Economic and environmental impacts of PEP2040

Forum Energii

About us

- Energy Forum is a think tank operating in the field of energy
- Our mission is to lay the foundations for effective, safe, clean and innovative energy sector based on data and analysis

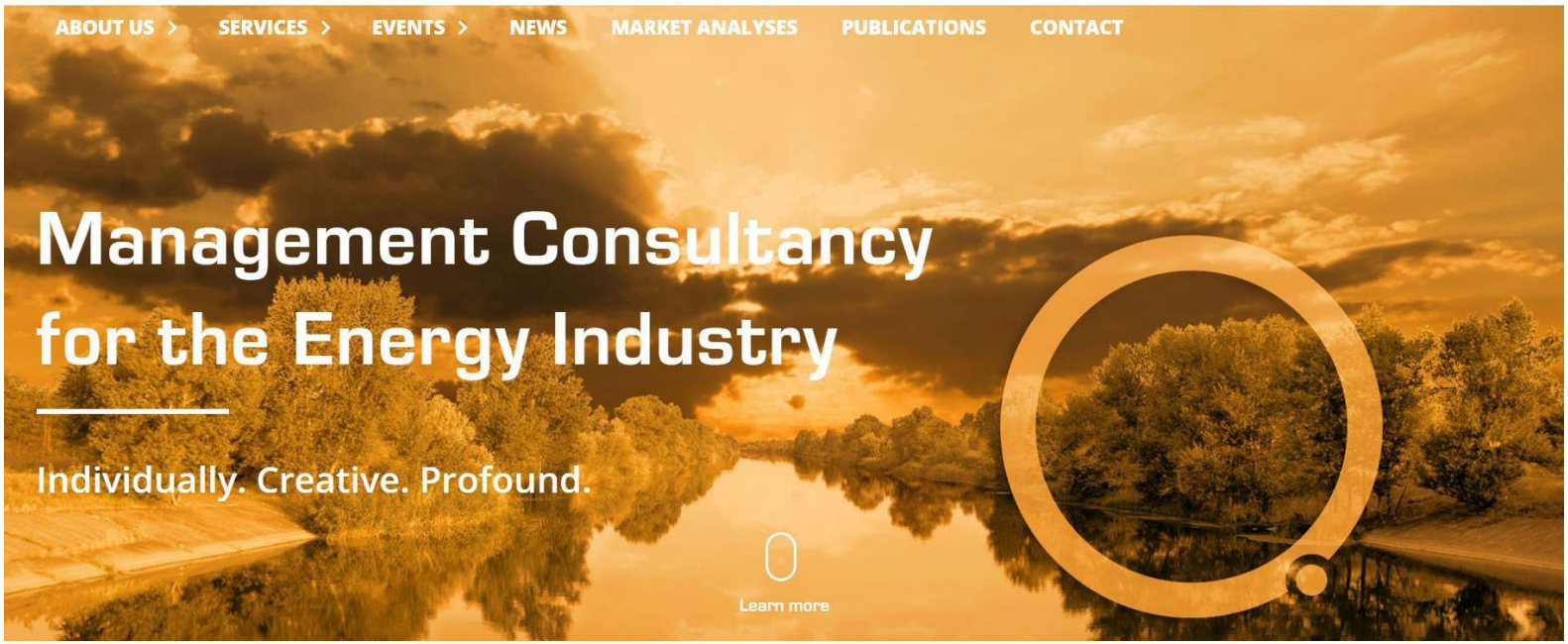
Strategic orientations

- Reliability of Poland's power system
- Reducing the environmental impact of the energy sector
- Energy efficiency and the role of a consumer

Purpose of the analysis

- Assessment of economic and environmental impacts of the scenario PEP 2040 (ME)
- Analysis and presentation of an alternative scenario
  - Wholesale electricity prices
  - Energy generation costs
  - CO_2 and other emissions
  - Fuels

Cooperation



- Modelling and forecasting of the electricity market in Europe
- Electricity, gas, heat and CO_2 markets in Europe and worldwide
- Sectors: energy, transport, networks
- Consulting for energy and other companies

Working method

1) Analysis of the Ministry of Energy scenario – **PEP2040 (ME)**

2) Verification of the PEP2040 (ME) scenario – **PEP2040 (e)** is created

3) Development of assumptions for scenario assessment – fuel prices, CO_2, etc.

4) Development of an **"alternative scenario"**:
   - without nuclear
   - with a faster phase out of lignite
   - gas, wind and solar power plants selected with the use of cost optimization method

