

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

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

ECORails

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Acronym:

ECORailS

Title:

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

Distribution:

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

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1. Executive summary

Work Package 4 performed concrete tests where the ECORailS Guidelines were used to review or to simulate real awarding procedures in four European sites (Berlin-Brandenburg, Øresund, Timișoara and Lombardy). The present deliverable contains a detailed report on the test activities and the achieved results.

Aims of the pilot applications were:

- developing new text modules and clauses to improve the present awarding of services and rolling stock with Energy Efficiency and ENVironmental targets;
- increasing the awareness of the potentials for saving energy and for reducing the environmental impact of regional rail;
- testing a draft version of the ECORailS Guidelines and giving feedback for the delivery of the final version.

The execution of the tests was framed by a common test methodology, although the four sites have relevant differences, due both to their baselines and to the willingness to cope with local real needs and opportunities. ECORailS consortium is convinced that the four sites in this way can represent the most relevant situations which may occur in the EU when integrating energy efficiency and environmental criteria in regional rail awarding procedures and contracts.

Some PTAs and TOCs were actively involved in the test process, both for the preparation of the text modules and the estimation of the potential savings. Many other national stakeholders had the opportunity to be informed and to give their feedbacks during the Site Stakeholders Groups meetings and other events.

The main results can be summarised as follows, according to the project key targets:

1. **Representativeness:** the four sites gave a picture of the existing different situations in the EU and of the feasible improvements, about:
 - status of regional rail services;
 - use of energy efficiency and environmental criteria.
2. **Legal feasibility:** all sites considered feasible to implement the ECORailS Guidelines in the present legal framework and wrote text modules, but this process could be helped a lot by:
 - an impulse by the EU and the Governments;
 - more homogeneous rules in Europe (e.g. compulsory energy meters, charging the TOCs for the real consumption of electricity, assessment of the energy consumption of vehicles by the manufacturers when rolling stock is provided).
3. **Manageability:** the four sites practiced the ECORailS Guidelines, collected the stakeholders' opinions and supported the preparation of an user friendly final version;
4. **Energy and emissions savings:** on-field measurement, simulations and discussions with the stakeholders showed the reachability of the 5%, 10%, 15% ECORailS KPIs.

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2. Aims and Approach

Work Package 4 performed concrete tests where the ECORails Guidelines were used to review or to simulate real awarding procedures. Four sites have been involved in WP4:

- Berlin-Brandenburg (Germany);
- Øresund (connection between Denmark and Sweden);
- Timișoara (Romania);
- Lombardia region (Italy).



FIGURE 1: THE 4 ECORAILS TEST SITES

Each site formulated an awarding text by integrating energy efficiency and environmental criteria into awarding documents which have already been used or could be used in its real-life. The execution of the tests was framed by a common test methodology, although the four sites have relevant differences, due both to their baselines and to the willingness to cope with local real needs and opportunities. ECORails consortium is convinced that the four sites represent the most relevant situations which may occur in the EU when integrating energy efficiency and environmental criteria in regional rail awarding procedures and contracts.

The WP4 management plan was described in D12 and the methodological approach was outlined in D13. WP4 also benefits of interactions with WP5. All sites had a common organisation, as showed in picture 1, where a relevant role was given to the national stakeholders, who had the opportunity to give feedbacks regularly as members of a Site Stakeholders Group.

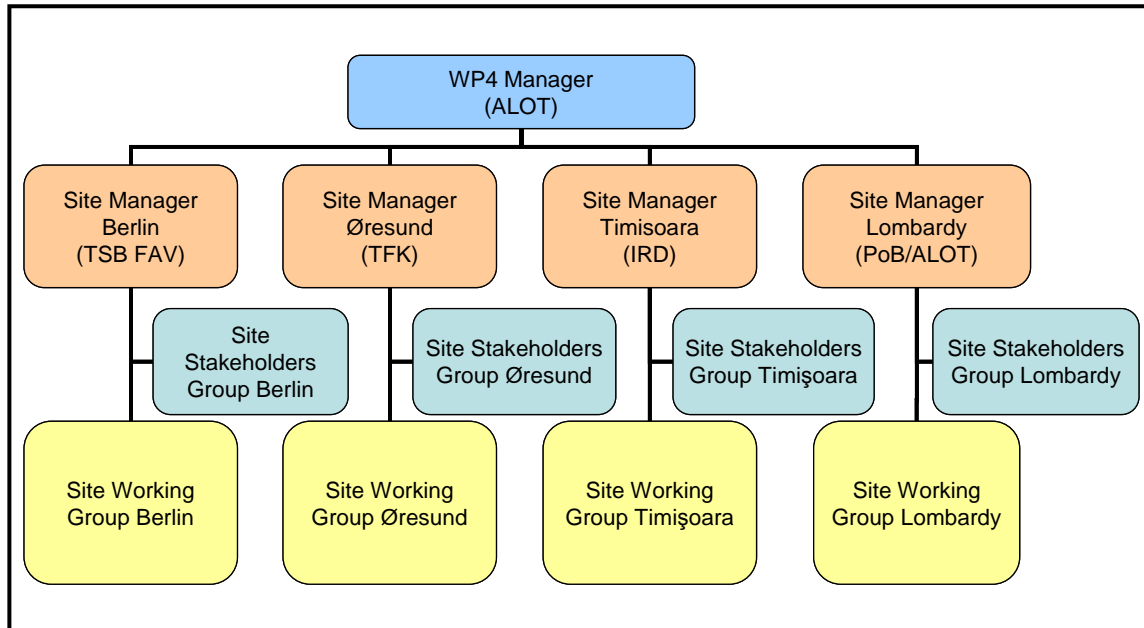


FIGURE 2: ORGANIZATION OF THE WP4 TEST SITES

The execution of each pilot application was divided into 4 main phases, called “Steps”:

- Step 1. Preparation of the tests, from April to September 2010
- Step 2. Definition of the Scenarios, from June to September 2010
- Step 3. Execution of the test, from August 2010 to January 2011
- Step 4. Analysis of the results, from December 2010 to February 2011

The methodological approach developed for WP4 is necessarily flexible, because of the various awarding objects and contexts existing in the four test sites. The methodology presented in D13 provided the key guidelines for the main steps of the pilot applications:

- How the awarding texts prepared by the test sites can be examples of how the criteria presented in the ECORailS Guidelines can deal with concrete local needs.
- How the interaction with the site stakeholders can be managed, mainly to validate the ECORailS Guidelines manageability and effectiveness.
- How the pilot applications can give a feed-back about the improved energy efficiency and reduced CO2 emissions by applying the ECORailS Guidelines (estimation of the project key performance indicators).
- In which way the pilot applications can provide contributions to the final version of the ECORailS Guidelines by incorporating both the stakeholders’ feedbacks and the text modules.

The WP4 outputs may be summarised as follows:

- 3 deliverables (D12, D13, D14);
- 4 awarding texts serving as examples for energy efficient/environmental friendly and sustainable awarding in Europe (see Volume II);
- site stakeholder group meetings;
- 1 international workshop with the administrations on the common and site-related goals of the pilot applications;

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- 1 international workshop with the administrations on the methodology of the pilot applications;
- 1 User Platform workshop on the results of pilot applications (administration level).

Presentations of the test results at international dissemination events (e. g. UIC, CER, UITP conferences) are on the agenda during ECORailS and in the following months.

The present Deliverable 14 gives a full report of the activities and results in the four test sites. The document is shared in four main paragraphs:

- The Site description paragraph provides useful information to evaluate the relevance of the pilot applications results on a European scale and their transferability.
- The Baseline data give a picture of the present status of energy efficiency and of the environmental policies in the four countries.
- The Test activities reports paragraph tells what was done by the test sites during the pilot applications.
- The Achieved results paragraph explains in details the outcomes of each pilot application, having a look to all their dimensions: text modules, quantitative and qualitative estimations, stakeholders' feedbacks, and improvement of the ECORailS Guidelines.

All the above listed contents are part of Volume I. Several other useful documents developed during the pilot applications are annexed, shared in other two volumes: Volume II contains the text modules prepared by each test site; Volume III collects additional information and reports.

The ECORailS consortium and the WP4 Manager, ALOT, thank very much the four Site Managers, Working Groups and Stakeholders Groups for the fruitful and open cooperation during the pilot applications.

3. Description of the Test Sites

The key features of the four ECORailS test sites are depicted in this paragraph. Several issues are included:

- geography and land use;
- economy and society;
- institutional organisation;
- the present regulatory framework for regional rail transport;
- regional rail infrastructures and traffic.

The four test sites altogether well represent the actual status of regional rail in Europe from two main perspectives: their territorial features and the progressive adoption of a common regulatory approach.

3.1. Berlin-Brandenburg (Germany)

The Berlin-Brandenburg test site hosts a big national capitol placed in a low density region as regards population. For the economy, it is a developing area inside one of the most developed countries in Europe and in the world. Several institutions share the administrative powers, while regional rail transport is regulated according to the German approach: competitive awarding of the services and the institutions acting as PTA supported by an agency (VBB) for practical duties, including the management of the awarding. Rail infrastructures are not recent, but well structured as well as the regional (R), regional express (RE) and suburban (S) services. The average 42% load factor takes into account the different situation in the urban area and in the outskirts.

3.1.1. Geography

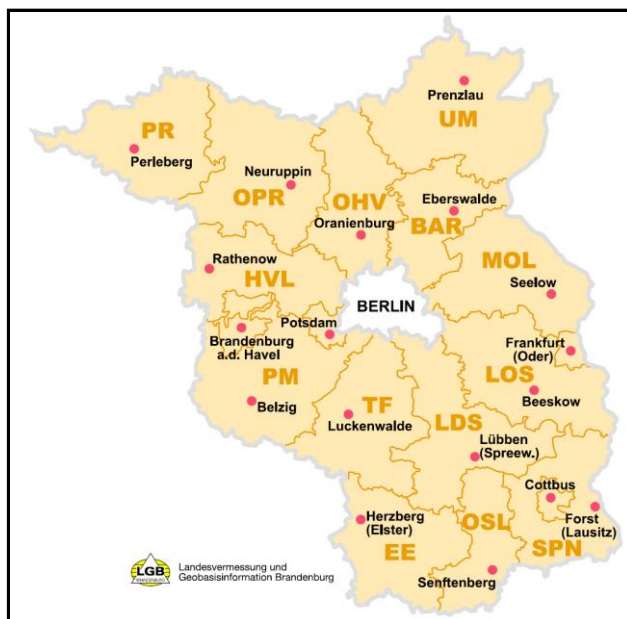


FIGURE 3: BERLIN AND BRANDENBURG MAP

The German Capital Region consists of the two Federal States Berlin and Brandenburg. The region has a total area of 30,367 km² (Berlin: 889 km², Brandenburg: 29,478 km²). Nearly 6 million people are living in the region (Berlin: 3.4 million, Brandenburg: 2.52 million). The largest cities are Berlin (Federal Capital with 3.4 million inhabitants) Potsdam (Brandenburg Capital with 155,000 inhabitants), Cottbus (102,000 inhabitants), Brandenburg (Havel) (72,000 inhabitants) and Frankfurt (Oder) (61,000 inhabitants).

The population density differs very much depending on the location: on the one hand there is the Federal State Berlin with an average population density of 3,869 inhabitants per km², on the other hand the Federal State Brandenburg with an average of 87 inhabitants per km². The Brandenburg population density differs within a wide range: from Potsdam (788 inhabitants per km² to the Prignitz administrative district in the north-east with 42 inhabitants per km².

Up to 2030 the following general developments are expected as regards population: slight decrease in Berlin, slight growth in the surrounding hinterland (especially Potsdam) and a strong decrease in the outer Brandenburg administrative districts.

3.1.2. Economy and Society

Economic fields of competence

According to the common innovation strategy of the Federal States of Berlin and Brandenburg the following fields of competences has been defined to be further developed: Biotechnology, ICT/Media, Medical Technology, Optics/Microsystems Technology, Power Engineering, Transport, Mobility and Logistics.

Gross income

The real GDP in 2009 declined in Berlin by -0.7% and in Brandenburg by -2.1%, that is below average when compared with other Federal States in Germany (-4.7%). According to the Berlin department for statistics, the GDP in power purchase parity in Berlin was 90.1 billion € in 2009 and 54.9 billion € in Brandenburg¹.

In 2008 the GDP per inhabitants has reached 99 % of the EU27 average in Berlin and 82% in Brandenburg².

Education

421.708 students are currently enrolled in a high school program in Berlin (12% of Berlin's population) and around 140.070 students are enrolled in a university program (4% of Berlin's population). In Brandenburg, there are currently 294.643 high school students (12% of Brandenburg's population) and 46.865 university students (2% of Brandenburg's population).

21% of the Berlin and 13% of the Brandenburg inhabitants have a university degree.

Levels of government and institutions

Berlin consists of 12 urban districts, which have each their own administration. The state government is the Berlin Senate. The Federal State of Brandenburg consists of 14 administrative districts (Barnim – BAR, Dahme-Spreewald – LDS, Elbe-Elster – EE, Havelland – HVL, Märkisch-Oderland – MOL, Oberhavel – OHV, Oberspreewald-Lausitz

¹ www.berlin.de

² Eurostat news release, 28/2011 - 24 February 2011 <http://www.eds-destatis.de/en/press/download/2011/02/028-2011-02-24.pdf>

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(OSL, Oder-Spree – LOS, Ostprignitz-Ruppin – OPR, Potsdam-Mittelmark – PM, Prignitz – PR, Spree-Neiße – SPN, Teltow-Fläming – TF, and Uckermark – UM) and 4 urban municipalities (Brandenburg (Havel) – BRB, Cottbus – CB, Frankfurt (Oder) – FF, and Potsdam – P) with their own administration. Seat of the Brandenburg State Government is Potsdam.

3.1.3. Regulatory framework for transport

Institutions and functions

The Federal States of Berlin and Brandenburg – namely the Berlin Senate Department for Urban Development (SenStadt) and the Brandenburg Ministry for Infrastructure and Agriculture (MIL) – are acting as PTAs for Regional Railway Transport services for Passengers (RRTP).

Because of the Federal State of Berlin is completely enclosed by the Federal State of Brandenburg, strong dependencies exist. In that case it is of major interest for both PTAs to follow a common strategy in terms of RRTP awarding.

On behalf of both Federal States the Transport Association Berlin-Brandenburg (VBB) is dealing with the administrative issues of RRTP awarding. Taking into consideration the political targets of the PTAs, VBB manages all phases of the awarding process from preparation of the awarding documents up to the monitoring during the service contract period. VBB is a private limited company according to German law (GmbH) which is owned by the Federal States of Berlin and Brandenburg and the Brandenburg administrative districts and urban municipalities. VBB coordinates the 41 public and private companies which are offering public transport services within the region. There is a big advantage for passengers to have a consistent tariff which is independent from the operator.

Contracts and tenders for service in force and planned

From 1996 to 2002 some RB line has been directly awarded (approximately 7 Mio. train*km per year); in 2002 competitive awarding of RB lines in Berlin-Brandenburg has been started. Until 2007, approximately 7.4 Mio. train*km have been awarded.

For the first time some RE lines have been awarded in 2009 with the Stadtbahn network: with 4 lots and more than 22 Mio. train*km it was the largest awarding process ever in Berlin-Brandenburg. That is about 50% of all yearly train*km which are operated with RB and RE lines in Berlin-Brandenburg. The operation of most awarded RB lines started in December 2011, RE lines in December 2012.

In 2010, 2.5 Mio. train*km per year have been awarded (two RE and two RB lines). An awarding of about 10 Mio. train*km per year (two RE lines) is currently in process.

The operation of the Berlin S-Bahn network has been awarded to DB for the last time in 2004. The current service contract is running until 2017.

The future strategy of VBB is to handle maximum 10 service contracts each of them 10 years long. In the consequence VBB aims to manage one awarding procedure per year.

How subsidies are decided and paid for services and rolling stock

For the awarding of the Stadtbahn network the offers were evaluated with a weighting of 70% for the price and 30% for quality criteria including the request for an environmental concept. The requirements were given not as a minimum standard. The limit values of TSI Noise have

been fulfilled by all vehicles, but the requirements of the awarding were slightly stronger and have not been fulfilled. A stepwise increase of limit values for noise is not foreseen.

3.1.4. Traffic

Berlin is a good example of a European capital city with a dense and effective public transport network, including a relevant urban and suburban service provided by the rail. Brandenburg is connected to the city by Regional and Regional Express trains with a lower load factor. Two RE lines have been selected for the ECORailS pilot application: RE6 and RE7. The regular interval timetable is in use everywhere.

The following table gives some traffic related information for both Federal States, while detailed data for the two RE lines selected for the pilot application are not available.

Topic	Federal State Berlin	Federal State Brandenburg
Car ownership	317 cars/1,000 inhabitants	497 cars/1,000 inhabitants
Number of travellers: season tickets, daily tickets	For Berlin and Brandenburg, 2009 (according to VBB): - Total: 1.260 Mio. - Season tickets (Zeitkarten): 390 Mio. (31%) - Daily tickets (Bartarif): 690 Mio. (55 %) - Other tickets: 180 Mio. (14 %)	
Average distance (time) travelled	7.5 km at a weekday (all modes, also bus and tram and underground services) ³	
Passengers*km	8,360 Mio. pass*km (VBB, 2009)	3,113 Mio. pass*km (VBB, 2009)
Seats*km	27,591 Mio. seat*km (VBB, 2009)	
Load factor	42 % (calculated average value, VBB, 2009)	
Average income: season tickets, daily tickets	852 Mio. € (gross income, VBB, 2009)	207 Mio. € (gross income, VBB, 2009)

TABLE 1: TRAFFIC RELATED INFORMATION FOR BERLIN AND BRANDENBURG

3.1.5. Infrastructure

The following tables give a picture of the main technical features of the regional rail infrastructures in the Federal States Berlin and Brandenburg, with details on both lines (RE6 and (RE7) involved in the ECORailS Pilot Application.

Topic	Federal State Berlin	Federal State Brandenburg
Network of RRTP: total	468 km	2,214 km
Network of RRTP: main lines (mostly operated with Regional-Express, Intercity, Freight)	211 km	1,456 km
Network of RRTP: Regional lines (mostly operated with Regional-Bahn)		680 km
Network of RRTP: S-Bahn	257 km	78 km
Number of stations	151	334
Traffic Performance (train*km per year)	35 million train*km/a	35 million train*km/a

TABLE 2: REGIONAL RAIL INFRASTRUCTURES IN THE FEDERAL STATES BERLIN AND BRANDENBURG.

³ According to Die kleine Berlin-Statistik 2010.

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Topic	line RE6	line RE7
Length	168 km	171 km
Number of tracks	Single track: 142 km Double track: 25 km	Double track
Traction	83% Diesel 17% 15 kV/16.7 Hz AC	100% 15 kV/16.7 Hz AC
Profile: curves, tunnels, slope	Slope: < 20 pro mille	Slope: < 20 pro mille
Speed: maximum, number of restrictions (for curved sections, level crossings, ...)	<ul style="list-style-type: none"> ▪ Wittenberge - Neuruppin (92 km): 55% of tracks with v_max = 120 km/h ▪ Neuruppin – Hennigsdorf (46 km): 90% of tracks with v_max = 120 km/h ▪ Hennigsdorf – Falkenhagen (16 km): 83% of tracks with v_max = 120 km/h ▪ Falkenhagen – Berlin-Spandau (14 km): 46% of tracks with v_max = 250 km/h 	<ul style="list-style-type: none"> ▪ Dessau – Roßlau (Elbe) (5 km): v_max = 160 km/h ▪ Roßlau (Elbe) - Wiesenburg (Mark) (29 km): v_max = 120 km/h ▪ Wiesenburg (Mark) – Berlin-Charlottenburg (78 km): 69% of tracks with v_max = 160 km/h ▪ Berlin-Charlottenburg - Berlin Ostbahnhof (Berlin Stadtbahn = 11 km): 100% of tracks with v_max= 60 km/h ▪ Berlin Ostbahnhof – Berlin Schönefeld Flughafen (18 km): 37% of tracks with v_max = 120 km/h ▪ Berlin Schönefeld Flughafen – Wünsdorf-Waldstadt (30 km): 31% of tracks with v_max = 160 km/h
Number of stops	21	31
Signalling and safety technologies for the spacing of trains	<ul style="list-style-type: none"> ▪ Signalling: main and distant signals ▪ Automatic train control system: PZB90: 132 km/ without ATC:35 km 	<ul style="list-style-type: none"> ▪ Signalling: main and distant signals ▪ Automatic train control system: PZB90
Fixed installations to provide energy and fuel	Nearest filling stations: <ul style="list-style-type: none"> - Neuruppin (nearby the RE6 track), - Berlin Lichtenberg, Seddin (not nearby the RE6 line) 	

TABLE 3: INFRASTRUCTURES USED BY THE RE6 AND RE7 LINES.

3.2. Timișoara region (Romania)

The Timișoara region is made by a mixed urban and rural landscape, with, on average, low density settlements of the population. It well represents the developing economy of many countries in Eastern Europe, supported by an important university. Four Counties and 12 Municipalities share the administrative powers, while regulation of regional rail transport is centralised: the national Government acts as PTA and the services are directly awarded to the national TOC, except for the non-interoperable lines. The rail infrastructures involved in the Pilot Application are one diesel secondary line and one electric main line. The average 56% load factor is high, in comparison with the Italian and German test sites.

