



Environment Center  
Charles University  
in Prague

# Impacts of Czech brown coal mines enlargement: assessment by energy model TIMES-CZ

69TH SEMI-ANNUAL ETSAP MEETING

**Lukáš Rečka** [lukas.recka@czp.cuni.cz](mailto:lukas.recka@czp.cuni.cz)

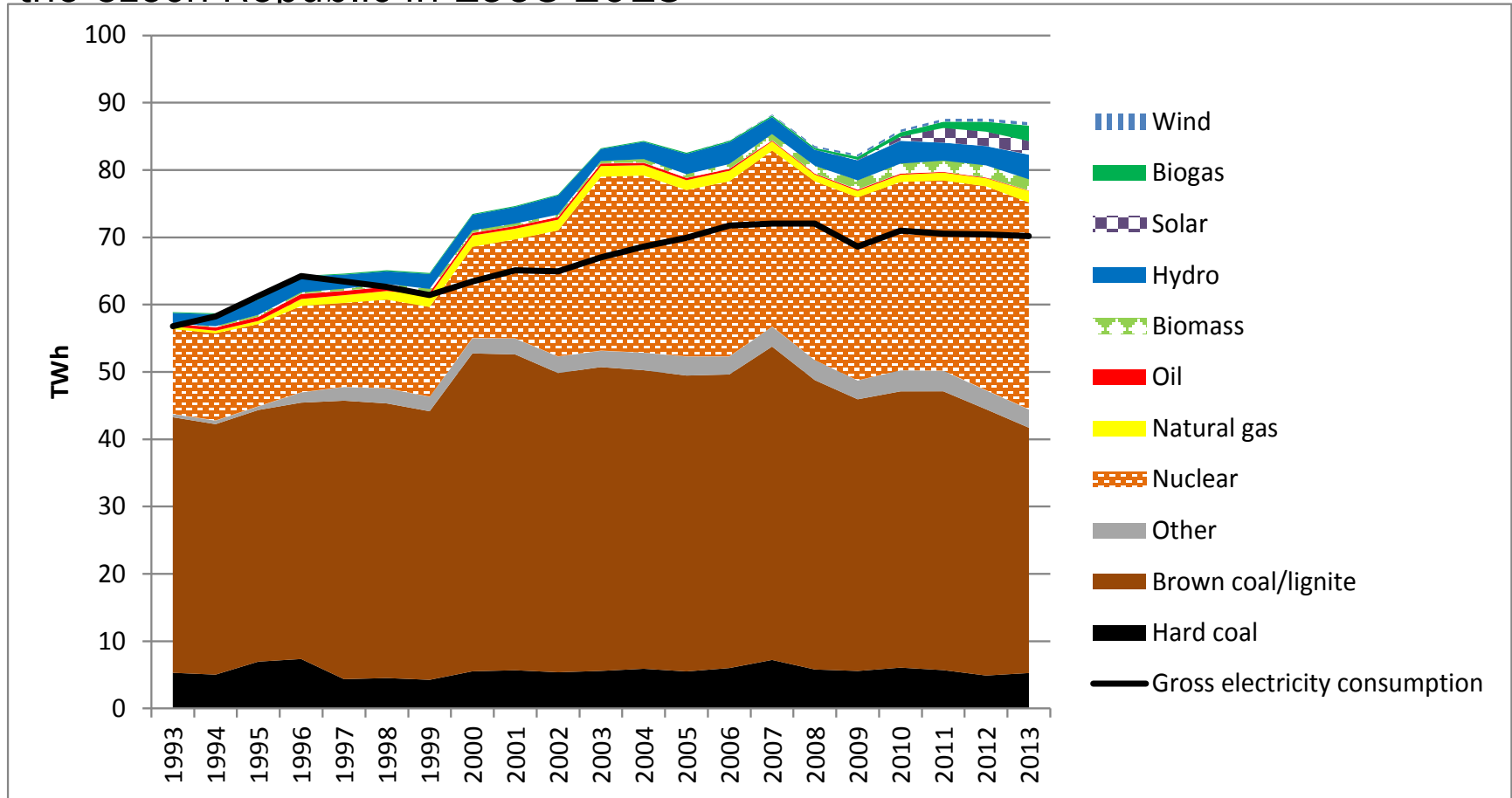
*Cork, 30<sup>th</sup> May, 2016*

# Agenda

- Motivation
- TIMES-CZ model
- Model Structure
- Scenarios
- Results
- Sensitivity analysis
- Conclusions
- Planned extension of the model

