Environment Center
Charles University
in Prague

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

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Current and Future Challenges to Energy Security

Lukáš Rečka lukas.recka@czp.cuni.cz
Milan Ščasný

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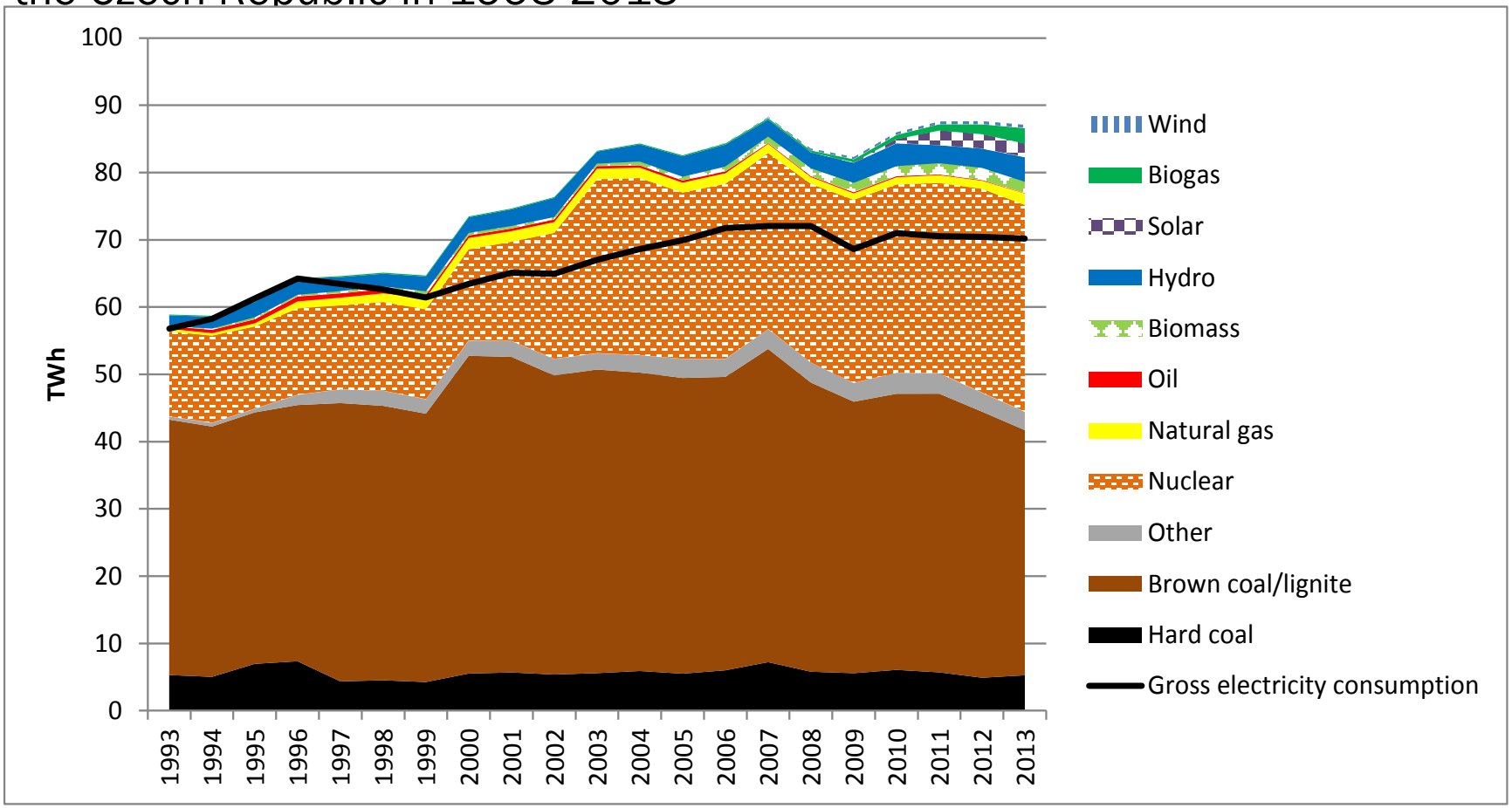
Motivation

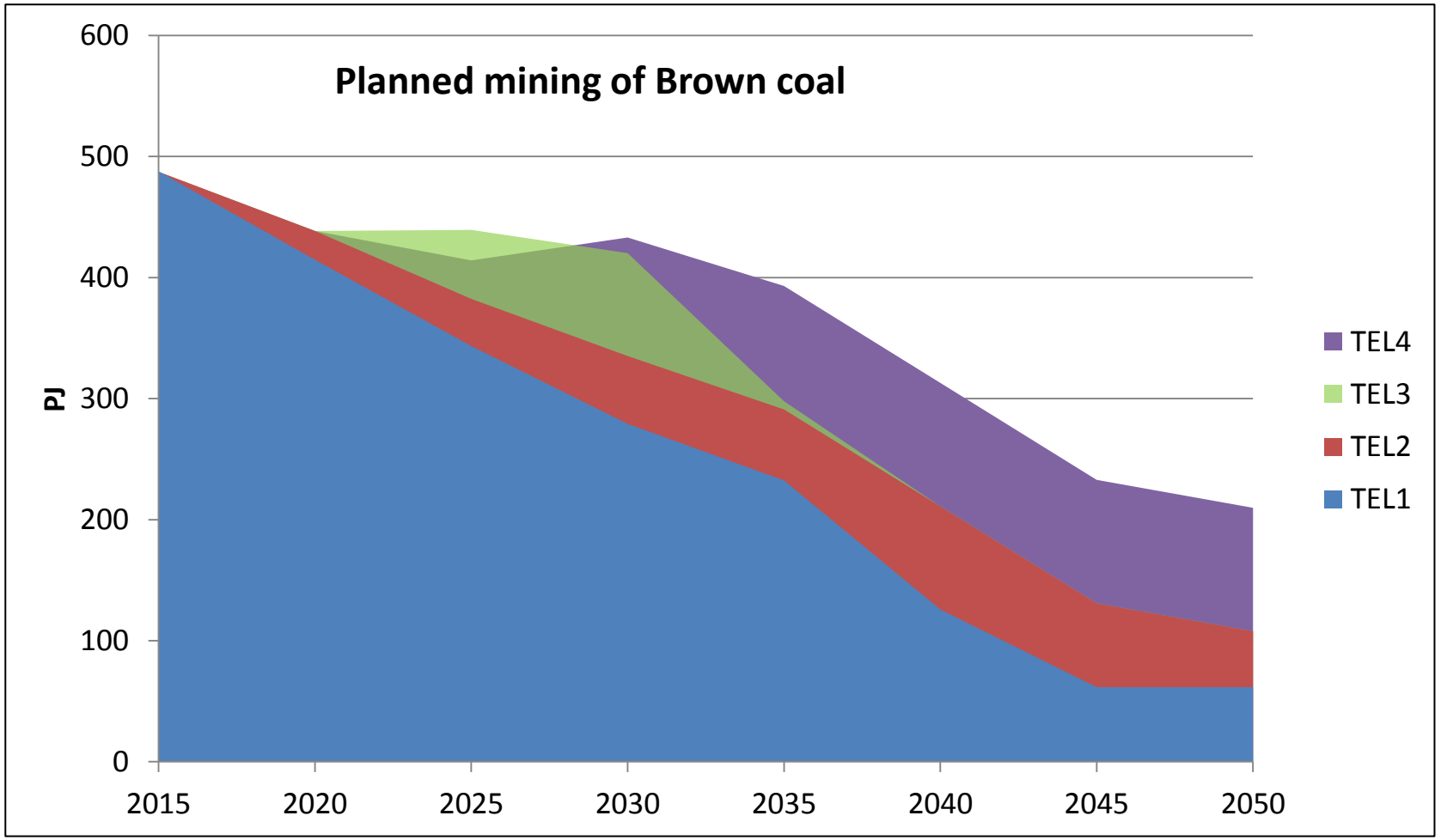
Gross electricity production by resource and gross electricity consumption in the Czech Republic in 1993-2013



