

TRAINER

Low-cost, no-regret measures
for optimising energy efficiency
at the European railways



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Intelligent Energy  Europe

Colofon

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Summary

TRAINER (www.iee-trainer.eu) aimed at improving energy efficiency by the railways in at least 5 EU-countries: the Netherlands, Slovenia, Slovakia, Italy, Greece. Training programmes and facilities have been developed and implemented to initiate and optimise energy efficiency improving measures by railway operators. The training programmes aim at train drivers, station personnel and the management of railway companies.

Improving energy efficiency by the railways has a very high potential. Field tests from Deutsche Bahn in Germany show that energy savings of 10% on average can be achieved, for both electric trains and diesel trains. TRAINER resulted in an annual 0.15 Mton CO₂ emission avoidance through the training of 19,550 train drivers and hundreds of station personnel, and through further dissemination.

Summarising table concerning the number of trained train drivers:

Railway company	Total employed	Total trained
NS	3,000	1,100
Slovenske Zeleznice	1,200	1,200
OSE	600	600
ZSSK CARGO	1,800	1,800
Trenitalia	14,850	14,850
Total	21,450	19,550

From 2010 on, when all the 21,450 train drivers of the 5 participating railway companies will have been trained, the result may mount up to 0.20 Mton/year. The potential for all 150,000 EU25 train drivers is an annual CO₂ emission avoidance of 2.4 Mton.

TRAINER focused on energy efficient driving (ecodriving) but went beyond, addressing additional energy saving possibilities concerning technology (rolling stock and infrastructure) and organisation. Long Term Agreements, which include Energy Management Systems (EMS), have also been addressed as means to accelerate and substantiate energy efficiency improving measures in the railway sector.

The objective of TRAINER was to engage train drivers to drive trains more energy efficiently, safer and more comfortably (ecodriving). Additionally: To encourage railway operators to initiate and implement measures aiming at optimising energy efficiency in the areas of technology (rolling stock and infrastructure) and organisation.

TRAINER closely collaborated with the FP6 project Railenergy (www.railenergy.org) and the association of European Railways UIC.

Partners

Railway companies

- Hellenic Railways Organisation OSE, Greece (non-beneficiary)
- Nederlandse Spoorwegen (NS), Netherlands
- Slovenske Železnice (SZ), Slovenia
- Trenitalia, Italy
- Železničná Spoločnosť CARGO Slovakia (ZSSK CARGO), Slovakia

Energy Agencies

- Centre for Renewable Energy Sources (CRES), Greece
- Ente per le Nuove Tecnologie l'Energia e l'Ambiente (ENEA), Italy
- NL Agency, Netherlands (formerly SenterNovem)(coordinator)

Other

- Solvera Lynx, Slovenia
- VVCR Europe (VVCR), Netherlands

Further information

- TRAINER website www.iee-trainer.eu
- TRAINER deliverables
 - Inventory of good practices
 - Instruction film train drivers
 - Universal manual
- These and various other deliverables are available at the TRAINER website www.iee-trainer.eu



1. Introduction

These are challenging times for the railway sector. We are facing problems like global warming and a world-wide economic crisis. Solutions may however lay in the railway sector. The sector has high potential to further improve their energy efficiency and to help slow down global warming. And furthermore from the cost savings to further increase their competitiveness with other modes of transport. Which is important because competing modes of transport are becoming more and more energy efficient as well.

TRAINER (TRAIning programmes to INcrease Energy efficiency by Railways) is one of the European projects that has been aiming at improving the energy efficiency of the European railways. The project ran from November 2006 until November 2009 and was co-funded by the Intelligent Energy Europe (IEE) programme. Several European railway companies participated in TRAINER (www.iee-trainer.eu) TRAINER collaborated with the International Union of Railways UIC and the European project Railenergy (www.railenergy.org).

TRAINER compiled the experiences, know-how and knowledge regarding energy efficiency optimising measures of various European railway companies, trainers and experts. These have been set down in various deliverables. The main deliverables concern:

- An inventory of good practices regarding energy efficiency optimising measures
- An ecodriving instruction film for train drivers and management of railway undertakings
- A universal manual for setting up energy efficiency optimising training programmes for train drivers, station personnel and management of railway undertakings

The inventory includes recommendations for the essential building blocks for the development of national training programmes. These building blocks were identified and completed in collaboration with the participating railway companies. The recommendations for the essential building blocks have been used by the railway partners to draft their training programmes.

The instruction film has been produced by New-Energy-TV. The script for the instruction film was developed in collaboration with the participating railway companies and experts from the UIC and Railenergy. The recordings were made on site, at the railway companies.

The film consists of 2 parts:

1. A general introduction dealing with the global challenges and opportunities of the railways and
2. A wide range of tips that can help train drivers to make their driving behaviour even more energy efficient

This engaging and informative film is available in multiple languages and can directly be deployed for eco-driving training sessions for train drivers.

The universal manual too is available in multiple languages and covers the building blocks and information for setting up training programmes for:

- Train drivers
- Station personnel
- Management

The in 2008 published UIC booklet 'Process, Power, People: Energy Efficiency for Railway Managers' (2008) was used as a guidance for the contents of the universal manual. The UIC booklet touches on several possibilities for railway managers to improve energy efficiency. One of them is ecodriving. In the booklet ecodriving is only briefly addressed. The TRAINER universal manual extensively elaborates on ecodriving and is therefore complementary to the UIC booklet.

The manual does not provide ready for use training programmes. This would not be appropriate because cultural and company characteristics vary too much to be able to make only one fit. The manual however provides railway companies all the ingredients and menus to be able to 'bake' their own favourite training 'cakes'.

The manual is aiming at the management of railway undertakings, station personnel, trainers, dispatchers and above all train drivers. The manual addresses numerous ways and tips for all target groups to improve energy efficiency, starting with selecting energy efficient rolling stock and properly deploying and maintaining stock. But the focus in this manual lies on energy efficient driving for train drivers, so called ecodriving. Of course the precondition always is that safety and punctuality prevail.

Improving the behaviour of professionals like train drivers can be quite challenging, for both management and trainers but also of course for the train drivers themselves. The professionalism and experiences of train drivers have to be respected and directly deployed for creating tempting and effective training programmes. Didactics and the

tone of voice are delicate issues to be seriously dealt with (chapter 6). Involving train drivers and dispatchers is the way to minimise opposition.

The energy efficiency behaviour of train drivers can be approved by providing them with dedicated training courses. Their behaviour can also be improved by giving them proper tools. Some tools, like the Gekko, are more or less auto didactical, showing the driver whether he is driving most economically or not. Other tools, like Routelint, provide the train driver with relevant information about the sections ahead, to be able to better anticipate. Combinations of training and tools always have added value and result in better performances.

A railway company can choose to go for isolated training courses, which on the short-term directly can have a significant impact. To go beyond these short-term savings it is recommendable to make energy efficiency part of a bigger strategy, or a bigger framework. This is also attractive from the perspective of communication. These bigger strategies can e.g. be provided by Long Term Agreements (LTAs) (chapter 7) and Energy Management Systems. An LTA can be concluded between a railway undertaking, the government and an independent organisation to do the monitoring. In an LTA goals are set regarding the to be achieved energy efficiency performance. These kinds of mechanisms can be a major drive for energy efficiency improvements. Sometimes simpler mechanisms suffice like rebate on paid tax on energy consumption when achieving agreed energy efficiency performances.

The monitoring of energy efficiency performances is crucial (chapter 6). This goes for the proof and the evidence (it does work), the engagement of the target groups (my contribution matters) and the communication (look what we have achieved). The monitoring can/should be done on multiple levels. The universal manual pictures how.

Peter Wilbers
NL Agency
Agency of the Dutch Ministry of Economic Affairs

Coordinator TRAINER



2. Global and rail sector challenges

Global warming

The international consensus is growing that the planet is facing irreversible climate change unless action is taken quickly. The EU has already formulated a clear response in the shape of an integrated energy and climate change policy, a commitment to cut emissions of 'greenhouse' gases by at least 20 % by 2020, and a promise to take the lead in international negotiations to adopt even more ambitious targets. This will help to prevent the world's temperatures rising by more than 2 °C, the level which is increasingly thought by scientists to be the point of no return. To achieve this goal, we need to use energy resources more sustainably and take switching to more renewable forms of energy, capturing and storing carbon dioxide and reversing deforestation more seriously. This may involve a change in our lifestyles, but need not jeopardise our standard of living, or those of future generations.

The easiest way to increase the security of supply and help the climate is to reduce demand for energy. This means using energy more efficiently so that less is wasted. This can be done through energy-saving technology or by changing our behaviour, or a combination of both. Above all, saving energy also makes economic sense: the EU's target of using 20% less energy by 2020 than we would otherwise be doing will reduce spending on energy by €100 billion a year.

This target may sound hard to achieve, but in practice there is great scope for using energy much more efficiently, sometimes with little effort. For example, energy labelling, minimum efficiency standards and voluntary agreements by manufacturers of household appliances have already reduced the energy consumption of an average new fridge or freezer by almost 50% since 1990. For several other appliances, such as washing machines and dishwashers, savings of over a quarter have been achieved. The international Energy Star programme provides guidance on the most energy-friendly office and computer equipment.

In March 2007, as part of a wide-ranging attempt to cut emissions, European heads of state agreed to set legally binding targets to reduce Europe-wide emissions of greenhouse gases by 20% of 1990 levels by 2020. This target may be increased to 30% by 2020 if a new global climate change agreement is reached in Copenhagen in 2009. The European Commission has further stated that work must begin immediately on a longer-term target of a 50% cut in global emissions by 2050. Producing 23% (2006) of all emissions, transport is the second largest source of man-made CO₂ in the EU-27

after energy production. Moreover, latest projections from the European Environment Agency (EEA) estimate that the sector's emissions are set to increase by 25% between 1990 and 2020. This is in contrast to emissions from industrial and energy sectors, which are falling.

CER press release: 8 May 2008

European rail sector to cut CO₂ emissions by 30%

Yesterday, the CEOs of the European railway and rail infrastructure companies committed themselves to a cut in the specific CO₂ emissions of trains of 30% over the period 1990 to 2020. This target will help to contribute towards the reduction in emissions from transport that is necessary in order to meet the EU's target of a 20% cut in absolute greenhouse gas emissions over the same period.

At the General Assembly of CER and UIC in Brussels, the companies decided to take this step which will underline the rail sector's position as the most sustainable major mode of transport.

"In spite of the improvements of the other transport sectors, rail transport is already the least polluting major mode of transport," said Executive Director Johannes Ludewig.

"The external costs our sector is producing are only a fraction of those of the road sector. But we wish to do even better, and use every possibility to reduce our greenhouse gas emissions further."

The ambitious cut of 30% by 2020 will be brought about by a range of methods, including technological innovation such as optimising the regeneration of braking energy, fleet modernisation, and operational procedures such as energy efficient driving ('eco-driving').

"There will be important investments from the companies required in order to achieve this goal," Mr Ludewig said.

