Performance measures for cooperative systems – the eCoMove approach

Stefan Trommer (DLR – Institute of Transport Research)

SEVENTH FRAMEWORK PROGRAMME

eCoMove
Cooperative Mobility Systems and Services for Energy Efficiency

www.ecomove-project.eu

Outline

- Introduction to the eCoMove project
- eCoMove assessment concept
- Performance indicators for validation and assessment
- Methods for validation and assessment of the eCoMove system

The eCoMove project

- 33 partners from 10 countries:
  - Vehicle and supplier industry
  - Map makers
  - Telecom
  - Infrastructure operators
  - R&D labs & universities

- Starting date: 04/2010 Duration 36 Months
- Coordinator: ERTICO ITS Europe

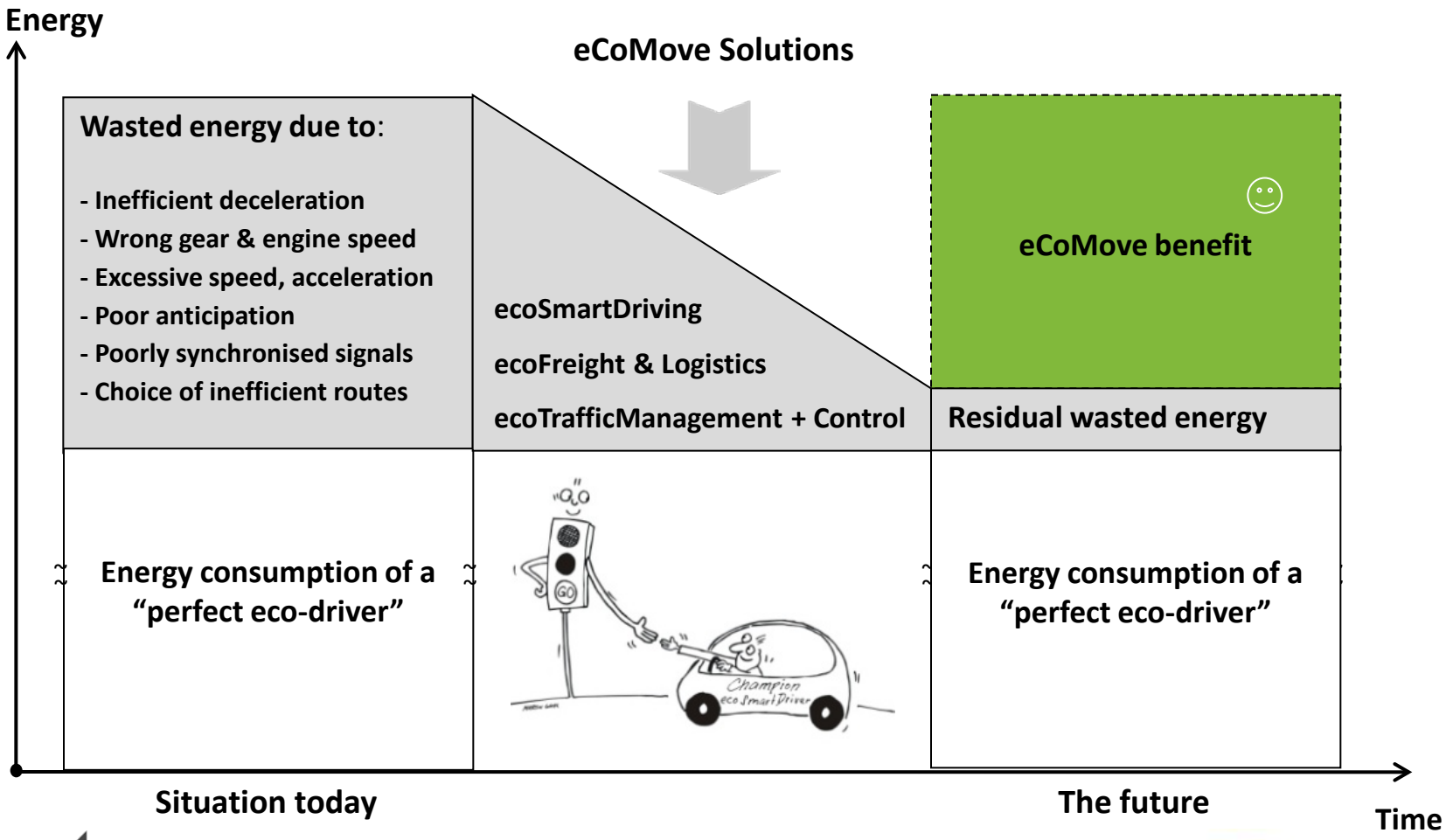
Project goal

To develop a **combination of cooperative systems and tools** using V2V and V2I communication to help:

- drivers sustainably eliminate unnecessary fuel consumption;
- fleet managers manage their vehicles more economically and promote eco-driving through feedback & incentives;
