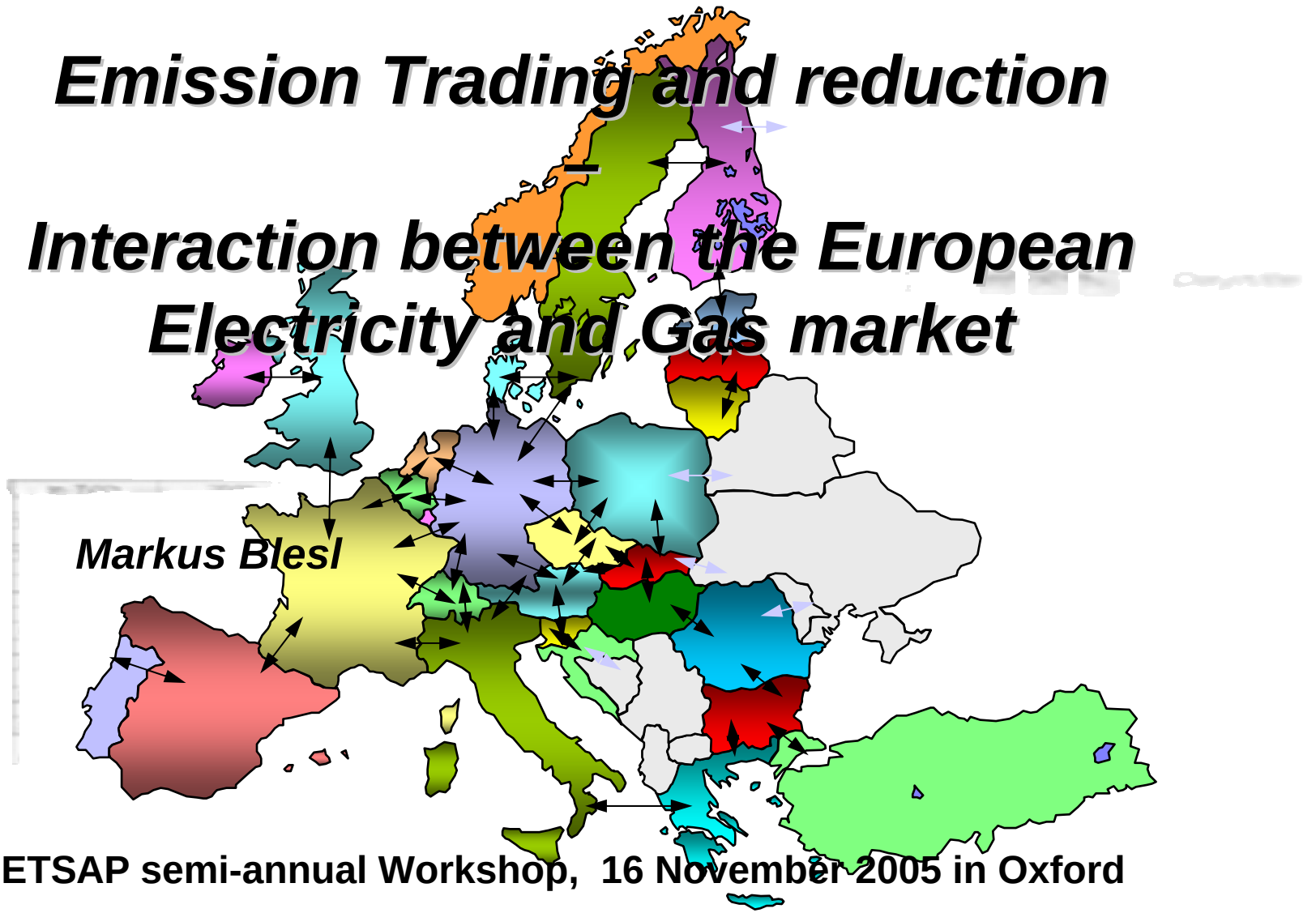
Universität Stuttgart
Institut für Energiewirtschaft und Rationelle Energieanwendung
IER

Emission Trading and reduction – Interaction between the European Electricity and Gas market



Markus Blesl

ETSAP semi-annual Workshop, 16 November 2005 in Oxford

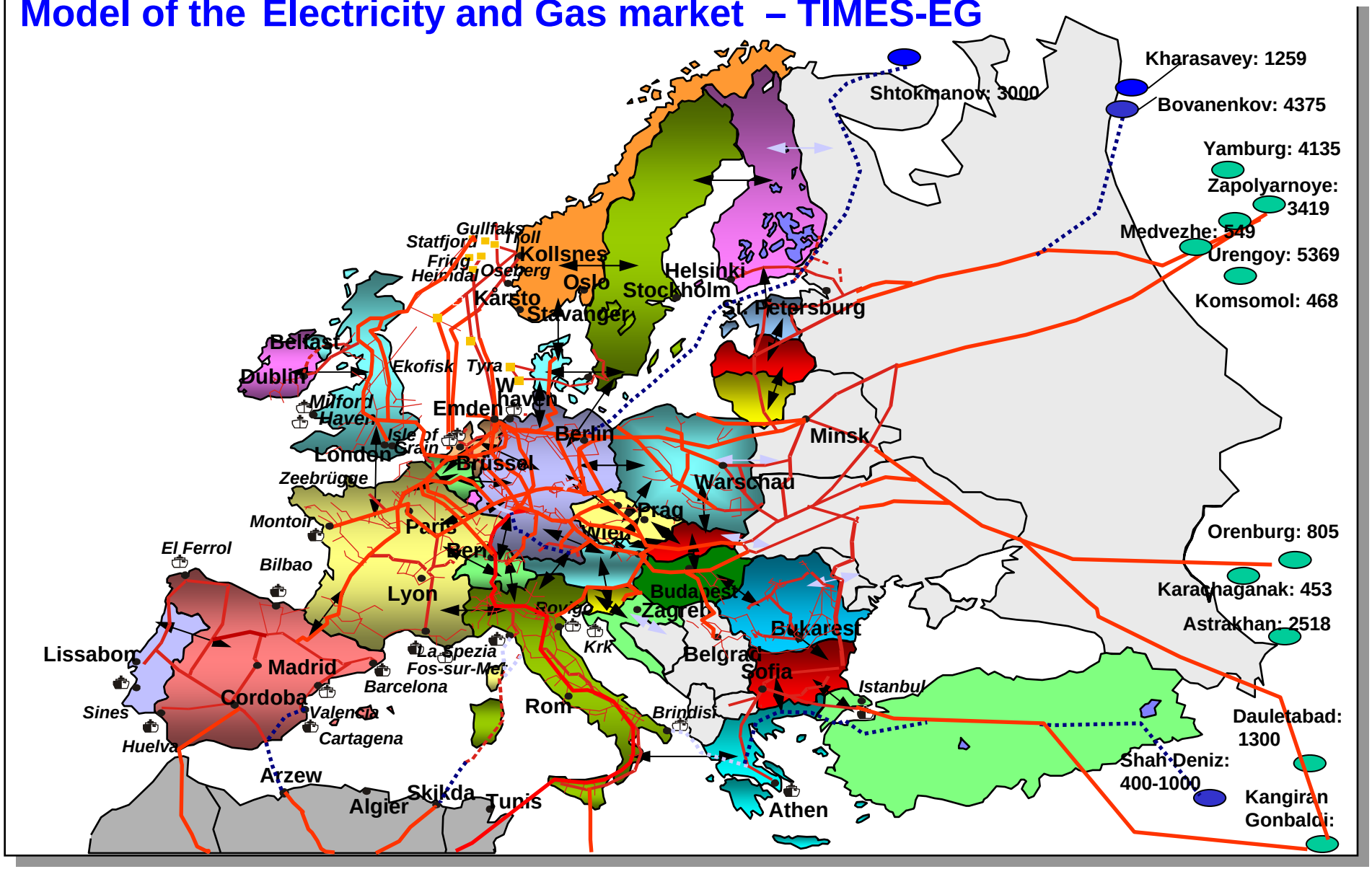
TIMES – EG (European Electricity and Gas Market)

