in choosing the electricity producer.

The present fuel consumption is today officially registered at refilling time: 1.47 litres/km or 14.8 kWh/km or 0.11 kWh/seatkm for the old rolling stock, on average.

- S3 line has electric 3 kV DC traction where double deck 4 coaches EMUs are dominant, which were built at the end of the nineties. Their features well reflect the more recent part of the regional electric rolling stock, which will not be replaced for many years. No energy meters are installed, while such trains are able to recover energy when braking: its reuse is subject to the well-known limitations of the AC system. The whole remaining old present electric fleet in Lombardy will be replaced within 5 years: the Guidelines, together with home-based pilot experiences, are influencing the design of the specifications for the awarding of the future rolling stock, even if the manufacturers seem not to be ready for all the proposed improvements.  
Here, no baseline is regularly collected today: from the trial runs it was argued for such a suburban line an average consumption around 16.7 kWh/ km or 0.035 kWh/ seat-km.

Part II “Guideline for the operational level” and the Technical Annex provide practical advices about how to arrange an energy/emissions saving plan, including both targets and measures. The SWG used several draft versions of this document during the Pilot Application process and gave feedbacks to the Editorial Group for refining it. For the two test lines – and also for the whole service in Lombardy – there was the need to understand, at first, how to collect and manage the consumption data, then which technologies and measures are suitable for the local conditions and, finally, how much energy could be saved. The information in the Guidelines successfully allowed the SWG to understand the key choices and potentials, but more detailed technical knowledge has to be gathered by the PTA when a monitoring and measurement system is put in practice. Not only the annexes or the other technical support available on the ECORailS web site, but also external sources have been therefore used, like other EU projects (Railenergy, Trainer) or experts. Such a start-up effort is not unusual for a PTA in Lombardy because it happened in past times, for example when the monitoring system of the public service contract was implemented.

The first ECORailS target wishes to measure how much a PTA can benefit of an energy saving policy, even without big investments, system-wide improvements or rolling stock renewal. Such a result should be reached mainly through operational measures supported by contractual incentives. This is the case of Lombardy. Prerequisite is to have a reliable running monitoring system, which uses on-board energy meters.

Most efforts of the Lombardy Pilot Application were therefore on the design of this monitoring system. On the other hand, energy efficient driving and timetabling – part of the measures listed in the ECORailS Pilot catalogue of technologies – were considered well-suited for Lombardy. For this reason the trial runs of the measurement tests were focused on eco-driving. In both cases – Valcamonica and S3 lines – they showed that a 5 % reduction is reachable, although side conditions – especially an instable circulation – can threaten very much the result. On Valcamonica line (4 trial runs) a reduction over 10 % was always reached and the best run saved about 16 %. On S3 line (2 trial runs), the reduction was about 8 % under very bad running conditions.

The SWG appreciated the relevant results, but had proof of the need to establish the above mentioned monitoring system.

The Lombardy Pilot Application was not focused on the awarding of rolling stock, although both the PTA and the TOC stated that the information provided by ECORailS will be taken into account when preparing new call for tenders for new trains. In past years Lombardy Region and FERROVIENORD successfully tested energy saving criteria – lowered weight and on-board use of braking energy – in the awarding of a fleet of DMUs.

Although those vehicles were not in service during the Pilot Application, the collected baseline for the diesel Valcamonica line allowed the SWG to compare the 30 years old DMUs with the 2 new ones (which are not part of the above mentioned tendered fleet). The data show a 10 % reduction of energy consumption in terms of kWh/seat-km along one year and without any eco-driving measure in force. This is an interesting result for the PTA wishing to move to more comfortable rolling stock, for example including air conditioning: such a modernisation does not cause increased running costs. In comparison with current rolling stock, the saving is bigger if checked having a look to the weight (37 % kWh/tonne-km).

No baseline data were available for the electric line S3.

The use of the Guidelines convinced the SWG that only a comprehensive policy can offer long-lasting environmental benefits, to be implemented after having established the monitoring system. The Guidelines suggest a set of powerful solutions; interesting developments will happen in next years. Starting from here the SWG therefore developed a document for the PTA and the TOC, called Memorandum of understanding, which outlines a plan between now and 2020, with an important deadline in 2015. Such a plan should involve also the Infrastructure Managers, especially for the recovery of braking energy, the timetabling and the control of side conditions. The measures in the plan will be applied to the whole regional rail service and therefore also a share of further fleet renewal is included.