3.2.1. Geography

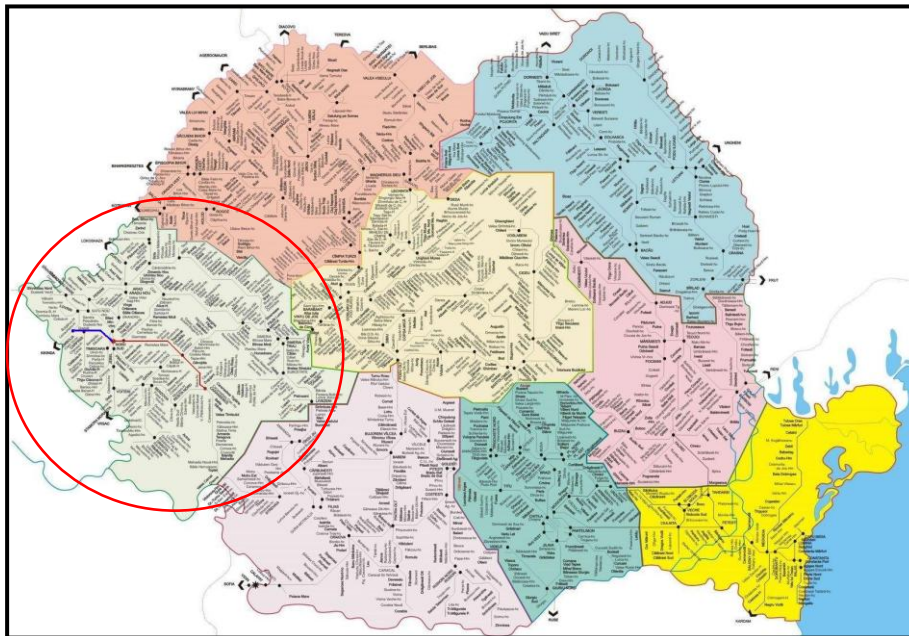


FIGURE 4: MAP OF ROMANIA WITH THE TIMISOARA REGION AND THE TEST LINES (IN THE RED CIRCLE).

The pilot application site is situated in the Western part of Romania, at the border with Hungary and Serbia. It is 32.034 km² wide. The minimum height is 70 m. and the maximum height is 740 m (higher settlement: Banita, lower settlement: Ionel).

The region is shared in 4 counties (Arad, Caraș-Severin, Hunedoara, Timiș) and 12 Municipalities.

The population is 1,904,200 inhabitants (2010), with an average density of 60.1 inhabitants/km² (2007).

Land use: mixture between occupied (63.6% urban settlements and 36.4% rural settlements) and agricultural areas.

3.2.2. Economy and Society

The main economic sectors in Timișoara region are agriculture, mining, industry, commerce and tourism.

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The development rate is higher than the Romanian average, second largest economic level and growth in the country. Gross income GDP (gross domestic product) reaches 42.995,7⁴, while the GDP European index per capita is 48,2⁵.

The foreseen population is declining (- 8,3% until 2025⁶). On average, the population in the region is ageing⁷.

542 schools and 14 higher education institutions are working in the Timișoara region. The population is distributed according to the level of education as follows: 13.2% higher education graduates, 4.7% vocational training graduates, 34.9% high school graduates, 18.1% secondary school graduates, 3.8% primary school graduates.

There are three levels of government: Central (the national Government), Regional (4 County councils), Local (12 local councils). Only the central level of administration has the power to regulate the transport sector. Other relevant institutions are the county Chambers of commerce and the county Agencies for Economic Development and for the Environment⁸.

3.2.3. Regulatory framework for transport

Institutions and functions

The passenger transport by rail takes place under the coordination of the Ministry of Transport and Infrastructure (MTI), the specialized body of central public administration, with legal personality, subordinated to the Romanian Government. The Ministry signs two kinds of awarding documents: a contract with the national Infrastructure Manager (CFR) and several public service contracts (PSC) with the national rail passenger transport operator (CFR Calatori) and with other companies that deal with passengers' public transport. RTFC Timișoara, which takes part to the ECORailS pilot application, is one of the 8 regional branches of CFR Calatori, without legal personality of its own.

Contracts and tenders for service and rolling stock

The PSC for interoperable lines is awarded directly by The Ministry of Transport and Infrastructure to the National Company for Railway Passenger Transport. Private operators may only participate at tenders for public transport service on non-interoperable lines. Rolling stock is awarded from public funds through tenders, being direct awarding prohibited by the public acquisitions law OUG 34. Private operators may use their own rolling stock or rolling stock leased from the National Railway Company.

Who does what

The PSC between the Ministry and CFR Calatori asks CFR Calatori to arrange and operate the necessary number and categories of trains to ensure the public social service. The minimum number and the categories of trains to run on rail sectors, which represent the

⁴ National Statistics Institute (NSI) - "Romania's Statistical Yearbook", 2010, Romanian currency.

⁵ Eurostat, February 2010, Romanian currency.

⁶ INS, Projection of Romania's population in territorial profile until 2025, p.21.; Romania's Statistical Yearbook 2006

⁷ Age: 88034 (0-4), 90394 (5-9), 99236 (10-14), 139915 (15-19), 144861 (20-24), 149126 (25-29), 150791 (30-34), 176903 (35-39), 112415 (40-44), 130191 (45-49), 145064 (50-54), 128488 (55-59), 90705 (60-64), 92131 (65-69), 77288 (70-74), 59559 (75-79), 33727 (80-84), 15614 (>85).

⁸ Institutions: County Council Caras-Severin, County Council Timis, County Council Hunedoara, County Council Arad, Chamber of Commerce, Industry and Agriculture Arad, Chamber of Commerce, Industry and Agriculture Hunedoara, Chamber of Commerce, Industry and Agriculture Caras-Severin, Chamber of Commerce, Industry and Agriculture Timis, County Agency for Economic Development Hunedoara, County Agency for Economic Development Timis, Regional Environment Agency Timisoara, Local Environment Agency Timisoara, Local Environment Agency Arad, Local Environment Agency Caras-Severin, Local Environment Agency Hunedoara.

minimum social package, can be modified by order of the MTI, in order to be adapted to market conditions or eventual modifications made to the technical infrastructure and proper adjustment of the compensation awarded according to the legislation. CFR Calatori/RTFC Timișoara provides the following services:

- National and international passenger traffic trains as stipulated in the train timetable, with additional trains or special order trains.
- Different transport capabilities based on comfort and service class coaches (cl. I and II, bed cars, saloon cars, business cars, restaurant and bar cars).
- The possibility of renting passenger cars of various types and categories.
- Sale of tickets in advance up to 30 days in national traffic and up to 90 days in international traffic.
- Information for passengers in the stations and trains, through its own information offices, media, web-site and train staff, on the travel rates, commercial offers and other useful information.

How subsidies are decided and paid for services and rolling stock

The Government grants for the rail transport subventions that change periodically. The 8 branches of CFR Calatori receive part of these subventions corresponding to the volume of their activity. In the same way, RTFC Timișoara receives subventions too. The level of the subsidies to be covered from the state budget as payment of public transport service is decided according to the “net cost” (difference between the costs incurred and the incomes from fares, plus the profit share).

The national operator’s rolling stock fleet is modernized and/or replaced through own funds or grants from the state budget, from external financing and from European funds.

3.2.4. Traffic

The CFR Calatori lines in the Timișoara region accounted 8,126,725 travellers in 2009 and 6,953,855 in 2010, with a declining trend. Passengers*km were 773,850,085 in 2009 and 663,057,379 in 2010. The average load factor in 2009 was 56%.

The produced service reached 9,930,809 train*km in 2009 and 9,414,349 in 2010.

The average income from season tickets was 14,678,450 € in 2009 and 12,703,627 € in 2010; from daily tickets it was in 2010 42,756 €/day in summer and 35,630 €/day off-season.

The average distance travelled by the carriages was 464.91 km/day in 2009 and 422.11 in 2010; by the traction units it was 1,430 km/day in 2009 and 1,586 km/day in 2010.

3.2.5. Infrastructure

Rail infrastructure in the Timișoara region has the following features:

- Total length: 3155.06 km (including private operators) out of which 1374.321 electrified.
- Current tracks: 2235.01 km out of which 967.159 km electrified; tracks from stations: 920.045 km, out of which 920.045 km electrified.
- Number of tracks: Main railways (infrastructures which allow higher speeds and weights): 6 lines totalizing 834,268 km; main lines: 6 lines totalizing 289,349 km; secondary lines: 40 lines totalizing 1,111,398 km.
- Traction: Electric: 43.56%; Diesel: 56.44%.

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- Profile: length of curves on current line: 609.52 km; Tunnels: 39 totalizing 8.121 km. Bridges and platforms: 3226; Maximum slope: main railways (21‰), main lines (10,2‰), secondary lines (23‰).
- Speed: Maximum: 120 km/h, Minimum: 20 km/h; Permanent speed restrictions: 167 cases.
- Signalling and safety technologies for the spacing of trains: Signalling devices used: 1) Signalling with two speed stages; 2) signalling with multiple speed stages. Safety and alertness devices: INDUSI and DSV (SIFA).
- Fixed installations to provide energy and fuel:
 - Electric traction: 22000-27000V alternating current, supplied by substations located at about 40 km one from another.
 - Diesel traction: filling stations at the Timișoara and Arad depots, and Caransebeș, Lugoj, Oravița și Simeria sheds.

3.3. Øresund (Denmark-Sweden)

The Øresund test site covers the international link between Denmark and Sweden, including one line in the Copenhagen metropolitan area; both services also stop at the airport. The international link can well be classified as regional because the two cities Copenhagen and Malmö are part of a unique transnational agglomeration since the Øresund bridge and tunnel were built. This complex area includes a mixed urban and rural settlement with a high population density. As regards the economy, both the Danish and the Swedish sides are well developed, but the Copenhagen metropolitan has more inhabitants. Several institutions, on two levels (Regions and Municipalities) share the administrative powers. Rail transport is regulated by the national Government in Denmark and by the Regions in Sweden. The Øresund rail service was awarded by competitive tendering, following a co-operative procedure between the two countries. Rail infrastructures are fast and modern; alternate current with different frequency are supplied in the two countries. The load factor is high and the users are growing: passengers of the Øresund rail link are mainly commuters who live in Sweden and work in Copenhagen.

3.3.1. Geography



FIGURE 5: MAP OF THE DANISH RAIL NETWORK, SHOWING THE ØRESUND LINK.

The Øresund region consists of Skåne on the Swedish side of Øresund and of Sjælland (Zealand), Lolland, Falster, Møn and Bornholm on the Danish side. The region has a total area of 21,203 km², of which 11,369 km² are on the Swedish side and 9,834 km² are on the Danish side.

There are 3.7 million people living in the region, most of them on the Danish side. The average population density is 176 inhabitants per km², but the population density is greater

on the Danish side of Øresund with 254 inhabitants per km² compared to 108 inhabitants per km² on the Swedish side of Øresund.

Geographic variation is considerable, from relatively sparsely populated rural communities in Lolland and in eastern Skåne to dense urban areas such as Copenhagen and Malmö. The largest municipalities on the Danish side are Copenhagen (528,000 inhabitants), Frederiksberg (97,000 inhabitants), and Roskilde (82,000 inhabitants). The largest municipalities on the Swedish side are Malmö (294,000 inhabitants), Helsingborg (128,000 inhabitants) and Lund (109,000 inhabitants).

The Danish and Swedish parts of the Øresund region are linked together by the 16 km long Øresund Bridge in the south, between Copenhagen and the Greater Malmö area, as well as ferry lines that run in northern Øresund between Helsingør and Helsingborg.⁹

3.3.2. Economy and Society

There are still no regional statistics on economic development in the Øresund region after 2007, but from a historical perspective, economic growth in the Øresund region has relatively high covariance with the national development in Denmark and Sweden. In both countries GDP is assumed to begin to grow in 2010. Growth in Sweden is predicted to lie at 2.7%, while Danish growth is expected to be around 1.3%.¹⁰

The Øresund region had approximately 3,732,000 inhabitants at the turn of the year 2009-2010. There are roughly 2,501,000 people living in the Danish part and 1,231,000 in the Swedish part. The average age on the Danish side of Øresund region is 39.6 and 40.8 in the Swedish side.¹¹

One third of the population between the ages of 25 and 64 in the Øresund region has a university or other higher education, which is above the national average for both Denmark and Sweden.¹²

Regional administration is made up on the Swedish side by Region Skåne (Skåne County) and 33 municipalities. On the Danish side the regional administration is made up of the Capital Region of Denmark, Region Zealand and 46 municipalities. On January 1, 2007 a new Danish municipal reform was enacted and a number of municipalities were combined to larger and smaller units. The number of municipalities has decreased from an earlier 99 to a present 46 municipalities. At the same time as the municipal reform, the earlier counties were annulled and replaced by two larger regions, the Capital Region of Denmark and Region Zealand. The Capital Region of Denmark consists of 29 municipalities and Region Zealand consists of 17 municipalities.¹³

3.3.3. Regulatory framework for transport

Denmark

In general, European legislation is used in awarding rail services. The national legislation concerning railway is described in "Bekendtgørelse af lov om Jernbane"¹⁴ and the relevant legislation concerning awarding is described in chapter 4 §8. This mainly covers the general

⁹ <http://www.tendensoresund.org/sv>

¹⁰ Ibid

¹¹ Ibid

¹² Ibid

¹³ <http://www.tendensoresund.org/sv>

¹⁴ Available at <https://www.retsinformation.dk/Forms/R0710.aspx?id=115614>

principles, for example that the ministry is responsible for establishing public service contracts (PSC) and also for choosing the awarding procedures to be used. The national legislation also requires DSB to provide rolling stock for public railway services and gives the ministry the right to award PSCs directly to DSB (for a compensation).

Sweden

Regional PTAs are responsible for regional rail. Regional railway services (except for SJ traffic) are usually awarded through competitive tendering. Direct awarding is allowed but used only in a few cases.

The railway passenger market is however still dominated by the former monopolistic enterprise “Statens Järnvägar” (SJ). SJ has the exclusive right to operate profitable interregional train services (which services are considered profitable is decided by SJ): this is about to change during the year 2010. Non-profitable, but essential interregional train services are awarded through competitive tendering procedures by Rikstrafiken, the state-owned tendering authority for this purpose. Since the development is that county borders to a lesser extent are representing the functional regions, interregional rail services are more and more important also for regional purposes. Due to this development there are currently ongoing experiments where the responsible PTAs is given the right to award services crossing the county borders. In some cases, two or more PTAs cooperate in awarding of non-profitable train services on behalf of Rikstrafiken.

In the case of rail services awarded by PTA, in general, the PTA is the provider of rolling stock. The rolling stock is usually provided through Transitio, a company which is jointly owned by most of the Swedish PTAs. Transitio is responsible for the awarding of rolling stock on behalf of the PTA.

3.3.4. Traffic

Train traffic has undergone a development; from 2001 to 2009 passenger rail traffic has increased from 4.9 million to 11.1 million passengers – an increase of 125%. In 2009, 56,800 passenger trains and 7,250 freight trains crossed the bridge.

The Øresund train has functioned mainly as an internal means of transport within the region, with 90% of the passengers travelling regionally. Four of five train passengers live in Sweden and one in five in Denmark. A very small percentage of passengers are foreigners. Commuting is also done by rail, where about 60% of the travellers on the Øresund train are commuting to work or to their studies. The remaining 40% are mostly leisure travellers, while a small percentage are travelling on business or holiday.

Passenger rail traffic is mainly run by DSBFirst, which took over operations of the Øresund train in January 2009. Freight traffic by rail on the Øresund Bridge is divided into several different companies.

On the Danish side, the train network goes past Copenhagen’s Kastrup airport, via Copenhagen’s central station and Nørreport to Helsingør.

On the Swedish side, the network branches out from Malmö to Gothenburg, Kalmar and Karlskrona¹⁵.

¹⁵ <http://www.tendensoresund.org/sv>

3.3.5. Infrastructure

Denmark

The overall network size in Denmark is about 2,132 km. Regional rail transport run on almost the whole network.

The main Infrastructure Manager is Banedanmark, which is responsible for almost the whole national network. There are some regional PTAs which also act as IM for local lines. Furthermore, there is the IM Øresundsbron (common owned by the Danish and Swedish government), which is responsible for managing the infrastructure of the Øresund Link and the IM AS Storebaelt (owned by the Danish government) who is responsible for the Storebælt Link. The Danish part of the IM Øresundsbron as well as the IM AS Storebaelt are part of the holding company Sund & Bælt Holding.

The Infrastructure Managers in Denmark are not integrated companies as they do not concurrently act as a TOC. Thus the disconnection of network and service is fully realised in Denmark. There is a specialty that the IM usually does not own e.g. maintenance facilities or stations. These are mostly owned by the national TOC DSB. In case of tenders, DSB grants access to its facilities to the awarded TOC. The conditions for the use of these facilities are described in the contract.

Sweden

The overall amount of the network size is approximately 12,000 km, which includes the network for regional rail services.

The major part of the infrastructure is owned and operated by Banverket, the Swedish Rail Administration. Banverket is responsible for the railway infrastructure, which includes administration, management and maintenance. Banverket does not operate rail services itself. Banverket is also in charge of co-ordinating local, regional and interregional rail services. It also provides energy for electric traction (AC 16.7 Hz).

The whole Swedish rail energy comes from renewable sources (99.2% hydro power, 0.8% wind power). Currently there is no alternative energy provider within Banverkets grid. Vehicles equipped with a system for energy recovery are receiving full compensation for the energy recovered. Banverket does not provide fuel for diesel traction.

Other IM that are partly concerned with regional railways are Öresundsbrokonsortiet (The Öresund bridge) and SL, the PTA in Stockholm (IM for light rail and underground). They also do not operate any rail services.

The tracks and platforms at stations and terminals are owned and maintained by Banverket, while the buildings and waiting areas are usually owned by the public owned company Jernhusen or to a lesser extent by the responsible PTA. TOCs have to pay an access fee to Jernhusen.

Pilot Application

Both lines involved in the ECORailS Pilot Application run on the same infrastructure.

The length of the Nivå-Kastrup service is 44.3 km. and the length of the Danish part of the Elsinore - Kastrup - Malmö service is 60.8 km.

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Traction

The main lines are electrified with AC 50 Hz while the neighbouring networks of Sweden and Germany use AC 16.7 Hz. The S-tog network in Greater Copenhagen uses DC 1.5 kV. However, a lot of the infrastructure is not yet electrified.

3.4. Lombardia region (Italy)

The Italian pilot application involves two separate areas in Lombardy:

1. the Valcamonica valley, from Brescia to Edolo, that hosts a regional diesel service connecting the Brescia metropolitan area, rural villages and the mountains;
2. part of the Milan metropolitan area from Milan to Saronno, served by the S3 suburban line.

Valcamonica, Brescia and the Milan area are very different and cover several features of the regional rail service in northern Italy: Valcamonica is a mixed land going from the plain to the hills, the lake and the mountains; Milan and Brescia are the two main cities in Lombardy. On average the population density is very high. Three levels of government act in the test area: Region, Provinces and Municipalities. For regional rail, the Regional Government of Lombardy plays the role of PTA: it decides the service specifications and pays the financial compensations. Province of Brescia shares the regulatory duties with the Region for the Valcamonica line because of its relevance for local mobility. The whole service is now directly awarded, after past pilot experiences of competitive tendering. The users of regional rail are growing and the load factor is close to the Berlin figure for the S lines and lowers for the Valcamonica line.

3.4.1. Geography

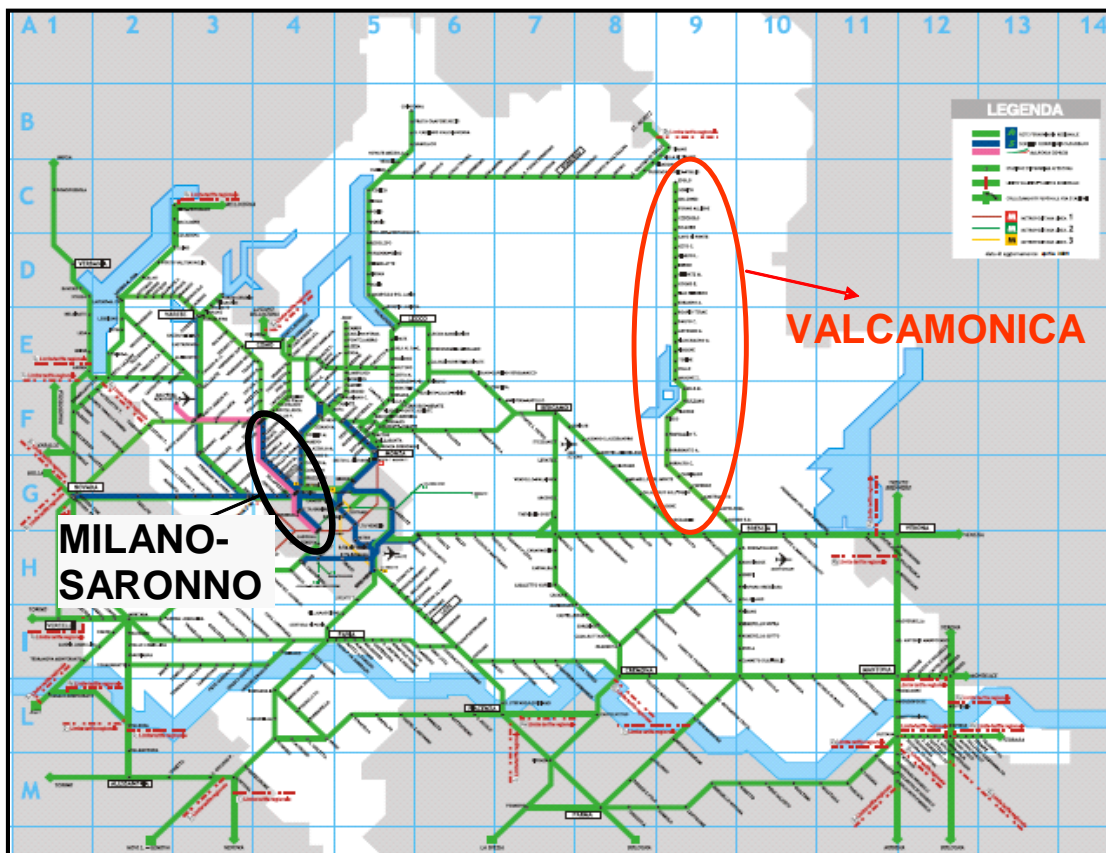


FIGURE 6: MAP OF THE LOMBARDY RAIL NETWORK, SHOWING THE TEST LINES.

