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DEFINE:
Scenario building (WP 4) & Quantification of GHG emission reduction potential of electric mobility (WP 5)

Kick-off-Meeting, Vienna, June 14th/15th

Florian Hacker, Peter Kasten, Öko-Institut e.V.

Oeko - Institut

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Oeko-Institut is a leading European research and consultancy institute based in Germany which is working for a sustainable future.

- founded in 1977, non-profit association
- offices in Freiburg, Darmstadt and Berlin
- more than 140 staff, including 90 researchers
- more than 300 national and international projects per year
- clients: European Union, ministries, industrial companies, non-governmental organisations
- annual turnover: approx. 12 million Euro

Overview of past research projects (2009-2011)

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- OPTUM:
  - user acceptance, market potential and environmental effects of electric mobility (BEV & PHEV) in Germany by 2030
- Future Fleet:
  - accompanying research on integration of EVs in SAP's company fleet
- E-Mobility Berlin:
  - accompanying research of the "Smart ed" fleet test in Berlin (in cooperation with Daimler Corp.)
- OPTUM Resources:
  - global impact of electric mobility on availability of rare resources and potential recycling strategies
- LiBRi:
  - development of recycling strategies for lithium-ion batteries

Current project – E-Mob 2050

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- E-Mob 2050:
  - research project (09/2011-09/2013) funded by BMU
- main goals:
  - long term market potential of electric and fuel cell vehicles in Germany until 2050 (including freight & public transport)
  - impact of changes in mobility behaviour and of new mobility services on the market potential of EVs / FCVs
  - consideration of long term development of the German power sector (with a high share of fluctuating renewable energy generation)
  - modelling of the long term interaction of EV use and power generation

What factors determine the environmental benefits of EVs?

- Starting points:
  - EVs cause no direct emissions
  - GHG balance of EVs is determined by source of electricity generation
- Necessary analytical steps:
  - technology development
  - acceptance of EVs
  - mobility behaviour
  - market development of EVs
  - interactions with the power plant fleet
  - electricity demand & GHG emissions

Deriving a market scenario for electric vehicles (AP 4)

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- Definition of scenario assumptions
  - e.g. technology development, energy prices
- Maximum potential of electric vehicles
  - Analysis of current usage profiles and mobility patterns
- Acceptance of electric vehicles
  - e.g. user survey data
- Consideration of market development
  - Diffusion of technological innovations in automotive sector
- Market scenario for electric vehicles
  - Determining new vehicle entry for 2010-2030
  - Modelling the passenger car fleet for 2010-2030

Determining the GHG reduction potential of EVs (AP 5)

- Determining the stock of electric vehicles and its structure (PHEV – BEV / small – large)
  - Different market scenarios
- Definition of framework conditions
  - Charging infrastructure etc.
- Determining use pattern of electric vehicles
  - Km travelled, time of operation, location
- Electricity demand in high (hourly?) resolution
  - Different charging scenarios
- GHG reduction potential
  - Km travelled that are substituted by electric vehicles (scenarios)
  - GHG emissions that are related to additional electricity production

