



ACTUATE

Advanced Training and Education for
Safe Eco-driving of Clean Vehicles

Final brochure



Co-funded by the Intelligent Energy Europe
Programme of the European Union

actuate





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WELCOME!

ACTUATE (Advanced Training and Education for Safe Eco-driving of Clean Vehicles) was a project of the EU's Intelligent Energy Europe Programme. Funded through the Executive Agency for Small and Medium-sized Enterprises (EASME), the aim of ACTUATE was to develop, test and implement advanced driver training and education concepts for safe eco-driving in the public transport sector.

Previously existing eco-driving initiatives had mainly focused on diesel vehicles and by supporting the introduction of safe eco-driving training for clean vehicles, ACTUATE was able to further exploit additional energy savings potential, by getting the most out of clean vehicles such as trams, hybrid buses and trolleybuses.

In order to unlock this potential, the project put a particular focus on the drivers, as they are the pivotal element for better vehicle handling, safer performance and optimised energy savings. ACTUATE developed numerous sets of training materials, such as concepts, brochures and presentations, in order to implement comprehensive programmes for safe eco-driving. Motivational campaign materials to start up targeted initiatives at public transport companies were also produced.

ACTUATE focused on sharing knowledge and helping build momentum with dedicated "train-the-trainer" work-shops. All of the training materials are available free of charge on the project website: www.actuate-ecodriving.eu.

Find out more on the following pages and enjoy learning about the impressive project results!

Your ACTUATE team



The ACTUATE team



WHO IS ACTUATE?

The ACTUATE project consortium consists of five public transport operators from four European countries and three other European experts in the field of clean urban mobility, including a bus manufacturer, a trolleybus association and a consulting firm which took over the coordination of the ACTUATE project.

Coordinator:

- Rupprecht Consult Forschung & Beratung GmbH, Germany

The ACTUATE public transport partners are:

- Salzburg AG für Energie, Verkehr und Telekommunikation, Austria
- Leipziger Verkehrsbetriebe GmbH and its driving school
- Leipziger Aus- und Weiterbildungsbetriebe, Germany
- Dopravní podnik města Brna a.s., Czech Republic
- Trasporti Pubblici Parma S.p.A., Italy
- Barnimer Busgesellschaft mbH, Germany

International action group to promote modern e-bus systems:

- trolley:motion, Austria

Industry partner:

- Van Hool NV (VH), Lier, Belgium

ACTUATE FACTS AND FIGURES

- Project duration:
May 2012 to January 2015
- Altogether, the public transport companies directly involved in the project operate fleets consisting of
 - 635 trams,
 - 261 trolleybuses and
 - 19 hybrid buses and employ
 - 1,237 tram and
 - 1,306 (trolley-)bus drivers
- Project budget: 1.345.568 EURO
(of which about 1 Mio. EURO or 75% funding)



WHAT IS ACTUATE ABOUT?

Eco-driving is driving that optimises energy use and contributes significantly to emission reduction as promoted by the European Commission. Identifying and reducing inefficient driving habits and energy-wasting manoeuvres (e.g. harsh braking, needlessly accelerating) has the potential to reduce both operating costs and emissions as well as to increase passenger safety. While the potential of eco-driving for private cars and diesel buses is well understood, eco-driving for electric fleets in the public transport sector is not yet widely known or practiced.

In response to the introduction of new clean vehicles and technologies and a lack of corresponding skill sets and divergence in implementation, the ACTUATE partners developed the necessary safe eco-driving trainings for clean vehicles. Hereby, ACTUATE made an attempt to match the clean vehicle technology market with the required skills needs.

ACTUATE objectives and main steps

- Integrate ACTUATE trainings for safe eco-driving into formal bus driver qualification of public transport (PT) companies by developing and testing safe eco-driving training programmes for tram drivers as well as hybrid- and trolleybus drivers (in accordance with EU Directive 2003/59/EC).
- Enhance the quality of bus driver training and expand the training to the special requirements of clean vehicles by defining minimum quality criteria & learning outcomes.
- Demonstrate the energy saving potential on the basis of capacity building in energy efficient driving of clean vehicles by evaluating training sessions with more than 1,500 drivers.
- Upscale the outcomes for wider take-up at European level by testing the trainings at additional PT companies & distributing "starter kits".

ACTUATE IN A NUTSHELL

ACTUATE partners will save nearly 18,000 tons of greenhouse gas emissions by 2020 through the application of safe eco-driving of their clean vehicle fleets!