Valcamonica is one of the longest Italian valleys (about 90 km.) from the Iseo lake (198 m. above sea level) to the Tonale pass (1,883 m. above sea level). The railway starts 20 km.

south from Iseo in the city of Brescia, the second bigger city in Lombardy (192,000 inhabitants). The rail service does not reach the pass, but ends in Edolo (700 m. above the sea level). The section from Brescia to Iseo passes through the suburbs of Brescia and the wining hills of Franciacorta. The whole area served by the rail is about 825 km², with 48 Municipalities, Brescia included, and 356,500 inhabitants in 2010. Most inhabitants of Valcamonica live in the lower and medium parts of this valley, in the plain between the Iseo lake and the steep slope which reaches Edolo.

Milan and the surrounding Provinces form a spread urban area densely populated with increasing traffic congestion and a great need of rapid and high capacity public transport. S3 serves, together with line S1, Milan (1.3 million inhabitants in 2010) plus other 6 Municipalities (151,600 inhabitants in 2010). The land profile is flat and mainly sub-urban or urban with a high density of population (6,193 inhabitants/sq. km.), although a slice of the Groane natural park is crossed by the railway.

3.4.2. Economy and Society

Lombardy is the leading Italian Region with regard to economy and industrial development and one of the most important in Europe. Its gross product is a quarter of the national one, while the average gross product for each inhabitant reaches 33,600 € and the European PPS index (base EU27 = 100) is 134.8 (Italian average index is 103.4)¹⁶. Manufacturing and services are the main sectors, but, as usual in a modern society, the tertiary sector employs 63% of the workers.

Population is increasing every year (about 9,7% in the last 10 years), mainly because of the continuous flow of immigrants from other Italian regions and from abroad. There are many young families with a high birth-rate. The educational qualification is usually good: 90% of the inhabitants have a medium degree; one third reaches the high school and 12% the university.

The above mentioned good and dynamic situation describes well the Milan area, while the Valcamonica line passes through different economic landscapes:

- textile and mechanical industries in the lower and middle parts of the valley, today affected by the global crisis;
- tourism and big hydroelectric power plants in the higher part of the valley.

Commuting to Brescia and to Milan is a common feature of both lines. As usual in mountain areas, social and income indicators are lower in Valcamonica than in the Milan area, such as the demographic trends, which are even then positive.

Both areas involved in the ECORailS pilot application have the usual administrative organisation in Italy with three administrative levels: the Region (Lombardy), the Province (Brescia, Milan and Varese), the Municipalities. Powers and competences are allocated among these bodies according to the spread of each service, so that decisions are taken at the closest level to the people. In mountain areas, where the Municipalities are often very small, some activities have to be run jointly by organisations established by the Municipalities called Mountain Communities: the Valcamonica line runs through the Mountain Communities Valle Camonica and Sebino Bresciano.

¹⁶ Annuario Statistico Regionale, Lombardia, most recent available data.

3.4.3. Regulatory framework for transport

Following the administrative structure, public transport in Lombardy is regulated by three bodies:

1. The Regional Government is responsible for regulating, planning and financing the whole public transport system. It also acts as PTA for the regional rail service by managing the awarding procedures and signing the public service contracts (PSC).
2. The Provincial Governments act as PTAs for the extra-urban bus services; Province of Brescia is also involved in the regulation of the Valcamonica line because it is strongly integrated with buses.
3. Main Municipalities, like Milan and Brescia, act as PTAs for the urban bus and metro services; smaller cities and villages are not autonomous PTAs, but they can finance additional bus connections, especially for pupils.

The establishment of public transport agencies is planned in Lombardy. They will regulate public transport over wider areas, generally including two or more Provinces and their main cities.

The awarding of regional rail services is subject to the EU regulations as implemented by the national law. After having tested competitive awarding of regional rail services in 2003-04 on 3 lines (only S5 line procedure ended successfully), Region Lombardy chose to award directly the whole service to the new joint company TRENORD (TN), formed by the past national and regional incumbents. The regional and national Governments own 50% of the shares each. The long-distance trains (high-speed and most of the InterCity trains) are subject to open market: here, competition among the TOCs is the rule and no public subsidies are admitted.

According to the EU directives, the management of the rail infrastructures is separated from the services and subject to regulations that have the aim to make it possible a fair use of the tracks by many TOCs at the same moment. The national infrastructure is owned and managed by the company called RFI. Lombardy has also a regional infrastructure built by private enterprises in past years: it is owned by the Regional Government and managed by the company FERROVIENORD. The access to the national infrastructure is regulated by law and charges are due by the TOCs for each train path used; the Regional Government is applying the same rule to the regional network too.

3.4.4. Traffic

Valcamonica line can easily depict the situation of an Italian line with middle and somewhere low ridership. The yearly revenues from passengers were about 1.6 million € in 2008 and the revenue for each passenger*km was 5 €cents.

The average number of passengers for each run was 35 in 2008, with 26% occupancy rate. On average each passenger travelled 5 km.

On the contrary, S3 is a typical suburban line, crowded mainly in peak hours. Unfortunately the available data are referred to all suburban and regional service on the FERROVIENORD infrastructure with electric rolling stock¹⁷: yearly revenues from passengers were about 46.6 million € in 2008 and the revenue for each passenger*km was 4 €cents. The average number of passengers for each run was 174 in 2008, with 40% occupancy rate. On average

¹⁷ TRENORD is progressively introducing automatic ticketing; during the present transitional period unfortunately more detailed data for each line are not available.

each passenger travelled 14 km (it should be remembered that electric FERROVIENORD regional tracks go about 46 km far from Milan).

3.4.5. Infrastructure

The whole rail network of Lombardy is 1,921 km. Long; its main part (83%) is managed by the national Infrastructure Manager, RFI, and the remaining by the regional one, FERROVIENORD. Both lines involved in the pilot application are part of the FERROVIENORD network.

Valcamonica line has diesel traction, single track and is 103 km. long.

In the first 68 km. the gradient does not exceed $10^0/_{00}$, while the last section going up on the mountain reaches $22^0/_{00}$.

Maximum speed was recently raised to 80-90 km/h in the first section (from Brescia to Iseo), while it is limited to 60 km/h in the middle valley and mountain sections. Some short tunnels and sharp curves exist in the mountain section and along the Iseo Lake, but main speed restrictions are due to 90 level crossings still working along the whole line.

One dedicated workshop is in Iseo and the depots are placed in Iseo and Edolo, such as the filling installations for fuel.

Signalling was improved recently: a central control room manages the traffic on the whole line without rail-men in all stations; conventional signals protect the stations and the level crossings.

S3 line has electrical DC 3 kV traction and is 21.5 km. long. The infrastructure has 4 tracks: 2 tracks are dedicated to S1 and S3 lines, the remaining to fast trains without intermediate stops. The gradient does not exceed $9^0/_{00}$.

Maximum speed is 85 km/h in the first urban section, mainly underground. The remaining 17 km. allow 120 km/h, but S3 trains do not reach this because of the very short intervals among the stops. The whole infrastructure is segregated, without level crossings and stations shaped like metro stops.

The main depot and workshop of FERROVIENORD is located along S3 line in Novate. Several substations feed the DC current for traction. The Milan Bovisa substation tested devices for the recovery of braking energy because of the big number of fast and suburban trains stopping there.

4. Baseline

This paragraph describes the present situation in the test sites about four main issues that are relevant for the implementation of the EE/Env policies described in the ECORailS Guidelines:

- the present service and the rolling stock in use on the test lines;
- the present energy consumption;
- the awarding documents today in use;
- the local stakeholders' expectations.

Such issues altogether form the starting point for implementing the EE/Env policies and for measuring the achieved results in terms of reduced energy consumption, improved awarding documents and successful use of the Guidelines. For this reason they are called in ECORailS the “baseline” of each test site.

The four test sites have of course different baselines:

- **Berlin-Brandenburg:**
 - mixed rolling stock (new DMUs and old push-pull electric trains) is in use, with non-homogeneous environmental performances;
 - energy consumption is monitored on most trains, but the PTA can not access the data;
 - some environmental policies have been already implemented (especially about noise);
 - competitive awarding of services (rolling stock provided by the TOCs) is the rule: for this reason the stakeholders see the introduction of EE/Env requirements and criteria a key success factor in next awarding procedures.
- **Timișoara:**
 - the old rolling stock prevails, sometimes with modernized engines and this has influence on energy efficiency;
 - energy consumption is monitored on most trains;
 - no law at present imposes limits about the environmental impact of the regional rail, just fragments from different laws encourage a green behaviour, as well as many EC communications and recommendations;
 - regional rail services are directly awarded and the PSC is the main regulatory instrument in use;
 - the local stakeholders are very interested in the ECORailS Guidelines and expect a manageable help, able to bind both the rolling stock manufacturers and the TOCs to significant environmental improvements.
- **Øresund:**
 - the Øresund rail link is operated by dedicated EMUs with good energy performances that could be improved, especially during the parking time;
 - energy meters are available on all trains, but their data are not public;

- on the Danish side neither the law nor the PSC ask any environmental requirement, except for noise emissions and diesel engine emissions; on the Swedish side environmental requirements were included in the contract, covering demand on renewable energy source, routines for recycling of waste disposal and vehicle washing;
 - the Øresund contract was awarded by competitive tendering with two coordinated parallel procedures managed by the Swedish and Danish PTAs;
 - the PTA experts expected from ECORailS a comprehensive Guidelines document including help in constructing the right weighting of Energy Efficiency indicators to be used for future awarding.
- **Lombardy:**
- a big effort to modernize the regional rail service is today running in Lombardy: the consumption data collected by ECORailS on the present mixed fleet showed the benefits of the new DMUs and EMUs in terms of energy efficiency and potential further savings, compared with the older vehicles;
 - no energy meters are at present in use and the energy consumption is not regularly monitored by the TOC;
 - no laws or policies today impose environmental requirements, but some technologies (recovering of the braking energy) and operational measures (eco-driving) are under test;
 - the present way electricity is charged by the Infrastructure Managers to the TOCs should be changed to incentive energy efficiency;
 - as the regional rail service is directly awarded, the PSC is the main regulatory instrument that can be improved following the approach recommended by the ECORailS Guidelines;
 - among the stakeholders, the PTAs expect from ECORailS convincing arguments and are afraid of the risk of new bureaucracy; the external stakeholders, like rolling stock manufacturers, TOCs and Infrastructure Managers, expect the Guidelines to incentive a general use of EE/Env criteria.

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4.1. Berlin-Brandenburg

4.1.1. Service

Two Regional Express (RE) lines have been chosen as baseline for the Berlin test site:

- from North-West Brandenburg to Berlin:
 RE6: Wittenberge – Neuruppin – Hennigsdorf – Berlin-Spandau, DMU operated;

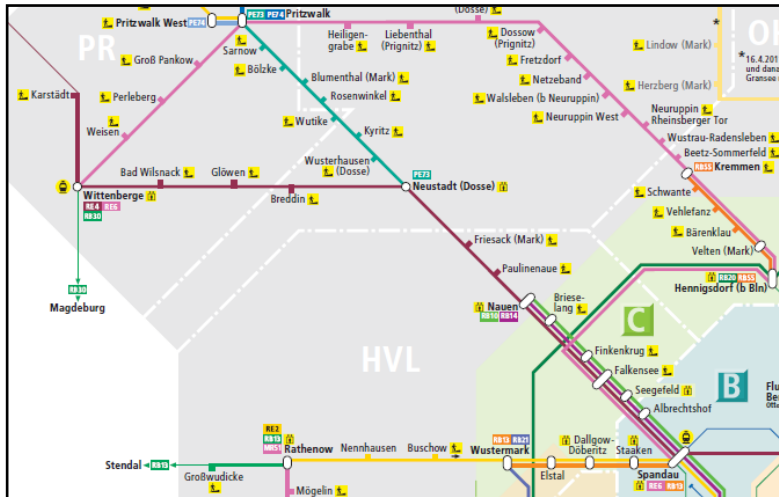


FIGURE 7: RE 6 LINE (PINK) IN THE BERLIN-BRANDENBURG NETWORK

- from Federal State of Saxony-Anhalt via South-West Brandenburg, Berlin-Stadtbahn and Berlin Schönefeld Airport to the southern surrounding hinterland:
 RE 7: Dessau – Bad Belzig – Berlin Stadtbahn – Wünsdorf-Waldstadt, operated with loco hauled trains, electric traction¹⁸.



FIGURE 8: RE 7 LINE (GREEN) IN THE BERLIN-BRANDENBURG NETWORK

The figures below give more detailed information about the operational service of these lines.

¹⁸ For the Berlin-Brandenburg network of regional trains please follow that link:

http://www.vbbonline.de/download/pdf/liniennetze/101212_Bahnregionalverkehr.pdf

For timetables please follow <http://kursbuch.bahn.de/nafas/kbview.exe> and enter «Kursbuchstreckennummer» = 206 for RE6 or 207 for RE7.

Topic		line RE6	line RE7
Route		Wittenberge - Neuruppin - Hennigsdorf - Berlin-Spandau	Dessau - Bad Belzig - Berlin - Wünsdorf-Waldstadt
Distances		Wittenberge – Neuruppin: 93 km Neuruppin – Hennigsdorf: 46 km Hennigsdorf – Berlin: 29 km	Dessau - Bad Belzig: 48 km Bad Belzig – Wünsdorf - Waldstadt: 133 km
Timetable	Kind of service	Regional-Express (RE)	Regional-Express (RE)
	Commercial speed	66 km/h	65 km/h
	Frequency	- At weekdays: every 60 min - At the weekend: every 120 min Wittenberge – Neuruppin - At the weekend: every 60 min Neuruppin – Berlin - Additional runs on shorter sections	- All days: every 60 min Bad Belzig – Wünsdorf-Waldstadt - All days: every 120 min Dessau – Bad Belzig - Additional runs on shorter sections
	Number of runs	- At weekdays: 16 runs per direction Wittenberge – Berlin	- At weekdays: 20 runs per direction Bad Belzig – Wünsdorf-Waldstadt
	Number of stops	- Wittenberge – Neuruppin: 12 (thereof 7 on demand) - Neuruppin – Hennigsdorf: 6 - Hennigsdorf – Berlin: 2	- Dessau – Bad Belzig: 6 - Bad Belzig – Wünsdorf-Waldstadt: 24
	Duration (minutes)	- Wittenberge – Neuruppin: 84 min - Neuruppin – Hennigsdorf: 39 min - Hennigsdorf – Berlin: 22 min - Total: 152 min	- Dessau – Bad Belzig: 38 min - Bad Belzig – Wünsdorf-Waldstadt: 127 min - Total: 168 min
Capacity	Seated places	- 108 seats per DMU (1st class: 7, 2nd class: 101)	- 122 seats per middle coach, - 91 seats per control cab coach (1st class: 28, 2nd class: 63)
	Standing places	- 104 (4 persons per m ²)	
	Number of coaches	- Wittenberge – Neuruppin: 1 DMU - Neuruppin – Berlin: 2 DMU	- 3 middle coaches - 1 control cab coach
Service profiles actually used for the line and for each kind of service (ref. Railenergy classes)		- Wittenberge – Neuruppin: Intercity - Neuruppin – Hennigsdorf: regional - Hennigsdorf - Berlin: Intercity	Intercity

TABLE 4: INFORMATION ABOUT ROUTE AND SERVICE OF THE LINES RE6 AND RE7.

4.1.2. Rolling stock

Modern DMUs run on RE6, while push-pull trains operate RE7, which are made by old locomotives and coaches of different ages. Diesel stage IIIA engines allow reduced emissions on RE6 line.

The estimated energy consumption of RE6 is 14.12 kWh per train*km or 0.065 kWh per seat*km (108 seats). The energy consumption of RE7 is about 10% lower (12.7 kWh per train*km) in terms of kilometres and much lower (58%) in terms of capacity (0.027 kWh per

seat*km) because of the bigger number of seats (457). The present locomotives of RE7 are not able to recover the braking energy.

More details are reported in the following table.

Topic	line RE6	line RE7
List of rolling stock in service (grouped in classes).	- DMU: class BR646/946 (GTW 2/6, Adtranz/ Bombardier/Stadler)	- Locomotive: class BR143 (LEW Hennigsdorf) not capable for energy recovery - Middle coach: DBuz (class 747) - Control cab coach: DABuz (class 760)
Number of train*km	Approx. 1.9 Mio. Train*km per year	Approx. 2.4 Mio. train*km per year
Electric power consumption estimated		Approx. 2,300 kWh per trip, that is equivalent to: - 12.7 kWh per train*km - 0.027 kWh per seat*km
Fuel consumption estimated	Approx. 240 litres per trip = 1.5 litres per train*km, that is equivalent to: - 14.12 kWh per train*km - 0.065 kWh per seat*km	
Noise measured	n/a	n/a
Exhaust emissions estimated	Stage IIIA engine: - CO ₂ : 3.8 kg/km - NO _x : max. 8.95 kg/km - PM10: max. 0.448 kg/km	According to energy mix provided by DB Energie: - CO ₂ : 7.29 kg/km (0.0160 kg/seat*km) - NO _x : 0.007 kg/km (0.0148 g/seat*km) - PM10: 0.0006 kg/km (0.0014 g/seat*km)
Average axle weight	9.1 t	- Class BR143: 20.6t - DBuz (class 747): 14t - DABbuzf (class 760): 14t
Vehicle weight	54.5 t	- Class BR143: 82,8t - DBuz (class 747): 46t (unloaded) 56t (loaded) - DABbuzf (class 760): 48t (unloaded) 56t (loaded)
Dimensions	Length: 38,660 mm width: 3,010 mm	- Class BR143: length: 16,640 mm width: 3,120 mm - DBuz (class 747): length: 26,800 mm width: 2,780 mm - DABbuzf (class 760): length: 26,800 mm width: 2,780 mm
Engines	MTU 12V183 550 kW	- Four 12-pole one-phase series-wound motors - 31-ary thyristor controller
Maximum power at wheel	420 kW	3,330 kW

Topic	line RE6	line RE7
Starting tractive power	77 kN	240 kN
Max. acceleration at gross weight	0.85 m/s ²	
Maximum speed	120 km/h	120 km/h
Auxiliaries and comfort functions	n/a	n/a
Availability of EE/ENV technologies listed in the ECORailS catalogue	None	None

TABLE 5: TECHNICAL FEATURES AND ENVIRONMENTAL PERFORMANCES OF THE ROLLING STOCK.

4.1.3. Awarding documents and procedures today in force

4.1.3.1. Relevant laws in force

There are relevant laws on federal level and state level which basically regulate the financing of public transport services in Germany:

- The Federal Law for Regionalisation of the Public Transport Sector (Gesetz zur Regionalisierung des öffentlichen Personennahverkehrs - Regionalisierungsgesetz), in force since 1996, regulates the general responsibility of the Federal States for establishing PTAs in charge of ordering and financing public transport services. Therefore a certain yearly budget is given from the Federation to the Federal States.
- Federal States, such as Berlin and Brandenburg, have their own laws regulating the public transport sector (ÖPNV-Gesetze). They have to install PTAs for RRTP (regional trains and S-trains) and for the remaining public transport means (undergrounds, trams, buses, etc.). Furthermore, the Federal States have to decide how to allocate the federal contribution among the transport services. Both Federal States Berlin and Brandenburg decided to act themselves as PTAs for the RRTP within their areas.

Especially for RRTP awarding procedures the following laws are used:

- German antitrust law;
- Official Contracting Terms for Award of Service Performance Contracts (Vergabe- und Vertragsordnung für Leistungen – Teil A, VOL/A);
- Law Against Restraints on Competition (Gesetz gegen Wettbewerbsbeschränkungen, GWB);
- Public Procurement Regulation (Vergabeverordnung, VgV);
- EU-Directive 1370/2007 taking effect from 3 December 2009.