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)



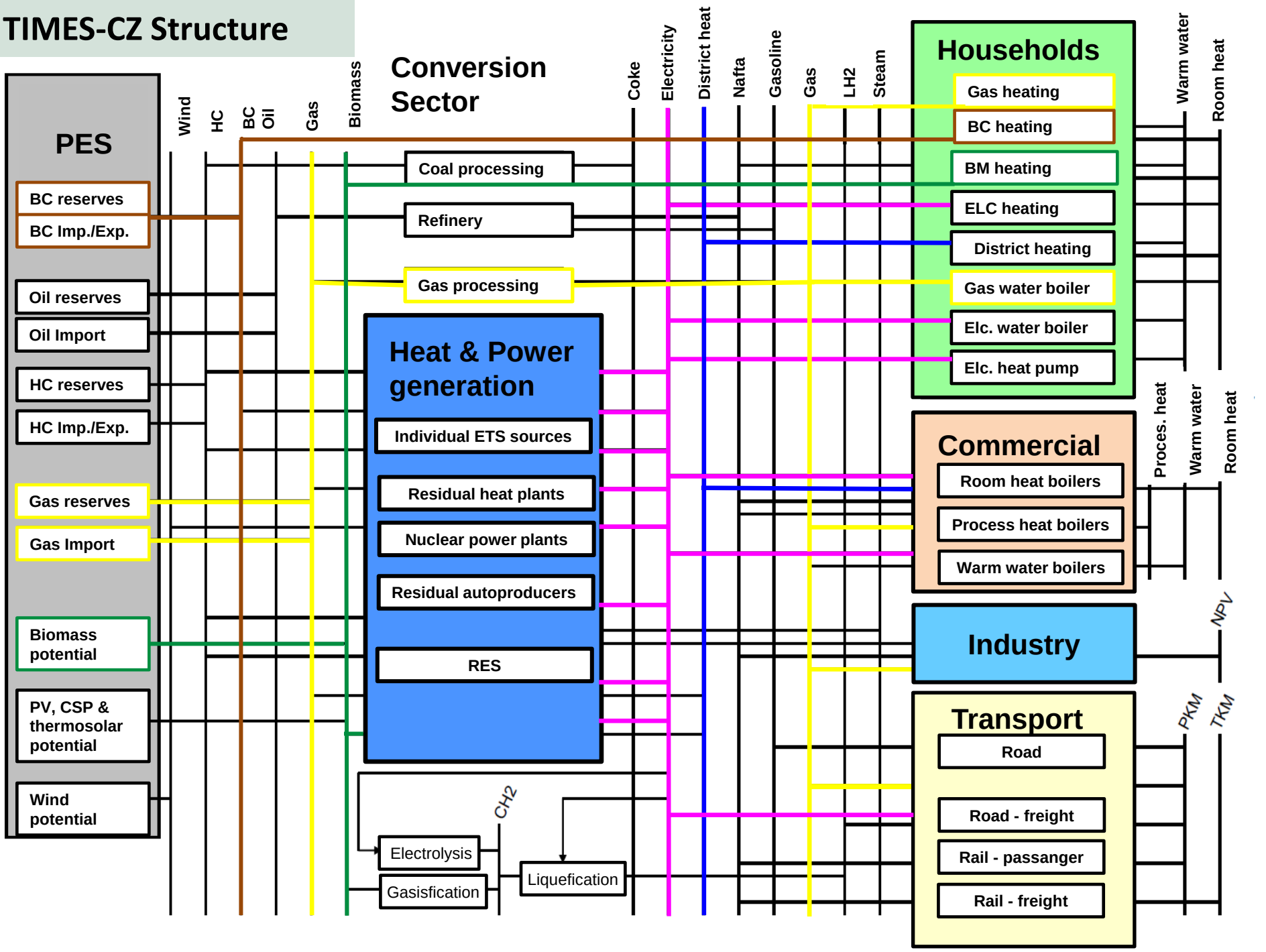
Source: Ščasný et al., (2015)

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 disagreated 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

