



Impact of the price of CO₂ certificates on CHP and district heat in the EU27

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Cooling,
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Objective and Scope

The Energy and Climate Package aims at achieving 20-20-20-2020 via

- EU Emission Trading Scheme: -21% GHG in 2020 compared to 2005
- In discussion a new climate action plan has foreseen: -34% GHG in 2020 compared to 2005

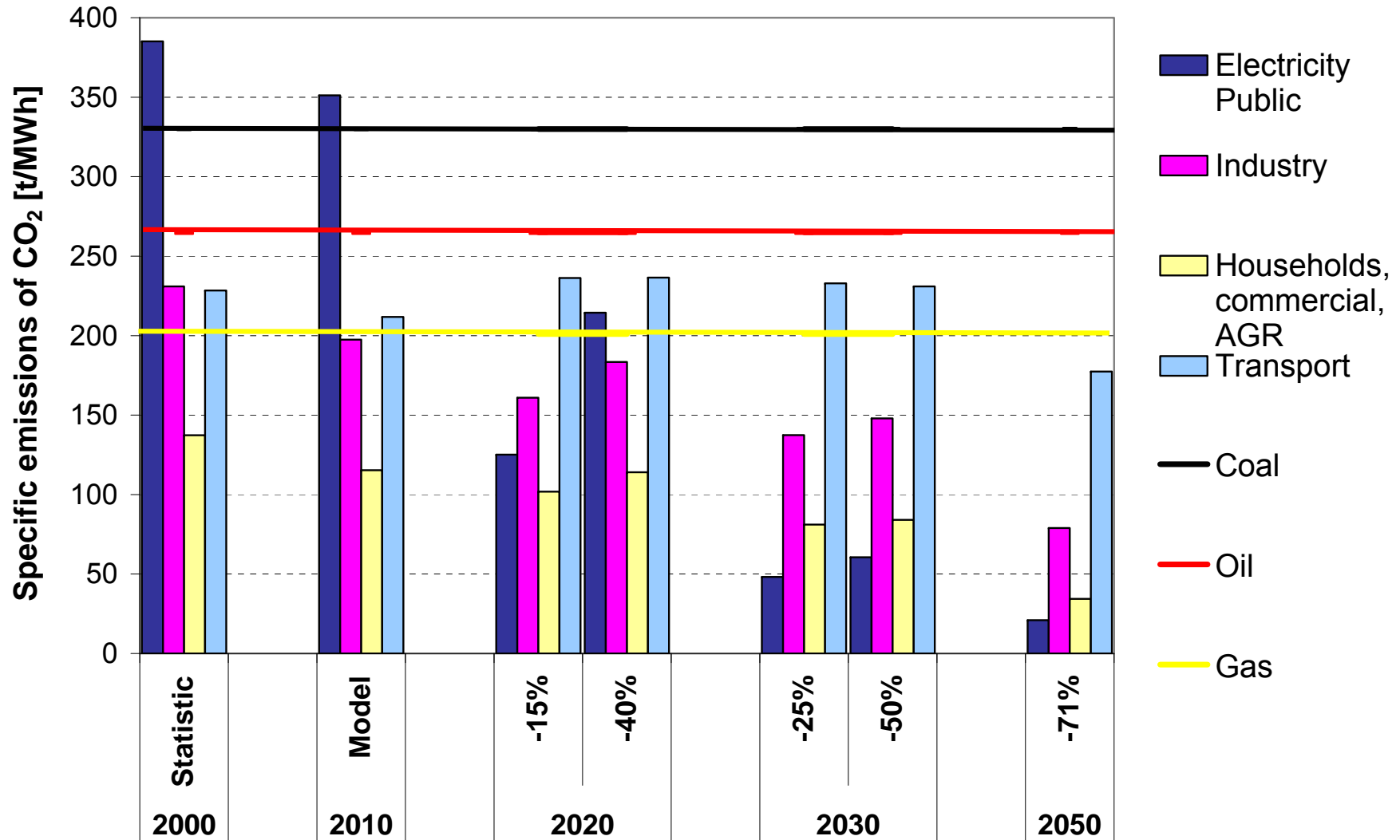
The 2°C target

- In the longer term the EU wants to achieve the 2°C: -56% to 85 % GHG till 2050 compared to 1990

