EU wide energy scenarios until 2050 generated with the TIMES model

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The scenario technique

A scenario is the description of a possible, consistent future development of a system (e.g. the energy system)

The purposes of scenarios are

- **the concretion and quantification of different ideas about the future development of technical systems and the consequences of these conceptions**
- **the analysis of changes in the analysed system caused by changed exogenous parameters**

ETSAP

IEA (International Energy Agency)

Implementing Agreements

Energy Technology Systems Analysis Programme (ETSAP)

IEA OECD ETSAP

Operating Agent

www.etsap.org

ETSAP news

Technology oriented analysis of energy system models with focus on greenhouse gas abatement strategies

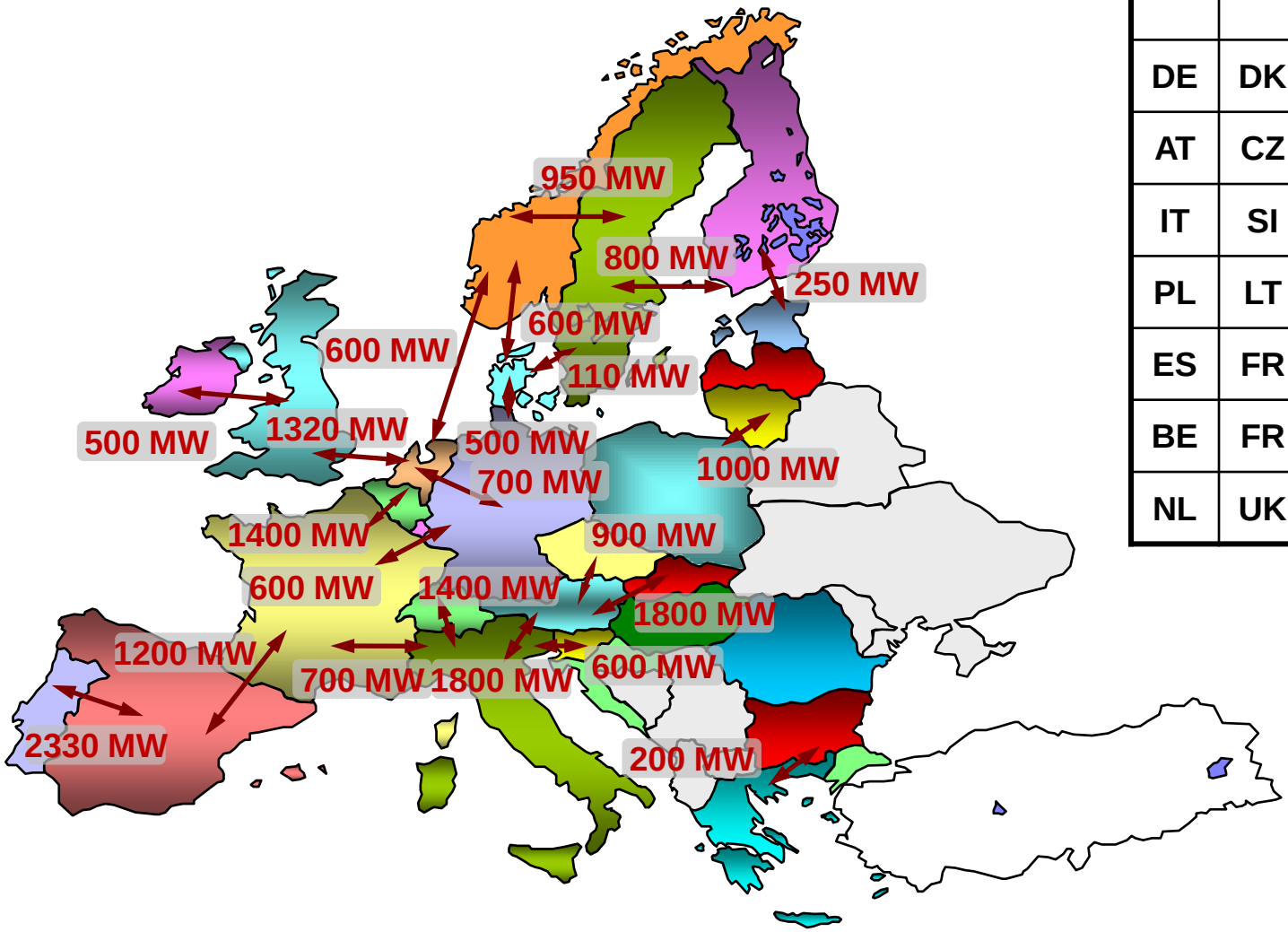
- *Analysis of national and multinational strategies*
- *Technology data review*
- *Model development (MARKAL, TIMES)*

Outreach

The PanEU TIMES Model – Characteristics (I)

- **Describes the chain from primary energy and energy conversion to demand of energy services**
- **Determines market allocations of technologies by minimizing total costs, however obeying constraints (minimum or maximum thresholds, maximum potentials and growth,..)**
- **30 region model (EU 27 + IS, NO, CH)**
- **Modelling horizon 2000 – 2050**
- **12 time slices (4 seasonal, 3 day level)**
- **Detailed power generation sector (CO_2 sequestration and capture options, CHP included) based on IER power plant database with 25,000 units included**
- **Country specific differences for characterisation of new power plants**
- **Country specific load curves based on UTCE statistics**