Suggested modelling approach

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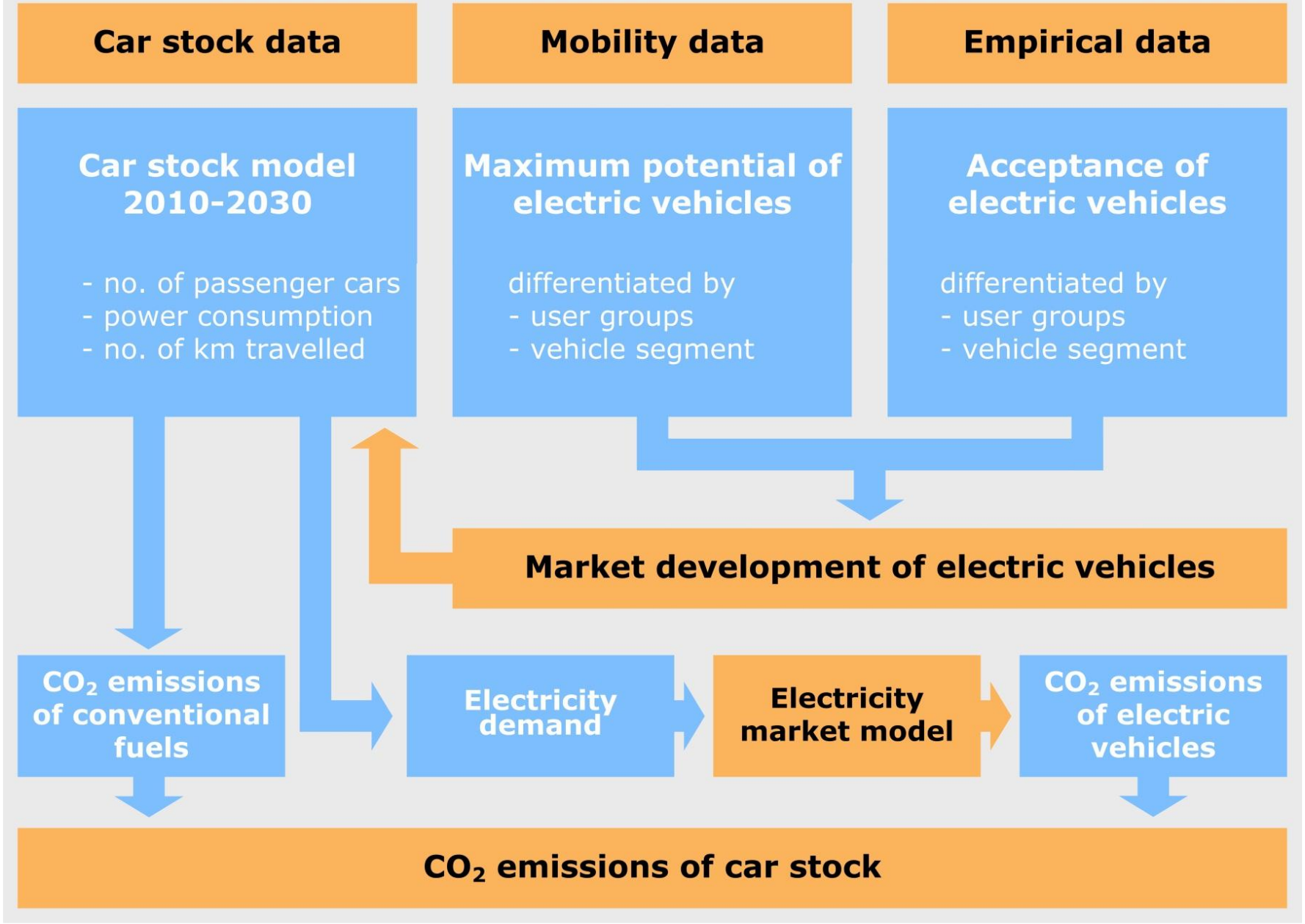

OPTUM: results of a research project on electric mobility

- Analysis of current vehicle use patterns
- Acceptance of electric vehicles
- OPTUM-market scenario for electric vehicles in Germany
- Impact on electricity production
- Impact of electric vehicles on GHG emissions

Vehicle use pattern and electric mobility

- Data source: „Mobilität in Deutschland“ 2008
  - Representative survey on mobility behaviour (each member of 26.000 households) at single data date
- Daily mobility behaviour and compliance with restrictions of electric vehicles
  - Criteria: daily km travelled (⇨ range restriction), parking times and locations (⇨ charging spot available), car segment, no. of cars in household
- Consideration of non-daily mobility behaviour
  - Probability of long trips (above range restriction of fully electric vehicles)

Acceptance of electric vehicle: Conjoint task

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Wenn das Ihre einzigen Optionen sind, welches Fahrzeug wählen Sie?