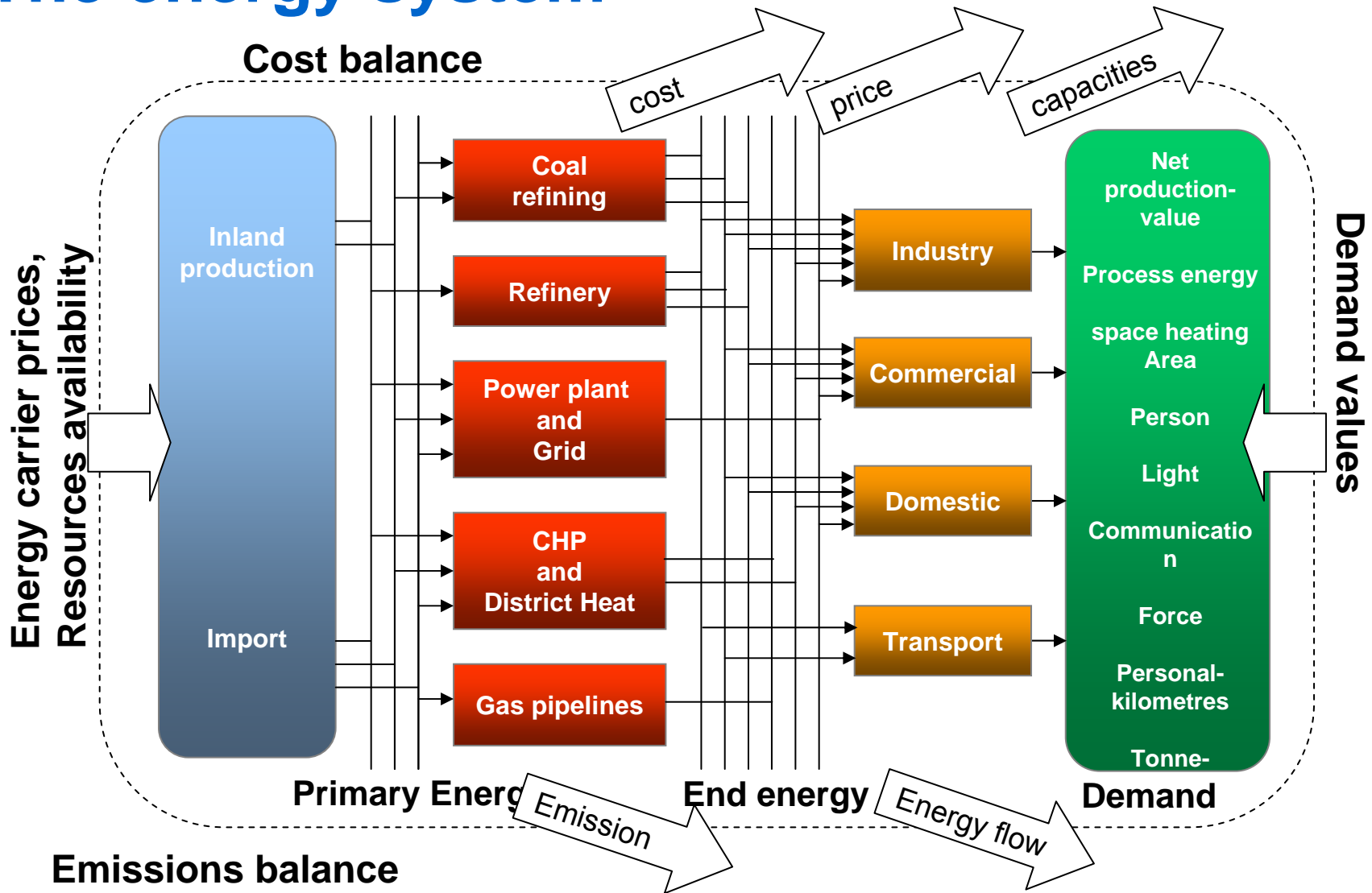
Assessment of the...

- role of different technologies and energy carriers in the future.
- CHP and district heat and cooling systems in the future.

Average specific CO₂ emissions by sector to achieve GHG emission targets by sector



The energy system





Characterization of the Pan-European TIMES model

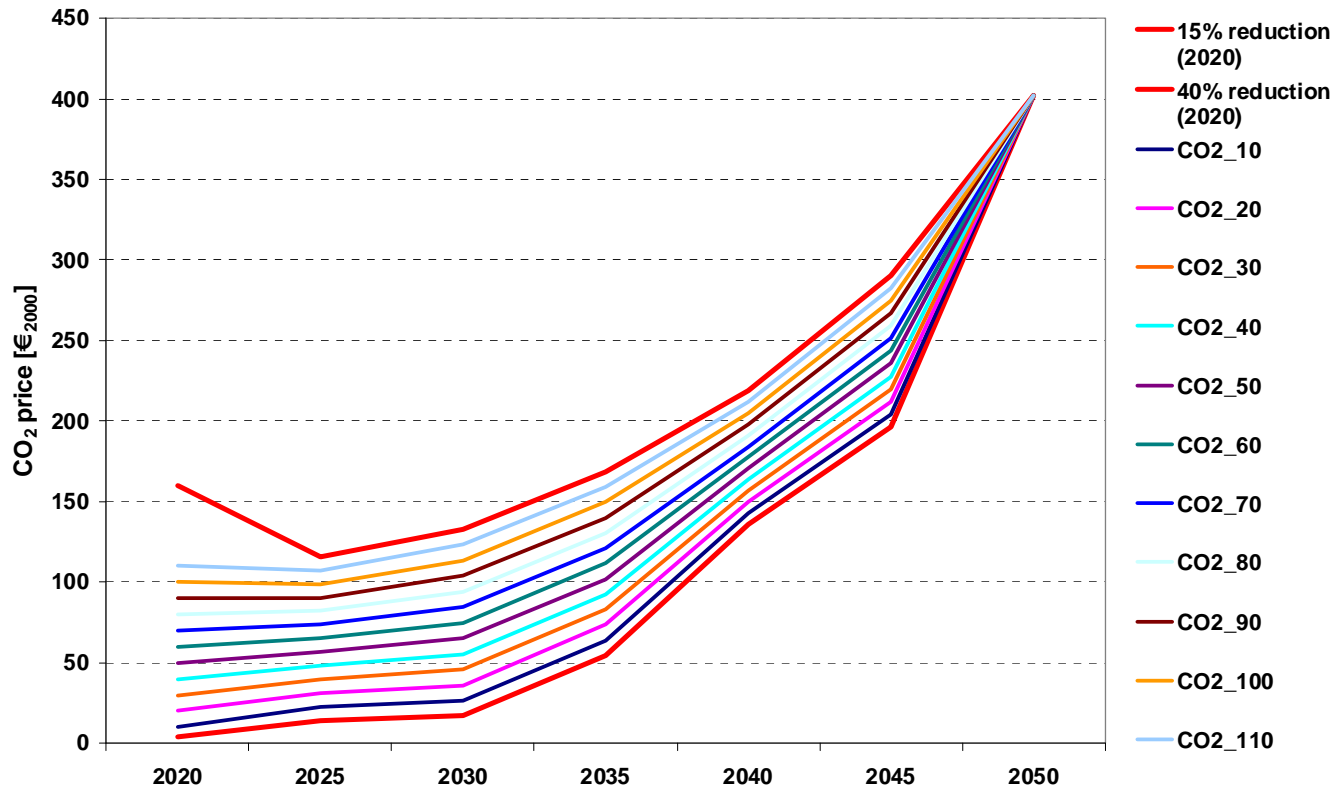
- **TIMES PanEU is a, 30 region (EU 27 + NO, CH, IS) partial equilibrium energy systems, technology oriented bottom-up model.**
- **Energy system model**
 - SUPPLY: reserves, resources, exploration and conversion Country specific renewable potential and availability (onshore wind, offshore wind, ocean, geothermal, biomass, biogas, hydro)**
 - Electricity: public electricity plants, CHP plants and heating plants**
 - Residential and Commercial: End use technologies (space heating, water heating, space cooling and others)**
 - Industry: Energy intensive industry (Iron and steel, aluminium copper ammonia and chlorine, cement, glass, lime, pulp and paper), food, other industries , autoproducer and boilers**
 - Transport: Different transport modes (cars, buses, motorcycles, trucks, passenger trains, freight trains), aviation and navigation**
- **Country specific differences for characterisation of new conversion and end-use technologies**
- **Time horizon 2000 - 2050**
- **GHG: CO₂, CH₄, N₂O, SF₆ /Others pollutants: SO₂, NO_x, CO, NMVOC, PM_{2.5}, PM₁₀**



