Climate Change Mitigation: Challenges for the European Electricity Sector

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Outline

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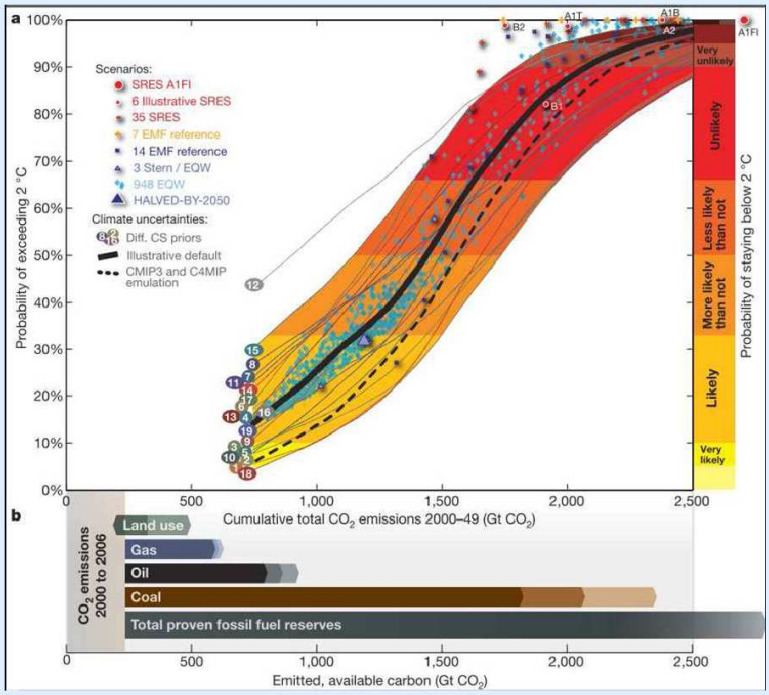
Climate Change, Introduction

- Global temperature change in 2100 should not exceed $+2^{\circ}$C compared to pre-industrial levels
- Medium and long term strategie for EU exists to meet the 2°C target
- Higher temperatures lead to serious changes in the earth system



(Meinthausen et al., Nature 2009)

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Research Objective

- To assess how the EU could achieve ambitious climate targets
- To assess climate change impacts on the energy conversion sector (adaptation)
- The analysis of technological pathways
- To identify associated costs and effectiveness
- Scenario-development in the framework of the European ADAM-project

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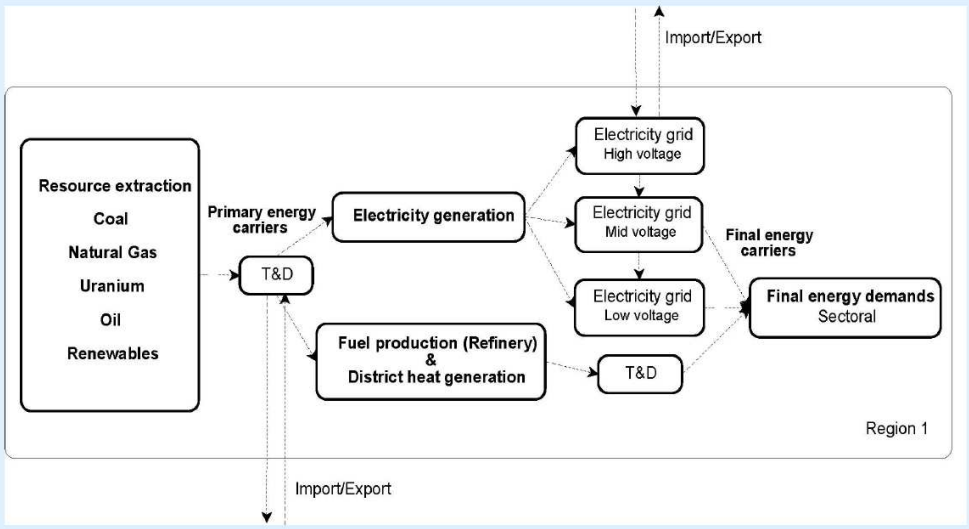
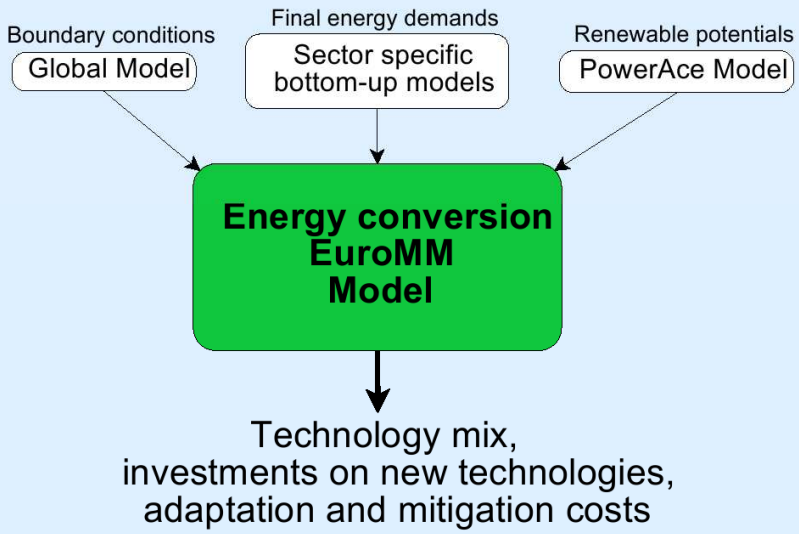
European Markal Model, EuroMM