Taking into account the actions planned in the Memorandum of understanding and the potential savings collected by ECORailS from the literature and from the other projects, the SWG concluded that a 15 % reduction in energy consumption is a feasible target for Lombardy within 2020, if the Memorandum will be significantly implemented. Simulation tools, like that provided by Railenergy project, can support this statement, but it can be confirmed only when the monitoring system will provide enough data about the baseline.

### 3.1.2 Results regarding related effects

Based on the analysis provided using the Railenergy Calculator, it is clear that there are significant saving potentials from the “out of service” energy consumption (parked trains) for the Danish part of the Øresund traffic (Kystbanen). The results could for some sound even surprising but this confirms the big potential for energy saving when the trains are parked.

Within the Timisoara site, the main related effects entailed by energy savings and chemical- and sound emissions reduction were studied in the specific documentation. These related effects refer to: life quality, social impact, ride comfort, safety degree.

Where possible, the indicators measuring the related effects were also measured and presented in the test site Report. One conclusion drawn was that the impact of related effects is sufficient so that it might represent good incentive for decision makers to focus on saving energy.

The implementation of the ECORailS criteria has positive system-wide related effects. They concern not only the environment, but also other social benefits, like health (e.g. less harmful emissions mean less diseases and longer life), economic development (e.g. faster transport, more advanced technologies in use), better quality of life (e.g. better rolling stock, more attractive rail, less car accidents). From the financial point of view, more cost-efficient operations means to save money that can allow, according with the local conditions, keeping in service or adding regional rail services which otherwise should be withdrawn or not added.

Today a quantitative estimation of such related effects for the Lombardy Pilot Application is not possible, but it will be part of the analysis asked by the above mentioned Memorandum of understanding.

### **3.2 Second Level performance indicators vs. ECORailS objectives**

#### **3.2.1 Flexibility and adaptability to the users' needs and particularities**

According to the results from the workshop in Test 1- Øresund the testing group found a large part of the information in the guideline less relevant to the objective of the project. The testing group also found the structure of the Guideline as not user friendly. The final version of the guideline has been approved according to both these remarks but it has also been clear that the Guideline has a large target group to consider.

The political and strategic level of the Guidelines has been shortened and is more focused on the purpose of the ECORailS objective, which is to handle environmental criteria. The testing group also thought that parts of the text in the Guidelines are better suited for the annex which was also done in the final version which makes the guideline flexible and user friendly.

After performing a test of the Guidelines under the Pilot Application from Timisoara Site, it has been indicated by the SWG and SSG that the Guide's concept is very useful and that it holds a lot of strong points, but the general feeling is that it still isn't manageable enough. Therefore, the stakeholders requested the drafting of a much more concise form that explains as clearly as possible the modality of introducing and evaluating the ECORailS criteria into the awarding documentations. These aspects were amended in the final version of the Guidelines by a better structuring of the text and the elimination of less relevant content.

Even if the first part of the Guide is intended for politicians and other responsible persons for the organisation of Public Passenger Transport, the designed text was seen as too general. The introduction (chapter 1) should be more focused on the element of novelty that the project brings, its necessity and benefits. Another observation regarding the test version of the guidelines was that the second chapter should be reduced and streamlined towards explaining why the Guide's application in future awarding procedures is necessary and why it is in the users/stakeholders' best interest. Furthermore, a general argumentation regarding the direct interest that PTAs/TOCs have with regard to the introduction of EE/ENV criteria in awarding procedures has to be added. The chapter dedicated to the legal framework is too detailed; at least chapter 3.1 should only enumerate briefly the legislation promoting economy, energy efficiency and environmental aspects. These aspects were nicely amended in the final version of the Guidelines making this version highly responsive to the needs identified during the test in Timisoara.

Another aspect improved in the final version was that the Guidelines now contain much more relevant indications in terms of which performance indicator would best be suited in the case of vehicle awarding. The Guidelines are now more practical by giving more concrete examples of how the ECORailS indicators (direct, indirect, specific) could be requested for in the awarding documentation, graded and prioritised during the evaluation phase, and monitored during the contract period/service life.



If one has a look to the four test sites of ECORailS, it stands to reason that they are so different and reflect various starting points, targets and perspectives. In the case of Lombardy, the local needs and expectations have been met well starting from the draft versions of the Guidelines. They in fact cover the general political and strategic needs, meanwhile they succeed in giving the key advices for implementing them in practice.