"But when the possibility of internalising external costs – which is foreseen in the upcoming Euro vignette Directive revision – will become a political reality, this investment will pay off. In any case, the railways are convinced that creating a sustainable transport system is crucial not only for the future of the sector, but a question of responsibility to society."

The decision came just one day after John Schellnhuber, one of the most distinguished climate researchers in Europe, addressed a CER conference in Brussels in which he outlined recent research that underlines the urgency in tackling climate change.

The EU Inventory Report of the European Environmental Agency, issued on 29 May 2009, shows that greenhouse gas emissions in the European Union fell by 1.2 % between 2006 and 2007 and it is expected that the Kyoto target – to achieve an average 8 % reduction in relation to 1990 levels for the period 2008 – 2012 – will be reached. This is despite the fact that transport emissions have risen, for the most part in the road sector where emissions are up 5.3 %.

Train to Copenhagen

At the end of 2009 the new climate deal, the successor of the Kyoto Protocol, will be agreed upon during the United Nations Climate Change conference, entitled COP15, in Copenhagen, Denmark (7 December – 18 December 2009). The outcome will be a new international protocol binding industrialised nations to more stringent mandatory CO₂ reduction targets. The conference represents a unique opportunity to achieve an

ambitious overall agreement involving all the countries of the world and addressing the major threat to our planet that is global warming.

On a global scale, transport is responsible for 23% (2006) of carbon dioxide (CO₂) emissions which cause global warming. The real challenge lies in the fact that while other sectors have managed to reduce their emissions, in the transport sector emissions have been consistently increasing. Curbing this increase and reducing transport emissions is one of the vital steps in combating global warming.

Despite all the technological advances transport is not yet developing in sustainable ways. The main reason is the enormous increase in demand for both passenger and freight services. Nowadays the road sector is responsible for over 80% of the sector's energy consumption.

Emissions from the aviation sector are increasing rapidly and aviation has the second largest transportation impact and accounts for more than 13% of total energy use of transport in Europe – on a higher altitude and thus representing more damage than indicated by the per cent figure.

Railways are crucial in reducing greenhouse gas emissions and developing sustainable transport systems. They provide the most energy efficient performance both in passenger/km and tonne/km.

A trip from Brussels to Copenhagen by plane or car produces over 3.5 times more emissions than by train. Look it up on www.ecopassenger.org, or <http://www.routerank.com/en>. The aim is for the “next generation Kyoto protocol” to focus more on the rail sector's contribution to the reduction of emissions in the transport sector.



3. Demonstrations for inspiration

Introduction

To inspire the participating railway companies and to support them with setting up their national training programmes, several actions have taken place in the preparatory phase of the TRAINER project, e.g.:

- A ‘backbone’ for training programmes was delivered, which covered more or less an education approach or philosophy
- An ‘Inventory of good practices’ that will be briefly touched on in 5.1
- Guided demonstration tours along good energy efficiency practices at the railways in Europe. These demo tours will be pictured in this chapter.

3.1 Demo tour I 24th –26th October 2007: Netherlands and Germany

On 24, 25 and 26 October 2007 SenterNovem, in cooperation with Nederlandse Spoorwegen (NS) and Deutsche Bahn (DB), organised the first part of a demonstration tour along European examples of good practices that have improved energy-efficiency in the railway sector. The demo tour I went along good practices in the Netherlands and in Germany, respectively along NS and DB. For this purpose SenterNovem had arranged a comprehensive and appealing day-to-day all-in package regarding venues, accommodation, transportation and programme contents. The programme of demo tour I was mainly dedicated to passenger transport.

Over 40 people attended the tour. Most of them participated the whole three days. Only a few attended partly. The demo tour started at the railway museum in Utrecht in the late afternoon of Wednesday 24 October. After a welcome and introductory presentation, the participants enjoyed a guided tour along various impressive classic



locomotives and train sets. The evening concluded with a joint dinner in one of the museum’s astonishing classic waiting rooms.

The demo tour continued the next day, on Thursday 25 October, with a dense package of presentations and site visits at the headquarters of the NS. The audience was welcomed by the NS CEO Mr Aad Veenman. The focus of the programme was on the

application of energy-efficient train driving, Long Term Agreements (LTA) and Energy Management Systems (EMS). The presentations showed that training programmes can range from autodidactical devices like the Danish GEKKO to intense 1-to-1 on the job training. Several examples showed that energy-efficiency improvements of 10-15% are possible. The presentations and the responses from the audience also showed that the possibilities of energy-efficient driving are highly depending on the infrastructure and the dispatchers. In this case the presentation of the rail network traffic related feature Routelint was informative.

In the early evening the audience started their group voyage from Utrecht Central Station to Frankfurt Hauptbahnhof by ICE train. The participants had the opportunity to pay a visit to the train drivers' cabin, to see energy-efficient driving in practice. Especially the energy meter on the train dash board was informative. Arrival at the Frankfurt Hauptbahnhof was at about midnight.

After a good night rest the participants had to line up for the continuation of the demo tour: A train voyage from Frankfurt Hauptbahnhof to the DB simulator centre in Fulda. In Fulda DB kindly hosted the TRAINER demo tour I participants. After an introductory presentation one half of the group got the opportunity to drive one of the many high-tech simulators. The



sophisticated simulators can move on a platform in a way that they really come close to the practical experience of driving a real locomotive. Most informative was also the print-out that the drivers received after their virtual train trip. A graph clearly indicated the energy-efficiency performance of the driver and the potential compared to a best practice reference trip.

The other half of the group went to visit a site with a rescue train. A guide took them for an informative walk through all the train compartments and explained the various ways the rescue train can be deployed. Afterwards both groups changed places.

The demo tour I ended in the late afternoon of Friday 26 October. After a train trip back from Fulda to Frankfurt the participants went home. According to an evaluation, held shortly after, the participants found the presentations and (site) demonstrations informative, inspiring and engaging.

3.2 Demo tour II 12th –14th March 2008: Slovenia, Slovakia and Austria

The second TRAINER demonstration tour on energy-efficient driving was successfully conducted from 12 to 14 March 2008, along good practices in Slovenia, Slovakia and Austria. The demonstration tour started in Ljubljana on Wednesday 12 March and ended in Bratislava on Friday 14 March 2008. The second demotour was kindly hosted by Železničná Spoločnosť Cargo (ZSSK Cargo) Slovakia, Slovenske Železnice (SZ) and the Austrian railway company (ÖBB),



Again over 40 participants learned more about the implementation of energy-efficiency training programmes for train drivers, Long Term Agreements and Energy Management Systems and 'toured along' best practices regarding energy-efficiency improvements in the railway sector in Slovenia, Slovakia and Austria.

The first day in Ljubljana was opened by Mr. Igor Hribar, Director of the Freight Division of Slovenian Railways. He underlined the importance of energy saving programmes for decreasing costs as well as ensuring revenue for the Slovenian freight operator. He was followed by a presentation of Bojan Dremelj reporting on the very promising energy-efficiency actions taken by Slovenian Railways and several other presentations on best practices at European Railways. It was highlighted that the specific energy consumption of the Slovenian Railways has been reduced by 6 % alone in 2007.

At the end of the day the participants got the opportunity to see with their own eyes how SZ had build in their meters in their locs.

On day two of the tour participants had the chance of a hands-on experience of energy-efficient driving on the train transfer from Ljubljana to Vienna. An evaluation of the energy consumption data of this train trip delivered very good results, which were far



below the average consumption. This very concrete example gave evidence of the large potential of energy-efficient driving for railways.

Before arriving at the final destination Bratislava the tour had a quick stopover in Vienna to get to know the latest developments regarding the Energy Saving Programme at Austrian Railways (ÖBB).

The third and last day of the demonstration tour was dedicated to new technical developments at ZSSK Cargo in cooperation with the Slovakian Infrastructure Manager ZSR. It is planned to install energy metering systems in all locomotives of ZSSK Cargo until end of 2009 and to set up an energy settlement system at ZSR. This integrated approach showed once again the importance of cooperation between railway undertakings and infrastructure managers in order to receive best possible results in terms of energy saving.

3.3 Conclusions of the demo tours

The following conclusions were drawn from the two demo tours:

- 1) **Training programmes.** Regarding training programmes for train drivers different approaches are possible. These are ranging from deploying autodidactical devices like the GEKKO to highly intensive 1-to-1 training at the job. In between all kind of variations are possible like theoretical and virtual training



programmes. Also the tone of voice of the training contents varies depending on the national and cultural context and also depending on the (sub) target group: train drivers of passenger trains need to be differently addressed than train drivers of freight trains. In addition the contents and tips for energy-efficient driving differ related to

the geographical conditions. E.g. in hilly terrains the emphasis is on using braking energy through recuperation.

- 2) **Monitoring and supporting systems.** The approaches to monitoring and supporting systems differ as well. Some railway companies deploy intense training programmes without investing into measuring systems. The difficulty

then is to keeping the train drivers and the management engaged if they get no proper feedback on their performances. Other railway companies invest a lot in measuring devices without deploying intense training programmes. The thoughts behind this are that measuring and feedback themselves have an energy–efficiency improving impact and what you can not monitor, you can not manage. The questions however are what might be the best balance and how far you should go in achieving optimal accuracy. Is it sufficient to do a few solid measurements and to calculate on the basis of estimations or best guesses the energy–efficiency improvements, or should one try to measure as much as possible, still facing some inaccuracies. Opinions differ on what has the highest impact and cost–effectiveness.

- 3) **Embedding frameworks.** It is supportive to embed energy–efficiency improving measures in some kind of framework. This might be ‘social responsibility’, ‘green entrepreneurship’, Long Term Agreements, Energy Management Systems or ISO 14000. This provides the management a drive to engage energy–efficiency improving activities and to exploit the communicational benefits. It is also beneficial to (further) engage train drivers to contribute. Sometimes more pragmatic issues like financial benefits can be a national drive to initiate energy–efficiency improving measures. Besides the direct cost reductions from saving energy and/or fuel, financial benefits can come from getting granted a tax exemption or reduction when implementing these kind of measures. Additionally a possible international drive is coming into sight: There might be possibilities for an overarching European LTA. The recently jointly published statement on CO₂ emission reductions from the CER might be building a foundation and acceptance for such a European LTA.
- 4) **Networking and collaborations.** It is important to establish a ‘community of know–how/knowledge’ regarding energy–efficiency improving measures in the railway sector. A lot of railway companies are reinventing the wheel concerning training programmes. TRAINER and in particular the demo tours contribute to making the knowledge, know–how and experiences generally available, e.g. through networking, collaborations and producing the universal manuals. Vital in getting the messages across is the collaboration with Railenergy, the UIC, the CER, the TRAINER consortium partners and the demo tour partners. Very supportive and to be highly appreciated is the current open mindedness and willingness of railway companies to cooperate and to exchange know–how and experiences.
- 5) **Virtual support.** There is a lot of interest for a supportive training tool like the virtual trainer. A first, pre–production version has been demonstrated at the demo tour II. It might be used either autonomously or as an additional support

in a more extended training programme. The benefits of, experiences with and best ways of deployment of the virtual trainer will be evaluated in TRAINER. It is obvious however that the demonstrated version of the virtual trainer still needs a lot of improvements before it can be properly deployed at all.

