Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

One path for GHG-neutral energy supply in the transport sector

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Oeko-Institut e.V.

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

145 employees work on more than 300 national and internationl projects per year.

Our key topics in the transport sector are:

- Climate protection scenarios (e.g. Renewbility, THG-neutraler Verkehr 2050)
- Contribution of e-mobility to the climate protection (e.g. OPTUM, eMobil 2050)
- Consultation of the Federal Ministry for the Environment on car/van CO_2-emission regulation
- Projects on carsharing (e.g. accompanying research of car2go)
- GHG emissions due to transport infrastructure

Study on GHG-neutral transport sector 2050

- Title: Treibhausgasneutraler Verkehr 2050: Ein Szenario zur zunehmenden Elektrifizierung und dem Einsatz stromerzeugter Kraftstoffe im Verkehr
- Objectives:
  - Development of an ambitious climate protection scenario for transport sector up to 2050
  - Basis of integration of transport sector into *GHG-neutral Germany 2050* study
  - Requirements: GHG emission-free transport sector, no biofuels
- Duration: 12/2011 – 09/2012
- Contractor/client:
  - Oeko-Institut/Federal Environment Agency, Germany (UBA)

Transport sector scenario framework

Scope: Germany (2010 – 2050)

- Road, rail, inland shipping: inland traffic
- Air: flight-stage principle
- Maritime shipping: polluter pays principle

Main framework conditions

- Decreasing population (72.2 M in 2050)
- Increasing GDP (0.7% p.a.)

Main assumptions/characteristics of GHG-neutral scenario

Travel demand

- Passenger traffic +18%, freight traffic (w/o maritime shipping) +87%
- Conservative assumptions for traffic avoidance/mode shift

Vehicle/transport system efficiency

- Maximum efficiency gains will be achieved in 2050
- Shift to high tank-to-wheel efficiency technologies

GHG-free energy sources

- Direct use of renewable electricity (e.g. rail, e-mobility)
  - Not available for road freight traffic, aviation, shipping
- Indirect use of renewable electricity (PtG, PtL)

Characteristics of electricity-based fuels

Criteria	Hydrogen	Methane	PtL
Efficiency	+	o	-
Flexibility of production	+	o	-
Carbon demand	+	o	-
Infrastructure adjustments	-	+	++
Application in transport sector	-	+	++

Electricity-based fuels in GHG-neutral scenario

PtL is applied for all transport carriers

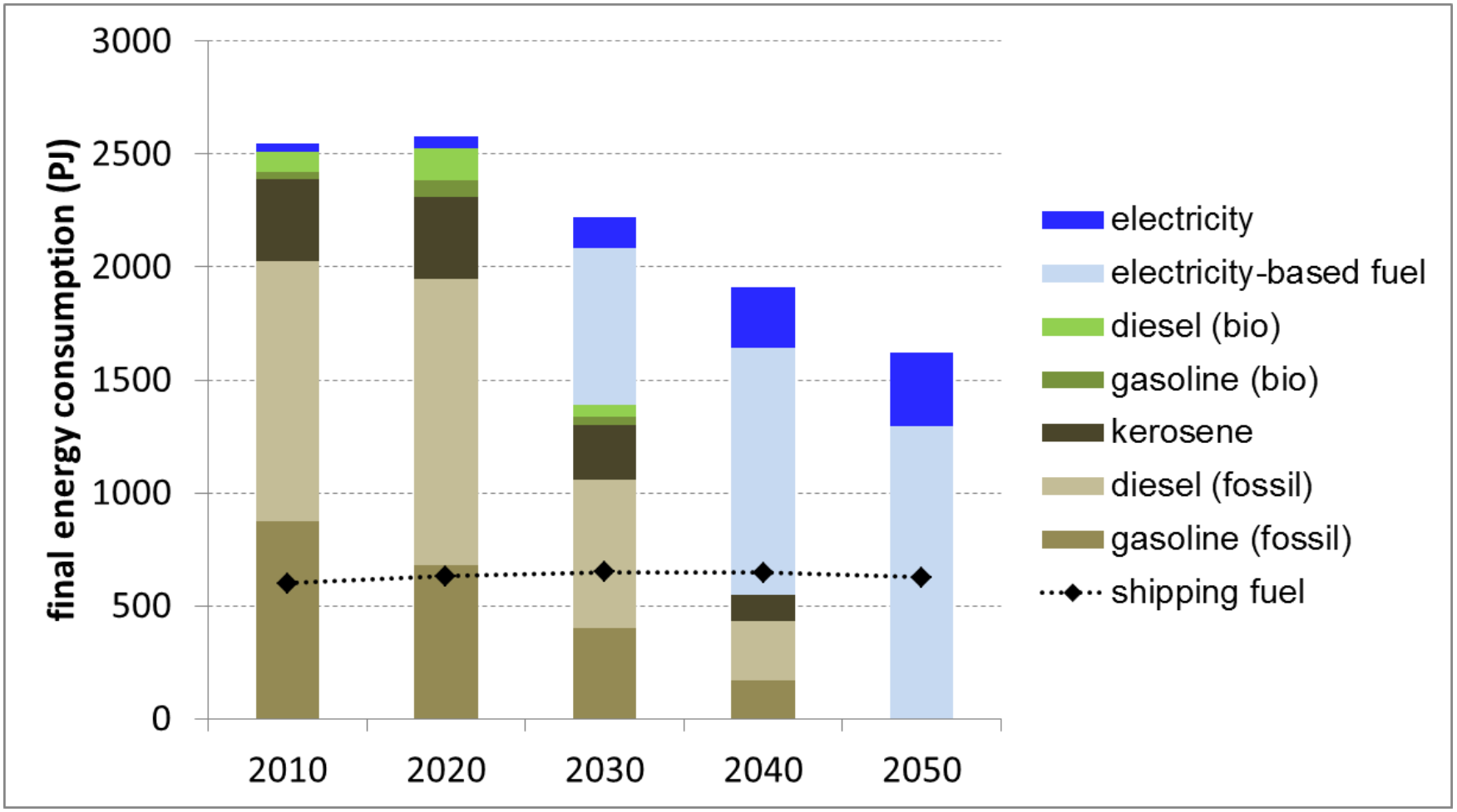
- Optimistic assumptions for PtL production
  - Production starting from 2020
  - Widespread application of high-temperature electrolysis
  - Carbon supply and distribution not considered
  - Efficiency of process chain in 2050: 64%