Motor	Verbrennungsmotor	Plug-In-Hybrid	Elektromotor
Leistung	120 kW/ 165 PS	120 kW/ 165 PS	90 kW/ 120 PS
CO_2	100 g/km	50 g/km	5 g/km
Anschaffungskosten	24.000 €	29.000 €	35.000 €
Kraftstoffkosten	12 €/100 km	8 €/100 km	4 €/100 km
Reichweite pro Ladung			200 km
Ladedauer			8 Stunden
Privilegien			Kostenfreie für Elektroautos reservierte Parkplätze in Innenstädten
	○	○	○

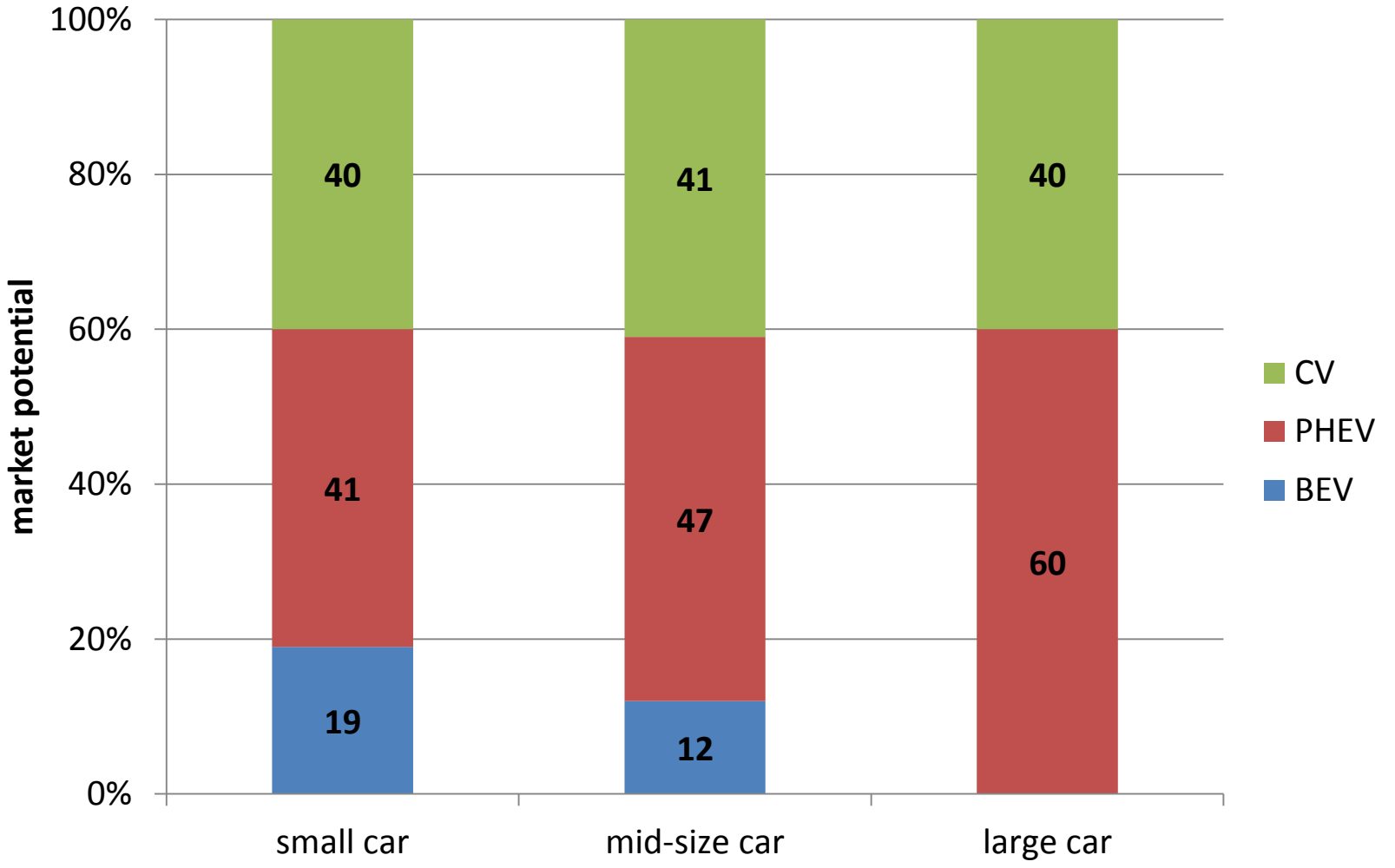
Mit Blick auf das, was Sie über den Automarkt wissen: Würden Sie dieses Fahrzeug, das Sie hier ausgesucht haben, tatsächlich kaufen?