4.1.3.2. Political instruments

There are several regional development plans aimed at an increased inclusion of environmental criteria, related to the political fields of energy and climate protection, noise protection and RRTP:

Energy and Climate Protection:

Voluntary guidelines on regional energy policy specifically with regard to transport:

- Energy Strategy Brandenburg 2020.
- Energy Concept Berlin 2020.

Agenda for Climate Change Policy Berlin:

- Noise Protection.
- Noise action plan Berlin/Brandenburg 2008/12.
- Strategic Noise Maps Berlin/Brandenburg 2012 (to be updated every 5 years).

RRTP:

- Berlin Urban development plan Transport (Stadtentwicklungsplan Verkehr Berlin 2025): contains targets, interim goals and approx. 100 potential measures, including their associated costs and time frames.
- Berlin Transit plan 2010/14 (Nahverkehrsplan Berlin): contains ambitious targets, aiming to reduce emissions by 40% by 2020 compared to 1990. It further contains information on compulsory environmental standards in RRTP, detailed noise pollution data, differentiated by time of day and tracks posing an increased risk of conflict. The transit plan 2010/14 (Berlin) also advises on monitoring, as well as active and passive measures.
- Brandenburg Regional transit plan 2008/12 (Landes-Nahverkehrsplan Brandenburg): aims at the inclusion of extensive standards for environmental protection in the awarding of contracts, as well as the acquisition of vehicles.

4.1.3.3. Awarding documents

Due to the competitive situation in terms of awarding of RRTP, the official awarding documents are mostly confidential. Some information was given by VBB to be used only within the ECORailS project.

4.1.4. Economic framework applied to services and rolling-stock

Due to the competitive situation in terms of awarding of RRTP, these data are mostly confidential.

4.1.5. Stakeholders

A balanced sounding board representing industry, PTAs, TOCs and further public bodies in the area with invested interests in energy efficient regional rail transport attended the Berlin test site SSG workshops:

Public Transport Authorities:

- Berlin Senate Department for Urban Development (Senatsverwaltung für Stadtentwicklung - SenStadt): PTA for local and regional railway service; will perform the actual test of the guidelines;
- Berlin Senate Department for Health, Environment and Consumer Protection (Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz - SenGesUmV): local authority for public health, environmental protection and consumer safety;
- Brandenburg Ministry for Infrastructure and Agriculture (Ministerium für Infrastruktur und Landwirtschaft - MIL): gives support on specific matters concerning the German procurement;
- Brandenburg Ministry of Environment, Health and Consumer Protection (Ministerium für Umwelt, Gesundheit und Verbraucherschutz - MUGV);

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- Transport Association Berlin-Brandenburg (Verkehrsverbund Berlin-Brandenburg - VBB): responsible for the management of awarding on behalf of the Federal States of Berlin and Brandenburg.

The leading question for PTAs is: what is the right-side for PTAs with regard to:

1. Rising energy prices, current constructions of service contracts and a decreasing range within the public budgets?
2. The rising risk for legal action due to noise exposures at railway tracks?

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 (S lines);
- Niederbarnimer Eisenbahn AG, which is operating two regional train lines in Berlin and its urban hinterland (NE lines);
- Association of German Transport Companies (Verband Deutscher Verkehrsunternehmen - VDV), in which numerous of TOCs operating in Germany are members.

The leading question for TOCs is: what is the right side for TOCs with regard to:

1. Rising energy prices/amplitudes?
2. Further use of vehicles after the end of a service contract period in face of rising requirements related to energy consumption and noise emissions?

Vehicle Manufacturing Industry:

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

The leading questions for the vehicle manufacturing industry are:

1. How can the industry prepare for the rising requirements?
2. What possible competitive advantages can be reached with energy efficient and silent vehicles?

Others:

- Alpha Trains Europa GmbH, which is a leasing company of rolling stock;
- Federal Environment Agency (Umweltbundesamt - UBA);
- Deutsche Bahn Environmental Centre (DB Umweltzentrum).

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4.2. Timișoara

4.2.1. Service and rolling stock

Two lines in the Timișoara area have been chosen as baseline for the Romanian pilot application. Both lines are operated by CFR Calatori:

- diesel line Timișoara-Jimbolia;
- electric line Timișoara-Caransebeș.

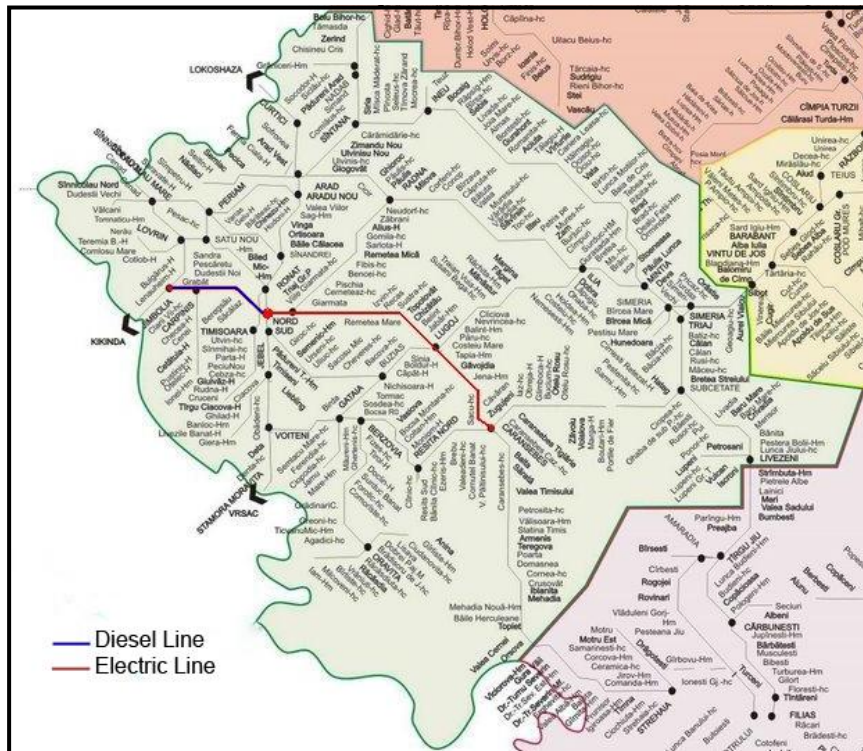


FIGURE 9: RAILWAY MAP OF THE TIMIȘOARA REGION SHOWING THE LINES INVOLVED IN THE PILOT APPLICATION.

Diesel line Timișoara-Jimbolia:

The present service on the Timișoara-Jimbolia line has 6 pairs of slow trains operated by:

- diesel hydraulic locomotives (both, old and modernized) carrying carriages series 2047 which were replaced in August 2009 with double decked carriages series 2617;
- railcars series 79 (LVT) and series 900.

No	Train forming		Max. speed Km / h	Train weight (without pass.)	No. of seats	Installed power kW	Engine type	
	Loco/ MU	Carriages						
		Series	Avg. no of cars					
1	LDH	2617	4	100	202,00	340	932	Sulzer, 6 LDA 28-B
2	LDH	2617	4	100	202,00	340	1000	Catterpillar, 3508B
3	LDH	2047	4	100	234,00	320	1000	Catterpillar, 3508B
4	LVT	M+T*	2	70	35,00	94	180	MAN 2866UH
5	A900	M	1	70	23,50	54	215	MAN D2156HMN8
6	Desiro	M+M	2	120	68,00	123	275	MTU 6R 183 TD13H

*M=motor car; T=Trailer car

TABLE 6: ROLLING STOCK ACTUALLY OPERATING TIMIȘOARA-JIMBOLIA LINE.

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Electric line Timișoara-Caransebes:

The present service on the Timișoara-Jimbolia line has 32 slow and fast trains, formed by EA and EC locomotives with carriages series: 1947, 1950, 1955,1957, 2047, 2057, 2050, 2054, 2055,2076, 8987, 1091, 2176, 1090, 1091, 1617, 2616, 2147, 1147, 2616, 4431, 2296, 7131 and 3616, and 2 electrical multiple units.

No	Train forming			Max. speed Km h	Train weight (without pass.)	No. of seats	Installed power kW	Engine type
	Loco / MU	Carriages						
		Series	Avg. no of cars					
1	EA1	1147;2147;2057	3	120	243,40	322	5100	LJE 108
2	EA1	1957;3x2047	4	120	284,00	294	5100	LJE 108,
3	EA1	1617;3x2617	4	120	252,00	262	5100	LJE 108,
4	EA1	2x3616;2x2616	4	120	319,60	436	5100	LJE 108,
5	EC	1957;2x2047;2050	4	120	241,00	294	3400	LJE 108,
6	EC	1957;3x2617	4	120	244,00	284	3400	LJE 108,
7	EC	1617;3x2617	4	120	212,00	262	3400	LJE 108,
8	RE	M+3T	4	120	132,00	156	615	GRLM 792a
9	Desiro	M+M	2	120	68,00	123	275	MTU 6R183TD13H

*M=motor car; T=Trailer car

TABLE 7: ROLLING STOCK ACTUALLY OPERATING TIMIȘOARA- CARANSEBES LINE.

4.2.2. Energy consumption and emissions

At the present time, the rolling stock forming RTFC Timișoara's fleet isn't equipped with any of the EE/ENV technologies, but almost all vehicles are fitted with energy/fuel metering devices.

4.2.2.1. Fuel / energy consumption

Almost all vehicles used on the 2 test lines are fitted with fuel/energy metering devices. The only types of vehicles that are not equipped as such are the railcars, for which estimations derived from the diesel fuel tank consumption have been made. Also, the data provided in the vehicles' technical specification was used to obtain further information.

Based on the values obtained and the vehicles' capacity and average occupancy level, consumption indicators – Railenergy KPI2 and KPI4 (kWh/seat km and kWh/passenger km) - were also computed.

Train type	Traction – winter Kwh/seat*km	Traction - summer Kwh/seat*km	Heating Kwh/seat*km
LDH	0,081077	-	0,066207
LDH C	0,063006	0,055008	0,042964
LVT	0,097627	0,081356	0,027661
Desiro	0,067148	-	-

Notes:

LDH – Diesel hydraulic locomotive (Sultzer engine) with 4 carriages

LDHC – Diesel hydraulic locomotive (Caterpillar engine) with 4 carriages

LVT – diesel railcar (M+T), runs in couples

Desiro – diesel railcar (M+T)

TABLE 8: ENERGY CONSUMPTION OF TIMIȘOARA-JIMBOLIA LINE.

The best performances are recorded by the modern DMU, as well as by the bigger trains made of 4 carriages and a locomotive equipped with a Caterpillar engine.

Train type	Traction – winter Kwh/seat*km	Traction summer Kwh/seat*km
EC	0,038040	0,026727
EA 1	0,033329	0,027709
RE	0,036572	0,028155
Desiro	0,100481	0,089522

Notes:

EC – electric locomotive (3400 kw) with 4 carriages (on average)
 EA1 – electric locomotive (5100 kw) with 4 carriages (on average)
 RE – electric multiple unit (M+T)
 Desiro – diesel railcar (M+T)

TABLE 9: ENERGY CONSUMPTION OF TIMIȘOARA- CARANSEBES LINE.

For the electric line the data show, firstly, that energy the efficiency increases with the capacity (number of seats) and, secondly, that the EMUs are more energy efficient than the conventional trains made of a locomotive and carriages.

4.2.2.2. Diesel emission levels

Using Corinair software, the level of exhaust emissions for each vehicle was computed, starting from the amount of fuel/energy consumed.¹⁹

4.2.2.3. Noise emission levels

Since such measures of noise levels are not a common practice at the Timișoara site, the values imposed through existing legislation were used, and also the information provided in the vehicles' technical specification.

4.2.3. Awarding documents and procedures today in force

4.2.3.1. Legal documents in use and relevant laws in force

Public acquisitions in Romania are made in compliance with the legal provisions of EU27, through Government Urgent Order 34/2006 (with its subsequent modifications) transposing EU Utilities Directives 17/2004 and 18/2004.

The railway transportation services comply with EU Regulation no. 1370/2007.

In what concerns the level of emissions from new diesel engines or for repowering, these have to respect the limits set by the NRMM Directive, no. 2004/26/EC (transposed through Government Decision no. 133/2008).

The level of noise has to respect the values set by EU Directive 2002/49/EC (transposed through Government Decision no. 674/2007).

In what concerns environmental protection within railways, there is no law imposing limits in this domain.

Details about the legal framework in Romania are given in the following list:

- a) Public acquisitions:
 - Government Urgent Order 34/2006, transposing EU Directives no. 17/2004 and 18/2004.

¹⁹ Similar to the energy/fuel consumption indicators, the specific emission was also computed.

- Order no. 563/02.07.2007 issued by the Ministry of Transport and Infrastructure regarding the approval of procedures for organizing public acquisitions.
- b) Railway transportation services:
 - EU Regulation number 1370/2007.
 - Communication from the Commission regarding: A sustainable future for transport: Towards an integrated, technology-led and user friendly system.
- c) Environment:
 - There is no law imposing limits in this domain, just fragments from different laws encouraging a green behaviour. However, there are many EC communications and recommendations on the subject matter, like: Communication from the Commission regarding Public procurement for a better environment; Communication from the Commission regarding Greening transport.
 - UIC 345 & UIC 330.
- d) Emissions:
 - EU Air Quality Directive no. 2008/50/EG.
 - NRMM Directives:
 - Directive 97/68/EC.
 - Directive 2002/88/EC.
 - Directive 2004/26/EC (transposed through Government Decision no. 133/2008).
 - Directive 2006/105/EC.
 - UIC 651 & UIC 623.
- e) Noise:
 - Government Decision no. 674/2007 transposing EU Directive 2002/49/EC relating to the assessment and management of environmental noise.
 - Government Order no.831/1461 from 16th of July 2008.
 - Government Order no. 152/558/1119/532 from 13th of February 2008.
 - Government Decision no.321 from 14th of April 2005.
 - Government Order no.678/1344/915/1397 from 30th of June 2006.
 - Government Order no.720 from 3rd of August 2007.
 - Government Order no.1830 from 21st of November 2007.
 - TSI Noise no. 2006/66/EC.
 - Communication from the Commission regarding: Measures to reduce rail noise at the level of the existing fleet.

4.2.3.2. Main clauses used at present

The Ministry of Transport and Infrastructure sets the minimum of the public service level for all sections of the railway network, expressed in train*km. Than such minimum service level is submitted to the Government's approval that applies the methodology to grant from the state budget and/or local budgets the difference between the fares and the costs for the public transport, according to decision no. 2408/2004.

The PSC between the Ministry and CFR Calatori/RTFC Timișoara asks CFR Calatori/RTFC Timișoara to arrange and operate the necessary number and categories of trains to ensure the public social service. The PSC establishes only the minimum compulsory conditions with regard to commercial speed, safety, comfort and services on board. If a private rail operator faces the situation where it can no longer fulfil its obligations of public service, CFR Calatori

will overtake the operator's activities to ensure continuity of public services. In this situation, CFR Calatori will receive an additional compensation.

4.2.4. Economic framework applied to services and rolling-stock

The level of the subventions to be covered from the state budget as payment of public transport service, is given by the difference between the costs incurred and the fares agreed with the opinion of the competent public authorities, plus the profit share between 3% and 5% set in accordance with the rules on substantiation, justification and grant amounts received from the state budget for certain activities performed by some operators.

At the present time, the PSC for the transport services on the interoperable lines is directly awarded by the MTI to the national state operator, while for the awarding of the transport services for the non-interoperable lines, private transport operators licensed by the MTI participate in public tenders. The contract signed by operators, public or private, with the MTI is approved by Government Decision.

The awarding criterion almost always used when awarding transport services or procuring rolling stock is the lowest price. There is no use of EE/ENV criteria in the present PSC or in the contracts for the procurement/modernisation of rolling stock.

4.2.5. Stakeholders' expectations

In what concerns the local stakeholders' expectations and questions at the beginning of the pilot application, the following can be noted:

- the ECORailS Guidelines should present ways to legally bind suppliers during the entire life cycle of the rolling stock for the indicators declared;
- whether the project's quantitative targets are attainable in the specific situation of RTFC Timișoara;
- the Guidelines should be extremely easy to be used (manageable).

4.3. Øresund

4.3.1. Service

The train service involved in the pilot application consists of two parallel regional train systems:

1. Nivå (DK) – Kastrup (Copenhagen Airport), run by IR4 EMUs;
2. Elsinore (DK) – Kastrup (S) and further on towards Malmö, run by ET EMUs.

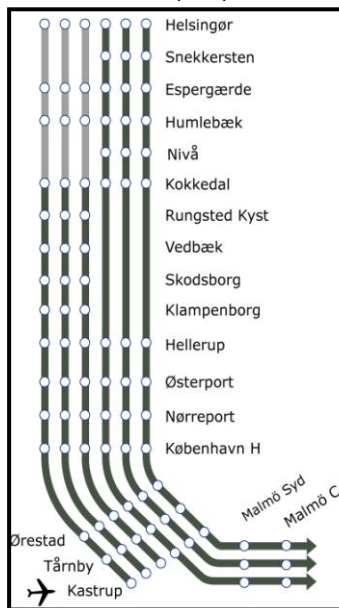


FIGURE 10: MAP OF THE TRAIN SERVICES INVOLVED IN THE ØRESUND PILOT APPLICATION.

The two systems run on the same infrastructure stopping at different stations. They supplement each other and deliver a 10 minute frequency service on main part of the line. On the central part of the line an hourly service runs through the night every weekday.

Travel times for Nivå – Kastrup and Elsinore – Kastrup are 51 min, respectively 1 h 01 min (1 h 17 min in the evening due to stops at every station).

There are 14 stops on the Nivå – Kastrup system and 13/17 stops on the Elsinore – Kastrup system, depending on the time of day.

Service profiles actually used for the line and for each kind of service, according to the RailEnergy classes are not specified.

4.3.2. Rolling stock

The fleet in use is made by 20 IR4 EMUs and 90 ET EMUs:

- IR4 EMUs consist of 2 traction unit and 2 coaches, with a seating capacity of 213 (+20 folding seats);
- ET EMUs consists of two traction units and a middle coach, with a seating capacity of 176 (+ 41 folding seats).

Trains runs in single, double or triple coupling, depending on the capacity needs.

Maximum speed of the rolling stock is 180 km/h. The infrastructure limits the maximum speed at Elsinore-Nivå-Copenhagen to 120 km/h, Copenhagen-Kastrup 160 km/h, Kastrup-Malmö 180 km/h.

The figure below shows the energy consumption per month for 2009 for all relevant trains involved measured in kWh/trainkm. If the each “train” is on average composed of only 1 train-set weighing around 145 tons, then the KPI 1 equals 48 Wh/trainkm. Since many departures have more than one train-set, the average weight/train-set should be adjusted to 210 tons. This would equal 33 Wh/tkm. The corresponding value from Railenergy estimations is 39 Wh/trainkm (for in+out of service).

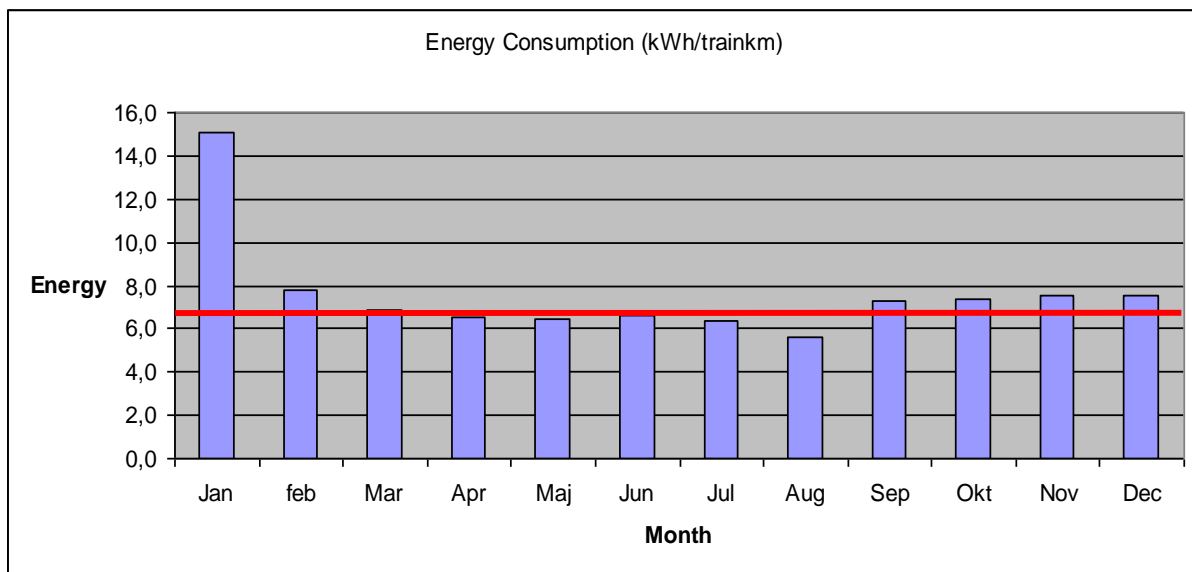


FIGURE 11: AVERAGE ENERGY CONSUMPTION BASELINE FOR THE ØRESUND PILOT APPLICATION.

