

Global, European and Nordic energy and emission scenarios to 2050

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THE NEW TIMES-NORDIC MODEL

Business from technology

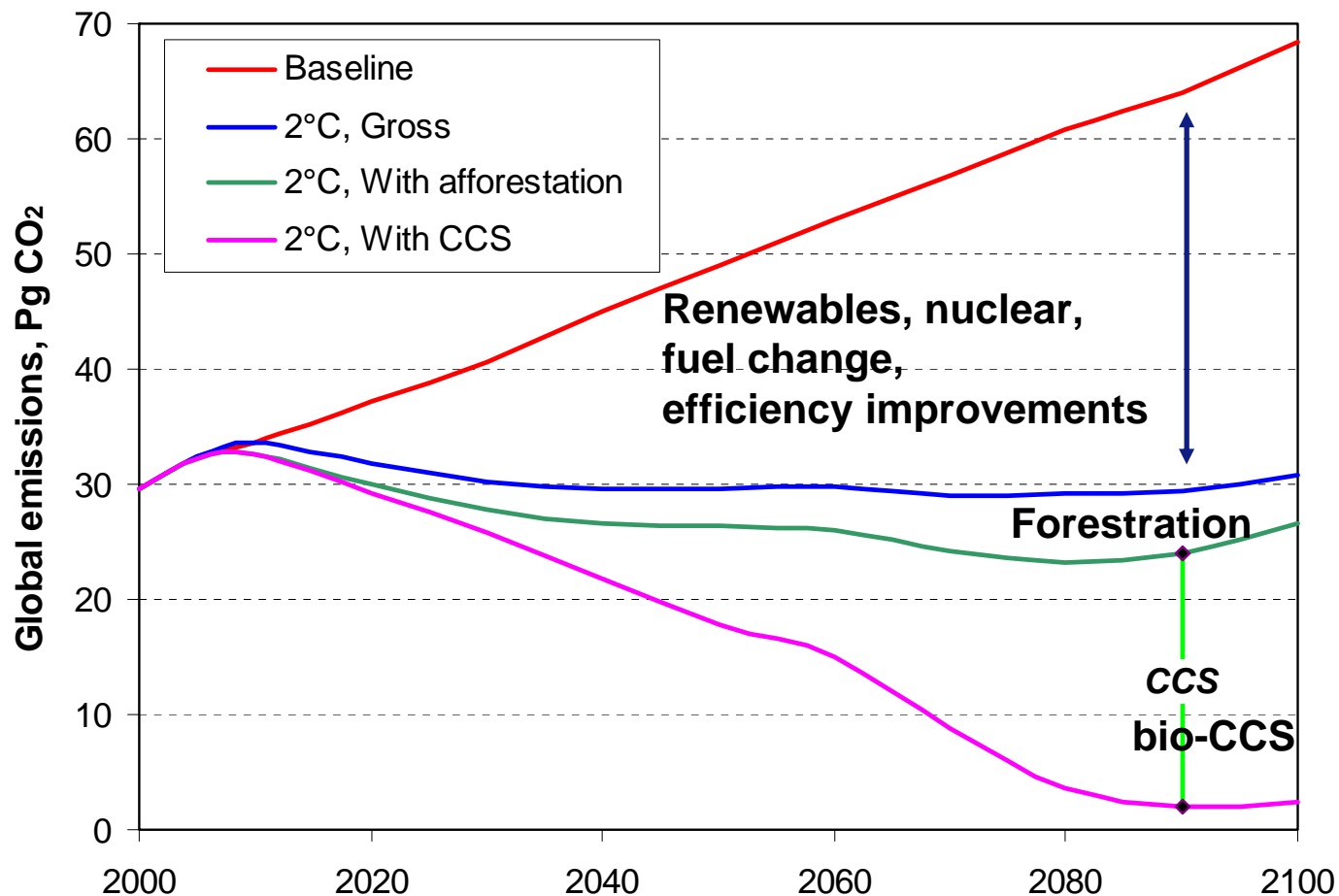
- ◆ Based on the 15-region global ETSAP-TIAM model
- ◆ All four Nordic countries added as individual regions
- ◆ Rest of Europe divided into Western and Eastern Europe
- ◆ Includes various trade links between regions:
 - ◆ Crude oil, main oil products
 - ◆ Natural gas, LNG (existing pipelines and new investments)
 - ◆ Hard coal
 - ◆ Nuclear fuel
 - ◆ Electricity (existing interconnections and new investments)
 - ◆ Biofuel trade: Liquid biofuels; Pending: solid fuels
- ◆ Nordic hydro power water reservoirs included