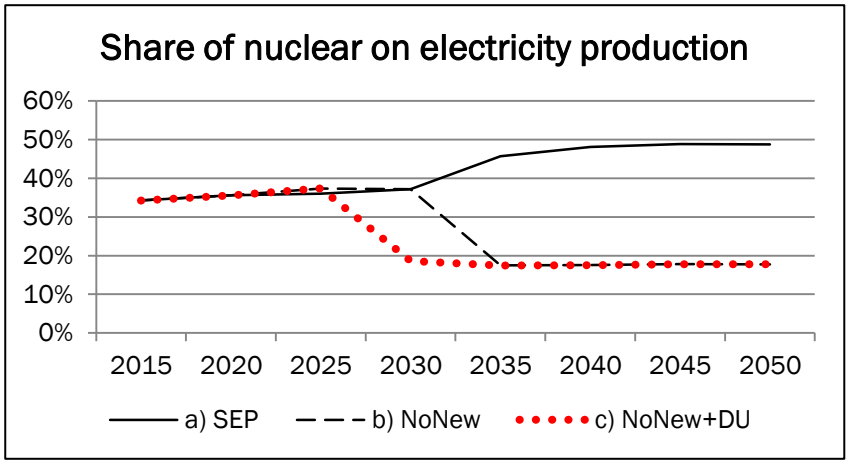
TIMES-CZ Structure

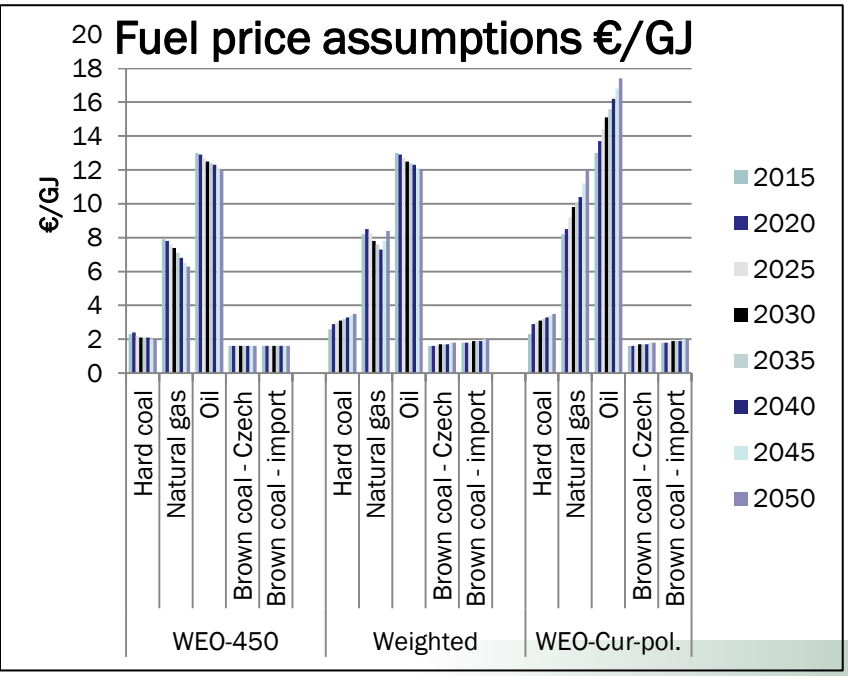


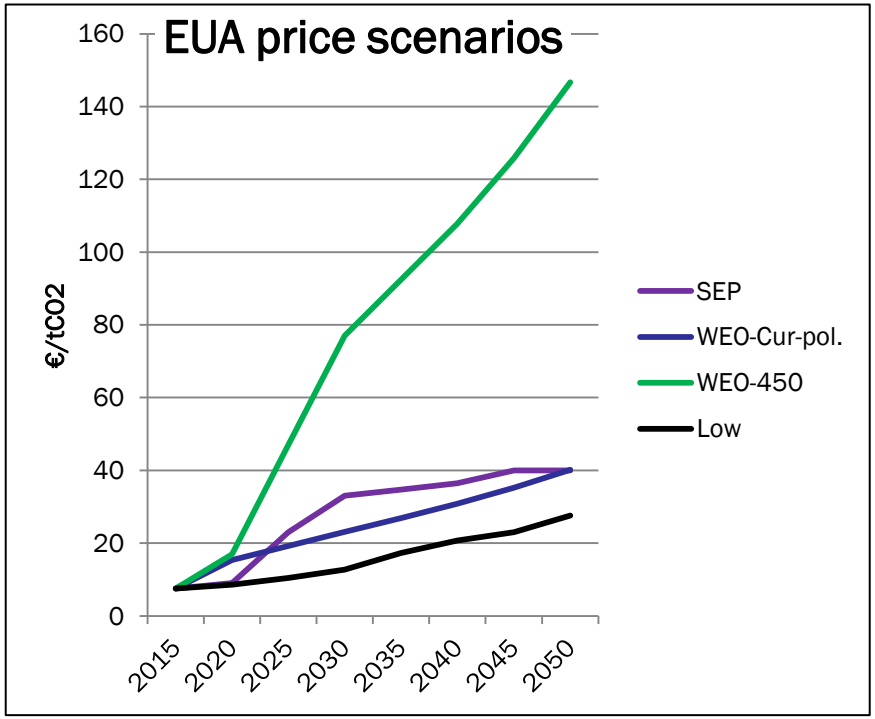
Scenarios assumptions

1) 4 variants of TEL
2) 3 Nuclear development pathways

3) 3 set of fuel price development
4) 4 EUA price scenarios







Scenarios

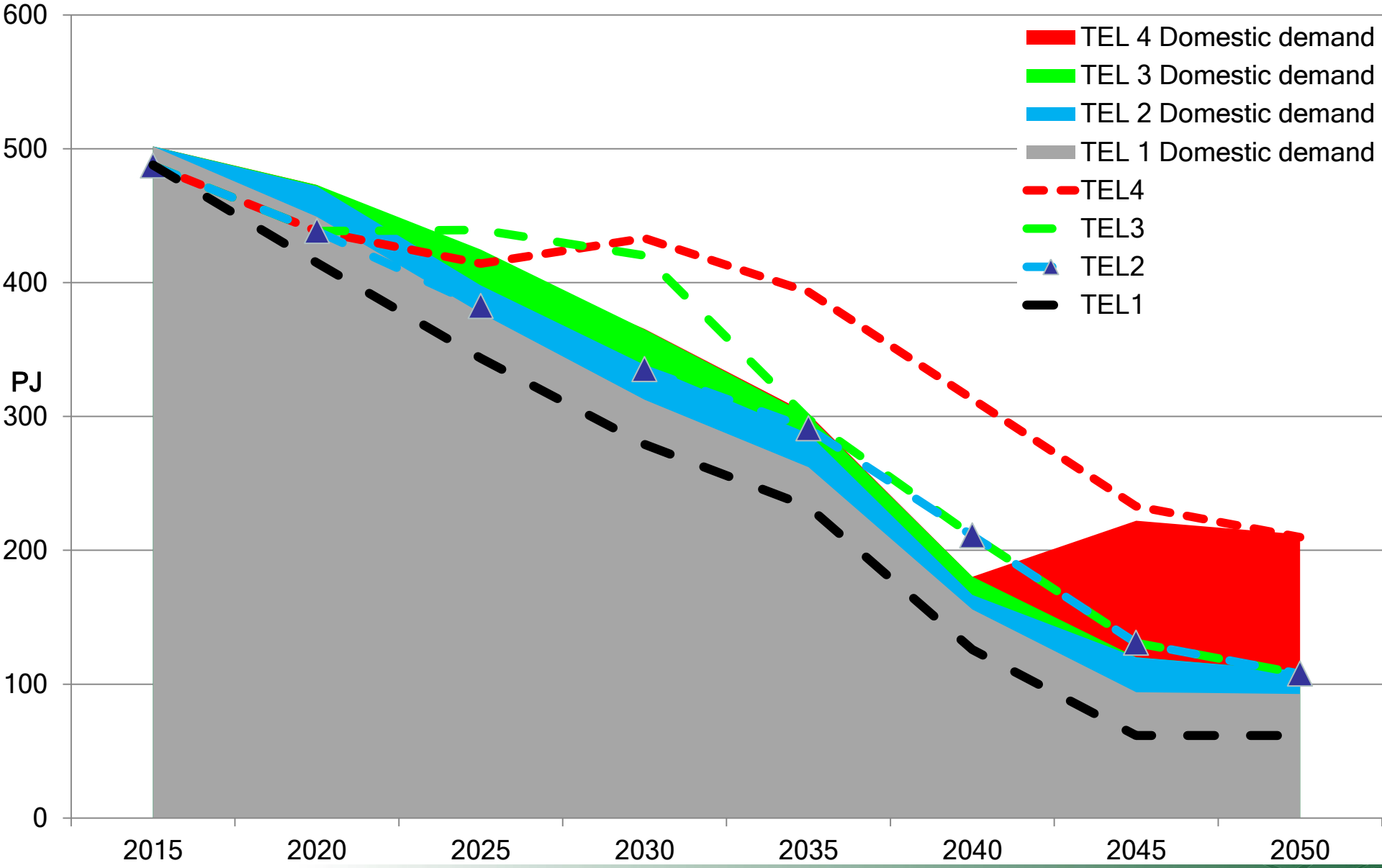
- 36 scenarios analized
  - 9 for each of 4 TEL variants