Systematic data about noise emissions and the emissions of pollutants are not available.

4.3.3. Awarding documents and procedures today in force

Denmark

In the awarding of rail services in the Øresund region there was a coordinated invitation to tender through two separate invitations, one Danish and one Swedish, but the results for each tender influenced each other. The minimum contract length is six years (2009-2015), with a possible two years extension. The contract allows changes of standards in case of new technologies. It is for example possible to change to ERTMS²⁰ during the contract, in which case the PTA will have to pay the expenses.

The Øresund contract includes the following types of incentives:

- Bonuses:
 - Performance/mal-performance: punctuality, reliability and customer satisfaction.
 - Number of passengers: growth in number of passengers and growth in fare incomes.
 - Special bonus in case of smooth start of operation.

²⁰ ERTMS (European Railway Traffic Management System) is planned to be the European train control and command system which once replaces the national systems.

- Penalties:
 - punctuality;
 - reliability;
 - customer satisfaction;
 - late/missing reporting of data;
 - missing delivery of other services described in contract and/or tender.

The Danish part of the Øresund contract does not include any environmental requirement or recommendation.

There are no national energy- or environment-related legislation/policies regarding rail transport, with the exception for noise emission. Diesel engine emissions have to some extent been covered in some invitations to tender.

Sweden

The Øresund contract was awarded by the Swedish PTA Skånetrafiken in cooperation with the responsible authority Trafikstyrelsen on the Danish side. In general, the basis of the contract is the same as described in the Danish chapter. However some important differences exist. On the Swedish side, environmental requirements were included in the contract, which included:

- Demand on renewable energy source.
- Routines for recycling of waste disposal.
- Vehicle washing.

Staff is to be educated in how to reduce the environmental impact from service operation, onboard services and vehicle maintenance.

For compliance to the environmental demands the TOC has to deliver an environmental report annually. PTA has the right to monitor the compliance through an external inspector.

Skånetrafiken has the right to change the environmental demands during the contract period; the TOC must be compensated if this means increasing costs. The rolling stock is awarded and provided by the PTA (Skånetrafiken). Incentives include passenger satisfaction, number of passengers and punctuality. The TOC is also bound to monitor the energy use since Skånetrafiken is the contractual part to the Infrastructure Manager (Banverket) which is the energy provider.

Environmental criteria are allowed to be used in awarding procedures but must be clearly specified. The government action plan “An environmentally adapted public rewarding procedure” contains goals for the coming years.

4.3.4. Economic framework applied to services and rolling-stock

The PTA is responsible for the strategic planning, setting the fares, collecting the fare income (gross-cost contract) and the timetable. The last three tasks are to be seen as a special case for this contract, since these usually lie within the responsibility of the TOC. Since the Øresund contract is a gross contract, the PTA collects fare incomes and thus bears the largest financial risk. Subsidy is paid for the actual train production offered in the tender by the operator.

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When it comes to rolling stock, the TOC is bound to rent it from the former TOC (DSB). The fleet consists of two-system EMUs (AC 16,7 Hz & 50 Hz). The TOC is, as usually in Denmark, responsible for the vehicle maintenance.

4.3.5. Stakeholders' expectations

As regards the ECORailS Guideline, the internal experts who willingly tested it expected an instrument, which could be used directly, without having to read and search too much elsewhere.

Assistance in constructing the right weighting of Energy Efficiency indicators in connection with the other quality elements in the contract would be desirable.

4.4. Lombardia region

4.4.1. Service

The baseline data come from the two lines of the regional rail network selected for the pilot application:

1. the diesel Valcamonica line, from Brescia to Edolo;
2. the electric S3 line, from Milan to Saronno, part of the Milan suburban network.

Regional rail service on the **Valcamonica** and S3 lines is based on the regular interval timetable which the Regional Government is introducing on the whole network. Valcamonica is a typical regional line which offers 3 levels of service:

1. fast trains running on the whole line every 2 hours in 120 minutes (commercial speed 60 km/h), with a stop about every 9 km;
2. regional trains running in the most populated area every 2 hours in 98 minutes (commercial speed 42 km/h), with a stop about every 3 km;
3. suburban trains running in the metropolitan area of Brescia and in Franciacorta every 2 hours in 32 minutes (commercial speed 52 km/h), with a stop about every 3 km.

The alternating regional and suburban trains offer in the section Brescia-Iseo an hourly service stopping in every station.

Yearly production is about 1.1 million train*km. The fleet is made of 10 train-sets, of which: 2 with 154 seats, 3 with 200 seats and 5 with 68 seats.

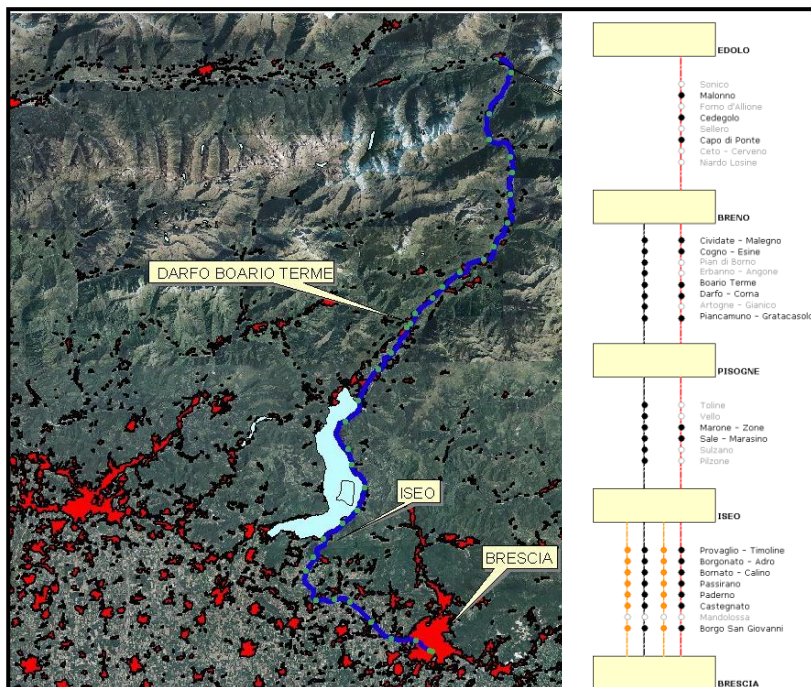


FIGURE 12: THE VALCAMONICA LINE AND ITS TIMETABLE.

S3 is a representative of the Milan suburban “S lines” system, whose main features are frequent stops, big capacity rolling stock (often double deck) and 30 minutes interval during all day on all 10 existing lines. On S3 line suburban trains run in 35 minutes from Milan (Cadorna station) to Saronno (commercial speed 36 km/h), with a stop every 1.7 km. on average.

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The alternating suburban S3 and S1 trains offer in the section Milan (Cadorna and Passante stations)-Saronno a 15 minutes frequency service stopping in every station.

Yearly production is about 592,000 train*km. The fleet is made of several combination of single and double deck rolling stock on 4 shifts, with capacity from 363 to 875 seats.

The whole rail service regulated by the Regional Government of Lombardy has a yearly production of about 33 million train*km, 418 stations, 330 train-sets and 1,920 runs per working day. Main part of the service is produced by electric rolling stock (93%).



FIGURE 13: THE S3 LINE, PART OF THE S LINES NETWORK.

4.4.2. Rolling stock

The rolling stock involved in the pilot application is:

1. Valcamonica line:
 - 11 old FIAT DU class Aln668 built in the years 1979-1994. They have 4 axles and 2 engines, each of 200 kW power, older than the EU emission standards. The average weight for each axle is 9.7 tons.
 - 2 new PESA DMUs class ATR220. This train has 8 axles and 2 engines, each of 382 kW power, compliant with the standard Euro IIIa. The measured average weight for each axle is 15.5 tons.
 - 8 new Stadler GTW DMUs will replace the old DUs within the year 2011. This train has 6 axles and 2 engines, each of 390 kW power, compliant with the standard Euro IIIa. The measured average weight for each axle is 11 tons.
2. S3 line: mainly recent double deck EMUs class TAF, built in the years 1998-2000. They have 4 coaches, 16 axles and 4 three-phase AC electric engines. The overall power of the train is 3640 kW. The average weight for each axle is 13.3 tons.

The remaining train-sets are made both by older rolling stock (EUs built in 1957 and 1982 pulling single deck coaches of the 50s or double deck coaches of the 80s) and by the new double deck EMUs class TSR.

4.4.3. Energy consumption and emissions

Baseline data about energy consumption for the rolling stock involved in the pilot application neither are regularly measured in Lombardy today, nor are energy meters in place on diesel and electric rolling stock. ECORailS project therefore promoted a short measurement campaign, which was strongly supported by the regional TOC TRENORD and by the regional Infrastructure Manager FERROVIENORD:

- fuel consumption for each vehicle and month from July 2009 to June 2010 were collected and processed as baseline of the test line Valcamonica;
- data collected by an energy meter, provided by the company FAR Systems and installed on the EMU class TAF n.27, gave useful information about the present energy consumption on the test line S3. In addition to this, a round trip was done on 15th December 2010 with different driving styles and traffic conditions.

Aim of the measurement campaign was not a precise assessment of the consumption data – which needs longer time and more energy meters – but the willingness to show the feasibility of such activity and its useful results:

1. Valcamonica line:

- Old diesel units of Valcamonica line registered an average fuel consumption of 0.73 litres/train*km or 7.39 kWh/train*km. Referring to the capacity, energy consumption is 0.11 kWh/seat*km.
- New DMU ATR220 registered an average fuel consumption of 1.49 litres/train*km or 15.12 kWh/train*km. Referring to the capacity, energy consumption is 0.10 kWh/seat*km.
- Compared with a train-set of 2 old DUs, ATR220 has 10% less energy consumption per seat*km, while it offers air conditioning and other comfort functions.

2. S3 line:

- By using the little database collected during the test runs on 15th December 2010, it can be calculated 16.7 kWh/train*km or 0.036 kWh/seat*km on average. On that favourable and crowded-of-trains infrastructure it was estimated 10% braking energy recovered and given back to the line.

CO₂ emissions of diesel trains are not systematically measured in Italy. Impacts from diesel lines are limited because electric traction is largely dominant. Renewal plans for the fleet envisage the replacement of all old traction units with new DMUs compliant with Euro III or higher standards.

CO₂ emissions of electric trains depend firstly on their energy efficiency and then on the energy mix used to produce the electricity. In general, oil, gas and coal are the most relevant sources for electricity in Italy (about 90%²¹). Energy industries are responsible for about 33% of the national CO₂ emissions. Energy intensity is below EU-27 average, while CO₂ emission

²¹ European Energy statistics.

intensity is slightly above EU-27 average. After the liberalisation of the energy market the rail Infrastructure Managers can freely choose their provider of electricity. The provider of FERROVIENORD declares about 17% of its total installed capacity from renewable energy, mainly hydroelectric plants in northern Italy.

As regards noise emissions due to the rolling stock, no systematic collection of data is available at present in Lombardy. For TAF class EMUs there were measured the following noise emissions:

- Start-Up Noise = 77.5 dBA (distance from the train = 1.5 metres).
- Rolling noise = 77.3 dBA (speed = 80 km/h; distance = 25 metres).
- Noise at stand-still = < 76 dBA (distance = 7.5 metres).

4.4.4. Awarding documents and procedures today in force

For both lines the service was directly awarded by Region Lombardy to the TOC TRENORD (TN), a joint venture between the state owned national incumbent Trenitalia and Ferrovie Nord Milano Group, controlled by the Regional Government. Competitive tendering was planned five years ago only for the Valcamonica line. The relationships between Region Lombardy and TN are regulated by a PSC, which covers the period 2009-2014 and may be extended till 2020.

The main features of this contract are:

- planning in charge of the Regional Government, which decides quantity and quality of the rail services and the maximum fares;
- strong financial engagement of the Regional Government, which not only pays for the public service obligations asked in the contract, but also is responsible for the rolling stock renewal plans and the management of the regional rail infrastructure;
- detailed definition of the production to be delivered by the TOC: list and timetable of the runs to be done, rolling stock to be used, minimum number of seats, accessibility and other comfort functions;
- detailed monitoring system, also involving inspections;
- detailed quality and reliability requirements, punished by fines and refund to the owners of season tickets.

Other relevant awarding documents for rolling stock were collected and analyzed for the pilot application, especially those involved in the Brescia action for the renewal of the Valcamonica fleet. Also the call for the new Molteno line rolling stock was analyzed because it is the first procedure in Lombardy using energy saving criteria to award rail vehicles.

The rolling stock involved in the pilot application is mainly owned by Region Lombardy. The regional Infrastructure Manager FERROVIENORD is in charge of its maintenance.

No Energy Efficiency (EE) and Environmental criteria (Env) are present in the current awarding, while some attempts were done in the provision of diesel rolling stock (the above mentioned Molteno line) and for energy recovery in fixed installations (Milan Bovisa station).

4.4.5. Economic framework applied to services and rolling-stock

The PSC for Lombardy follows the net cost approach: the regional subsidy therefore is referred to the costs not covered by the fares. The amount of subsidy is negotiated between

the Regional Government and the TOC before the contract is signed: the risk of losses due to increased costs or lower revenues is up to the TOC. Besides, the cancelled runs are not paid.

The present average subsidy is 7.22 €/km; as the ridership differs from one line to another, the share of the overall costs covered by the subsidy goes from about 85% of Valcamonica to less than 60% of the Milan lines. In 2008, for the regional TOC LeNORD the fuel cost was about 6% of the whole cost of Valcamonica diesel line (0.79 €/train*km), while the electricity cost was about 8% of the whole cost of all electric lines (1.47 €/train*km). In other words, the energy costs are 17% of the regional subsidy.

Rolling stock can be purchased and financed in different ways: by the TOC (its depreciation is included in the costs covered by the public service agreement), co-financed or fully paid by the Regional Government. Lombardy, together with the Province of Brescia has the ownership of all Valcamonica train-sets, while TAF class rolling stock for the S3 line is publicly financed by paying an annual rent in the public service contact in addition to the subsidy.

4.4.6. Stakeholders' expectations

As the Italian starting point does not see any use of Energy Efficiency and Environmental criteria in the awarding procedures, main stakeholders' expectations concern the potentials and the advantages reachable by following the ECORailS approach.

The PTAs expect from the ECORailS Guidelines convincing arguments; they are afraid of the risk to add new bureaucracy to a sometimes over-regulated transport mode. Meanwhile, they are aware that energy efficiency is not the main feature of the existing rolling stock and operational procedures.

The external stakeholders, like rolling stock manufacturers, TOCs and Infrastructure Managers, expect the Guidelines to incentive a general use of EE/Env criteria. Rolling stock manufacturers support a standardized approach, especially when the energy performances are measured (for example trains could use test circuits).

A user-friendly document is asked by everybody, but they know of course that it will not be able to deal with all local particularities.

5. Tests activities reports

This paragraph reports the activities done in the test sites during the pilot applications. The key task of the Site Working Groups (SWG) was to practise the ECORailS Guidelines by developing new text modules to be added to the awarding documents today in use on each site. They had the opportunity in this way to provide the ECORailS team with useful feedbacks to deliver an improved version of the Guidelines. Relevant local stakeholders took part to this process to collect additional inputs. The local PTAs and/or TOCs played an important role in the tests, being directly involved in the preparation of the text modules. Another result of the pilot applications was the estimation of the potential impacts of such changes in the awarding documents, in terms of reduced energy consumption and emissions.

All sites succeeded in performing the planned test activities, including the preparation of text modules for the awarding documents. The text modules are enclosed in Volume II of the present deliverable and further information can be found in Volume III.

As regards the contents of the tests, each site chose a slightly different approach to take into account local specific conditions and needs or constraints. The main differences concern the kind of procedure (direct awarding or competitive tendering), the object of the awarding (regional rail services or rolling stock), the technologies or operational measures involved and the method (functional or detailed approach).

Object of the pilot application	Test sites			
	Lombardy	Berlin	Øresund	Timișoara
Direct awarding of services	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Competitive tendering of services			<input checked="" type="checkbox"/>	
Competitive tendering of new rolling stock	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Competitive tendering of services, including the rolling stock		<input checked="" type="checkbox"/>		

TABLE 10: OBJECTS OF THE PILOT APPLICATIONS IN THE FOUR TEST SITES.

5.1. Berlin

5.1.1. General approach and goals

The core part of the Berlin tests was a workshop process which involved the local stakeholders in five meetings:

- Information and preparation workshop on 29 January 2010;
- 4 Test site workshops on 12 March 2010, 10 June 2010, 30 September 2010 and 27 January 2011.

The main objectives of the Berlin test site workshops were:

- to discuss the main issues relevant for the inclusion of EE/Env criteria in the current awarding process for the regional rail services, as recommended by the ECORailS Guidelines:
 - consideration of the relevant risks for PTAs and TOCs resulting from developments during the contract period:
 - framework conditions rooting in public rail transport demand;
 - energy prices;
 - legal environmental requirements (e.g. ambient noise regulation) and juridical decisions;
 - information to be provided (by the PTA or the TOC):
 - consumption and emission reduction potentials as well as cost estimations;
 - LCC approaches;
 - further;
- to make a reality check of the Guidelines test version by the Site Stakeholder Group (SSG) acting as a „**Sounding Board**“;
- to understand the interests of the different stakeholders (PTA, TOC, Manufacturing Industry);
- to test the Guidelines in particular for the phases preparation and elaboration regarding:
 - comprehensiveness and correctness of contents;
 - perceivability;
 - completeness.

5.1.2. Activities done

The competitive situation regarding the awarding of RRTP in the Berlin-Brandenburg region made it not possible to test the Guidelines by using real data from the RE6 and RE7 lines, as described in the baseline chapter.

A virtual test case was therefore devised by using data from the wide range of regional rail varieties of the Berlin area. The Berlin pilot application is based accordingly on the awarding of the virtual Regional-Express train lines RE 74, 75, 76. Such virtual call for tenders has the following features:

- annual production: a total of 12.5 million train*km:

- in Berlin: 2.8 million train*km per year;
- in Brandenburg: 9.7 million train*km per year;
- with diesel traction: 1.5 million train*km per year;
- maximum speed: 160 km/h (electric), 120 km/h (diesel);
- contract duration: 12 years;
- probable start of operation: December 2014;
- vehicles:
 - electric traction: double-deck EMU or locomotive-hauled double-deck trains for about 190 coaches;
 - diesel traction: sets of two-cars DMUs or the respective number of coaches (one floor).

The pilot application in Berlin exemplifies a process centred around the awarding of services through a call for tender, as direct awarding is not ordinarily permitted in accordance with VgV §4 (Verordnung über die Vergabe öffentlicher Aufträge - Order about the assignment of public orders).

The Berlin pilot application is designed to review present awarding documents developed for competitive tender. The ECORailS Guidelines were presented to the local stakeholders during the workshops at every step of their development, with the User Platform functioning as a sounding board to check for completeness, conciseness and reliability of content.

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

- market related conditions;
- energy prices;
- legal requirements.

The central issues facing the local stakeholders concern the management of older vehicles and the monitoring of environmental and energy components.

5.1.3. Energy Consumption Test

The following four examples for the energy consumption of different rail vehicles have been done to evaluate the EE/Env impacts in the Berlin test site. They are results of numerical simulation. 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 TecRec 100-001.

To make the comparison, the train configurations which are currently in operation on lines RE 6/7, on the one hand, and, on the other hand, those planned to be in operation according to the latest awarding (Stadtbahn network – lot 1 and lot 3) from 9 December 2012 have been taken into consideration, as showed by the following table.

	Current operation	In operation from 9 December 2012 according to awarding of Stadtbahn network – lot 1/lot 3
DMU	<ul style="list-style-type: none"> - Class BR 646/946 (GTW 2/6), Adtranz, Bombardier, Stadler - Line RE 6 	<ul style="list-style-type: none"> - Class BR 646/946 (GTW 2/6), Adtranz, Bombardier, Stadler - Line RE 6 (not included into Stadtbahn network awarding process)
Loco hauled train	<ul style="list-style-type: none"> - Class BR 143, LEW Hennigsdorf - 3 double deck middle coaches (class DBuz 747) - 1 double deck control cab coach (class DABbuzf 760) - Line RE 7 	<ul style="list-style-type: none"> - Class BR 182 (Taurus), Siemens - 3 double deck middle coaches (class 752), not older than 1998 - 1 double deck control cab coach (class 763), not older than 1998 - Line RE 1 (Magdeburg – Brandenburg/Havel – Potsdam – Berlin – Frankfurt/Oder – Eisenhüttenstadt)
EMU	- n/a	<ul style="list-style-type: none"> - Class BR 442/443 (Talent 2), Bombardier, three part, five-part - Line RE 7

TABLE 11: THE TRAIN CONFIGURATIONS COMPARED DURING THE ENERGY CONSUMPTION TEST IN BERLIN.

a) Diesel Multiple Unit (DMU) class BR646/946 (GTW 2/6):

The GTW 2/6 is an articulated diesel-electric multiple unit (DMU) with the axle arrangement 2'+Bo+2', which consist of three modules. There is a drive module in the middle containing the power pack, the generator, the intermediate circuit converter, the IGBT-converters for asynchronous motors in the motor bogie and the bogie itself. Each end of the GTW consists of a control trailer with a running gear at the one end and a joint to traction unit at the other end. In order to providing adequate conditions for the passengers, there is air conditioning and a temperature guided ventilation system. Further details can be found in the annex of this document.