# Motivation

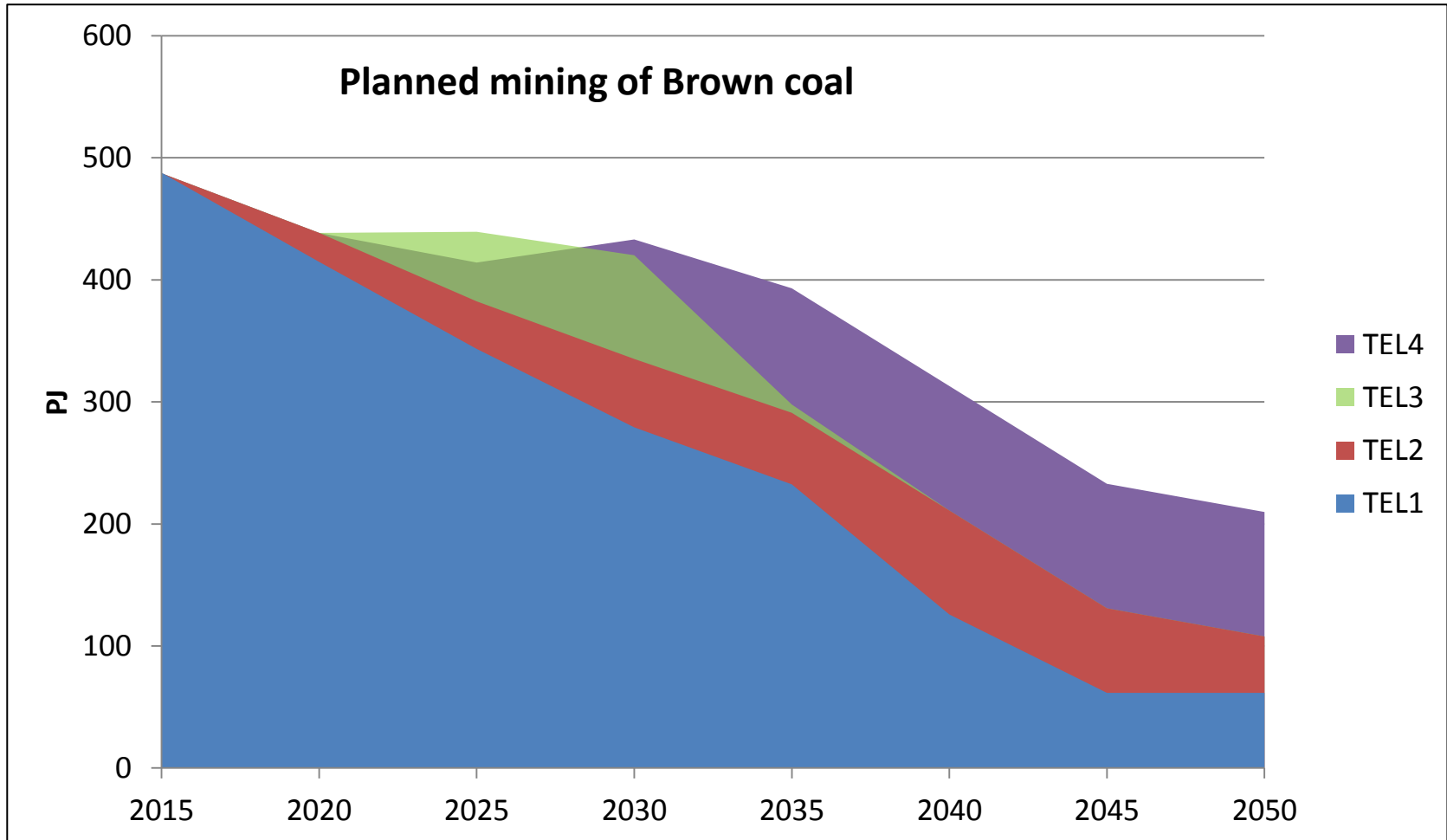
Gross electricity production by resource and gross electricity consumption in the Czech Republic in 1993-2013



Source: Eurostat

# Assess the impacts of possible extension of Czech brown coal mines on Czech energy system

- 4 scenarios to assess the 'breaking' of the territorial ecological limits (TEL)

