The 2013 EU Reference scenario: EU energy, transport and GHG emissions trends to 2050

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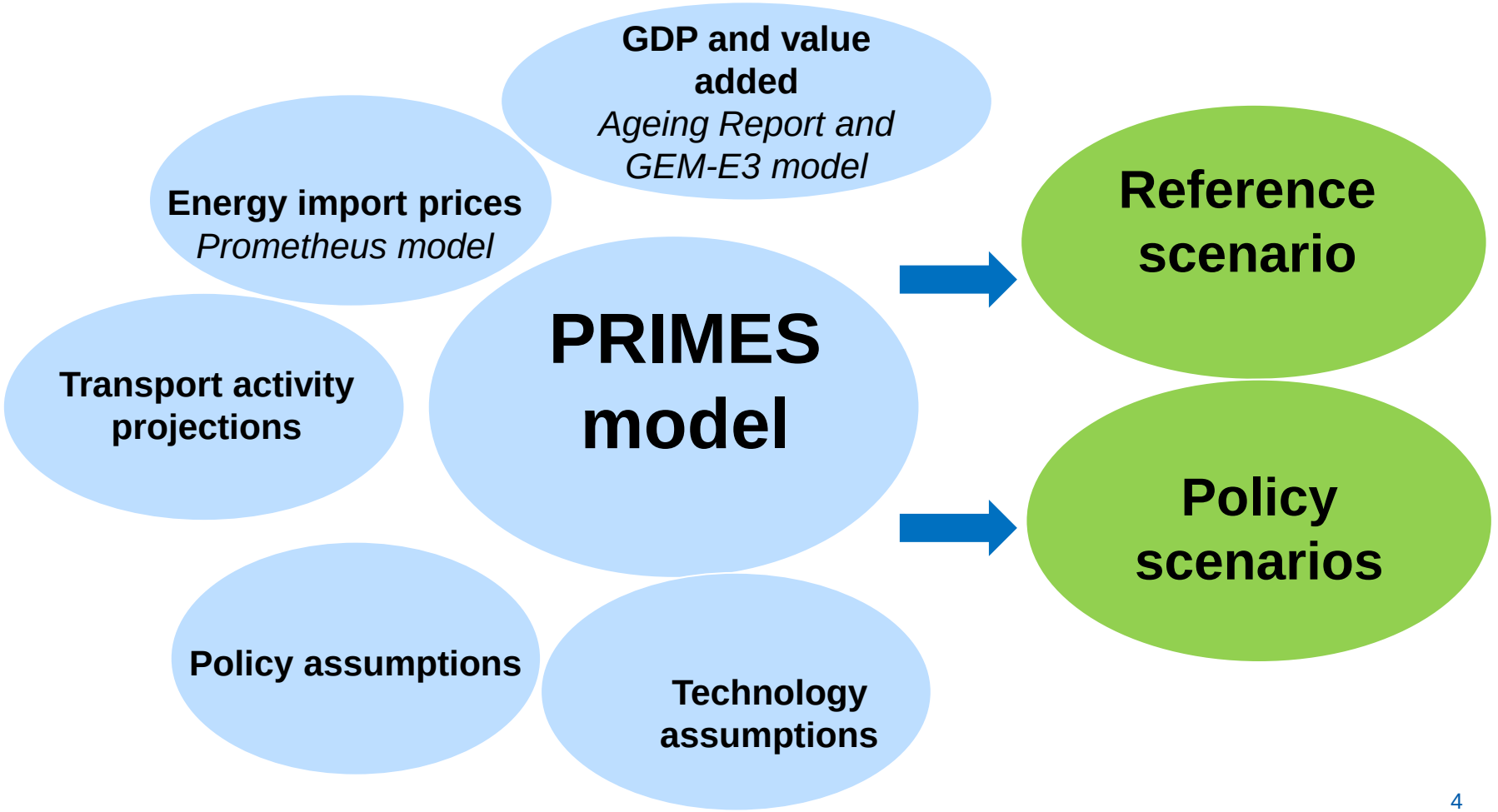
I. Introduction: EU Energy, transport and GHG emissions Trends to 2050

- Realised for the European Commission and funded by the Commission.
- Projection up to 2050 of energy demand, energy supply, investment, prices/costs, GHG emissions.
- Detailed coverage of all sectors and all EU 28 Member-States.
- Work carried out in 2012-2013 using PRIMES and other models.
- Projection exercise preformed in common by DG ENER, CLIMA and MOVE.
- Periodical update - every 2-3 years, since 1990.

I. Introduction: PRIMES energy system modelling

- PRIMES is **partial equilibrium model** of the energy system (different from optimisation models) – linked to many sectoral modules.
- It features **separate functions for all types of agents** – makes projections on formation of energy prices, supply and demand.
- PRIMES enables a **full scale representation of energy system** in current and future possible shape, covers all sectors and technologies.
- Assumptions and draft results for each step are **consulted with Member States** and relevant Commission services.

I. Introduction: PRIMES energy system modelling



I. Introduction: Objectives and Scope

- Projection not a forecast.
- It shows what are the **likely trends** if policy includes only the currently adopted measures.
- Includes adopted policies (until spring 2012).
- Serves as **comparison basis for other policy scenarios**.
- So it shows the impacts of current policies and the **gap** from long term objectives, such as for climate change mitigation.
- It is **not a static scenario** - apart from adopted policies, drivers of change are market and technology trends.
- The model-based simulation of behaviours and markets ensures **consistency of projection**.

II. Policy assumptions on 2020 targets

- The legally binding **2020 GHG target**
- ETS linear factor
- The legally binding **2020 RES target** (use of RES values, RES aid)
- **Conservative implementation of the Energy Efficiency Directive** (EE values and other modelling tools) and implementation of specific energy efficiency policies, e.g. eco-design and energy performance of buildings directives, CO2 and cars/ vans leading to energy savings of 17%

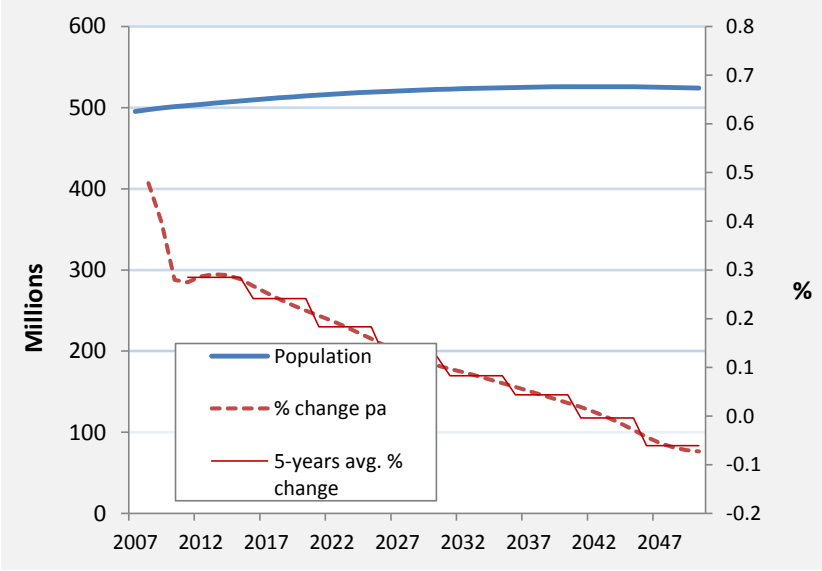
II. Technology assumptions

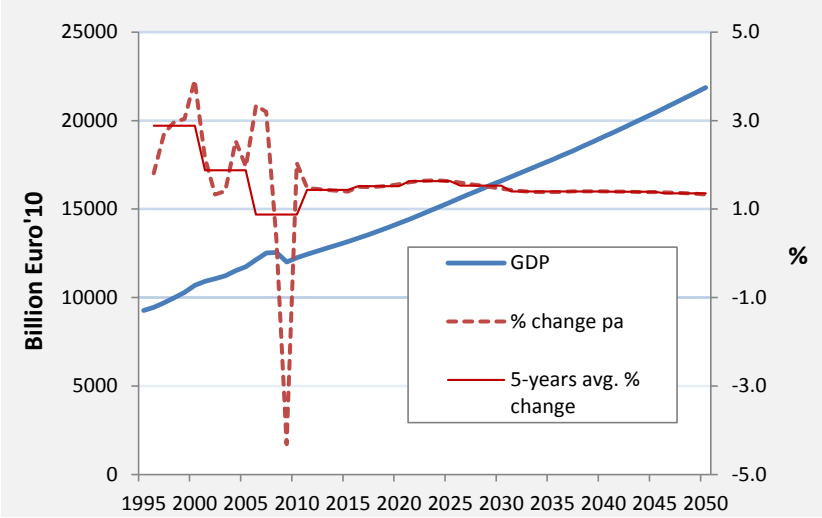
Technology parameters are

- exogenous in PRIMES
- demand-side and supply-side technologies considered
- based on existing databases, studies and expert judgement
- regularly compared to other sources
- might vary in policy scenarios depending on policy assumptions