- 6) **Infrastructure managers versus operators.** It is important to try to narrow the current gap between railway operators and infrastructure managers to achieve optimal energy–efficiency results. Train drivers can be trained to improve their energy–efficiency performance but they are largely dependent of the dispatchers. The dispatchers set the boundaries for the energy–efficiency improvements that can maximally be achieved. The train driver’s energy–efficiency performance can be swallowed up partly or completely when having to brake and wait for a red signal. Systems like Routelint can contribute to see ahead and to anticipate. But it is obvious that optimal energy–efficiency improvements can only be achieved when the communication and exchange of views and knowledge is going to be improved. Mutual training programmes might considerably contribute.

4. Training pilots

Introduction

After the inspiring actions in the preparatory phase of the TRAINER project that have been touched on in the previous chapter, it was time for the participating railway companies to set up their national training programmes.

This chapter paints the preparation, realisation and evaluation of the training programmes of the following railway companies, the:

- Dutch railways NS Reizigers
- Slovenian railways Slovenske Zeleznice
- Greek railways OSE
- Slovakian railways ZSSK CARGO
- Italian railways Trenitalia

4.1 Dutch railways NS Reizigers

Preparation

During the fall of 2007 NS had a change of project manager, which slightly delayed the progress. One of the consequences was that the preparatory activities had to be partly taken over by NL Agency.

An expert group (consisting of members of different Dutch operators) met five times and delivered input for the development of training modules for drivers and station personnel. A general ‘training backbone’ was produced including a modern training philosophy based on ‘situational awareness’ and ‘situational learning’ as a guideline for



the development of training modules by the project partners from the railway companies. Training modules have been developed for drivers and station personnel.

For learner and experienced drivers different modules have been developed. The modules for learner drivers have been tested in two or three controlled try outs in which the 1st line management has been trained as well.

The module for experienced drivers (a general introduction on the environment, the instruction of Energy efficient Driving (EED), especially the UZI method, practical examples, a quiz and a Q&A) has been fine tuned during the training sessions for the RouteLint pilot throughout 2008. National rollout is expected for 2010/2011.

Other personnel are either cleaning staff or technicians. The second group can use most of the materials developed for train drivers. This materials have been shared with NedTrain, the maintenance company. NedTrain developed a simple tool for cleaning staff to be able to switch trains on and of at the start and conclusion of the cleaning process.

In the PMC and expert group meetings the decision has been made that 1st line management could be trained using the same training modules as used for the experienced train drivers. NS declared the 'train-the-trainer' activity as the single most important project within the EED/TRAINER context. This includes: Mentor and instruction drivers, 1st line management and trainers from the in-house training institute. This has been implemented on a small scale as part of the RouteLint pilot.

The Operations Director has declared that EED is a priority in July 2009. Training the trainer and the use of the new full scope train simulators in the training of EED will be among the first steps to implement EED. Experts of the simulator centre in Amersfoort will develop an approach in which EED training is integrated with training modules for other purposes. EED is defined as part of the basic skills.

For 2nd line and higher management training should consist of information on a wide range of subjects, naturally including energy efficient driving. The TRAINER website (www.iee-trainer.eu) with links to a range of Railenergy sites is a vital part of this information. Most important is a booklet from Railenergy about Energy Management Systems which was delivered in September 2008 (initiated by ATOC).

No separate training module has been developed for light trains. This for the reason that the 'new to come' train type in the Netherlands is actually not more than a lighter conventional train for which the main energy efficiency driving style tips equivalently apply (the aluminium body and modern traction installation reduce energy consumption up to 30% compared to older rolling stock).

For the development of the virtual trainer NS, compiled a long list of games suppliers, simulator suppliers and consulting firms with rail experience. NS, together with the consortium partners and NL Agency put together specifications for a virtual training

tool (part game, part educational tool). After a formal bidding procedure (led by NS) only one bid remained which complied with the specifications and was within the price range and timeframe and therefore CMG Logica has been selected.

The delivery of a properly running virtual trainer has passed several deadlines and CMG Logica in the end only delivered a pre-production version for testing purposes which did not run well and confronted the user with all kind of technical problems, even after extensive testing and improvements. And after a laborious installation it is hardly possible to drive the train properly.

At the end of May 2008 NS and NL Agency, in consultation with the EACI, decided to cancel the further efforts to try to get the virtual trainer properly running. The problems turned out to be insolvable. After a lengthy dispute it was decided that all payments but the first (€ 18k) were to be credited.

In Rome NS and CRES suggested to make a TRAINER instruction film instead. This idea was embraced by all the TRAINER partners. NL Agency took the lead in producing the film which was formally presented during the Energy Efficiency Days 2009 in Tours. As a spinoff (outside of the TRAINER project), a short promotional film of 3 minutes to explain the Dutch EED strategy has been developed.

In December 2009 NS has planned to evaluate the results of of the training modules with a big public transport company in Amsterdam. This might result in an additional training module for light rail (beyond the scope of the TRAINER project).

Realisation

At NS the following results have been achieved:

- An evaluation of the training modules developed for train drivers and technical station personnel by an expert panel. The panel made recommendations about how to fit the modules in the NS base training programme, which has a slightly different approach.
- Three try outs of the base training programme in Amsterdam, Rotterdam and Amersfoort. An evaluation was scheduled end of 2009.
- Training for cleaning station personnel. Due to frequent changes, a lack of technical knowledge and language problems, a simple instruction leaflet has been developed which shows by means of pictures how to put a train from cleaning mode in parking mode, to reduce the energy consumption.

- During the training sessions for experienced drivers during 2008 an instrument was developed which will be used for 'train the trainer' sessions, team leaders and mentor drivers. It is basically the same training module enriched with tips on coaching.
- The UIC EMS booklet will be the basis for the training package for the management.
- Train manuals will be revised according to the TRAINER contents.
- The new CEO of NS, Mr. Bert Meerstadt, highlighted the importance of energy efficient driving in the realisation of CO₂ goals in a workshop end of February 2009. The CEO talked to train drivers on this subject on 25th March 2009 in Rotterdam.
- A presentation on energy efficient driving was given to the top management of NS Reizigers Operations in April 2009.
- The management of Operations declared sustainability a priority for the coming years. Energy Efficient Driving (EED) is deemed to be an essential part of the skills of train drivers in that context. A company wide task force will be formed to implement EED, adding elements of energy efficient planning and energy efficient traffic management.
- The full scope simulators will become an integral part of EED training with a focus on EED and punctuality.
- Train-the-trainer will be the most important EED training activity in 2010.

Five energy meters have been installed on locomotives on the The Hague - Venlo line. The plan was to use them to evaluate the energy efficient driving performance during the RouteLint pilot. First the meters have been used for testing a track side instrument to determine energy consumption based on speed profiles. Later the meters were used to evaluate EED for individual trains and drivers (voluntary).



The VIRM trains, around 30% of the NS rolling stock are equipped with a diagnostic computer with an optional energy measuring capability by their manufacturer. The possibilities have been investigated to use these data to support EED by a feedback on energy consumption to drivers. Most drivers drive on a VIRM regularly and it is expected that the feedback education at a VIRM will improve driving behaviour on other types of rolling stock as well. The Sprinter Light trains and the DDARs, the older double

deck rolling stock will most likely also get the capability of measuring energy consumption data. If feasible these data will then be used in a feedback tool as well. If the Sprinter Light trains and DDARs are equipped with a feedback tool, then half of the NS fleet offers a feedback system to its drivers.

To get a picture of the possible maximum results a competition was organised by the expert panel. Compared to the 2007 average energy consumption per km, savings of up to 40% were reached during individual trips from Amsterdam to Rotterdam.

During the RouteLint pilot energy consumption was calculated based on speed profiles (EMMA tool, University of Dresden). The Solvera Lynx energy meters are used to verify these data and offer the potential to give train drivers feedback on their EED behaviour.

Also from the University of Dresden and together with ProRail NS are experimenting with the Beatool. This is a laptop based tool which offers EED advice to drivers based on the actual situation.

The energy data from the diagnostics computer of VIRM (1 / 3 of NS fleet) are going to be used in a feedback tool. The tool is being developed parallel to an onboard communication system. The pilot will start in 2010. The final implementation is expected to start in 2011.

In total 1,100 train drivers of NS have been trained in ecodriving. The other 1.900 drivers will be trained as part of the further rollout in 2010/2011.

Evaluation

NS has a permanent expert group consisting of train drivers and team leaders. This group meets 4–5 times a year and was also deployed for the TRAINER project. On several occasions this team has been enforced with train drivers and managers from NedTrain (maintenance managers), Railion/DB Schenker (freight train drivers), Hispeed (passenger train drivers) and small passenger railway companies (train drivers, management). This expert group assisted in the development and evaluation of the training programmes.



A national workshop on the exchange of the implementation experiences was held in May 2009. About 35 representatives of the above mentioned railway companies participated. The results of this workshop have been used to further improve the training programmes. After a slow start there is now big engagement at NS for further implementation of and improvements regarding energy efficient driving.

4.2 Slovenian railways Slovenske Železnice

Preparation

The Slovenian Railways, Slovenske Železnice (SZ), started preliminary programmes with train drivers, driver's instructors and train management personnel (engineers). The detailed programme was introduced to the company management from the very beginning and they were regularly informed about the progress. For reasons of



optimisation SZ had lectures with all train drivers during regular education services for the drivers. They already had discussions on energy efficient driving in depth with 1022 train drivers, 66 driver's assistants and 28 driver's instructors. Each of them was involved in 2 x 2 hours of discussions. SZ also organised lectures with 12 engineers from the department of railway traffic management.

SZ had the full support of the top management. SZ have not organised special lectures for the management, but they periodically received information and were involved in discussions and decisions.

SZ introduced the TRAINER programme to the members of a G-4 summit (directors of ÖBB, HŽ, MAV, GySEV, ZSSK, SŽ) in Vienna with a proposal to form a group of experts for the energy efficiency challenge.

SZ collected and analysed the data from energy meters that are installed on board of the locomotives. SZ already tried different ways of driving energy efficiently. SZ used various elements of the "Inventory of good practice" to build their training programmes on.

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SZ published several articles about energy efficient driving in their company magazine 'Nova progna'. The feedback on the articles was very positive. The magazine is distributed to all the employees of SZ, so everyone is familiar with the goals and plans for improving energy efficiency.

SZ tendered and outsourced the professional assistance for conducting the training programmes.

Realisation

SZ actually started simultaneously with the theoretical education of both drivers and driver instructors. Later they organised extra lectures for the instructors who took care of the training of individual drivers. The drivers have to go through 36 hours of training per year by legislation, related to their job. The training is divided into 6 courses. SZ incorporated the TRAINER programme in each of these courses. So, all the drivers get lessons on energy efficient driving every two months, 6 times a year.