PtL as indicator for electricity demand of electricity-based fuels

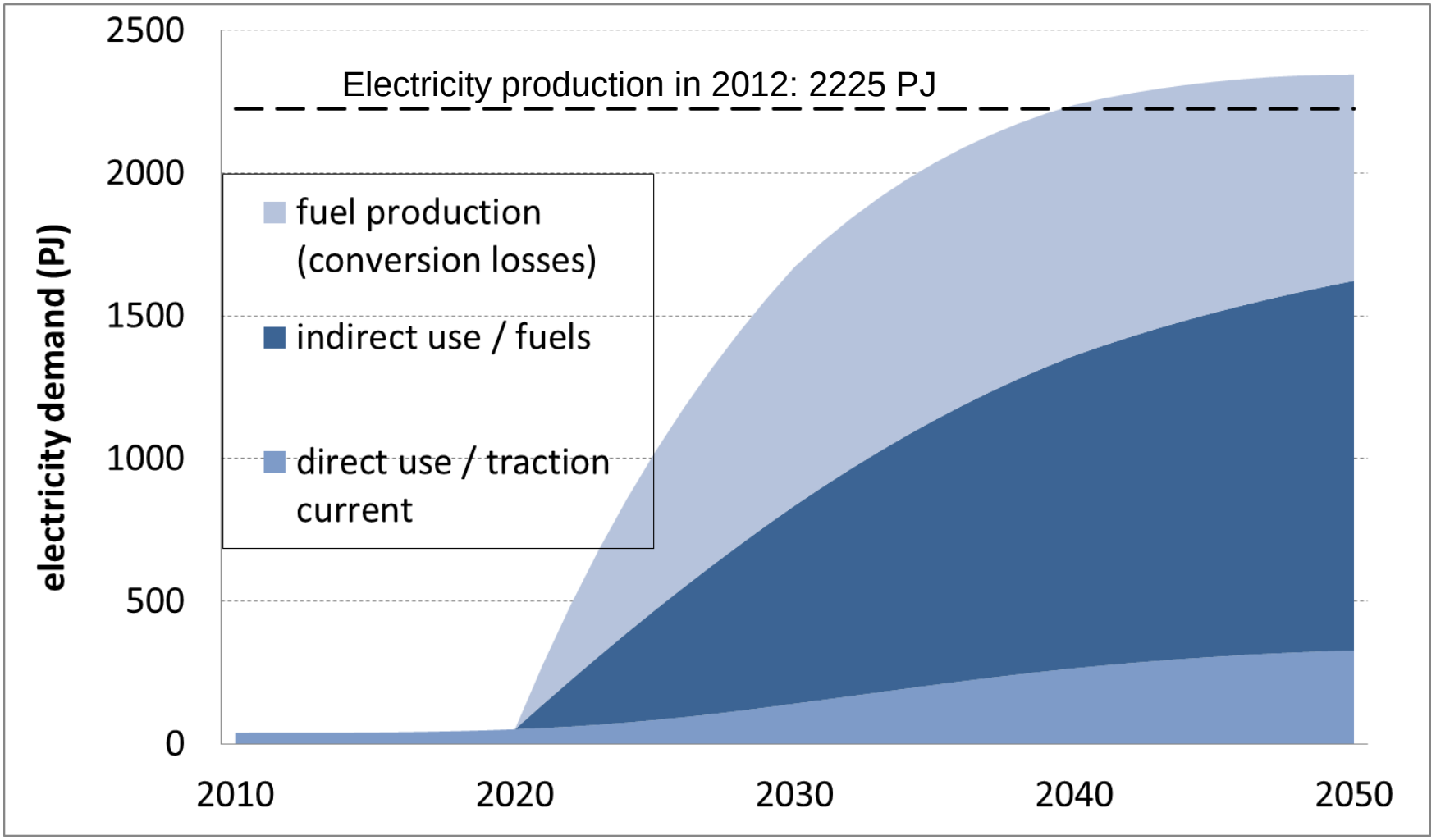
- No assessment of different options of electricity-based fuels