II. Technology learning assumptions

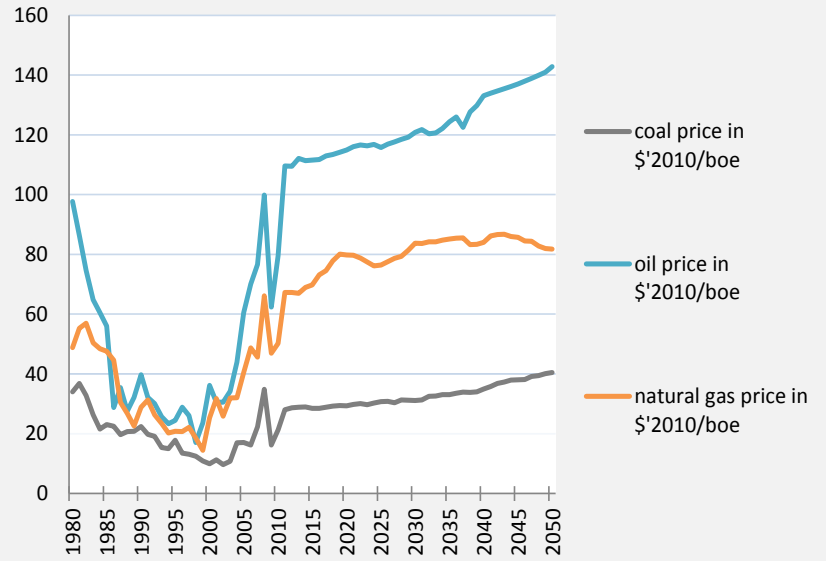
- Eco-design regulation drives cost reduction of energy efficient appliances and equipment.
- CO2 car standards facilitate the uptake of more efficient ICE vehicles and moderate emergence of electric cars in the long term.
- Diminishing Solar PV costs continue in the future.
- Currently expensive wind offshore improves in the long term.
- New generation biomass supply technology gradually emerging after 2020.
- Nuclear more expensive after Fukushima.
- CCS reaches maturity after 2030 provided that it can be commercially deployed which depends also on ETS price.

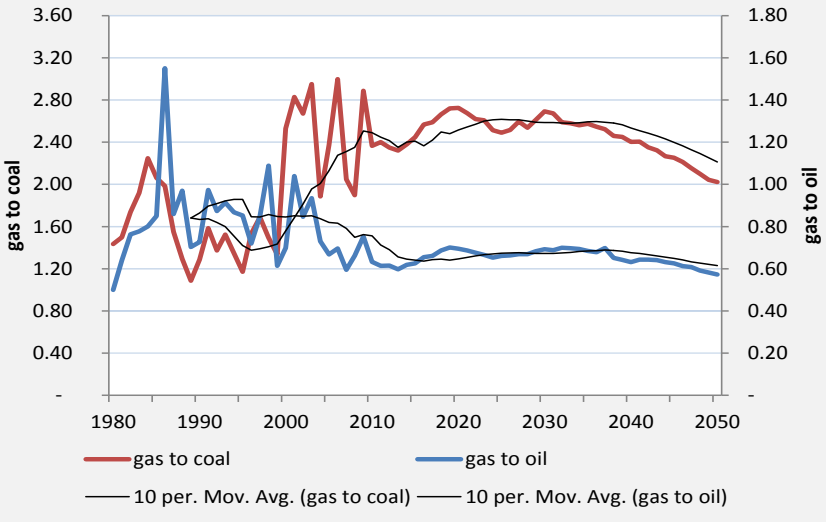




II. Key macroeconomic assumptions

- **GDP growth** projection based on EPC/DG ECFIN short and medium term projections and Ageing report long term projection 2012
  - average EU GDP growth 1.6% 2015-2030, 1.4% 2030-2050
- **Population** trends as in 2012 Ageing report
  - 0,2% annual growth 2010-30, then stagnation
- GEM E3 model used to produce **consistent sectoral activity projections**
  - Industrial activity is projected to recover from crisis and follow an increasing pace in the future
  - Output from energy-intensive industries increases less than output from rest of industries

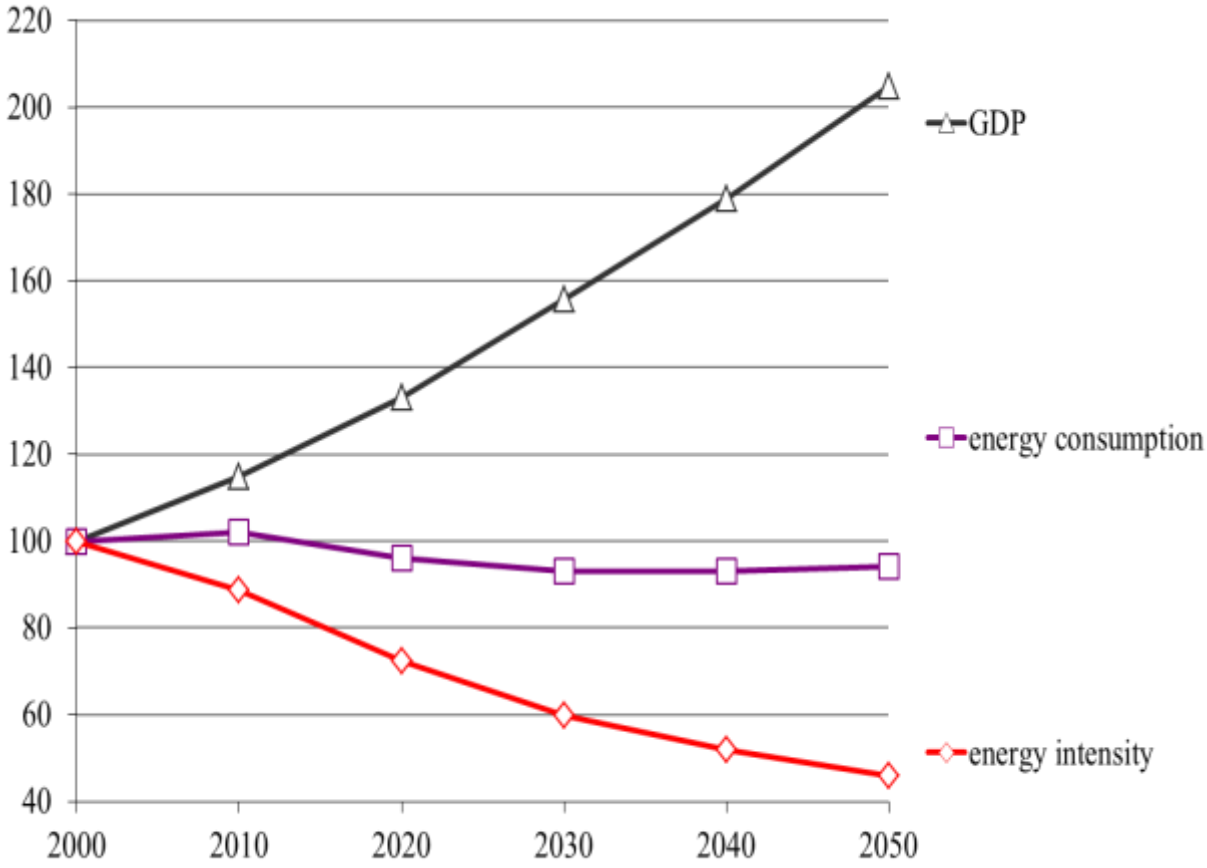




II. International fuel price assumptions

- High global GDP growth and shifting of activity to emerging economies drives demand for energy and use of fossil fuels, with Copenhagen-Cancun pledges being insufficient to curb emissions
- Persistence of high oil prices in the short/medium term driven by demand growth and tight capacities
- **Gas prices initially follow oil prices but start decoupling after 2020 owing to increasing contribution of unconventional gas resources**
- Thus gas prices stabilise in the long term and gas competitiveness vis-à-vis coal improves
- The EU's domestic hydrocarbon production decreases over time the **role of shale gas is assumed to remain limited in the EU**