Instructors trained the drivers both theoretically and practically, by giving them suggestions and advises while driving in the cabin. The training about how to drive more energy efficiently will be continued even after conclusion of the EU TRAINER project.

For their training sessions the instructors used all kind of TRAINER publications and information like the inventory of good practices and the knowledge and know-how from the monitoring and analyses of different styles of driving. They also used the UIC publication "Process, Power, People". All the materials were published on the intranet as well.

Part of the training for train drivers is driving on a train simulator. For this purpose SZ rents a locomotive simulator from the Austrian LogServ company. Their locomotive simulator can be easily transported and installed. The simulator can realistically simulate the actual driving characteristics and dynamics of the locomotive type Taurus, which the Slovenian Railways have in their rolling stock. Part of the simulation programme is dedicated to energy efficient driving.



Regarding the management SZ arranged one lecture for technicians who are responsible for conveying the knowledge to the dispatchers and managers. The Slovenian railways didn't arrange courses about energy efficiency for the top company management, but they send regular reports to the board of directors about the steps that had been taken.

The results were encouraging. SZ managed to decrease the overall specific consumption with about 10%. All train drivers have been trained by lectures, articles in magazines and by training their instructors. SZ will continue to train energy efficient driving on simulators, through web applications and DMI (Driver Monitoring Information) systems.

SZ decided to continue energy efficient driving after conclusion of the TRAINER programme.

In total 1,200 train drivers of SZ have been trained in ecodriving.

Evaluation

SZ organised workshops in February and March 2009, in two rounds. The first round mainly involved experts who were closely connected to the Traction division (part of the company responsible for rolling stock, drivers, hauling the trains). The second round involved experts from other fields of activities, amongst them also high ranked people from the Traction division, specialists for maintenance and experts from the C&G



company, which is not part of the railway company and which cooperated with us in preparing the didactical materials for the lectures and internal analysis.

Discussions went about the optimisation of ecodriving and the measures needed to accomplish this. The discussions were very lively and inspiring. Many practical ideas, tips and solutions came along regarding how to increase the motivation and all kind of technical details concerning the rolling stock.

For example, SZ also invited a small company that provides smart and innovative education tools. This company came up with the idea of publishing a comic book about

ecodriving, to be able to more effectively convey the message to the train drivers. Such a comic book would also be appealing to be read by their next of kin. Unfortunately SZ finally had to take the decision to postpone the publishing of the comic book, due to purely economical reasons.

4.3 Greek railways OSE

Preparation

In Greece OSE (Greek Railways) assigned a working group of railway experts from own-personnel who participated in the development and the coordination of the training programmes in Greece. This working group comprised OSE board members, traction & education managers and technical staff responsible for energy management in the company. After several bilateral meetings between CRES and members of the OSE working group it was commonly agreed that CRES and OSE were going to implement the training seminars for all the 600 OSE train drivers, station personnel and railway managers.

The training material was initially developed by CRES and has been suitably modified by OSE experts in collaboration with CRES in order to fulfil the special characteristics of the Greek railway system, rolling stock and train drivers work experiences. The manual for train drivers was based on the building blocks of the Inventory of Good Practices along with some additional measures from OSE experts (e.g. avoidance of idling for diesel trains).



In the field of station cleaning personnel, the training material of the cleaning personnel was a brief printout with simple energy efficiency recommendations for the personnel along with instructions for station/depot managers. The cleaning personnel in stations are not from OSE but from a subcontractor cleaning company. Therefore the training of the personnel was kept as simple and practical as possible.

As far as concerns the training of railway managers, OSE took the responsibility to train traction and infrastructure managers all over Greece with training/informative materials based on the major project deliverables such as the Inventory of Good Practices of CRES

and a theoretical backbone for training programmes of NS. Basically a significant number of leading managers and decision makers of the Greek railways were represented in the working group. Therefore they were well informed about energy efficiency measures in the railway sector.

The training manuals have been supplemented with additional training presentations and other materials produced by CRES and the OSE training division.

Realisation

The training programmes at OSE started mid 2008 and they have been included in the periodical training of train drivers with a special additional seminar on energy efficient train driving. Train drivers were divided into groups of 10–15 persons and attended a seminar with theoretical and practical training on the train, whenever possible. For these seminars printed manuals were used as training materials and a dedicated presentation about how to apply energy efficient driving. The manuals are based on the general principles and techniques as depicted in the TRAINER inventory of good practices and the demonstration tours, completed with national experiences. The Greek version of the TRAINER film was used only at the end of the training seminars due to the fact that it was only delivered near to the completion of the training seminars. It will however stay in use for future related seminars. All the train drivers have been informed about the existence of the film and have been encouraged to visit the TRAINER web link to the film.



In order to support the promotion of energy efficient driving in Greece and to support future training programmes, CRES has had produced 200 USB sticks for OSE train drivers, instructors and managers. The USB sticks covered the training material, the Greek version of the TRAINER universal manual and the Greek version of the instruction film.

The presentations included specific ecodriving tips for several existing train tracks in Greece. These specific tips are the results of tests from OSE experts on these tracks. Train drivers are made aware of the differences in energy consumption related to different driving scenarios on the same train track (e.g. % of energy savings with small increase of travel time, reduced speed, reduced acceleration and combinations). For

instance at the track “Athens–El. Venizelos airport” an increase of travel time of 11% results in 47% electricity savings and lowering the speed limit by 10% results in 35% savings.

Due to significant changes in the administrative structure and operational function of OSE the start of the training programmes in 2009 were significantly delayed. But by September 2009 all OSE train drivers (over 600) had been trained.

OSE has also trained the instructors. The instructors have been trained to be able to provide personalised advice to the train driver and specific instructions for each train. Energy efficient driving is mainly an economic issue for the company.

The training of station personnel and railway managers followed accordingly with the distribution of the TRAINER leaflets and oral instructions for improving energy efficiency, especially related to the parking and cleaning of trains. Railway managers were encouraged to visit the TRAINER website and read the project’s deliverables and documents from the demonstration tours.

The monitoring of the driving performance of train drivers before and after the seminars was very difficult to be determined. Most of the OSE trains are diesel trains which are not equipped with fuel measuring devices that enable the calculation of the average fuel consumption. The installation of diesel fuel meters was not possible due to the high costs and questionable accuracy. The idea of measuring consumption by relating fuel refills to driven kilometres would be very complicated and also not accurate. Therefore OSE decided that only a few electric trains on particular tracks are going to be equipped with energy meters.



In total 600 train drivers of OSE have been trained in ecodriving.

Evaluation

OSE and CRES jointly organised an expert meeting on energy efficient driving and the exchange of experiences regarding the implementation of the training programmes on 10th September 2008. The meeting was held at the OSE headquarters in Athens with the participation of the OSE TRAINER working group, the OSE training department and the CRES staff. The main issues discussed during the meeting were the positive aspects of energy efficient driving, the problems raised in the training programmes as well as the suggestions for improvements made by the training staff. The major outcome of the meeting was that the OSE board should promote energy efficient driving as a high priority measure in order to further engage train drivers to apply this driving style under real conditions. It is a simple, no-regret, low cost measure to help train drivers to save energy and OSE to significantly reduce the costs of their energy bill.

CRES has advised OSE to also give special care to the introduction of a bonus system (monetary or other) for train drivers with a good performance on ecodriving.

Due to the fact that OSE is the only long distance train company in the country a national workshop involving other railway companies was not applicable for Greece. All the railway experts and managers are OSE's own personnel. CRES and OSE however disseminated the project and training information also beyond the railway company 'borders'. E.g, the information was disseminated through a press conference of the Ministry of Transport. The press conference was organised by the Ministry of Transport in August 2009 for the announcement of a national ecodriving campaign within the framework of the IEE project ECODRIVEN. The press conference was covered by most of the national media. The Minister of Transport touched in his speech on the TRAINER project and on OSE's training activities concerning energy efficient driving. The event and the free publicity for OSE and TRAINER were very engaging for all the railway experts and managers of the Greek railways.

4.4 Slovakian railways ZSSK CARGO

Preparation

Železničná Spoločnosť Cargo Slovakia, a.s. (ZSSK CARGO, Slovak Cargo Railways) have produced training programmes for the train drivers and the management. ZSSK CARGO does not employ any station personnel responsible for the cleaning and maintenance of the trains during parking. In 2008 ZSSK CARGO has though incorporated components of the “Inventory of good practices” into the training programme of ZSSK CARGO to



“allow” the companies which employ the station personnel to use the information for their own training programmes.

At the beginning of the process separate, dedicated training programmes for management and train drivers were foreseen. However with regard to ongoing opportunities in the legislation of the Slovak Republic, ZSSK CARGO decided to integrate

an additional educational block for train drivers and for the management to the standard educational package of ZSSK CARGO.

The “Efficient Driving Training” programme for the train drivers takes 2 hours per person per year and it is divided into:

- Theoretical training with presentation and/or with printed ecodriving material
- Provision of feed back about how energy efficiently the train driver drives
- Discussion about energy efficient driving and the experiences of the train drivers

The initially planned virtual training with the TRAINER virtual trainer has been replaced by training in the cabin of the locomotive and introducing the TRAINER instruction film.

In 2008 ZSSK CARGO distributed questionnaires amongst the train drivers to obtain information about their experiences with applying energy efficient driving in practice and how it can be further improved. After evaluation the training content was slightly adapted in June 2009 on. All training activities have been conducted by ZSSK CARGO’s own mentors of the train drivers and other personnel directly involved in the TRAINER project.

The “Efficient Driving Training” programme for the managers has been part of workshops and seminars and was divided into:
Theoretical training with presentations and/or with printed material
Discussion about possibilities how to improve the energy efficiency of ZSSK CARGO

The training programme for the management takes 2 hours per year. The training activities for the management have also been conducted by personnel working directly on the TRAINER project.

Realisation

Železničná spoločnosť Cargo Slovakia, a.s. (ZSSK CARGO) has developed training programmes for train drivers and management. ZSSK CARGO does not have any station personnel responsible for the cleaning and parking of trains. But with regards to the comments of the EACI, ZSSK CARGO incorporated information from the “Inventory of good practices” into the training programmes of ZSSK CARGO to allow companies with station personnel to use the information for their own training purposes.

The initial idea was that all the training could be realised through additional educational courses on top of the standard educational package. Due to new legislation ZSSK CARGO integrated the extra educational course in the standard educational package to reduce personal costs. The “Efficient Driving Training programme” for both the train drivers and the management took 2 hours per year.

ZSSK CARGO put at the company web page information about the TRAINER project to contribute to the dissemination of the TRAINER and its results. The information was available in the Slovak and English language. From the ZSSK CARGO webpage it was possible to link through to (components of) the TRAINER website.

ZSSK CARGO started the training of its staff by training the instructors of the drivers in July 2008. After the training of the instructors, a working group incorporated some recommendations of the instructors in the training programme. New, updated and slightly modified version of the training programme was introduced in June 2008. Instructors started the implementation of the updated training programme in August 2008.