Beside practical advices given to PTAs especially in Part II of the Guidelines, It has been clearly stated by the SSG and SWG of the Berlin test site that it is essential to address not only the administrative but also the political level for improving the framework conditions for including of EE/ENV criteria into awarding procedures. Therefore Part I of the Guidelines will give good advice.

The political and strategic part of the Guidelines helped in understanding the relevance of the environmental policies supported by ECORailS and in preparing a Memorandum of understanding able to pave the way for a concrete reduction in energy consumption. The operational part, together with the annexes, provided the basic knowledge to arrange the on-site measurement and to write the new contractual clauses.

The main improvement happened between the draft and the final version is the streamlining of the document. It was expected by the users of the SWG, to meet several goals: fewer pages to read, a clearer and more practical index, better distribution of the contents among the general part, the operational part and the annexes, according to their end-use.

### 3.2.2 Efficiency of the Guidelines for developing the awarding procedure

The Guidelines will probably be used in several different ways depending on the users need for support in the tendering process. The final version of the Guidelines is produced to meet the needs of a broader target group and is more efficient and adequate than the test version.

The second part of the Guidelines dedicated to the practical and working level contains now useful information and avoids references to the normal awarding procedure compared to the previous version. In this sense, chapter 4 was heavily shortened and cleaned of all the tables because they were subjective and incomplete, did not bring any effective support for the elaboration of the awarding documentation. This improvement greatly contributed to the efficiency of the guidelines to be used in practice. In its final version, the Guidelines Chapter 5 is focusing on clearly defining the modality of integrating, evaluating and monitoring the ECORailS criteria and now answers to the project objective.

A very important chapter in what concerns the test from Timisoara is the one dedicated to the Life Cycle Costs. The test version of the Guidelines containing this chapter did not provide the necessary basis for an LCC driven procurement of railway vehicles. This was amended and now the Annexes have ample examples for the integration of LCC criteria in the awarding of rolling stock and services. The final version of the Guidelines now focuses on teaching the PTAs/TOCs on how to request the costs on the entire lifecycle so that the offers could be easily compared, evaluated and monitored.

As regards the technological development and the norms, the Guidelines refer to the situation in 2011 and contain a key reference: the final version has a clear cross-reference to the main sources of updated technical knowledge, but it is advisable to provide the users with a long-lasting dynamic

support. On the other hand, it is easier for the PTAs to deal with the administrative issues related to an awarding procedure because this matter is closer to day-by-day life of these bodies.

Finally, the present release of the Guidelines could have a further development focused on a deeper operative analysis of the energy consumption monitoring issues. On Lombardy SWG's opinion there is the need that all stakeholders agree on a EU-wide common approach, including the legal consequences when the required energy consumption and environmental targets are not met by the rolling stock manufacturers and by the TOCs.

### 3.2.3 Acceptability and participation

The Site Working Group from Timisoara has appreciated very highly the action to simulate an awarding procedure based on real data from the Timisoara region. The fact that all necessary data was received by the project partners shows the commitment and the interest the main stakeholders to help the project.

The members of the Site Stakeholders Group generally view the ECORailS initiative as very useful for Romania and made this point very clear in all User Platform Meetings and the Workshop and Dialogue Event in Bucharest. However, they believed that the test version of the Guidelines wasn't manageable enough, but efforts were successfully made towards its shortening and streamlining of information to respond to the specific objectives of the project. In its final version, the Guidelines were improved in this aspect by incorporating all user feedback.

The Lombardy Pilot Application recorded a high acceptability level both by the SWG and by the SSG. All interested bodies were involved in the process, as much as the project time-schedule allowed.

The feedback to the test version of the Guidelines given by the SSG of the Berlin test site was a generally positive one. Regarding manageability it was a consensus of the SSG of the Berlin test site, that the tested version of the Guidelines is too long. Useful hints for a better Guideline's structures have been given by the SSG. The participation of the different stakeholders of the Berlin test site, mainly coming from PTAs, TOCs and the Railway supply industry, lead very engaged and fruitful discussions during the Berlin test site workshop process.

Region Lombardy and the regional TOC agreed on the clauses in the Memorandum of understanding and this paved the way to the real implementation of what developed during ECORailS. Those clauses are now under discussion to become part of the new public service contract covering the whole regional rail service in Lombardy.