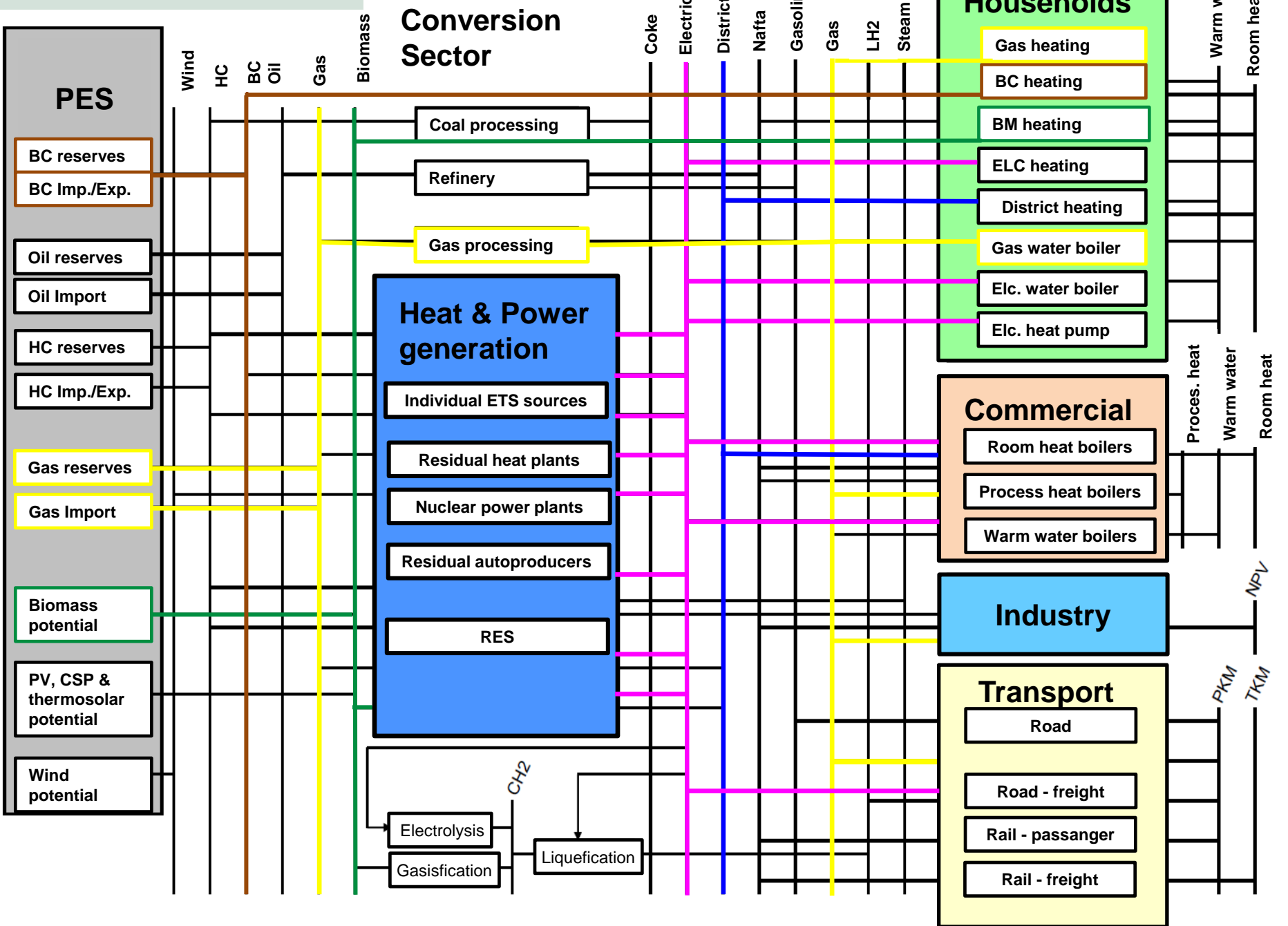


# TIMES-CZ

## **Model of the Czech Energy System including the whole energy ballance**

- based on Czech region of TIMES-PanEU
  - Updated from 2010 to 2012 data
  - ETS sectors disaggregated on plant level (except Iron and Steel industry)
  - Non-ETS sectors as in TIMES-PanEU
- time horizon 2012-2050
  - 5 year periods
- ETS sectors: plant-level data of fuel use, emissions and electricity/heat generated
- District heating partly regionalized
- RES potentials based on State Energy Policy (SEP)
- Reserves of brown coal according to 4 variants of territorial ecological limits
- Capital costs of new technologies based on DIW (2013)
- Fuel cost base on World Energy Outlook 2014

# TIMES-CZ Structure



# Scenarios

1) 4 scenarios based on SEP to assess the 'breaking' of the territorial ecological limits (TEL) only

- Main trends according to State Energy Policy (SEP)
  - Electricity production, RES, Nuclear, price of EU ETS - up to 40€/CO2t