III. Results: GDP, energy demand and energy intensity (2000 = 100)



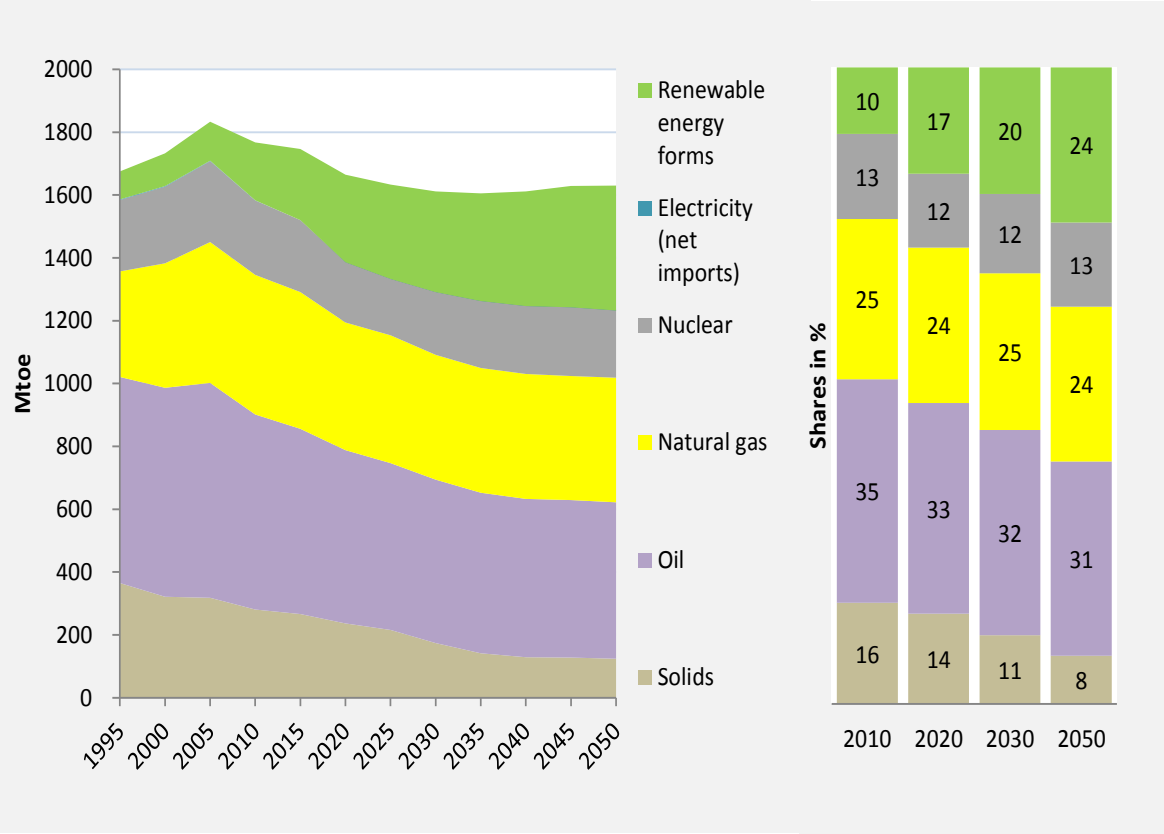
Strong decoupling of energy demand from GDP.

Energy intensity down on 2010 by 33% in 2030 and 48% in 2050.

2% annual intensity improvement by 2030 falling to 1.3% in 2030-50.

2020 savings objective not fully reached (- 17%); using same metric (2007 Baseline) gives -21% for 2030.

III. Reference scenario results: Fuel mix (GIC)



Only RES increase their share in primary energy demand.

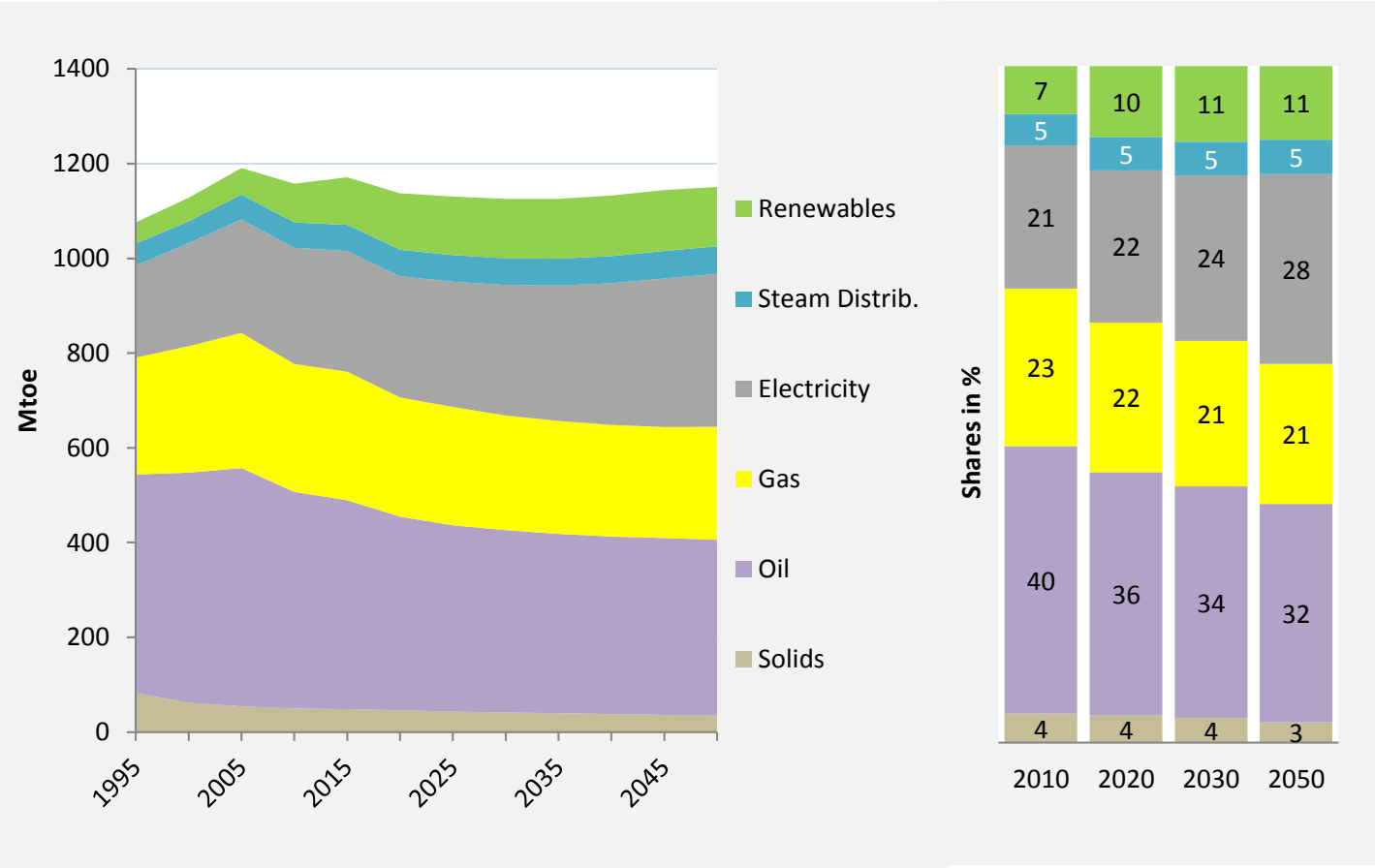
Nuclear shares in GIC remain constant

Gas share also remain constant, as gas-based balancing in power sector increases and gas share in final demand is robust after 2020