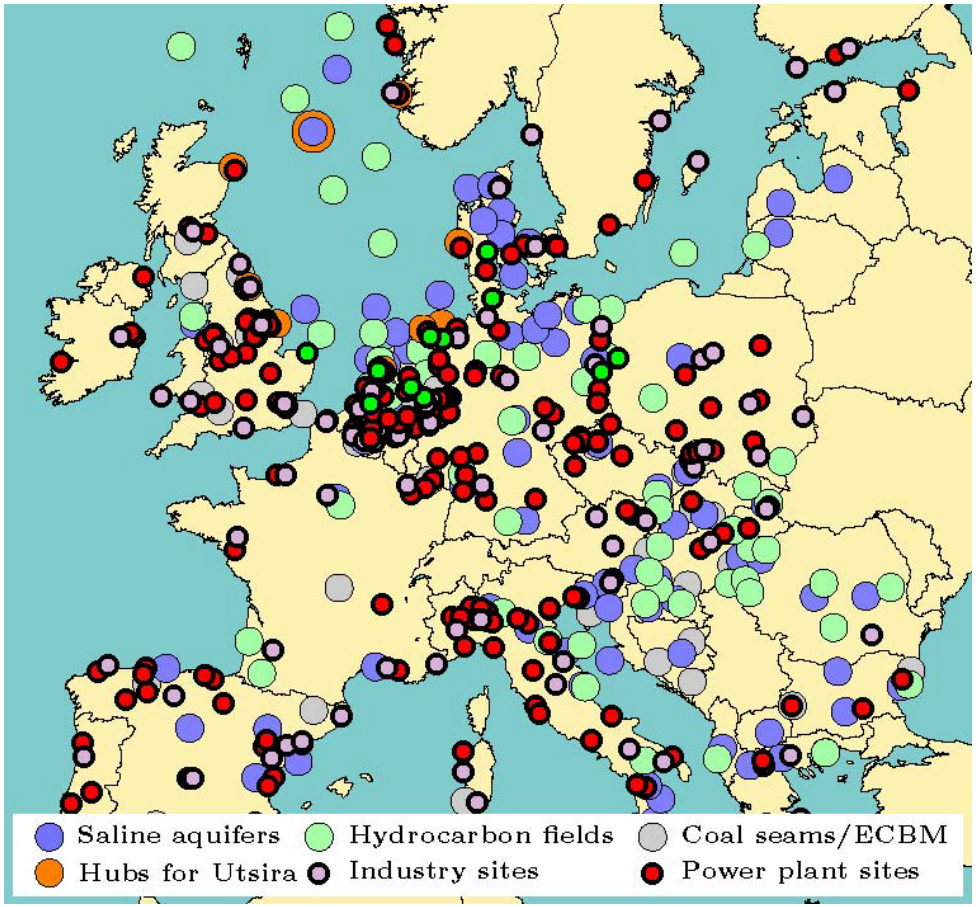
Regions in the Pan-EU model and planned electricity interconnection extensions



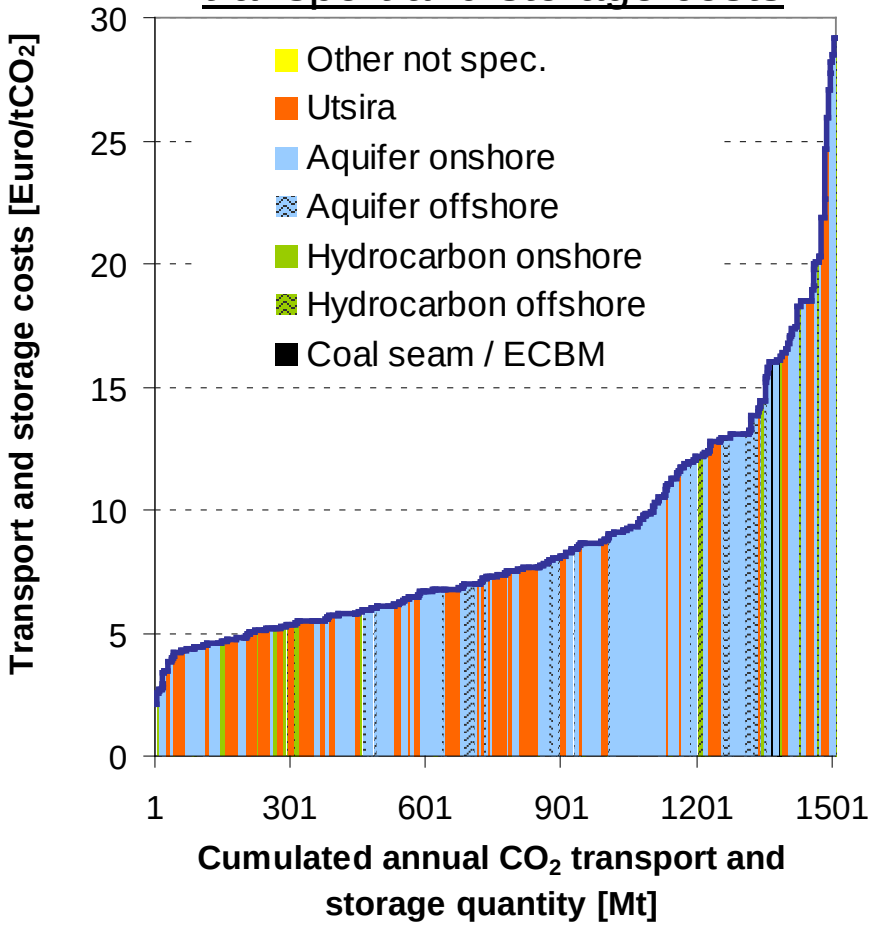
European Priority Projects			
		P in MW	Year
DE	DK	500	2012
AT	CZ	900	2009
IT	SI	800	2011
PL	LT	1000	2013
ES	FR	1200	2009
BE	FR	400	2015
NL	UK	1320	2010

Matching CO_2 sources and sinks → cost potential curve for CO_2 transport and storage for Europe