ILLUSTRATIVE SCENARIOS WITH THE NEW NORDIC TIMES MODEL

Business from technology

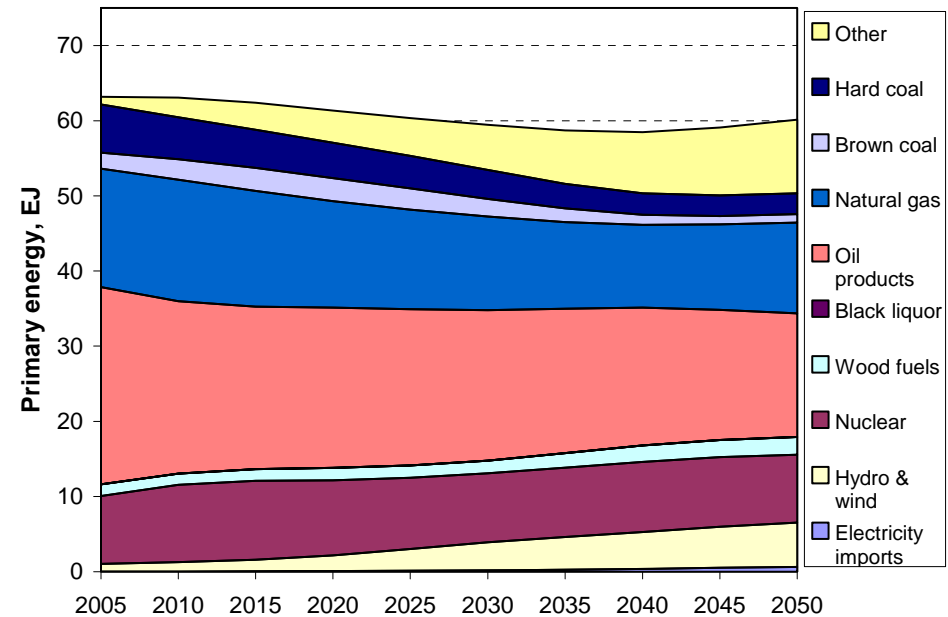
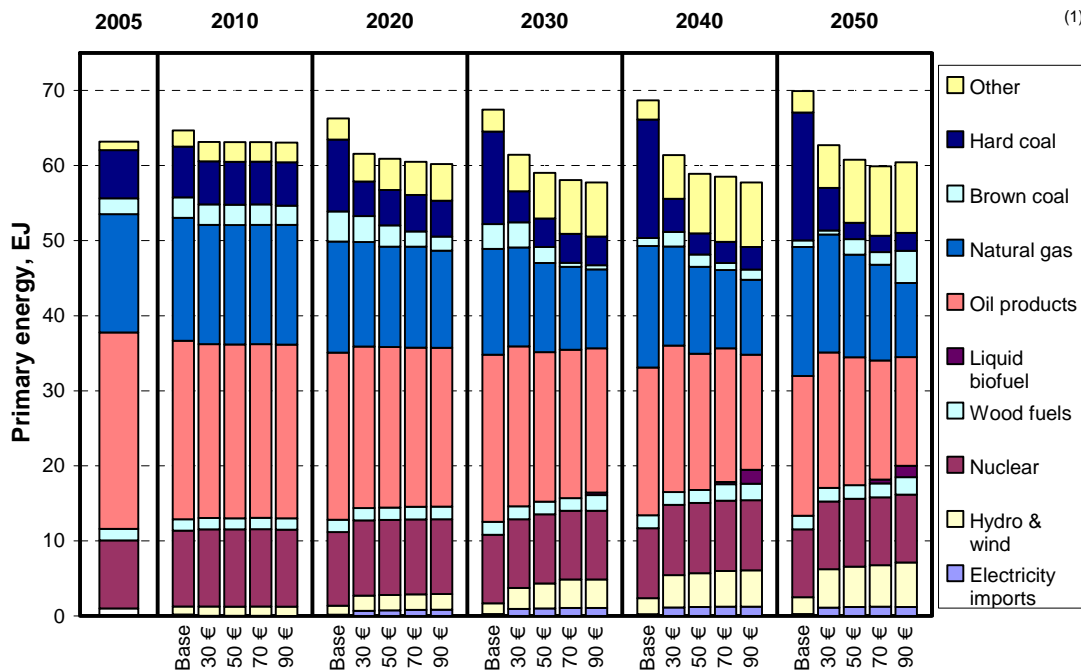
- ◆ 1) Baseline scenario: No emissions trading, but other existing policies
- ◆ 2) EU policy scenario with EU emission trading:
 - ◆ Exogenous allowance prices increase gradually from 20 €/tonne in 2010 to higher levels:
 - ◆ 30 €/tonne in 2040
 - ◆ 50 €/tonne in 2040
 - ◆ 70 €/tonne in 2040
 - ◆ 90 €/tonne in 2040
 - ◆ Trading assumed to include all GHGs, thereby simulating cost-effective allocation of emission reductions between sectors
- ◆ 3) Global climate change mitigation to at most 2°C temperature increase
 - ◆ European emissions to be reduced at least 60% by 2050

Global target to mitigate climate change to 2 C degrees would require “zero emission systems” by 2100



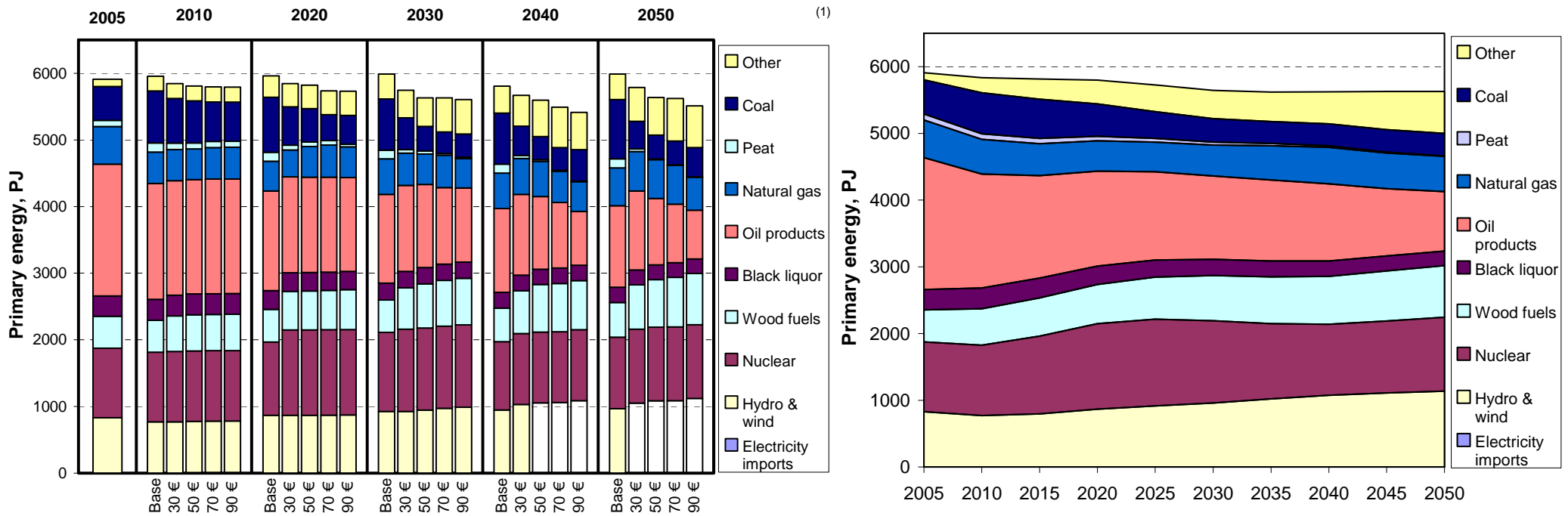
Primary energy supply in the Western Europe in the EU and global policy scenarios