Based on the overall reduction of energy consumption by 4.5% as a result of the eco-driving trainings applied in ACTUATE's public transport partner companies, this leads to primary energy savings of 549 tons of oil equivalent per year and a reduction of 2,938 tons of greenhouse gas emissions per year!

Between 2015 and 2020, it is projected that the ACTUATE partners will achieve primary energy savings of 3,294 tons of oil equivalent and will reduce their greenhouse gas emissions by 17,628 tons!

With about 190 tram cities, 150 trolleybus cities and approximately 50 cities operating hybrid, battery-powered or hydrogen fuelled buses in Europe, there is vast potential to upscale the effects of the ACTUATE project.

1

results



WHAT WAS ACHIEVED?

ACTUATE's project results confirm potential savings of several thousand tons of greenhouse gas emissions and Euros per vehicle and year! Our results show that eco-driving boasts a huge potential to make

bus and tram fleets safer and significantly more energy efficient. By training drivers how to adopt an eco-driving style, entire electric bus and tram fleets can be made much more energy efficient. Thus, several

thousand Euros and vast quantities of energy can be saved per vehicle, per year. This also means a reduction of air pollution and CO₂ emissions in our cities. Furthermore, it creates an even bigger environmental advantage for clean public transport vehicles over comparable diesel vehicles or private cars.

Energy savings per year by ACTUATE partners¹ based on a 4,5% scenario

| | Tram | Trolleybus | Hybrid Bus | Total |
|---|-------------|------------|------------|-------------|
| Number of vehicles in ACTUATE's partner fleets | 635 | 261 | 19 | 915 |
| Total annual energy consumption of vehicles before the action (kWh) | 105.113.225 | 30.846.829 | 5.987.800 | 141.947.854 |
| Annual energy consumption after trainings with 4,5% savings (kWh) | 100.383.130 | 29.458.722 | 5.718.349 | 135.560.201 |
| Energy saved during the ACTUATE project (kWh) | 4.730.095 | 1.388.107 | 269.451 | 6.387.653 |

Project partner results (calculated for one year)

| | Approximate annual costs for energy to operate clean vehicle fleets (in EURO) | Average energy savings – based on long-term evaluation | Money savings (in EURO) |
|--|---|--|-------------------------|
| Eberswalde (Trolleybus) | 353.303 | 6.4% | ca. 22.500 |
| Salzburg (Trolleybus) | 540.000 | 6% | ca. 32.000 |
| Leipzig (Trams) | 7.000.000 | 3% | ca. 210.000 |
| Leipzig (Bus) | 5.625.000 | 4% | ca. 225.000 |
| Brno (Tram) | 3.043.370 | 2.5% | ca. 76.000 |
| Brno (Trolleybus) | 1.126.950 | 6.5% | ca. 73.250 |
| Parma | 300.000 | 4% | ca. 12.000 |
| Total money savings for ACTUATE partners | | | ca. 650.750 |
| Average energy savings | | 4.6% | |

ACTUATE project achievements:

- More than 1,700 drivers have been trained with ACTUATE's training programmes for safe eco-driving of clean vehicles (800 tram and 944 bus drivers);
- More than 250 training sessions have been carried out;
- More than 1,500 training rides have been evaluated to determine the energy saving potential of safe eco-driving behaviour;
- More than 90% of the trained drivers rated the overall quality of the ACTUATE training as either 'excellent' or 'very good';
- More than 40 multipliers have been skilled to train tram drivers in Leipzig and Brno in safe eco-driving;
- More than 70 trainers from 28 public transport operators have been educated in train-the-trainer workshops to perform the safe eco-driving trainings at their companies;
- More than 70 drivers tested the ACTUATE e-learning modules to refresh their knowledge on eco-driving, almost all of whom rated the modules as useful and recommendable.

context

legacy



WHY ECO-DRIVING?

An eco-friendly driving style means not only the actual saving of fuel, but also energy and money!

Eco-driving is useful for ...

- **the driver:** the driver is more relaxed and less stressed while driving
- **the passenger:** the passenger feels safer because she/he senses the calmness of the competent driver through their anticipatory and gentler way of driving
- **the infrastructure:** the infrastructure is subject to less stress with an anticipatory and gentler way of driving, resulting, for example, in less wear on points and track intersections. In the long term this means significant savings in infrastructure costs.
- **the vehicle:** eco-driving of the vehicle means it runs more smoothly and is subject to less stress, for example with less wear on the rim-tyres or less wear on the electronic control system.
- **the company:** the company will save a lot of money in the long term through lower energy consumption, fewer repairs to vehicles and infrastructure and greater employee satisfaction.