This vehicle is used since 2000/2001 in the Area of Berlin Brandenburg. In case of the Berlin test site of this Project, this vehicle is used on the line called RE6 from Berlin Spandau to Wittenberge. From Spandau to Hennigsdorf this DMU is driven on an electrified track (16,7 Hz/15 kV). The type of operation changes several times a day. In high frequented times two vehicles are coupled and used in double traction between Berlin Spandau and Neuruppin West. From Neuruppin West to Wittenberge only one vehicle is used.

The following results were obtained:

GTW2/6 single traction VBB (550 kW)

- 108 seats;
- Traction energy consumption at 25% seating capacity utilisation: 3,2 kWh/km (0,97 l/km);
- Mean value of Energy consumption for comfort functions: 1,5kWh/km (0,47 l/km).

b) Loco hauled trains using the class BR143:

At the moment on the Regional-Express line RE 7 loco hauled trains are used. The BR143 are old fashioned electric locomotives working with 16,7 Hz and 15 kV. They are not capable to recover energy during breaking.

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One train set consists of one locomotive three double decked passenger cars (DB class 743, 745, 746, 747) and one double decked control trailer (DB class 760). Therefore 478 seats per train set may be used.

The following results were obtained:

Class BR143 train set VBB (3540 kW)

- 478 seats;
- traction energy consumption at 25% seating capacity utilisation: 10,9 kWh/km;
- mean value of Energy consumption for comfort functions: 0,8 kWh/km.

c) Loco hauled trains using the class BR182 (Taurus):

On some other Regional-Express lines then the RE 7 loco hauled trains will also be used. There the class BR182 an electric locomotives working with 16,7 Hz and 15 kV having the capability of recovering energy during breaking, is offered.

In order to compare the energy consumption of the old fashioned train set with the energy consumption of a more modern train set with class BR182 locomotive simulations with track model of the RE 7 were carried out.

The train sets consist of a class BR182 locomotive three double decked passenger cars with air condition (DB class 752) and one double decked control trailer with air condition (DB class 763). Therefore 478 seats per train set may be used.

The following results were obtained:

Class BR182 train set VBB (3540 kW)

- 478 seats;
- traction energy consumption at 25 % seating capacity utilisation: 8,6 kWh/km;
- mean value of Energy consumption for comfort functions: 1,5 kWh/km.

d) Electric Multiple Unit (EMU) class BR442/443 (Talent 2):

For the new traffic contract the class BR442 will be used on RE 7 line. Therefore the simulation model used for the calculation of the energy consumption of the loco hauled trains was adapted and the vehicle parameters were changed to the data given by Bombardier (see below).

The following results were obtained:

Class BR442 VBB (3030 kW) 5-part vehicle

- 300 seats (273 standing [4 people/m²]);
- traction energy consumption at 25% seating capacity utilisation: 4,6 kWh/km;
- mean value of Energy consumption for comfort functions: 1,4 kWh/km.

According to Bombardier simulations there is following picture for Talent 2 vehicles (class BR442/443) to be considered:

Real-life data on present electricity & fuel consumption is exceedingly hard to come by, due to German trade secret protection legislation, classifying electricity & fuel consumption as business secrets and absolving TOCs from having to release them. However, industry

representatives supplied data about their model of the Talent 2 EMU, including differences in consumption due to operational measures such as energy-efficient driving, train length and capacity utilisation. The test drive assumes the use of energy-conscious parking, 80% Energy recovery and EBI Drive 50, an integrated system assisting drivers in optimising their driving style. The Talent 2 EMU will be in use on several RE- and RB- lines throughout Berlin's city railway net ("Stadtbahn") starting in December 2012.

Calculations were based on the following assumptions regarding the capacity utilisation of RE-trains on a track of 19.870 m with 2 stops along the way. The calculations are based on the 5- and 3-part Talent 2 EMU's with an access height of 600 or 800 mm above top of rail.

5-part vehicle VBB (3030 kW)

- 300 seats (273 standing [4 people/m²]);
- energy consumption at 50 % seating capacity utilisation: 6,23 kWh/km;
- energy consumption at 100 % seating capacity utilisation: 6,50 kWh/km;
- 100 % seats 2,16 kWh / 100 km per person;
- full capacity (seats and standing) 1,11 kWh / 100 km per person.

3-part vehicle VBB (2020 kW)

- 167 seats (75 kg) (176 standing [4 people/m²]);
- energy consumption at 50 % seating capacity utilisation: 4,23 kWh/km;
- energy consumption at 100 % seating capacity utilisation: 4,33 kWh/km;
- 100 % seats 2,59 kWh / 100 km per person;
- full capacity (seats and standing) 1,25 kWh / 100 km per person.

Simulations including the operational and technological measures detailed above showed an energy saving potential of 9% for the 3-part RE-vehicle compared to the energy consumption calculated for the standard speed profile. Calculations and simulations took into account external factors such as maximum speed, curve radius and gradient as they determine much of a vehicle's energy consumption. There is no available data on the energy saving potential of 5-part trains.

5.1.4. Legal Test

The inclusion of environmental criteria into awarding processes is explicitly permitted by European and national public procurement law. However, such standards have to be recorded in the contract. Where direct awarding is concerned, environmental standards are subject to negotiation.

The introduction of a bonus/malus system into awarding is legally sound, both with regard to regional, as well as European law as long as the methodology is transparent and fair in both the awarding of contracts, as well as the validation and monitoring of results.

5.1.5. Evaluation of EE/Env criteria for the awarding of regional rail services

Members of the SWG presented ways of factoring emissions, noise or general incentives for environmental standards beyond a call's minimum requirements into the awarding process, modelled on the current needs of Berlin and Brandenburg.

Key criteria can be included in the awarding as minimum requirements that need to be fulfilled or as results of a gradual process following a compulsory development plan to be implemented throughout the contract period.

The improvement of standards beyond minimum requirements can be guided by weighing criteria differently in relation to each other according to the needs of the individual region. A bonus/malus system can offer financial incentives for TOCs to improve their environmental performance beyond what is strictly required, while penalties discourage inflating offers beyond what is realistically feasible.

Representatives from German government bodies further suggested the use of a checklist, providing an overview of the various implications and consequences of environment related demands for the overall awarding process. The checklist should address:

- technological feasibility (divided into new and existing vehicles);
- costs;
- financial feasibility;
- necessary timeframe, split according to PTA, TOC and manufacturer;
- effects on the competition.

Possible examples for how to include noise pollution and emissions as criteria into awarding are listed in the following paragraphs.

5.1.5.1. Emissions

Minimum requirements in order to guarantee a necessary environmental standard:

- no Diesel traction on tracks that are fully electrified;
- ambitious but feasible standards for new vehicles:
 - i. stage III B;
 - ii. or stage III A plus additional particle filters by 2012;
- for existing vehicles:
 - i. at least UIC II;
 - ii. stage III A < emissions' standards at stage III A plus particle filters < stage III B < stage III B + denitrification;
- minimum requirements for fleet updates:
 - i. for example, compliance with stage III B through retrofitting or the replacement of substandard vehicles within x years (x meaning, for example, half the contract period).

Possible incentives for a further reduction of emissions:

- bonus payments for new vehicles:
 - i. stage III B + denitrification (70 % reduction minimum);
 - ii. stage III A plus particle filters + denitrification by 2012;
 - iii. diesel/electro-hybrid-vehicles on partly electrified tracks;
- a monetarisation of emissions' values - by imposing penalties or paying bonuses based on actual data - can be used to encourage further improvement.

5.1.5.2. Noise

Minimum requirements, as well as improvements beyond the required standard can be defined as:

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- Actual situation:
 - Actual situation - XdB, differentiated by vehicle type.
- TSI-Noise:
 - TSI-Noise +/- XdB, differentiated by vehicle type.
- VDV 154 (Association of German Transport Companies, VDV recommendation 154: Noise from Mass Transit Rail Vehicles acc. to BOStrab):
 - VDV 154, +/- XdB, differentiated by vehicle type.
- Special requirements: Braking noise, rail noise, maintenance, noise at standstill, platform requirements, depot related requirements.

5.2. Timișoara

5.2.1. Goals

Object of the Timișoara pilot application was the elaboration of an awarding documentation based on the ECORailS Guideline, aiming at:

- Integrating in the present way of awarding:
 - the requirements related to energy and economic efficiency;
 - the requirements related to the reduction of the emissions;
 - the awarding criteria to select the offer that best meet these requirements.
- Evaluating the Guidelines and the awarding documents according to the ECORailS objectives.

The Technical Specification elaborated²² refers to the procurement of rolling stock (respectively of 10 DMU and 10 EMU).

5.2.2. Technologies/measures involved

The following 10 technologies were incorporated in the new awarding documents developed by the Timișoara SWG:

1. Composition of a multiple-unit train.
2. Way of choosing a diesel engine.
3. On-board use of braking energy.
4. Energy recovery and storage.
5. Train Control and Management System (TCMS).
6. Optimized control of equipments.
7. Optimized control of train heating, ventilation, air-conditioning (HVAC).
8. Driver assistance system.
9. System for the control of comfort functions in parked trains.
10. Analysis of life cycle costs (LCC).

5.2.3. Scenarios

The awarding procedure developed as pilot application is based on new concepts elaborated in the ECORailS project, according to the EU directives and strategies on transport sustainable development.

The awarding procedure is elaborated as an ECORailS test. Consequently, particular attention was given to ECORailS objectives, while less stress was laid on some concrete, detailed aspects which are not within the scope of this project.

According to the new procedure, in the Technical Specification there were specified the main conditions and targets required by the user, the tenderer having the freedom to decide on the technical concepts and solutions to best meet them.

²² See Deliverable 14, Volume III.

Based on these procedures, there shall be certain mandatory (minimal) requirements, while for the rest, the tenderer may propose one or several optional variants / sub-variants which will be evaluated and scored so that the offers may be ranked accordingly.

Through the description submitted and by filling in the required forms, the tenderer shall account for and quantify the proposed variant based on the following elements (referred to in what follows and in the awarding documents, as „**ECORailS Criteria**”):

- a) Difference in terms of energy consumption during service [kWh, kWh/S, kWh/pkm].
- b) Differences in terms of harmful emissions levels [Emissions: g CO₂-pkm, g NO_x /pkm, Noise etc.].
- c) Life Cycle Costs (LCC) – life cycle is herein considered 30 years long.
- d) Technical advantages or advantages in terms of utilization (as well as the modality in which they influence the values above).
- e) Advantages in terms of availability and reliability in service.
- f) The difference in price (*if any*) an optional version (equipment / technology etc.) is likely to induce in the total purchase price as compared to the tenderer’s standard version.

ECORailS criteria shall play an important role in the evaluation of the offers, aiming at stimulating the tenderer’s application of the most competitive technical solutions, technologies and equipment, in order to reduce energy consumptions, emissions and operation costs.

Far from being a dogmatic document, the developed awarding documentation is rather a guide trying to explain and assist with the elaboration of such documentations according to the new ECORailS concepts.

Summing up, the awarding documentation elaborated, the test report and their annexes may be regarded as guides (together with / in completion to ECORailS Guide), particularly in setting up:

- elaboration principles;
- modalities of drafting the forms to be filled in by the tenderers;²³
- modalities of performance indicators follow-up in service;
- modalities of evaluation of the offers (criteria, shares, bonuses / penalties etc.);
- modalities of evaluating the medium and long term energy and environment benefits of the offer, as compared to the short-term financial benefits;
- drafting modalities for the tenderer’s contract liabilities as to the data in the offer and to the products behaviour in service (bonuses, penalties, sanctions)²⁴.

5.2.4. Test methodology

To perform the pilot application, at first the awarding documentation has been elaborated by using the ECORailS Guidelines.

²³ The role of these forms is to impose a unitary modality of filling in by the tenderers of certain performance indicators for the technical conditions and for ECORailS criteria, respectively. That will facilitate a comparison among offers and their evaluation, as well as the specification of the parameters to be checked through measurements and stand tests, or on a test line at product acceptance and during current service, respectively.

²⁴ The awarding documentation elaborated refers to the procurement of multiple-units (10 DMUs +10 EMUs), but many of the modalities proposed, as well as the related explanations, the foot notes etc. can be also applied to other procurements (products or services) aimed at reducing energy consumptions, harmful emissions and operation costs.

Then, some offers were simulated. This task was based on the good practice examples collected by ECORailS, as well as on a laborious documentation²⁵ and on the procedures described in details in a specific report.

Within ECORailS tests, actual 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.

A large number of measurements and statistics were made related to train current service on various routes and in various operating conditions (electrified or non-electrified tracks, in winter / summer, parking, different number of passengers etc.). Consequently, statistics were made over long periods of time.

There were collected data from ECORailS catalogue of operational technologies and measures, examples of tenders, norms, technical documentations from suppliers or specialized literature from other related projects (Railenergy, Prosper, Event, Repid, Ravel etc.). For each item in the requirements stipulated in the ECORailS Specifications, specific data were collected / elaborated under the test, according to the paragraphs above.

Analyses were made on decision matrices with balance point, namely:

1. The pessimistic criterion (Wold).
2. The optimistic criterion (Wald).
3. Probable value determining through the criterion of the extremes (Hurwicz), the criterion of the regrets (Savage) and the criterion of the balance (Baye Laplace).

This analysis was made based on the data collected / measured / calculated according to the three criteria, in order to determine the optimism – pessimism coefficient, namely fewer regrets, or anticipated value calculation.

In order to analyze the above, and to determine the decision matrices, the following were also considered:

- the probability of concurrently having minimum / maximum percentages for various hypotheses;
- annulment of non-conclusive extreme values;
- correlation of various calculated / measured / collected data;
- importance / credibility / accuracy of the sources and methods for data determining.

Within the test, based on the data collected / elaborated according to paragraphs „a+f” and to the analysis as per paragraph „g”, the degree to which the quantitative criteria were met was determined for each of the ECORailS objectives, namely:

- energy / emissions reductions as compared to awarding procedures conducted through the current methodology (without ECORailS criteria) - by 5%;
- energy /emissions reductions as compared to the rolling stock in current service - by 10%;
- energy /emissions reductions through ECORailS application over the next 20 years - by 15%.

Within the test, an analysis was made in order to evaluate level 2 set up by ECORailS, too, namely the Guidelines manageability and the agreement to the testing modality.

²⁵ Reported in a detailed bibliography.

The analysis made by the SWG was completed having taken counsel with transport authorities (PTA), users (TOC), rolling stock suppliers and stakeholders involved / interested in the project scope). That was achieved through direct consulting with specialists and decision makers, through processing the data from ECORailS meetings with the users, through questionnaires and various workshops organized with the users / stakeholders.²⁶

5.2.5. Activities done

Within the Timișoara pilot application, the following activities were performed:

- Test site description.
- Definition and collection of baseline.
- Definition and completion of users and stakeholders database.
- Analysis of current awarding procedures and documents.
- Establishment of a methodology for the drafting of the awarding and testing documentation.
- Elaboration of awarding documentation based on ECORailS criteria.
- Establishment and execution of necessary supplementary tests within real operating conditions – train with passengers, in different configurations, with different driving styles and with the measurement/recording of necessary parameters (consumption, speed, rotative speed, durations, etc.).
- Analysis of effects for each of the ECORailS criteria (technologies) through theoretical calculus, analysis and processing of test data, theoretical data – connected documentations, etc.
- Editing of the Report on ECORailS test performance – Timișoara Site.
- Presentation of the test results within the Site Stakeholder Group workshop organized in Bucharest on the 10th of February 2011.

5.2.6. Interaction with the stakeholders

Because of the importance that stakeholders and users play within the project, the most important national players from the rail sector, like Public Transport Administrations, Train Operating Companies, Rail Associations, rolling stock producers, etc., were co-opted in the Site Stakeholder Group (SSG) and, some of them, in the SWG.

Their active participation within the tests took place through direct communication and periodic correspondence with the aim of their informing and updating with regard to the

26 Notes:

- 1) The own evaluations made within the Timișoara test were made by comparing the data obtainable through the provisions under ECORailS documentation to the current awarding documentation (without ECORailS criteria), as well as to the data referring to the rolling stock currently in service in Timișoara site.
- 2) The evaluations made through the ECORailS Guideline, as well as those based on other current sources (directives, norms, suppliers' documentations, Railenergy- and other projects) referring to technologies or recent-date or future perspectives, compare their effects to the products which would be obtained through the current awarding documentations (without ECORailS criteria).
- 3) Except for the direct evaluations based on the current rolling stock (the pessimistic criterion) the other evaluations are made based on the current awarding documentations.
- 4) In the case of the probable value, the same percentages shall be taken into consideration for the comparison to the current rolling stock; these percentages are, of course, minimal (covering).
- #) In the case of a real tender, if the awarding documentation is properly elaborated, offer evaluation should be easy and obvious, leaving no possibility of being disputed.
- §) Tests performance is difficult, as it shall allow for simulating actual comparable conditions, so that the quantitative indicators at the 3 levels set up through ECORailS objectives may be determined on a well grounded basis.

project activities' evolution. Therefore, even from the project's debut, the stakeholders participated to a number of 6 meetings, at national level (2 organized in Bucharest and one in Timișoara), as well as at European level (2 User Platform meeting held in Berlin and one in Milan), received through mail various versions of the Guidelines as it was developed and were informed with regard to the project's evolution after each consortium meeting; 5 press releases have been elaborated and published in about 23 places, both written publications and different web sites. Also, dedicated articles about the project were published in specialty publications like: Innovation Magazine, Railway Business Magazine, Engineering Universe, Transurb, etc.

5.2.6.1. SSG workshop on the Timișoara Pilot Application's results

Participants:

The SWG managed to gather a core of stakeholders representing the National Railway Authority, the National Public Acquisitions Authority, the National Passenger Railways, Regional Passenger Railways and a Private Train Operator Company. The diversity of users attending the meeting ensured that the test results in the Timișoara region were analyzed on multiple levels since each part of the Timișoara test site presented different degrees of interest according to the priorities of each organization.

Presentations:

The presentations session began with an overall introduction of the project and of the Guidelines to allow the users to familiarize with the base topics.

The highlights of the workshop were the four presentations which showed the results of the Timișoara test site. The users were particularly interested in the quantitative achievement of the test objectives, i.e. the energy efficiency and CO₂ reductions compared to the current awarding and currently used rolling stock.

The presentations contained as much of the relevant results of the Timișoara test site, including the elaboration of the test awarding specifications, potential for energy saving and emission reduction from the diesel engine, LCC forms and overall energy efficiency potentials of the Timișoara region.

Discussion:

The users were generally satisfied with the presentations given; however, as it is natural some discussions and questions were raised. The first comments were made by the representative of GFR (private TOC). He noted the importance of maintenance costs during the life cycle of the vehicles. He also pointed out that his company is currently using a system which estimates the cost incurred by each rolling stock and the maintenance costs remaining by the end of the life cycle without emphasis on energy. He also expressed their interest in finding in the Guidelines indications regarding the modality in which requirements can be formulated when requiring a diesel engine.

The representative of the National Authority for Regulating and Monitoring Public Procurement was interested in the awarding procedure that was used in the Timișoara test. She underlined that, even though the current acquisition law does not allow any other form of procurement, due to the high amount of information that need to be made available to the competitors, a separate legal context could be used and developed specially for the transport

field. The Authority's representative highlighted the current favourable context which could sustain the ECORailS initiative, given by the following facts:

- The action decided by the Romanian Government and the EU Commission and started in January 2011 with the view to standardize the public acquisition procedures within 5 fields of interest, transport being among them (within the Transport working group, mister Octavian Udriste and mister Dan Caraman were co-opted as a result of their experience and also because of the know-how gained through their involvement in ECORailS).
- EU action for directing public acquisitions within the transport sector at national level, towards the inclusion of energy efficiency criteria.

The representative of the Romanian Railway Authority was particularly interested in the monitoring of the energy efficiency performance of rolling stock during the life cycle and underlined that the Romanian Railway Authority is interested in the Guidelines from this perspective.

All participants have confirmed their interest in the project and asked for materials/presentations in order to present their management and colleagues. In particular, the following were considered were useful:

- the concrete reasoning of ECORailS benefits as compared to a “normal” awarding, as it is practiced today in Romania;
- examples of procedures and formulations from the Technical Specification.

5.2.7. Use of the Guidelines

Because the performance evaluation of the Guidelines constitutes the central piece of the tests, the awarding documentation was elaborated and simulated basing primarily on the instructions given in the Guidelines, and secondly on personal experience and connected documentations.

Therefore, chapters 2.2 and 2.4 of the Guidelines draft version were used in order to explain the need of better performance in terms of energy consumption and CO₂ emissions, and chapter 3 provided the needed legislative base to be used for the simulation of rolling stock acquisition.

Other important chapters of the Guidelines draft version used in the test were: chapters 5.5 and 5.6 for determining the levels of noise and exhaust emissions, chapters 5.4.2 and 5.4.3 for identifying the EE and Env potential of braking energy recovery/storage technologies, chapter 5.4.8. for identifying the EE and Env potential of energy efficient driving, chapter 5.4.9 to identify the benefits of energy consumption measuring and recording, chapter 5.4.1 to determine the EE and Env potentials of controlling the comfort functions in parked trains and chapter 5.3 to elaborate a simplified LCC approach, so necessary at the acquisition of rolling stock.