Regional Coverage Pan-European TIMES model

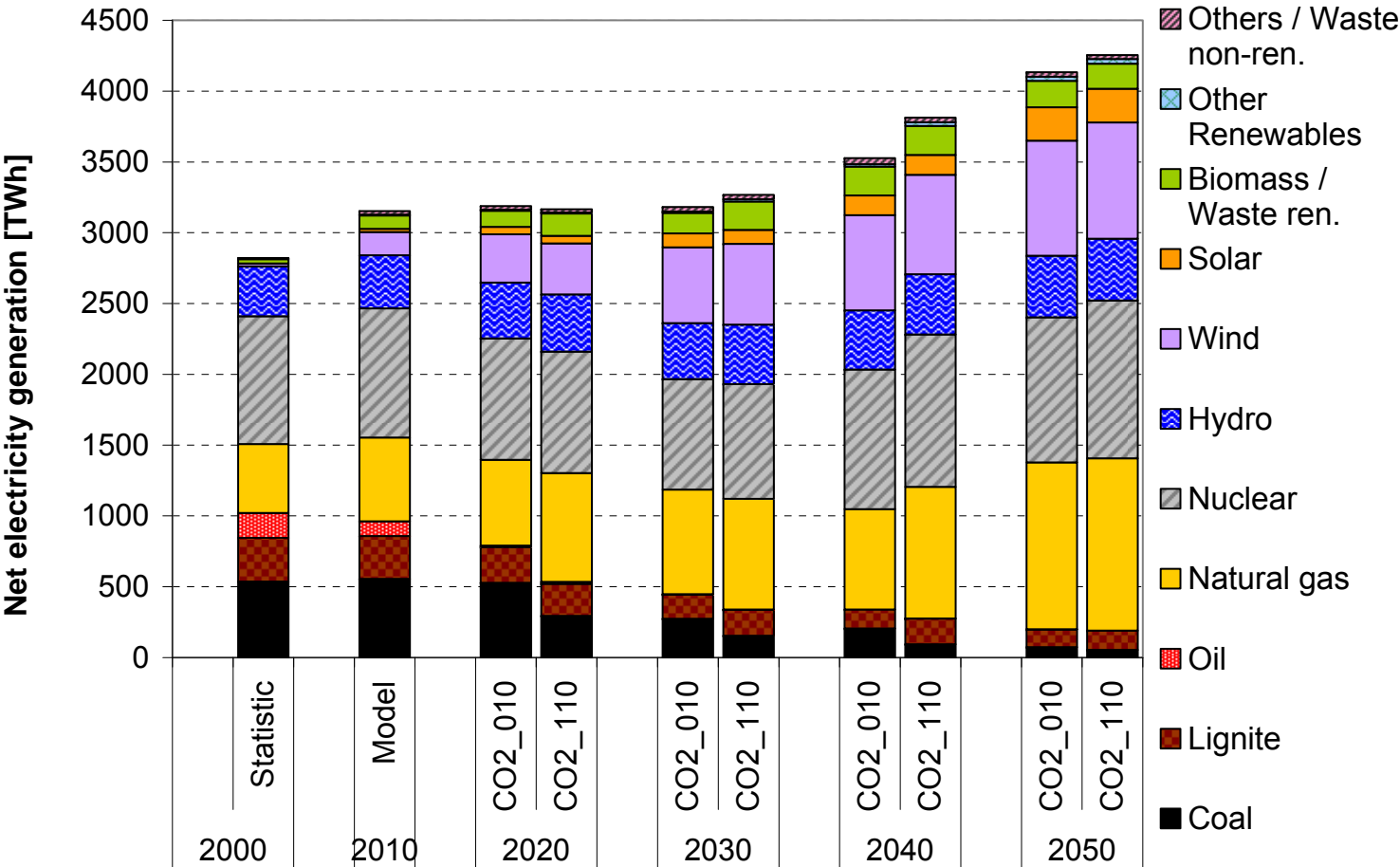


Scenario definition by CO₂ price variation



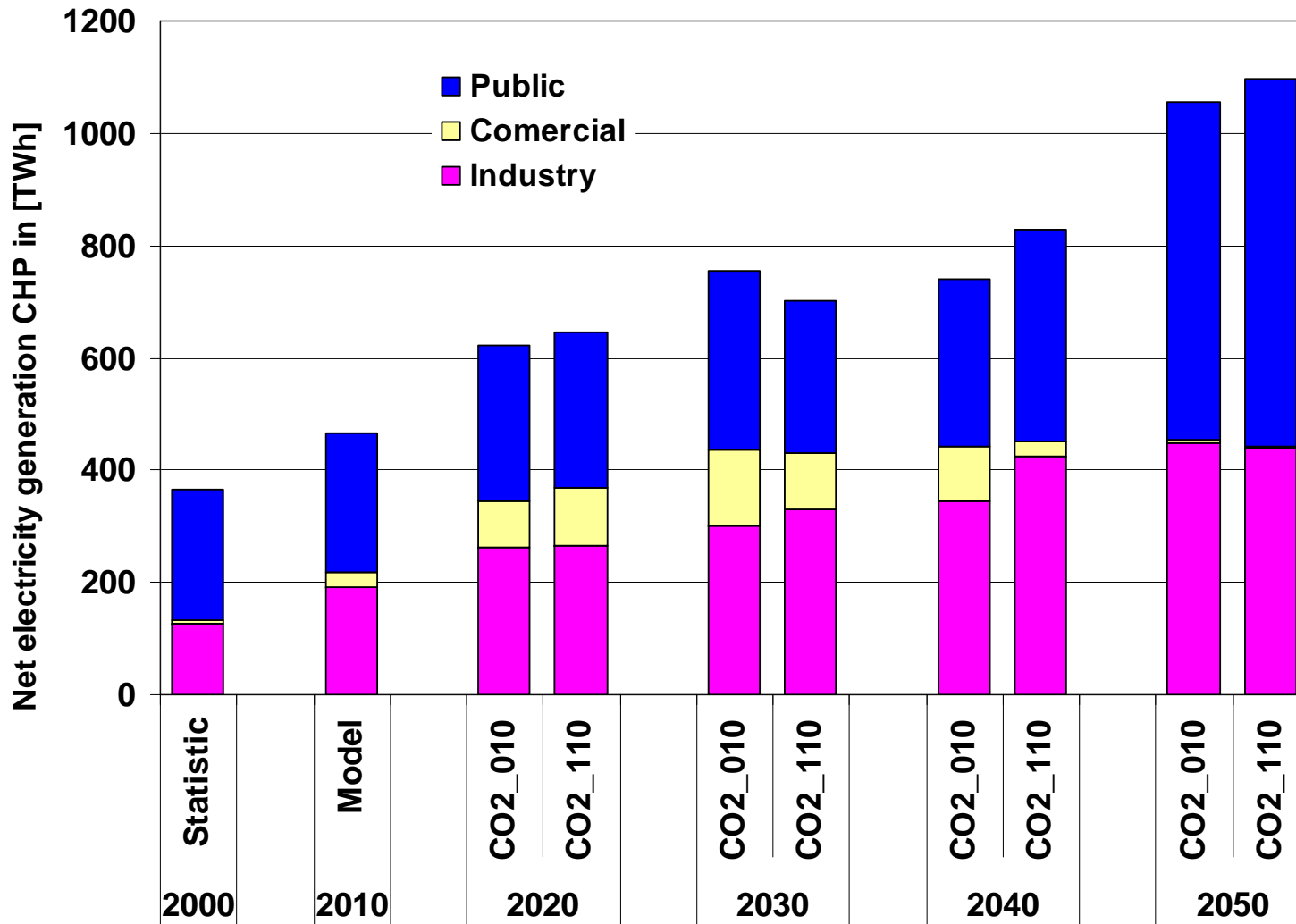
- CO₂ price as a result of -15% (2020) and -40% (2020) scenarios as lower and upper bound
- variation of the CO₂ price within this range of the two scenarios in equal steps
- in 2020: variation from 10€/t CO₂ to 110€/t CO₂