They introduced new, more detailed analyses of different driving styles, the possible savings and the practical application. Instructors discussed with the train drivers the possibilities of implementing energy efficient driving in practice. In a first phase 1852 train drivers and 24 lecturers of the drivers were trained.

In November 2008 the TRAINER training programme was also introduced to the managers of the traction unit during periodical seminars. The main aim was to introduce the TRAINER project and the possibilities of energy efficiency improvements. The training was managed by members of the working group and the Energy Dispatching Centre. Discussions about the possibilities of application of some measures at ZSSK CARGO were also part of the training.

ZSSK CARGO started with the practical training of the train drivers in January 2009. The instructors accompanied the train drivers in the train cabin, providing them instructions during the trip. It was part of the periodical training, but solving some operational problems had now and then higher priority than ecodriving.

Based on the feedback from the train drivers the working group updated the training programme and formulated ecodriving tips and recommendations for heavy freight trains. The working group also made new analyses in February 2009, to make the training programme even more attractive and appealing to the train drivers. The new updated version of the training programme was introduced at the end of October 2009.

ZSSK CARGO then also distributed copies of the TRAINER instruction film to the 26 instructors of the train drivers. It was introduced to the drivers during standard training lessons. The instruction film was also distributed to the passenger operator ZSSK and the infrastructure managers.

In total 1,800 train drivers of ZSSK CARGO have been trained in ecodriving.

Evaluation

ZSSK CARGO organised a presentation for a group of infrastructure managers in October 2008. The presentation introduced TRAINER and some analyses of the energy metering, made during the project. Representatives of ZSSK CARGO also presented their decision to start implementing some further measures introduced by TRAINER. The infrastructure managers were requested for their cooperation. This was a vital element for the train drivers and the management to get engaged for energy efficient driving. The infrastructure managers were surprisingly willing to cooperate.

Next ZSSK CARGO organised a workshop for the representatives of the traction management and transport execution division in November 2008. The workshop was part of the training for managers of ZSSK CARGO. The aims were:

To introduce TRAINER, the results of training the train drivers, the results of realised analyses in the field of ecodriving and the measurement of energy consumption;
To discuss the further possibilities of applying ecodriving and the potential energy savings.



The participants highly appreciated the activities of ZSSK CARGO but showed some scepticism about the possibilities to implement the presented measures within the current conditions (infrastructure, infrastructure management, time schedules and safety). The participants recommended to start discussions with the infrastructure managers. The potential for energy savings in the freight transport heavily depends on a fluent transport on the track (green line) and the elimination of unexpected stops of the trains on the track and in front of entry signals.

4.5 Italian railways Trenitalia

Preparation

In Italy Trenitalia started working on the development of training programmes during the late spring of 2007. It started with a first meeting in Florence where each of the three Divisions (Long Distance Passengers, Regional Passengers and CARGO) was represented by one member of its management. At this occasion the communication strategy towards the target groups was defined and discussed, as well as a first draft of a possible adapted timetable for the implementation of the training programmes.

Just after summer holidays 2007 two groups of experts, one for the management and one for the drivers, started meeting to elaborate on the documents to be presented to the target groups during the following implementation phase.

Regarding the management, it was agreed that the training had to focus on the information flow regarding European best practice on energy efficient driving, energy

consumption and related CO₂/pollutants emissions (both direct and indirect), data and elements to improve energy strategies and on environmental communication.

Concerning the train drivers, it was decided to make the training very practical and “direct”. So, also taking into account the CRES Inventory of Good Practices, a range of



slides were produced to present the drivers the basic concepts of efficient train driving. Later it turned out that the three Divisions of Trenitalia have some particular aspects that make a slightly differing message necessary. Therefore it was agreed to adapt the documents for each Division.

Later on, together with the management of the Divisions, the meeting with the drivers’ instructors were scheduled and it was decided what modalities the subsequent training for the drivers were going to be (including on board training and training at the simulator).

Personnel at stations, initially included in the development of the training programmes, were eventually excluded due to a re-organisation of the Italian Railway Group. Most of the station personnel were transferred to a new employer, the Infrastructure Management company, a separate company from Trenitalia.

Realisation



The theoretical training started officially In May 2008. It took place in several cities: Milan for the Long Distance Passenger Division, Foligno for the Regional Passenger Division and Chiusi for the CARGO Division. The number of meetings was slightly lower than it was initially programmed (15 instead of 18) but all instructors were directly involved in the efficient driving training.

Trenitalia completed the training of all Passengers Long Distance Division Instructors (83) in June 2008 and all CARGO Division Instructors (88) in July 2008. Trenitalia then continued with the Passengers Regional Division.

Next the instructors started their job with the drivers, training them in classrooms or “on the job” (in the cabin). Every instructor meets in the classroom or “on the job” each of his drivers (an average of 60) at least once every 6 months. This way all of the Trenitalia train drivers have been reached by a first “wave” of training.

The management participated in several training sessions, showing their support and commitment. It was also an occasion for them to get acquainted with the topic, to be updated with the implementation of the training programmes and to trigger new ideas and proposals.

The instructors and managers got many suggestions and ideas for additions and improvements that have been incorporated in modified training programmes.

Moreover, the link with the Railenergy project was improved, which led to an intense exchange of experience between the people of Trenitalia working on the projects TRAINER and Railenergy.

Trenitalia has distributed many TRAINER leaflets at the training sections, the meeting and the workshop, about 400 leaflets in total. An additional 100 leaflets have been handed over to the people that represented the Quality and Environmental Departments at the workshop. The total number of distributed leaflets so far is about 600. Additional leaflets have been distributed in 2009 at meetings and conferences about Energy/Environment.

Concerning the training on board and on the driving simulators, all the instructors have been asked to introduce energy efficient driving parameters for the evaluation of the drivers. This recommendation was agreed on with the managers in charge of the traction and was endorsed by the board.

Trenitalia have in total 14,000 train drivers. All of them have been reached via the trained instructors. The TRAINER budget was too little to train all the drivers directly and individually. In April/May 2010 the training programme will be continued from own resources, with more in depth training for the train drivers.

In total 14,850 train drivers of Trenitalia have been trained in ecodriving.

Evaluation

Trenitalia organised its national meeting to exchange the experiences of the implementation of the training programmes in Florence, on 13th February 2009. The scope of the meeting was quite technical, and most of the time was spent listening to the impressions reported by the people that represented the traction departments. The common feeling was that energy efficient driving definitely has potential and that it had been underestimated as a no-regret, cost-effective measure so far.



About a month later Trenitalia organised a workshop in Rome. This workshop also included people from the Quality, Environment and Engineering Departments, plus one external environmental expert. The discussion was less focused on the driving techniques and more on the possible further improvements of the training programmes, the communication strategy and the possibility of collaboration between the different departments of the company.

5. Hands-on information and products

Introduction

The training programmes of the railway companies have been evaluated (see previous chapter). The experiences, know-how and gained knowledge have been the building blocks for the 2 main TRAINER products:

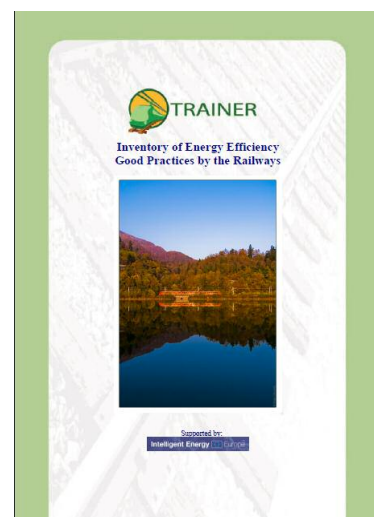
- An ecodriving instruction film for train drivers and management of railway companies
- A universal manual for setting up energy efficiency optimising training programmes for train drivers, station personnel and management of railway companies

These will be briefly presented hereafter. We will however start with another TRAINER product: The inventory of good practices. The railway companies have made use of the inventory for composing their national training programmes. All three TRAINER products offer relevant, practical, hands-on information for railway companies, which intend to either start with or to give follow-up to energy efficiency optimising training programmes.

5.1 Inventory of good practices

TRAINER has delivered an ‘Inventory of good practices’. The inventory includes recommendations for the essential building blocks for the development of national training programmes. These building blocks were identified and completed in collaboration with the participating railway companies. The recommendations for the essential building blocks have been used by the railway partners to draft their training programmes.

Moreover the inventory covers inspiring good practices presented in the 2 demonstration tours of the TRAINER project (see chapter 3), along with some best practices identified in the 3rd UIC Energy Efficiency Conference in Portoroz. It additionally addresses information about Energy Management Systems and Long Term Agreements



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(LTAs). The inventory has been used for dissemination in the European railway sector and beyond, as a useful, informative and inspiring handbook for energy efficiency improvements in the railway sector.

The inventory of good practices is available on the TRAINER website.

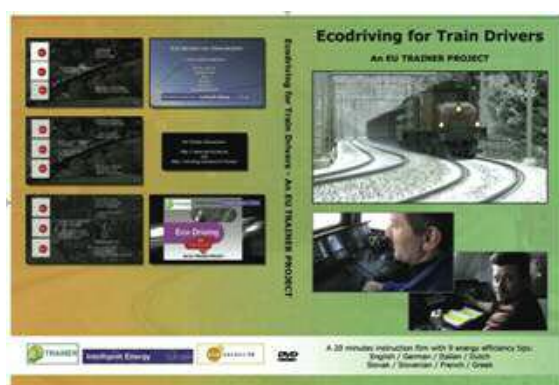
5.2 Instruction film

Another product that TRAINER has delivered is an instruction film for train drivers and management of railway companies. The instruction film has been produced by New-Energy-TV. The script for the instruction film was developed in collaboration with the participating railway companies and experts from the UIC and Railenergy. The recordings were made on site, at the railway companies.



The film consists of 2 parts:

3. A general introduction dealing with the global challenges and opportunities of the railways and
4. A wide range of tips that can help train drivers to make their driving behaviour even more energy efficient



The length of the film is approximately 20 minutes. The premier screening of the instruction film took place at the UIC Energy Efficiency Days 2009 in Tours, France in September 2009. The responses were very positive.

The film is available in multiple languages: English, Dutch, Slovenian, Slovakian, Greek, Italian, French and German.

The instruction film is available on the TRAINER website, on the Railenergy website and on the UIC website.

5.3 Universal manual

TRAINER also delivered a so called 'universal manual'. This manual covers the building blocks and information for setting up training programmes for:

- Train drivers
- Station personnel
- Management

The in 2008 published UIC booklet 'Process, Power, People: Energy Efficiency for Railway Managers' was used as a guidance for the contents of the universal manual. The UIC booklet touches on several possibilities for railway managers to improve energy efficiency. One of them is ecodriving. In the booklet ecodriving is only briefly addressed. The TRAINER universal manual extensively elaborates on ecodriving and is therefore complementary to the UIC booklet.

Part of the contents of the universal manual has been extracted from the 'Inventory of good practices' (5.1) and from the backbone for training programmes that TRAINER delivered in the preparatory phase of the project (see chapter 3 'Introduction').



