Material flow analysis: Sustainable mobility up to 2030 in the context of renewable energies

Project scope and results

Stakeholder Workshop, EU Transport GHG: Routes to 2050

Brussels, 10th November 2009

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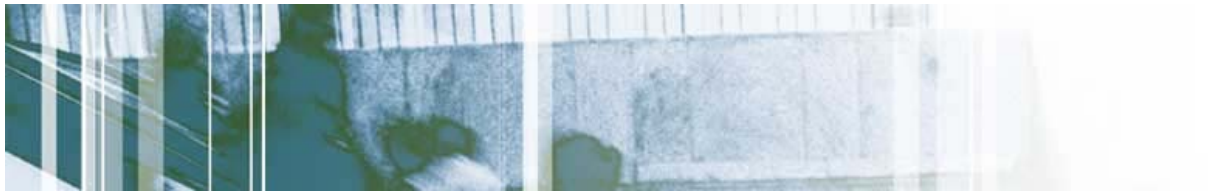

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Renewbility: Project objectives

- To develop an integrated method for modelling policies and measures for sustainable mobility in passenger and freight transport, taking into account interactions with the energy sector;
- To incorporate broad spectrum of stakeholders in model development at an early stage and to develop a consistent climate protection scenario up to 2030 for the transport sector in Germany including participation of these stakeholders.

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Project team

Öko-Institut, Berlin / Darmstadt / Freiburg
(Project management, material flow analysis, scenarios)

DLR Institute of Transport Research, Berlin
(Transport demand, scenarios)

Research Partners

Institute for Energy and Environmental Research, Heidelberg

German Biomass Research Centre
(formerly the IE Leipzig)

TU Dresden, Institute for Traffic Flow Studies

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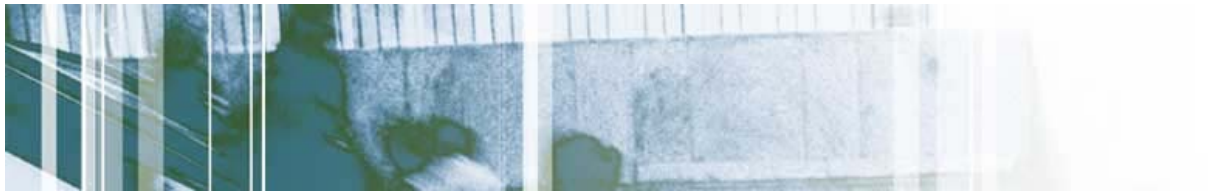

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Development of a technology database:

- Vehicles: Passenger cars, light and heavy duty vehicles, others (trains, aeroplanes, etc.) with up to 4 different efficiency stages for 2010, 2020, 2030 plus alternative technologies (CNG, plug-in hybrid, battery-electric and fuel cell vehicles)
- Fuels: Database contains conventional and a large variety of renewable energy carriers (biofuels, Bio-CNG, H2, electricity) including upstream emissions

Integrated modelling approach:

- Combined, dynamic consideration of mobility supply and demand
- Integration of explanatory modelling of mobility behaviour in passenger transport on a micro level for representative areas
- Incorporation of interactions arising between transport and energy sectors with a view to promoting renewable energies