The 2 C scenario is comparable with the 70 €/t CO₂ EU scenario



Primary energy supply in the Nordic area in the EU and global policy scenarios

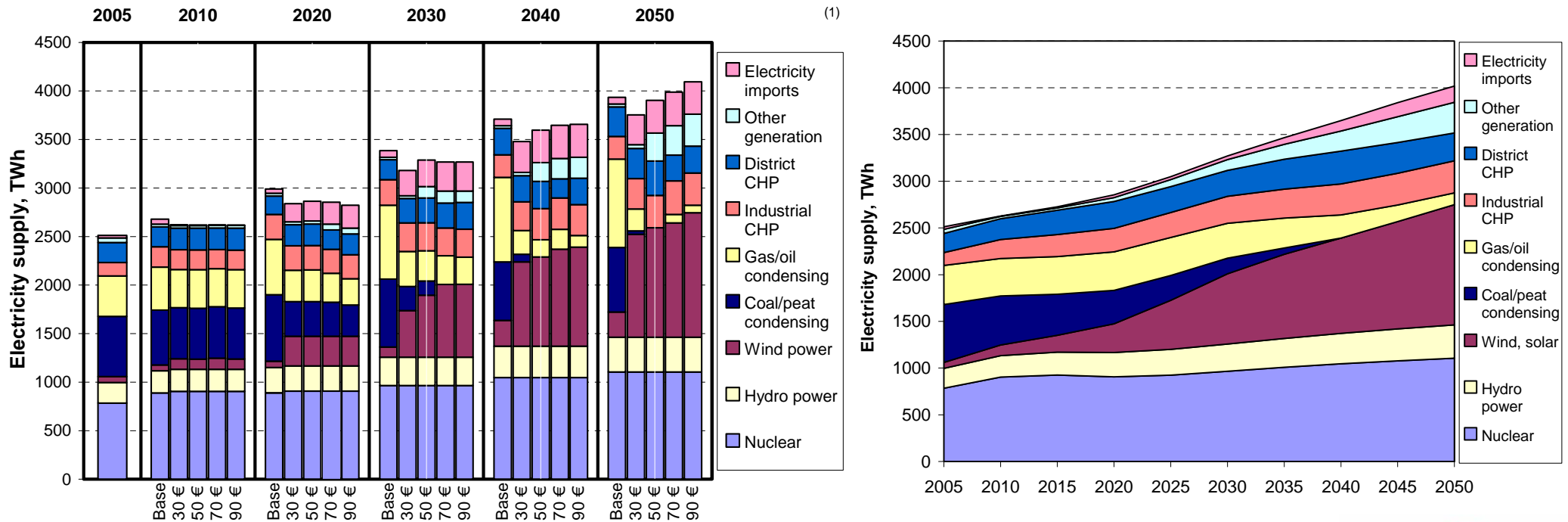
The share of renewables from the total primary energy is much higher in the Nordic area than in the Western Europe



The 2 C scenario is comparable with the 70 €/t CO₂ EU scenario

Total net electricity supply in the Western Europe in the EU and global policy scenarios

Rapid increase in wind power after 2020 is obvious in all the scenarios
 Increase in electricity consumption with higher CO₂ prices

