

Eco-driving for clean vehicles – The driver makes the difference!



Wolfgang Backhaus, Rupprecht Consult
Brussels, 4 December 2013



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



Background

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

- **Safe eco-driving** has the potential to reduce energy consumption, emissions, operating costs and to increase passenger safety, but is so far only available for diesel-engine vehicles.
- The ACTUATE project develops eco-driving training concepts for professional drivers of different clean vehicle types (trolleybuses, hybrid buses, euses with "supercapacitors" and trams), which will be developed, tested and evaluated.

- Project duration: 05/2012 to 10/2014 -



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



ACTUATE – Project Partners

- **Rupprecht Consult – Forschung & Beratung GmbH (RC)**, Cologne, Germany
- **Salzburg AG für Energie, Verkehr u. Telekommunikation (SAG)**, Salzburg, Austria
- **Leipziger Aus- und Weiterbildungsbetriebe GmbH (LAB)**, Leipzig, Germany
- **Leipziger Verkehrsbetriebe GmbH (LVB)**, Leipzig, Germany
- **Barnimer Busgesellschaft mbH (BBG)**, Eberswalde, Germany
- **Dopravní podnik města Brna a.s., (DPMB)**, Brno, Czech Republic
- **Trasporti Pubblici Parma S.p.A. (TEP)**, Parma, Italy
- **TrolleyMotion (TM)**, Austria
- **Van Hool NV (VH)**, Lier, Belgium



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



Objectives and Main Steps

- **Integrate ACTUATE trainings for safe eco-driving into formal bus driver qualification** of PT companies;
 - *trainings 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**;
 - *definition of minimum quality criteria & learning outcomes* -
- **Demonstrate the energy saving potentials** on the basis of capacity building in energy efficient driving of clean vehicles;
 - *evaluation of 200 training sessions with about 1.500 drivers* -
- Upscale the outcomes for **wider up-take at European level**.
 - *test of trainings at additional PT companies & “starter kits”* -



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



Training topics

Developed according to learning outcomes:

- **Skills:**
E.g. „to be able to use hybrid bus drive train most efficiently when braking or accelerating”.
- **Knowledge:**
E.g. „about the ideal drive-cycle between stops incl. topographic conditions of local network/lines”.
- **Competencies:**
E.g. “to recuperate highest possible amount of energy in operation based on knowledge about topographic conditions”.

Basic requirements:

Requirements	Trainings shall maximise energy savings by eco driving
	Training material for safety aspects of clean vehicles
	Training material for specific bus types and tram control technology
	Pre-instruction and briefing of trainers and technical experts by bus and tram manufacturers about specifics of vehicle types
	Training only for drivers that are on duty on clean vehicles

Minimum 50% of training sessions should be realised as practical driving session!