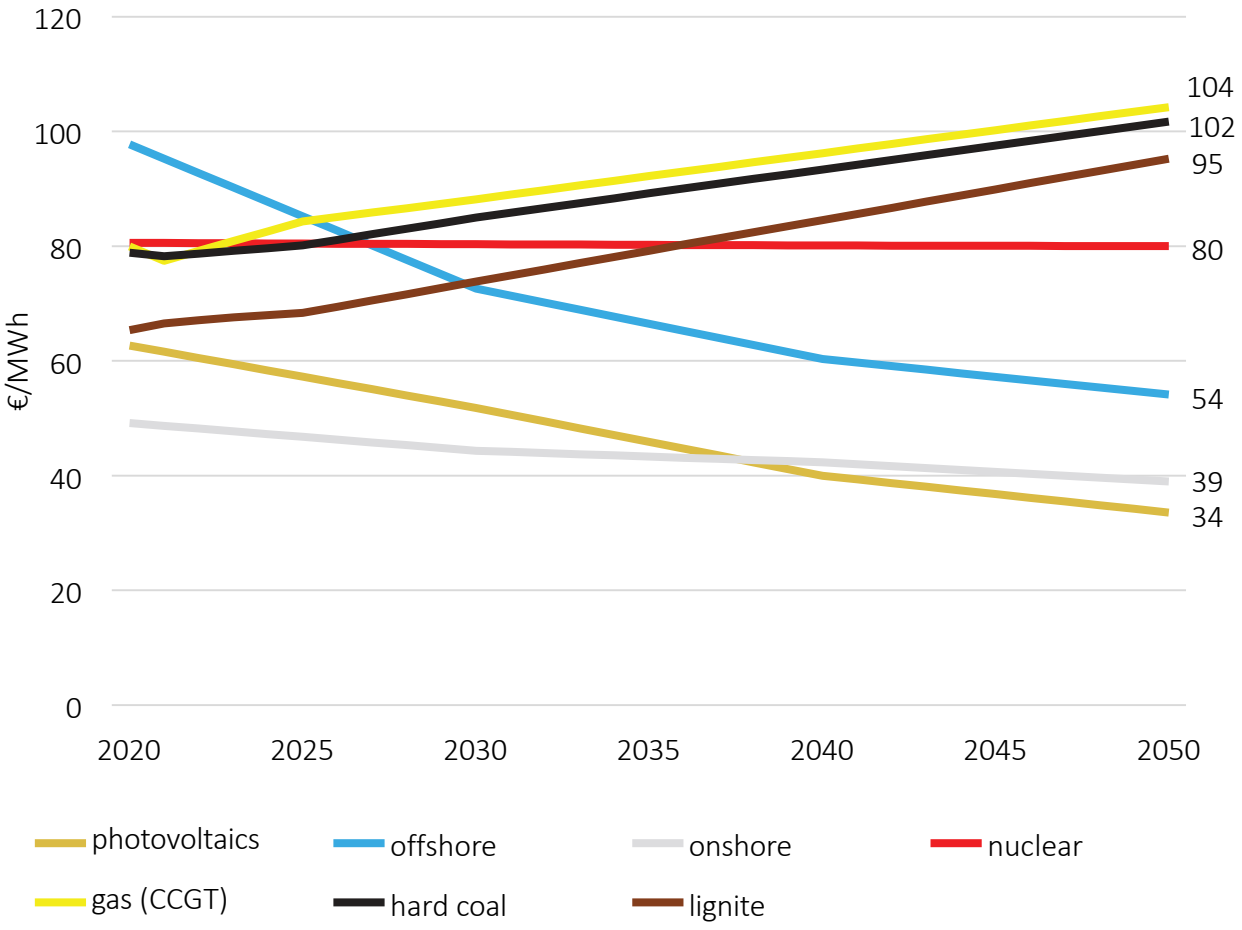
5) Economic dispatch modelling

Challenges:
- the Ministry of Energy scenario does not take into account cross-border exchanges
- a reference to the costs of network development
- nuclear dilemmas

Assumptions

Main model parameters	PEP2040	Alternative scenario
Prices of fuels and CO_2	Until 2021, futures contracts concluded in the fourth quarter of 2018; “New Policies” scenario IEA, WEO 2018.	
Nuclear power	Launch of the first unit in 2033; 7.5 GW in total after 2040	Without nuclear power
Lignite	Replacement of lignite with nuclear energy. To remain: • 2030: 7.5 GW • 2040: 1.5 GW	Phasing out of lignite in accordance with the expected depletion of exploited deposits. To remain: • 2030: 2 GW • 2040: 0.5 GW
Hard coal	Units currently under construction, maintenance of CHP at 6 GW, withdrawal of old units • 2030: 18.5 GW (3.7 GW currently under construction) • 2040: 12 GW	Units modernized and included in the capacity market • 2030: 13 GW • 2040: 7 GW • 2050: 4 GW (only units constructed after 2018)
Gas	• 2030: 6 GW • 2040: 10 GW	According to cost optimization, mainly CHP: • 2030: 16 GW • 2040: 20 GW
RES	In 2040: • PV 20 GW • Offshore 10 GW • No new investments in onshore; phase-out until 2045	In 2040: • PV 20 GW + cost optimization • Offshore 10 GW • Onshore 24 GW (cost optimization)
Demand for electricity	Average increase by 1.7%, i.e. up to 230 TWh in 2040 in accordance with the PEP2040 assumptions, among other things, due to the increase of GDP, e-mobility etc. adopted by the Ministry of Energy.	

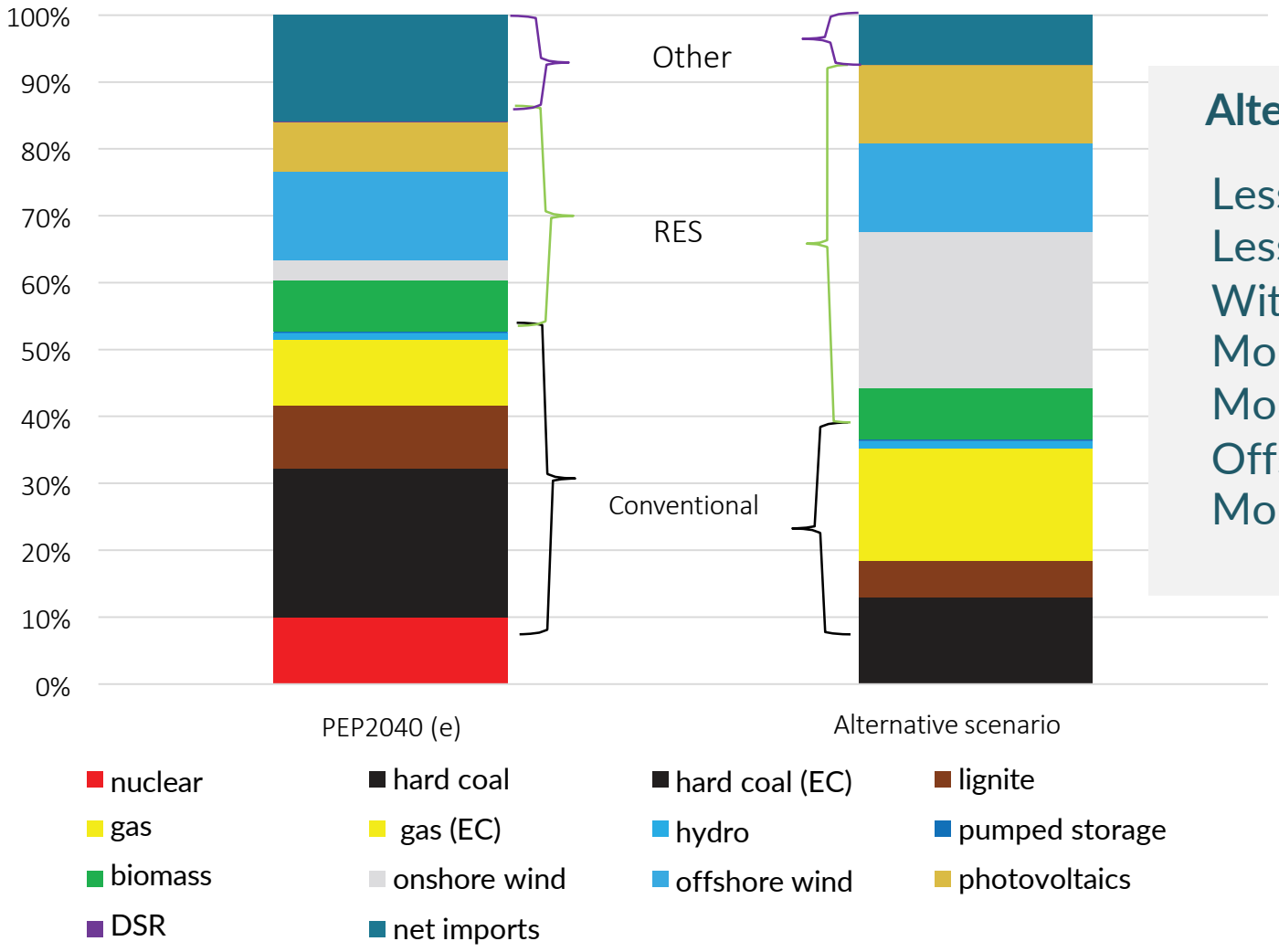
Technology costs – LCOE



Change in costs by 2050

PV	46% ↓
Offshore	45% ↓
Onshore	21% ↓
Nuclear	no change
Gas	↑ 30%
Hard coal	↑ 29%
Lignite	↑ 46%