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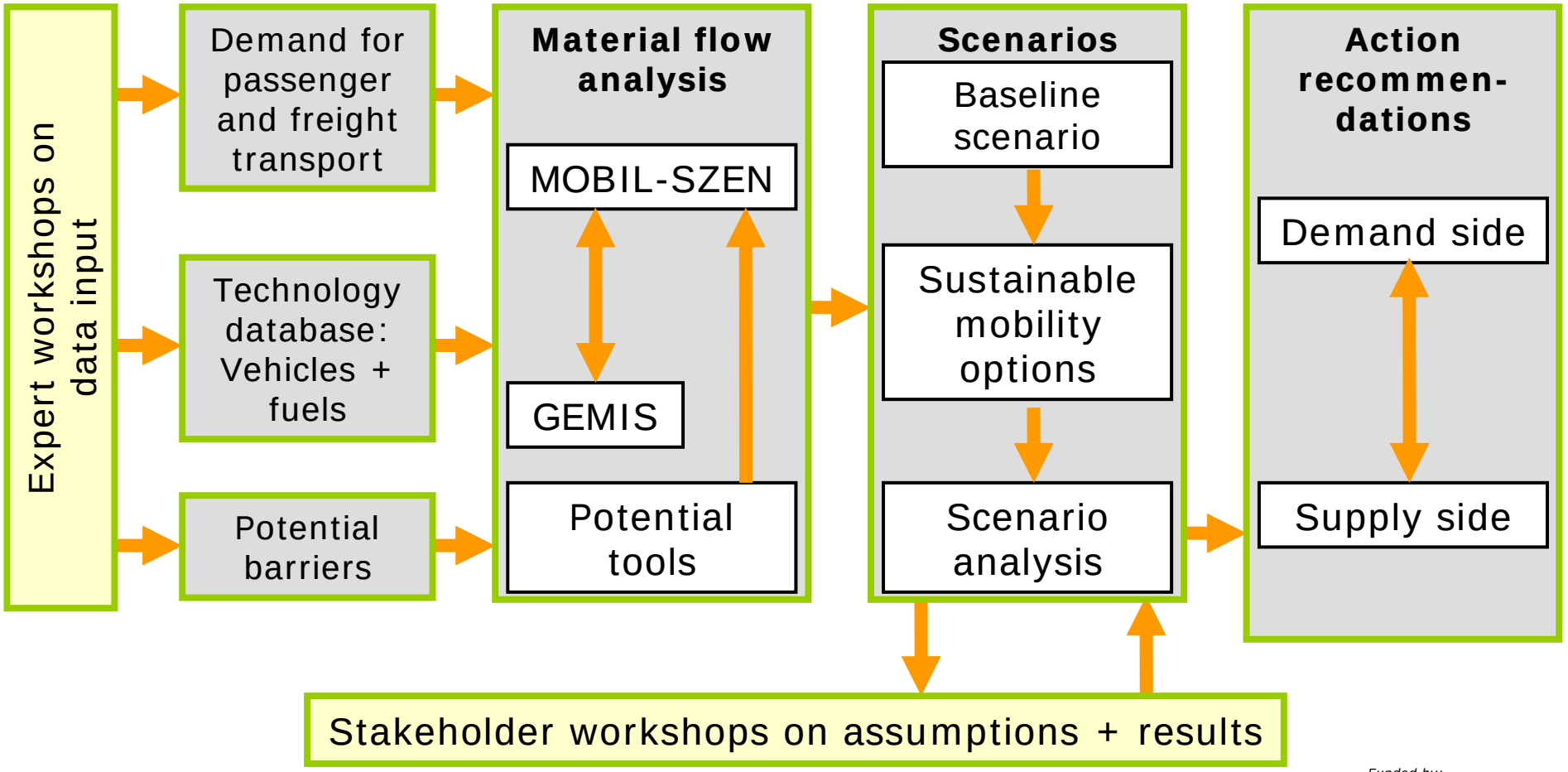
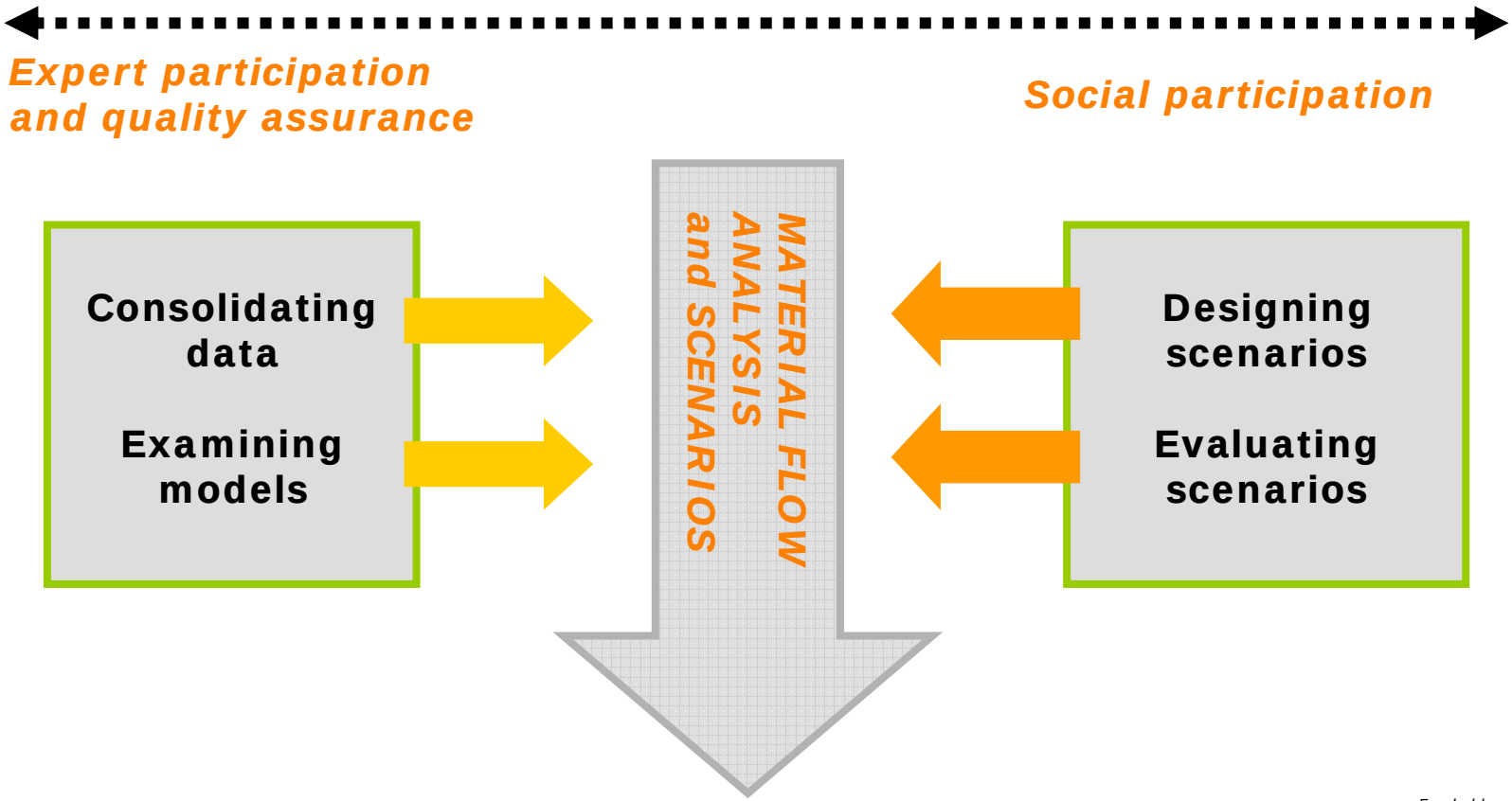
Research process