- Technology oriented bottom-up model with prefect foresight
- 31 region model (EU 25 + Ro, Bu, Tu, Cr, N, CH)
- Detailed power generation sector (CO_2 sequestration and capture options, CHP included) based on a IER power plant database with 25,000 units included
- Country specific differences for characterisation of new power plants
- Detailed electricity exchange balances based on ETSO statistics
- Country specific load curves based on UTCE statistics
- Consideration of CHP expansion options
- Renewable potential (onshore wind, offshore wind, geothermal, biomass, biogas, hydro (small, middle, large))
- Country specific availability factors for renewable
- Country specific heat and electricity demand reduction options
- GHG: CO_2, CH_4, N_2O included
- Pollutants: NO_X, SO_X, particles

TIMES-EG (European Electricity and Gas Market)

- **Consideration of the extraction capacities and the gas resources in EU25 and in Russia, Iran, Azerbaijan, Turkmenistan, Algeria, Libya**
- **Detailed modeling of the existing gas grid between the different countries (EU31 + Russia, Ukraine, Belarus, Serbia, Morocco, Tunisia, Iran, Azerbaijan, Turkmenistan, Algeria und Libya)**
- **Modeling the gas consumption in the other sectors in EU30 + Russia, Ukraine, Belarus, Serbia, Morocco, Tunisia, Algeria and Libya**
- **Consideration of the existing and planned LNG Terminals capacities in Europe**
- **Time horizon 1990-2030, 5 year periods, plus 2008 and 2012, up to 64 time segments per year**

Model of the Electricity and Gas market – TIMES-EG



Scenario definition

Reference case (REF)

CO_2-reduction scenarios:

- CO_2 - Emission target “Soft landing” for EU15 and national targets **(SOFT)** (in 2010 8 % and in 2030 15.6 % CO_2-emission reduction compared with 1990)

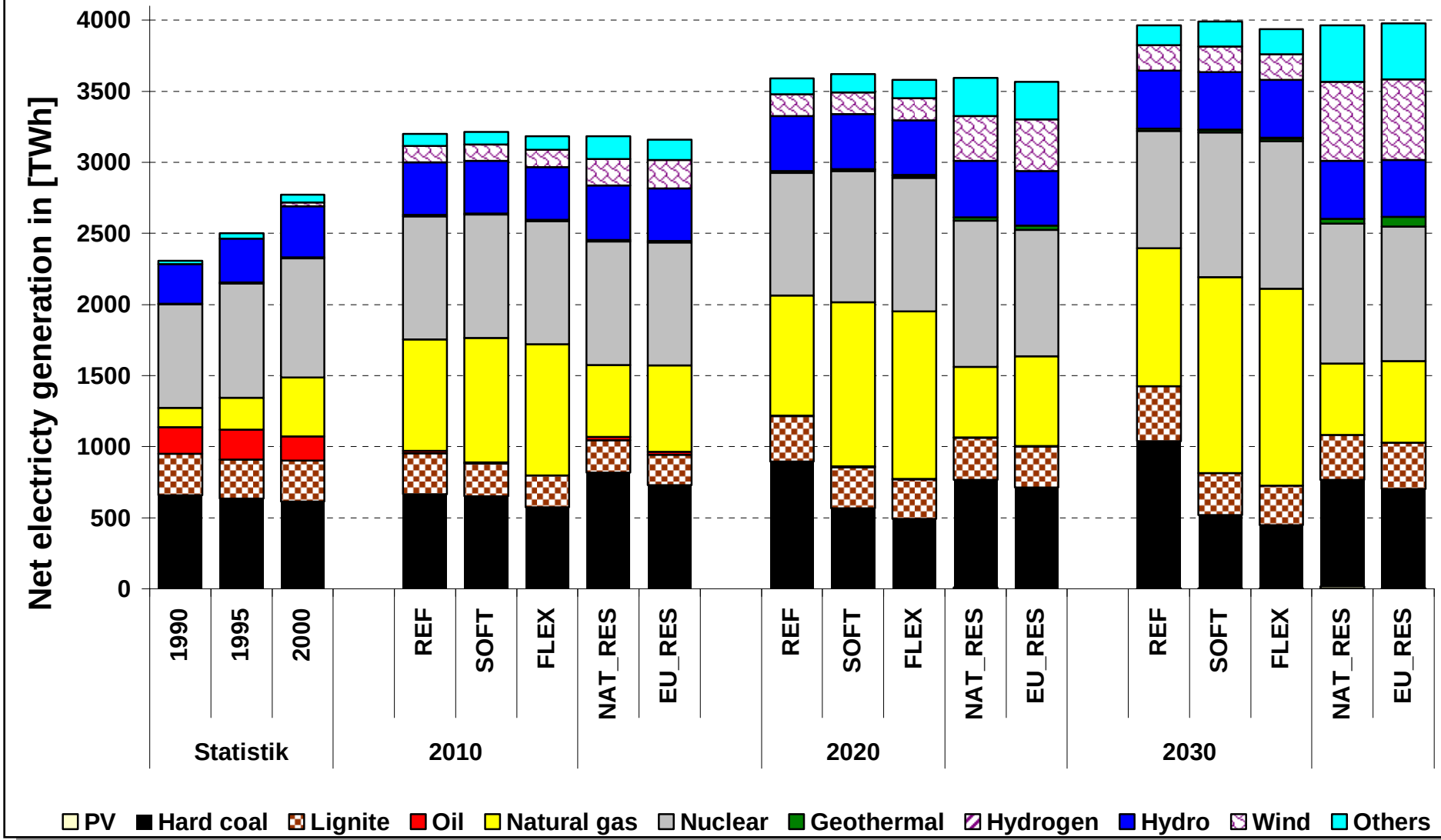
- CO_2 - Emission target “Soft landing” for EU25 (**FLEX**)

CO_2-reduction + renewable scenarios:

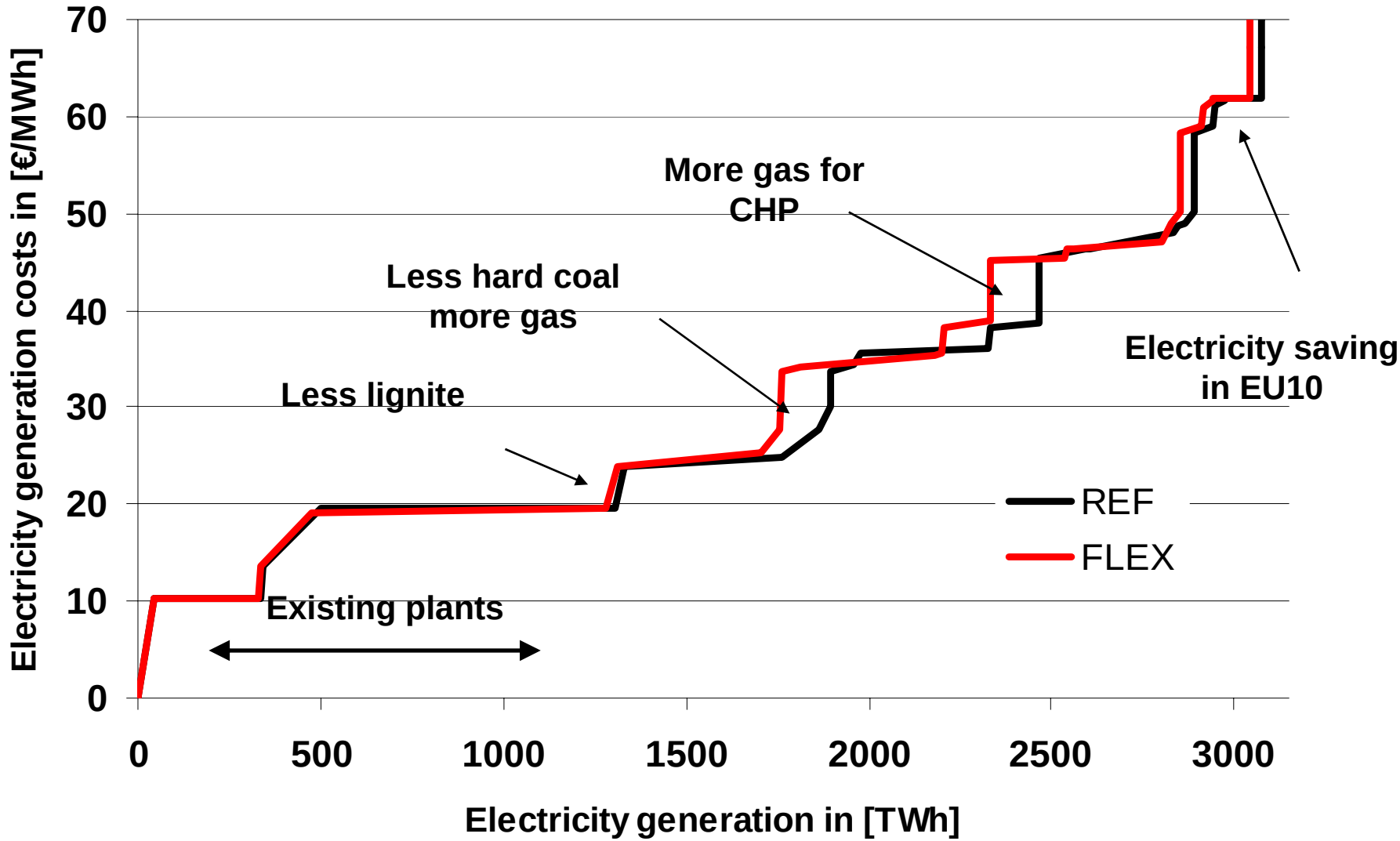
- CO_2 - Emission target “Soft landing” and **national** renewable electricity consumption targets for EU25 (**NAT_RES**)

- CO_2 - Emission target “Soft landing” and **EU25** renewable electricity consumption targets for EU25 (**EU_RES**)

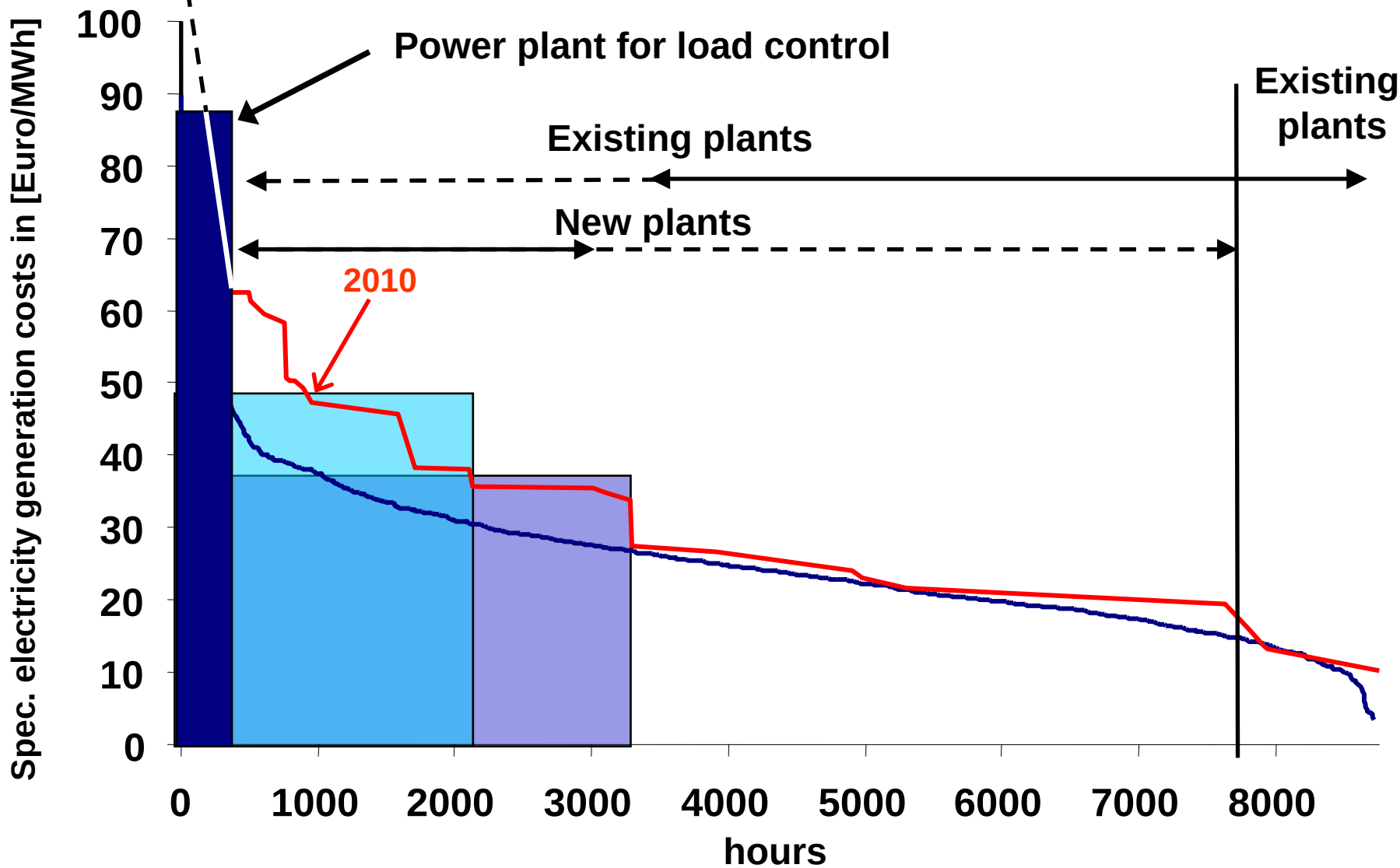
Net electricity generation by energy carriers in EU25