emission sources and sinks



transport and storage costs



Nuclear power plants in Europe

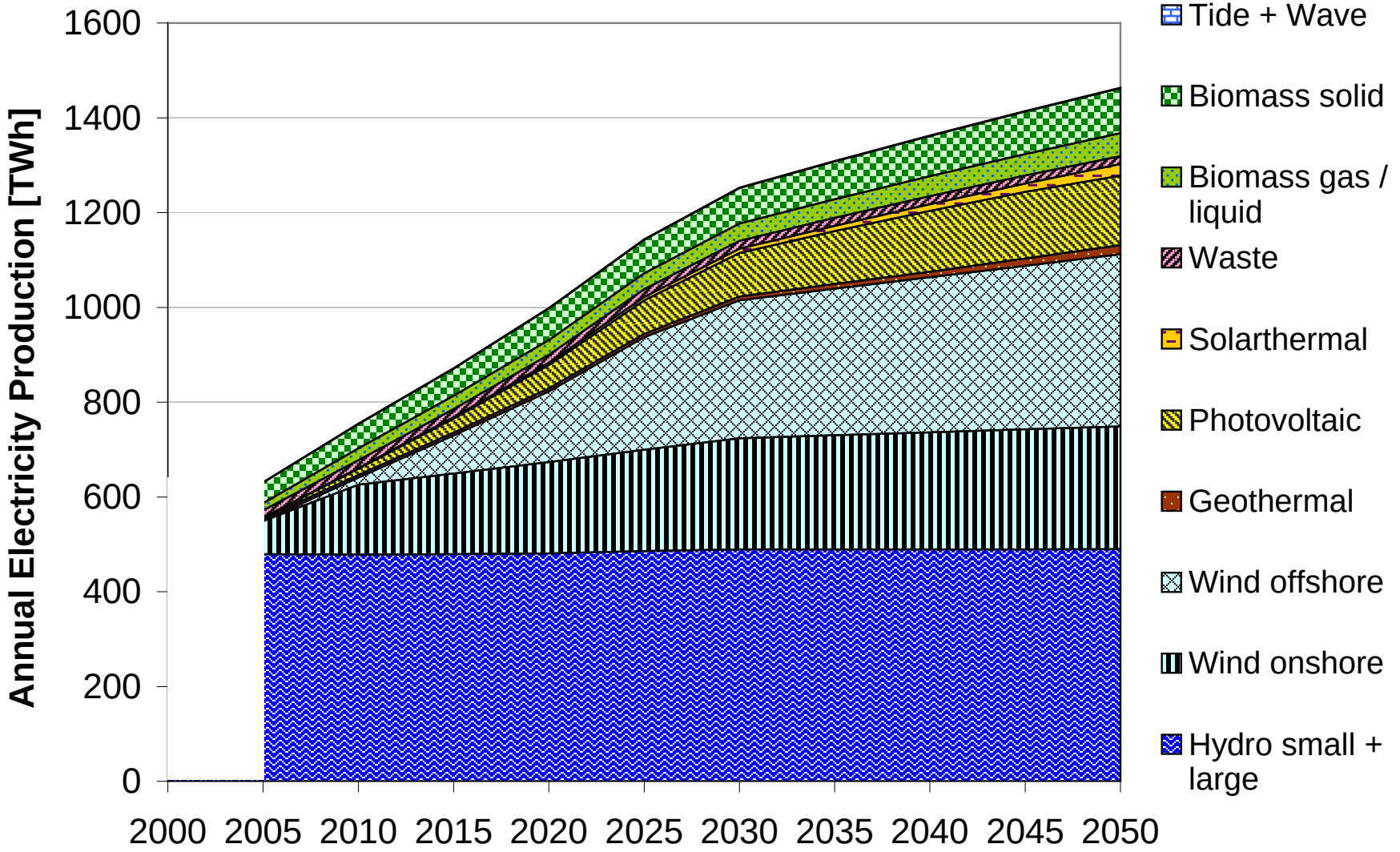
Phase out decision

- Germany, Spain, Sweden, Netherlands, Belgium,

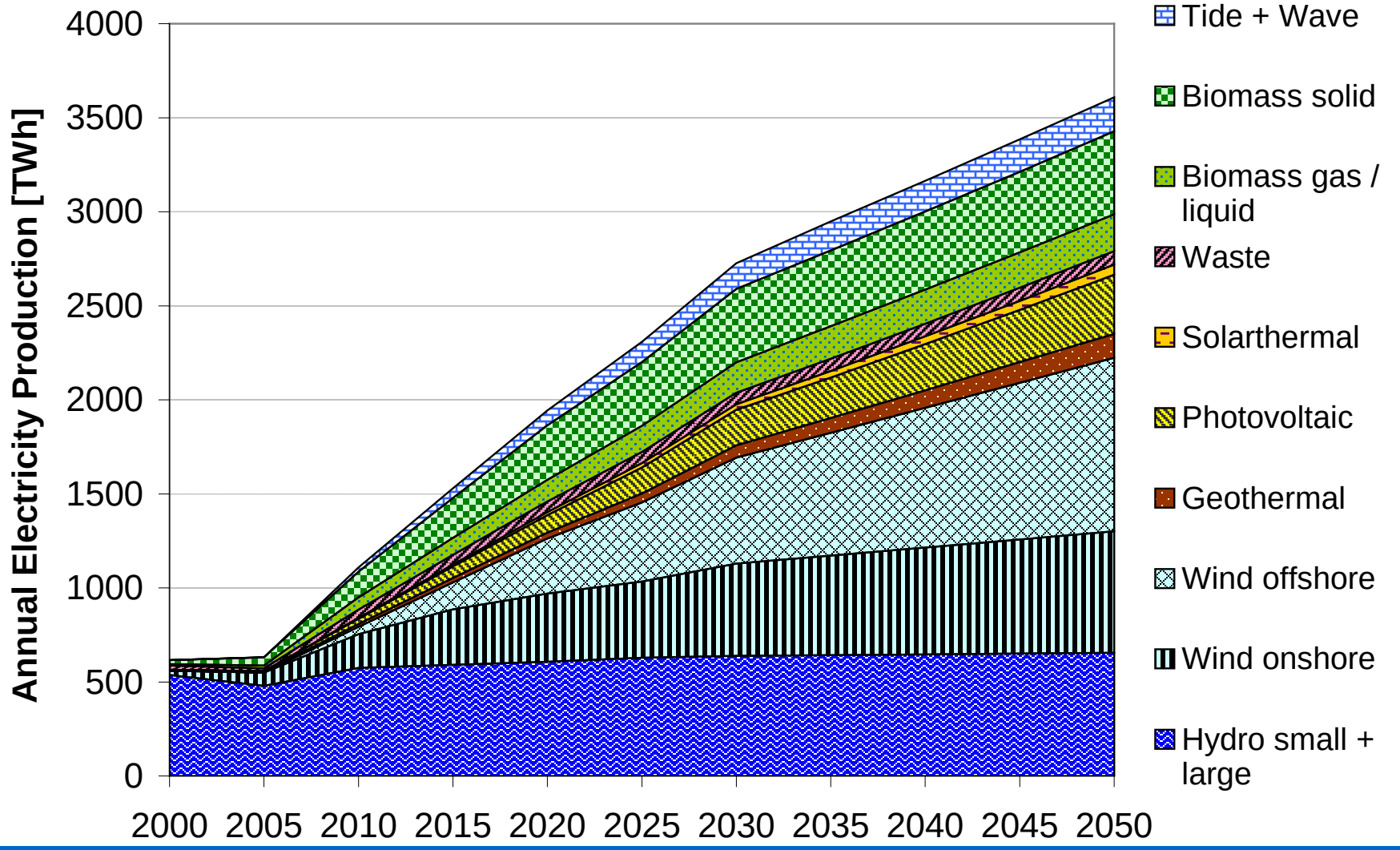
New nuclear power plants

- France, UK, Slovak Republic, Czech Republic, Romania, Hungary, Bulgaria, Switzerland, Finland, Lithuania, Slovenia, Poland Italy