Participatory material flow analysis

as a basis for discussion on sustainable mobility



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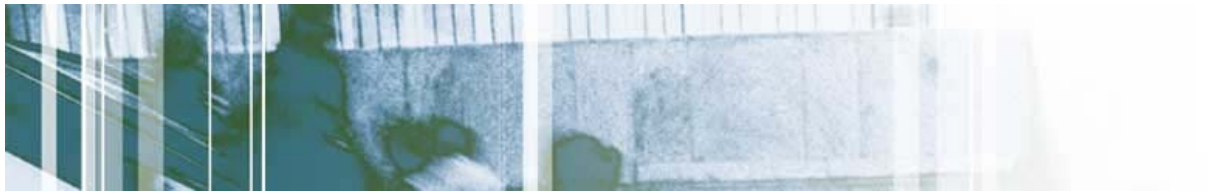

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Stakeholders: Scenario group

- ADAC e.V. – major German automobile club
- BBE – Federal Association for Bioenergy
- BEE – Federal Association for Renewable Energies
- BUND – environmental NGO
- Dachser GmbH & Co KG – major German logistics company
- Deutsche Bahn AG – German rail
- Deutsche BP AG – German branch of British Petroleum
- dena – German Energy Agency
- Deutsche Post – German postal service + DHL
- E.ON AG – leading German energy supplier
- Shell Germany – German branch of major oil company
- vzbv – Federal Association of Consumer Protection Centres
- VCD – environmental NGO for transport
- VDA – German Association of Automotive Industry

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Baseline scenario

- Basis for comparing impacts of measures = not a forecast

The basics:

- Transport section contains only (political) measures that reflect prevailing law
- Transport demand: Transport forecast of the German Federal Ministry for Transport
- Energy demand (electricity, heat): “Lead Study 2008” – Renewable Energy Scenario of the German Federal Ministry of the Environment
- Updates trend development (economy, population, mobility budget)
- Fuel prices increase to 1.65 $€_{2005}$/l petrol and 1.47 $€_{2005}$/l diesel up to 2030

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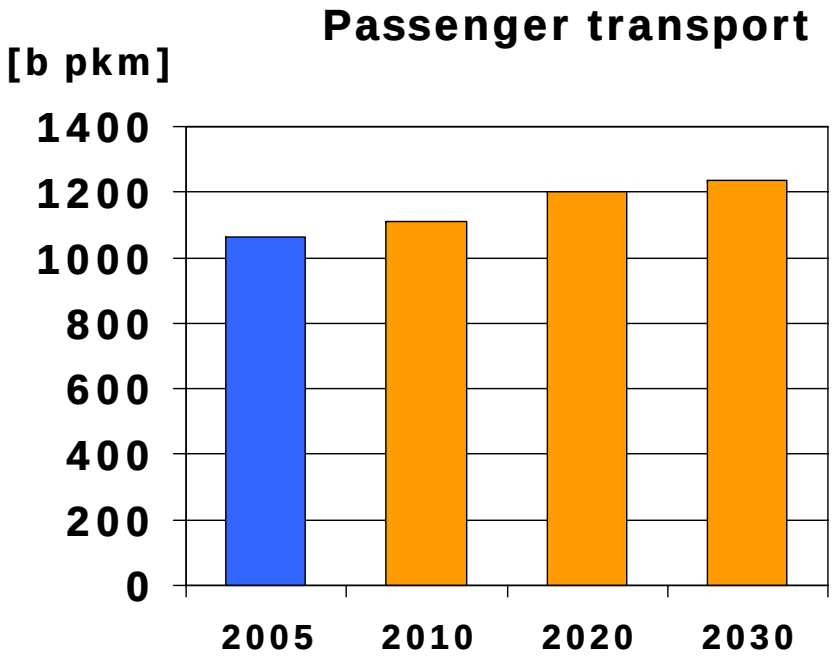
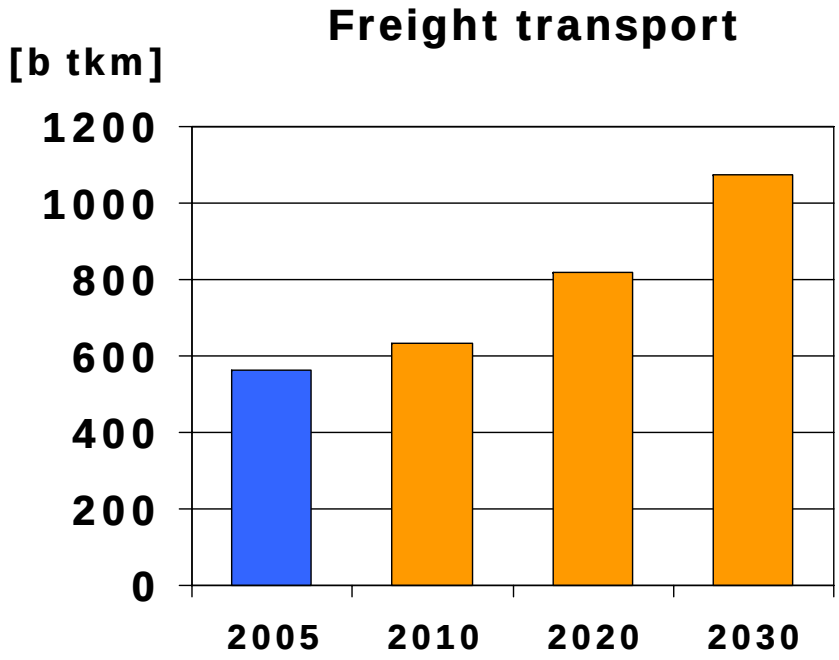
Transport demand in baseline development in Germany