- Constructing reduction potential curves

2000-2050: Electricity Generation EU-27

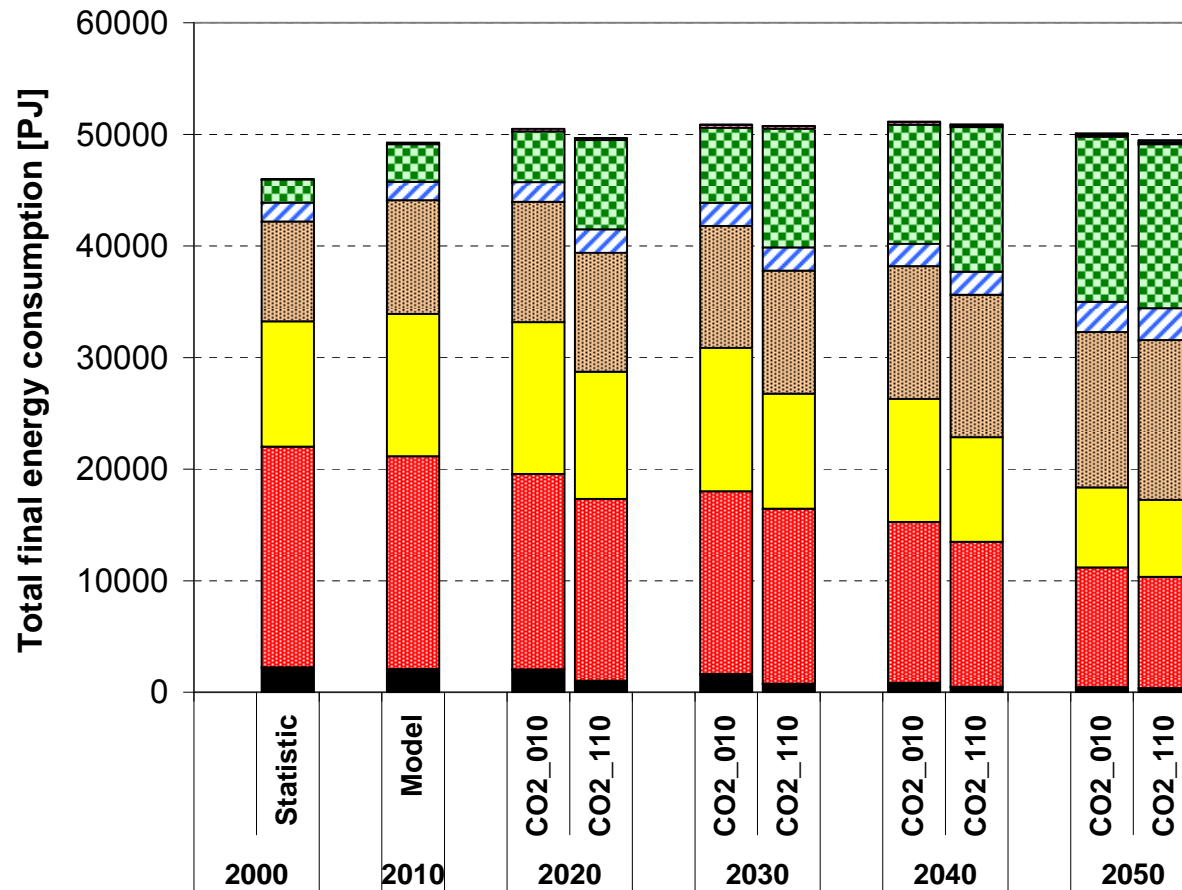


- Results of lowest (10€/t CO₂ in 2020) and highest (110€/t CO₂) CO₂ price
- differences in the mid term periods
- Higher consumption of electricity at later periods (450ppm target)
- 2030: higher use of nuclear, renewables and CCS at higher carbon price