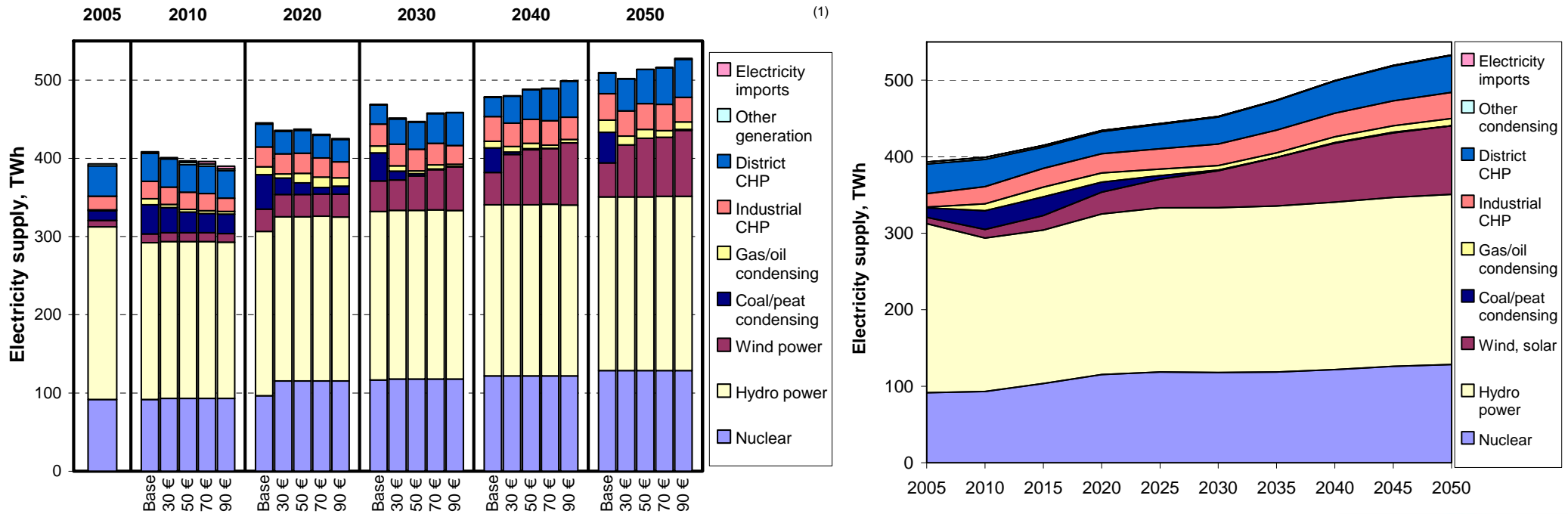


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Total net electricity supply in the Nordic area in the EU- and global policy scenarios

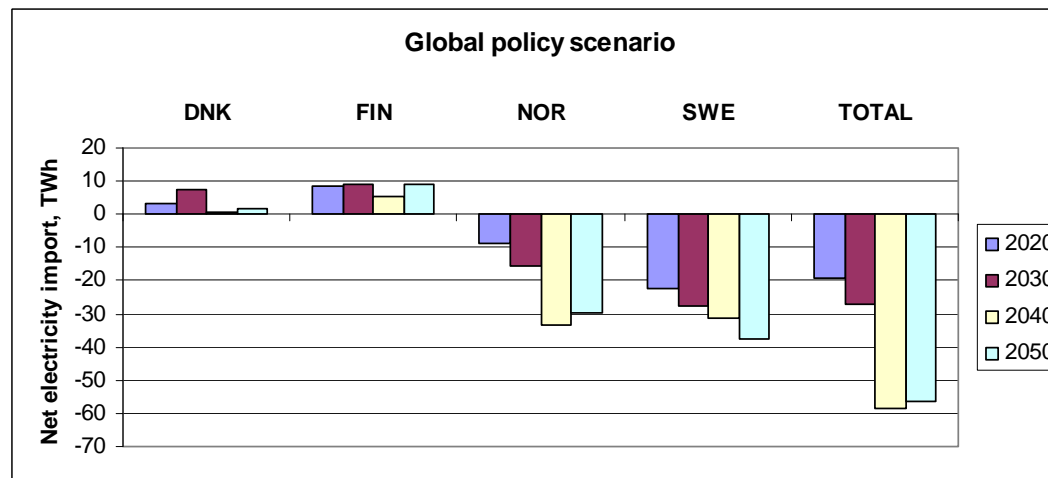
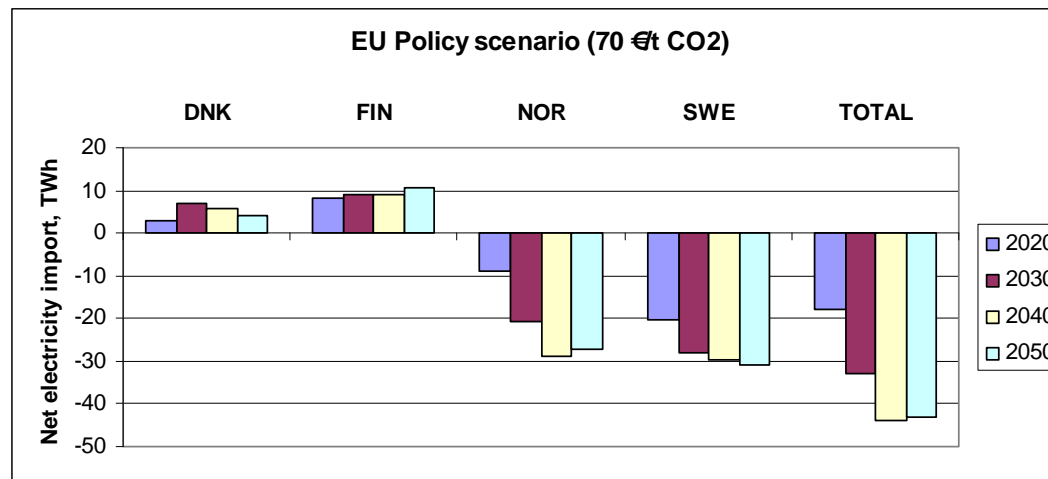
In the Nordic area the increase in electricity consumption with higher CO₂ prices is smaller due to higher share of renewables in the primary energy mix