- road operators balance traffic flows in the most energy efficient way.

Target: reduce fuel consumption and therefore CO_2 emissions of road transport by 20%

Vision and motivation



Main activities

Develop eCoMove core technologies

- V2X communication platform based on CVIS & SAFESPOT results
- ecoMessage – standardised cooperative messages for energy efficiency-relevant information exchange
- ecoMap – digital map database enhanced with eco-relevant attributes

Develop eCoMove applications

- **ecoSmartDriving applications** – fuel-efficient driving performance
- **eco Freight & Logistics applications** – green freight routing and fuel consumption- optimised logistics
- **ecoTrafficManagement & Control applications** – energy-efficient traffic control & management measures

Validation and impact assessment of eCoMove applications

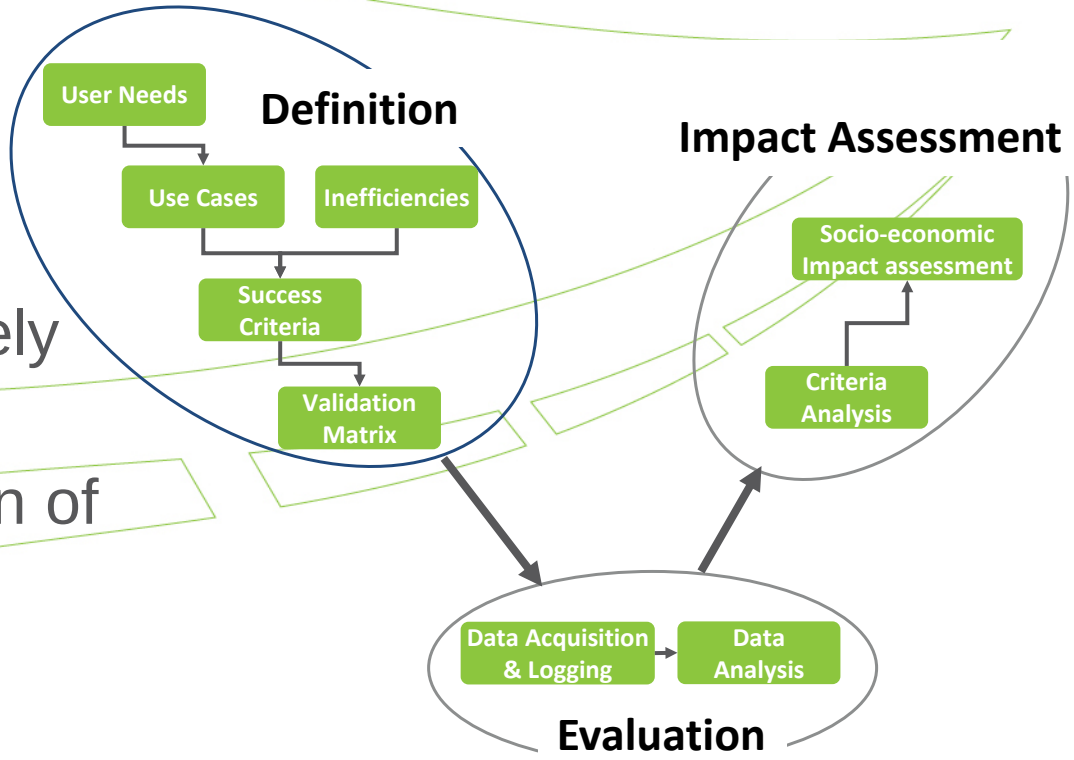
- Validation and assessment in field trials and simulation