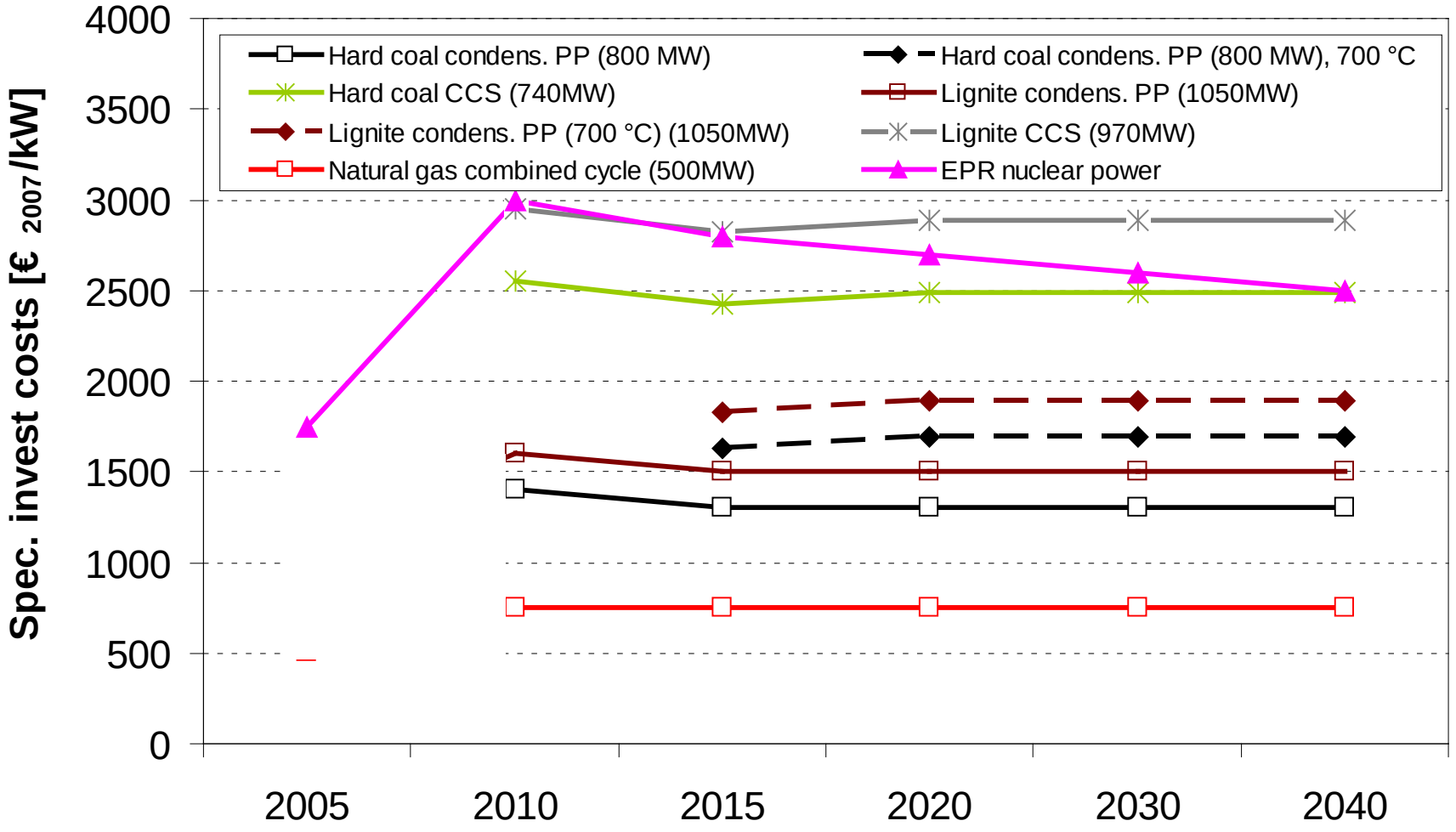
Electricity generation from renewables according to current EU-27+3 RES policies



Potentials of electricity generation from renewables



Invest costs of new non renewable power plants in TIMES PanEU (excerpt) –from NEEDS and OECD



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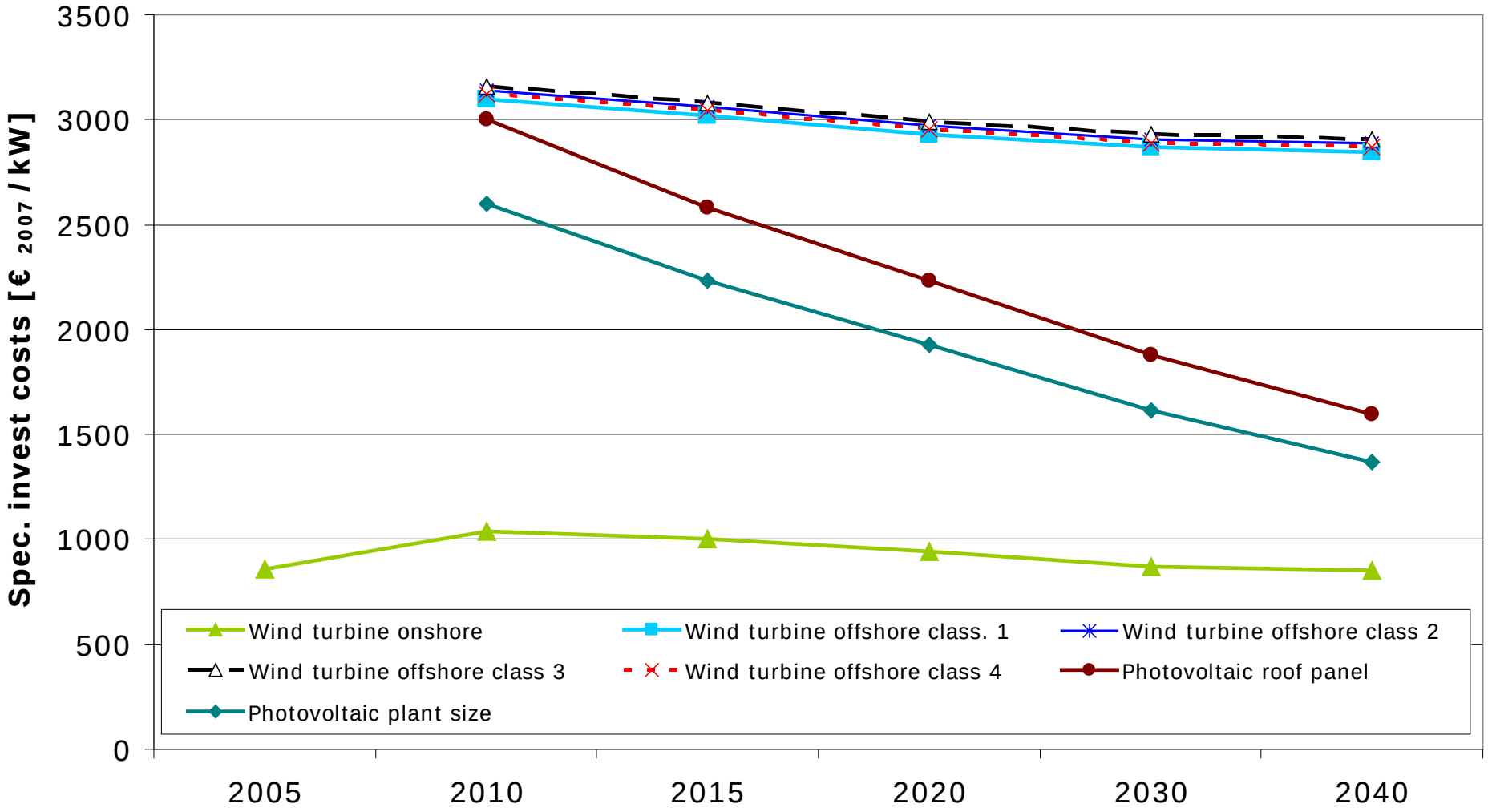