2000-2050: Electricity Generation CHP EU-27

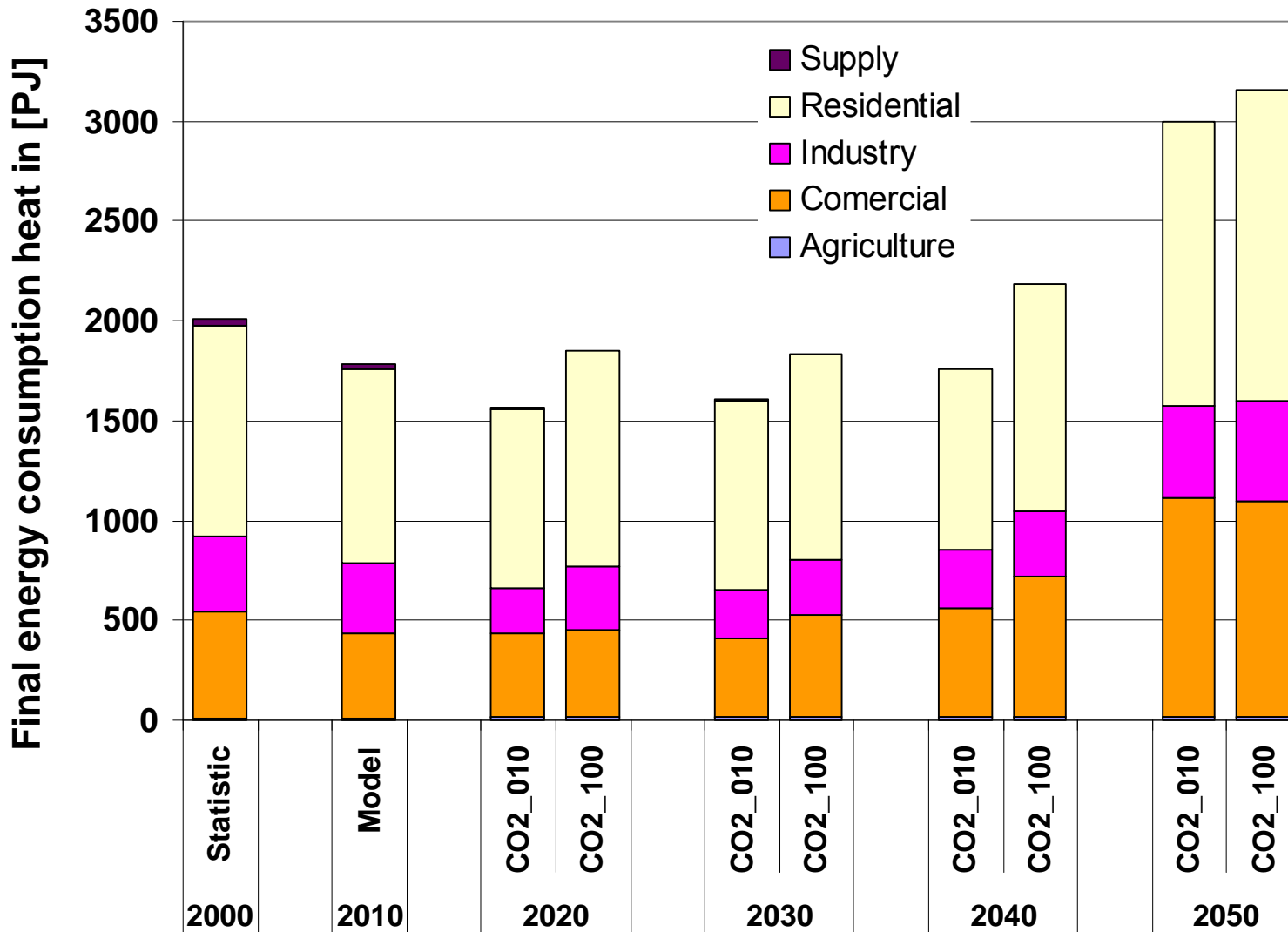


2000-2050: Final Energy Consumption EU-27

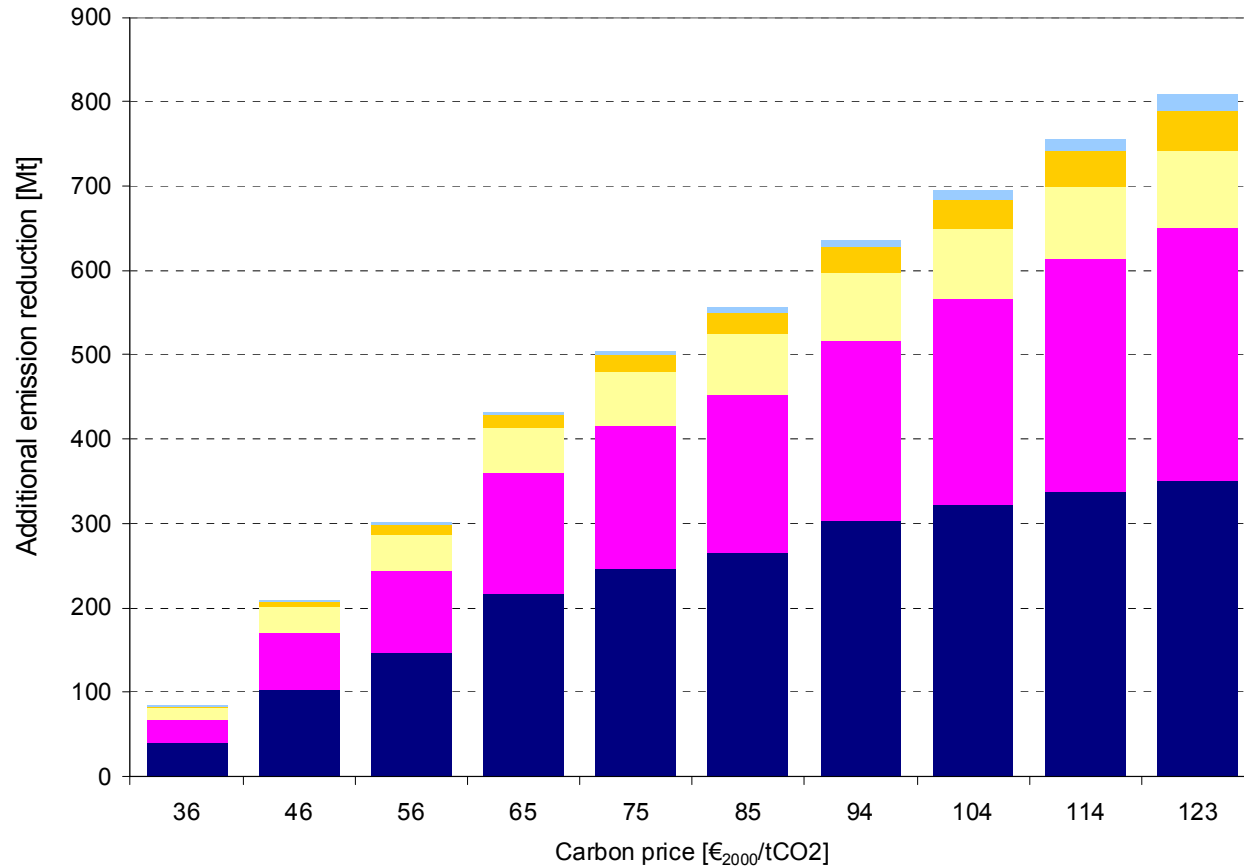


- Decreasing FEC in the long run
 - higher share of electricity => high end use efficiency
 - efficiency improvements at residential/commercial (buildings/heating) and in the long run in the transport sector
- Others (Methanol, Hydrogen)
■ Waste
■ Renewables
▨ Heat
■ Electricity
■ Gas
■ Petroleum products
■ Coal