Research questions to answer

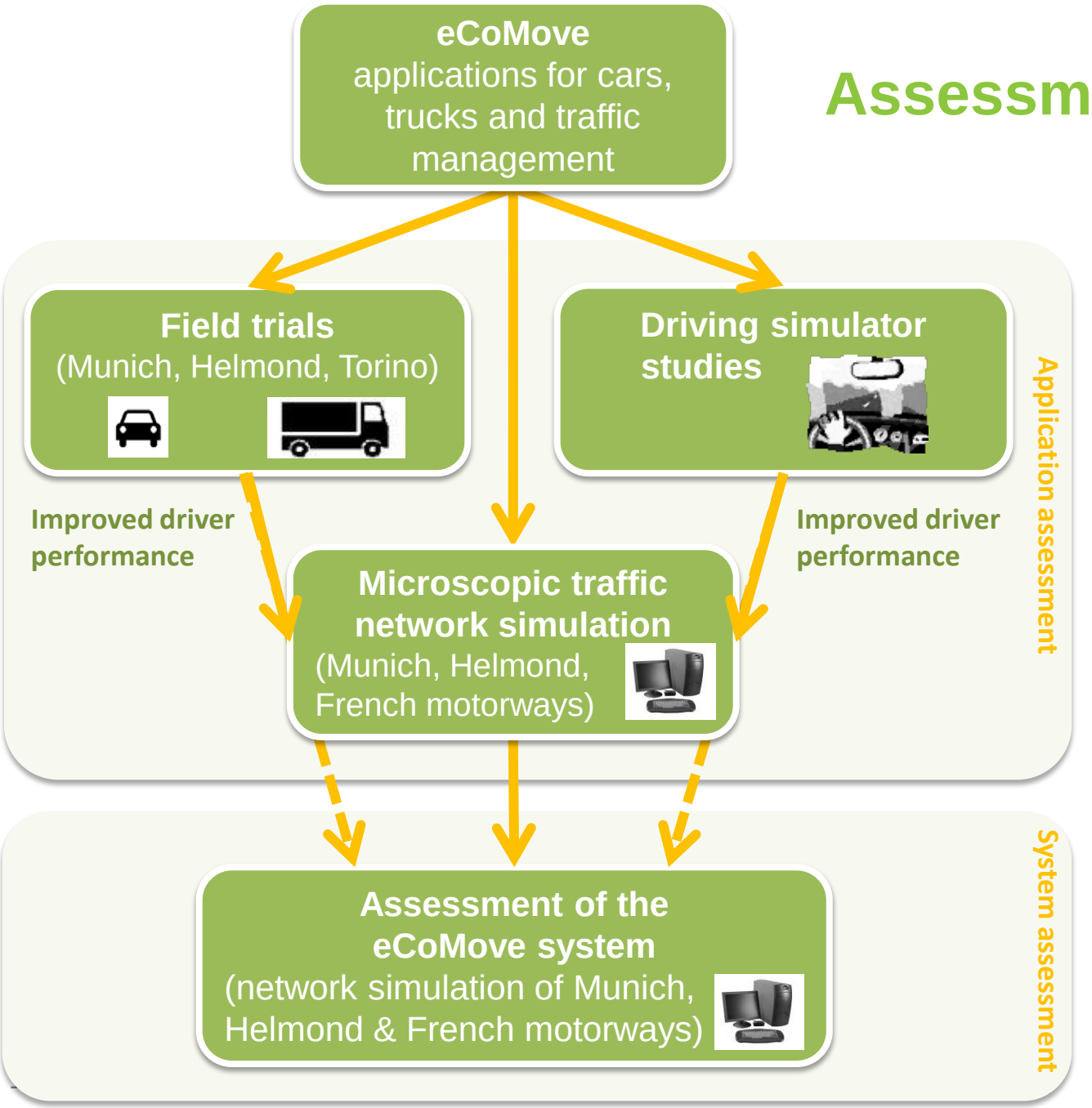
1. To what extent can eCoMove **decrease the fuel consumption and** therefore also **CO_2 emissions with cooperative technologies**?
2. How can eCoMove **sustainably change the performance** of private and professional drivers **into a more eco-friendly driving style**?
3. What **impact** have eCoMove solutions in a cooperative environment **for the traffic system?**