○ Ja
○ Nein

Weiter

0% 100%

Market simulation 2020 (conjoint analysis)



Source: OPTUM 2011

OPTUM-market scenario for electric vehicles

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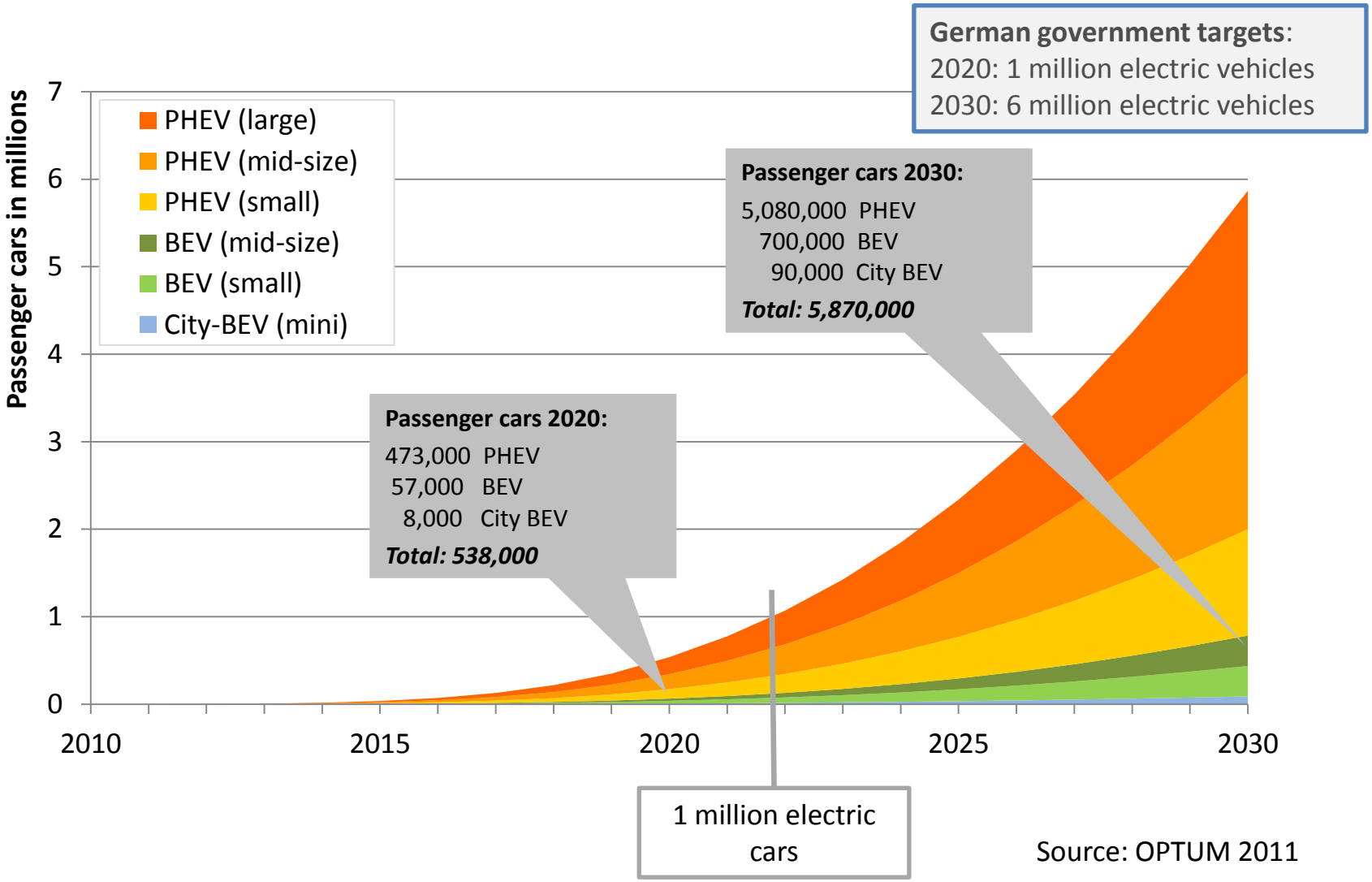