2000-2050: Final energy consumption heat EU-27

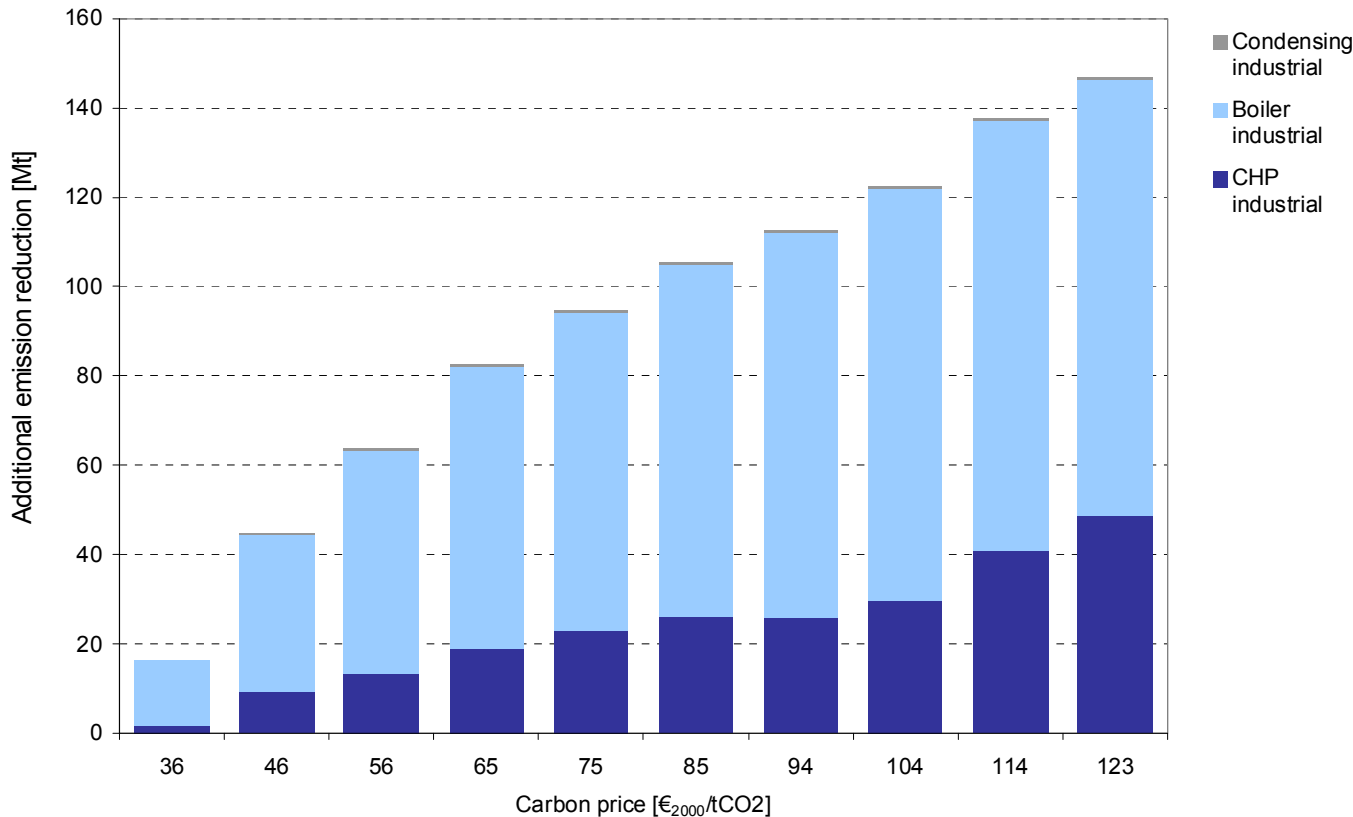


Additional emission reduction (2030) by sector



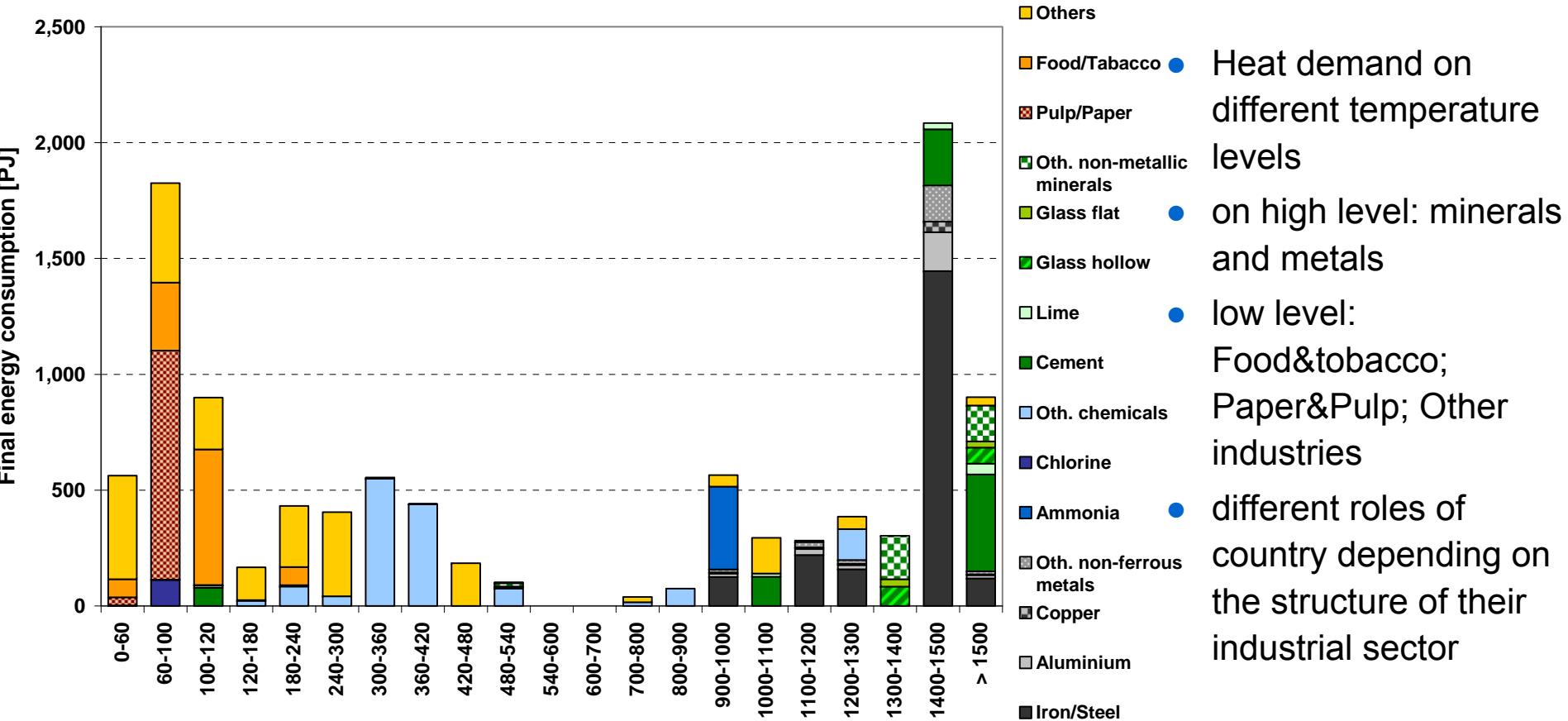
- Additional CO₂ reduction in 2030 compared to reduction at lowest CO₂ price (27€/t CO₂ in 2030)
- Key role of conversion/production and industrial sector
- Additional reduction of 301 Mt. CO₂ in industrial sector