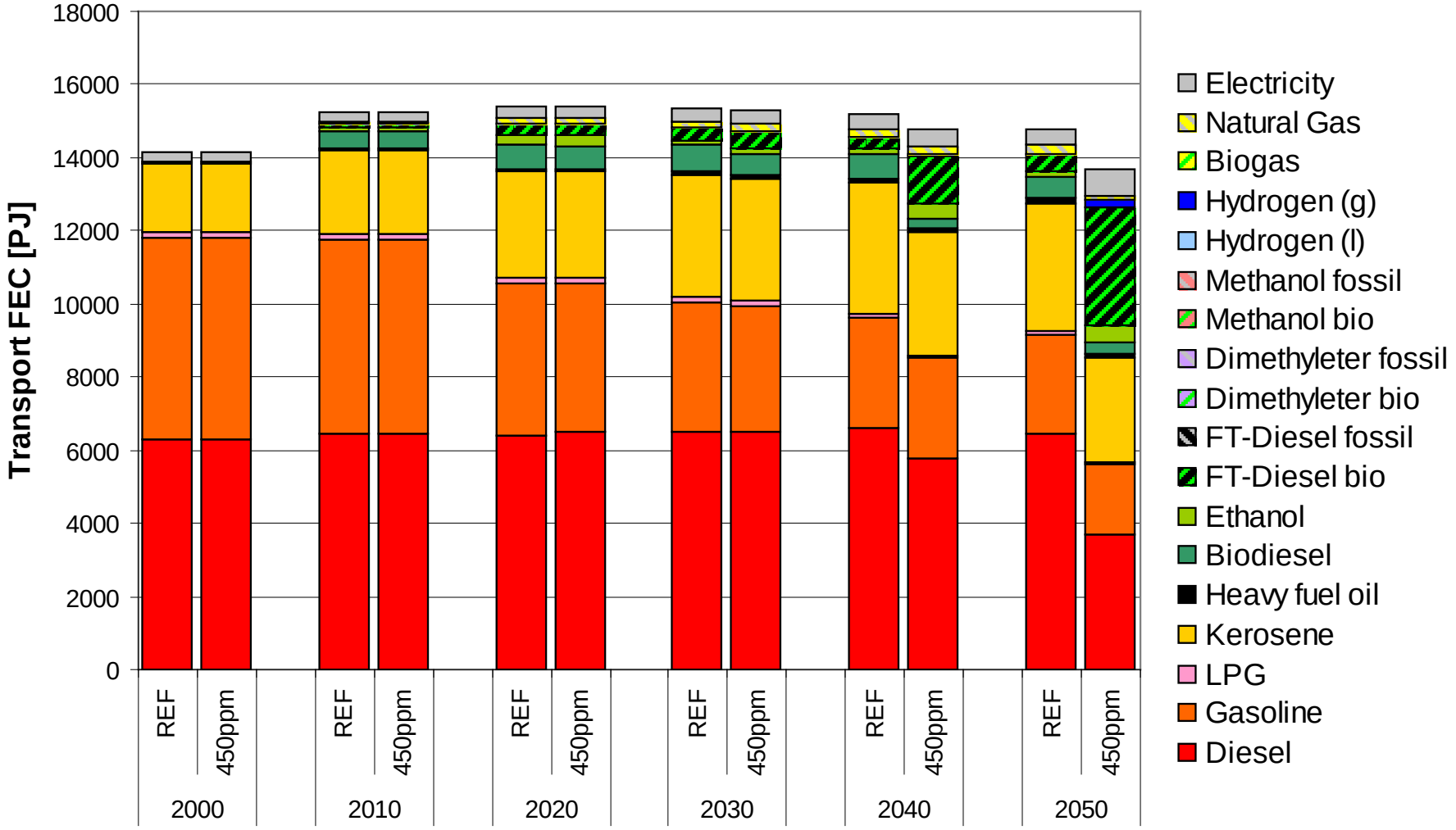
General assumptions

EU27	2007	2030	2050
Population [Mio.]	495.3	493.3	471.7
GDP [Bill. €$_{2000}$]	- Average annual growth 2010 - 2050: 1.8% - Regional differences among countries		
Oil price [US$$_{2007}$/bbl]	69	75	78
Other assumptions	- Restricted use of nuclear power - Implementation of EU biofuel directive		

Definition of scenarios

REF	-Business as usual case -CO_2 emission reduction ETS-Sectors (related to 2005): -21 % until 2020 -55 % until 2050 (1,74%/a) -Current national pograms for promoting/subsidizing renewable energies continue (which leads to 40% CO2 reduction 1990 - 2050)
450ppm	- CO_2 emission reduction ETS-Sectors (related to 2005): -31.5 % until 2020 -1.74 % p.a. after 2030 -Overall reduction of greenhause gases (related to 1990): -71 % until 2050

Transport final energy conumption by fuel (EU27), goods transport, air traffic increasing



Industry

- Processes (production of iron & steel, cement, paper and chemicals) cause highest energy demand
- Step 1: improve efficiency, use waste heat
- Step 2: change processes (e.g. electric arc furnace for iron & steel, dry processes for clincer production);

  from 2030 on CCS

leads to increasing electricity demand

Households and Trade and Commerce

- Increasing electricity demand due to increasing use of electric and electronic devices and more air conditioning
- Insulation leads to decreasing demand for heating