On the stakeholders' side, an Italian group of selected stakeholders had the opportunity to contribute to the development of the draft Guidelines in the final version. Their opinions have been collected through questionnaires: all respondents answered that they intend to use the Guidelines in future awarding procedures and that they are highly convinced of the Guidelines impact and usefulness.

### 3.2.4 EU wide applicability

This issue can be evaluated from two points of view: the legal approach and how the contents are structured.

From the legal point of view, the Guidelines are EU-wide applicable because they have been written in compliance with the European law both on public awarding and on the public service obligations in the contracts between the PTAs and the service providers. They also conform to the international standards and technical rules. Notwithstanding, problems may arise due to local regulations if they are still not fully aligned with the EU directives. This is not the case of Lombardy: on the SWG's opinion the requirements and/or incentives presented in the Guidelines can be easily inserted in an Italian public service contract as public service obligations or can be used as criteria in the awarding procedures which follows the "tender most economically advantageous" approach.

As regards the way they can match with still so different situations in the EU countries, the final version of the Guidelines has been streamlined in a way focused mainly on key general advices and, about the technological issues, on clear criteria, helpful to support a better choice in all main occurrences. This successfully happened for Lombardy, where the main needs are, firstly, political and strategic support and, then, a concrete help in establishing the monitoring system. On the other hand, as much essential is the Guide as more the annexes and external sources have to be used.

When it comes to EU wide applicability the guideline probably will be an important tool for many users but in a different way. The users within the EU do not have the same work process when it comes to the tendering procedures and will therefore use the guide in a way that is more suitable for their needs. The guideline could be a good starting point in the process to involve environmental criteria in the tendering procedures for many PTAs within the EU while it will be a useful tool for others to continue the already ongoing process to include environmental criteria in the tendering procedures.

The Guidelines' contents are transferable to other regions, especially in their Final version. The Pilot Applications, as explained by Deliverable 14, did not show relevant technical differences in the test sites, but, on the other hand, they underlined that the cultural and regulatory starting points differ significantly in the project partners' countries. ECORailS covers all these situations and the Guidelines rightly should support countries without a widespread environmental culture and countries willing to enhance their environmental performance.

Since all specifications regarding energy efficiency, CO<sub>2</sub> emissions, noise and other related effects were taken from the European or international legislation, norms and recommendations there is a high plausibility that the guidelines could be used in other EU regions with similar effects. However the compulsory usage of national legislation in terms of awarding does leave some issues to be managed by each PTA.

### 3.3 Third Level performance indicators vs. ECORailS objectives

For the Italian site 17 organisations have been involved in the ECORailS activities:

- Federmobilità, the Italian association of the PTA for transport, supported the whole participation and took part to the User Platform and to the SSG
- Region Lombardy and the Province of Brescia have been project partners and members of both the SWG and SSG
- Other two Regions, Veneto and Emilia-Romagna, have been interviewed to describe the present situation and the expectations
- The Italian Ministry of Transportation was interviewed to describe the present situation and the expectations
- The National Agency for rail Safety (ANSF) accepted to be kept informed of the project results as external member of the SSG
- The Ferrovie Nord Milano Group (including the Infrastructure Manager FERROVIENORD and the TOC TRENORD, owned also by the national TOC Trenitalia) took part to the User Platform, to the SWG and to the SSG
- Ferrovie Udine-Cividale (regional TOC owned by Region Friuli-Venezia Giulia) took part to User Platform meetings
- Ferrovie Emilia-Romagna (regional TOC owned by Region Emilia-Romagna) was interviewed to describe the present situation and the expectations
- Four national and international manufacturers of rolling stock (AnsaldoBreda, Alstom, Stadler, Bombardier) were members of the SSG
- An Italian manufacturer of energy meters and member of CENELEC working group (FAR Systems) took part to the SSG and supported the measurement campaign
- The Autonomous Province of Bolzano-Südtirol took part to the Bruxelles dissemination event

Two meetings of the Italian stakeholders took place:

- on 11<sup>th</sup> December 2009 in Brescia, Broletto palace
- on 17<sup>th</sup> December 2010 in Brescia, ALOT offices

The feedbacks of the stakeholders have been collected by submitting them the WP5 questionnaire, whose main contents have been presented before. All answers gave a positive feedback about the Guidelines and the changes they can cause (88 % of positive answers). The work-in-progress of the Pilot Application made also many stakeholders confident that the energy and emission saving targets of 5 %/10 %/15 % are reachable by implementing the Guidelines (83 % of positive answers). Finally, they recommended further in-depth examination of special issues.