Cumulative electricity production up to 2050



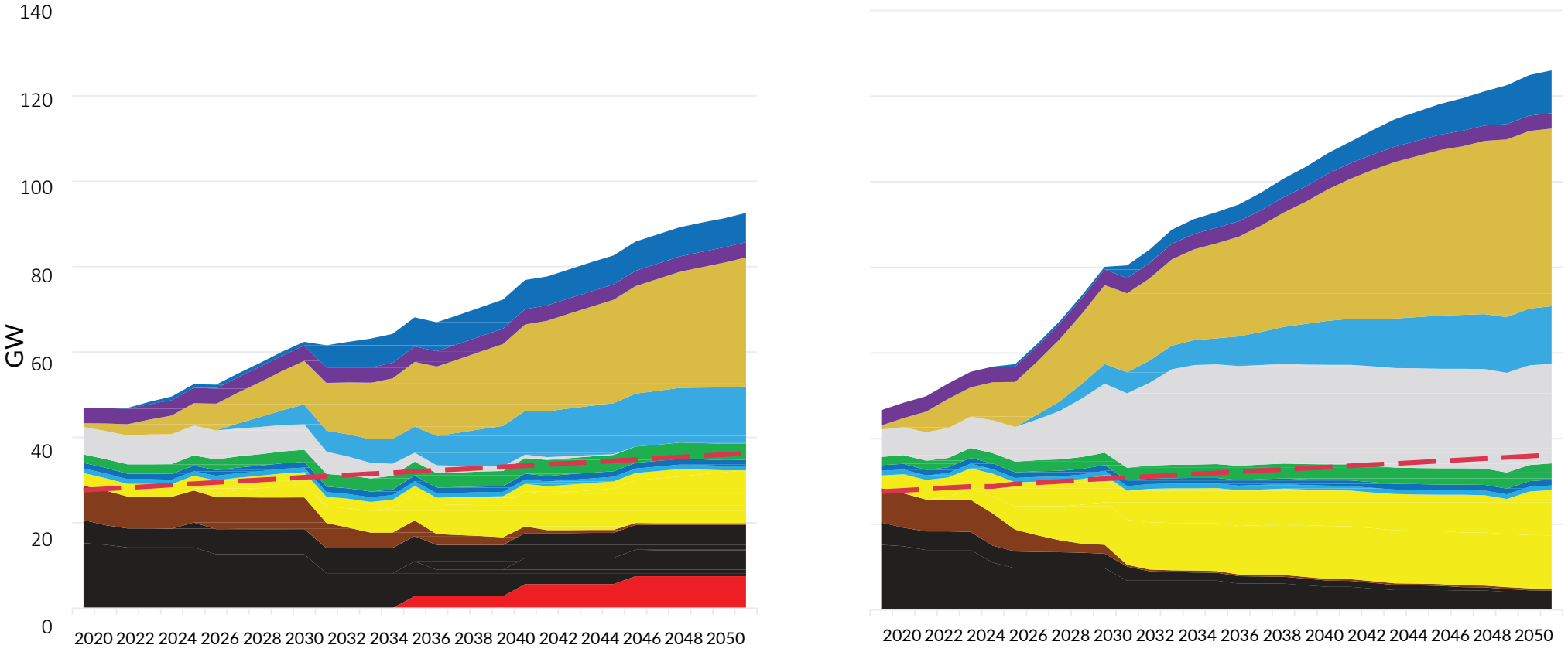
Alternative scenario

Less net imports	9% ↓
Less coal	8% ↓
Without nuclear	
More PV	↑ 6%
More wind	↑ 27%
Offshore same level	
More gas (due to CHP)	↑ 7%

Installed capacity

PEP2040 (e)