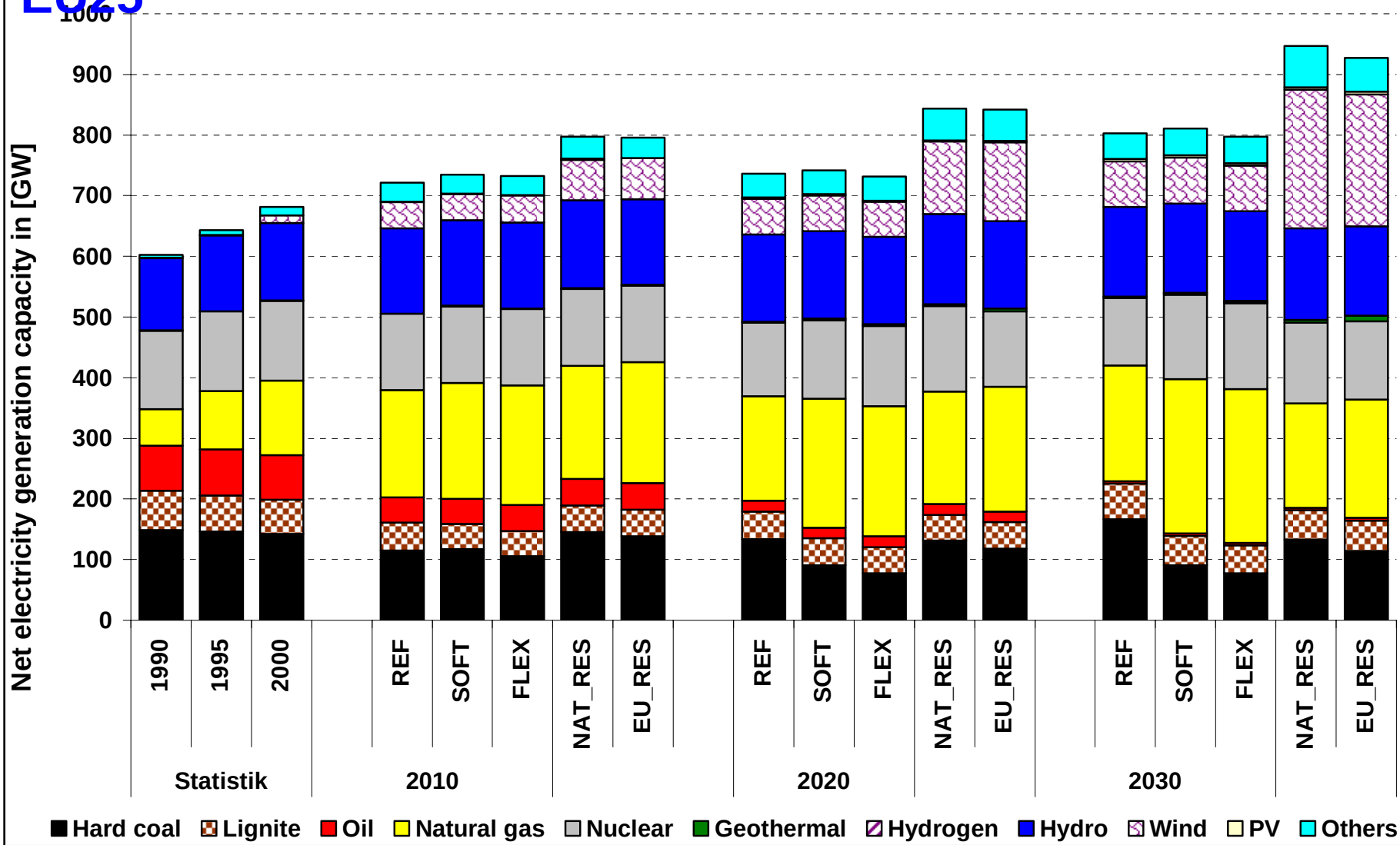
Electricity generation costs in the EU25 in 2010



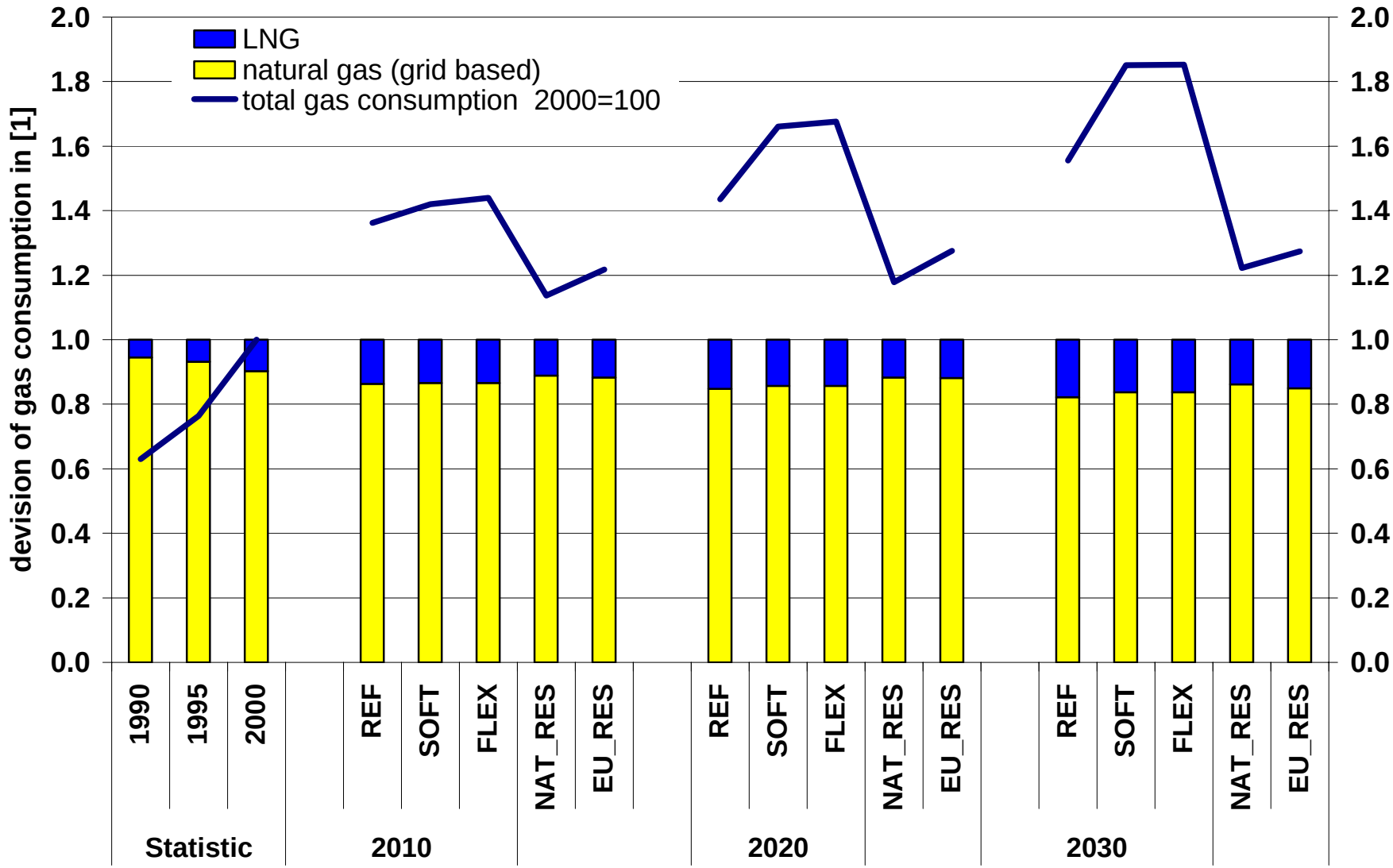
Cost correlated load curve of electricity generation in EU25