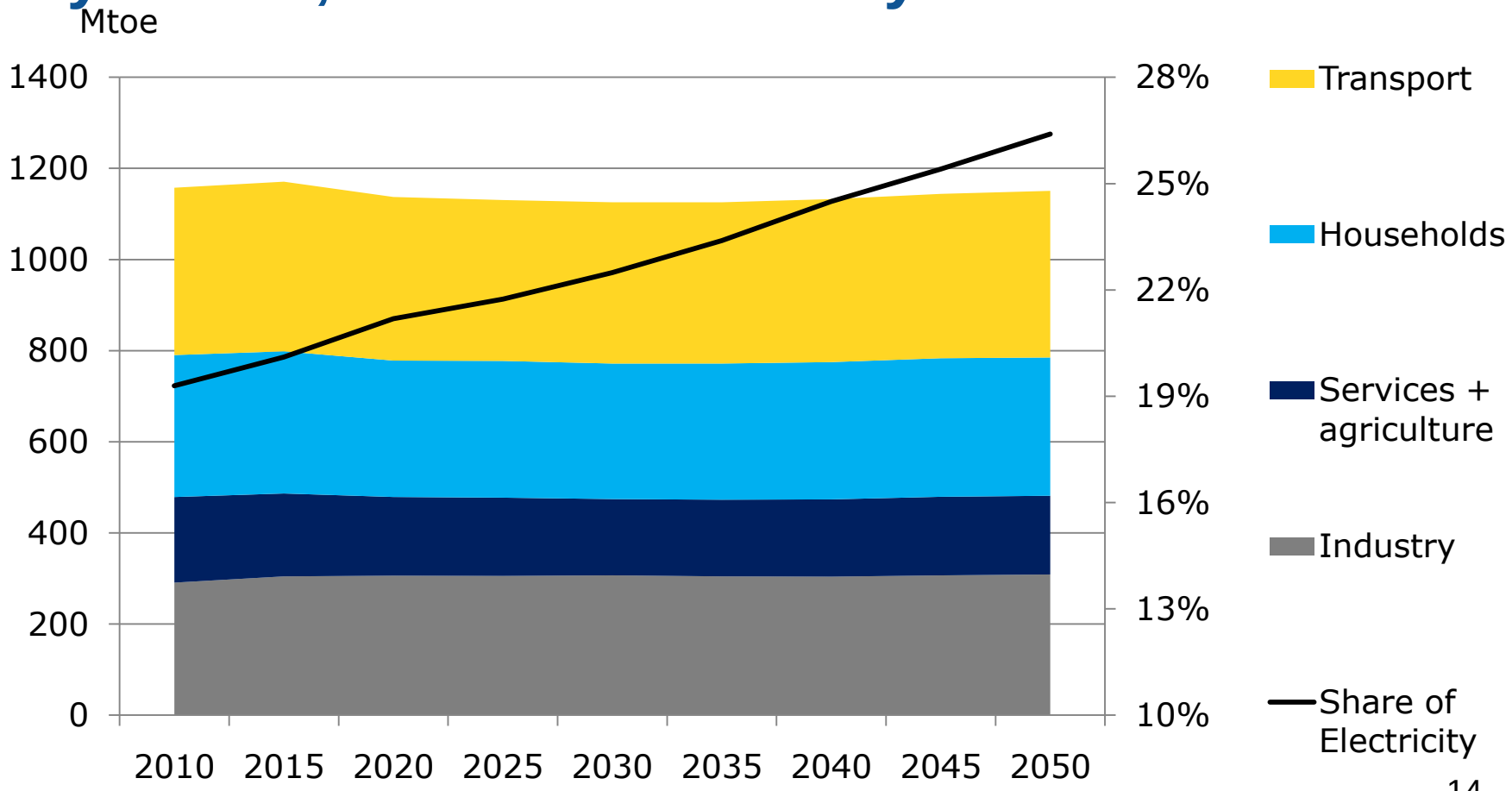
Efficiency improvements in transport drives reduction of oil consumption

Coal/lignite shares strongly decrease over time driven by ETS

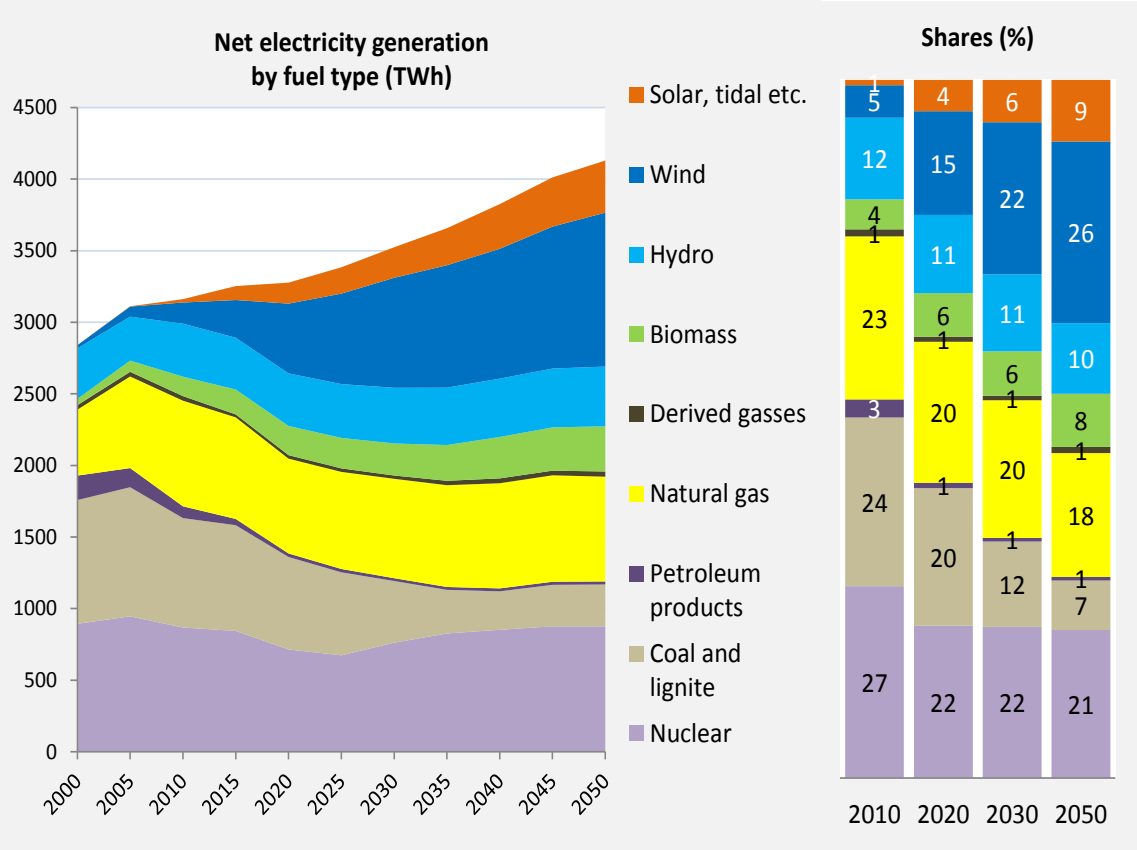
III. Reference scenario results: Fuel mix (Final energy demand)



III. Reference scenario results: Final energy demand by sector, share of electricity



III. Results: Electricity generation by fuel type



Significant penetration of RES (35% in 2020, 43% in 2030 and 50% in 2050) mainly Variable RES.