	Parameter/ Assumption set	BL	BL-N	BL-N+D	CP	CP-N	CP-N+D	EUAlow-Faver	EUAlow-Fhigh	450ppm
Fossil fuel price	WEO-450 (low)									X
	Weighted (middle)	X	X	X				X		
	WEO-CP (high)				X	X	X		X	
EUA price	SEP	X	X	X						
	WEO-Cur-pol				X	X	X			
	WEO-450									X
	Low							X	X	
Nuclear power	SEP	X			X			X	X	X
	NoNew		X			X				
	NoNew+DU			X			X			

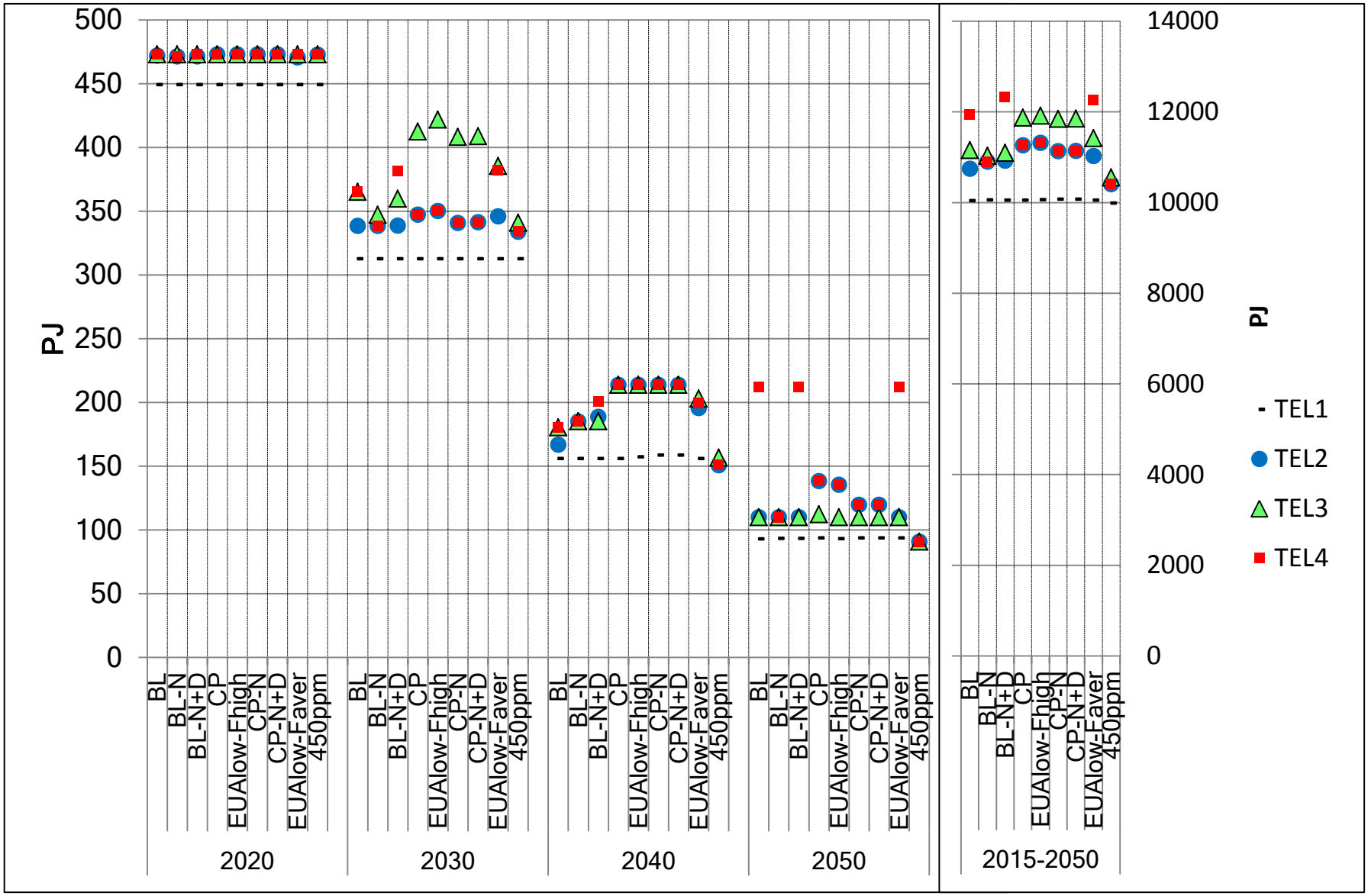
Results – sensitivity analysis

- **Brown coal**
  - Basiseline assumption set – 4 TEL variants: consumption and mining
  - SA: Brown coal consumption in all 36 scenarios
- **Power generation porfolio**
  - TEL 1 three baseline assumption set with diffeternt nuclear pathways
  - Difference in electricity production shares in TEL2's scenarios compared to TEL1 BL
- **GHGs emissions**
  - Basiseline assumption set – 4 TEL variants
  - Cumulative GHG emission in all 36 scenarios
- **Costs**
  - Undiscounted costs in milestone years of TEL1 BL
  - difference of TEL2 assumption sets compared with scenario TEL1 BL
- **Externalities**