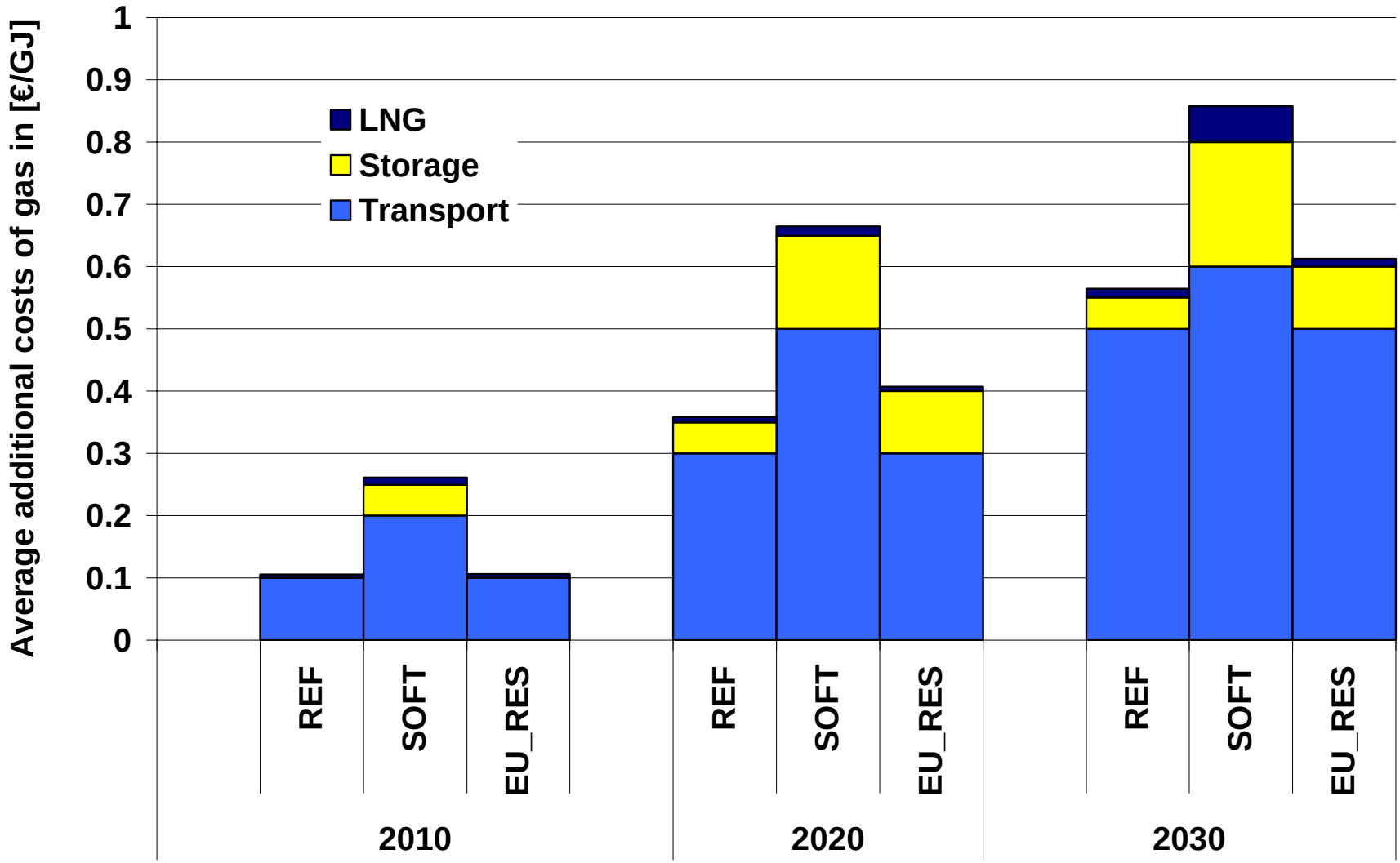
Net electricity generation capacity by energy carriers in EU25



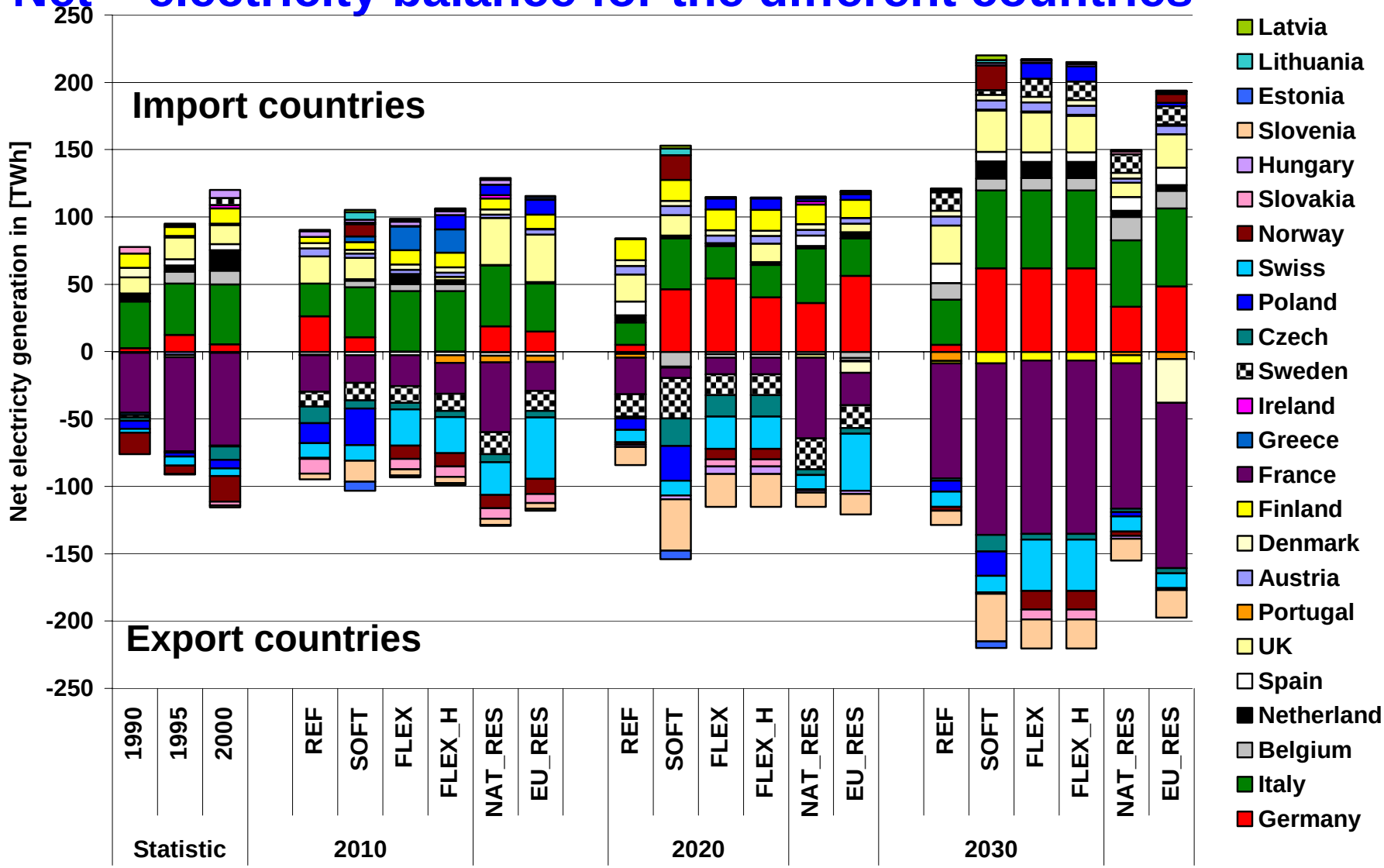
Primary energy consumption of gas in EU 25