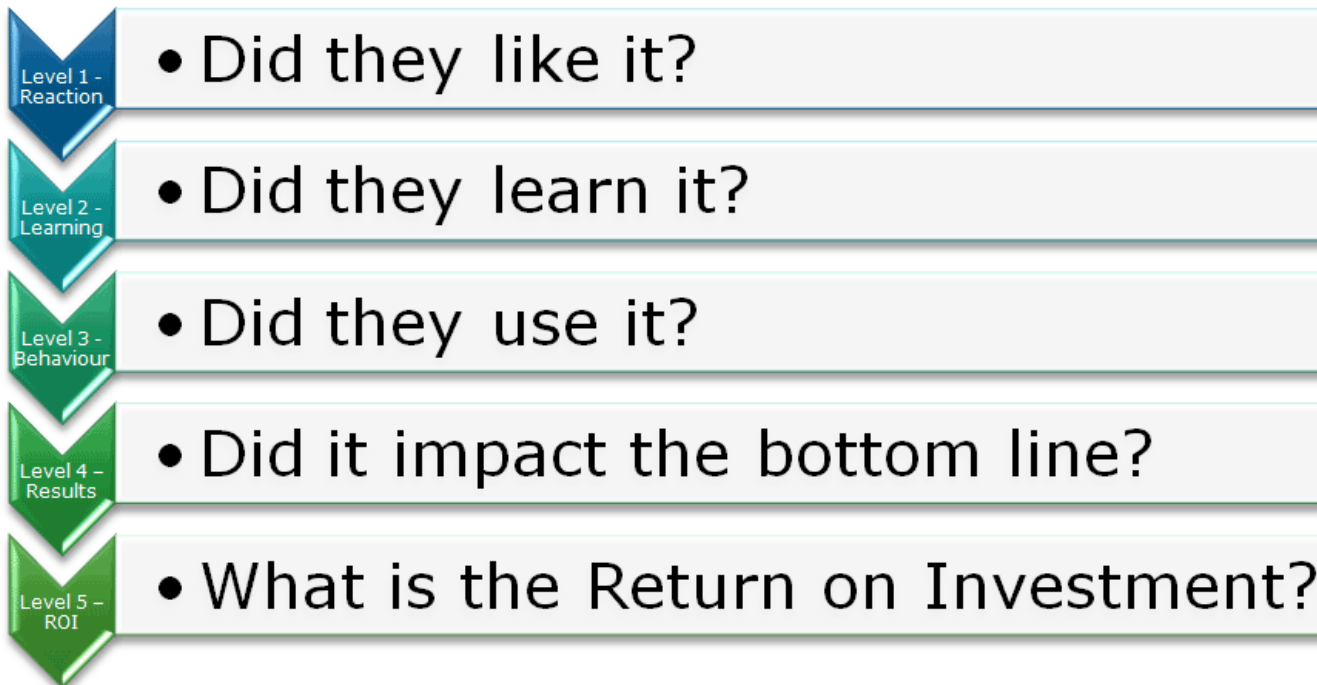


Co-funded by the Intelligent Energy Europe Programme of the European Union



Training programme evaluation

ACTUATE evaluation levels for safe eco-driving training programmes for clean vehicle drivers (according to Kirkpatrick's model 1994):



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



Training programme evaluation

Level 1 -
Reaction

• Did they like it?

- **Measurement focus:** Drivers reaction and perception to/of trainings
- **Question(s) addressed:** What did drivers think of the safe eco-driving training programmes?
- **How do we measure that:** Questionnaires after training sessions
- **Results:** e.g. for trolleybus drivers training in Salzburg (273 drivers trained):
 - more than 90% of SAG trolleybus drivers rate the overall quality of the ACTUATE training as either 'excellent' or 'very good (especially the practical part of the trainings received very positive feedback by the drivers)
 - 89% rate the topic of safe eco-driving as 'very important' or 'important' for their daily work



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



Training programme evaluation

Level 2 - Learning

• Did they learn it?