Additional reduction by industrial supply side (2030)



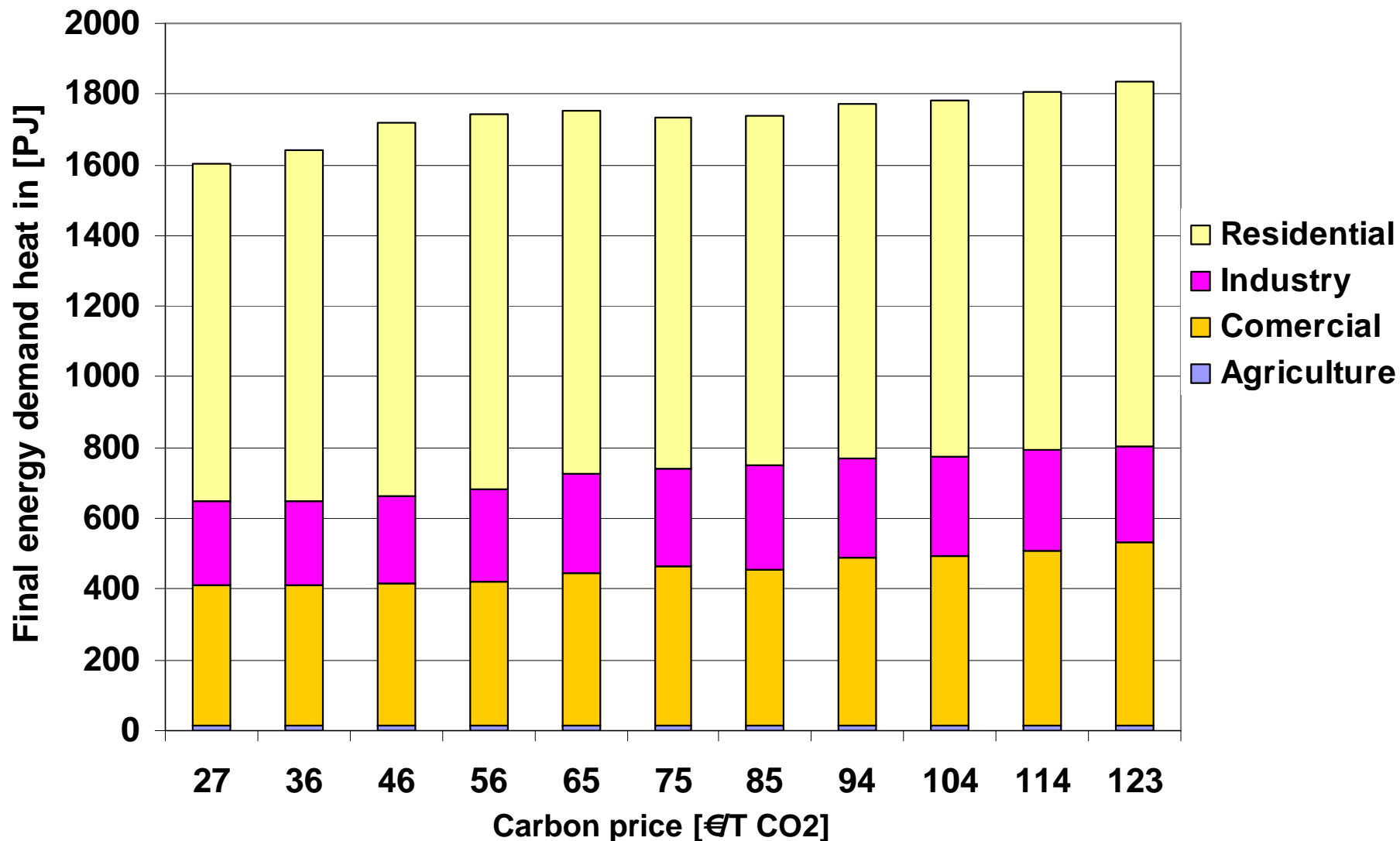
- Reduction of boilers caused at lower carbon prices by extended use of renewables
- At higher carbon prices: switch from boilers to CHPs (less heat from boiler)
- CHP: constant level at medium prices due to extended use
- CCS use at CHPs at above 94€/t