ALOT organised or took part to other relevant dissemination events in Italy and abroad:

- on 25<sup>th</sup> January 2010 at Politecnico of Milan university ALOT presented the ECORailS project during the Italian Association of Rail Engineers (CIFI) conference “For a careful use of energy in railway transport” (public event)
- on 14<sup>th</sup> April 2011 in Brescia a meeting among the four Provinces of Brescia, Bergamo, Cremona, Mantova and two Croatian counties (Varaždin and Medimurie) took place to exchange experiences, including ECORailS (event on invitation)

- on 9<sup>th</sup> May 2011 in Rome ALOT presented the Guidelines and the Lombardy Pilot Application during the Federmobilità conference on the development of rail services in Italy (public event)
- on 12<sup>th</sup> May 2011 in München ALOT organised a workshop to disseminate the results of ECORailS to the participants to the international logistic fair (public event)

Other dissemination events are planned also after the project final conference. Among them: an afternoon workshop for a detailed presentation of the Guidelines and the project results to the Italian Association of Rail Engineers (CIFI), in Milan; the presentation of a paper at the international Thredbo 12 conference on competition and ownership in land passenger transport, in Durban (South Africa).

The interest and demand for energy efficiency and environmental criteria in awarding procedures has been recognised within this project due to the users and stakeholders that have been participating in this project. Within the Øresund test the Danish Trafikstyrelsen and DSB First have participated with their time and expertise according to the objective of the project. The feedback from test made in the Øresund area also shows that the environmental issue is important for the transportation business. The testing group gave important advice to the project concerning the content and requirements of the Guideline. The members of the testing group from the Danish Trafikstyrelsen are experts on the tendering/procurement process, contractual issues, traffic demand and the law within the area of procurement/tendering issues and traffic demand.

In Romania, the dissemination activities were very result orientated with the involvement of users in key areas concerning test and other project activities. One of the goals of the dissemination was to involve the Romanian stakeholders in as many international meetings as possible to facilitate the transfer of information and dialogue between them and their homologues from other EU countries. This goal was fully achieved since every User Platform had representatives from Romania.

The main focus however, was to ensure the involvement and dissemination of project results and activities to a diversity of users from various organisations, with various responsibilities, in order to ensure the wide spread dissemination rather than focused on a specific target group.

In this regard, we involved representatives of the Transport Ministry, public and private rail transport operators, Railway Authority, vehicle manufacturers and the National Authority for public acquisitions. All these stakeholders have different needs and particularities which were all taken into consideration in the test performed in the Timisoara region.

In addition, Integral Consulting R&D participates in a national wide initiative which aims to standardise awarding documentation. This initiative is coordinated by the European Commission and the National Authority for Regulating and Monitoring Public Procurement which was a stakeholder in the ECORailS project. Due to this fact, IRD was invited to participate in several working groups concerning the railway transport field and show the ECORailS project as good practice example. This achievement could finally lead to the inclusion of principles promoted by the project to be included in the national procurement framework legislation.

Stakeholders from 15 institutions took part at the Berlin-Brandenburg test site workshop process:

#### Public Transport Authorities

- Berlin Senate Department for Urban Development (Senatsverwaltung für Stadtentwicklung - SenStadt)
- Berlin Senate Department for Health, Environment and Consumer Protection (Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz - SenGesUmV)
- Brandenburg Ministry for Infrastructure and Agriculture (Ministerium für Infrastruktur und Landwirtschaft – MIL)
- Brandenburg Ministry of Environment, Health and Consumer Protection (Ministerium für Umwelt, Gesundheit und Verbraucherschutz - MUGV)
- Transport Association Berlin-Brandenburg (Verkehrsverbund Berlin-Brandenburg - VBB), which is responsible for the management of awarding on behalf of the Federal States of Berlin and Brandenburg

#### Train Operating Companies (TOCs)

- DB Regio Nordost GmbH, which is currently operating the majority of regional trains in the Berlin-Brandenburg region - Regional-Express (RE lines) and Regional-Bahn (RB lines)
- S-Bahn Berlin GmbH, which is currently operating all S-Bahn lines in Berlin and its urban hinterland
- Niederbarnimer Eisenbahn AG, which is operating two regional train lines in Berlin and its urban hinterland
- Association of German Transport Companies (Verband Deutscher Verkehrsunternehmen - VDV), in which numerous of TOCs operating in Germany are members