- Parameters: income, costs and freight volume
- Passenger kilometers travelled increase by approx. 16 %
- Freight kilometers travelled increase by approx. 90 %





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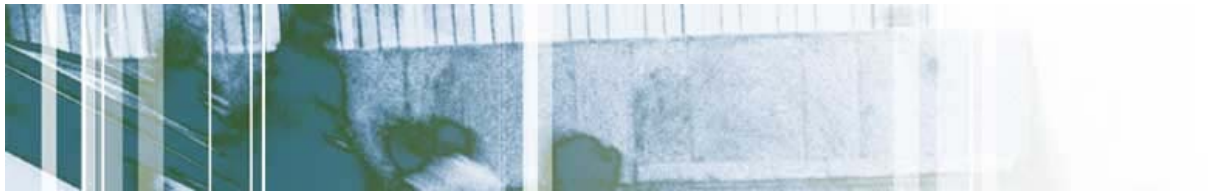

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The "Climate protection in the transport sector – Perspectives up to 2030" scenario

- Structural framework data remains unchanged
- In-depth **discussion in the scenario group** on model and scenario development
- Result: Package of measures and assumptions on the development of framework conditions

  → "Climate protection in the transport sector – Perspectives up to 2030" scenario
- Scenario options for measures on which there has been no general agreement

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Assumptions and measures of the "Climate protection in the transport sector – Perspectives up to 2030" scenario

1. Expansion of public transport service

- Increase of **operational performance** by a maximum of **25 %**
- **Shorter journey times** through individual optimisation of service according to region type, e.g. higher frequency, extended hours of operation
- Awareness of public transport service is increased

2. Emission standards for new passenger cars

- **80 g/km in 2030**
  - No segment shift compared to baseline development
- Emission standards for new PCs are mainly achieved on basis of conventional vehicles

3. Taking electric vehicles into account

- Determining the share of **battery electric vehicles** and **plug-in hybrid vehicles** by assessing collected transport data and historic diffusion rates of new technologies in automotive sector
- Required electricity demand covered by additional renewable energies

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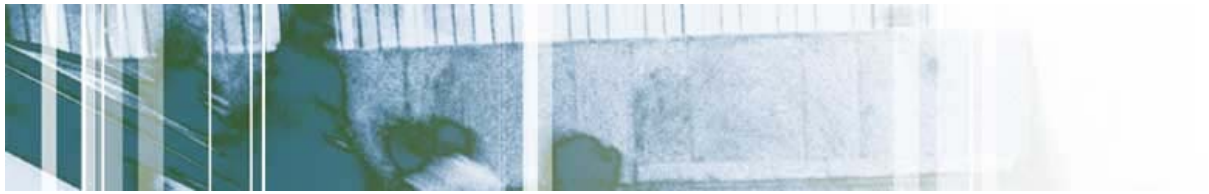

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4. Increases in fuel prices and fuel tax

- Fuel prices increase to **2.0 €$_{2005}$/l** (2020) and **2.5 €$_{2005}$/l** (2030) for petrol
- Adjustment of petrol and diesel prices prior to taxation
- Calculation of fuel tax per GHG unit, whereby diesel is approx. 5 cents more expensive than petrol

5. Biofuels: Quota and criteria

- Quota as in baseline: **10 %** 2020 and **15 %** 2030
- Additional: More ambitious social and environmental sustainability criteria - leads to a limited variety of biofuels being used

6. German annual lorry tax

- Transition to **CO_2 emissions as basis** for tax calculation from 2020 onwards
- Pre-requisite: EU-wide, standardised procedure for data on fuel consumption of the whole lorry
- Implemented: Tax is staggered across vehicle types with different efficiency levels (average corresponds to current tax level)

7. Optimisation of logistics

- Improved trip patterns
- Optimised vehicle load through improved transport logistics
- Further reduction of the “empty run” share
- Using telematics systems in freight transport