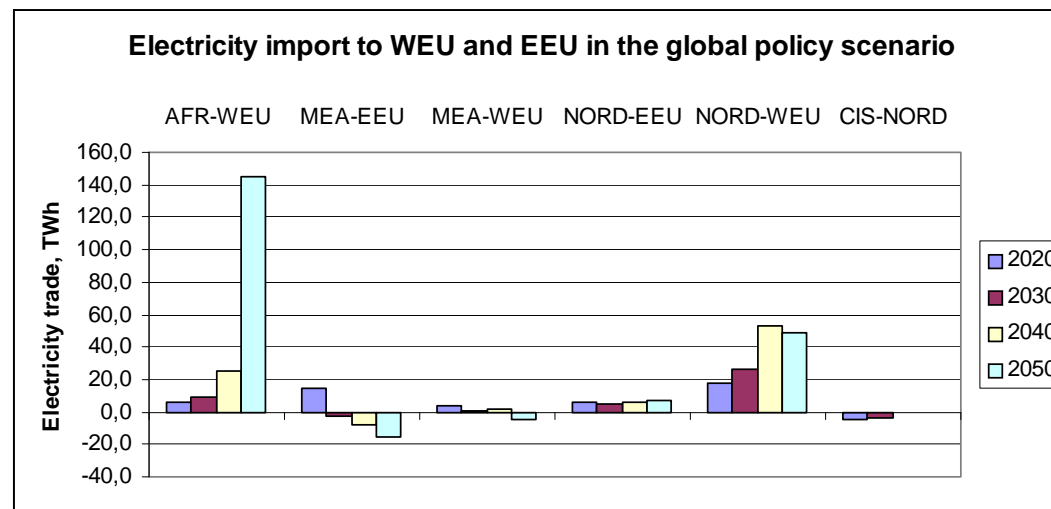
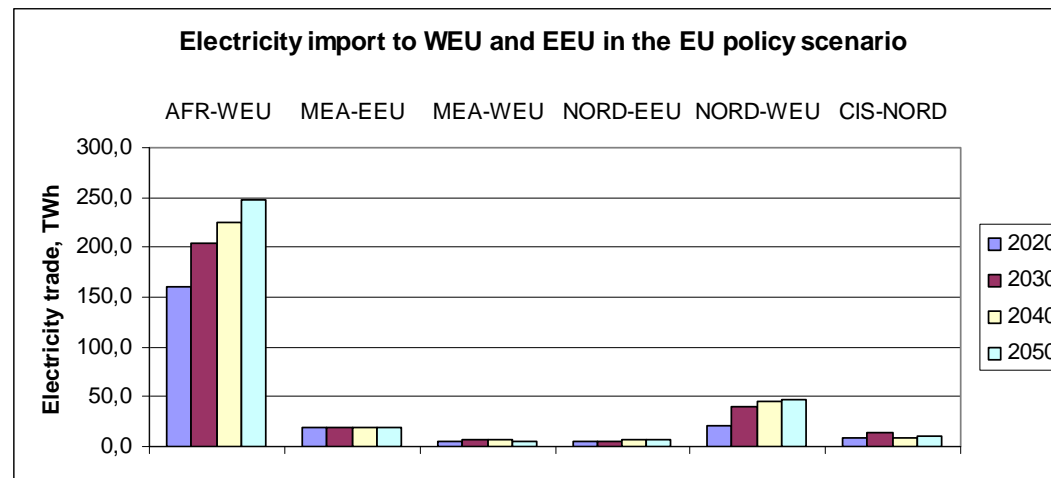
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Regional net electricity import (+) and export (-) in the Nordic area