ACTUATE'S LEGACY – TRAINING MATERIALS AND CAMPAIGN ELEMENTS

The ACTUATE partners developed several training materials for safe eco-driving to help other public transport companies and transport stakeholders – those that either operate clean vehicles or are involved in education and training of professional drivers in public transport – to implement safe eco-driving training programmes in their own companies and to give trainings on this topic. The complete training programme comprises:

- a training concept:
The training concept presents the aims, objectives, content and tips for the implementation of safe eco-driving trainings for clean vehicles and is the essence of the development, testing and implementation process of the safe eco-driving training programmes by the ACTUATE partners.
- training presentations and brochures:
The training presentations and brochures for safe eco-driving of clean vehicles such as trams, trolleybuses and hybrid buses constitute the basic training materials; whereas the presentation is the main training material used for the training sessions and the brochure can be used as handouts to drivers, trainers and managers as background

information or to recap what they have learned at any time after the training sessions. The training is structured around the three main topics:

- Introduction and functioning of the clean vehicle „system“
- Theoretical input about safe eco-driving principles for the clean vehicle type
- Safety aspects and emergency procedures for the clean vehicle type

Practical driving shall be integrated before and after the theoretical input about safe eco-driving principles to enable a comparison of “blind” and “coached” training rides to analyse and illustrate the learning impact of the trainings.

- E-learning modules
To support the positive results and to constantly refresh the knowledge about safe eco-driving behaviour, the ACTUATE partners developed a series of e-learning modules that could be flexibly integrated into training sessions for professional drivers of clean vehicles or could be used anywhere drivers have access to a computer or mobile device with an internet connection, allowing for a self-paced learning process. The ACTUATE e-learning modules are available in English, German, Italian and Czech for the vehicle types tram, trolleybus and hybrid bus and can be tested freely at the following link: <http://www.rupprecht-academy.eu>.

nutshell



WHY ECO-DRIVING?

IN A NUTSHELL:

The comparison of “blind” and “coached” training rides showed a potential energy savings of 10% to 20% on average depending on the vehicle type. The customised measurement software solutions and the possibility to monitor and protocol the results are helpful to visualize the learning outcome in “black and white” and effectively increase drivers’ motivation.

Furthermore, a “lessons learnt” brochure, a report on the definition of minimum criteria and learning outcomes as well as an introduction strategy are available as further documents

facilitating the implementation of safe eco-driving training programmes in public transport companies. All of the training materials, reports and campaign elements that were produced and developed as part of the project may be obtained by interested public transport operators free of charge. You will find all materials as file downloads under the “Outputs” section on ACTUATE’s website www.actuate-ecodriving.eu.

The training materials for all three vehicles types are available in the following languages: English, German, Italian, French, Spanish and Czech, as well as Polish (only tram and trolleybus materials) and Romanian (only trolleybus materials).

Because periodic trainings often only have short-term effects, but changing driving behaviour requires a long-term approach, the ACTUATE partners developed in-house (motivational) campaigns, targeted at the driver’s workforce, to sustain the training effect with regard to eco-friendly and economic driving behaviour. The ACTUATE partners developed different concepts for in-house campaigns ranging from poster campaigns and drivers championships to green licenses with a bonus point system (as an incentive system).



Training materials for safe eco-driving of trams, trolleybuses and hybrid buses



Examples for ACTUATE’s image campaign elements



Christian Osterer, ACTUATE project manager, Salzburg AG

„During the first training session, all energy consumption measurements were still made without the drivers having been educated in the principles of eco-driving. It was only in the second “hands-on” session that the drivers started to apply in practice what they had learnt in theory and immediately 20% electricity savings on average became apparent. This formidable figure clearly demonstrates the huge savings potential, if eco-driving is consistently and continuously applied. In a best-case scenario, we could save 6% of our total annual energy consumption through the introduction and application of eco-driving and therefore believe that 3% will be realistic on a long term basis.”

HIGHLIGHTS AND GOOD PRACTICES FROM ACTUATE PARTNERS – SALZBURG , AUSTRIA

Salzburg AG (SAG) is among the largest trolleybus operators in Europe. About 38 million passengers use the trolleybus system in Salzburg every year. Salzburg is internationally renowned as a leading trolleybus city and was responsible for the development of the safe eco-driving training programme for trolleybus drivers.