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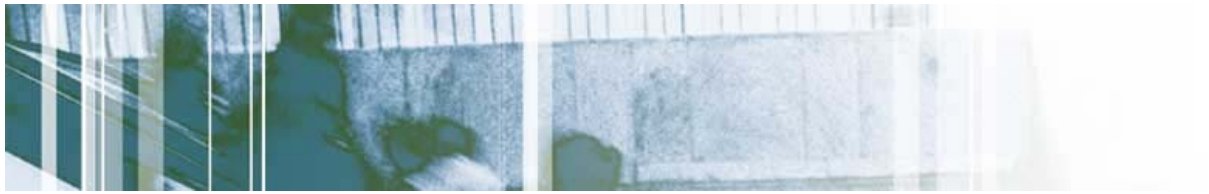

8. Fuel-saving behaviour behind the wheel

- Vouchers for fuel-saving training when buying a new vehicle
- Broad use of gear shift indicators in vehicles
- Cheaper insurance premiums when participation in fuel-saving training can be proven
- Implementation of corresponding directives for the public sector

9. Telematics systems, I&C technologies

- Use of telematic systems and I&C technologies leads to improved transport management
- Dynamic navigation systems which take up-to-date traffic news into account = reduced congestion on German motorways and reduced fuel consumption

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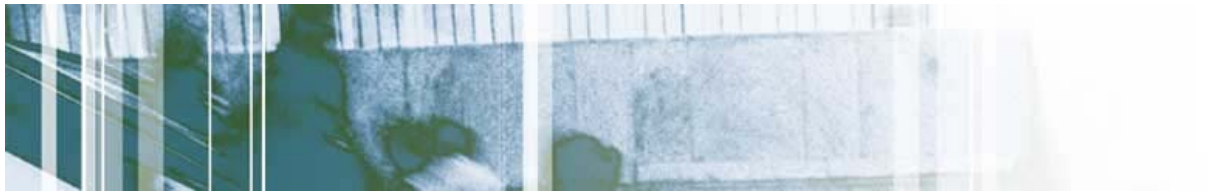

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10. German lorry toll

- Lorry toll on German motorways for lorries with a total permitted weight of >12 tons increases to **0.37 €$_{2005}$/km** in 2030

- Bonus rule for lorry toll: 10 cent reduction when there are 25 % (2020) or 30 % (2030) more efficient vehicles compared to 2005