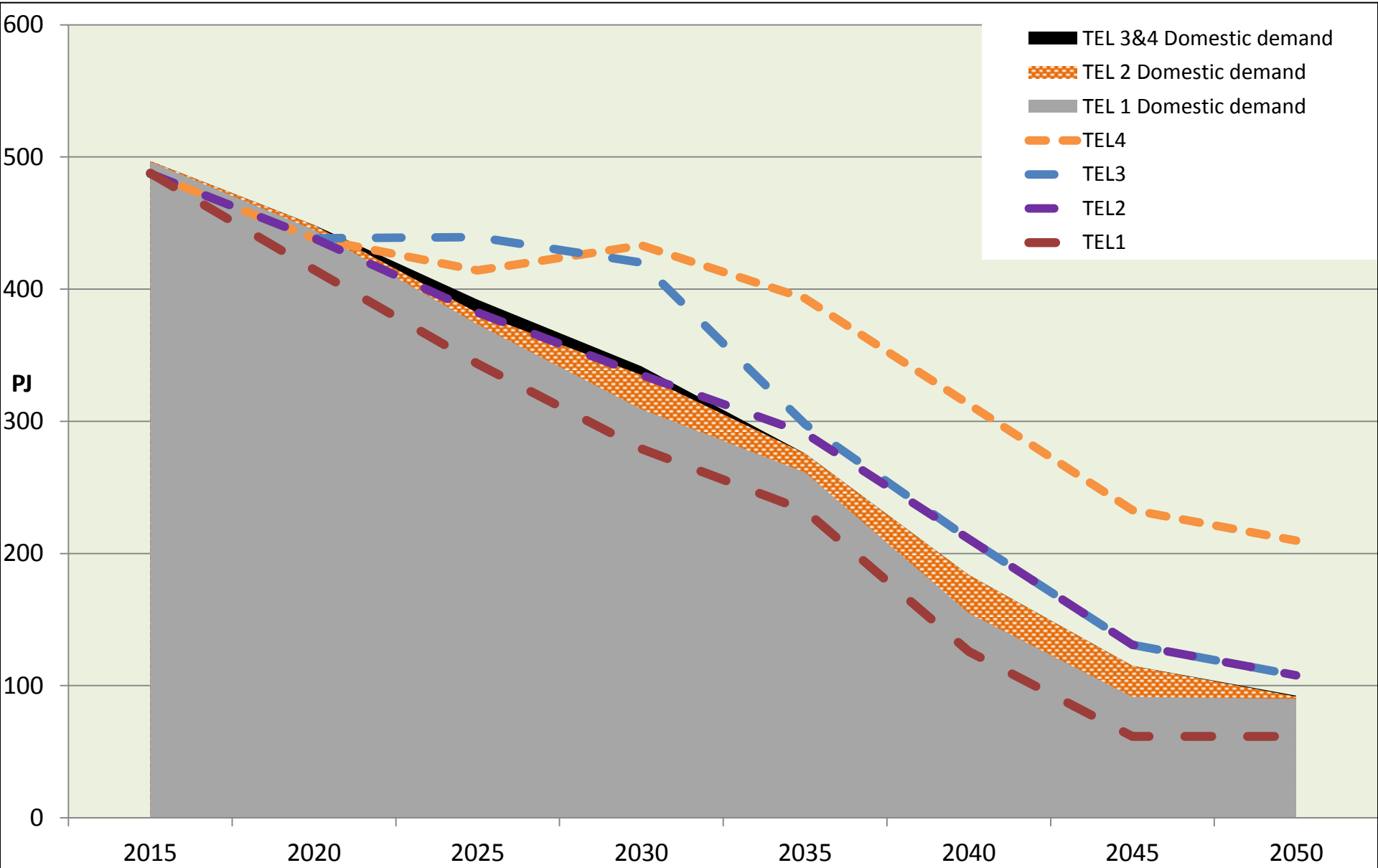
2) + Relax assumption on Nuclear

3) + Relax assumption on RES

- RES potentials increased according to RES Chamber

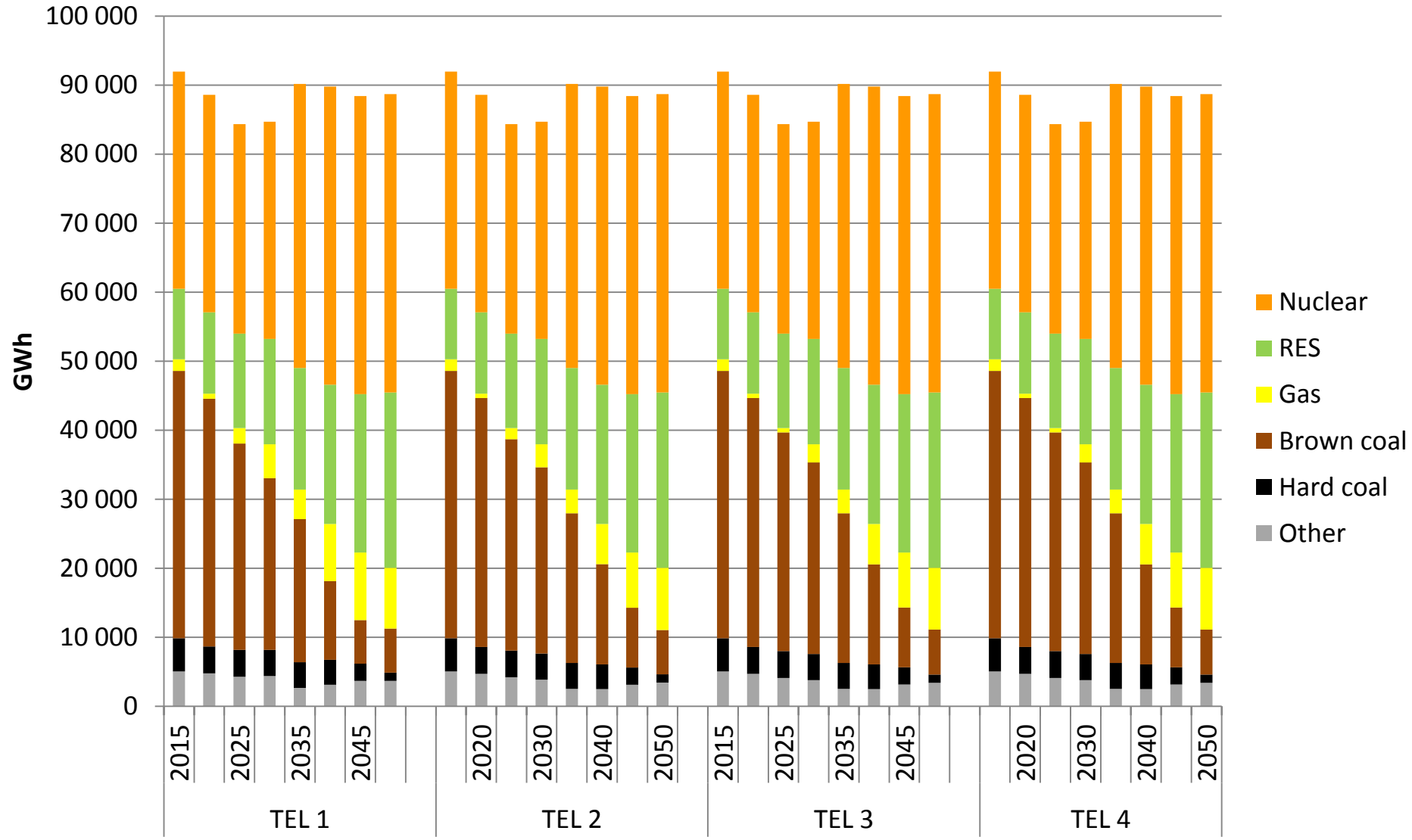
	Wind	Biomass	PV	Water	Geothermal	Total
Twh	18.3	22	12.7	2.7	9.7	66