Generation from conventional thermal decreases until 2030 and stabilize thereon.

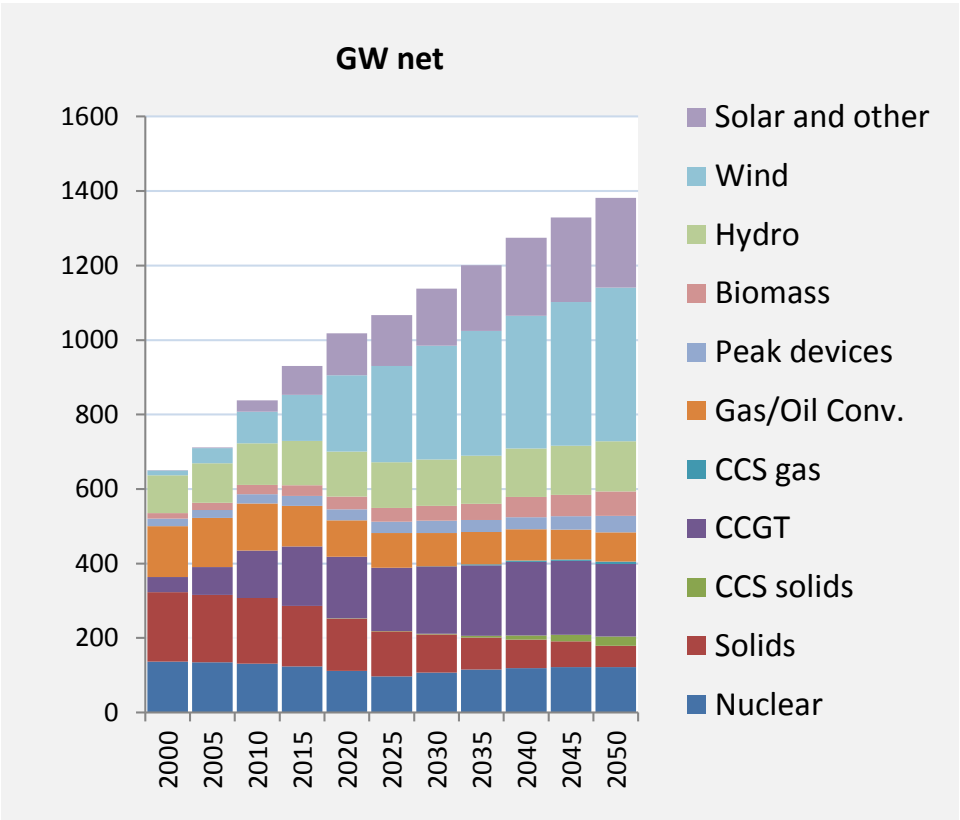
Solids-fired generation declines; more than half from CCS by 2050.

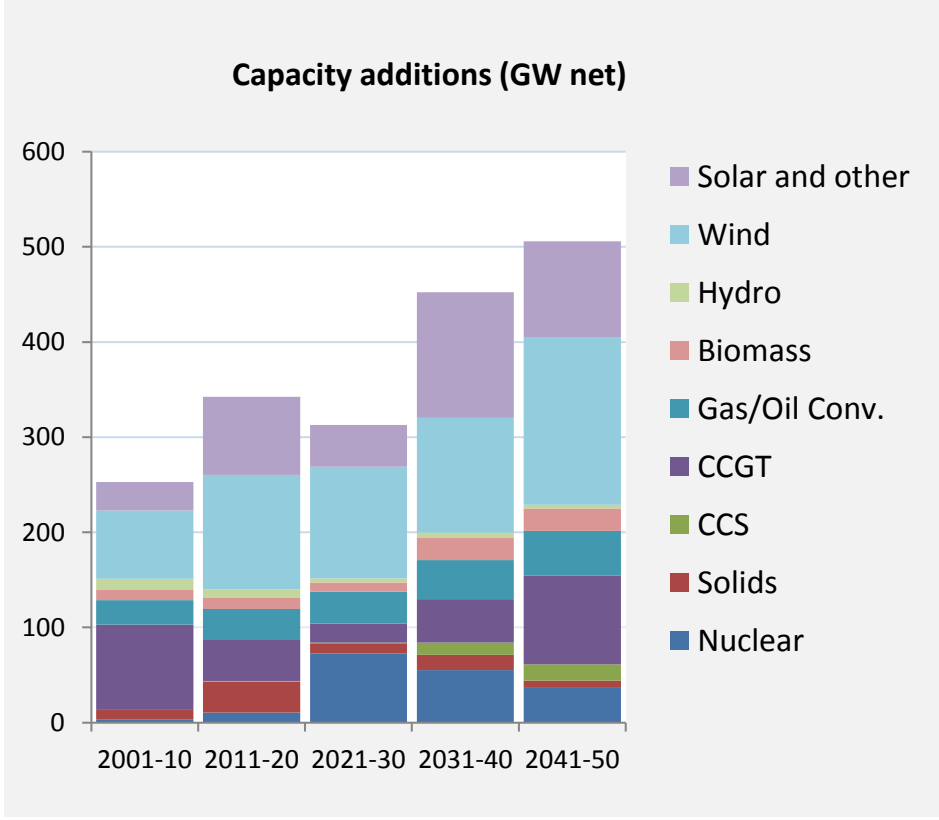
Gas-fired generation slightly decreases until 2020, but increases thereafter playing a balancing role.

Elec. generation from nuclear decreases up to 2025 driven by national phase-out policies.

Cogeneration develops significantly.

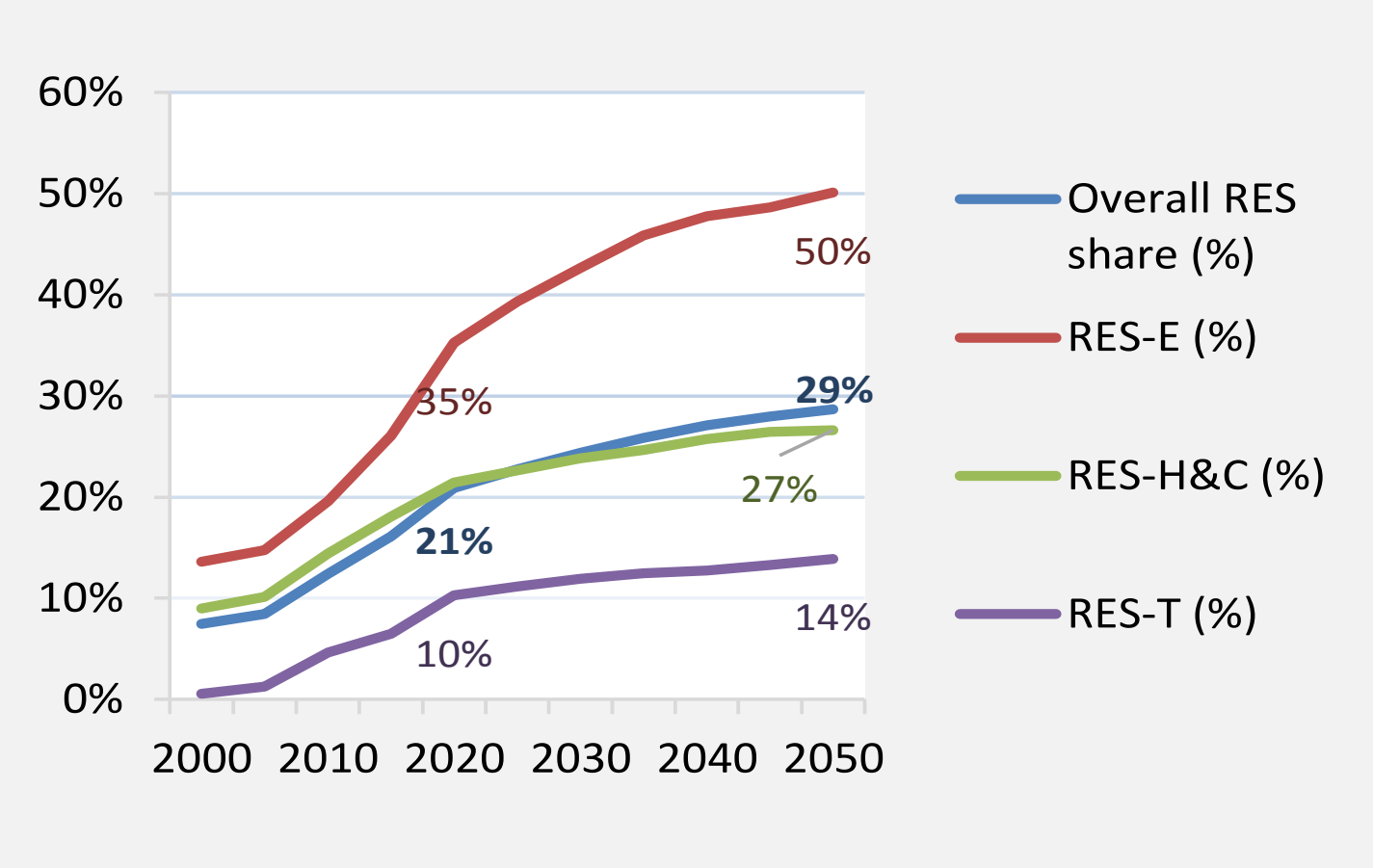
III. Results: Net power generation capacity