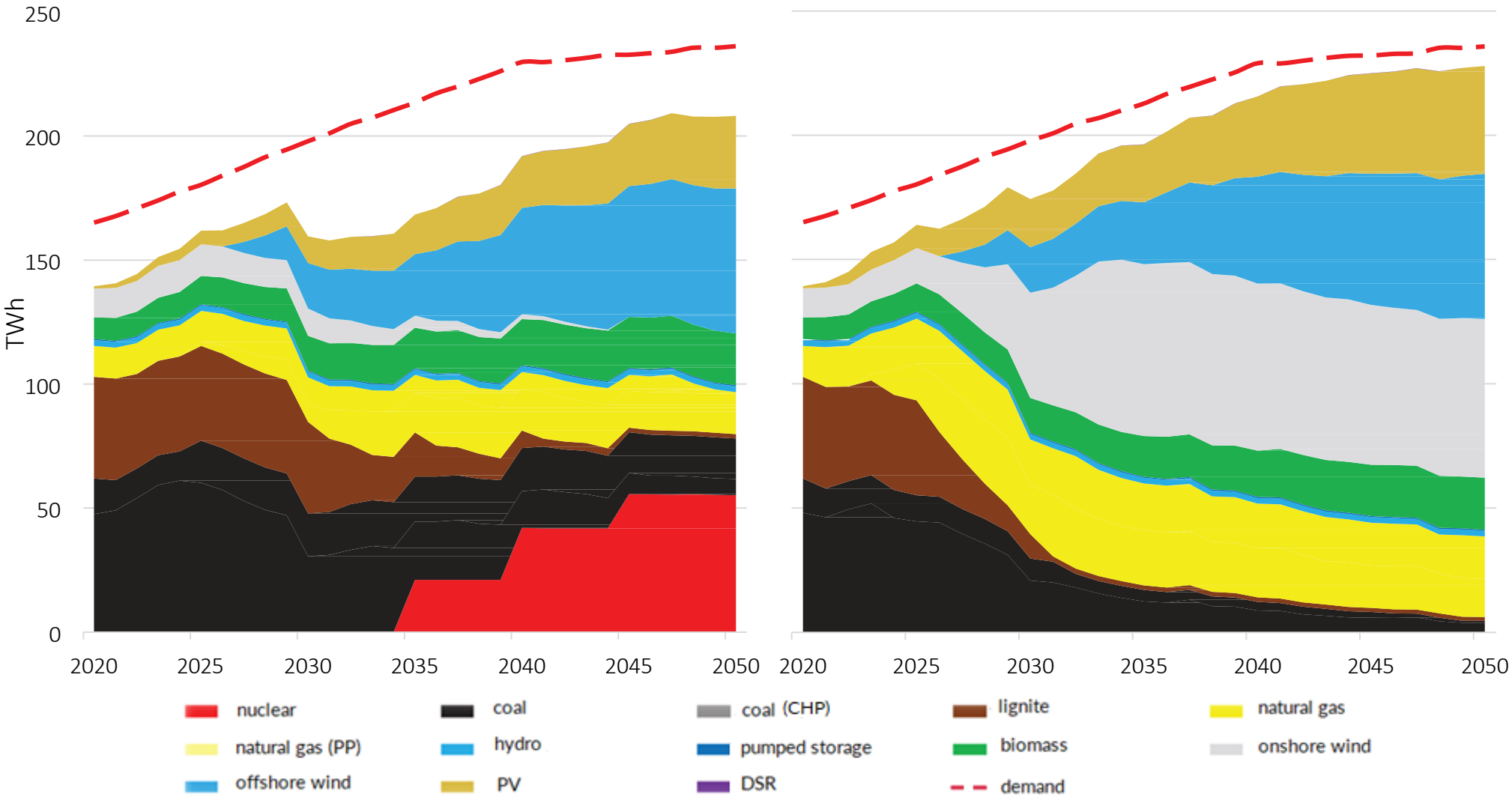
Alternative scenario



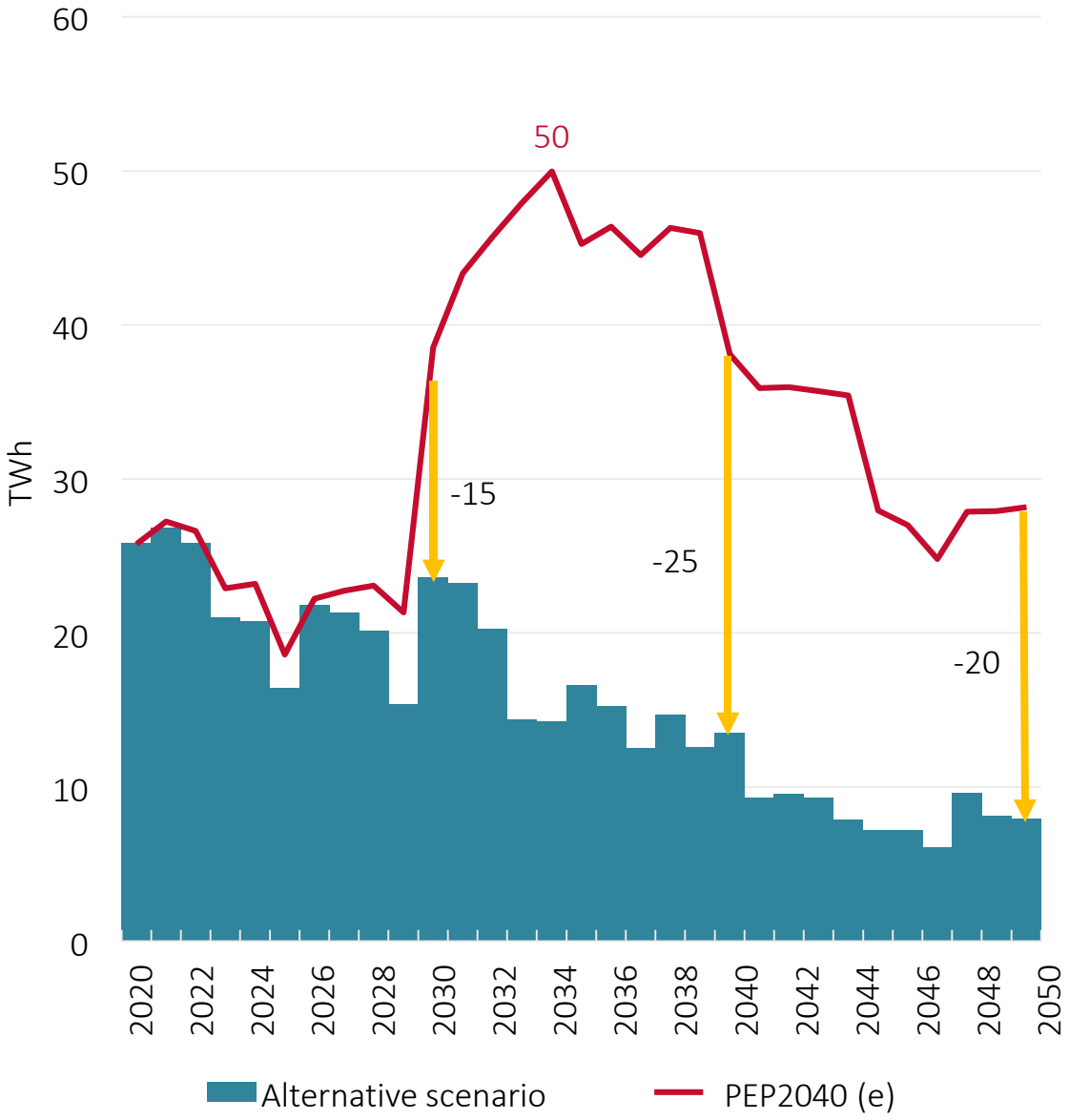
Production of electricity

PEP2040 (e)

Alternative scenario



Balance of electricity imports

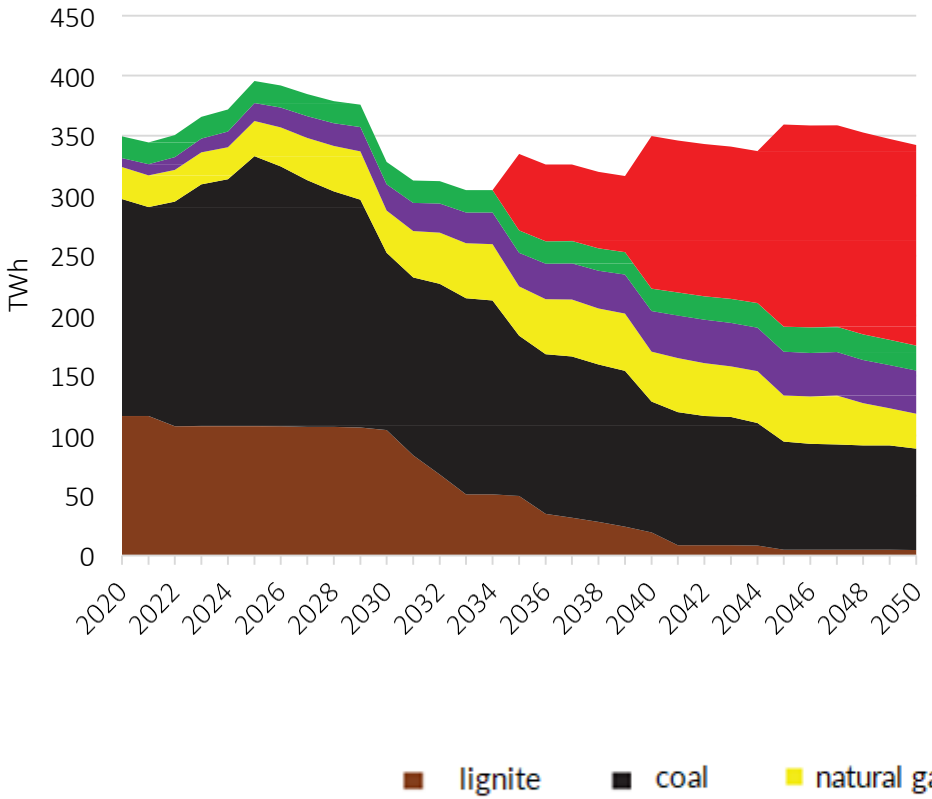


The alternative scenario allows for a 54% reduction in imports over the whole period.