# 1) Results – Brown coal consumption & mining

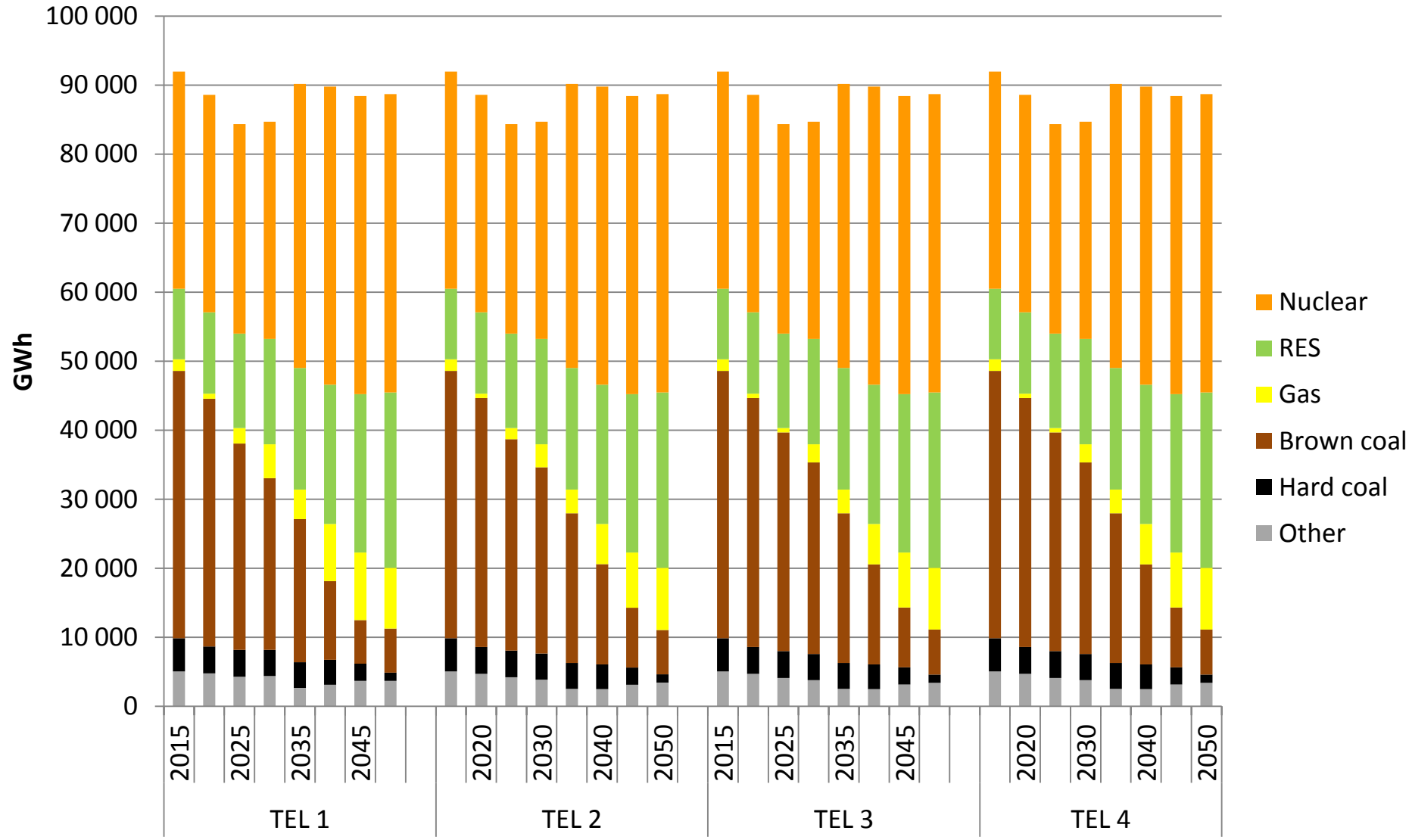




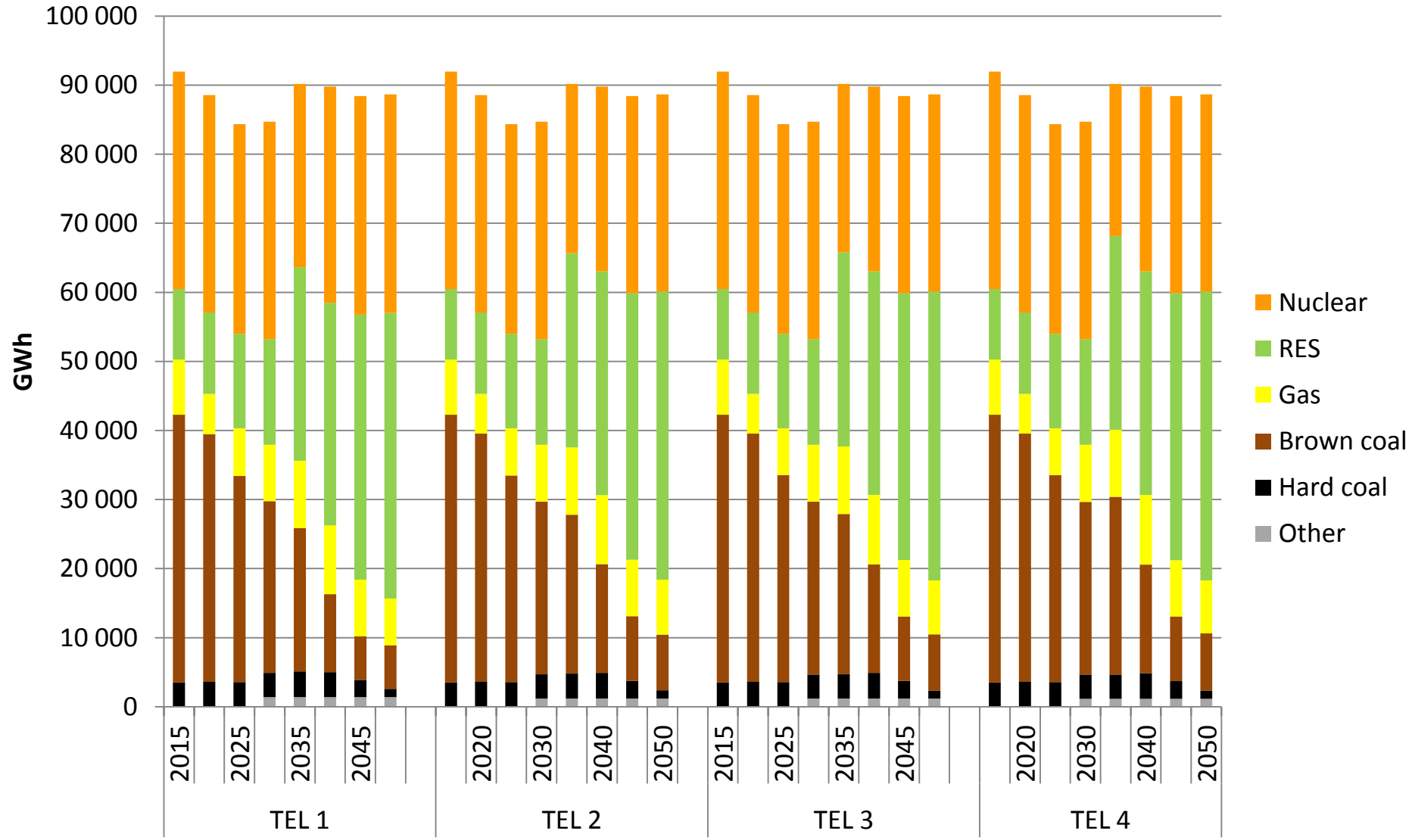
# 1) Results – Electricity production by source