Source: OPTUM 2011

Electricity production for electric vehicles

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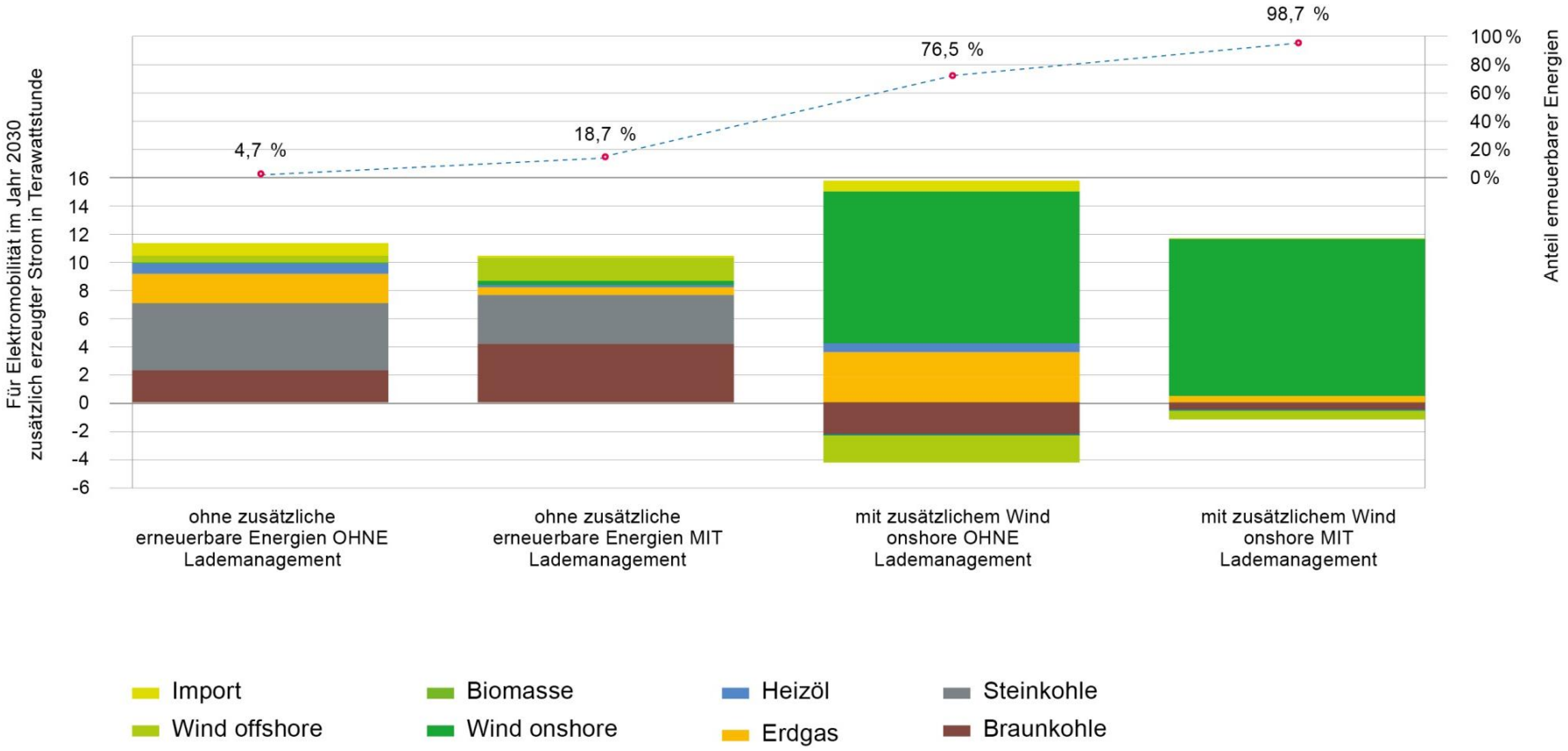