First an English version of the universal manual has been produced. The English version was then used for having the contents translated by the partners into their national languages. In general they had to stick to the original English text, but there was some room to add some country or even railway company specific paragraphs. And in the one country (e.g. Greece) there is more focus

on diesel trains than in the other (e.g. Netherlands). The universal manual is available in English, Dutch, Slovenian, Slovakian, Greek and Italian. It has been produced in collaboration with experts from the UIC and Railenergy.

The universal manual has got a wikipedia like design. It is a comprehensive guideline including many references to further sources of information. The links refer to websites, reports, presentations, etc. The universal manual also includes the links to the ecodriving instruction film for train drivers (in multiple languages) as an additional training tool.

The digital versions of the universal manual can be downloaded from the websites of TRAINER, Railenergy and the UIC). Tips for using the universal manual:

Copy it to your hard disk before opening it. It will then work much faster.

When opening documents through links use the right mouse button. Only then it is possible to go directly back to the manual

6. Energy efficiency and CO₂ emission results

Introduction

The performances of the TRAINER project have been monitored. Collecting accurate and solid monitoring data turned out to be difficult. Unlike for road vehicles it is a hard job to get a clear picture of the energy consumption of a single train or train set. In countries with more than one railway company the energy bills are mostly split on the basis of calculations based on assumptions of e.g. the energy consumption of the rolling stock, the number of kilometres driven and the seat occupancy. Energy efficiency improvements made become not naturally noticeable as a cost reduction for a particular railway company. Its competitors too profit. The monitoring of the energy consumptions of train and train sets and of single railway companies is the subject of tough energy billing discussions. The reduced CO₂ emissions resulting from TRAINER therefore had to be calculated by means of estimates, best guesses, assumptions and general data from the UIC data base.

The railway market opened few years ago and railway companies split up in infrastructure managers and railway operators. The energy consumption of the network is measured by the infrastructure manager, not by the railway operator.

In addition, the energy consumption of the whole network measures not only the consumption of the trains which have been observed in the TRAINER project, but of all trains, freight and passenger trains, that are using the infrastructure. This makes networks with mixed traffic measurements from the *network* energy consumption virtually useless for energy efficiency evaluations.

The only exception is the Slovenian railways. They are both infrastructure manager and railway operator and at the time being the only operator in the network. In the Slovenian case it was possible to collect all the necessary data.

In 6.1 some measured results will be presented. In case of the Slovenian railways Slovenske Železnice the energy performances could directly be measured from the grid. In other cases the results have been measured on specific tracks.

In 6.2 higher level performances for the railway companies will be presented, which have been calculated by means of estimates, best guesses, assumptions and general data from the UIC data base.

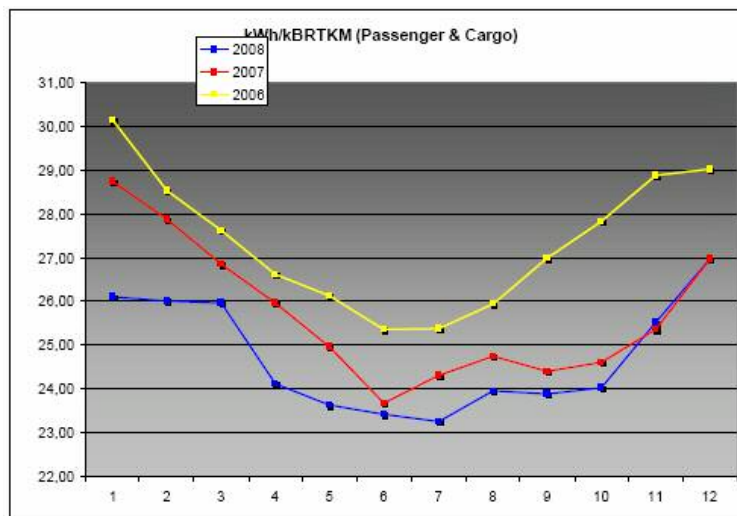
6.1 Measured results


Slovenian railways Slovenske Železnice

The energy consumption of the network is conditionally useful when it is possible to collect all the information regarding the traffic in the network (self-enclosed networks). This is usually not the case.

The network energy consumption, compared with the timetable data, was successfully used on the Slovenian railways (it is a self-enclosed network). Data have been collected for the last three years, when the TRAINER project was running. The diagram shows that the specific consumption is the highest in the winter and it decreases in the summer time.

It is evident that the consumption has dropped significantly since 2005. The volume of the traffic increased less than 5% (a high increase may decrease the specific consumption) and no significant technological improvements have been implemented. Therefore it may be concluded that most of the savings have actually been achieved through the drivers' training.



 Slovenske železnice

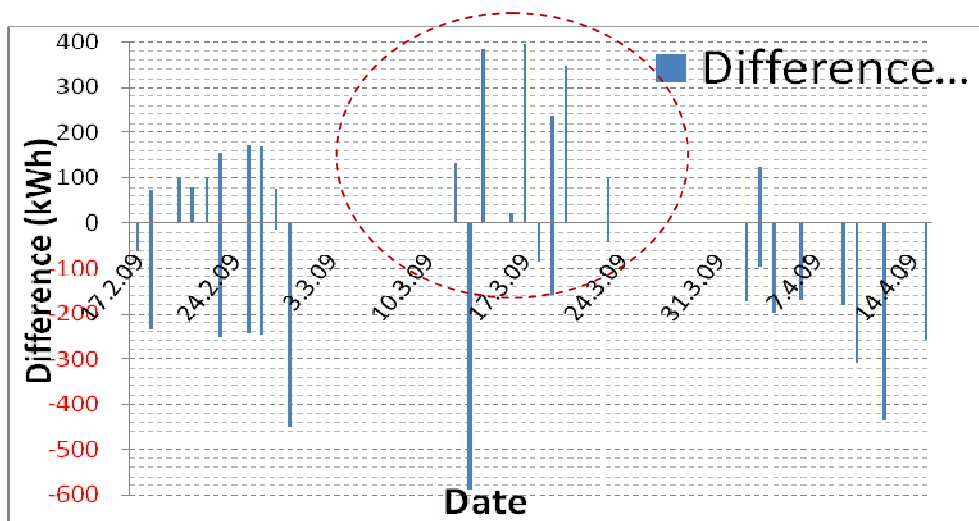
Specific consumption per gross ton kilometre of SŽ from 2006–2008

	2005	2006	2007	2008
<i>Specific consumption per gross ton kilometre</i>	27,33	27,27	25,65	24,68
<i>Decrease in energy consumption (compared to 2005)</i>		- 0,2%	- 6,1%	- 9,7%

Comparing 2006 and 2008 the consumption decreased from 9 to 11%. This equals an average saving of 9,7% a year. This means 10 GWh of electricity less and 5,000 tons of CO₂ emissions.

Italian railways Trenitalia

In order to demonstrate the effectiveness of the training the Italian railways measured the consumption on the route Milano - Verona. They measured it before (February 2008) and after the training was done (April 2009). The measurements include the comparisons of more than 100 train journeys, which guarantees a statistically significant data sample. The experiment was not done in a controlled environment and there was no control group. This means there are parameters which may have had an impact on the consumption and are not evaluated here. However, the high number of trains and the relatively short period allows the assumption that the results are relevant. These concern real measurements, made with an on-board meter installed on a locomotive. The device compares the consumption, on the same track, after and before the training.



Specific energy consumption of Italian trains after training date.

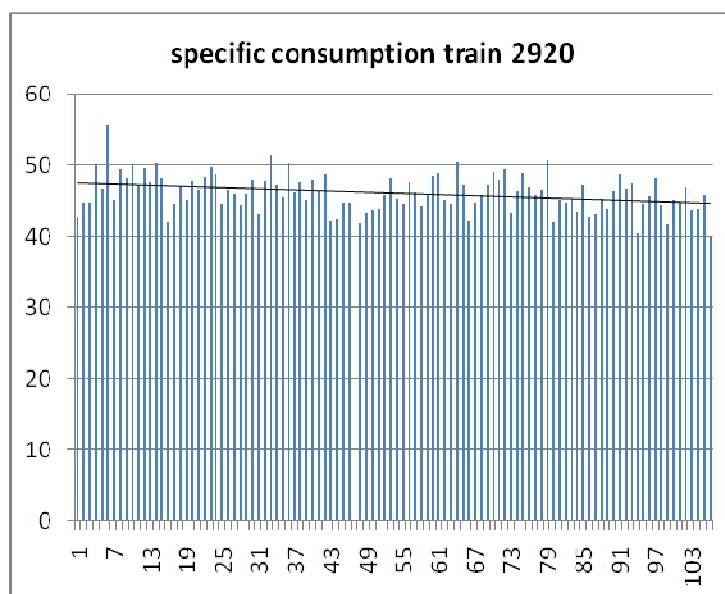
The bars on the x-axis show surprisingly a higher consumption after the training. The red circle shows the period when the consumption after the training was in average higher than before. After the analysis done it was found that this increase is most likely due to significantly changed weather conditions. In spite of that period the average consumption after the trainer was on the long-term around 3% less.

Slovenian railways Slovenske Železnice

The Slovenian railways have all their locomotives and trainsets equipped with energy meters. The training was successful and resulted in energy savings already in 2007 and even higher savings in 2008. The Slovenian railways have a significant energy measurement database which enables a thorough analysis for various types of journeys and the impact the training has had on the driving style.

Local trains

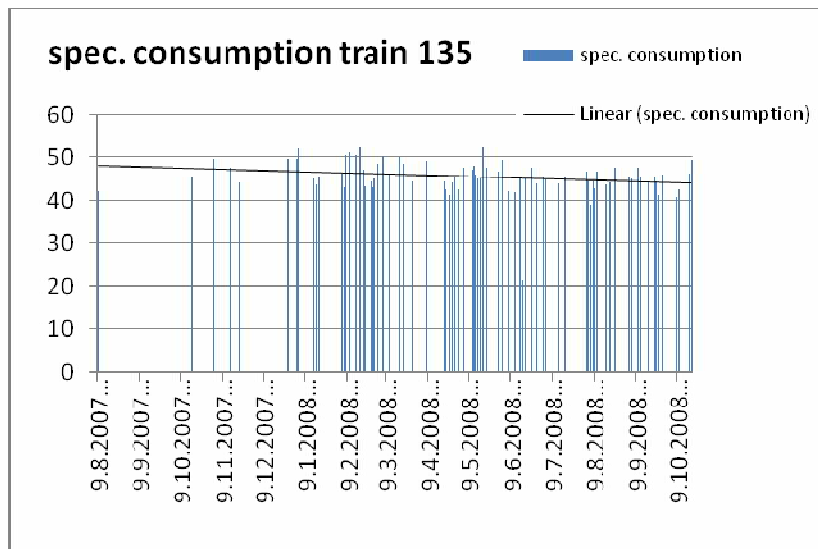
The energy saving potential is the highest in the local trains. This is because of the many stops, accelerations and decelerations. The specific energy consumption per train journey was significantly decreased because of the improved driving style. With the local trains savings of around 10% were achieved after the training.