- Bottom-up energy system model with detailed representation of technologies
- Cost optimization model: identifies least-cost solutions for the energy system under a given set of assumptions
- Representing the energy system of EU-27 plus Norway, Switzerland (18 model regions)
- Bilateral trade of electricity
- Seasonal resolution for electricity generation and demand

EuroMM - Reference Energy System



ADAM Project Setup



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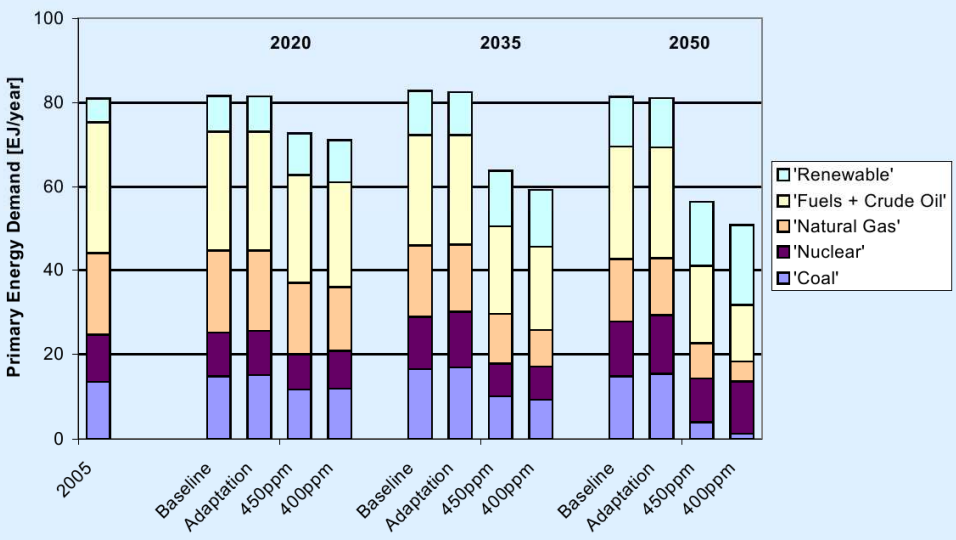
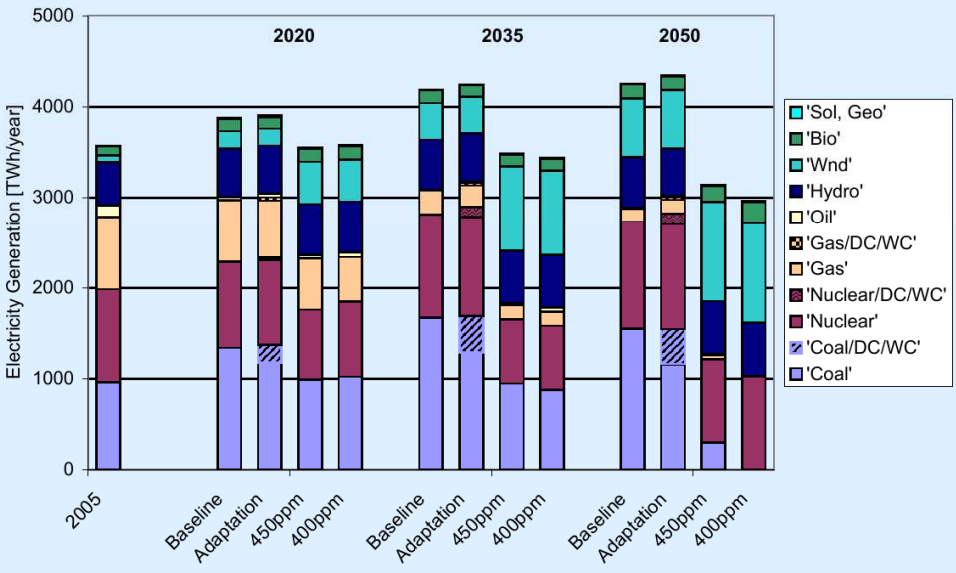
Scenario Analysis