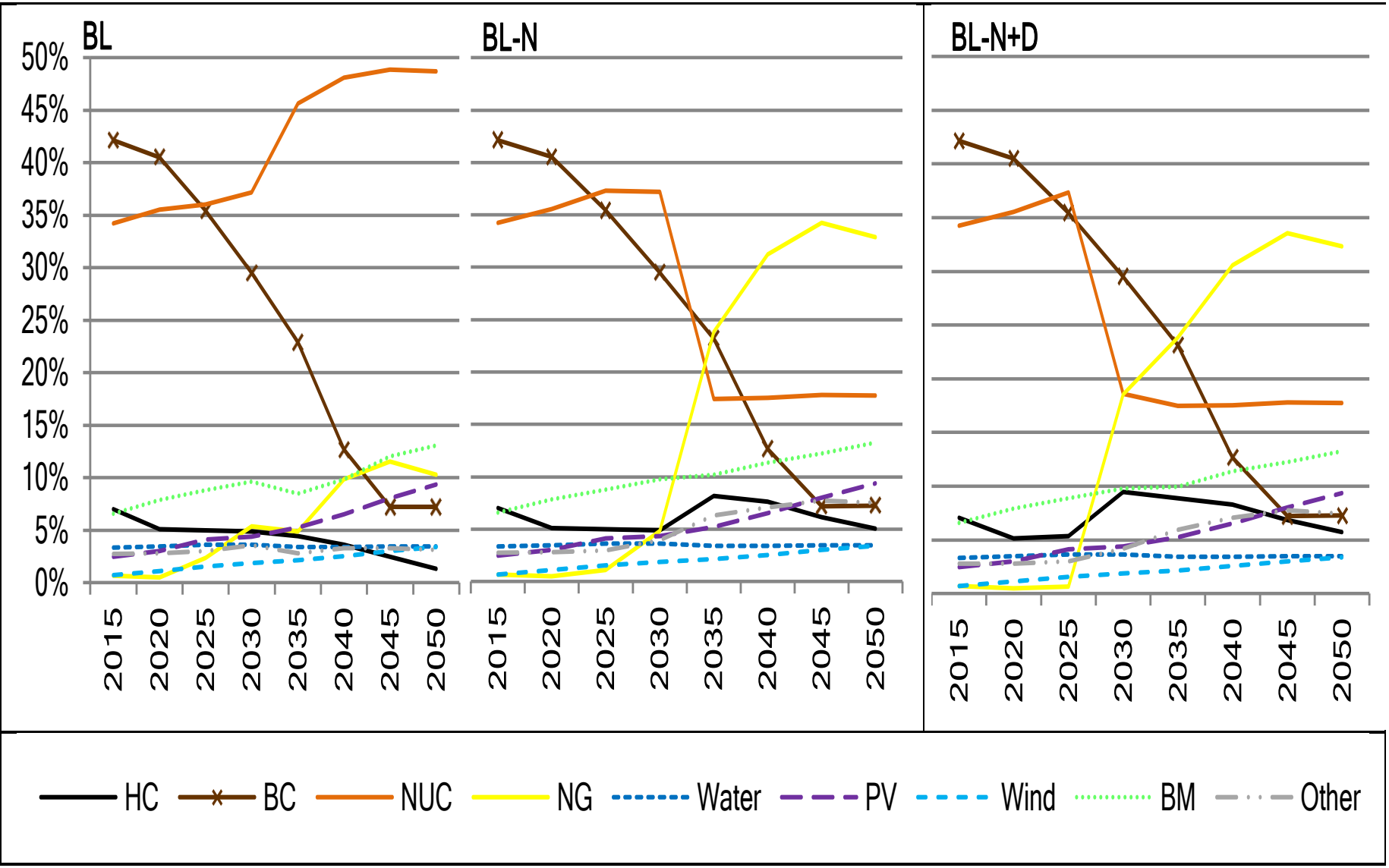
BL: Brown coal consumption & mining



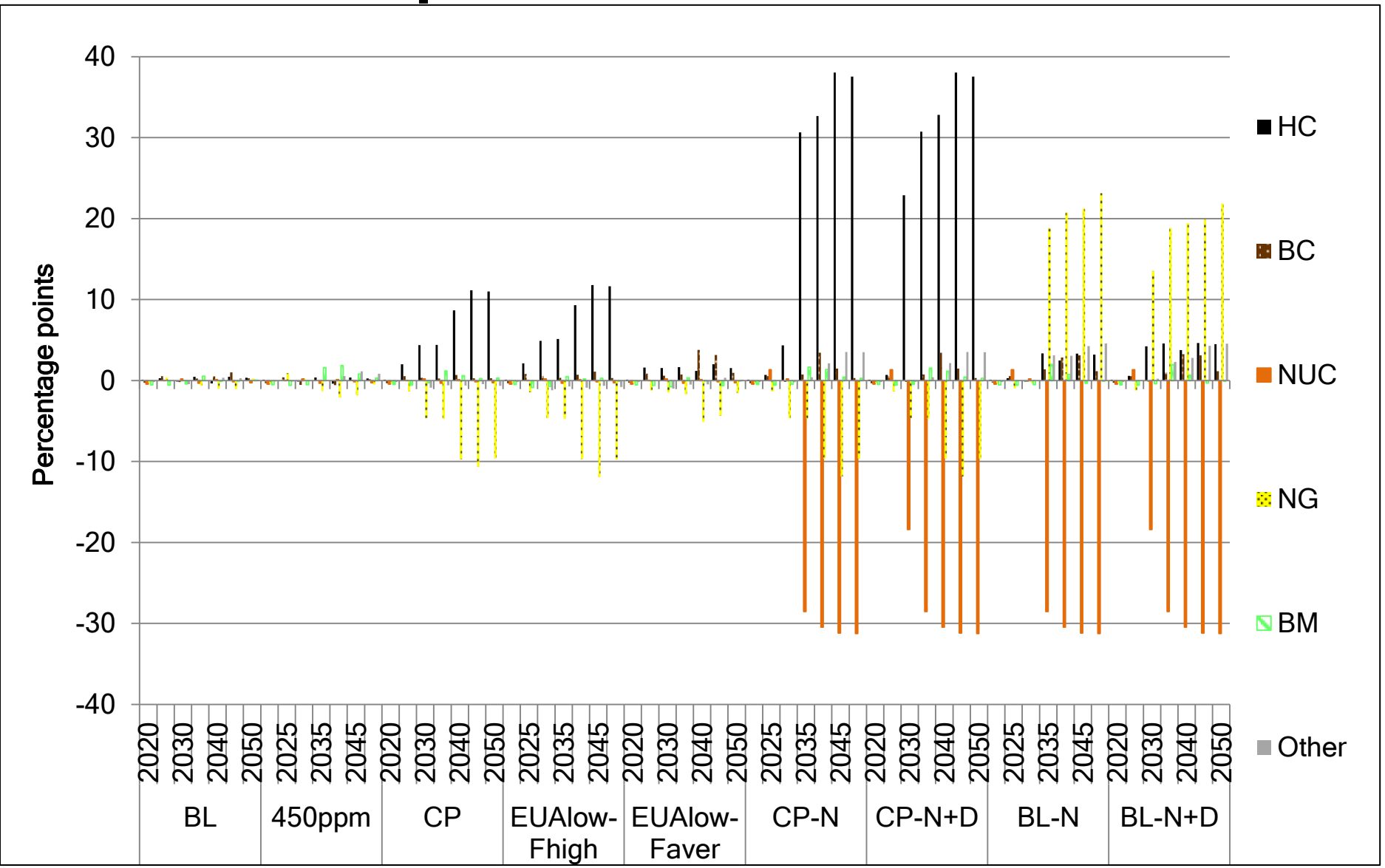
BC consumption in milestone years and cumulative 2015-2050