Salzburg: 250 trolleybus drivers trained in safe eco-driving

The trolleybus operator Salzburg AG, as all other bus operating partners, formally integrated ACTUATE's training into the companies' periodic training from the beginning, making the newly developed safe eco-driving trainings for trolleybuses a mandatory module on eco-driving according to the Directive 2003/59/EC. The Directive on the initial qualification and periodic training of drivers of certain road vehicles for the carriage of goods or passengers was the entry point for the introduction and internal standardisation of safe eco-driving training for trolleybus drivers in Salzburg, as drivers so far only had the chance to train with diesel bus based materials. ACTUATE's safe eco-driving training programme is now not only a mandatory subject of the periodic training of trolleybus drivers in Salzburg, but it also provides the basic elements of eco-driving principles as well

as practical parts already during the initial qualification of drivers.

The trained drivers participated in a 3.5 hour theoretical session and a 3.5 hour practical driving session on a regular line of Salzburg's trolleybus network (without passengers). The before and after comparisons showed that more than 90% of all drivers were able to cut down energy consumption by 20% on average by applying the safe eco-driving techniques learned during the training. In addition to all drivers, 39 SAG employees from management, vehicle services and the depot who possess the appropriate driving license participated in the ACTUATE trainings. With this approach a strong support for the ACTUATE project across all departments at SAG was ensured. Especially the practical part of the trainings received very positive feedback from the drivers and the management level, and is regarded overall as highly effective.

IN A NUTSHELL:

250 trolleybus drivers were able to cut down energy consumption by 20% on average by applying the safe eco-driving techniques during the training sessions. This shows the vast – but theoretical – potential of safe eco-driving training programmes, which can be captured more and more in the future by continuing safe eco-driving trainings combined with further prioritisation of public transport in urban traffic and intelligent IT-driving assistance systems.



LEIPZIG, GERMANY

Leipziger Verkehrsbetriebe (LVB) was responsible for the development of the safe eco-driving training programmes for the tram and hybrid bus vehicle types as well as for the coordination of evaluation activities in terms of energy measurements. LVB operates the tramway and bus transport services in the city of Leipzig. On 14 tram lines and 60 bus lines, about 130 million passengers are carried annually.

In the LVB-Group, LAB is the service provider for knowledge and skills. LAB was responsible for coordinating and moderating the definition process for minimum quality criteria and the definition of learning outcomes.

LAB operates in four business areas: vocational training and staff development, recruitment and training, operation of a driving school and mobility services for LVB.

Leipzig: successful driver trainings for hybrid buses and trams

In Leipzig about 1,350 drivers have successfully participated in the safe eco-driving trainings for trams and hybrid buses. For hybrid buses, on average a reduction of 13% to 17% of diesel fuel consumption - depending on the vehicle type - was observed during the training sessions. In the long term an average energy reduction of about 3% is estimated for trams, while diesel fuel savings of about 4% have been measured during the long term observation comparing the years 2012 (without training) and 2013 (with training). These savings are in line with the expected and desired outcome for the Leipzig Transport Company.

Michael Schoppe from LAB comments on the EBUS award:

„We are very grateful to have received the EBUS Award and also see it as a measure of obligation for the future. We were pleased to have received this prestigious distinction for a truly sustainable concept, which will have positive effects and far reaching benefits, long beyond the timeline of the actual project. Now we are keen to prove that the energy savings and financial benefits generally associated with eco-driving can be implemented and maintained on a long-term basis.“

IN A NUTSHELL:

**The driver makes a difference!
Leipzig's bus and tram drivers save about 1,600 tons of CO2 emissions per year and more than 400,000 Euros by applying safe eco-driving techniques!**

The training sessions were conducted in cooperation with Leipziger Aus- und Weiterbildungsbetriebe (LAB) and both partners were awarded with the German EBUS prize 2014 for this initiative. The EBUS Award, the German Environmental Award for public local transport, is given to successful projects and innovative products. The prize was awarded by Forum für Verkehr und Logistik, founded by the Association of German Transport Companies (VDV) and the insurance company DEVK. An expert panel under the patronage of German Federal Minister of Transport and Digital Infrastructure Alexander Dobrindt chose the ACTUATE application from numerous forward-thinking technical solutions and concepts for the operation of e-buses. The partners LVB and LAB from Leipzig were honoured for



The ACTUATE project managers from LAB, Michael Schoppe, LVB, Eberhard Nickel and Rupprecht Consult, Wolfgang Backhaus (from left to right)

their sustainable concept of employee motivation and training for the safe eco-driving of e-buses, as the concept not only included the safe eco-driving trainings, but also an internal communication concept of a "green" driving license. This license was handed over to drivers after participating in the safe eco-driving trainings for trams and hybrid buses. Each license has an individual number code and shall be used for follow-up activities to refresh the learned skills and knowledge about eco-driving and to increase or sustain motivation to apply eco-driving in daily driving operations.