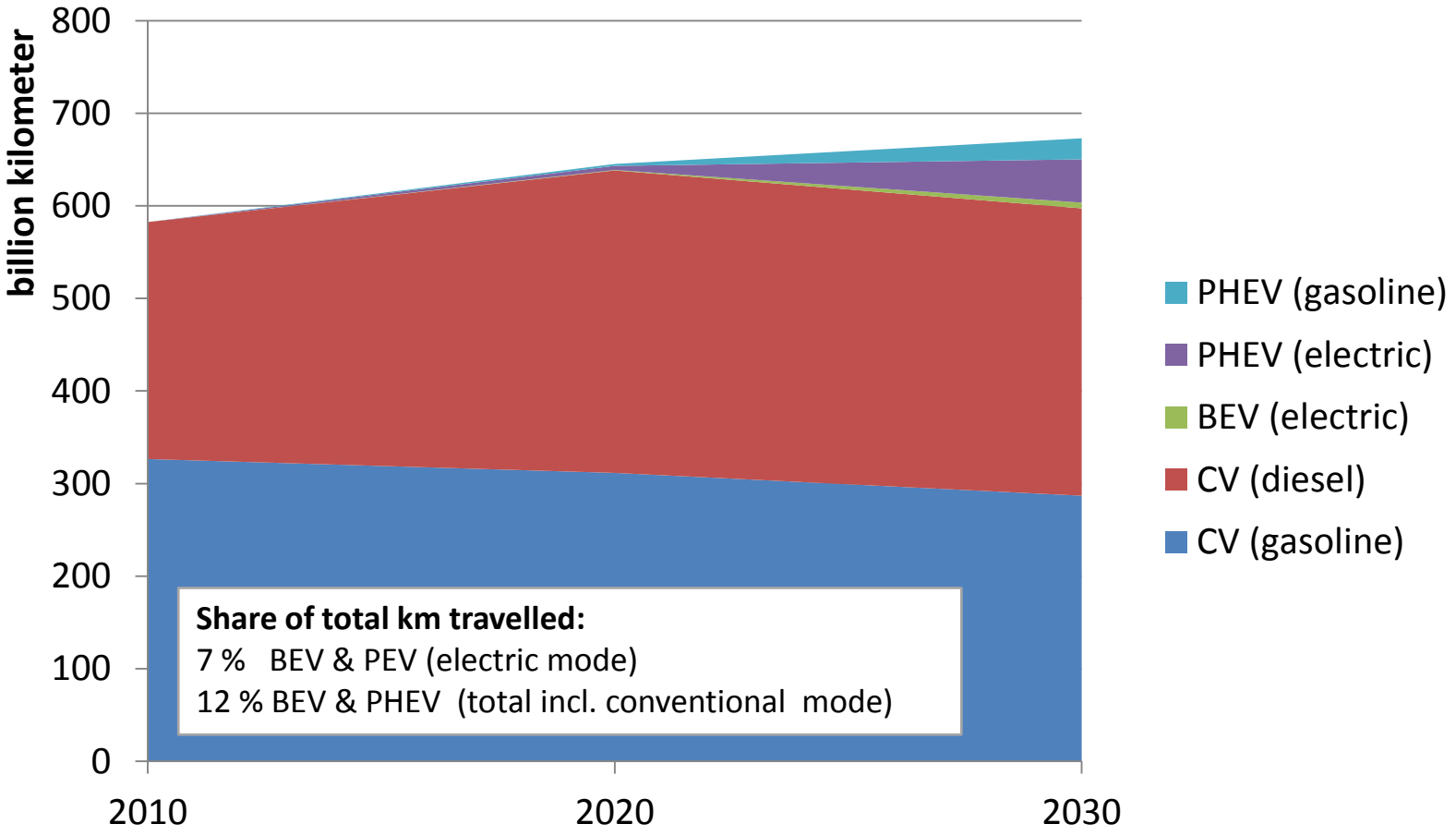
- **Potential impacts of additional electrictiy demand from electric vehicles on the power sector in 2030:**