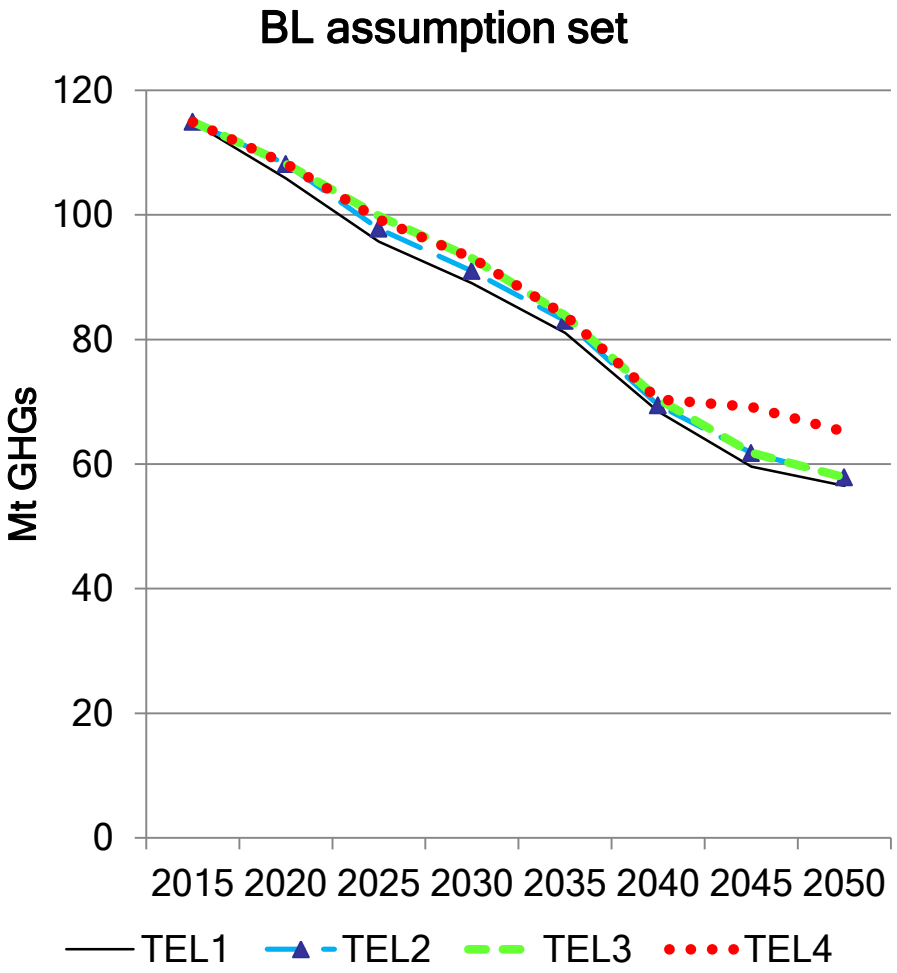
Power generation porfolio TEL 1 BL, BL-N, BL-N+D