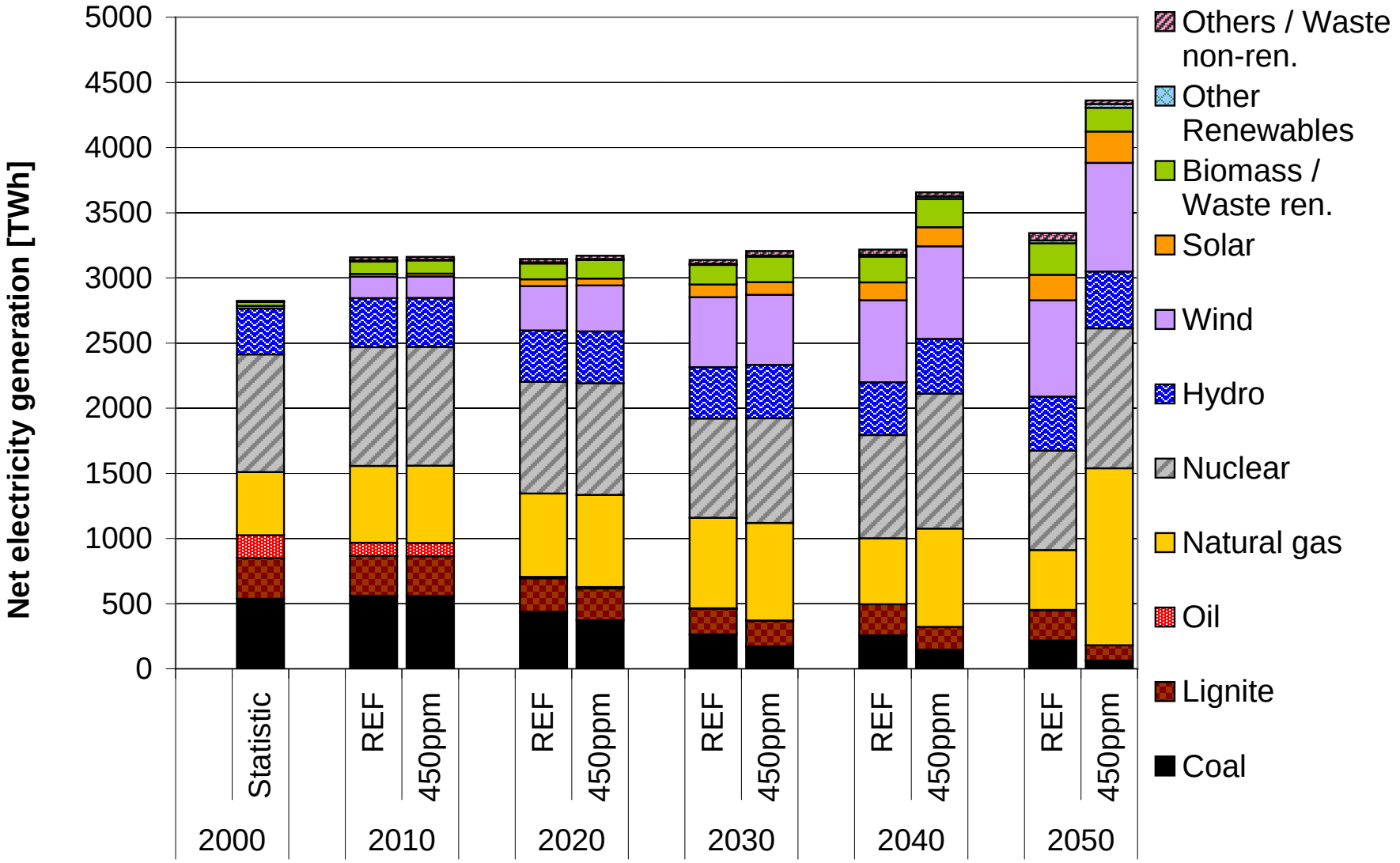
Reference: more gas, wood, solar thermal

Climate scenario: further enhanced insulation;

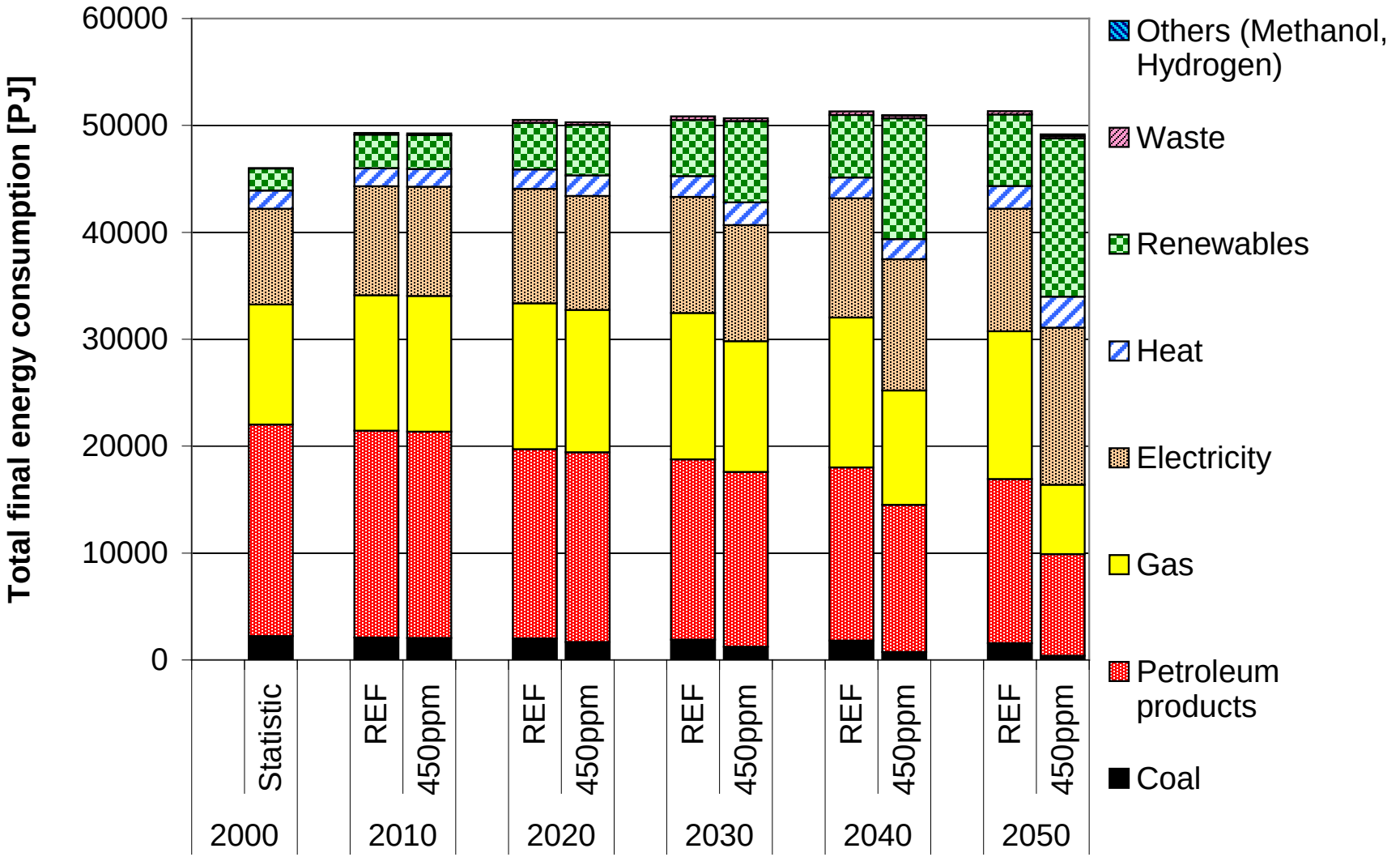
use of electric and gas heat pumps;