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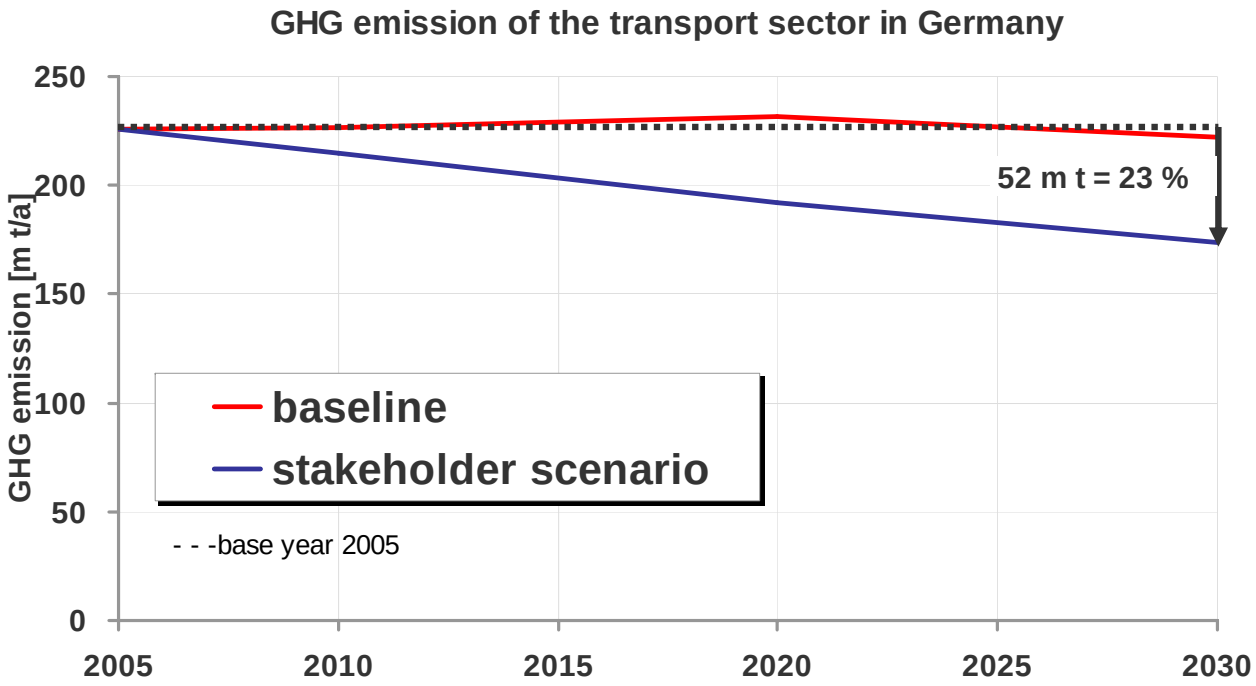
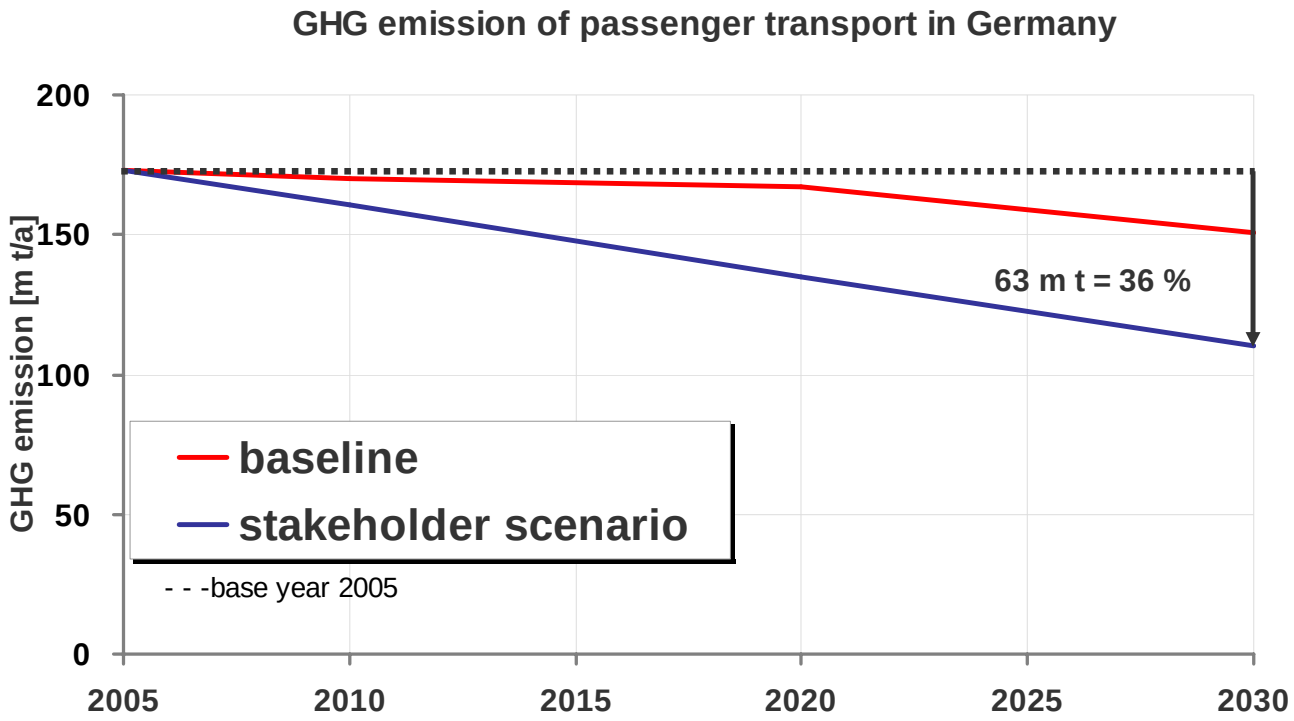
Up to 2030 reductions in greenhouse gas emissions of 23 % compared to 2005 are possible when all assumptions and measures are combined



- Direct GHG emissions and upstream emissions from fuel and vehicle production are taken into account
- Baseline scenario: GHG emissions are more or less stable despite increasing mileage – due to improved efficiency and increased share of biofuels
- Climate protection scenario: 2005 to 2030 reduction of GHG emissions by 52 m t is possible
- In the context of national climate protection targets: Reduction of direct transport emissions of approx. 20 % by 2020 and 30 % by 2030

In passenger transport a reduction of GHG emissions of 36 % by 2030 compared to 2005 is achievable



- **Baseline scenario PT:** GHG emissions reduced by 23 m t by 2030 – in spite of increasing mileage due to improved efficiency and increased share of biofuels
- **Climate protection scenario PT:** Significantly higher reduction potentials (63 m t): Emissions can be reduced by 36 % compared to 2005
- Reduction of specific GHG emissions per passenger kilometre by 43 % by 2030