Dalibor Šimka – Head of trolleybus depot

„The ACTUATE project was a huge success! Based on drivers' very good experience, the feedback from the quality controllers regarding the applied eco-friendly driving style, the results of the energy consumption measurements and the passengers' positive feedback on this safe eco-driving initiative, DPMB benefitted substantially from the project. DPMB will continue to use the new training methods, including the eLearning modules and instructional videos, and we will transfer our positive experience and newly gained eco-driving know-how to other interested clean vehicle operators. For example, we just started a close cooperation with Pilsen's public transport company with whom we will share the training methods and organise train-the-trainer workshops.“



BRNO, CZECH REPUBLIC

Brno's public transport Operator (DPMB) is the primary public transport operator in the city of Brno and also in the Integrated Public Transport System of the South Moravian Region. On 13 tram lines it operates 310 vehicles which transport 190,000,000 passengers per year. DPMB employs about 3,000 employees, most of them being drivers.

Brno: enriching safe eco-driving trainings with e-learning and instructional videos

DPMB, as the public tram and trolleybus operator of the City of Brno, adapted the eco-driving training materials from Salzburg (trolleybus) and Leipzig (tram) to their local needs. A good practice added by DPMB to the local training context was the shooting of eco-driving video materials showing specific traffic situations or locations in the energy network with a narrator explaining how to drive in a more eco-friendly way in these situations or at these locations. These situations serve as examples which support the theoretic learning material, and were

later recreated so that drivers could experience them in practical driving sessions. These videos were also included in the e-learning modules for safe eco-driving trainings to provide these videos for repetition of the learning matter anywhere drivers have access to a computer or mobile device with an internet connection, allowing for a self-paced learning process.

DPMB developed an in-house campaign to motivate the trained drivers to practice safe eco-driving in daily operations by introducing a driver competition scheme to sustain the safe eco-driving skills. Energy efficiency was monitored daily through on-board computers in trolleybuses and in some chosen trams, taking into consideration certain conditions which drivers cannot influence (e.g. traffic and weather situations). All drivers that were involved received a special remuneration for their extra activity in the ACTUATE project. The prizes ranged from special gifts (e.g. tram and trolleybus models) to extra bonuses for the best eco-drivers of the year. The competition idea was fully supported and became very popular among DPMB's drivers and will be continued in the future.

IN A NUTSHELL:

Make use of an in-house motivation campaign that supports your goals with visually appealing material, a rewarding system and incentives! To sustain the beneficial training effect with regards to eco-friendly driving behaviour in the long-term, ACTUATE's in-house (motivation) campaigns targeted at the drivers were a huge success and such initiatives should be implemented as an complementary measure when introducing safe eco-driving training programmes.



Flip Bamelis, ACTUATE project manager, Van Hool:

„For Van Hool as a bus manufacturer, the ACTUATE project outcome is valuable for further improvement of our vehicles’ energy efficiency. The importance of the drivers’ interactions with regard to the vehicle’s energy requirements has been clearly illustrated. The high variance of energy consumption for different drivers indicates that there is an opportunity for further decreasing this variance with an increased bus intelligence. These systems are to be developed in the future.”

PARMA, ITALY AND VAN HOOL, BELGIUM

Trasporti Pubblici Parma (TEP) is the public transport company that serves the city and the province of Parma. TEP (trolley-)buses run 11 million km and carry 37.5 million passengers per year. Services are provided by nearly 400 buses and trolleybuses driven by 450 drivers.

VAN HOOL N.V. was founded in 1947 and is based in Lier-Koningshooikt near Antwerp, Belgium. The company is one of the largest independent manufacturers of integral buses and coaches in Western Europe. Approximately 1,600 buses and coaches are produced each year and commercialised through the VAN HOOL network. The company currently employs about 4,000 people in Koningshooikt and delivered nine brand new Exqui.City trolleybuses with “supercaps” in 2012 to Parma.

Parma – our drivers have an environmentally friendly foot!