# 2) Results – Electricity production by source

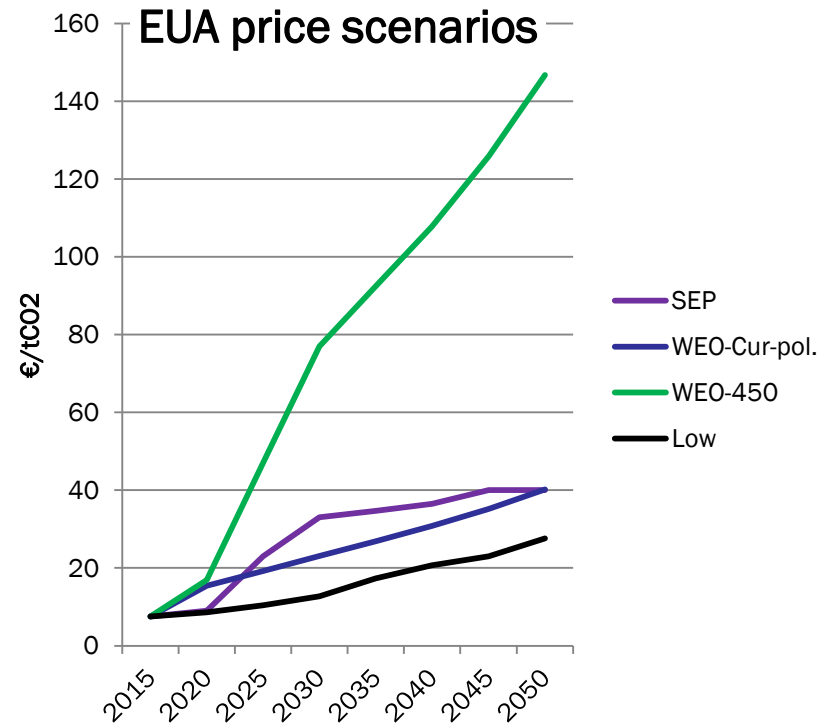
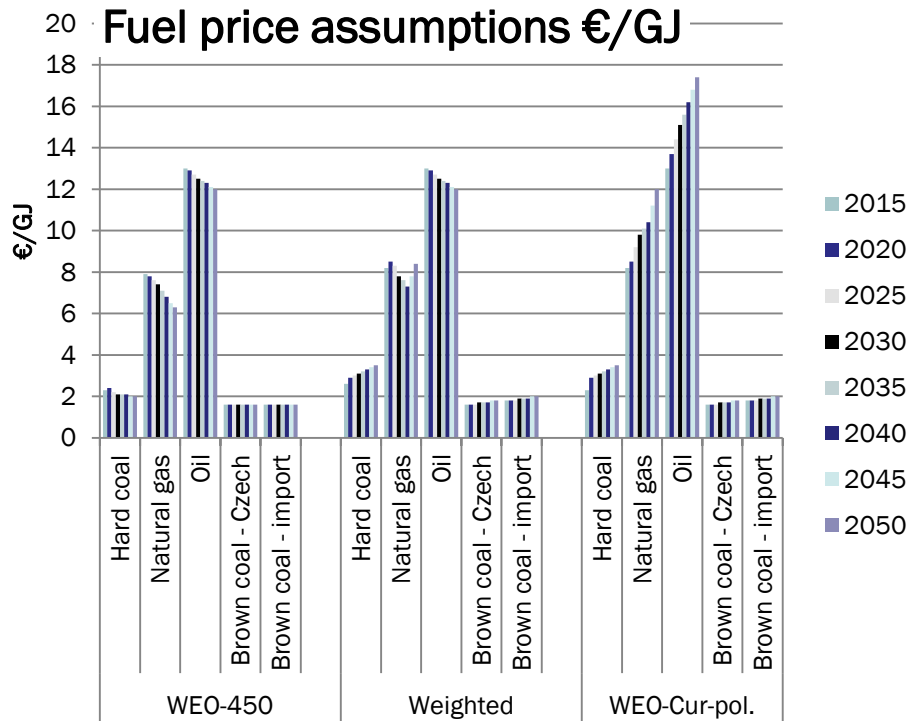