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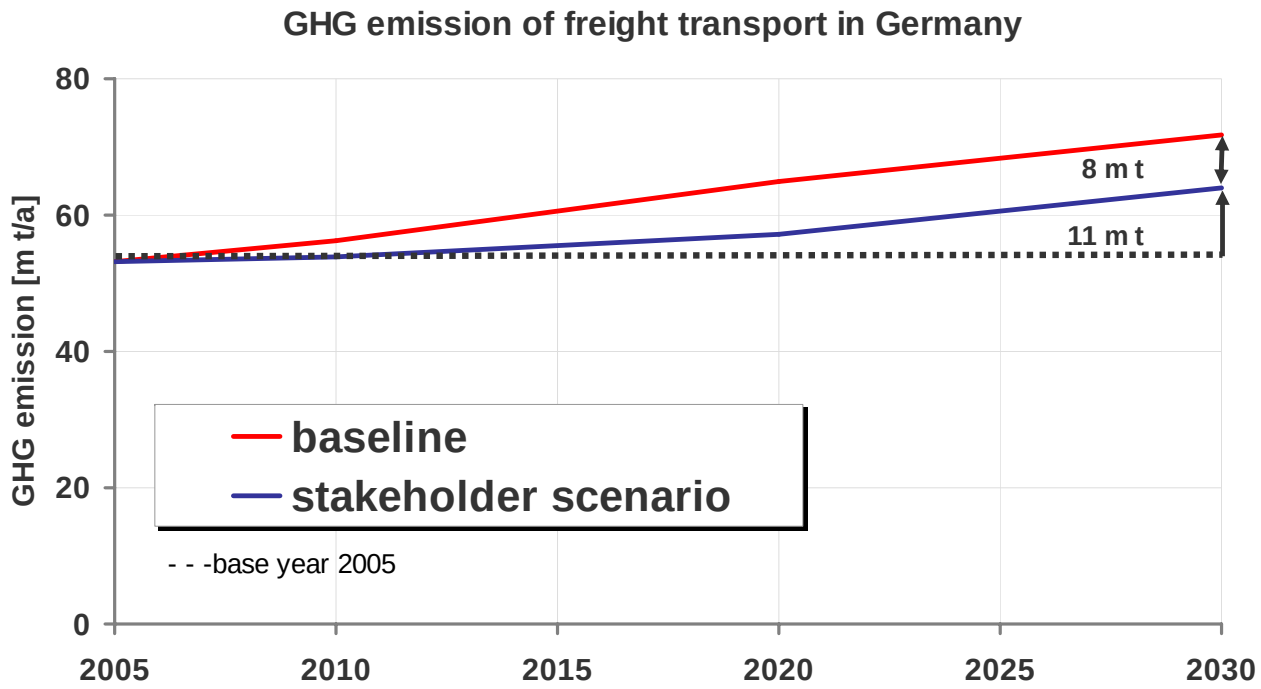
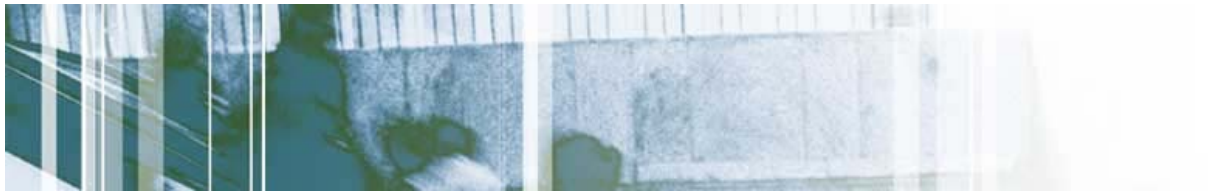
Expected increase of GHG emissions of freight transport can be limited to 11 m t up to 2030 = thereby almost halved



- **Baseline scenario FT:** Due to strong increases in transport volume, GHG increase of almost 20 m t from 2005 to 2030
- **Climate protection scenario FT:** significant decrease to 11 m t is possible
- Reduction of specific GHG emissions per ton-kilometer by approx. 35 %



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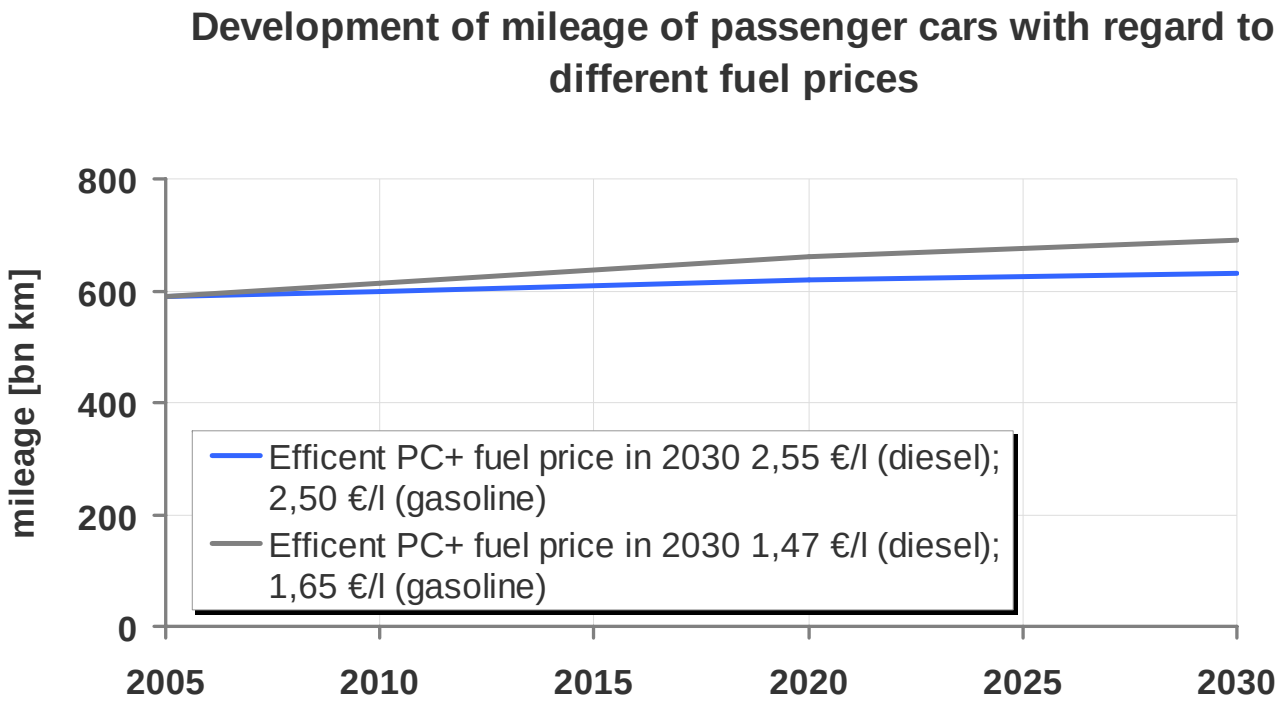
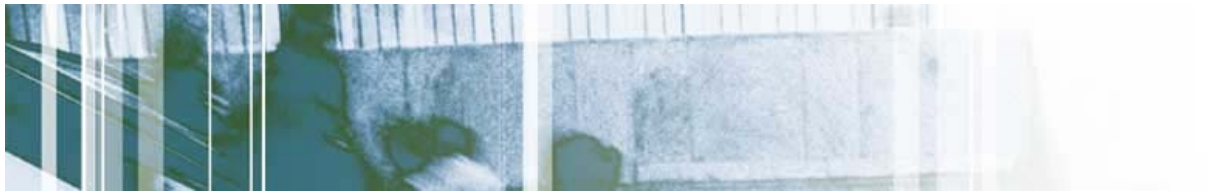
Share of renewable energies in final energy demand increases by a factor of 4 up to 2030