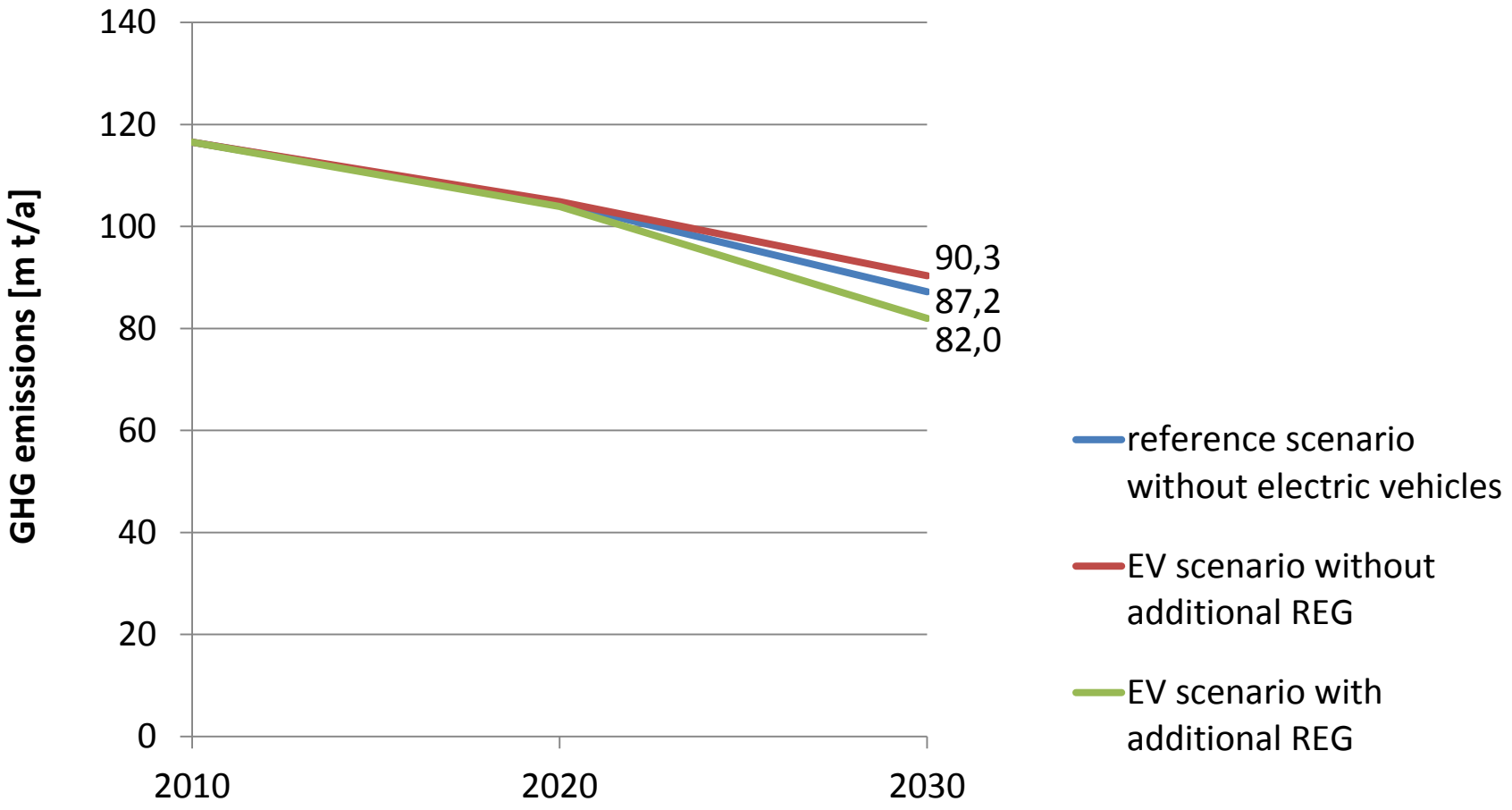
Development of km travelled by mode



Source: OPTUM 2011

OPTUM-market scenario: emission impact of electric vehicles

GHG



Source: OPTUM 2011

Open questions for discussion

- Technology database & framework conditions:
  - Common understanding of technology development (AT, PL, D)
  - Development of consistent assumptions on framework conditions (⇨ scenarios) requires early coordination among partners
- Modelling approach (scenario building):
  - Availability of data – mobility and acceptance survey data (AT, PL, D)
  - Development of a common methodological proceeding (or different approaches?)
- GHG emissions of electricity generation for EVs:
  - Electricity mix versus marginal electricity generation (⇨ attributional or consequential approach?)
- System bounderies:
  - Focus on cars only or consideration of entire road transport?