Electricity import (+) to the Western Europe and Eastern Europe

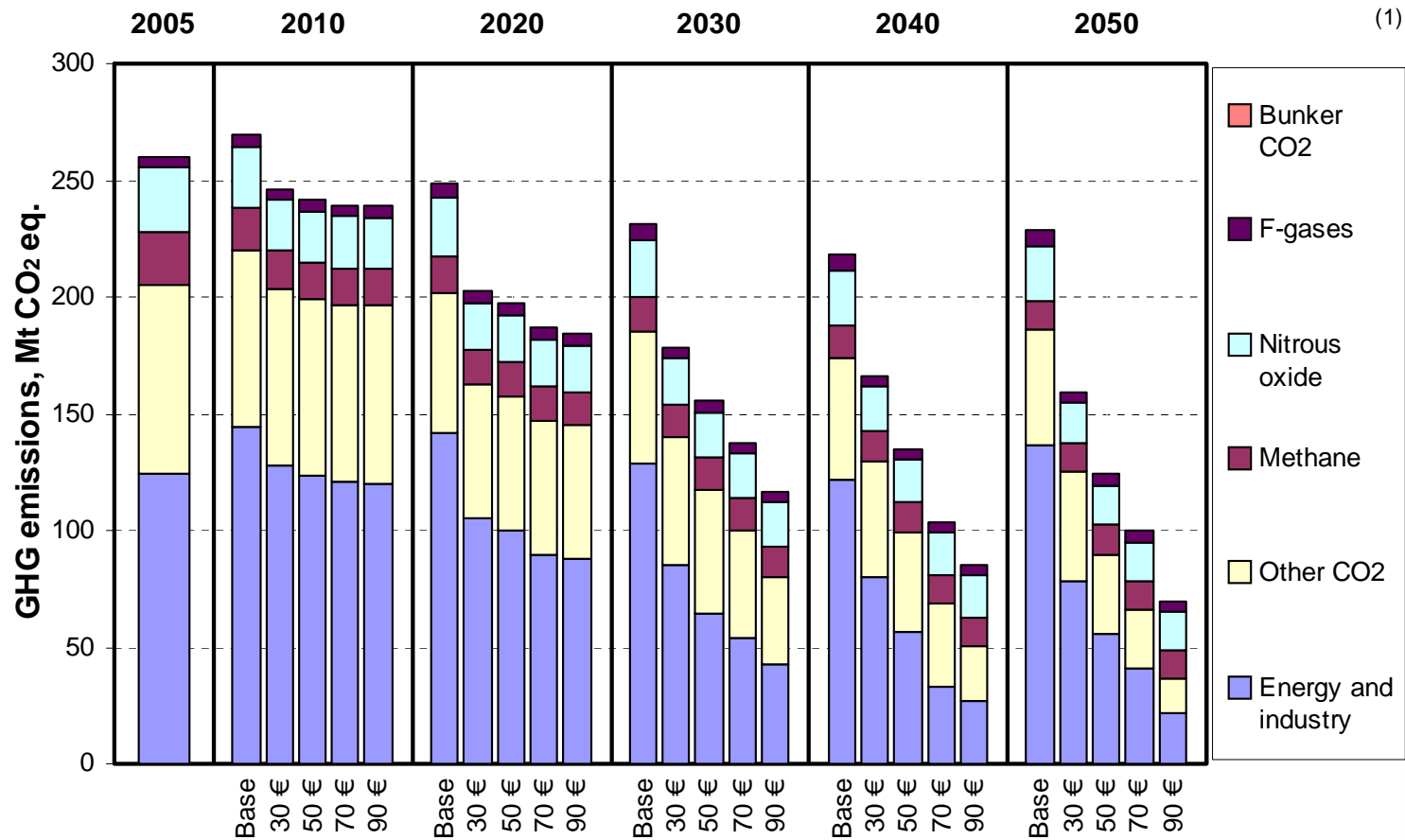


AFR: Africa
 CIS: Former Soviet Union excluding Baltic countries
 NORD: Nordic area
 EEU: Eastern Europe
 MEA: Middle East
 WEU: Western Europe