#### Railway Supply Industry

- Bombardier Transportation GmbH
- Siemens AG Mobility Division
- Stadler Pankow GmbH

#### Other

- Alpha Trains Europa GmbH (lessor of rolling stock)
- Federal Environment Agency (Umweltbundesamt - UBA)
- Deutsche Bahn Environmental Centre (DB Umweltzentrum)

Five workshop meetings of the Berlin-Brandenburg stakeholders took place: on 29 January 2010, 12 March 2010, 10 June 2010, 30 September 2010, 27 January 2011. The feedbacks of the stakeholders have been collected by discussion during the workshops and bilateral meetings as well as by submitting them the WP5 questionnaire. In general there was given a positive result by the

stakeholders, based on the evaluation of test version of the Guidelines. The most positive results was reached by the argument, that it is necessary to have an EU wide applicable set of Guidelines for the awarding of passenger rail vehicles and services at regional level. Beside practical advices given to PTAs especially in Part II of the Guidelines, It has been clearly stated that it is essential to address not only the administrative but also the political level for improving the framework conditions for including of EE/ENV criteria into awarding procedures. Therefore Part I of the Guidelines will give good advice. Useful hints for a better Guideline’s structures have been given by the SSG.

Members of the SWG organised and/or took part to other relevant events to disseminate the results of ECORailS in 2011:

- 20 January 2011: ECORailS Dialogue and Training Event in Budapest, participation of TSB FAV and ApS
- 22-24 February 2011: Eurorail 2011 in Berlin, Business Services trade show, round table participation of TSB FAV and SenStadt
- 12 May 2011: “transport logistic” fair in Munich, participation of ApS in a workshop for presenting the ECORailS results
- 16/17 May 2011: ECORailS Dialogue and Training Event in Belgrade with participation of TSB FAV
- 17/18 May 2011 in Bielefeld: VDV conference on realisation of the UITP charta for a sustainable development within companies operating public transport services, participation of ApS and presentation of ECORailS results
- on 19/20 May 2011: ECORailS Dialogue and Training Event in Zagreb with participation of TSB FAV, SenStadt and ApS
- on 22 June 2011: 4<sup>th</sup> ECORailS User Platform in Berlin with participation of all project partners
- on 23 June 2011: ECORailS Final Conference in Berlin with participation of all project partners

### 3.4 Results sum-up

Performance Indicator	Validated	Comment
5 % Energy efficiency and CO <sub>2</sub> emission reduction compared to current awarding	<b>Yes</b>	Evidence from the test sites show that results beyond 5 % are achievable in this regard. In fact, the potential stands in the reach of 10 % which is a very encouraging result
10 % Energy efficiency and CO <sub>2</sub> emission reduction compared to currently used rolling stock	<b>Yes</b>	The test site which had as explicit objective to acquire new rolling stock has shown via calculations that savings as high as 15 % can be obtained. This is solid evidence that there is lots of potential to save energy and the project objective was achieved and even surpassed.

15 % System wide Energy efficiency and CO <sub>2</sub> emission reduction until 2020	<b>Yes</b>	The test has shown that it is plausible to achieve 15 % energy efficiency by 2020 however there are objective factors that govern the achievement of the result.
Manageability of the Guidelines	<b>Yes</b>	This being a key objective of the project, lots of critique and feedback was given in this regard. Compared to previous versions, the final Version of the Guidelines has incorporated the majority of comments and all key aspects regarding manageability thus making the final product manageable. Four axes were used to determine the overall manageability of the Guidelines. The key aspect of acceptability and participation was covered by the many comments and feedback received from the users and their positive feedback concerning the future use of the Guidelines. EU-wide applicability was considered one of the most important aspects of the guidelines and the successful testes in the four regions reinforce this characteristic of the Guidelines. The efficiency of the Guidelines to elaborate upon an awarding procedure was greatly improved mainly through feedback from the test and test results making this aspect covered in the final version. The flexibility of the Guidelines is attested twofold: the Guidelines covered the majority of the test specific issues and all user comments were integrated in order to cover all key topics which presented interest for them.
Dissemination	<b>Yes</b>	Disseminations activities were a prime component of the ECORailS project. The scope of the dissemination was to approach a large base of users and stakeholders – objective which was achieved.  The broad participation in the User Platforms and project workshops along with the discussions held at the events also prove that the quality of the dissemination was high.