# 3) Results – Electricity production by source



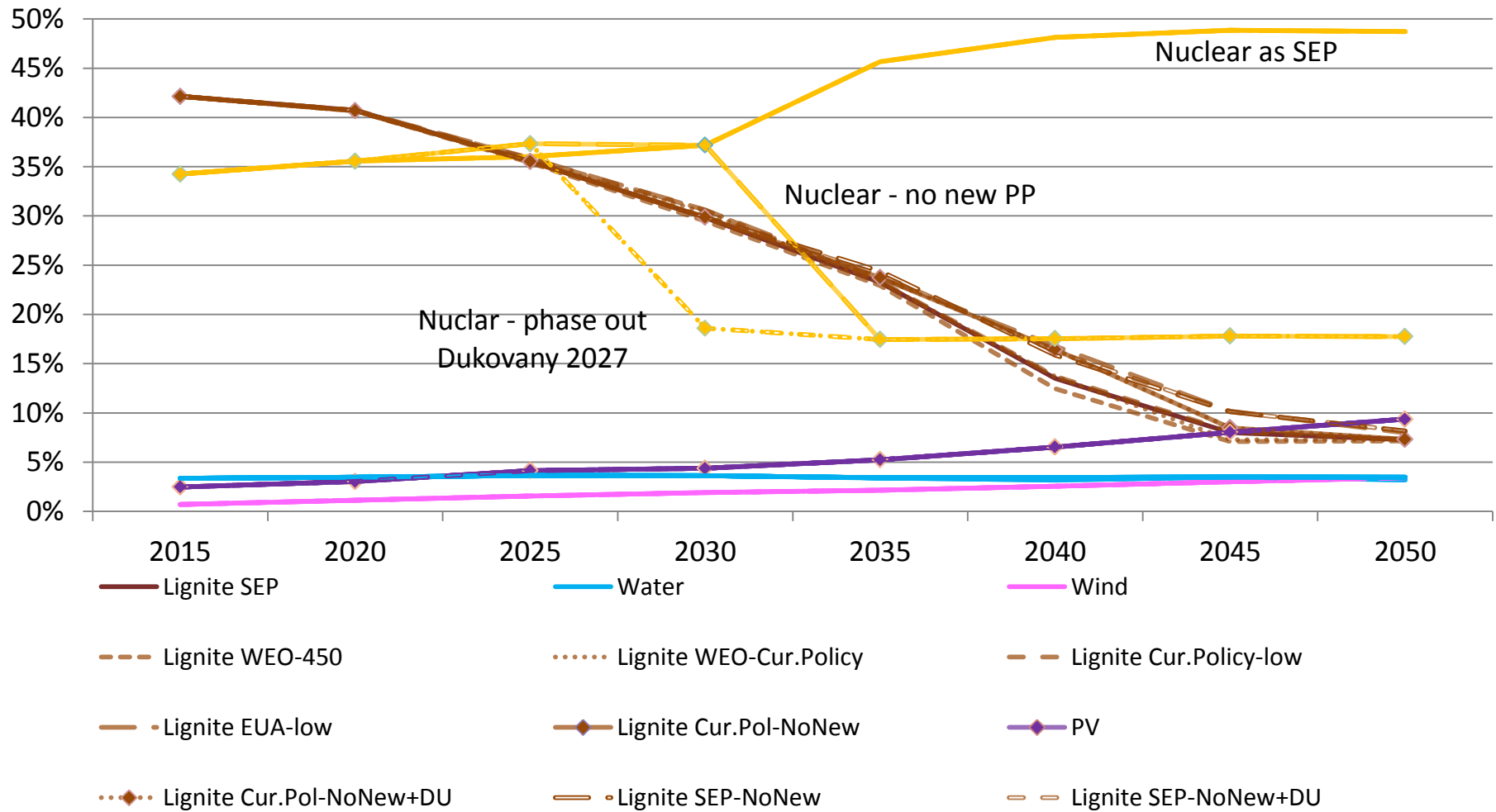
# Sensitivity analysis

- TEL 2 – the selected ,breaking‘ of TEL
- 3 fuel price assumption sets, 4 EUA price scenarios
- 3 scenarios of nuclear development



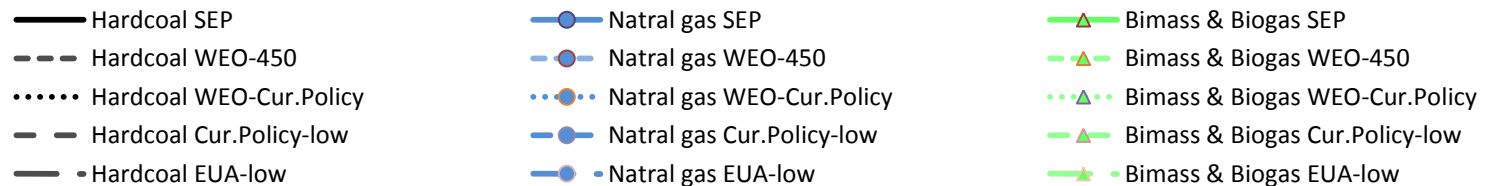
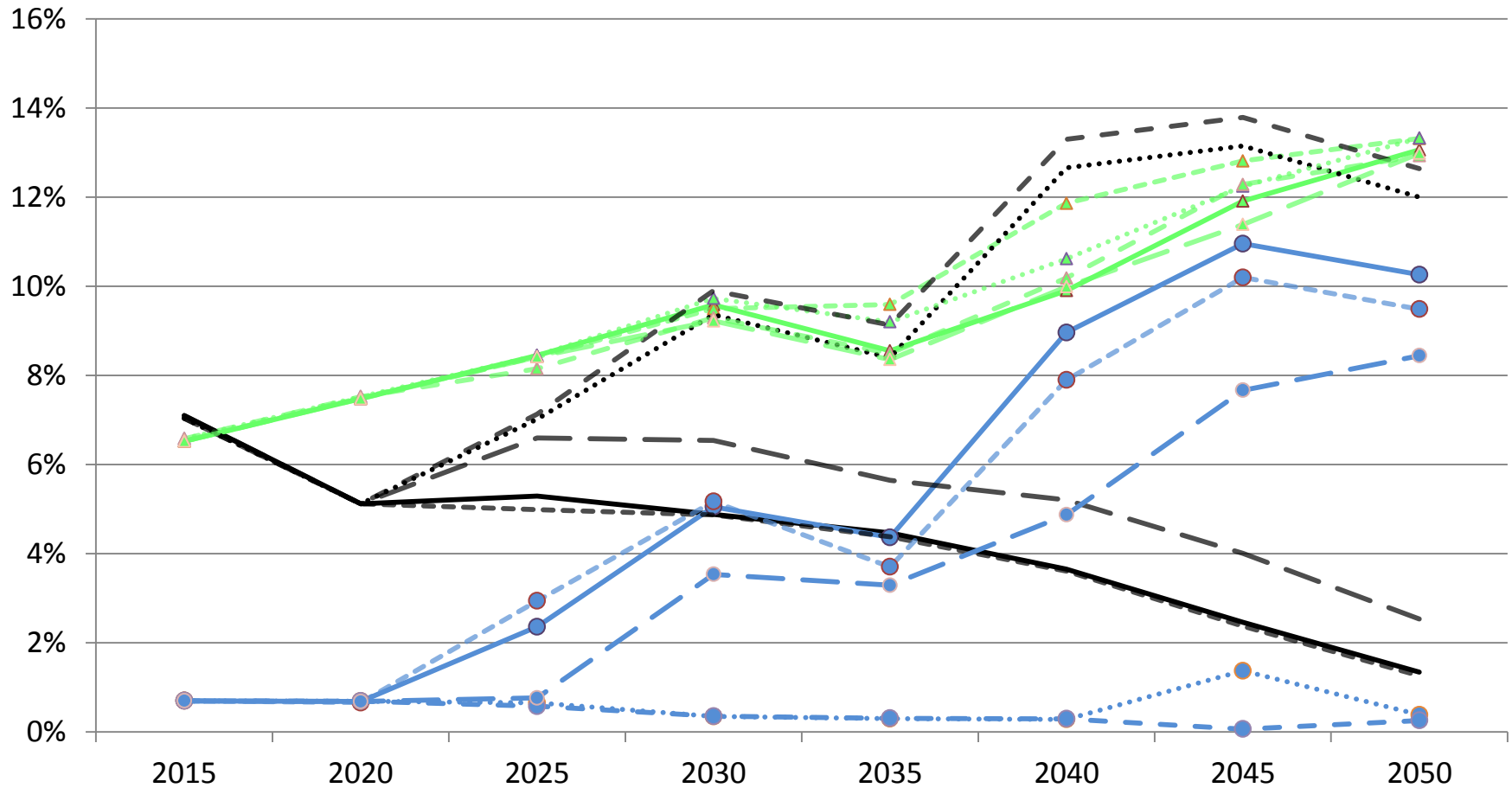
# Sensitivity analysis – share of electricity a)