- Baseline scenario with business as usual growth
- Adaptation scenario with higher global average temperatures in 2050
- Mitigation scenario 1, 450ppm $CO_{2,eq}$ emission target (50% probability of achieving 2°C target)
- Mitigation scenario 2, 400ppm $CO_{2,eq}$ emission target (80% probability of achieving 2°C target)

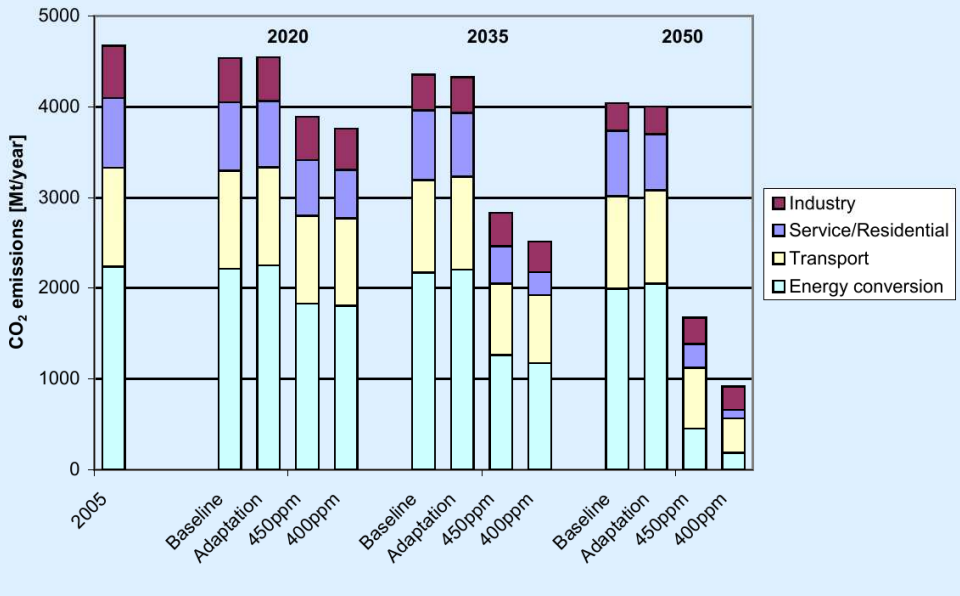
Results - Primary Energy Demand



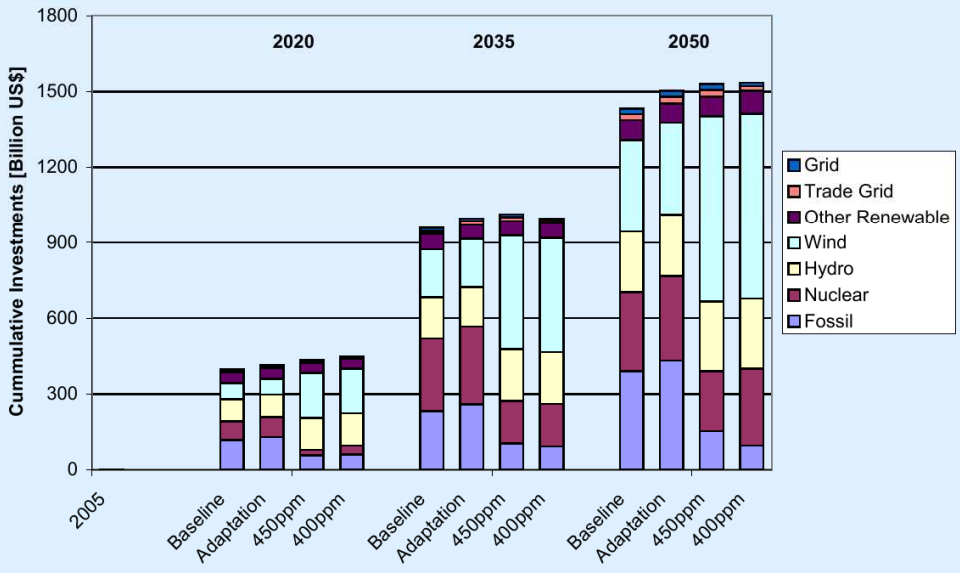
Results - Electricity Generation



Results - CO_2-Emissions



Results - Investment Costs



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Further research

- Sensitivity analysis for final energy demands
- Iterations between ADAM models for 400 ppm scenario
- Policy analysis

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Conclusions

- Mitigation scenarios are important to depict future challenges for the energy conversion sector
- Low emission targets require extreme technological deployment rates
- Efficiency improvements and CO_2-free electricity generation are mandatory to achieve mitigation targets

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Thank you for your attention

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