## 4. Recommendations

In a world of demographic change, urbanisation, and climate change an efficient use of non-renewable resources is highly deemed. The mounting use of fossil fuels will have an impact on the global climate, helping drive climate change and greenhouse gases. The growing population and its increasing concentration in urban centres are fuelling worldwide passenger and freight volumes. Since transport's share in world CO<sub>2</sub> emissions is 23 % (source: International Energy Agency), energy efficiency and environmental aspects are key areas that must be considered. These issues are important for the future development of sustainable transportation and also for the R&D process with in this area.

To include energy efficiency and environmental criteria in a guideline for tendering procedures for rolling stock and services is an important step for a more environmental orientated thinking when it comes to transportation. The Guidelines shows many possibilities for creating a more environmental awareness in the transportation business.

For this reason the project partners worked at the elaboration of a useful and practical instrument assisting public authorities and rail operators when awarding/procuring railway rolling stock and/or services, keeping in mind the more and more severe exigencies of law and the general public when it comes to the environment and economy/costs. The Guidelines elaborated under the project shows many possibilities for creating a more environmental- aware behaviour in the transportation business.

Even if quality criteria have constituted an awarding criterion for some time now, issues related to the environment must became of central attention also. Although the railways already constitute the most environmental friendly means of transport, the other modes of transport are continuously improving their environmental performance, so in order to keep its lead the railways must follow the trend also. Moreover, with experts' prediction that 90 % of the future population growth will be concentrated in the cities, mobility is becoming the biggest challenge when it comes to ensuring sustainable growth. In the course of these developments, the demand for individual mobility will continue to soar – intensifying the need for increased transport.

In order for mobility and sustainability to go hand in hand, all actors involved in the transport sector must become environmentally conscious. The ECORailS Guidelines comes in the support of all transport market players as a tool teaching them how to adhere to the new concept of energy efficient and environmental-friendly awarding. Within the Guide, public authorities can find ways of requesting, evaluating and monitoring environmental criteria while doing it in a legally secure way. Since all considerations were written in accordance with EU27 law, it assured the usability of the Guidelines even outside the project partner countries, making it a useful tool provided small modifications or adaptations are made according to country specifics.

Because of its broad approach, the instructions from the Guideline can be followed in any type of awarding procedure specific or imposed by national law, for any type of awarding project – described functionally or solution oriented – always promoting the principles of efficiency, both economical and environmental

The Guidelines can be used as a primary source concerning the introduction of energy efficiency criteria in the awarding of rail vehicles and services, since it contains all main issues concerning

these aspects. The advantage of the Guidelines is that it incorporates a lot of feedback coming from the users which signifies that key points of concern are addressed.

The Guidelines also were designed to be a practical instrument to be used in real awarding of rail vehicles and services and in this respect, it contains step by step information on how to approach the awarding process in a systemic manner. One noteworthy feature of the Guidelines is that it provides information, where available, on what changes or what the users should pay attention to when introducing EE/ ENV criteria compared to business as usual practices. This aspect should be a key point in the future use of the Guidelines.

The Guidelines contain concrete information regarding technologies and operational measures in terms of energy efficiency potential which represents a good reference source which users could use as a “quick acid test” to get an idea of the potential in their region. In addition, since the Guidelines were tested in four regions, the power of their example can serve a powerful stimulant to initiate actions to reduce energy on a regional level via awarding.

The Guidelines contain useful information regarding LCC driven procurement and the importance of an LCC approach in the awarding of vehicles and services. Within the Guidelines, a direct link between energy efficiency and economical efficiency (which is a point of interest for all stakeholders) is drawn as a strong convincing point is concerning the advantages of saving energy. This should be one of the focuses of further promoting the Guidelines since all users face budget issues.

In addition to all practical advantages, the Guidelines can have a future dissemination role to increase awareness rising concerning energy efficiency issues on a regional level. In this regard, the Guidelines can have a persuading role by making decision makers understand that the underlying issuers of saving energy are important and one solution to more energy efficiency is to award services and vehicles with regard to energy efficiency and the environment. The Pilot Applications in the four regions successfully tested the use of the ECORailS Guidelines to develop a strategy and to select measures and legal clauses able to reach feasible energy saving targets.