Average additional gas supply cost for the EU25



Net – electricity balance for the different countries



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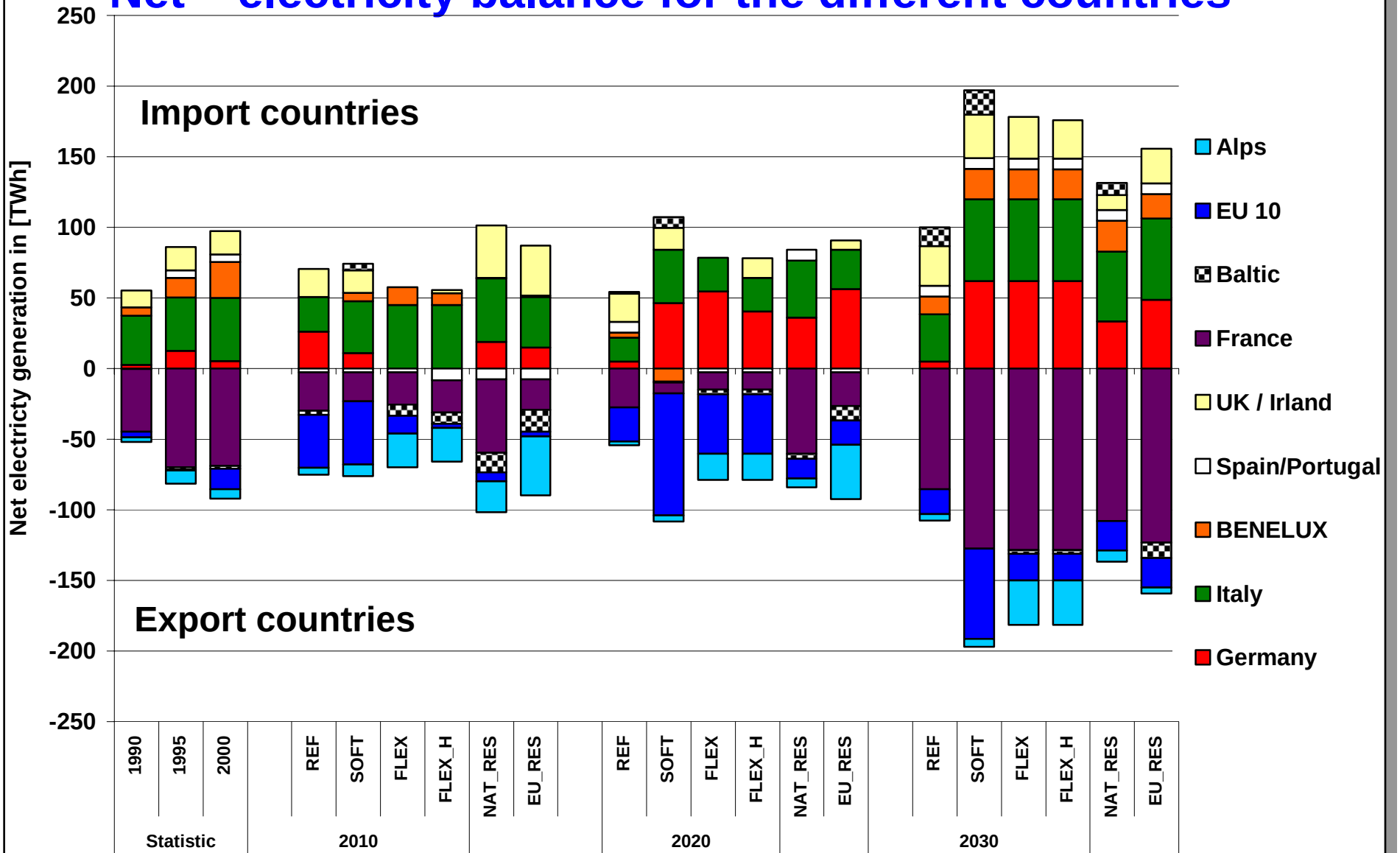
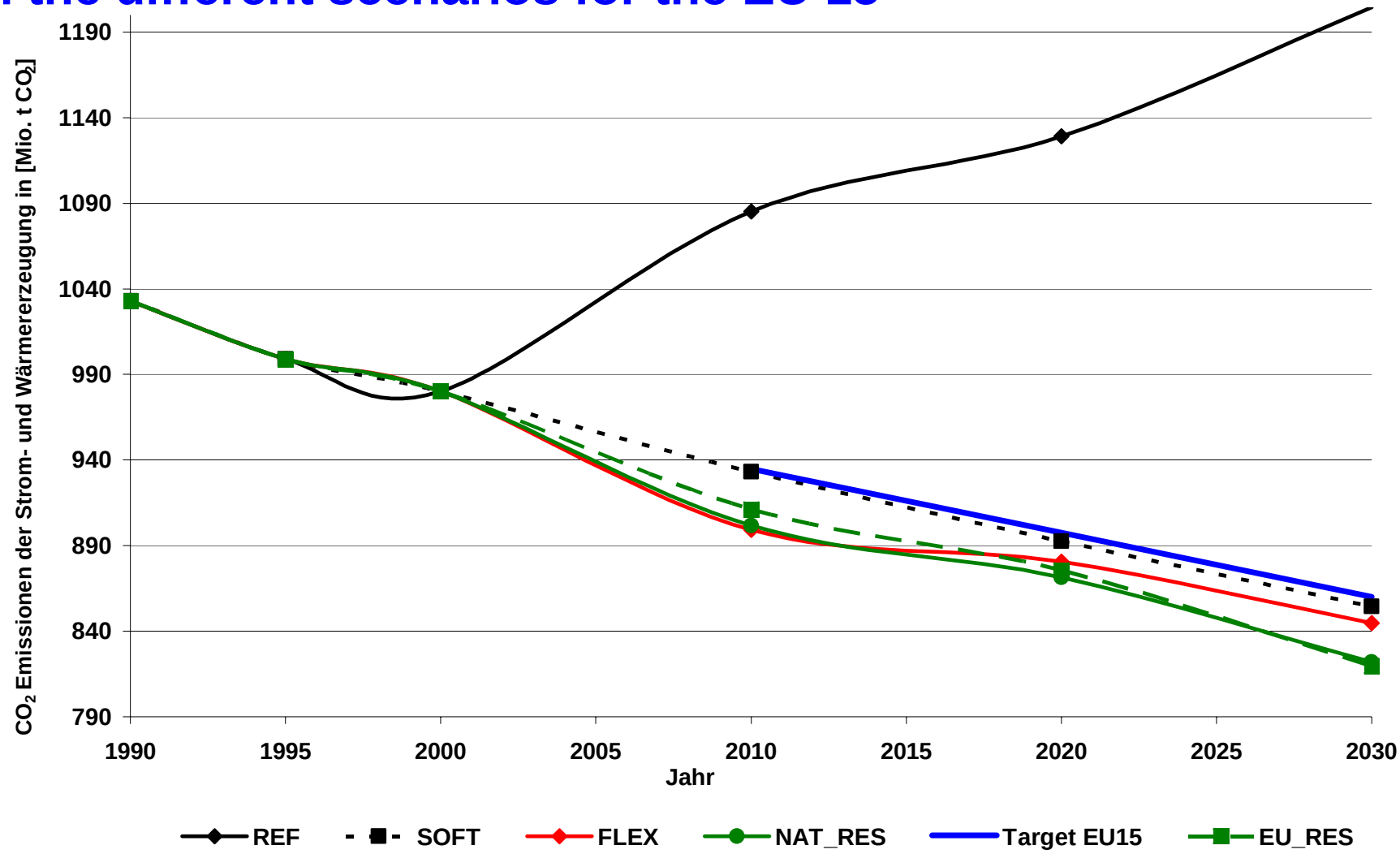
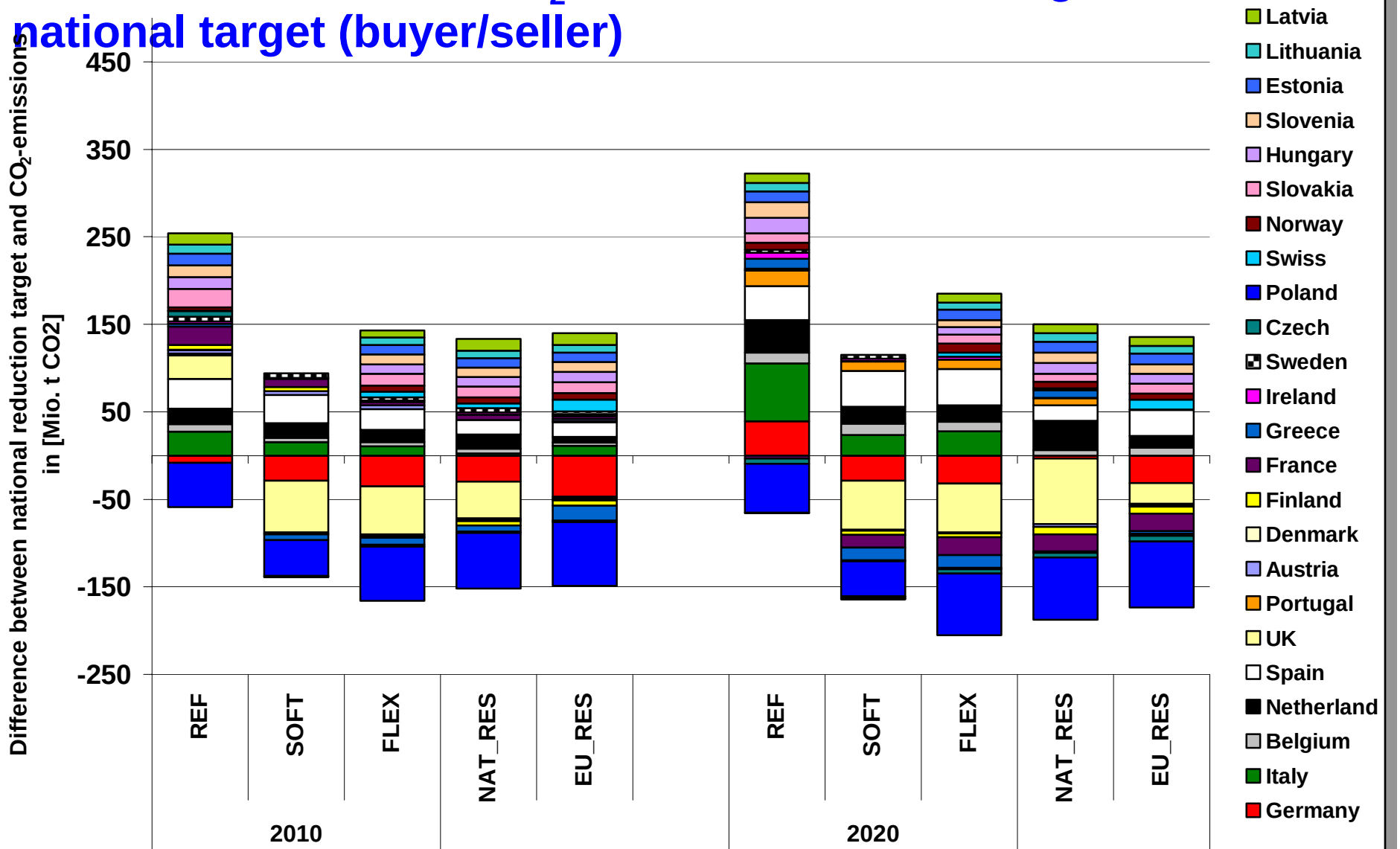