The trolleybus company TEP from Parma developed an image campaign in order to promote the education programme and training sessions for safe eco-driving also to the general public. Customer surveys in Parma showed that 74% of

travellers generally appreciated the safe eco-driving initiative and rated energy savings and environmental sustainability as very important. 84% of passengers stated that they even would accept a slightly longer journey time in order to ensure an energy efficient ride. The campaign not only had a very positive response from the public, but also from the drivers themselves. The campaign put a very positive focus on the drivers, making them genuine ambassadors of eco-driving and social responsibility in Parma. TEP’s drivers became the “faces” of the campaign and this kind of personalised image campaign had two effects: 1) it helped to increase the public appreciation of bus drivers and 2) the drivers accepted the campaign as a token of esteem for their work and they really felt proud to be given credit for their job.

IN A NUTSHELL:

Image campaigns for safe eco-driving increase the public’s appreciation for the drivers’ job and strengthen the drivers’ self-esteem!

TEP worked very closely together with its vehicle supplier Van Hool to adapt the given training material for safe eco-driving of trolleybuses, in particular to find the optimal eco-driving style for their newest trolleybuses: the Exqui.City trolleybus equipped with “supercaps”. Van Hool developed a software tool to evaluate the drivers’ interaction with the vehicles and subsequently the energy efficiency for traction for this vehicle type. This tool was used to evaluate the effect of the eco driving training provided to TEP’s drivers showing that by applying an eco-friendly driving style, an Exqui.City trolleybus with supercaps can be operated with 10% less energy consumption.

IN A NUTSHELL:

The analysis of the vehicle’s response to driving behaviour and of the energy consumption measurement and monitoring results helps with identifying the most economic and eco-friendly driving style by using the driving patterns of the best drivers. Based on this, clean vehicles’ performance can be improved and IT-based eco-driving support systems can be developed to assist drivers in applying such a driving style!



Volkmar Pilz – BBG's head of personnel department

„After completing the ACTUATE trainings, it is important to ensure their sustainability. The excellent and jointly-developed materials will be made use of in our company for yet many years to come. Generally speaking, newly recruited personnel will be trained promptly. Already existing staff is being further trained through the, so called, professional driver qualification (German: Berufskraftfahrerqualifizierung) after 12 months. The energy reductions set out to achieve are, from an economic point of view, very important for us.“



EBERSWALDE, GERMANY

Eberswalde has the oldest trolleybus system in Germany (set up in 1901). Since its establishment in 1953, the Barnim Bus Operator (BBG) has worked on the technical development of environmentally-friendly vehicles. BBG operates the first trolley-hybrid-bus equipped with a lithium-ion battery and “supercaps” in Europe.

Eberswalde – IT support for eco-driving with display devices

BBG tested IT eco-driving assistance devices to ensure constant feedback to drivers about their driving behaviour. The devices help drivers to bear in mind the learnt eco-driving style by providing easy-to-understand information about their current driving style and energy consumption rate. The device is installed in the operator's cabin and displays whether the driver is making use of an eco-friendly driving style, and is highly recommendable to sustain the positive impact of eco-driving in the long term. Drivers looked upon the driving assistance favourably without exception.

IN A NUTSHELL:

The experience and testing of IT driving assistance devices in ACTUATE showed that higher energy savings can be reached through the use of these devices. In order to optimise drivers' learning effects, the installation of tools providing constant feedback helps drivers to bear in mind and apply the rules of eco-driving.



Illustrations of IT-eco-driving assistance displays tested in Eberswalde and Parma



Alexandra Scharzenberger

„Our industry members really appreciated the knowledge exchange with training departments of public transport companies on how to handle clean vehicle technology the right way. The feedback from trainers and drivers is a valuable resource to improve the driveline and energy management of clean vehicles. Overall, we recognised an increasing interest in the topic of safe eco-driving of clean vehicles over the project lifetime in our stakeholder network with more than 5.000 contacts.“

TROLLEY:MOTION, AUSTRIA

trolley:motion is the leading European trolleybus interest group. It constitutes part of a wide trolleybus community and has well-established contacts to relevant e-bus actors, such as trolleybus cities, industry manufacturers and transport operators.

trolley:motion was responsible for ACTUATE’s dissemination and networking activities.

Do “good” and talk about it! – communicating ACTUATE’s project results for further take-up

ACTUATE partners “spread the word” about their new safe eco-driving programmes through various communication channels supported by trolley:motion. In particular, train-the-trainer workshops were organised in Germany, Austria, Italy, Czech Republic and Poland for more than 70 trainers from 28 public transport operators, and received an overwhelmingly positive feedback on the high quality and practical value of the eco-driving training sessions. To encourage other public transport companies to benefit from the positive experiences of ACTUATE partners, trolley:motion prepared a “starter kit” to introduce safe eco-driving trainings in their own companies. The free kit includes a USB-stick with all training materials, advertising posters, a “lessons learned” brochure, practical give-aways and a project flyer.