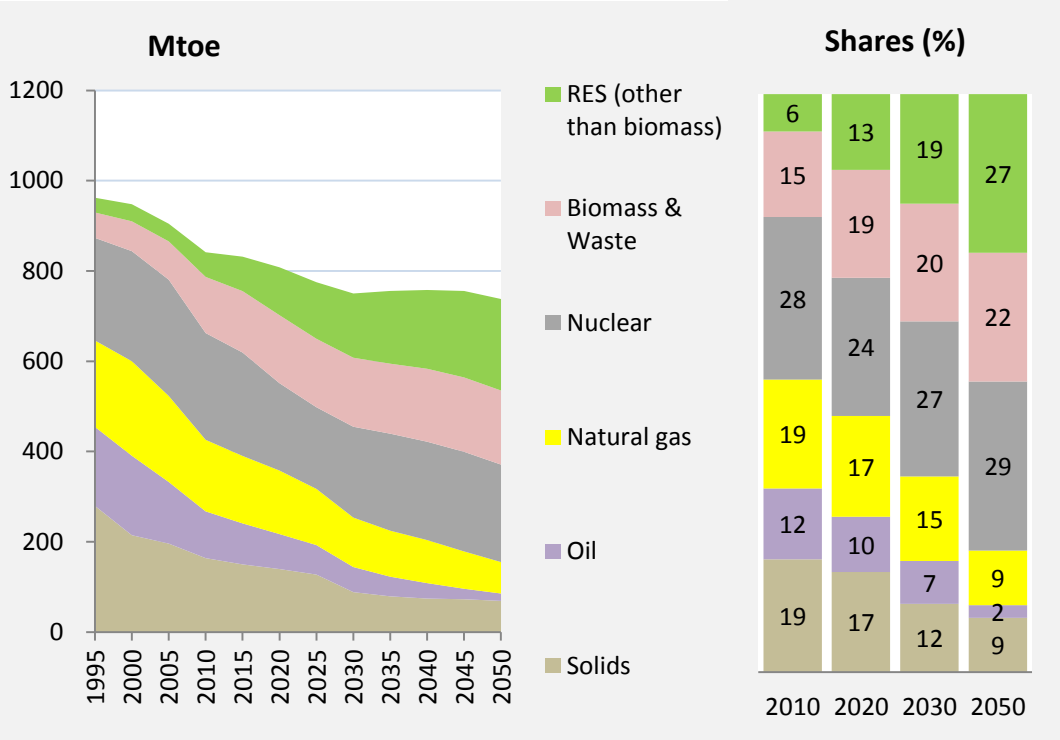


III. Results: RES share total and by sector

(RES share in gross final energy consumption)



III. Results: Primary energy supply



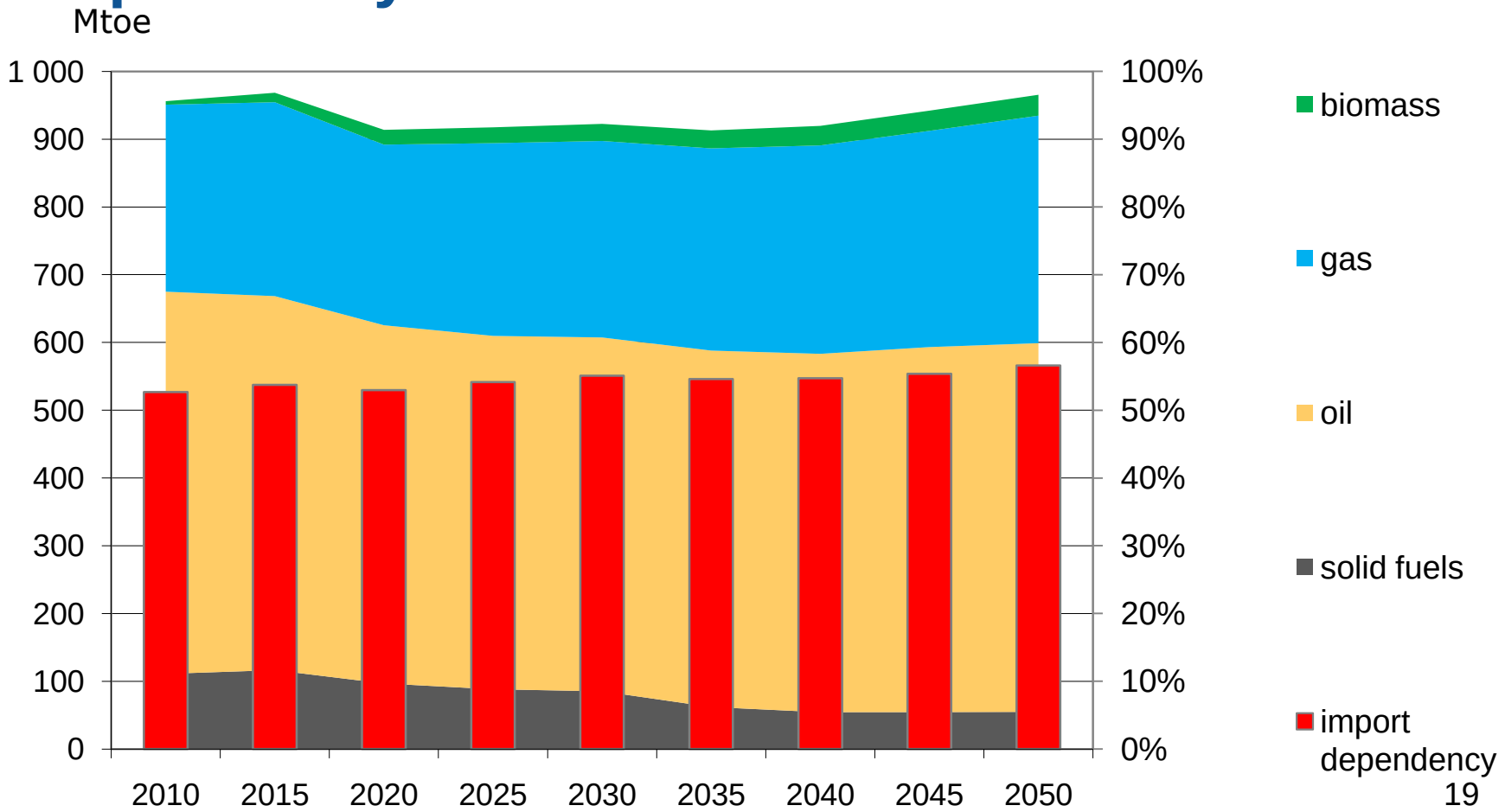
Domestic **EU production of fossil fuels steadily declines** in the future, due to limited reserves. Non-conventional hydrocarbons play a limited role.