5.3. Øresund

The test activities have been executed by a Site Working Group established within the Danish authority Trafikstyrelsen (TSY). A formal Site Stakeholder Group was not activated, but the current operator (DSB First) and the Danish Ministry for transportation were involved in the process.

5.3.1. Activities done

As preliminary work, several activities were executed by the SWG:

- translation of the present awarding documents;
- SWAT analysis;
- continuous individual update about the ECORailS developments;
- a plenary meeting about:
 - presentation of the draft version of the Guidelines;
 - discussion of the baseline;
 - feedbacks.

Two tests have been performed by TSY:

- Test I: the Guidelines have been tested and evaluated by a group of experts on traffic supply, tendering process and contractual issues within the organization of TSY.
- Test II: the Øresund test was performed as a simulated tendering process covering phase A Preparation and phase B Elaboration, according to the Guidelines' definition of a tendering process.

The overall goal of the test has been to determine whether the Guidelines can be used in connection with the tendering process used in TSY. 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.

Also it has been tested whether the energy efficiency and CO₂ reduction targets set out in the ECORailS project could be met, when using the Guidelines. To do this, the Guidelines have been used to select the types of technology feasible in the Øresund rails services, as well as to determine how to implement the use of the desired technology. Then, a calculation report was prepared to evaluate the energy saving potential reachable by applying the ECORailS EE/Env criteria to the Øresund rail services.

5.3.1.1. Calculation report – Baseline and saving potential

In the calculation report a baseline was established and the energy consumption was calculated for the Øresund traffic on the Danish side, also called “Kystbanen”.

Furthermore the purpose was to identify realistic saving measures and calculate the overall energy saving and CO₂ reduction potentials that could result from such measures. This result was then used for predicting to which extent the ECORailS Guidelines 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 calculation methodology applied was taken from the EU project Railenergy, that makes an online decision support tool freely available at:

www.railenergy.eu/calculator/calculator.aspx

5.4. Lombardia region

This paragraph shortly describes the goals and structure of the Italian pilot application, then summarizes the activities performed, under the coordination of ALOT, with the organization showed in the following chart.

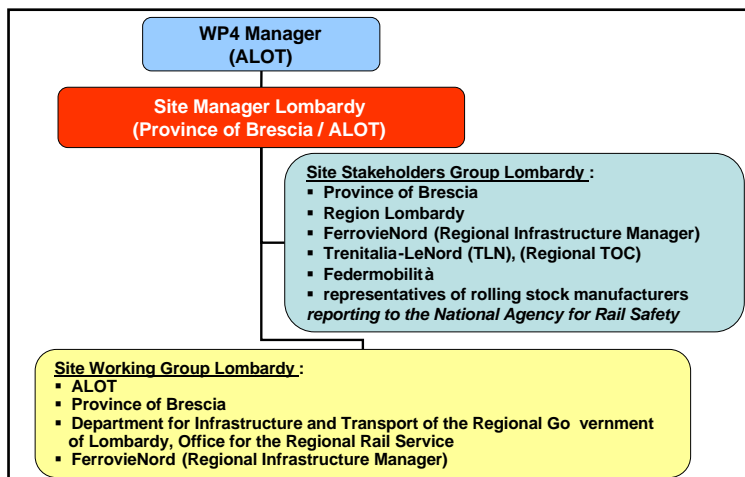


FIGURE 14: WORKING GROUP AND STAKEHOLDERS INVOLVED IN THE PILOT APPLICATION.

A key role was played by the SWG, who actively took part both in the structuring and in the execution of the test activities. Region Lombardy – as PTA regulating the rail service – and FerrovieNord – as technical body in charge of the provision of the publicly financed rolling stock – were happy to test the ECORailS approach to enhance the environmental performances of their service.

5.4.1. Goals

When designing the pilot application, the SWG decided to match the testing activity of the ECORailS Guidelines with the local needs. In this way the SWG was convinced that the result will not be only a theoretical exercise, but also the starting point for practical implementation.

It should be mentioned here that EE/ENV criteria are not in use at present in Italy to award rail services or rolling stock, while Italian TOCs and Infrastructure Managers already tested some technical solutions.

In details, the following goals were decided:

1. To increase the awareness of the potentials for saving energy and for reducing the environmental impact of regional rail.
2. To use the ECORailS Guidelines to improve the present PSC with new EE/ENV clauses.
3. To receive feedbacks about the ECORailS Guidelines and the strategy for Lombardy from a wider panel of stakeholders.

The first goal was pursued by using the ECORailS Guidelines to provide strategic arguments and on-site tests to show technical potentials. At the end of the pilot application an

agreement with Region Lombardy was reached, which decides clear steps to be implemented in next five years.

To write the new EE/ENV clauses, the operational part of the Guidelines was used together with the multi-annual experience of the Regional Government as regulator of the regional rail service. As competitive awarding is not applied today in Lombardy, the new clauses will be progressively inserted in the PSC which regulates the existing direct awarding to the TOC TRENORD.

To deal with the third goal, a stable SSG was established. The local stakeholders took part to dedicated workshops, to the ECORailS User Platform Italian meeting and to other events.

5.4.2. Scenarios

As mentioned before, during the pilot application reviewed or additional clauses were developed for the existing public service contract between Region Lombardy and TRENORD. As the starting point is without any experience in Lombardy in the PSC about energy measurement and saving, the SWG chose a progressive approach including clauses to be used in a “beginner” scenario and in an “advanced” scenario. The first can be used by the Regional Government to start with the ECORailS criteria, the latter could be an improvement, when basic conditions will be available. Such basic conditions in Lombardy are: energy meters installed on each motorized vehicle and collection of baseline data for some years to build a reference database.

A big renewal of the regional fleet happened during the past years. Therefore, the pilot application assumed the use of the existing rolling stock, but the Regional Government is also interested in finding in the Guidelines useful advices for future specifications of new trains. For this reason a requirement about the energy efficient providing of rolling stock is in the advanced scenario: the usual Reliability, Availability, and Maintainability clause is improved by adding an energy consumption statement and warranty by the manufacturer.

The proposed changes in the PSC will not ask for new rolling stock. Therefore, the energy saving goal, according to the input given by the ECORailS Guidelines, will be around 10%. This could be reached by operational measures, but also some recovering potentials will be soon available in Lombardy both for electric and diesel traction.

On-site measurement was done on the two lines selected for the pilot application to show the potential impacts of EE/ENV policies.

5.4.3. Activities done

As prescribed by the Management Plan (D12), the pilot activities were structured in four Steps:

1. Preparation, from December 2009 to July 2010: the organization was established, the goals were decided, baseline data and documents were collected and the SSG met the first time in Brescia on 11th December 2009.
2. Design of Scenarios, from August to September 2010: the “beginner” and “advanced” scenarios were decided, the following activities were planned.
3. Execution, from August 2010 to January 2011: the ECORailS Guidelines were tested and the legal clauses prepared; test runs on Valcamonica and S3 lines were performed and feedbacks collected from the SSG.

4. Analysis of the results, from January to February 2011: main findings were reported in D14 and to the Evaluation Group; the final steps to finalize the agreement with the Regional Government were scheduled.

5.4.4. Interaction with the stakeholders

Interaction with the stakeholders was running during all steps of the pilot application:

- FerrovieNord, Lombardia region, Federmobilità (the Italian association of PTAs), Province of Bolzano-Südtirol, Province of Brescia, Ferrovia Udine Cividale, the main rolling stock manufacturers in Italy (Alstom, Bombardier, AnsaldoBreda, Stadler) took part to international User Platform meetings and training events.
- Two main SSG meetings were held in Brescia on 11th December 2009 and on 17th December 2010.
- The pilot application results were presented in the ECORailS User Platform meetings and international training events and in the Italian conference organised by the association of rail engineers.
- During and after the SSG meeting of December 2010, feedbacks have been collected by using the methodology developed in WP5. Comments were based on D22: “Final Version of the Guidelines, 2nd update version for the tests”, released on 15th November 2010. Also the company FAR Systems, technology provider and member of CENELOC working group, was invited to give technical feedbacks. A guided discussion took place focused on four main topics:
 - monitoring of energy consumption in the PSC;
 - incentives to save energy;
 - use of the ECORailS criteria for the provision of new rolling stock;
 - evaluation of the Guidelines, which were sent in advance to the participants.

5.4.5. Use of the Guidelines

The ECORailS Guidelines have been used and evaluated in both their strategic and operational parts:

- The strategic general approach inspired the strategy of progressive adoption of EE/ENV criteria and technologies in the regional rail service of Lombardy.
- The operational section was followed to prepare the new clauses for the PSC:
 - the paragraphs and annexes relevant for the pilot application were selected and analysed;
 - starting from these inputs, the clauses have been written, also following the legal rules currently in use in Italy and in Lombardy.

At the end of this process an overall evaluation about its manageability was given by the SWG members.

6. Achieved results

At this final stage of Deliverable 14 the main results achieved by the four test sites are presented. In a few words:

- The **Berlin** test site followed a workshop approach, the test being performed during five meetings with the local stakeholders.
 The Guidelines were used to formulate criteria for tendering the virtual lines RE 74, 75, 76 and some impacts on energy consumption have been estimated by simulations.
 From the legal point of view, the new approach for the awarding of regional rail services was considered feasible, without any change to the present regulations.
 At the end, an agreement among the participants to the workshop process was reached on the new criteria, but the TOCs asked the PTA to carefully take into account the implications on competition of such new approach when putting it in practice.
- The **Timișoara** test site reviewed and improved the present way the rolling stock is awarded in Romania by competitive tendering. Object of the test was the provision of 20 multiple units to be used in the Timișoara region, 10 for a diesel line and 10 for an electric line.
 A complete technical specification and a set of evaluation criteria for the offers were developed, based on the advices in the ECORailS Guidelines. The approach followed in Timișoara evaluated in details 10 technologies for the new rolling stock from the catalogue included in the Guidelines. The prepared awarding text allows the tenderers to offer better performances than the minimum requirements asked by the technical specification; such improvements are evaluated according to the LCC criterion. Finally, some offers were simulated to allow an estimation of the impacts.
 The proposed way of evaluating the offers is unusual in Romania, where only the maximum rebate criterion is today admitted for the public procurement. The Romanian National Authority for Regulating and Monitoring Public Procurement was interested in this proposal and agreed to involve the ECORailS team in the working group in charge of reviewing the present rule.
 A key legal problem raised by the Timișoara pilot application is how bind the rolling stock suppliers to the offered energy performances during the life cycle for a longer period than the usual 24 months warranty.
- The **Øresund** test site reviewed the tendering documents used for last tendering process for the cross border traffic across the new connection to Sweden. The main test activities were performed internally by the Danish authority Trafikstyrelsen (TSY).
 Two kind of test were performed: the Guidelines have been tested and evaluated by a group of experts on traffic supply, tendering process and contractual issues within the organization of TSY; then, a tendering process was simulated, covering phase A Preparation and phase B Elaboration, according to the Guidelines' definition of a tendering process. Besides, the reachable energy saving by using the technologies and measures in the Guidelines was estimated by simulations, according to the methodology developed by the Railenergy project.
 Useful technical and contractual improvements were found at the end of this job, able to improve energy efficiency also if the present rolling stock is kept.
- The **Lombardy** test site at first produced arguments and data able to convince both the regional PTA and the TOC: this was the first successful test use of the Guidelines. The Guidelines arguments were supported by the numbers collected during test runs on Valcamonica and S3 lines, in cooperation with the regional TOC TRENORD.
 New clauses for the PSC between the Regional Government and the TOC were prepared as second step: they became part of a Memorandum of understanding – annexed to the

new PSC – where the PTA and the TOC agreed a plan to progressively implement a monitoring system and operational measures to reduce energy consumption in Lombardy. The regional Infrastructure Manager FERROVIENORD was also involved in the plan.

The Italian stakeholders gave positive feedbacks on the test activities and results. They also asked the National Government and the European Commission to support their efforts aimed to increased energy efficiency in the regional rail sector. On their opinion, common rules in Europe and incentives are needed about compulsory energy meters, charging the TOCs for real electricity consumption from the infrastructure and the liability of rolling stock manufacturers for the EE/Env performances of the vehicles.

All together the test sites showed that the ECORailS targets for energy savings are reachable, even if the starting conditions in the five countries are not homogeneous. The estimations kept the present energy mix. For further details, please see Deliverable 17 “Validation report including tests and recommendations”. The following table summarises the quantitative results of the four test sites.

Topic	Berlin	Timișoara	Øresund	Lombardy
Compared to current awarding	up to 9%	10.5 %	12.9%	8% - 10%
Compared to currently used rolling stock	evaluated during the workshop process with the stakeholders	15.6 %	no change of rolling stock in the pilot	no change of rolling stock in the pilot (10% monitored)
At system level	evaluated during the workshop process with the stakeholders	27.56%	15% reachable with additional investments	15% reachable by implementing the agreed mid-term plan

TABLE 12: ENERGY AND EMISSION SAVINGS IN THE FOUR TEST SITES.

Besides, all test sites provided the ECORailS Editorial Group with very detailed feedbacks and inputs to prepare a more concise and manageable final version of the Guidelines, as described in the following paragraphs for each site.

6.1. Berlin

The test results of the Berlin pilot application have been elaborated split up into the awarding modules “Energy Consumption”, “Noise Emission” and “Exhausted Gas Emissions”.

6.1.1. Energy and environmental impacts

- Existing spaces of time between the invitation to tender, the awarding and the start of operation are not suitable for accelerated implementation of available and innovative technologies worth to improve energy efficiency of vehicles. A possible solution will be a long-term phase in/phase out strategy independent from certain awarding procedures.
- A further approach is that a PTA sets incentives to the TOC for improving energy efficiency of their vehicle fleet either by modernisation or by exchange of vehicles during the service contract period.
- The design of the timetable has an important role in reducing energy consumption and environmental impacts of the service. Reducing time of travel is in conflict with energy efficiency and low environmental impacts. PTAs have to take care of this when designing timetables that are the basis for tenders.

6.1.2. Energy Consumption

A common sense has been achieved between the participating stakeholders regarding the energy efficiency related awarding module, resulting in the following points:

- Due to economic reasons, a general interest exists for saving energy during operation by the TOC. To absorb budget risks due to the possibility of rising energy prices, a PTA has also a huge interest towards energy efficient train operation with energy efficient vehicles in connection with RRTP, which has been awarded to TOCs.
- Instead of the current procedure for PTA’s payment of energy costs to the TOCs – a fixed percentage of the total costs per train*km – two general possibilities will be useful for the PTA: 1) determination of an energy cost share based on realistic assumptions or 2) determination of a state-of-the-art maximum energy consumption value for vehicles to be operated by the TOCs. The PTA’s assumptions can base on scientific calculations or on test runs. Due to the better reference to the awarded network, the PTA prefers test runs.
- The bidding TOCs will have the possibility to undercut these maximum values given by the PTAs and then be rewarded with a bonus. In case of overstepping the offered values for energy consumption by the chosen TOC - detected by means of trial runs before starting the service contract - the bonus payment has to be recovered and a contract penalty per train*km depending on the value of overstepping has to be paid to the PTAs.
- A practicable monitoring procedure has to be established. The monitoring should base on aggregated data on energy consumption per line or network for periods of less than a year. In case of test runs before starting operation, the local ambient and timetable conditions have to be defined very exactly.
- To make the TOCs sensible for the energy saving potentials of the parked train mode this issue should be mentioned explicitly within the awarding text. A certification of a TOC according to EN 16001 should be considered by the PTAs in a positive manner.
- To make the TOCs sensible for the energy potentials given by energy efficient driving (eco-driving) the PTAs should be enabled to prove the existence of an eco-driving scheme (technologies, qualification of staff) by means of a checklist.

- PTAs should look at widely accepted energy and environmental standards as an essential precondition for production of large vehicle series connected with economies of scale for TOCs.

6.1.3. Noise Emissions

A common sense has been achieved between the participating stakeholders regarding the noise related awarding module, resulting in the following points:

- The development periods of vehicles have to be harmonised with the periods of aggravation for rules on noise emissions. The lead time between announcement and implementation of aggravated rules on noise emissions has to be used. According to statement of the industry, the limit values of TSI Noise, which will be implemented by 2016, are already today the basis for development of vehicles.
- The ECORailS Guidelines foresee bonus payments for exchange and modernisation of noise intensive vehicles during the service contract period.
- Based on the balance of interests between industry, TOCs and PTAs, the PTAs should influence the process of updating of rules on noise emissions at the political level.

Regarding the noise related awarding module there are some open aspects remaining, which are worth to be further discussed:

- The possibility for the PTA to require limit values for noise emissions that are more ambitious than those of TSI Noise.
- The determination of realistic limit values for noise emissions, which are more ambitious than those of TSI Noise.
- A proper measuring method for determination of noise emission values and adequate monitoring procedures before and during the service contract period.

6.1.4. Exhausted Gas Emissions

The pollutants related awarding module shows a similar picture to the noise related awarding module. Especially, it is noted by the stakeholders that there is a demand for the development of a feasible and nation-wide harmonised monitoring procedure.

The stakeholders have been supported to continue the discussion of open aspects, especially for the noise and pollutants related awarding modules.

6.2. Timișoara

6.2.1. Manageability and usability of the Guidelines

After performing a test of the Guidelines under the pilot application, it has been indicated by the SWG and SSG that the Guidelines's concept is very useful and that it holds a lot of strong points, but the general feeling was that its draft version used in the pilot applications was still not 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 documentation.

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 too general and detailed. The introduction (chapter 1) should be more focused on the element of novelty that the project brings, its necessity and benefits, and less focused on the organisation of public transportation services and other unnecessary information, unrelated to the object of the project. The second chapter should be reduced and streamlined towards explaining why the Guideline'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 should be added. The chapter dedicated to the legal framework was too detailed; at least chapter 3.1 should only enumerate briefly the legislation promoting economy, energy efficiency and environmental aspects.

The second part dedicated to the practical and working level contains useful information but must avoid the references to the normal awarding procedure, as the people interested in these chapters already have the necessary knowledge to prepare a "classic" awarding documentation. In this sense, chapter 4 should be heavily shortened and cleaned of all the tables because they are subjective and incomplete, and do not bring any effective support for the elaboration of the awarding documentation. Instead of ambiguous tables, simple and concrete explanations/advice should be given. On the other hand, within chapter 4.4.4, more detailed explanations about phase G should be given taking into consideration that it is very "special" in what concerns the ECORailS procedure. Chapter 5 being the technical one should focus on clearly defining the modality of integrating, evaluating and monitoring the ECORailS criteria. It should provide advice and instructions with regard to the use of the new criteria, together with concrete examples and best practices. The awarding text modules resulting from the four pilot applications should also be inserted into the respective chapters from the Guidelines.

All in all, the stakeholders involved in the pilot application have appreciated the quality of some chapters, but efforts towards making the Guidelines more targeted and manageable are still in order.

Flexibility and adaptability to the needs and particularities of Timișoara test region

Since within the Timișoara test site it was decided to simulate the acquisitions of railway vehicles, the SWG found in the Guidelines general indications in terms of which performance indicator would best be suited in the case of vehicle awarding and selected "kWh per seat km". However, the Guidelines could be 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.

A very important chapter in what concerns the test from Timișoara is the one dedicated to the Life Cycle Costs. The draft form of this chapter did not provide the necessary basis for an LCC driven procurement of railway vehicles. This chapter should focus on teaching the PTAs/TOCs how to request the costs on the entire lifecycle, so that the offers could be easily compared and evaluated.

In general, the tools needed for making the awarding procedures more economical and environmental friendly were given by the draft version, but they were too theoretical and not practical enough.

Efficiency for developing the awarding procedure in the test site Timișoara

The simulation of the awarding procedure from the Timișoara pilot application was made in its majority based on the specialized literature, related projects, manufacturers' brochures and advertising materials, and own experience, and not so much based on the draft version of the Guidelines, which failed to explain in a practical manner all matters related to the inclusion of energy efficiency and environmental criteria in the different steps of the awarding process.

Overall, a poor level of manageability was achieved from the perspective of the Timișoara site; therefore, the information provided needed to be more structured, shortened and to the point.

Acceptability and participation by the Timișoara Site Stakeholders Group

The SWGroup has appreciated very highly the action to simulate an awarding procedure based on real data from the Timișoara region. Obtaining this information (the baseline) for the national rail operator is hard to come by in Romania. The fact that we received said data, we received the right to use and disseminate it and we received it all in due time shows the commitment and the interest our main stakeholders had in the test.

The members of the SSG 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 believe that efforts should be made to improve the draft version of the Guidelines used in the pilot application towards its shortening and streamlining of information to respond to the specific objectives of the project.