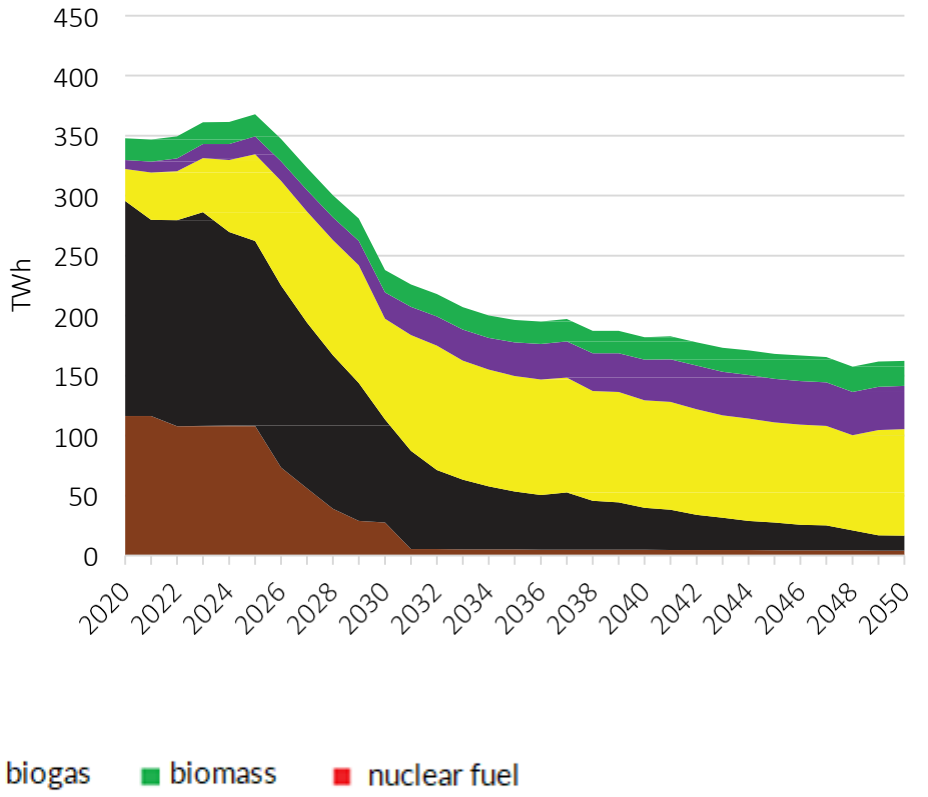
PEP2040 (e) scenario in the peak demand period requires approx. 50 TWh of imports.

Primary energy in fuels

PEP 2040 (e)

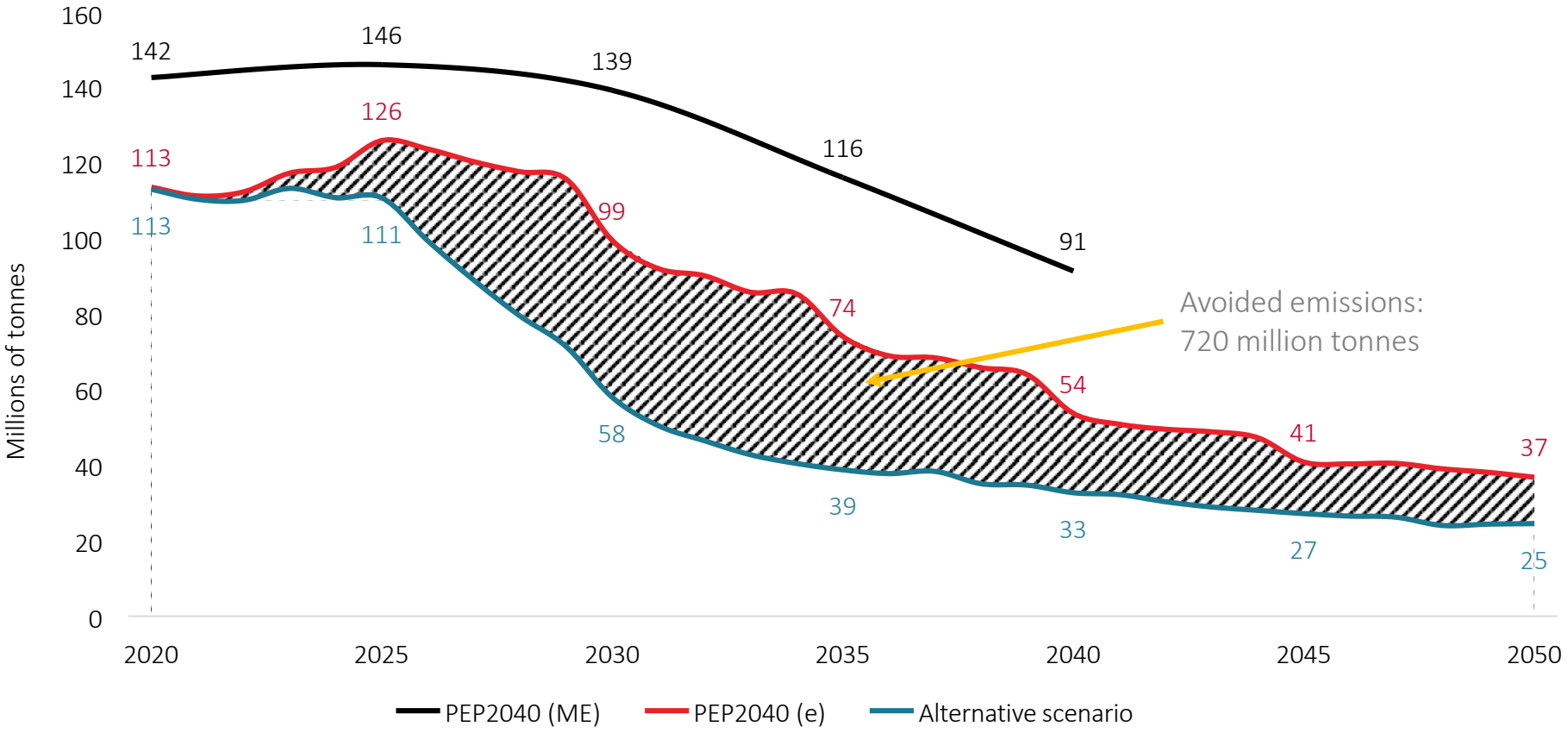


Alternative scenario



lignite coal natural gas biogas biomass nuclear fuel

CO_2 emissions

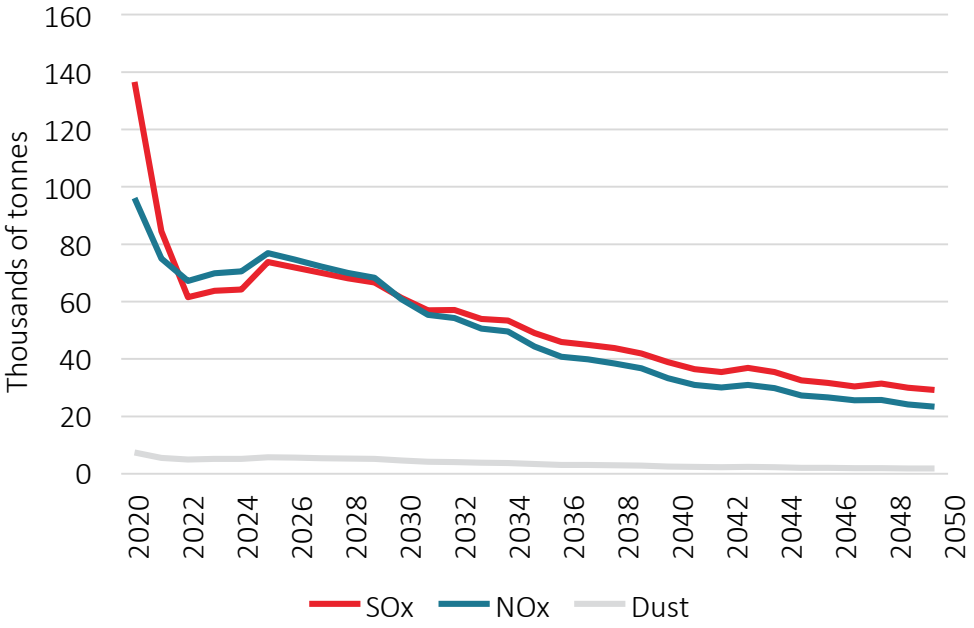


Alternative scenario:

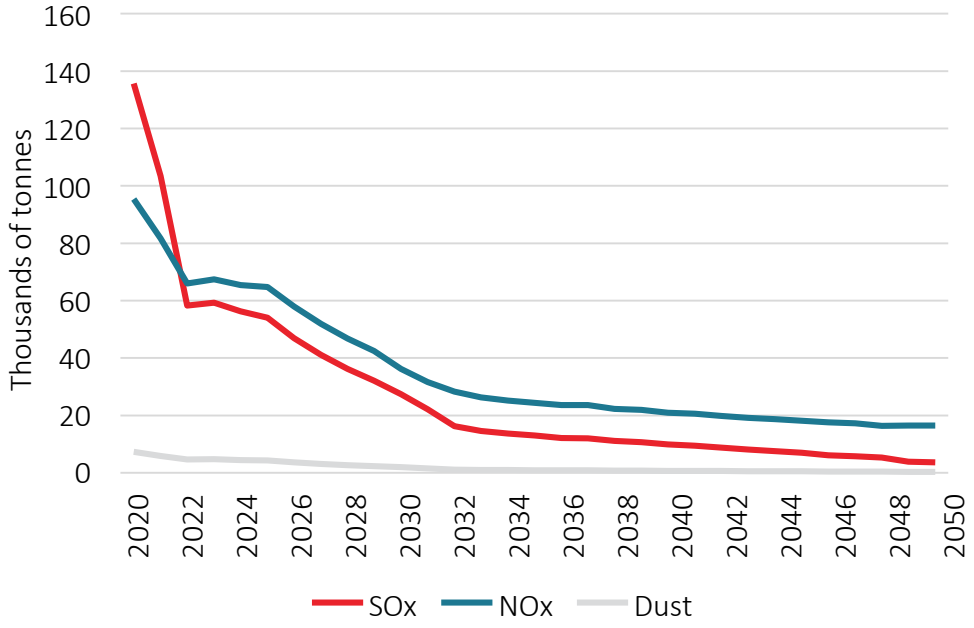
- 29% less CO_2 emissions than in PEP2040 (e)
- in 2026 the emissivity falls below 550 g/kWh

Other emissions

PEP 2040 (e)



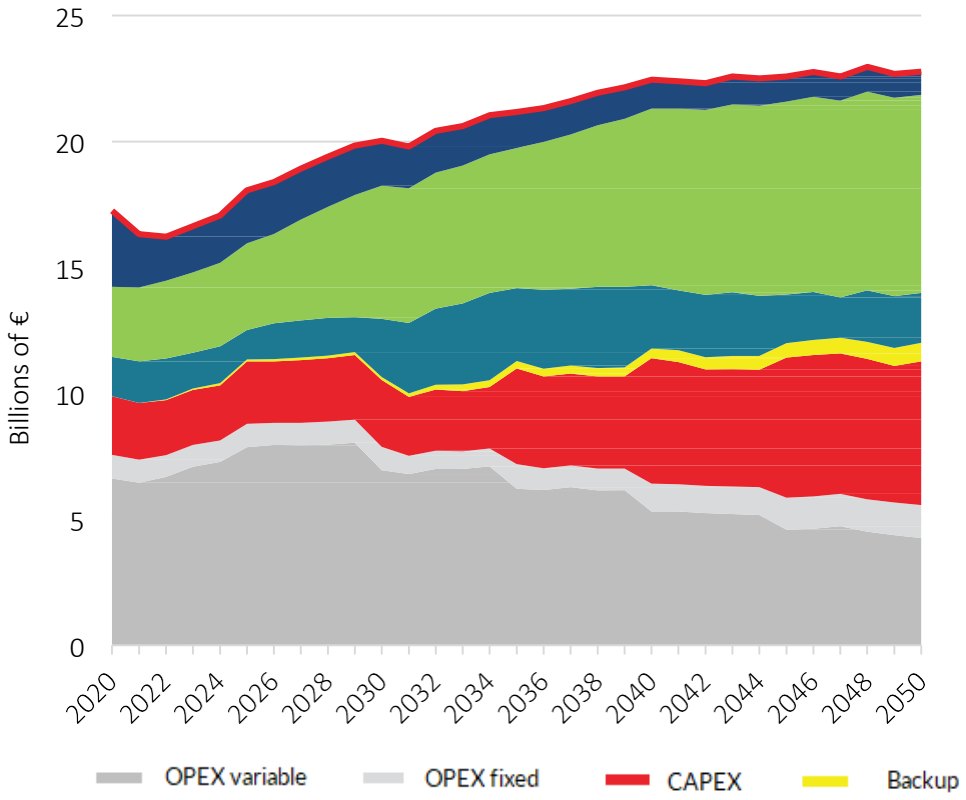
Alternative scenario



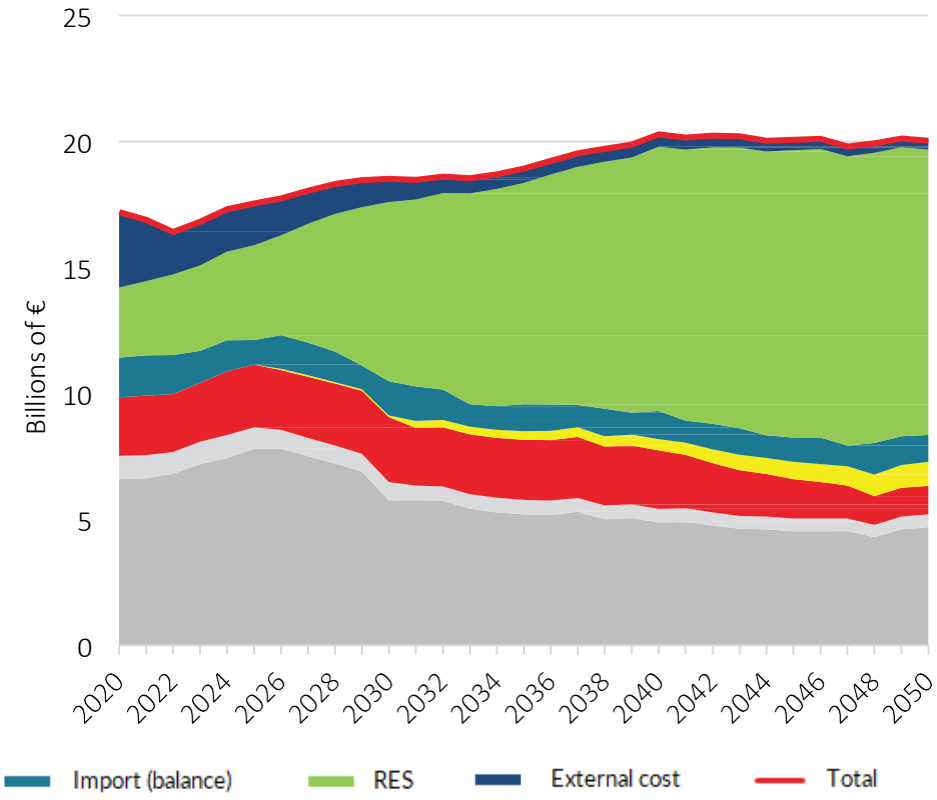
The decrease in SOx and NOx emissions is due to the adjustment of all units to emission standards (BREF conclusions).