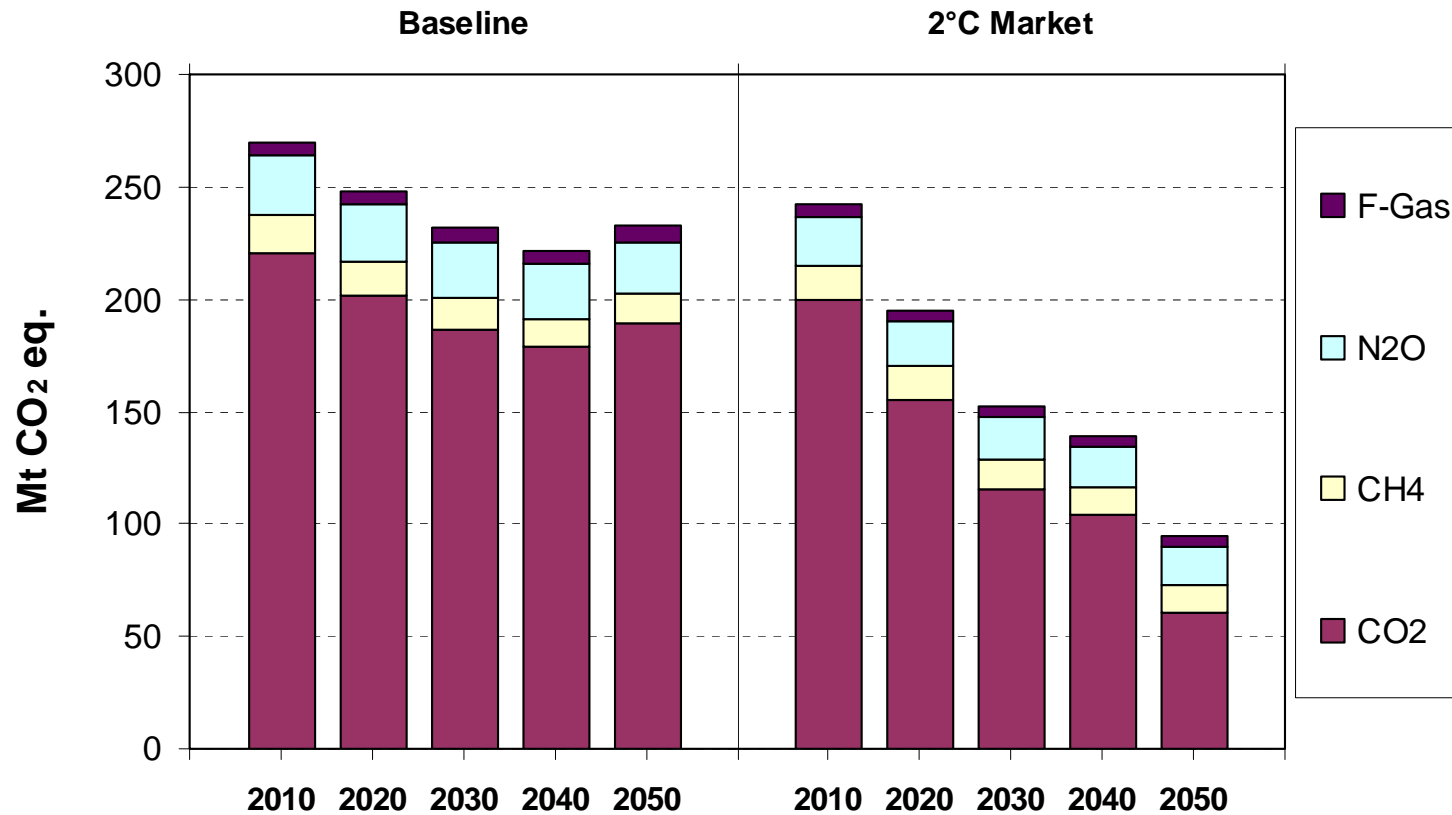


Greenhouse gases in the Nordic area

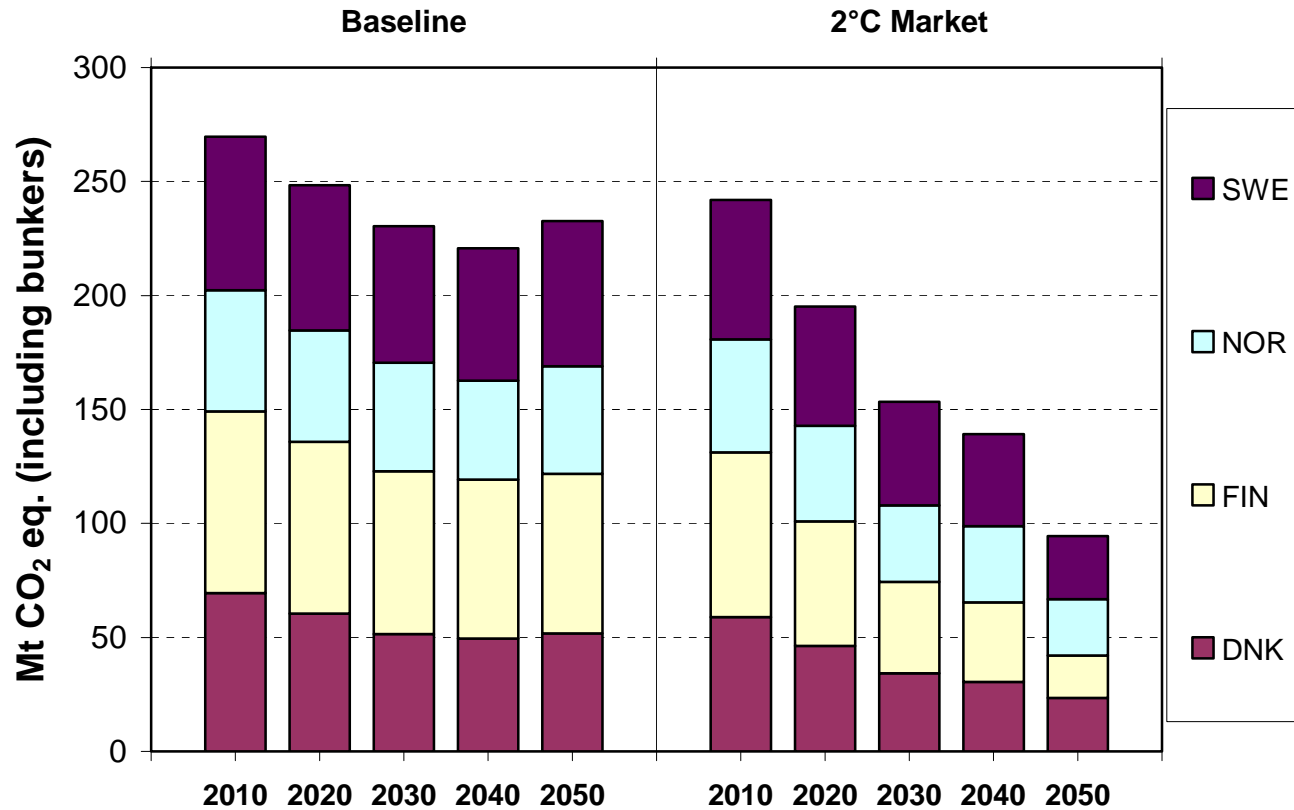
The maximum ghg reduction from the 2005 level is above 75 %