Domestic production of biomass is projected to develop. Domestic production of RES, including all forms of RES, almost compensates for the decline of fossil fuel extraction.

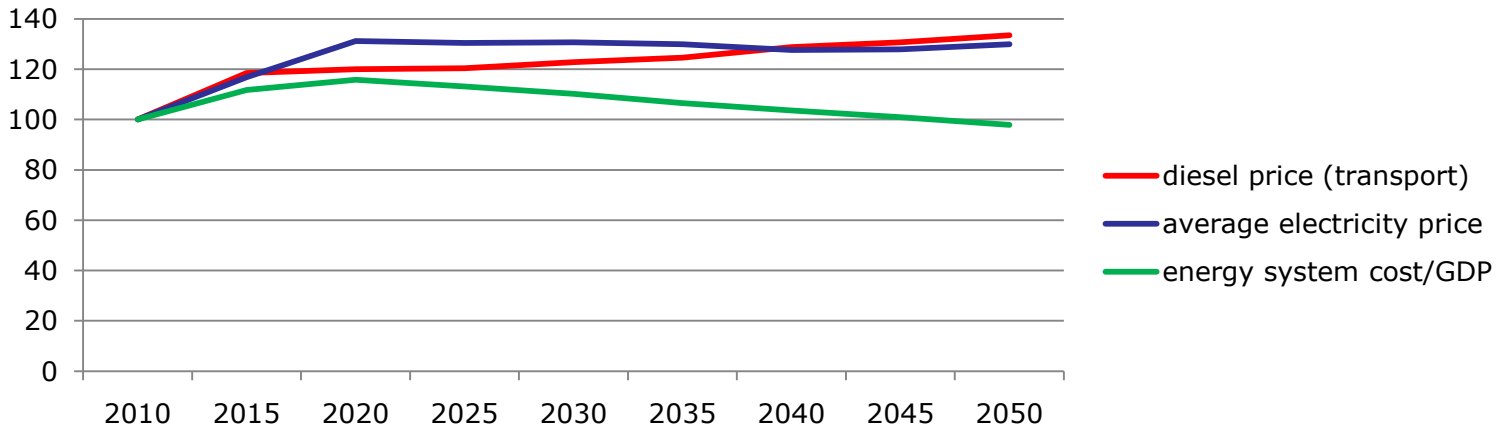
RES deployment is combined with energy efficiency improvements and nuclear production which remains stable.

Therefore currently adopted policies bring **significant benefits in terms of reducing import dependency**. Incremental net imports relative to 2005 are negative for oil and coal and slightly positive for gas.

III. Results: Net energy imports and import dependency



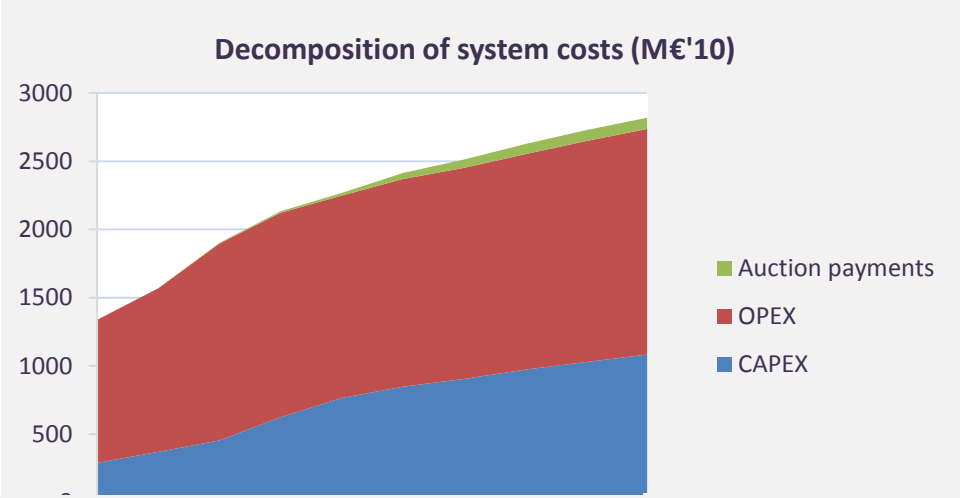
III. Results: energy prices and costs

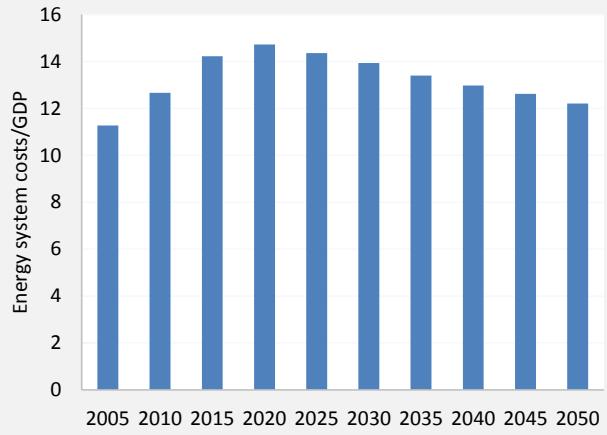


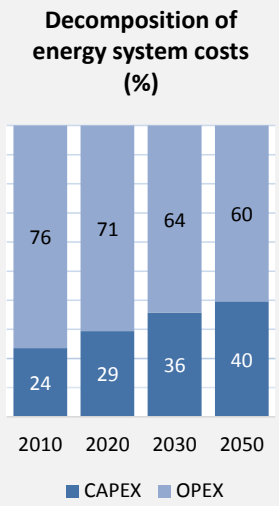
(index, 2010=100; system cost excl. auct. payment)

- **Rising international fossil fuel prices** are key driver for the 2010-15 increases for diesel, electricity and overall system costs
- Additional reasons for further increases until 2020 related to electricity prices: **power generation investment**, **especially for RES, grid investment**, **effects of energy efficiency** against the backdrop of dominance of fixed costs, ETS (in later phases)
- Electricity prices after 2020 stabilise as investment costs up to 2020 **generate substantial savings in fuel input** costs in later periods combined with technological progress
- Energy system costs peak in 2020, then falling due to fuel cost savings

III. Results: Energy system costs







Total energy system costs increase significantly until 2020 (ratio of 15% in relation to GDP) due to:

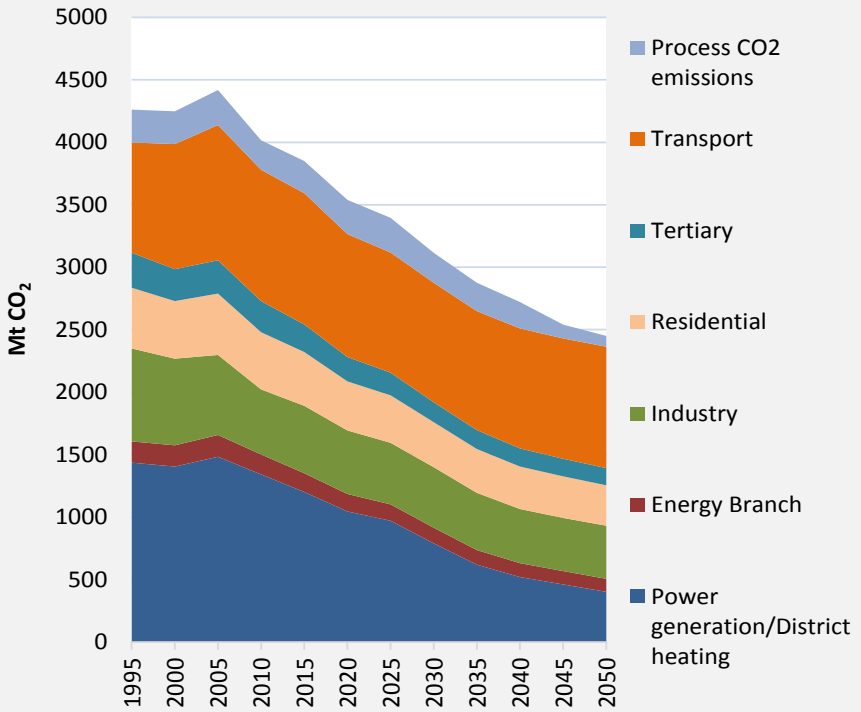
- strongly increasing international fossil fuel prices (main driver)
- direct capital expenditures in both the demand and supply side
- capital expenditure for power generation in the process of modernisation and restructuring towards decarbonisation and high RES contribution