The Site Working Groups recommended the use of the Guidelines because they explain in a simple way the key arguments and the key choices and opportunities. The Guidelines may be used as a self-standing comprehensive instrument to be used alone when preparing awarding documents, but moreover they help in preventing inaccuracies or underestimating the environmental potentials of the regional rail services. People who worked in the Pilot Applications (the team and the stakeholders) support further developments (second ECORailS step), mainly focused on more detailed explanation and testing of monitoring, calculating the optimal energy consumption for the site conditions and drawing a financial plan for the needed investments.

## 5 Conclusions

The Guidelines being the most important output of the project are the most relevant document to which the validation of project results refers to. Being the core output of the project, the Guidelines incorporate many of the project's objectives and for this reason it is the prime source of information for this validation report. Many of the project's objectives can be achieved directly through the Guidelines while others are strongly related to it.

Due to the overall concept, the Guidelines were released early in the project and constantly improved according to the users' comments and feedback, test needs and results and evaluation needs. It is for this reason that the Guidelines received mixed feedback and even critique during its lifetime. However this was one of the goals of the guidelines – to be permanently updated and to permanently take in to consideration feedback. Since the Guidelines and their objective are regarded as a novelty item, it was necessary to carefully integrate suggestions and eventually incorporate them in the Final Version of the Guidelines, which makes the object of this report.

As it was expected, most comments were received during the tests (especially during the final stage) and in this regard the test version of the Guidelines was heavily upgraded in order to produce the Final version of the Guidelines. The feedback received from the users and from the project partners was the base for improvement of the Guidelines, which in its final form achieves the desired level of manageability. The tests performed in the four regions have demonstrated and shown the plausibility to achieve the quantitative targets of the project. This has revealed the potential to save energy on a regional level, potential which can be exploited via awarding of services and vehicles considering energy efficiency and environmental criteria.

## Bibliography

D22- Final Version of the Guidelines  
D16 – Results analysis report  
D14 – Report on pilot applications  
D15 - Validation Strategy

## Annex I - Questionnaire for the users

# ECORails

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

For the ECORails project to have a sound success we require your opinion regarding the project's development and materials under discussion. Please answer the following questions by marking the appropriate "degree of appreciation" field:

Question	Degree of appreciation				
	VHD	HD	N	LD	VLD
Based on the test results how evident is the achievement of 5% energy efficiency in comparison to the current awarding?					
Based on the test results how evident is the achievement of 5% CO2 emission reduction in comparison to the current awarding?					
Based on the test results how evident is the achievement of 10% energy efficiency in comparison to currently used rolling stock?					
Based on the test results how evident is the achievement of 10% CO2 emission reduction in comparison to currently used rolling stock?					
Based on the test results how evident is the perspective of 15% energy efficiency in the regional passenger rail transport by 2020?					
Based on the test results how evident is the perspective of 15% CO2 reduction efficiency in the regional passenger rail transport by 2020?					
In which degree do the Guidelines successfully achieve the introduction of energy efficiency and environmental criteria in the awarding of regional passenger rail services?					
In which degree do the Guidelines successfully achieve the introduction of energy efficiency and environmental criteria in the awarding of regional passenger rail vehicles?					
In which degree can an awarding documentation be elaborated based on the instructions found in the Guidelines?					

In which degree can an evaluation and scoring procedure be elaborated based on the instructions found in the Guidelines?					
In which degree do you intend to use the Guidelines in future awarding procedures?					
In which degree are you convinced of the Guidelines impact and usefulness?					
In which degree do you see the Guidelines useable with similar effects outside the test region?					
In which degree do you consider necessary to have an EU wide applicable set of Guidelines for the awarding of passenger rail vehicles and services at regional level?					
In which degree do you consider the User Platform to be an effective way to disseminate information?					
In which degree were the information presented on the website sufficient to present the aims and objectives of the project?					
In which degree was the ECORailS campus eloquent in indicating the usefulness of the Guidelines?					

Note: The degrees of appreciation are as follows: VHD – Very high degree; HD – High Degree; N – Normal; LD – Low degree; VLD – Very low degree

### Open Questions:

Which topics treated by ECORailS need further investigation?	
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<p><b>Do you see important topics which have not been treated by ECORails? If yes, could you shortly list and explain them?</b></p>	
<p><b>Do you believe some project objectives are more important than others? Shortly list the most important ones.</b></p>	
<p><b>Based on the recent experience of the User Platform do you see the project objectives as achievable?</b></p>	

**Comment Box**

*Please make any remarks regarding the questions and ECORails project.*

**Name**

**Date**