Influence of the reduction targets to the total CO_2 emissions in the different scenarios for the EU 15



Differences between CO_2 Emission „soft landing“ and national target (buyer/seller)



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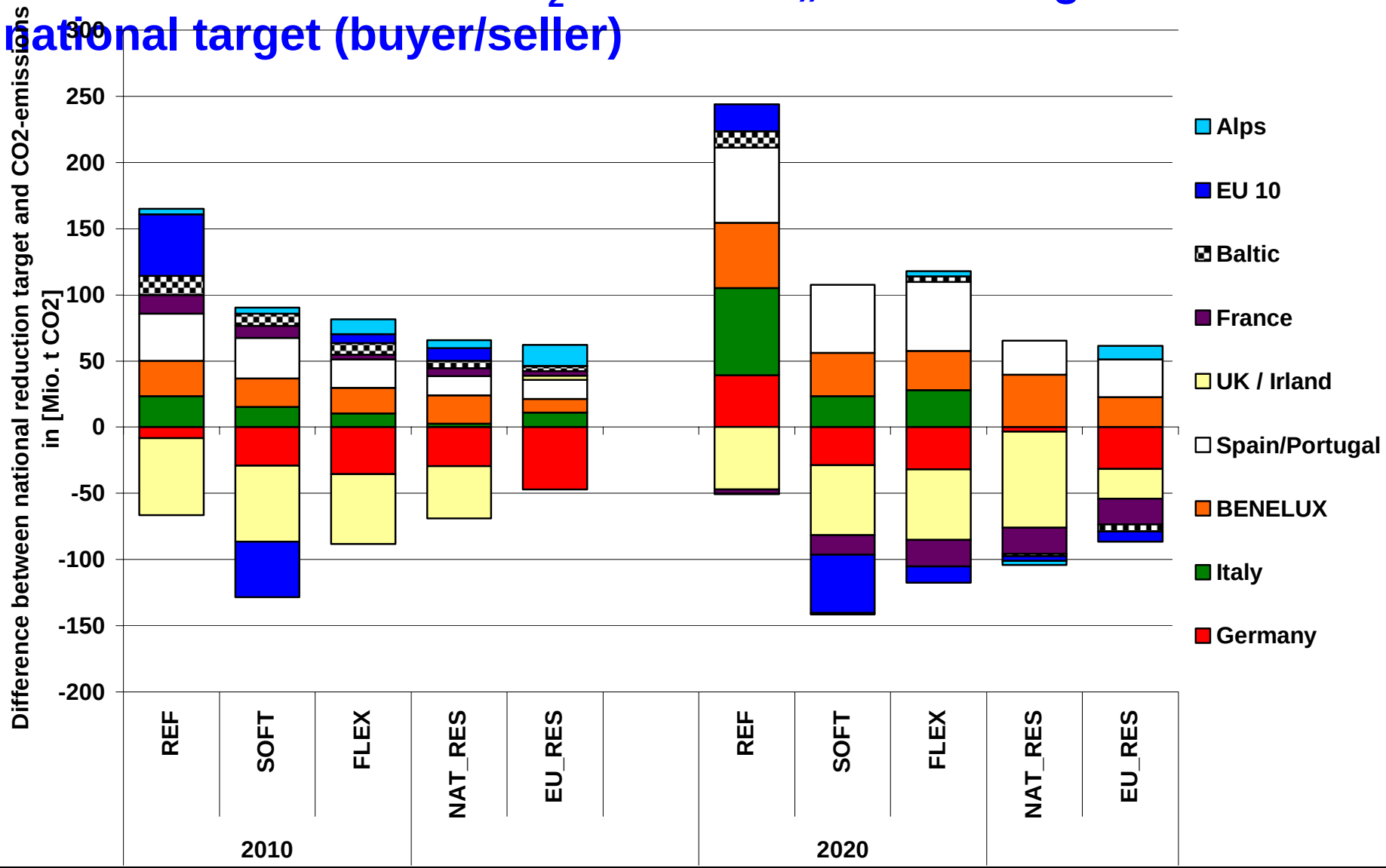
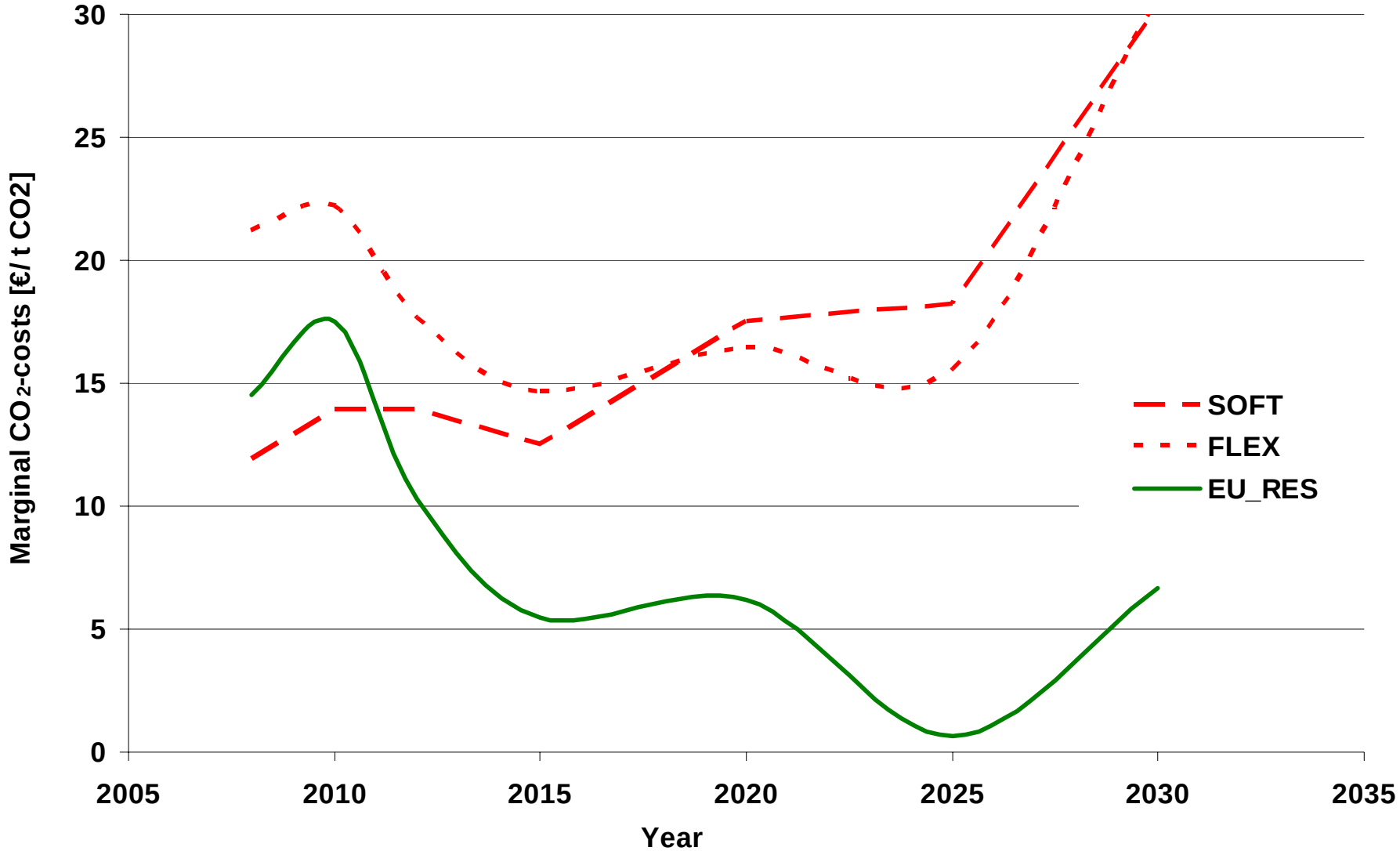
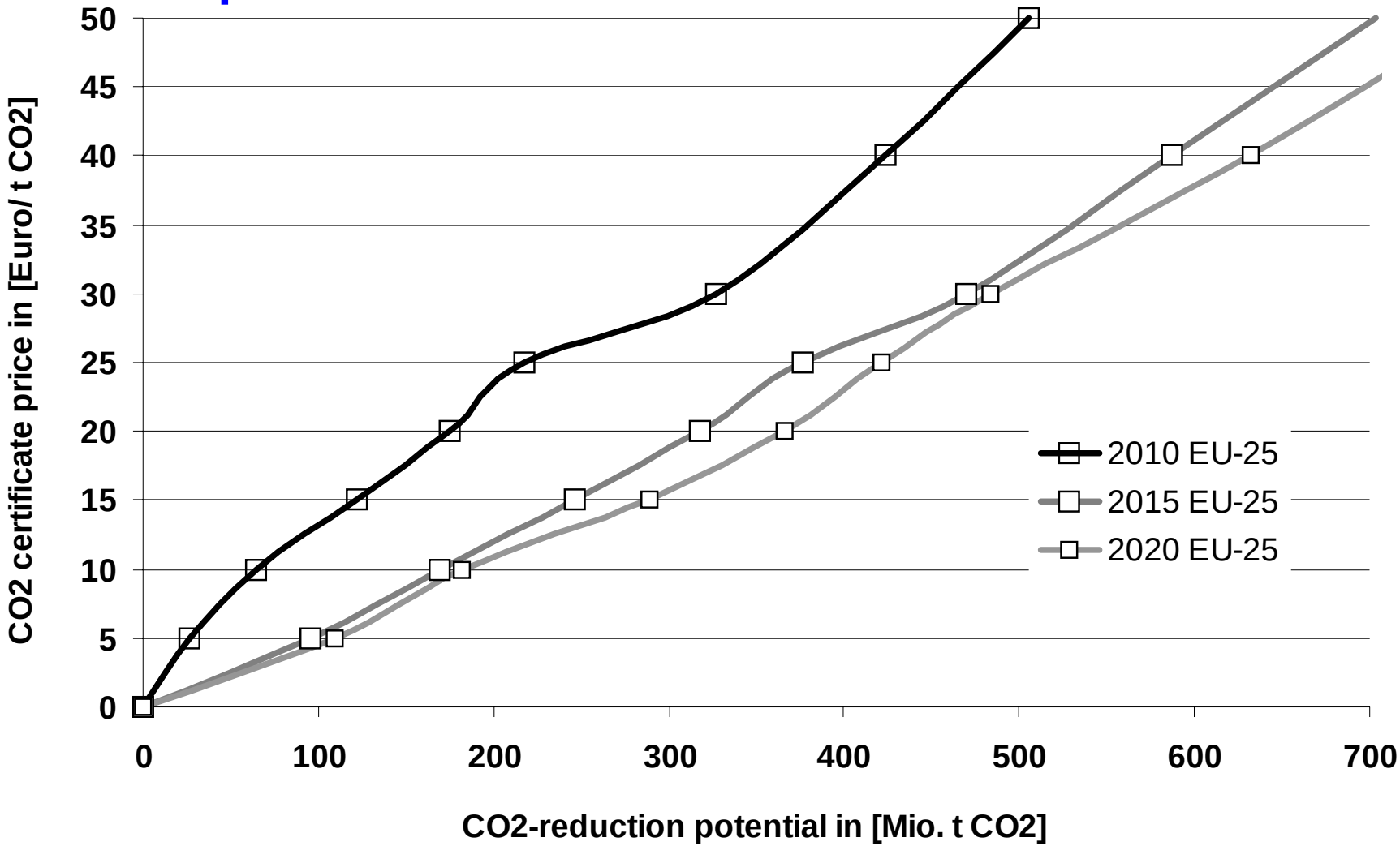


Marginal cost of CO_2 reduction



CO_2-reduction potential in the EU25 depending of the CO_2 certificate prices



Conclusions

- **Trading scheme:**
  - **Emission trading between all EU-25 countries sensitive on the gas price projection.**
  - **“Hot air” exists in some of the new member states compared to individual achievements of the national targets (SOFT).**
  - **The total amount of country specific electricity balance depends much on the expected decommissioning of the existing power plants.**

- **Gas market:**
  - **Only with a weak CO2 reduction target of 8 % in 2010 and approx. 16 % in 2030 compared to the year 1990 the increase of the gas consumption will be more then 40 percentage points higher.**
  - **A impact of policy measures to the gas prices can be recognized in a significant way because a refinancing of the capital costs for the additional infrastructure of the gas supply system is necessary.**

- **Electricity Market:**
  - **The cost correlated load duration curve of the electricity generation will get broader in the future.**
  - **In competitive markets or because of market imperfections the increase of the gas and electricity prices might be much higher.**