to less extent use of heat from decentralised CHP plants using gas

Electricity generation in the EU-27



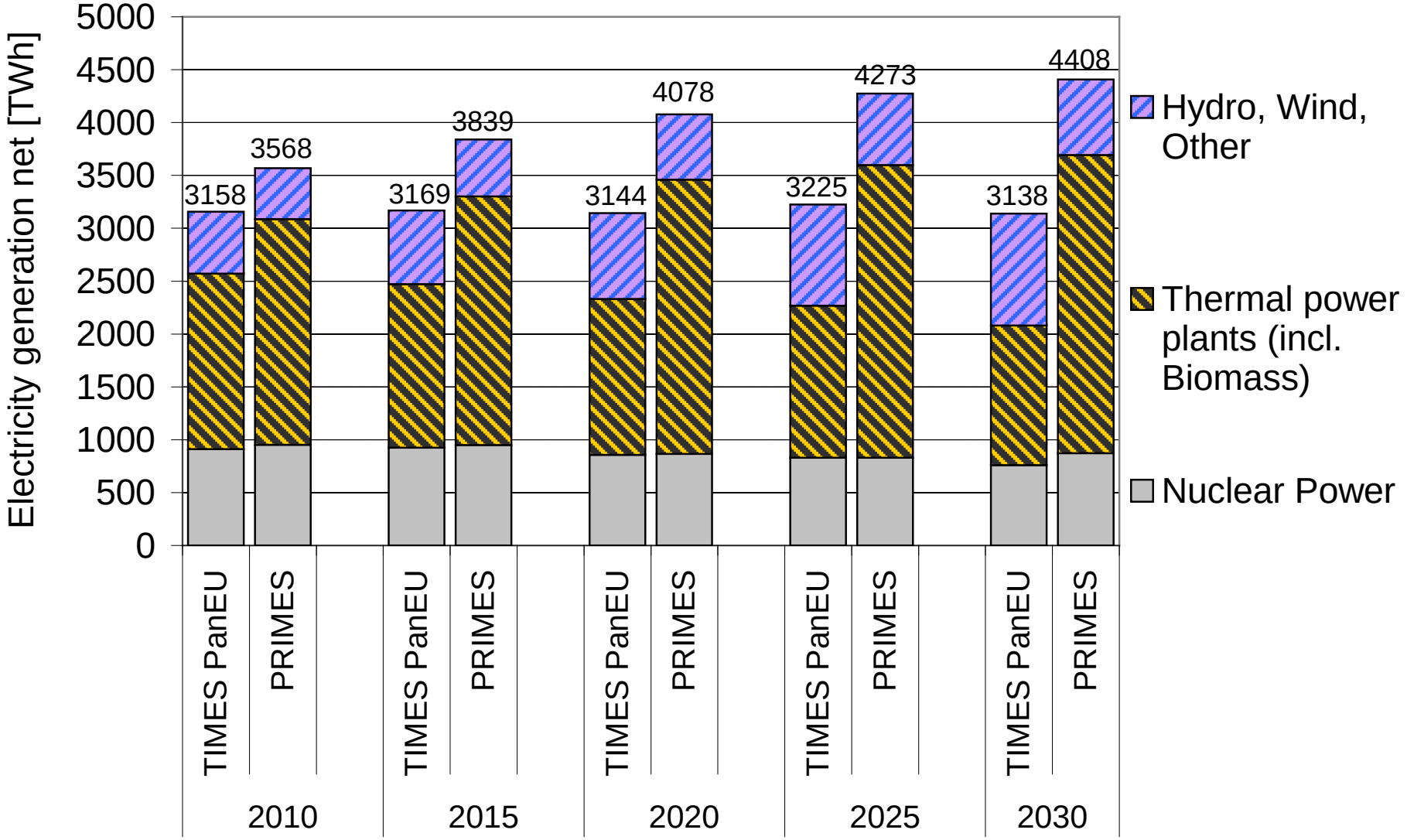
Final energy consumption (EU27)