## Nuclear, Brown coal, Water, Wind and PV



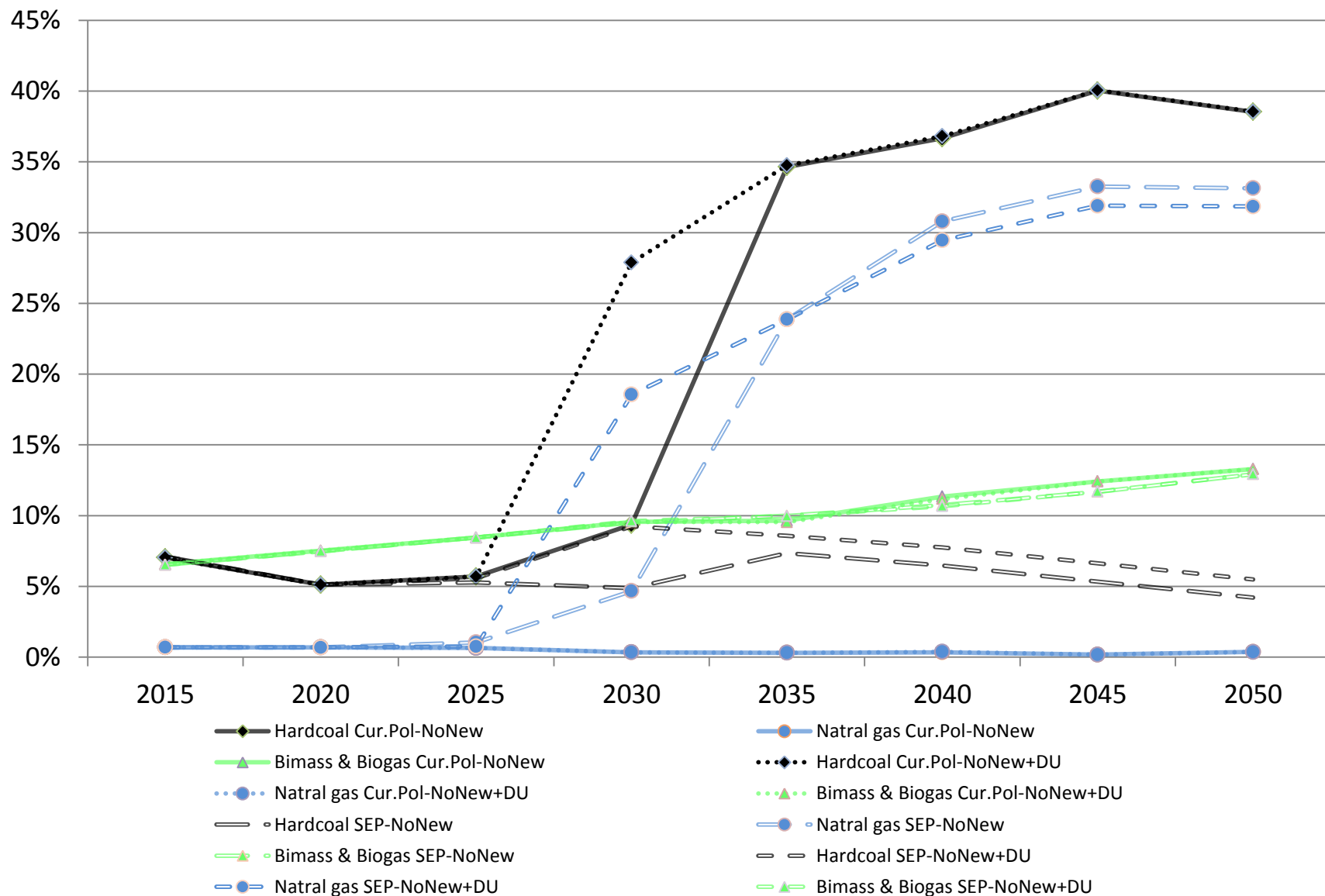
# Sensitivity analysis – share of electricity b)

## Nuclear as in SEP – Hard coal, Nature gas and Biomass



# Sensitivity analysis – share of electricity c)

## No new Nuclear – Hard coal, Nature gas and Biomas



# Conclusions

- 'breaking' of the territorial ecological limits does not have significant affect of Czech energy system
  - If SEP assumptions are fullfilled
  - If higher installlation of RES is allowed - according to Czech RES chamber assumption
- Approximately 3 mil. t of brown coal would need to be imported in case of not 'breaking' of the territorial ecological limits
- RES are at least competetive with nuclear sources at EUA price at 40€
- Sensitivity analysis shows fuel switch btw Hard coal and Natural gas



# Planned extension of the model

- Disaggregate Steel and Iron industry on EU ETS plant level
- Elasticity of demand
- Load curve with higher time resolution - up to hourly profiles
  - Electricity storage
- Better regionalization of heat supply and demand