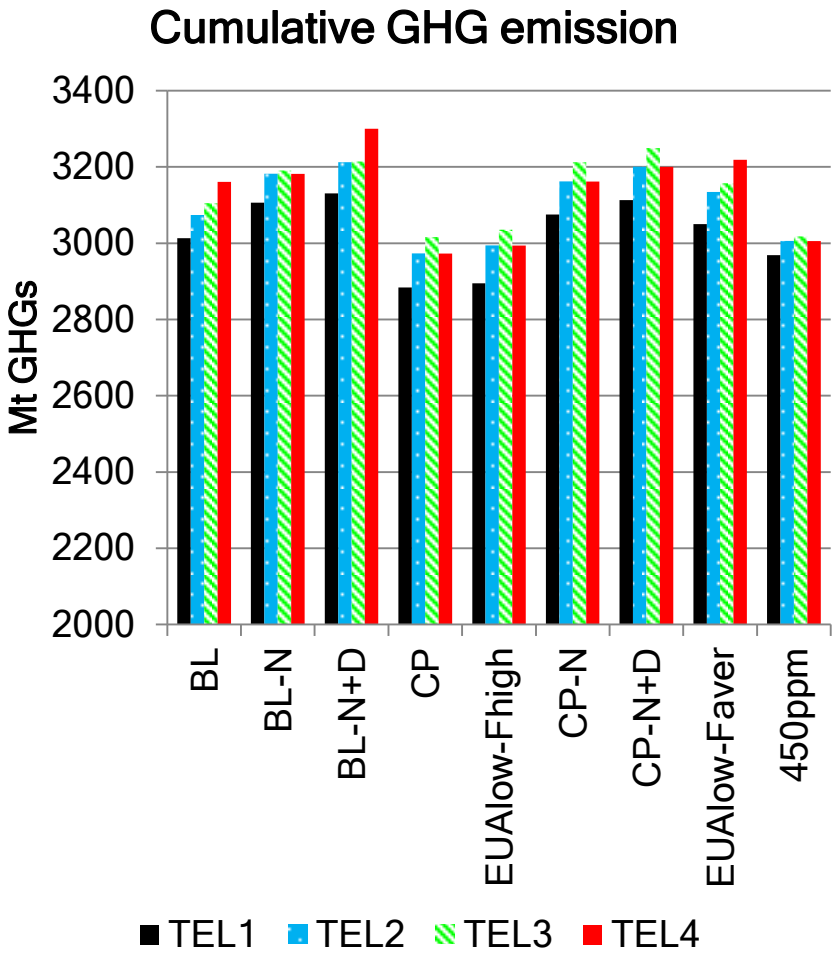


Difference in power generation in TEL2's scenarios compared to TEL1 BL

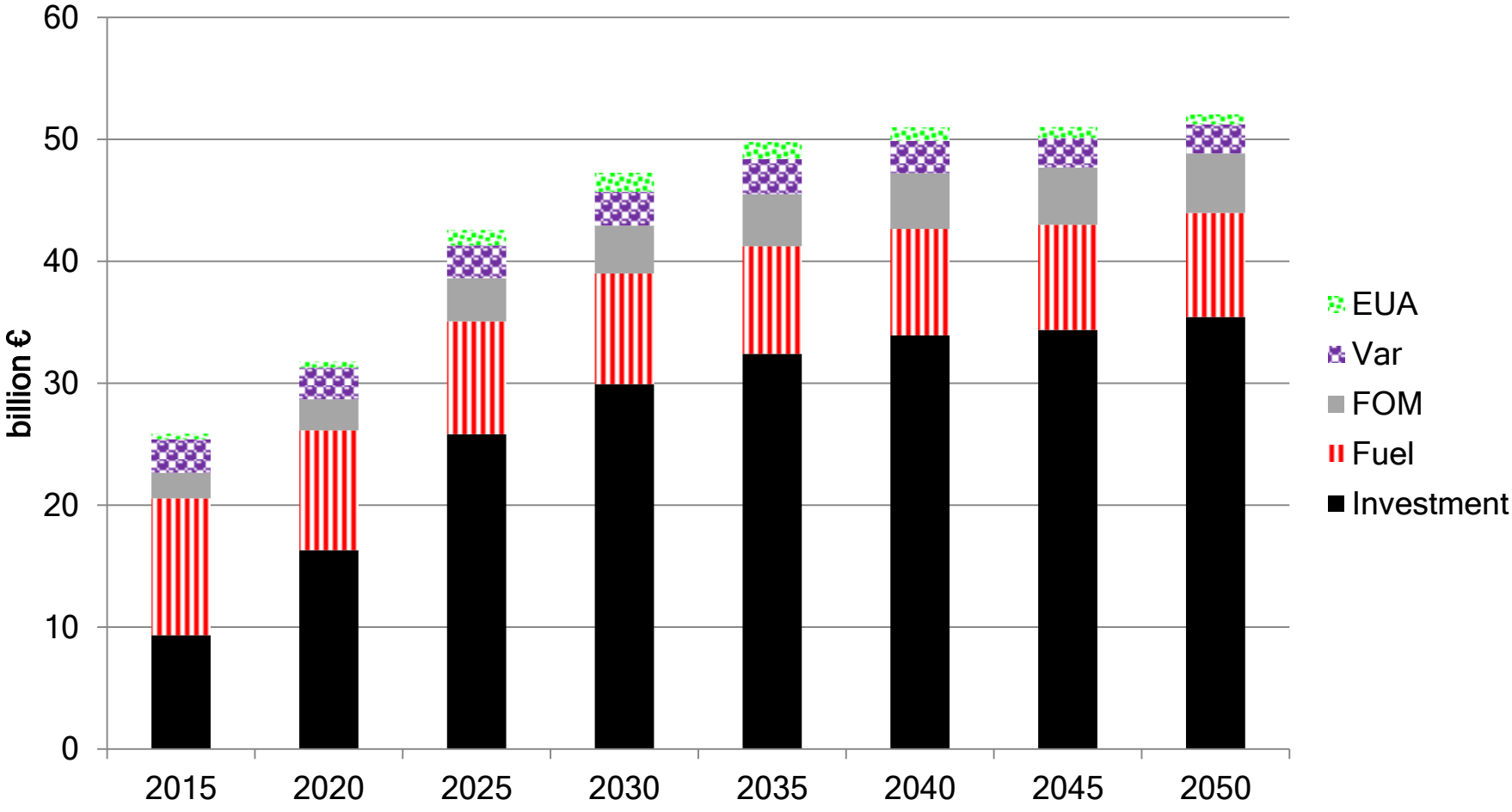


GHG emission

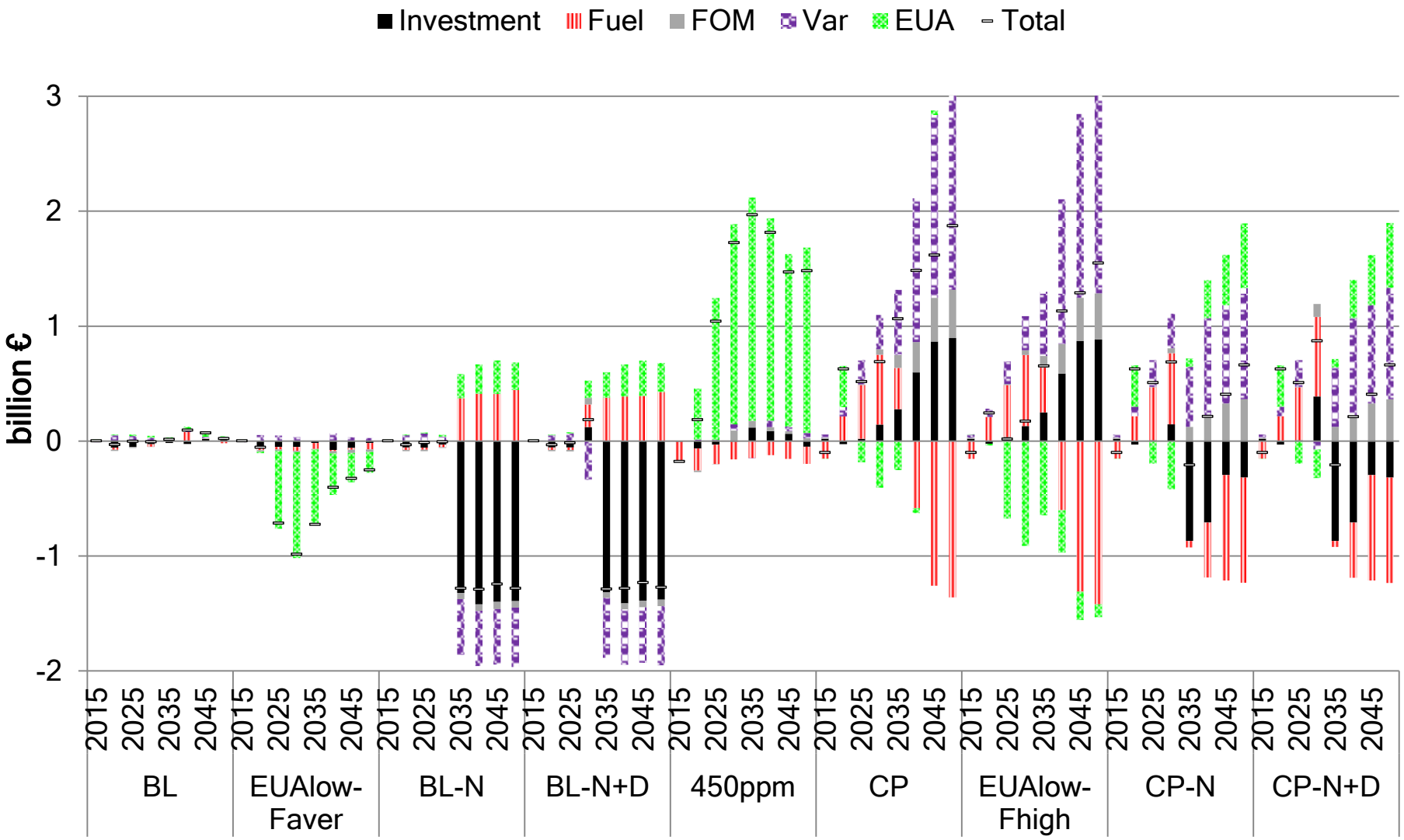




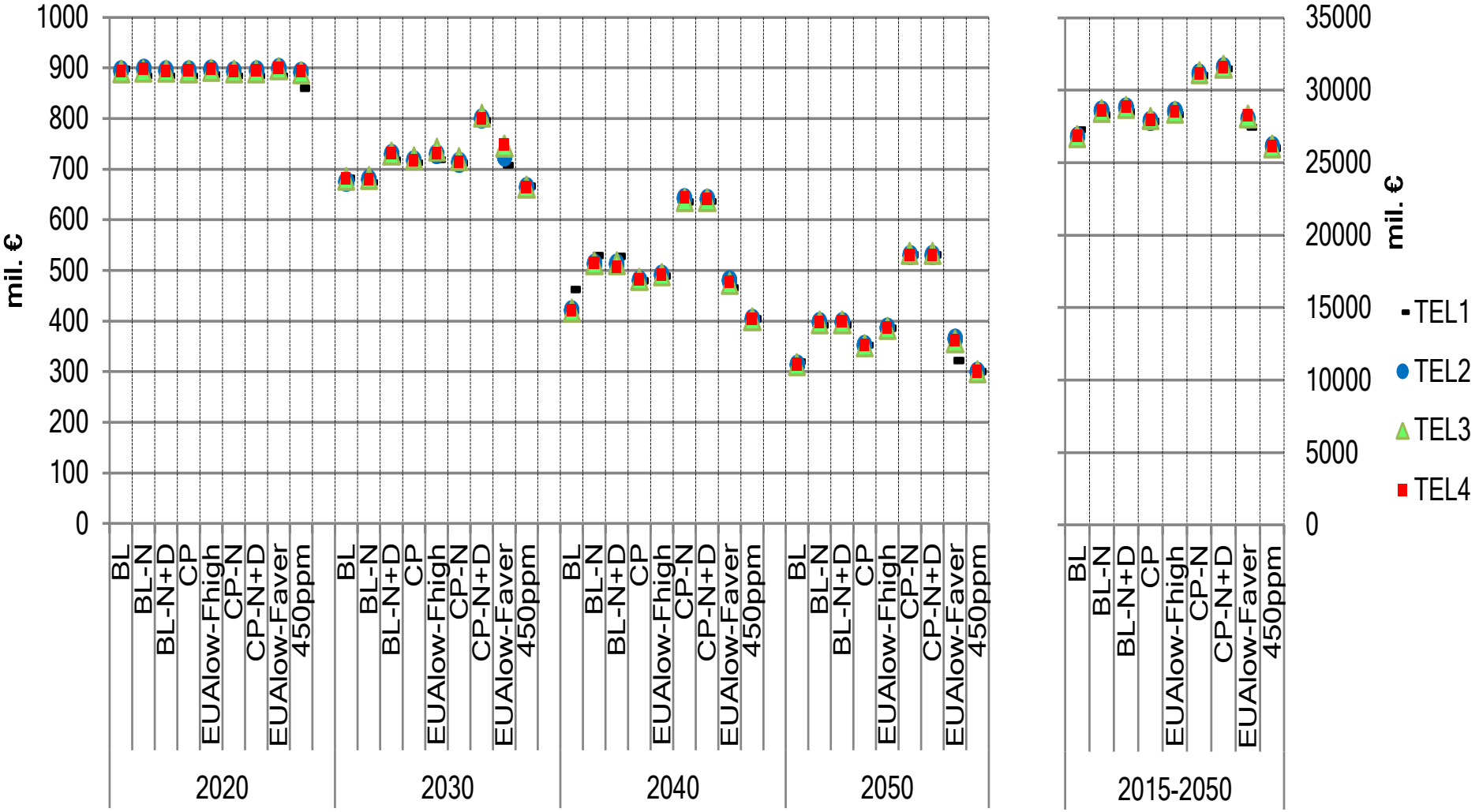
Undiscounted costs of the whole energy system (including traffic and other) in TEL1 under BL assumption set (billion €2012)



Undiscounted costs difference of TEL2 assumption sets compared with scenario TEL1 BL



Externalities from district heat and power generation in selected years and cumulative



Conclusions

- ‘breaking’ of the territorial ecological limits does not have significant affect of Czech energy system under most of assumption sets
- Fuel and EUA prices have higher impacts on Czech energy systém than availability of bronw coal
- 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

Thank you for your attention and comments!

Acknowledgement

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