⇨ no strategic advice

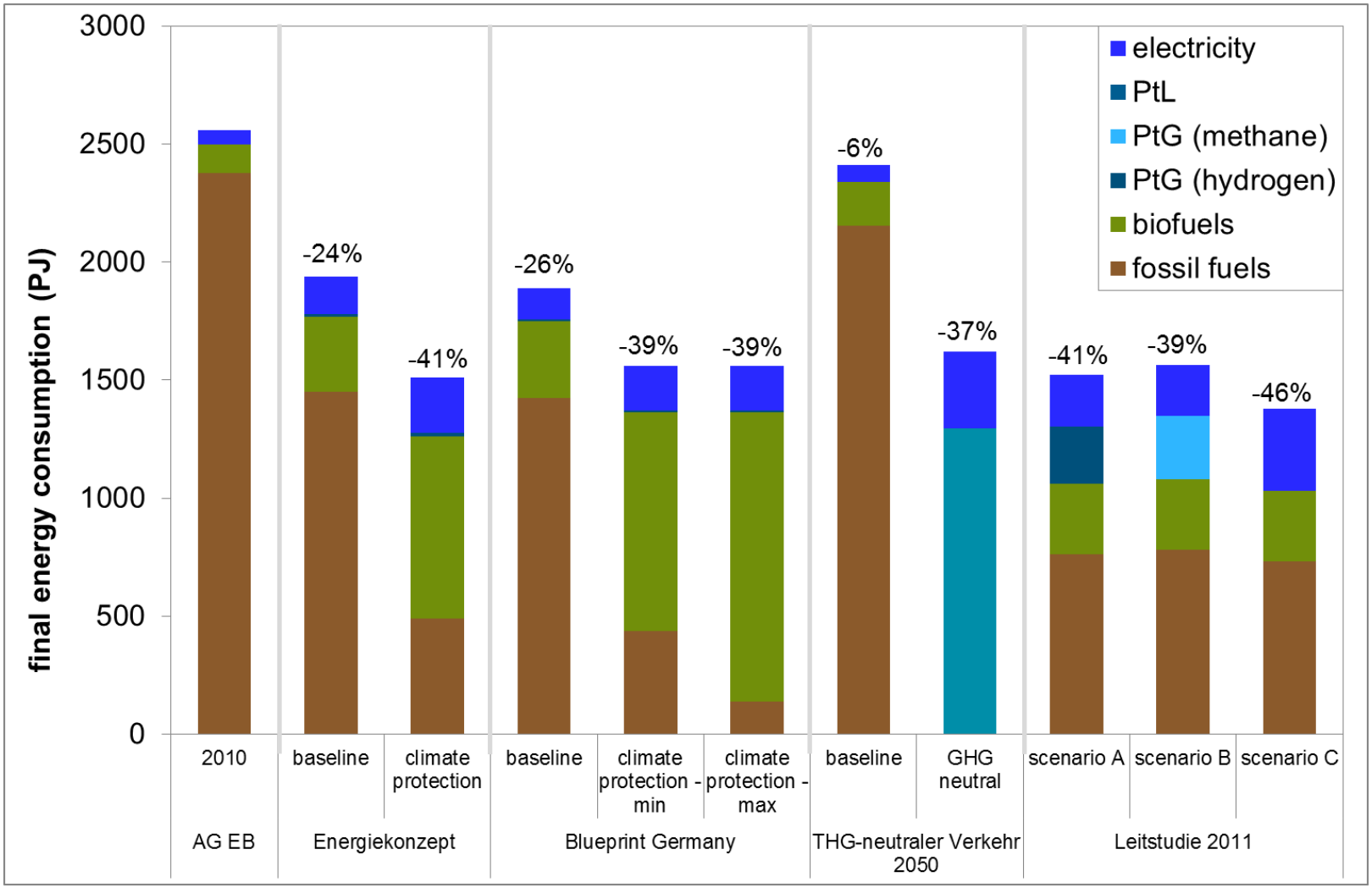
GHG-neutral scenario: Final energy consumption of Germany's transport sector



GHG-neutral scenario: Electricity demand of Germany's transport sector



Climate protection scenarios up to 2050: Final energy consumption of the transport sector in 2050



Conclusions

Required electricity demand higher (~ 650 TWh) than electric production today (2012: 618 TWh)

- Direct use of electricity whenever possible
- Indirect use of electricity is possible, but:
  - high storage/conversion losses → high costs
  - uncertainties of availability of vehicle technologies and energy carrier production, storage and distribution system
  - further analysis is needed to better understand the interactions between electricity sector and transport sector
- Biofuels vs. indirect use of electricity

⇨ Is traffic avoidance conceivable while maintaining the mobility level/social and occupational participation the same?

Thank you for your attention!

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