Heat demand of industrial sector

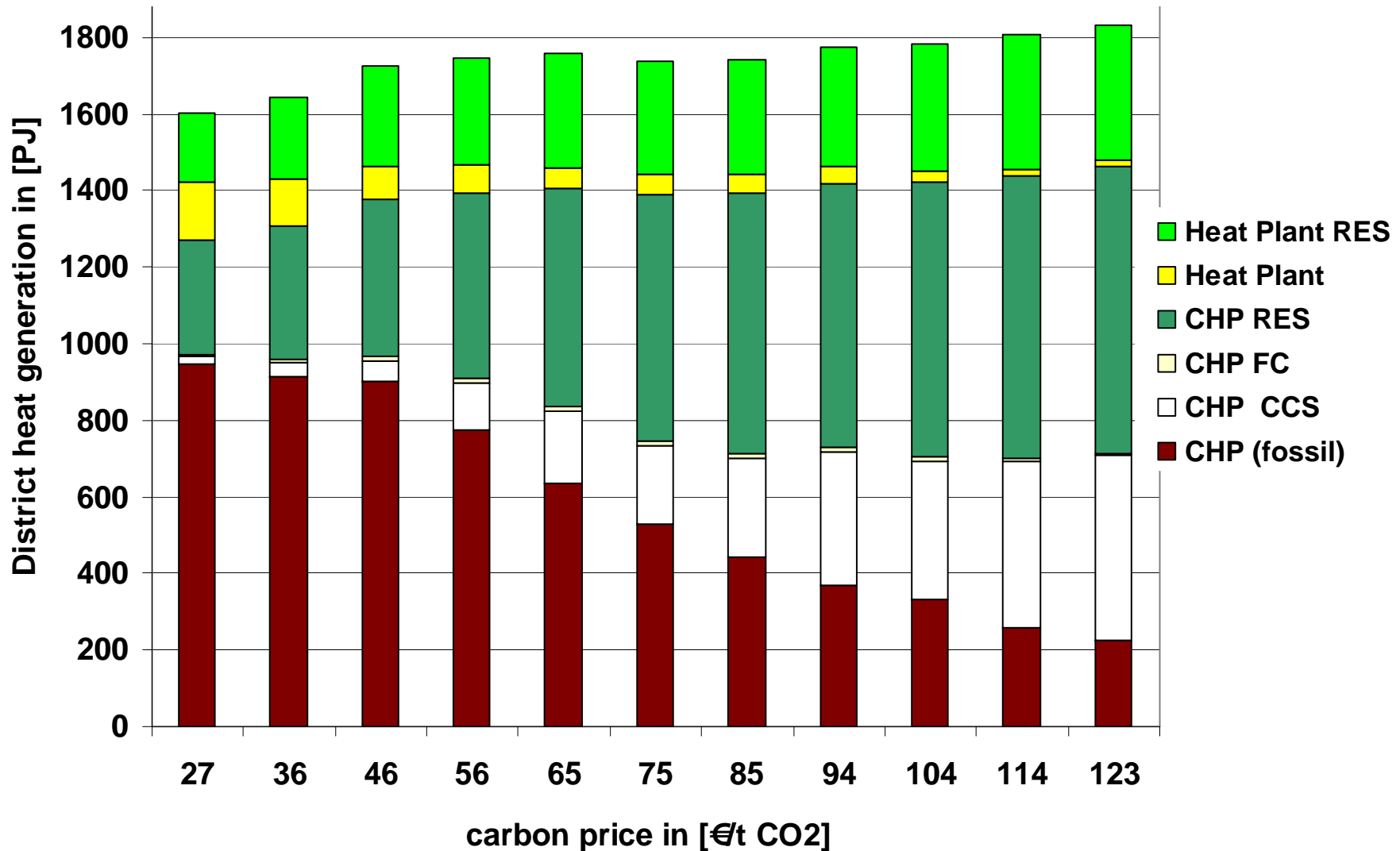




District heat generation in the EU27 (2030)



District heat generation in the EU27 (2030)





Conclusions

- **District heating generation offers an economic potential for extension in the future. The share of CHP in the industry and public growth up rapidly.**
- **Which are the constrains in the opposite direction? Technology availability or missing R&D investments in new systems at the right time.**
- **Are there possibilities to further extend the share of CHP and DH? Additional cost reduction and new systems**
- **The emission reduction targets claim a compensation of parts of the fossil based CHP and DH systems of today in one or two decades.**
- **In the long run to a CO₂-neutral world, the possibility to generate district heat with renewable energy and the use of CCS make the decarbonisation of the energy consumption in the end use sectors possible.**



Thank you for your
attention !

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