Specific energy consumption of the local train 2920.

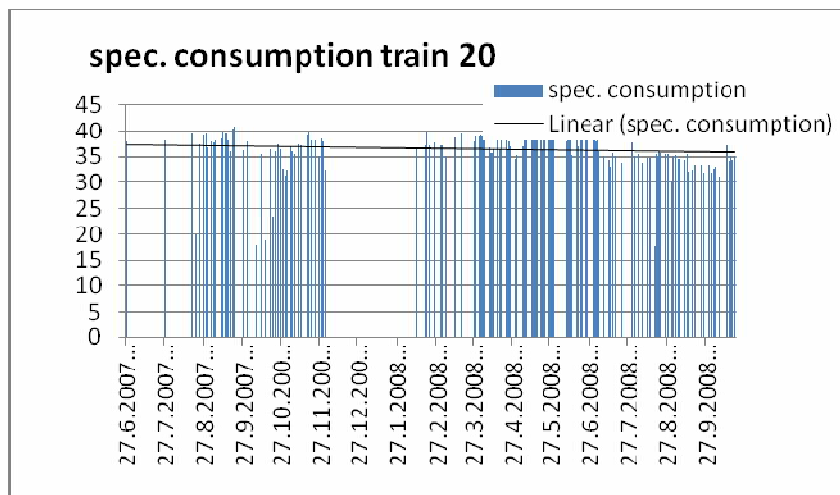
Regional trains

With the regional trains savings of around 8% were achieved after the training.



Specific energy consumption of the regional train 2920.

High speed trains

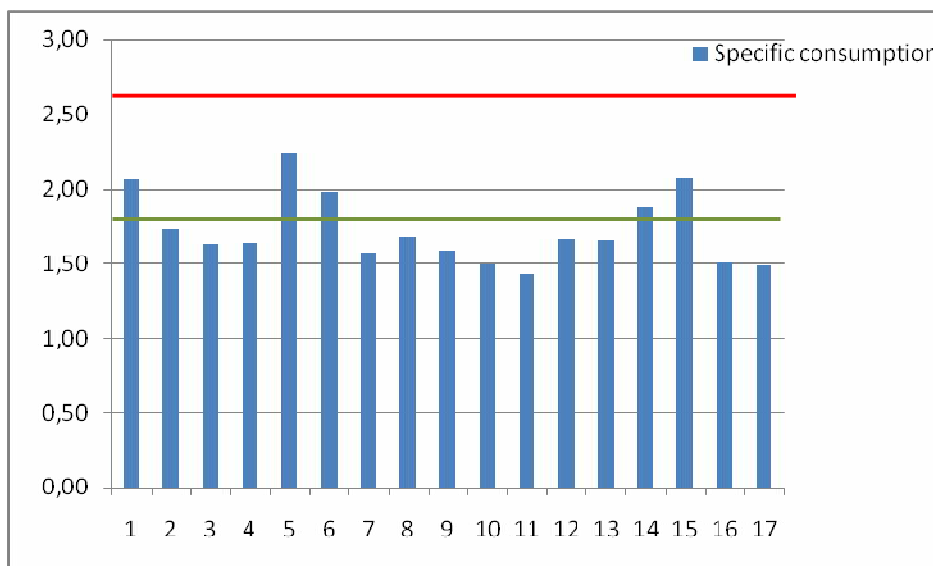


Specific energy consumption of the high speed tilting train 20.

Due to a low number of stops, accelerations and decelerations the impact of the driving style on the energy consumption is less for high speed trains. That is why the savings are less, around 5% after the training.

Dutch railways NS Reizigers

As part of the training process, the Dutch railways NS organised demonstration ecodriving journeys on a particular track. Five energy meters have been installed on locomotives on the The Hague - Venlo line. The results in the ideal conditions (fluent traffic, no wind, very experienced drivers) were encouraging, showing big saving potentials, even over 30%.



Specific consumption of the 17 train journeys of Dutch railways (green line average). Red line long-term average specific consumption.

To get a picture of the possible maximum results a competition was organised by the expert panel of NS in 2009. Compared to the 2007 average energy consumption per km, savings of up to 40% were reached during individual trips from Amsterdam to Rotterdam.

6.2 Calculated and estimated results

Slovakian railways ZSSK CARGO

		2006	2007	2008
Realised traffic	<i>Gross ton km</i>	9 061 996 287	9 031 843 051	9 312 457 742
Consumed energy	MWh	135 620,90	135 396,43	139 179,80
	<i>Specific change (to 2005)</i>		+0,2%	- 0,1%

The Slovakian Cargo railways operate with competing operators on the same infrastructure. The numbers in the table are official but estimated (not measured) energy consumptions from the period when the trains were not yet equipped with on board measurements. The consumption was estimated on the gross ton kilometres. If it is not possible to measure the energy consumption directly from the grid or on-board trains with specific measurement equipment, the only possibility is then to make use of more abstract data en best guesses and impressions from experts. This is the only methodology to be deployed for the Slovakian, Dutch, Greek and Italian railways.

Higher level emission reductions

The core activity of the project was the training of train drivers. As reported by the railway partners all their drivers have been trained, except for NS. At NS 1,100 out of their 3,000 train drivers have been trained. Altogether almost 20.000 drivers.

Railway company	Total
NS	1,100
Slovenske Zeleznice	1,200
OSE	600
ZSSK CARGO	1,800
Trenitalia	14,850
Total	19,550

The data from the Dutch, Italian, Slovenian and Slovakian cases give a good impression of the possible savings as a result of an adapted driving style. A 10% savings potential is a reachable and realistic goal. But not in the first year after the training programmes and not by a train-the-trainer approach only. Changing driving style and thus changing behaviour takes time and it needs a continuous pushing and pulling.

For calculating the CO₂ emission avoidance of TRAINER two types of data have been used:

- 1) The UIC database on the annual CO₂ emissions by the EU railways
- 2) Best guesses about the average energy savings after the training from experts of the participating railway companies

The annual CO₂ emissions of the railway companies have been multiplied with the best guessed savings from the experts. The best guesses of the experts are based on a comprehensive compilation of data from the company and on collective impressions. The data can come from measurements in the cabin of a train, from simulator results, energy bills, etc.

During the action 19,550 train drivers have been trained in ecodriving through train-the-trainer activities. For these 19,550 train drivers the calculations result in an annual CO₂ emission avoidance of 0.13 Mton. Additionally hundreds of station personnel have been trained. It is hard to tell how many exactly due to their relative independency from the railway companies. But it is plausible to assume that from all the participating railway companies some 500 station personnel have been engaged to better consider energy efficiency at their work. Furthermore TRAINER has reached additional train drivers from non-partner railway companies. The instruction film and the universal manual have been downloaded and distributed some 500 times. It is to be assumed that regarding the multiplier effect of these deliverables (one can be seen/read by many) at least a few and possible some hundreds of train drivers have been inspired by the contents and message of either the instruction film or the universal manual or both. It seems therefore reasonable to calculate in an additional 0.2 Mton/year. Added up this results in an annual CO₂ emission avoidance of 0.15 Mton.

Not all the train drivers of NS have been trained within the TRAINER action. They will however be in the course of 2010. They will be trained accordingly the within TRAINER developed ecodriving training programmes. From 2010 on, when all the 21,450 train drivers will have been trained, the CO₂ emission avoidance may mount up to 0.20 Mton/year. This will be the result of a relatively 'soft' train-the-trainer approach. A further intensification of the training of the train drivers may result in a doubling of the CO₂ emission avoidance, meaning 0.40 Mton/year.

Potential emission reductions Europe-wide

Using the UIC CO₂ emission data (see appendix) and combining them with the TRAINER findings it is possible to predict the potential emission reductions of ecodriving training programmes Europe-wide. Through an intense training of all the EU train drivers and/or massive implementation of a sophisticated driver advisory system like the Gekko (used by the Danish railways (DSB)) the CO₂ emission avoidance might mount up to 2.4 Mton/year.

7. Long Term Agreements

Introduction

One of TRAINER objectives was to investigate if there might be possibilities for preparing Long Term Agreements (LTAs) in consortium and/or non-consortium countries. An LTA is a covenant between a railway company, the government and an independent organisation, often an energy agency. The covenant sets a long-term target for energy efficiency improvements compared to a base line year. The energy agency periodically monitors the results.

This chapter pictures the efforts, obstacles and successes of the investigations that TRAINER made regarding the possibilities for preparing LTAs in Europe.

7.1 National Long Term Agreements

Firstly all the partners investigated the possibilities for an LTA in their country except for the Dutch partners because in the Netherlands there is already an LTA in place. For that cause the coordinator NL Agency provided the partners with all kind of relevant information about LTAs and the LTA in the Netherlands between the Dutch railway company NS, the Dutch Ministry of Transport and NL Agency.

A short list was made to identify the countries in which the chances for success were estimated to be the highest: Spain, Switzerland (though not a EC country), and Germany. Besides those countries, initial interest was sensed in Slovakia, Slovenia, Belgium, Ireland and in the UK at the London Underground.

Secondly at least three parties in a country (government, energy agency, railway company) have to be engaged and informed about the benefits and potential of an LTA, the right person in the organisations has to be reached, and only then an internal process possibly starts. The contact persons have to engage their colleagues/management.



Difficult but vital is to start the discussion with high level persons at the government, the agency and the railway company. The best way is to have them invited for a joint meeting. Due to the possibility of direct questioning and answering it is mostly very clarifying and engaging. It is almost not possible to properly engage and inform parties by mail or phone only.

The biggest progress towards the conclusion of an LTA has been made in Slovakia and in Belgium. On 17th January 2008 a successful joint meeting took place in Bratislava. All vital parties were present: ZSSK CARGO, the Ministry of Economy and Ministry of Transport and telecommunications and the national energy agency SIEA. NL Agency presented the LTA and moderated a workshop. On 23th June 2008 a follow-up meeting took place to further explore the possibilities of concluding an LTA and to define the necessary steps.

In February 2009 ZSSK CARGO was requested to prepare a proposal. In the course of 2009 several meetings took place to discuss the proposal, the last one in November. ZSSK CARGO was then requested to draft a more in depth analysis of the whole process of setting up, concluding and maintaining an LTA. This should reveal the personnel, time and budget needs, the roles, responsibilities and obligations of the participants and the potential (financial) benefits. This in depth analysis should be ready until January 2010. There might then be a possibility to incorporate the plan in the governmental Action plan for 2011.

Also pretty successful was a meeting in Brussels on 31st May 2007, organised by NMBS-holding. Present were representatives of the three companies of the holding: Infrabel, the Belgian Railway infrastructure management, NMBS, the biggest Belgian railway operator for both passenger and freight rail transport and NMBS-Holding, responsible for the management of the stations but also coordinating for the Group the environmental related items. NL Agency presented the essence of LTA and the Dutch implementation. Though the participants were very engaged, there was only limited communication afterwards.