Generation costs

PEP2040 (e)



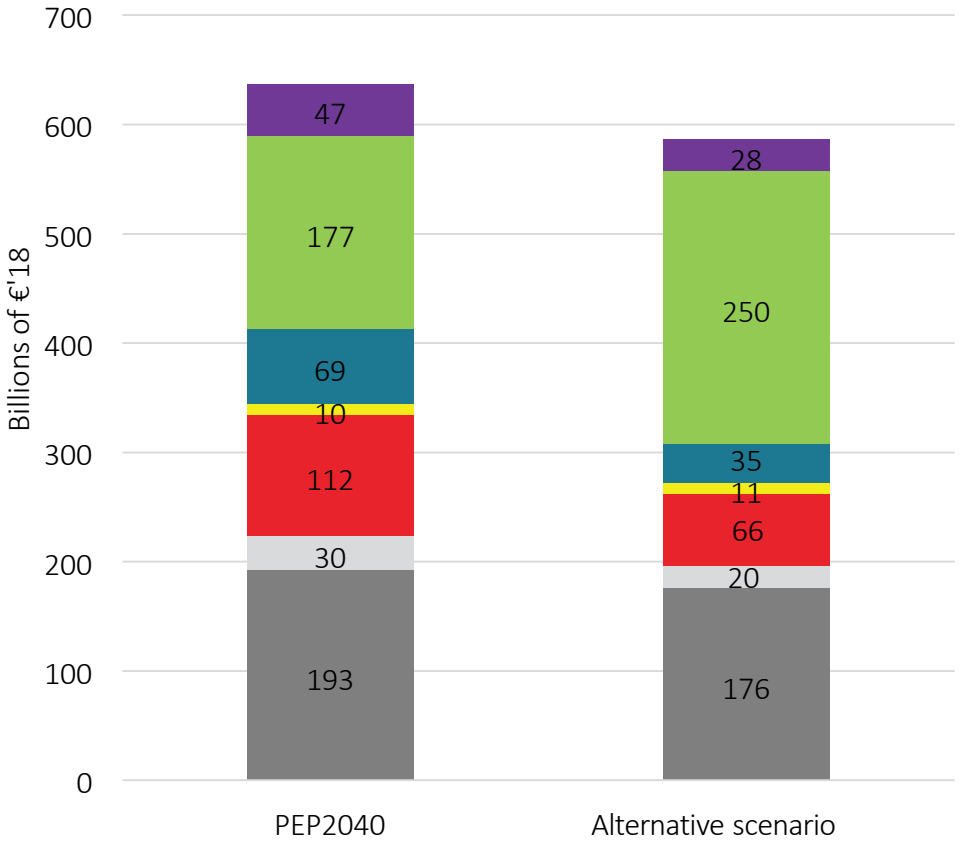
Alternative scenario



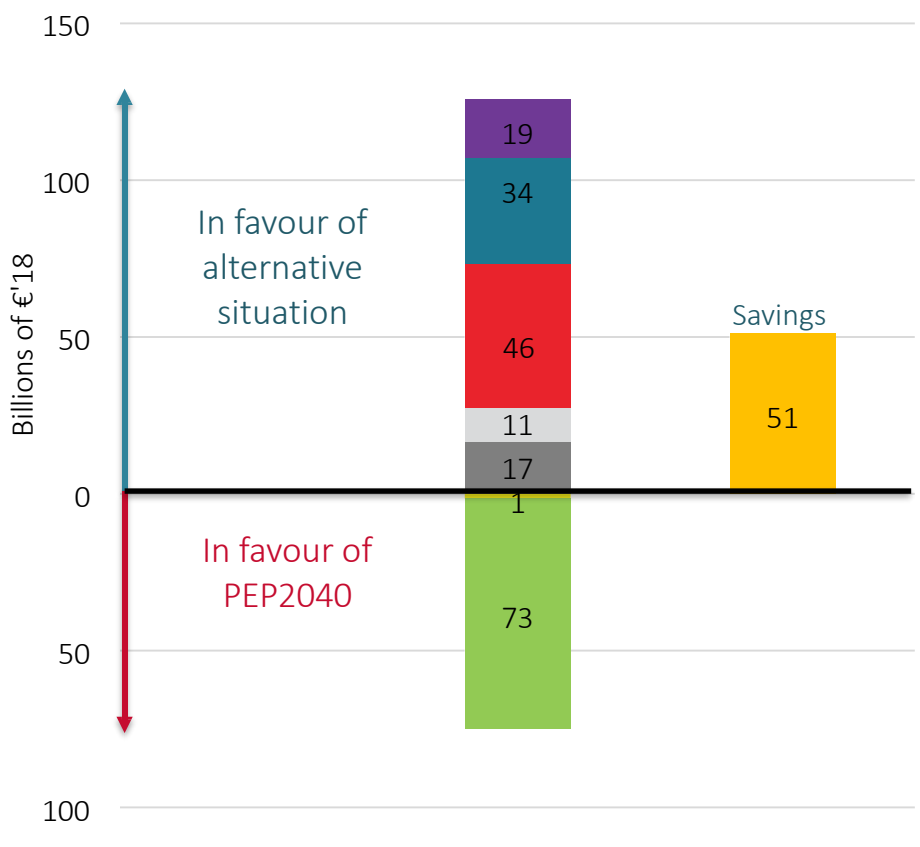
- the OPEX and CAPEX categories represent costs of conventional technologies
- RES – total CAPEX + OPEX

