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

69TH SEMI-ANNUAL ETSAP MEETING

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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)

Source: Eurostat
TIMES-CZ

Model of the **Czech Energy System** including the **whole energy balance**

- 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
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 assuption on Nuclear

3) + Relax assuption on RES
   • RES potentials increased according to RES Chamber

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1) Results – Brown coal consumption & mining

The graph illustrates the projected consumption and mining of brown coal, categorized by different TELs (TEL 1, TEL 2, TEL 3, TEL 4) from 2015 to 2050. The data indicates a significant decrease in coal consumption over the years, with TEL 3 & 4 Domestic demand showing the most significant reduction. The graph uses a logarithmic scale on the y-axis to represent the decreasing trend more accurately.
1) Results – Electricity production by source

![Graph showing electricity production by source from 2015 to 2050 for TEL 1 to TEL 4. The x-axis represents years from 2015 to 2050, and the y-axis represents GWh. The graph uses different colors to indicate the contribution of nuclear, renewable energy sources (RES), gas, brown coal, hard coal, and other sources to the total electricity production.]
2) Results – Electricity production by source

The graph illustrates the electricity production by source for different scenarios from 2015 to 2050. The sources included are Nuclear, RES, Gas, Brown coal, Hard coal, and Other. Each vertical bar represents a specific year, with different segments indicating the contribution of each source. The bar lengths are proportional to the amount of electricity produced, with values ranging from 0 to 100,000 GWh.
3) Results – Electricity production by source

![Graph showing electricity production by source from 2015 to 2050 for TEL 1 to TEL 4. The graph compares nuclear, RES, gas, brown coal, hard coal, and other sources.](image-url)
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

- Nuclear, Brown coal, Water, Wind and PV
- Nuclear as SEP
- Nuclear - no new PP
- Nuclear - phase out Dukovany 2027
- Lignite SEP
- Water
- Wind
- PV
- Lignite WEO-450
- Lignite WEO-Cur.Policy
- Lignite Cur.Policy-low
- Lignite EUA-low
- Lignite Cur.Pol-NoNew
- Lignite Cur.Pol-NoNew+DU
- Lignite SEP-NoNew
- Lignite SEP-NoNew+DU

Graph showing the share of electricity from different sources from 2015 to 2050.
Sensitivity analysis – share of electricity b)
Nuclear as in SEP – Hard coal, Nature gas and Biomass

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Sensitivity analysis – share of electricity c)
No new Nuclear – Hard coal, Nature gas and Biomas

- Hardcoal Cur.Pol-NoNew
- Bimass & Biogas Cur.Pol-NoNew
- Natral gas Cur.Pol-NoNew+DU
- Hardcoal SEP-NoNew
- Bimass & Biogas SEP-NoNew
- Natral gas SEP-NoNew+DU
- Hardcoal Cur.Pol-NoNew+DU
- Bimass & Biogas Cur.Pol-NoNew+DU
- Natral gas SEP-NoNew+DU
- Hardcoal SEP-NoNew+DU
- Bimass & Biogas SEP-NoNew+DU
Conclusions

• ‘breaking’ of the territorial ecological limits does not have significant affect of Czech energy system
  • If SEP assuptions are fullfilled
  • If higher installlation of RES is allowed - according to Czech RES chamber assuption
• 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 competitorve 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