In case you are interested in getting a “starter kit”, please let us know which language version you need. The kits are available in EN, DE, IT, CZ, FR, ES and PL, as well as RO (only trolleybus kit; please find contact data on the inside front cover of this brochure).

IN A NUTSHELL:

The topic of eco-driving for clean vehicles is becoming more and more important, as it matches clean vehicle technology with the skills needed to operate them. ACTUATE’s safe eco-driving trainings maximise both the economic and environmental impact benefits of these vehicles! ACTUATE sent nearly 150 safe eco-driving “starter kits” to clean vehicle fleet operators across Europe!

„Cožpak nejsou tramvaje už tak dost „zelenou“ dopravou?“

- Tramvaje městské hromadné dopravy jsou poháněny elektřinou, proto jezdí **bez emisí**.
- Využitím úsporných technik při řízení tramvaje však dokážeme ušpóřit **další 3% energie!**
- Tato úspora v součtu představuje spotřebu elektrické energie **420 domů** s roční průměrnou spotřebou 4000 kWh!

Logos: ACTUATE, European Commission, European Union, Obus SLB, etc.



RUPPRECHT CONSULT, GERMANY

Rupprecht Consult Forschung & Beratung GmbH (RC) coordinated the project and is an independent, private research and consulting company based in Cologne, Germany. The company works in the field of sustainable development of cities and regions in Europe and around the world, covering topics such as sustainable urban mobility planning, clean public transport systems and training and dissemination for European projects.

Fitness for use - joint quality criteria and new approaches for professional drivers' training

Coordinated by Rupprecht Consult, the ACTUATE partners defined the minimum criteria and standards for the joint quality aspects of the trainings. This included the definition of learning outcomes – following the European Qualification Framework (EQF) approach defining which knowledge, skills and competences should be reached within ACTUATE's safe eco-driving trainings. By taking this approach, the partners were "starting from the end", focusing on the output "drivers learning" rather than the input, e.g. time duration of training or training method. The jointly defined learning outcomes describe what drivers will be able to do and how they will apply that skill or knowledge after the training. This helped to establish a common understanding among the project partners about what safe eco-driving trainings are based on and what shall be achieved by these trainings. It also ensured the development of high-quality training concepts and materials.



Trolleybus in motion in Salzburg

Example for learning outcomes description

| Learning Topic | Safe eco-driving |
|---|---|
| Learning Objective | Efficient braking and accelerating to optimise energy-efficiency of clean vehicle types |
| Directive 2003/ 59/EC objectives (according to Annex I) | 1.3: ability to optimise fuel consumption (by applying know-how with regard to points 1.1 and 1.2) 1.1: to know the characteristics of the transmission system in order to make the best possible use of it (curves relating to torque, power, and specific consumption of an engine etc.) 1.2: to know the technical characteristics [...] in order to control the vehicle, minimise wear and tear and prevent malfunctioning (limits to the use of brakes and retarder, combined use of brakes and retarder, making better use of speed and gear ratio, efficient ways of slowing down and braking on downhill stretches) |

| Learning Topic | DE | AT | IT | CZ |
|--|--|--|--|---|
| Reference to National Qualification Frameworks | Level 1 German Qualification Framework (Berufskraftfahrer) = level 4 in EQF; | N/A | N/A | N/A |
| National specifics | In-house training organised by the employer is allowed; training programme and details of module must be in compliance with BKrFQG; practical driving is not compulsory and simulators may also be used. | In-house training organised by the employer is allowed; use of simulators is not allowed; practical driving is not compulsory. | In-house training organised by the employer is allowed (but only for companies with at least 80 employees); practical driving is not compulsory. | In-house training organised by the employer is allowed; practical driving is not compulsory |



Recuperated energy is valuable: 98% of the energy fed back into the grid is being used by our project partner LVB.

| Learning Outcomes | | |
|---|--|---|
| Skills | Knowledge | Competences |
| <ul style="list-style-type: none"> To be able to drive electric powered clean vehicles in an energy efficient and safe way; To be able to brake and accelerate in the most energy efficient way | <ul style="list-style-type: none"> Knowledge about kinematic chain/energy flow electric power train; Knowledge about the ideal drive-cycle between stops incl. topographic conditions; Knowledge about characteristics of electrical parts and losses | <ul style="list-style-type: none"> Ability to apply knowledge about ideal drive-cycle between stops and recuperate highest possible amount of energy based on knowledge about topographic conditions |