Nordic greenhouse gas emissions in the Baseline and 2°C scenarios

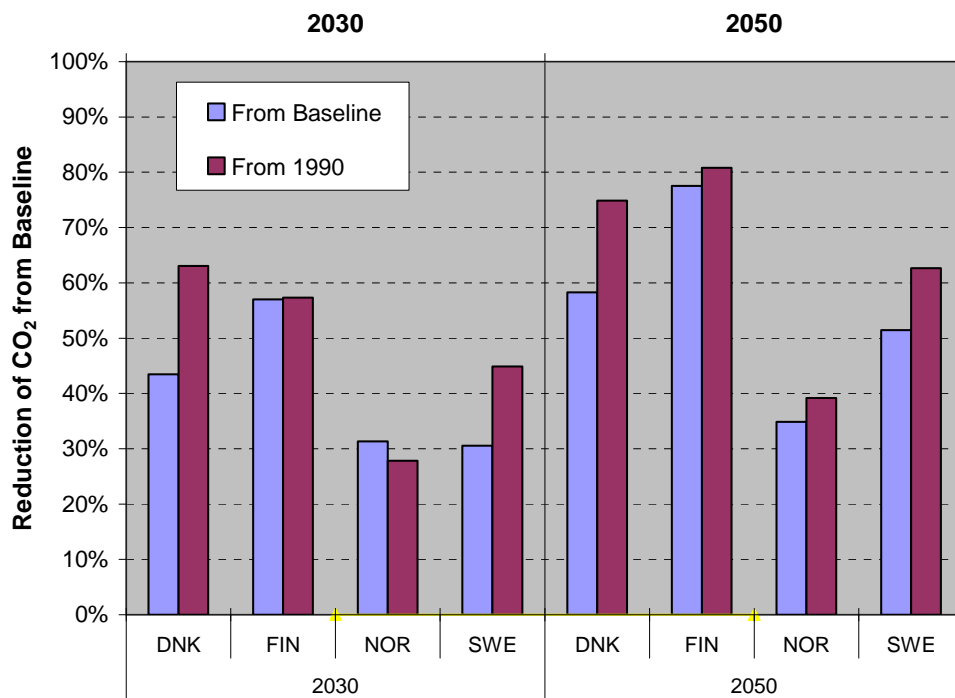


Development of the regional ghg emissions in the Baseline and 2°C scenarios

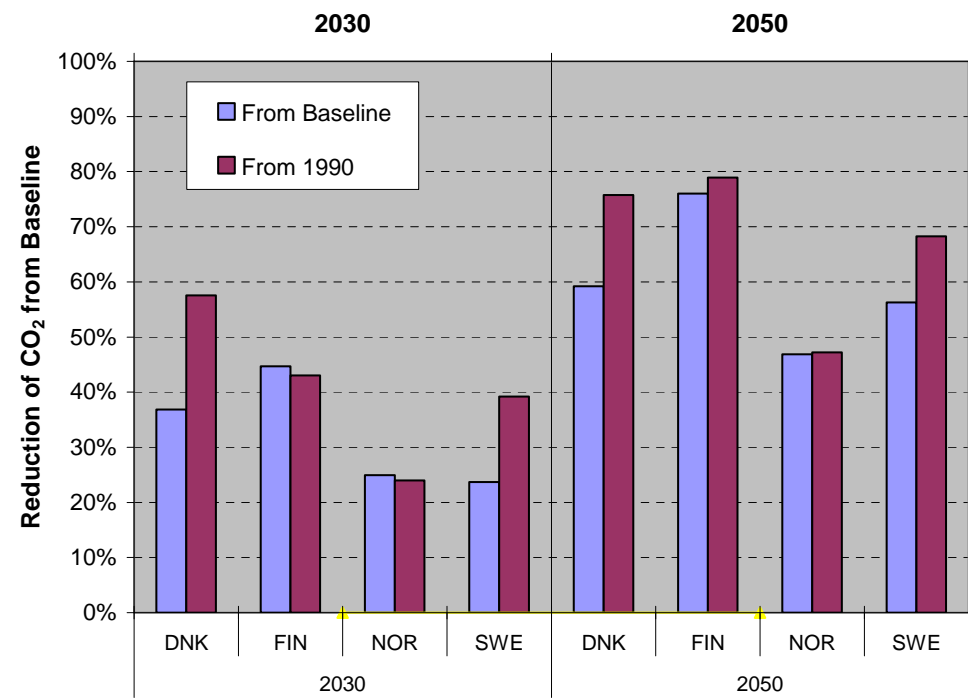


Reductions of CO₂ emissions by region in the EU and global policy scenarios

EU policy scenario with 70 €/t CO₂

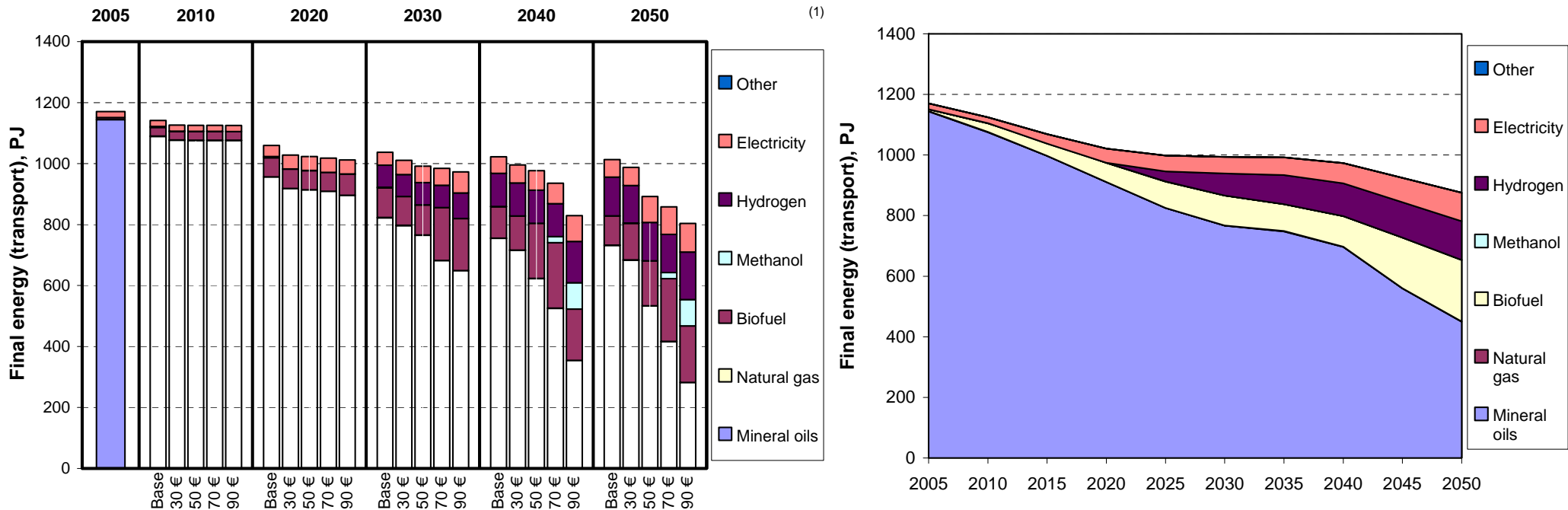


Global policy scenario



Final energy consumption in the Nordic transport sector in the EU and global policy scenarios

The final energy consumption decreases even in the Baseline due to increased fossil fuel prices



The 2 C scenario is comparable with the 70 €/t CO₂ EU scenario



CONCLUSIONS

- Nordic countries have an advantage to increase their renewable energy more than Western Europe
 - Electricity export from the Nordic area to the Western and Eastern Europe
 - On the other hand, national policies to support renewables could change the picture a lot

- Nordic countries could reduce their ghg emissions slightly more than Western Europe
 - However, there are great differences between Nordic countries



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technology**