On 3rd July 2009 a follow up meeting took place at the NMBS-Holding premises in Brussels. The discussion mainly focused on the bottlenecks for preparing an LTA in Belgium. NMBS, Infrabel and NMBS-Holding all have performance-related contracts with the federal administration, which besides issues as punctuality involve energy efficiency. These performance-related contracts are already some sort of LTA. E.g. the contract covers a commitment to reduce energy consumption in buildings (stations, workshops, offices, etc.) by 7,5% in 2012 and by 20% in 2020 (compared to 2005). Until

now, no goals concerning energy efficiency of train traction have been specified. This might however become the case in due time. The fact that in the latest rolling stock order energy meters have not been included, proves that there is still a way to go.

NL Agency contacted the Austrian energy agency AEA about the possibilities of an LTA with the Austrian Railways ÖBB. ÖBB already happens to have an LTA on energy efficiency. It includes a quantitative goal (energy improvement of 5% in 2010 compared to 2006), covers housing and traffic and is signed by the Ministry of Environment and ÖBB. The LTA results are not transparently monitored.

NL Agency also got in touch with the Spanish energy agency IDEA about the possibilities of an LTA with the Spanish railways Renfe. After investigations IDEA reported that an LTA could be interesting, but signing an LTA is yet a step too far: Short-term thinking is currently more important than the long-term thinking necessary for concluding an LTA.

There have also been some initial contacts and communication with the railways in Romania, the UK and Ireland. In the beginning they were interested, but after a while the communication came to a dead end.

All the contacts have been/will be sent the links to the universal manual and the instruction film.

In general it turned out to be very difficult and time consuming to initiate energy efficiency

LTA's in EU countries. The Netherlands have a successful LTA running including the NS, the Dutch government and NL Agency. The Dutch LTA concept however

can not simply be copied to other countries. The relations between government and railway companies and the necessary negotiation process and monitoring seem to be culturally bound.



In the Netherlands the Dutch Railways, Inframanager ProRail and the Ministry of Transport (VenW) have started their negotiations for a new LTA: an LTA3 (2011–2020). There is a possibility that other Rail Operating Companies –which are operating in The Netherlands – can join this Agreement. This LTA will be concluded at the end of 2010.

Apart from this LTA NS (Dutch Railways) have signed a covenant with the government on e.g. a CO₂-emission avoidance (1990–2020).

7.2 European Long Term Agreement

The EU project LTA uptake (<http://www.ltauptake.eu>) covers requests from European countries for assistance for concluding LTAs. These might also cover LTAs for railways. This is taking the opposite way: Identifying the needs for an LTA first and then offering know-how and knowledge. LTA uptake deploys a website with all kinds of supporting tools and documents in English for starting up LTAs. To make this work it is necessary to have an energy agency guide the companies and ministries through the LTA process.

The in 2009 jointly published statement on CO₂ emission reductions from the UIC and the CER might be an important building block for a European LTA. The acceptance for a European LTA is growing. One of the discrepancies between a European LTA and a national one, is that in the latter a national Ministry is party in the LTA, covering local national policies. For a European LTA the European railway companies will not be able to conclude a legal covenant with the Euro commissioner on transport because it is prohibited by EC-treaties. In other words: which Euro commissioner should sign such a European covenant?

There are all kind of barriers for setting up and concluding an LTA. These can touch on:

- Politics (e.g. instability)
- Strategies (e.g. might not fit in company strategy)
- Personnel (e.g. who can shake the tree)
- Competition (e.g. tax schemes might be equivalently effective)

It is however worthwhile to further explore in a succeeding project the possibilities for an LTA covering the railways of all European countries for a period until e.g. 2020 and involving an independent organisation/agency which accredits the energy efficiency plans of the railways and evaluates the monitoring results.

8. Perspective energy efficiency and railways

From the evaluation it shows that TRAINER, together with Railenergy and the UIC, has started up a process, which should be proceeded in a subsequent European project in the near future. Preferably jointly with (part of) the Railenergy consortium and the UIC. This would fit the ambitions of the European railway sector as is depicted in the recently drafted paper 'Rail Strategy 2030 and beyond for Environment, Energy and Sustainable Mobility' (draft December 2009).



Objectives and target setting for 2030 and 2050

The direction for the environment and sustainability efforts of the European railways is reflected in the following ambitious targets for 2030 and towards 2050:

Climate protection

- By 2030 the European railways will reduce its specific average CO₂ emissions from traction energy consumption by 50% compared to base year 1990; measured per passenger-km (passenger service) and gross tonne-km (freight service).
- In addition, by 2030 the European railways will not exceed the total CO₂ emission level in absolute terms even with projected traffic growth compared to base year 1990.
- By 2050 the European railways will operate their trains 100% carbon-free (including CO₂ and CO₂-equivalents) and thereby providing society with a completely climate neutral transport alternative.

Energy efficiency

- By 2030 the European railways will reduce their specific average energy consumption by 30% compared to the base year 1990; measured per passenger-km (passenger service) and gross tonne-km (freight service).
- By 2050 the European railways will reduce their specific average energy consumption by at least 50% compared to the base year 1990; measured per (passenger service) and gross tonne-km (freight service).

9. Conclusions

The railways are a surprisingly motivated sector when it comes to energy efficiency improving measures. They turn out to be far less conservative than one might expect. Technical innovations in the railway sector run ahead of other transport sectors. The 'problem' however is that railway companies are using the same rolling stock for several decades. This slows down the penetration of innovative, more sustainable rolling stock and technologies.

The railway sector is currently heavily in motion, oil prices are sky rocketing and the current time period creates all kind of exciting and challenging opportunities for them, to enhance their competitiveness to the road sector. It is therefore relevant to go on with the initiatives and products that have been established and developed in both the TRAINER and the Railenergy project. The good collaboration and promising results have engaged the Railenergy and TRAINER consortia and the UIC to jointly continue by submitting a proposal for a follow-up project in one of the next FP or IEE calls. The essence of such a proposal would be the (further) implementation and roll-out of the outcomes and products from TRAINER and Railenergy.

Collecting accurate and solid monitoring data turned out to be difficult. Unlike for road vehicles it is a hard job to get a clear picture of the energy consumption of a single train or train set. In countries with more than one railway company the energy bills are mostly split on the basis of calculations based on assumptions of e.g. the energy consumption of the rolling stock, the number of kilometres driven and the seat occupancy. Energy efficiency improvements made become not naturally noticeable as a cost reduction for a particular railway company. Its competitors too profit. The monitoring of the energy consumptions of train and train sets and of single railway companies is the subject of tough energy billing discussions. The reduced CO₂ emissions resulting from TRAINER therefore had to be calculated by means of estimates, best guesses, assumptions and general data from the UIC data base.



During the TRAINER project several activities have been going on, which exceeded the actual scope of the project but anyhow had a strong relation with TRAINER. For example the UIC energy billing data exchange (UIC leaflet 930) and refreshed EN 50463 standard are one of the building blocks for proper traction energy data collection. The energy efficiency data of TRAINER and the training programmes of the railway partners will be used as input for the standardised energy billing process and will become

available for all the railway operators in the EU. This has been an unexpected but important outcome of TRAINER.

TRAINER initiated also discussions between the railway operators and the railway infrastructure managers regarding the data ownership and data access. This has been a time consuming process. Since the technology and process of the to be installed measurement devices and the analysis of the generated data were new to the railway companies it took a long time to decide and to prepare the plans for the installation of the devices on the locomotives. So one of the results of the TRAINER project is also an increased knowledge and know-how and moreover TRAINER initiated a decision process, which will significantly decrease time and other resources needed for subsequent activities in the future.

During the action 19,550 train drivers have been trained in ecodriving through train-the-trainer activities. Furthermore hundreds of station personnel have been trained and the instruction film and the universal manual have been downloaded and distributed some 500 times. Together this results in an annual CO₂ emission avoidance of 0.15 Mton. From 2010 on, when all the 21,450 train drivers will have been trained, the result may mount up to 0.20 Mton/year. An intensification of the training of train drivers may result in a doubling of the CO₂ emission avoidance, meaning 0.40 Mton/year. Through an intense training of all the EU train drivers and/or massive implementation of a sophisticated driver advisory system like the Gekko (used by the Danish railways (DSB)) the CO₂ emission avoidance might mount up to 2.4 Mton/year.

From the evaluation results it can be concluded that TRAINER has reached most of its objectives. TRAINER started a big process, that is still going on and goes far beyond the running period and geographical limits of the TRAINER project. TRAINER, together with Railenergy and the UIC, has started up a process, which should be proceeded in a subsequent European project in the near future. Preferably jointly with (part of) the Railenergy consortium and the UIC.

It proved to be difficult to initiate energy-efficiency Long Term Agreements (LTA) in EU countries. The Netherlands have a successful LTA running including the NS, the Dutch government and NL Agency. The Dutch LTA concept can however not simply be copied to other countries. The relations between government and railway companies and the necessary negotiation process and monitoring seem to be culturally bound. In Slovakia the most progress has been made and resulted in negotiations between the Ministry of Transport and Telecommunications, the Ministry of Economy and ZSSK CARGO.

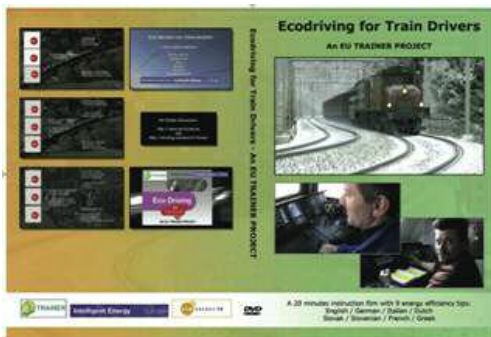
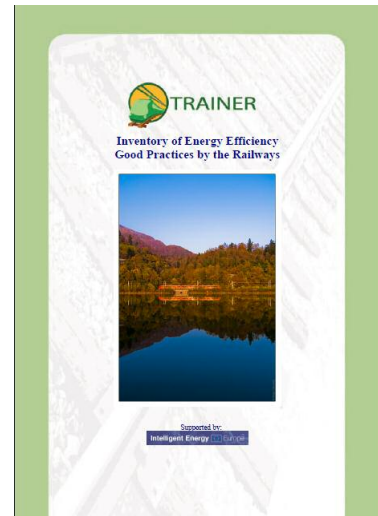
In the future possibilities may come along for an overarching European LTA. The jointly published statement on CO₂ emission reductions in the railway sector from the UIC and the CER in 2009 might build a foundation and acceptance for such a European LTA. Moreover in the provisional strategy of the cooperating organisations of the EU-Railways (UIC, CER and UNIFE) the newest goals (for energy and CO₂-emissions) are beyond expectations.

10. Further information



TRAINER website www.iee-trainer.eu

Inventory of good practices



Instruction film train drivers

Universal manual



These and various other deliverables are available at the TRAINER website www.iee-trainer.eu

TRAINER: Low-cost, no-regret measures for optimising energy efficiency at the European Railways

Appendix: Contact details TRAINER partners

	Name	Phone	E-mail	Website
Railway companies				
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