- Use of RE in transport (biofuels and electric mobility) approx. 4 % in 2005, just above 16 % in 2030 (share of final energy demand in transport sector), i.e. a four-fold increase in demand
- Predominant share of this increase through use of biofuels; smaller share – which increases after 2020 – through electric mobility
- Massive improvement of energy efficiency of all vehicles in the future is crucial:
  - In baseline scenario, final energy demand of transport increases slightly up to 2030; in climate protection scenario, final energy demand can be reduced by approx. 20 % compared to 2005
  - Significant decrease in consumption leads to an increase in share of renewable energies

When vehicle efficiency increases, motorised individual transport becomes more attractive



- When efficiency increases, real journey costs decrease and PC becomes more attractive (rebound effect)
- When fuel prices remain the same, mileage would increase by approx. 10 % based on the passenger car efficiency
- Effect is counteracted when fuel prices are increased to 2.50 / 2.55 €$_{2005}$ / l in 2030



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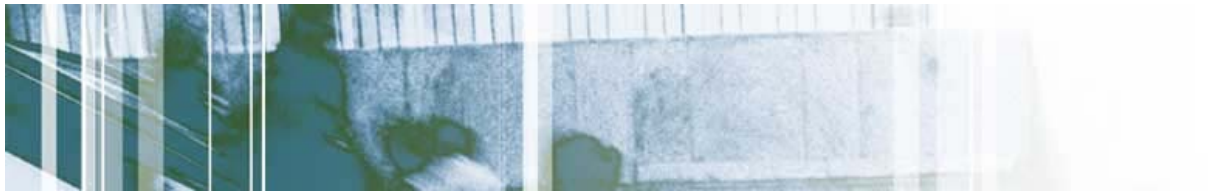
Summary

- The “Climate protection in transport – Perspectives up to 2030” scenario was developed by stakeholders in the form of a package of measures and assumptions on development of framework conditions
- Results are:
  - GHG emissions can be reduced by 23 % by 2030 compared to 2005;
  - Total energy demand in transport sector is reduced by 20 % up to 2030 and share of renewable energies used in transport sector increases from 4 % to 16 %.
  - Dynamics in passenger and freight transport are completely different
  - It is important to take interactions between different measures into account when designing future policies (such as the rebound between fuel efficiency and fuel prices);



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Outlook

- Even if some of the measures in the stakeholder scenario could be seen as politically very ambitious - against the background of climate protection requirements, it should be asked whether further or more ambitious measures are also needed.
- The integrated model approach developed within renewbility project provides now an instrument for exploring relevant different policies and measures and for showing their reduction potentials up to 2030 for Germany.
- After 2030 it is much more difficult to model measure-driven but indicative scenarios are important. E.g., independently of renewbility project, Öko-Institut analysed scenarios up to 2050 for WWF and showed what needs to be done as well as options with regard to 95 % target.

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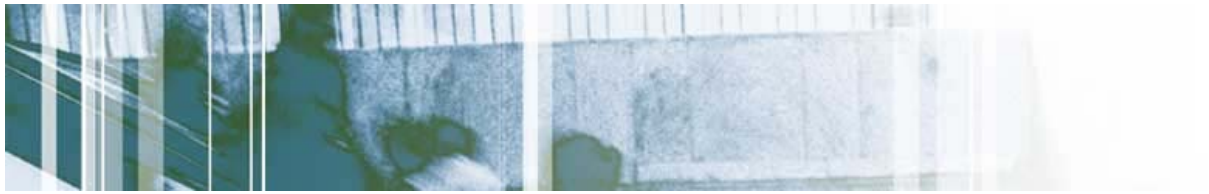

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Thank you for your attention!

For further information as well as results brochure and final project reports, please visit www.renewbility.de (currently only in German).

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