Wolfgang Backhaus, ACTUATE project coordinator, Rupprecht Consult GmbH

„The feedback from all the drivers that participated in the training sessions has been very positive. Many stated that the emphasis on “looking ahead” and pro-actively anticipating traffic situations helps them to reduce stress on the job. The added value of this health benefit cannot be underestimated, as traditionally public transport operators are faced with high sick leave rates for their drivers. Eco-driving just might be one way to counter or reverse such circumstances.“



Many people place their trust in their local public transport system daily.

To test new ways of professional drivers learning, ACTUATE developed a series of short e-learning modules for safe eco-driving of clean vehicles. As the Directive 2003/59/EC does not provide a clear picture of the application of e-learning in professional drivers' qualification and periodic training, and ACTUATE's partners were committed to the "credo" that learning safe eco-driving requires practical lessons, e-learning was embedded into wider training concepts and also became part of the motivational in-house campaigns. To sustain ACTUATE's positive training results, e-learning should be used for the possibility to constantly refresh and retrain drivers to maintain motivation and their new driving behaviour. The ACTUATE project partners have developed e-learning modules which contain general information as well as all of the latest project results and evaluation data following an "edutainment" approach – thus designed to educate and to entertain – allowing drivers independent learning or refreshing of eco-driving knowledge at their own pace. The feedback from about 70 drivers who tested the e-learning modules was almost consistently positive with regard to format and content, and the drivers would also recommend the modules to colleagues!

The modules are available free of charge for the clean vehicle types tram, trolleybus and hybrid bus in EN, DE, IT and CZ and will be offered on an ongoing basis on Rupprecht Consults web-based academy: www.rupprecht-academy.eu.

IN A NUTSHELL:

E-learning can be an attractive learning channel to refresh knowledge of professional drivers, but it cannot replace practical eco-driving courses. Eco-driving e-learning content should therefore be integrated into regular directive-specific compulsory trainings to ensure at least annual refreshers of the drivers' knowledge. For this, e-learning should be better regulated by the EU Directive 2003/59/EC, as e-learning could increase the level of flexibility and attractiveness of trainings.



IF YOU WOULD LIKE TO IMPLEMENT ECO-DRIVING IN YOUR ORGANISATION, WE HAVE THE FOLLOWING TIPS!

- I. Be well organised and plan ahead when introducing safe eco-driving training programmes!
- II. Understand the existing levels of energy-consumption in your fleet of different public transport vehicles, so that you know what the established benchmark is and how much energy can be saved by introducing eco-driving!
- III. Higher energy savings can be reached through the use of measurement devices. In order to optimise drivers' learning outcomes, install these easy-to-understand and highly-illustrative tools.
- IV. Make sure that senior-level management is committed to the eco-driving training programmes!

- V. Do not misuse the data resulting from the monitoring of energy consumption for the purpose of controlling individual driving performances!
- VI. Organise the practical parts of trainings in small groups of not more than 4 to 6 people, so that you can engage all drivers sufficiently in the training session. Dedicate a substantial amount of time to the application of what was learned in theory!
- VII. Make use of illustrative training material such as brochures, colour codes or short driving instruction movies!
- VIII. Make sure that senior management embraces and promotes a learning culture in

- your organisation which includes both internal as well as external communication!
- IX. Make use of an in-house motivational campaign that supports your goals with visually appealing material, a fun rewards system and – if agreed – financial incentives for the drivers!
 - X. Promote your eco-driving related goals with a creative advertisement campaign to gain support from the public!

If you want to learn more about these tips, take a look at ACTUATE's lessons learned brochure available on the project's website www.actuate-ecodiving.eu.



5 GOLDEN RULES FOR SAFE ECO-DRIVING OF CLEAN VEHICLES:

- 1) *acceleration should be quick*
- 2) *the “steady state” on the throttle /accelerator should be avoided*
- 3) *the rolling ratio should be as high as possible, while ensuring compliance with the schedule*
- 4) *unnecessary braking should be avoided and usage of wear-free electric brakes for energy recuperation should be optimised*
- 5) *conscious use of the heating, air conditioning and ventilation system*

A balanced, foresighted and customer-friendly driving style saves energy and calms your nerves!