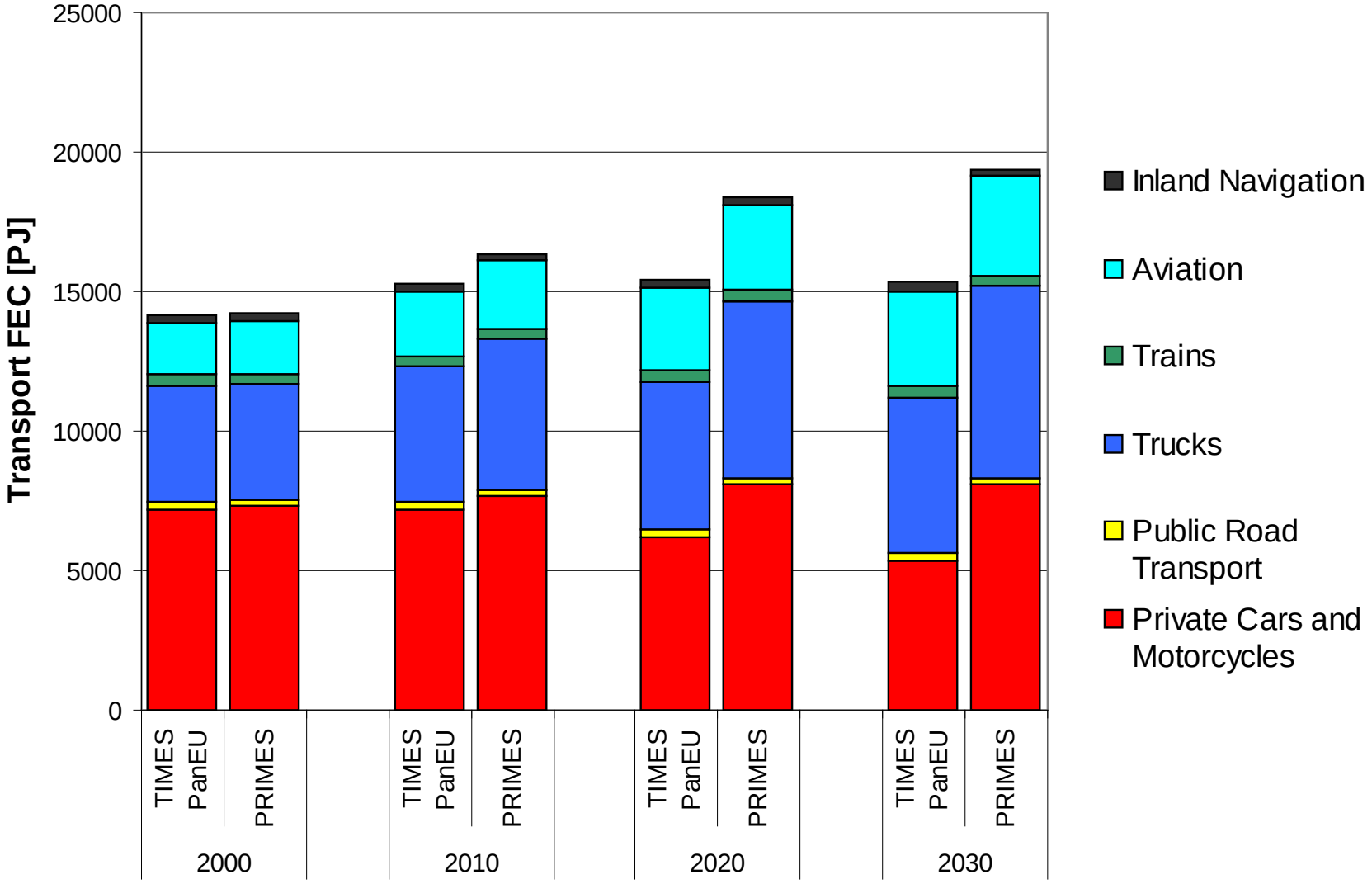
Comparison of
TIMES PanEU
and
PRIMES*

*PRIMES data according to „European Energy and Transport, Trends to 2030 - Update 2007“ (EC 2008)

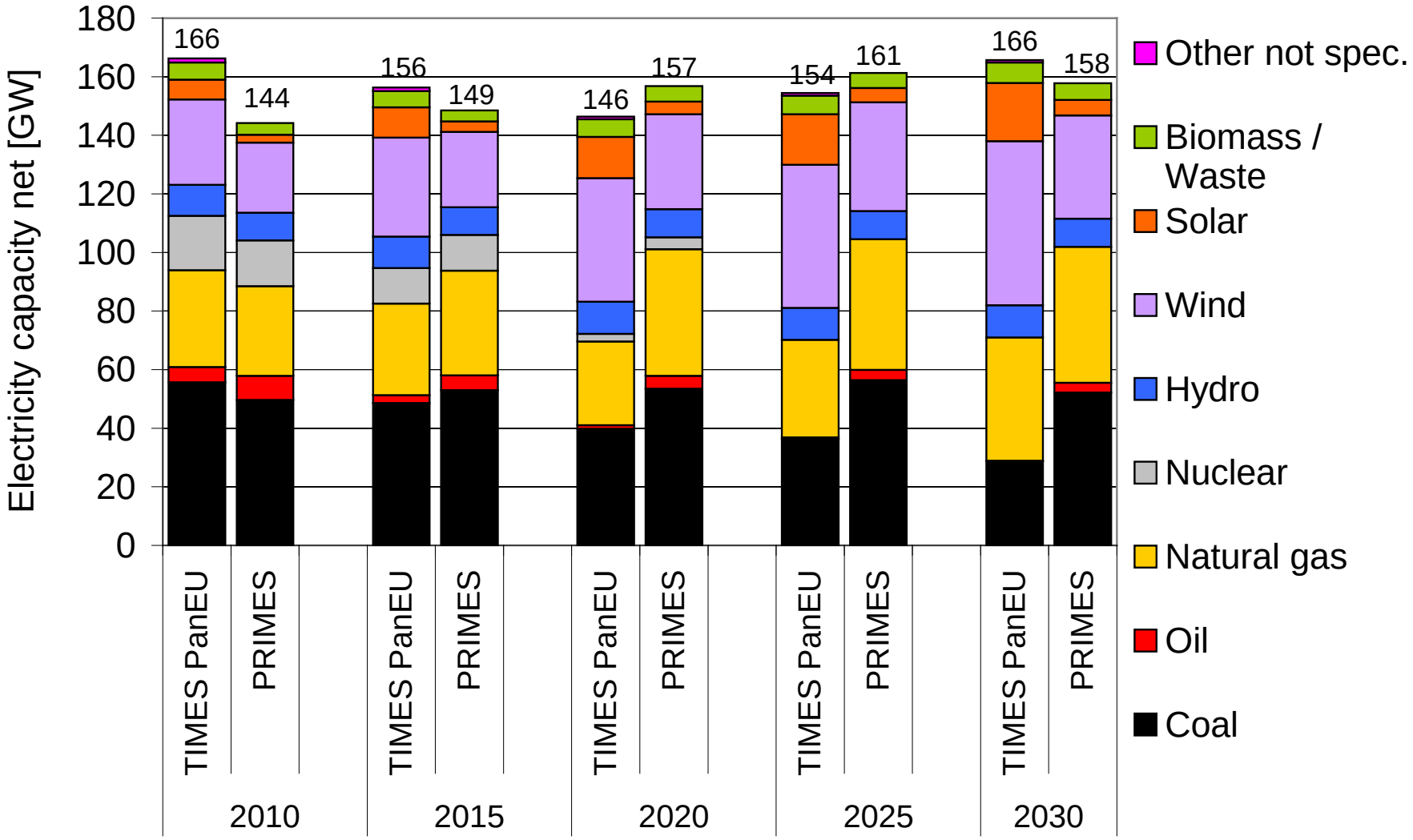
Electricity generation in the EU-27



Transport FEC by mode (EU27)



Electricity capacity in Germany



Conclusions

- The assumptions made strongly influence the scenario results. It is thus essential to describe the assumptions and to make sensitivity analyses to find out how robust the results are.
- Improving energy efficiency is a key element for climate and health protection.
- The future price of gas – and the availability of CCS - determines, whether gas (in the reference case without CCS) or coal is used; lignite – with CCS - is further used in countries with lignite resources.
- CO2 reduction is especially expansive in the transport sector. Thus only in the climate scenario a major shift to BTL and electricity is occurring.
- Water, wind, wood, biogas are the least expensive renewables. Depending on the development of PV costs solar thermal (more likely) or PV rank next. The share of BTL and electricity in transport depends on the ambition of the climate objective and the progress in battery development.