Total costs

Accumulated cost

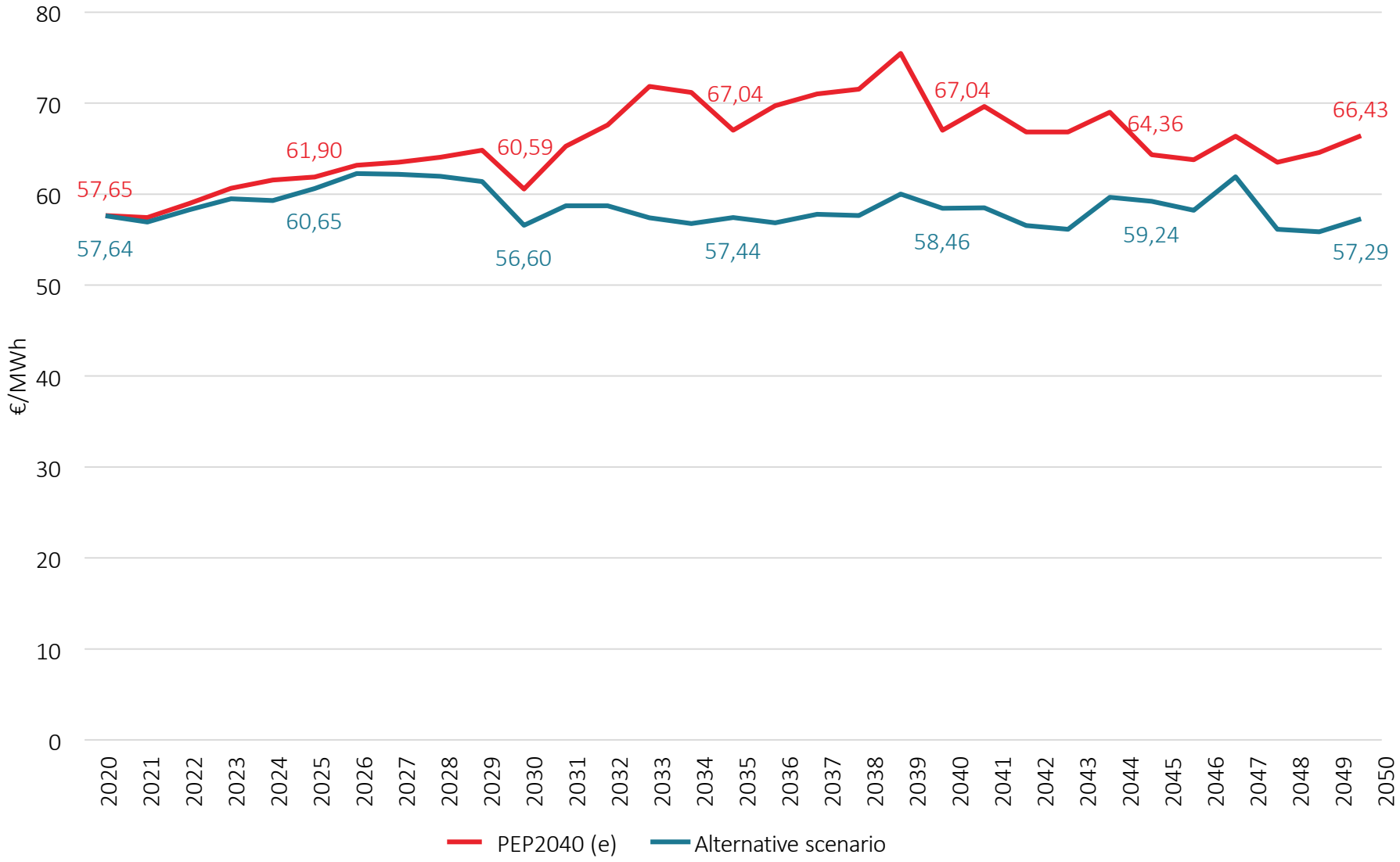


Comparison of cost difference

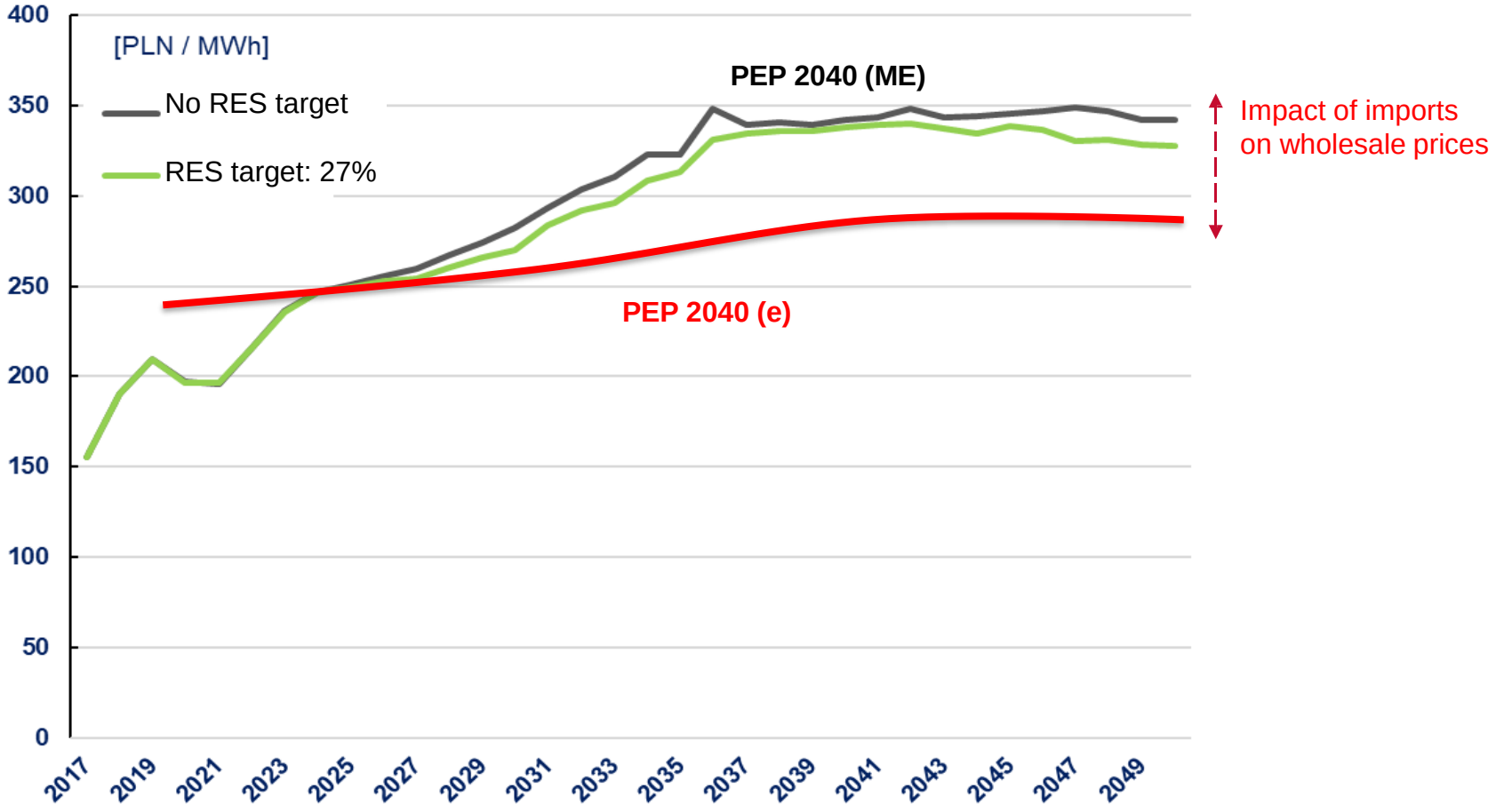


OPEX variable | OPEX fixed | CAPEX | Backup | Import (balance) | RES | External cost

Wholesale prices



Wholesale prices – comparison of scenarios



Conclusions

- Insufficient reference to EU regulations
- Lack of costs optimization
- Electricity demand projection does not result from activities towards electrification of heating and transport
- Lack of strategy regarding electricity imports
- Lack of a reliable fuel balance
- No reference to the functioning of the energy market
- Too little reference to district heating

Risks

- Delays in commissioning of nuclear power plants, adequacy problems after lignite phase out
- Costs and wholesale prices
- Unlimited imports of electricity

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Thank you for your attention