6.2.2. Awarding documents prepared

The most important documents prepared for the awarding documentation are:

1. The Report on ECORailS test performance – Timișoara site_ ECORailS_WP4_W4, and its Annexes, mainly:
 - Annex W41-05_Comparative analysis of Diesel rolling stock
 - Annex W41-06_Train composition comparison_actual documentation
 - Annex W41-07_Train composition comparison_current rolling stock
 - Annex W41-08_comparison in terms of diesel engine characteristics
 - Annex W41-09_energy regeneration at braking

- Annex W41-10_driver assistance system
 - Annex W41-11_related effects
 - Annex W41-12_Perspective for 2020
 - Annex W41-13_Documentations
 - Annex W41-14_Conclusions
2. The Technical Specification (WP4_W42-02_Specifications) for the procurement of 10 DMUs and 10 EMUs, with its technical data sheets (Annex ECORailS_WP4_W42-03-BD):
- FT01_ DMU EE and EF Characteristics (Annex W42-03-01)
 - FT02_DMU Diesel engine EE and EF Characteristics (Annex W42-03-02)
 - FT03_ Electrical transmission EE and EF Characteristics (Annex W42-03-03)
 - FT04_ DMU air system and braking EE and EF Characteristics (Annex W42-03-04)
 - FT05_ Train Control and Management System EE and EF Characteristics (Annex W42-03-05)
 - FT06_ HVAC System EE and EF Characteristics (Annex W42-03-06)
 - FT07_ Lighting EE and EF Characteristics (Annex W42-03-07)
 - FT08_ Smart stabling EE and EF Characteristics (Annex W42-03-08)
 - FT09_ DMU Overall Life Cycle Costs – LCC (Annex W42-03-09)
 - FT10_ LCC technologies (Annex W42-03-10)

6.2.3. Estimated impacts and results

The application of the ECORailS Guidelines has a positive impact over:

- Users: important economic effects throughout the service life.
- Suppliers: the acquisition price can rise, but the tenderers with innovative solutions, as well as the long-term partnership with the user, are at an advantage.
- Public: higher life quality and the pre-requisite of a sustainable transport.

The project's quantitative indicators have been attained, as follows:

- **10.5%** compared to current awarding (without ECORailS);
- **15.6%** compared to the currently used rolling stock;
- **27.56%** at system level, by 2010.

For each of the technologies proposed in the documentation and evaluated through the tests (calculations, field tests by RTFC Timișoara on the test lines, etc.), the ECORailS indicators were exceeded.

6.2.4. Recommendations and problems

Those who were involved to a larger extent into the test activities have understood and agree that the ECORailS procedure is very useful and efficient for a long term.

To the others, the ignorance of these issues, as well as their complexity, are a major impediment very unlikely to overcome, unless such criteria and procedures are imposed by national and / or EU regulations (directives, norms etc.).

Some modalities of formulating the requirements and evaluating the offers, respectively, the modality of testing and follow-up in operation etc. call for a highly complex and specialised knowledge of technical (and also economic, legal and procedure-related) issues. Perhaps, for such issues, specialised consultancy would be necessary, or ECORailS project could be further carried on by a project in support of the practical applicability, optimization and development of these applications etc.

6.3. Øresund

6.3.1. Manageability and usability of the Guidelines

Results of Test I

The testing group thought that the Guidelines hold several good things, but the overall impression was that the framing is too general. More substantial and structured information/issues are requested. The group found the structure of the draft version of the Guideline used in the pilot application as not user friendly.

More detailed feedbacks have been formulated for the two main parts of the Guidelines:

- Part I, the political and strategic level, should be shortened and more focused on the purpose of the ECORailS, which is to handle environmental criteria.
 Aspects like that Part I contained too much history and only the environmental parts of the legislation should be presented. The Guidelines should only be about environmental issues. This part should only be about 2 pages and the rest should be in an annex. Basic legal issues are known and do not need to be in the Guidelines. The testing group requested a document like an encyclopaedia.
 The charts were too many and made it hard to absorb the content of the document. Chapter 3.3 was too obvious and a something that a purchaser already know.
- Part II: The testing group accentuated the value of natural incentives. The environmental requirements can in some cases be too expensive and ambitious. If you are using environmental requirements there should be a connection between reason and the expense for the operators. Environmental criteria should be used when it is relevant and it must be possible to evaluate these requirements.
 Evaluation criteria should not be in the contract. The testing group requested a writing of pre-qualification and pointed out that this could be of use when it comes to evaluation of the activities. A good example is pointed out on page 33, 4:3 “How to include EE/ENV criteria”. The evaluation criteria should be relevant for the things you purchase.

Results of Test II

The Guidelines have been tested regarding usability in the elaboration phase (Phase B according to the Guidelines).

The following tendering documents describing the Øresund train service have been used for the test:

- Volume of service and service characteristics (Bilag 2 Trafikbetjening).
- Rolling stock (Bilag 3 Rullende materiel).
- Staff (Bilag 6 Personale).

- Incentive schemes (Bilag 8 Incitamentsordninger).
- Operators contract with the Infrastructure Manager (Bilag 10 Operatørkontrakt med Banedanmark).
- Reporting (Bilag 12 Rapportering).
- Description of the tender (awarding criteria and assessment) (Tilbudsgrundlag).

The Guidelines have been consulted to elaborate on above mentioned tendering elements, with the goal of updating the text modules of the individual tendering documents.

Volume of service and service characteristics

After a further analysis, it did not seem feasible to include EE/ENV criteria in this document.

Rolling stock

Using the Guidelines recommendations regarding criterion, the choices made for operational measures in phase a match, at least to a larger extent. The control of functions in parked trains has a significant energy saving potential in the Øresund case. In the table 4.4. this operational measure was however stated as “not relevant”.

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

Staff

In order not to prescribe which operational measures to be used by the operator, neither requirements for training in eco driving, nor to describe, to what extent the staff could contribute to EE/ENV should be described in the tendering documents. It is deemed more feasible for the operator to identify how training, energy awareness campaigns etc. could support energy efficient operation.

Incentive schemes

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

A bonus/malus scheme should be setup to encourage the operator to optimise his energy performance. Break even is the base line energy consumption per train-set*km, alternatively per seat*km.

The bonus/malus scheme should follow the principles of the other bonus/malus schemes (for instance regularity) to ensure transparency and manageability in the contract period. In principle, the setup described in the Guidelines could be used, with the adaption of incentive and penalty levels to the actual situation.

The draft version of the Guidelines did not support the concrete elaboration of text modules, regarding the reporting and monitoring of the KPI(s). More specific, the potential conflicting requirements/bonuses for energy consumption in, respectively, out of service, needed further explanation.

Operators contract with the Infrastructure Manager

No relevance of changing requirements. However, reporting on energy consumption should be made to the PTA as well as to the Infrastructure Manager.

Reporting

In general terms, the existing energy consumption monitoring scheme provides the necessary information and manageability for contractual follow up. One additional reporting feature requiring the operator to report the energy consumption directly to the PTA should be added to the requirements set out in Bilag 12.

The energy consumption used for parked trains (when not using the pantograph) should be extracted and revised separately by the operator before reporting to the PTA.

Description of the tender (awarding criteria and assessment)

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

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

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

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

The Guidelines promise a potential predominant rating of EE/ENV, even if the weighing scheme weighs price at 70% (and EE/ENV requirements 15%). In the view of TSY, this is not realistic, since the EE/ENV criteria will appear alongside a longer row of criteria to be assessed and weighed by the PTA. The real benefit of actually including EE/ENV criteria is that it forces the bidder to analyse and describe his EE/ENV performance, and it is possible to make a contractual follow up on the promised performance.

6.3.2. Estimated impact

Results of Test II

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.

The CO₂ 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 very 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.

6.3.3. Recommendation and problems

Results of Test I

The testing group accentuates the following requirements:

- Requirements that have environmental effect – “environmental drivers” – that gives economical revenue.
- Focus on the most economical environmental requirements.
- Functional requirements instead of technical requirements. Technical requirements could be outdated within a short period of time.

Shall-requirements or incentives

The document should give support and help to set requirements in the procurement process. It is important to not set up requirements that become clash of interest to each other.

Shall-requirements or natural incentives are issues that the testing group discussed. Should the Guidelines advocate some technical solutions or are the natural incentives enough? The testing group lack information about shall-requirements.

About the weighting and scoring, on the Danish SWG’s opinion, it could be a problem from a juridical aspect if you use levels instead of the highest value when it comes to environmental requests.

Evaluation of requirement

The testing group request information about how to evaluate the requirements that are placed. Environmental requirement should be pointed out to make it possible to evaluate. The group lacked a description in the draft version of the Guidelines on how a PTA should evaluate the requirements. The group pointed out the danger of using charts without explanations. They think it would be helpful to have an example out of the baseline, from calculations not from goals.

It should not be possible to get good grades because you are the least bad chose, the evaluation should be estimated from goals and requirements.

Issues to exclude from the Guidelines

On the Danish SWG’s opinion, to develop the final version of the Guidelines:

- the three first chapters should be shortened;

- the juridical chapter should be shortened;
- the part about EU-legislation should be shortened;
- the historical part should be shortened.

It would be enough to make a listing in the chapter 5.4 of the different technologies and to put the rest of the information in an annex.

Exclude the writhing of LCC and CBA when it does not relate to the procurement process.

6.4. Lombardia region

6.4.1. Summary of main results

The pilot application in Lombardy, as mentioned before, aimed to deliver both the testing of the ECORailS Guidelines and an operational approach to be used in Lombardy for starting with the use of EE/ENV criteria in regional rail services.

First result was to have enhanced the awareness of the benefits brought by the approach supported by ECORailS. To reach this, a key role was played at first by the arguments reported in Part I of the Guidelines and in the User Platform meetings, then by the on-field tests performed by the SWG on the two lines involved in the pilot application. The results confirmed other pilot experiences, made both by the regional Infrastructure Manager FERROVIENORD and the national TOC Trenitalia, which involved the recovery of braking energy on board (Molteno awarding procedure for diesel trains) and in fixed installation (recovery of electricity at Bovisa sub-station) and eco-driving (Trainer project).

As second result, the regulators and the operators taking part to the SWG agreed to design within the pilot application a path which can bring the regional rail to a significant use of the EE/ENV criteria. The deadline of 2015, when the Expo 2015 will be hold in Milan, could be an incentive to act fast and effectively.

After discussions – also with the stakeholders – the present way of awarding regional rail services without competitive tendering was seen as a good opportunity: in fact, the directly awarded public service contract allows the intermediate adaptations needed to implement such a progressive approach. Besides, it allows – through the use of side agreements/regulations – designing a broader strategy by including also actions in charge of the Infrastructure Managers, like a new way of charging the electricity cost to the TOCs.

It was therefore written a draft agreement to be signed by the Regional Government and the TOC, where a list of actions – both on the regulator and the TOC sides – is decided and the results to get at the intermediate steps are agreed. This agreement contains also the criteria to be followed for the changes to be introduced in the public service contract at each intermediate step. About this issue, the regional regulators were still not fully convinced of using bonus/malus incentives, because of the bureaucratic burden and the regulatory risk due to the many uncertainties to manage, which may cause additional subsidies to be paid by the Regional Government. On the other hand, they support, in competitive tendering for buying the new rolling stock, a clause like the usual Reliability Availability Maintainability (RAM) clause to make the manufacturer declaring in advance the energy consumption of the train and giving a guarantee that it is kept during the day-by-day service.

Third result was the evaluation of the draft version of the Guidelines. They were distributed to a broad range of stakeholders who were asked to fill-in the questionnaire prepared for WP5. Stakeholders also took part to the SSG meeting in Brescia on 17th December 2010, where

they analysed in details the Guidelines contents and structure. The discussion was focussed on the main measures proposed by Part II of the Guidelines, of which the strengths and weaknesses have been evaluated.

6.4.2. Manageability and usability of the Guidelines

The following are main feedbacks from the SWG about the use of ECORailS Guidelines in the Pilot Application Lombardy:

1. Manageability:
 - In spite of the work-in-progress feeling, the Guidelines give clear advice about the available measures and their pros and cons.
 - The Guidelines alone are not sufficient and the PTA should add its knowledge and way-of-doing in awarding.
2. Evaluation of impacts:
 - Key information about how to arrange a monitoring system for energy consumption and emissions, but additional technical information may be needed by the PTA, maybe from external sources.
3. Preparation of awarding texts:
 - Although other text modules could be added, key reference existed in the draft version of the Guidelines for the contract design in the Lombardy pilot.
 - In any case, for a successful implementation of the ECORailS approach the PTA needs to customize the Guidelines content to its way-of-doing, which is strongly dependant on local conditions.

Besides, the strategic picture of arguments, measures and goals gave by Part I of the Guidelines worked very good to help Lombardy in designing its path to introduce the EE/ENV criteria in the regional rail service. If available, an example of a best-practice strategy (may be coming from the Pilot Applications) could be added at the very beginning, including its time frame and the foreseeable costs.

The second SSG meeting hold in Brescia on 17th December 2010 gave the opportunity to build a systemic picture of the feedbacks coming from the Italian stakeholders. 6 stakeholders took part to the meeting:

- 1 national association of PTAs (Federmobilità);
- 2 PTAs (Region Lombardy and Province of Brescia);
- 1 TOC (TRENORD);
- 1 rolling stock manufacturer (Alstom);
- 1 technology provider and member of CENELOC working group (FAR Systems).

Main results can be summarized as follows:

1. Monitoring of energy consumption in the public service contract:
 - For Region Lombardy, monitoring the energy consumption should be introduced in the PSC; a good way could be to measure the consumption of each train set in use in standard conditions which can reflect the main infrastructure characteristics and service profiles.

- For TRENORD, a key issue to deal with is the installation of energy meters, which are not compulsory in Italy till now. Besides, to make the monitoring reliable other relevant data should be collected, like the number of travellers on board.
2. Incentives to save energy:
- The Regional Government is worried about contractual incentive systems because they are not easy to manage and can have secondary effects like the reduction of commercial speed. Without a strong cultural commitment of the TOC there is the risk of additional costs or duties for the PTAs.
 - For TRENORD the simplest incentive (natural incentive) is to charge the TOCs for the real energy costs (without subsidising the inefficiencies).
 - For FAR Systems the present way of charging energy in Italy (flat price) should be changed by the National Government as pre-condition for effective energy efficiency policies.
 - For Federmobilità an example of energy saving package with LCC calculations could be useful to convince and to show the time to repay the investment.
3. Use of the ECORailS criteria for the provision of new rolling stock:
- For the Regional Government of Lombardy, all calls for new rolling stock should include energy meters on-board because of the minor additional cost.
 - For TRENORD a combination of liability clauses and checks of energy consumption under standard conditions could work well. All declarations by the manufacturers should be checked through on-field measurement.
 - For Alstom the manufacturers support a wider use of measurement of energy consumption; to allow this to be put in practice easily international standard test circuits should be preferred.
 - Alstom points out that the evaluation models used for the tenders should incentive more the energy efficiency features of the offered rolling stock.

The WP5 questionnaire was submitted to the stakeholders to evaluate the draft version of the Guidelines, together with the preliminary results of the pilot application²⁷:

- 60% of the answers about the Guidelines had a High Degree of appreciation, 26% a Normal level of appreciation. All participants were interested in using the Guidelines in future awarding procedures. They are convinced of its impact and usefulness and consider necessary to have an EU wide applicable set of Guidelines for the awarding of passenger rail vehicles and services at regional level.
- 4 participants accepted to give also a preliminary feedback about the preliminary results of the pilot application: 42% of the answers had a High Degree of appreciation, 42% a Normal level of appreciation. All respondents were convinced that the ECORailS KPIs can be reached in comparison to currently used rolling stock and in the year 2020 perspective. The Regional Government of Lombardy and the rolling stock manufacturer are more sceptical about the successful impact of only operational measures not supported by new rolling stock and changes from the side of the Infrastructure Managers.

²⁷ 6 stakeholders gave their answer: 1 national association of PTAs (Federmobilità), 1 PTA (Region Lombardy), 2 TOCs (LeNORD and Ferrovia Udine Cividale), 1 rolling stock manufacturer (Alstom), 1 technology provider and member of CENELOC working group (FAR System).

6.4.3. Legal documents prepared

A key result of the pilot application is the delivery of the text of an agreement (called Memorandum of understanding) between the Regional Government of Lombardy and TRENORD about the introduction of the ECORailS criteria in the regional rail service, including legal text modules for the “beginner” and “advanced” scenarios.

At first the agreements contain the list of measures to be implemented:

- Introduction of environmental and energy consumption’s indicators in the PSC monitoring system, able to provide data at the beginning with energy meters available only on a sample of the traction units.
- Side agreements with the Infrastructure Managers, the manufacturers of rolling stock and other relevant stakeholders: these agreements can foster the availability of technology and infrastructural improvements or a more energy efficient design of timetables.
- Installation of energy meters on all new rolling stock acquisitions.
- Arrangement of plan to install energy meters on the existing rolling stock in a way to cover at the beginning a sample of main types in service.
- The commitment to adopt, in the awarding procedures for new rolling stock, requirements specification and evaluation criteria for tenders that propel energy efficiency and noise and pollutant emissions reduction.
- The commitment to define affordable improvement actions for energy efficiency and noise and pollutant emissions of existing more recent vehicles at intermediate revisions.
- The Regional Government will introduce a new charging system of electricity costs provided in the regional infrastructure by FERROVIENORD, based on real consumption; this pilot project will be presented to the National Government to be extended to the national infrastructure (following the prescription written in the rail reform update law of 2009).

The implementation instrument of the agreement is a plan, which has to be jointly prepared by the Region and the TOC. This plan contains clear targets and deadlines referred to short, intermediate and final steps:

1. Preparation step, which aim to supply regional rail service with basic tools, data and know-how adequate to start concrete actions for reducing energy consumption and emissions.
2. Kick-off step, during which monitoring system, acquisition criteria and supplying of rolling stock and partnership/cooperation with Infrastructure Managers will be operating and will be specified by single lines. At this step the “beginner” contractual clauses can be introduced.
3. Trimming step, which foresee wide application of incentive tools extended to whole regional rail service, also assuming standard energy consumption and cost. At this step the “advanced” contractual clauses can be introduced.

An incentive system is foreseen for the plan, to foster its adoption. As all Italian PTAs are now asked to cut their budgets for subsidies, it is not possible to find financial sources for all improvements included in the plan. Some measures, like regulatory changes, have no cost; other, like the requirements for energy meters and other EE/ENV improvements on new

rolling stock, may be easier financed because the collection of capital investment finance is simpler and the benefits brought by ECORailS are more evident.

For each step, main contractual text modules have been outlined:

- In the kick-off step (beginner contractual clauses), priority was given to the liability like-RAM clause for the providers of new rolling stock and to the study of selected incentives related to energy saving targets.
- For the trimming step (advanced contractual clauses), a text module was prepared which fixes the energy cost in advance, according to energy consumption standards (for each service profile and each class of rolling stock) and to a standard cost of energy decided by the PTA, with a predefined indexing.

From the legal point of view, the content of the agreement was evaluated as compliant with the present Italian and Lombard laws. The SWG considered useful to check the impact of the ECORailS criteria about the provision of rolling stock with the regulations made by the national rail safety agency ANSF about the authorization of the vehicles.

6.4.4. Estimated impacts

The plan envisaged by the agreement will estimate the whole impact of the involved measures, according to the possible implementing steps. In the pilot application demonstrative tests were done on the diesel Valcamonica line on 4th September 2010 and on the electric S3 line on 15th December 2010 to show in practice the reachable potential by using:

- operational measures like eco-driving;
- introducing lighter and advanced new diesel rolling stock;
- the regenerating system available on the TAF and on the more recent rolling-stock.

Measurement of fuel consumption is usual for the Valcamonica line because of tax reductions allowed to public transport operators. Fuel is usually measured by TOC's employees in the tank at refilling time. Official checks are regularly made when asked by the tax policemen. As the present measurement method does not allow the collection of data for each run, during the test runs fuel consumption was measured by using the standard device available on the ATR 220 trains (not an additional energy meter). Measures were done at each stop planned in the timetable. The service profile was regional fast train with 11 stops in 103 km (1 stop / 9,4 km). Fuel consumption measured at the tank was previously compared with that resulting from the standard device to check the accuracy of the instrument.

For electric traction TRENORD was testing an energy meter – compliant with the international standards – provided by the Italian company FAR Systems. A unique energy meter was available on the class TAF EMU n.27 for the pilot application. In the test runs it was used to make a practice of energy measurement, as follows: consumed energy was measured at each stop planned in the timetable; the service profile was suburban with 12 stops in 21.5 km (1 stop / 1.8 km); electricity given back to the network was measured too²⁸.

Both on-site measurement days showed how energy consumption depends on driving style and unpredictable traffic conditions.

28 TAF rolling stock is able to regenerate energy from electric braking, but in the Italian DC system it is accepted by the network only if another train which can use it is present in the same area.

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During the test runs in Valcamonica the eco-driving approach was tested. There were used two different drivers with specific tasks:

- First driver: to optimise fuel consumption (without electronic assistance in the cab).
- Second driver: to drive speedy and without attention to fuel consumption.

The second driver consumed 16% more energy than the other, in spite of a 5% reduction of the travel time.

In the special runs on S3 the measured gap of energy consumption was about 8%, mainly due to extra stops for congestion on the line.

The data collected for Valcamonica line allowed also a comparison between old and new rolling stock: lighter new DMUs with comfort functions like air conditioning and information perform well better than the old spartan diesel cars (10% less energy consumption measured as kWh/seat*km, 37% less measured as kWh/ton*km).