eCoMove Validation Plan

- Based on the FESTA V-Modell
- Challenges:
  - Many applications that need to be assessed, separately and combined
  - No FOT – validation of many applications using different methods



Assessment concept



Individual assessment of applications using different methods

Integration of findings from field trials and driving simulator studies into the traffic simulation model for following system assessment

Assessment of the eCoMove system using traffic simulation models and emission models. Qualitative assessment of long term effects.

Validation categories & performance indicators

- **Environment**
  - fuel consumption, CO_2 emissions (in total, per trip or per vehicle per km or tkm), other emissions (CO, NO_X)
- **Mobility**
  - total/individual travel times, delays, number of stops, network speed, level of service
- **Safety**
  - times to collision, time headways, variations in speed, # hard braking events, speeding, distraction and workload
- **Compliance**
  - following advices: on vehicle condition and on strategically, tactically and operational driving
- **Driver performance**
  - gear changes, acceleration & deceleration performance, speed, idling
- **User acceptance**
  - system on/off, usefulness, ease of use, satisfaction with the system

Field trials

- Testing of applications for cars, trucks and traffic management in real world conditions
- Taking actual emission measurements & connect them to application usage
- Collecting objective & subjective feedback from drivers

Test site	Vehicles
Munich (GER)	BMW, MINI, VOLVO, CRF Centro Ricerche Fiat, DAF A PACCAR COMPANY
Helmond (NED)	Ford, DAF A PACCAR COMPANY
Turin (ITA)	CRF Centro Ricerche Fiat

Environment | Mobility | Safety | Compliance | Driver performance | User acceptance

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Driving simulator studies

- Implementing and testing eCoMove applications in a controlled environment
- Three studies planned to cover different research questions (DLR, TUM, VOLVO)
- Testing different feedback and training strategies to improve driver performance:
  - Gear changes, acceleration & deceleration, compliance rate, HMI design, distraction

Environment | Mobility | Safety | Compliance | Driver performance | User acceptance

Traffic network simulation

- VISSIM environments of Munich, Helmond and French motorways
- eCoMove traffic management apps run in real-time mode
- Changes in driver performance are modelled based on findings from field trials and driving simulator studies
- Assessing direct and indirect effects:
  - total/individual travel times, delays, number of stops, network speed, level of service,
  - fuel consumption, CO_2 emissions (in total, per trip or per vehicle per km or tkm), other emissions (CO, NO_X)

Environment | **Mobility** | **Safety** | **Compliance** | **Driver performance** | **User acceptance**

Sensitivity analysis

	Munich	Helmond	French motorways
Type of signal control What are the gains of eCoMove in a less optimised environment?		X	
Fleet composition What is the impact on fleets with lees average emissions? Which effect has a higher or lower share of truck traffic?	X		X
System penetration It is important to demonstrate gains with lower penetration to encourage fast deployment	X	X	X
Incidents affecting the traffic network Incidents in the traffic network are regular and need to be analysed.	X	X	X

Next steps & outlook

- Definition of the data collection system
- Planning of scenarios for field trials & driving simulator studies
- Field trials start July 2012
- Assessment results expected December 2012

Thank you for your attention

Stefan Trommer
DLR – Institute of Transport Research

Tel: +49 (0)30 67055209
stefan.trommer@dlr.de

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