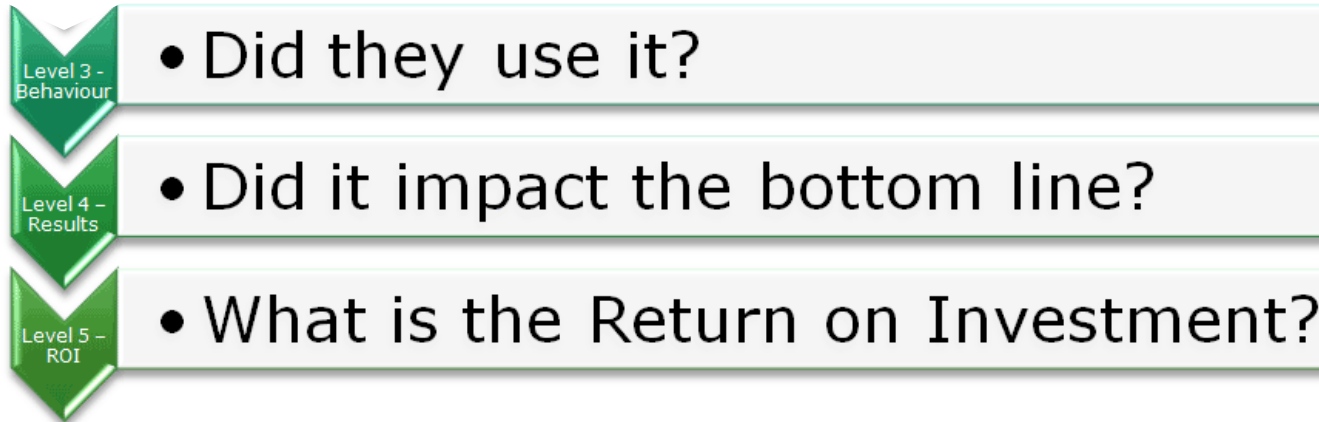
- **Measurement focus:** Knowledge and skills gained by drivers
- **Question(s) addressed:** Was there an increase in knowledge and/or skill level of the trained drivers?
- **How do we measure that:** energy consumption measurements during trainings
- **Results:** e.g. for trolleybus (273, Salzburg) and hybrid bus (about 600, Leipzig) drivers trained:
 - more than 90% per cent of all trolleybus drivers were able to cut down energy consumption by 20 per cent on average by applying safe eco-driving techniques
 - 5% reduction of diesel fuel consumption on average reached by hybrid bus drivers applying safe eco-driving techniques



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



Training programme evaluation



- **Measurement focus:** Worksite (the driver's workplace, line operation) implementation, business impact on organisation, return on investment
- **Question(s) addressed:** Is the new knowledge/skill being used on the job?; What effect did the training have on energy consumption of clean vehicles?; ROI?
- **How do we measure that:** pre- and post-training energy consumption measurements, driving behaviour observation, impact/return calculations etc.



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



IT-support to optimise, evaluate and monitor driving behaviour



- Simple displays to present „eco-status“ of driving style
- (Mobile) on-board devices for monitoring of driving style & vehicle energy consumption
- Driving-Style tutor client devices to give feedback to the drivers about driving behaviour



Source: TELEPARKING Srl



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



Support for the long-term impact

Motivational in-house campaigns:

- To support the introduction of safe eco-driving trainings and to motivate drivers to apply and retain their newly acquired eco-driving skills and knowledge
- Comparison of different approaches:
 - bonus schemes
 - competitive schemes
 - image campaign schemes



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



Expected Impacts

- Evaluate the training programme in terms of effectiveness to reduce the energy consumption based on scenarios (realistic 3% & optimistic 6% energy reduction):
 - Assuming the “optimistic” scenario of 6% energy consumption reduction; primary **energy savings of 9.360 tons** of oil equivalent and **50.135 tons of CO₂** reduction could be reached by 2020 for the clean vehicle fleets of the ACTUATE partners
 - Assuming the “optimistic” scenario of 6% energy consumption reduction; this would lead to **annual budgetary savings of 420.000 EURO for tram operation** in Leipzig (7 Mio. EURO annual cost for traction current)
 - Assuming the “optimistic” scenario of 6% energy consumption reduction; this would lead to **annual budgetary savings of about 43.000 EURO for hybrid bus operation** in Leipzig (36.000 litres of diesel reduction for 19 hybrid buses)
- Assess further (monetary) benefits of the trainings incl. the **reduction of abrasion** effects on clean vehicles (which have high unit cost) & on needed infrastructure in case of trolleybus/tram systems, **reduced status of drivers’ illness** etc.



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



Thank you for your attention!

Dr. Wolfgang Backhaus

Rupprecht Consult GmbH – Forschung und Beratung GmbH

Clever Str. 13-15, 50668 Köln/Cologne, Germany

+49 221 60 60 55 19

w.backhaus@rupprecht-consult.eu

www.rupprecht-consult.eu

www.actuate-ecodriving.eu



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