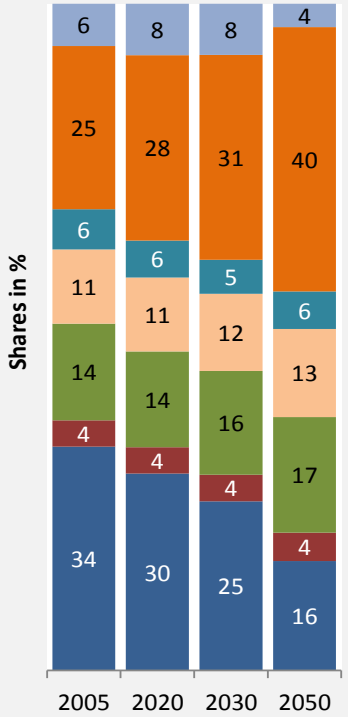
Post 2020 energy system costs continue to increase but at a lower pace reaping also benefits from previous investments.

The share of CAPEX increases over time reflecting increasing capital intensiveness of the energy system.

Auction payments do not present a cost for the economy as a whole.

III. Results: GHG emission results



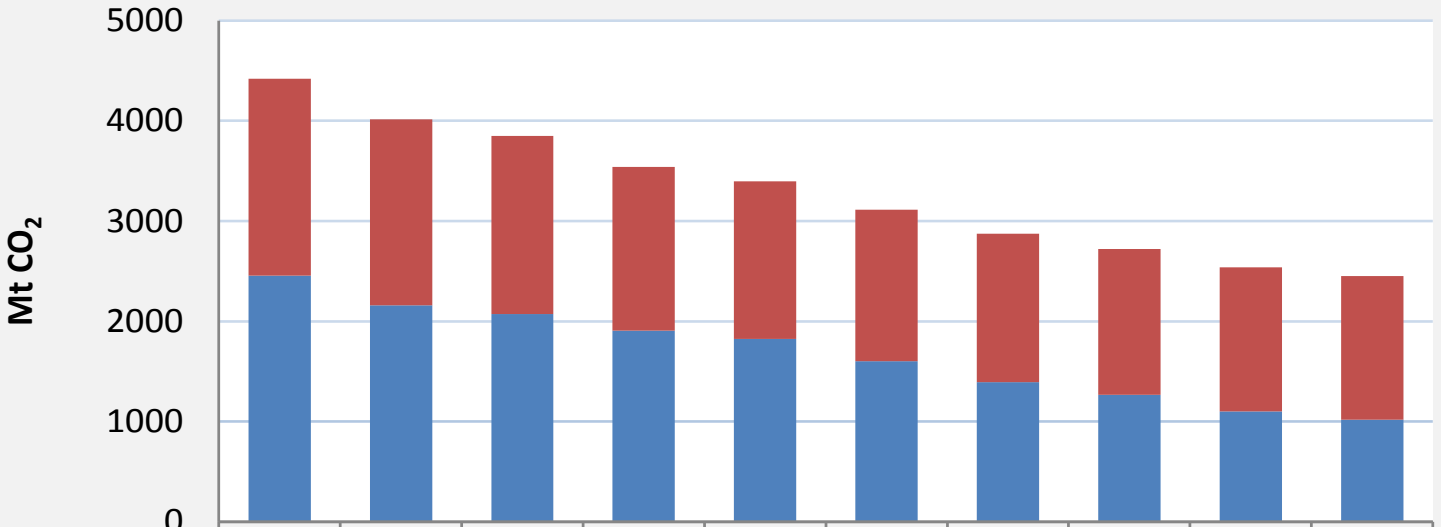


The reference scenario projects decreasing CO_2 emissions until 2050, but remaining emissions significantly exceed 80% emission reduction target for 2050.

Compared to 2005 Energy related emissions are lower by 21% in 2020, 30% in 2030 and 43% in 2050.

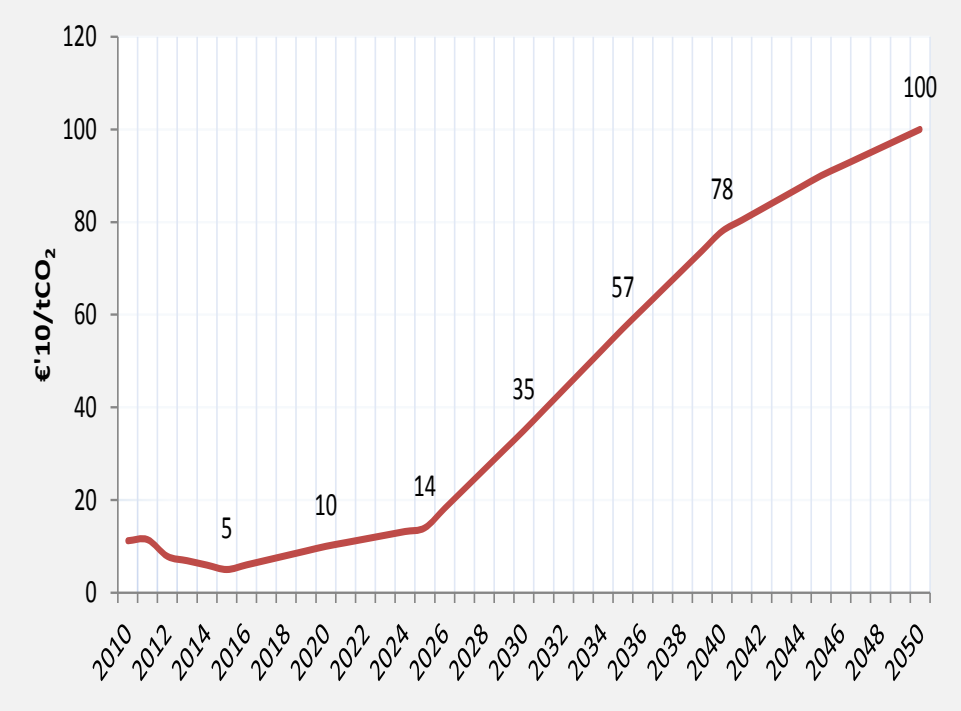
As power generation is gradually decarbonized, the transport sector becomes the largest source of CO_2 emissions (high marginal abatement costs in this sector).

III. Results: ETS and non-ETS emission results



	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Non-ETS	1962	1854	1776	1631	1569	1515	1481	1456	1440	1432
ETS	2456	2162	2074	1908	1826	1601	1395	1266	1101	1018
Total CO2	4419	4016	3850	3539	3396	3116	2876	2721	2541	2450

III. Results: ETS prices



- Substantial reduction of energy demand driven by energy efficiency policies, moderate GDP growth and high prices.
- Achievement of Renewables targets in 2020 and continuation of RES development after 2020 driven by market forces despite phase-out of RES subsidies.
- Low ETS carbon prices until 2025 followed by escalation due to persisting decrease of allowances issuance.

Reference scenario is available at:

http://ec.europa.eu/transport/media/publications/doc/trends-to-2050-update-2013.pdf

Thank you!