

Global energy futures and export opportunities of Nordic clean energy technologies

Tiina Koljonen, Antti Lehtilä, Raili Alanen
VTT Technical Research Centre of Finland

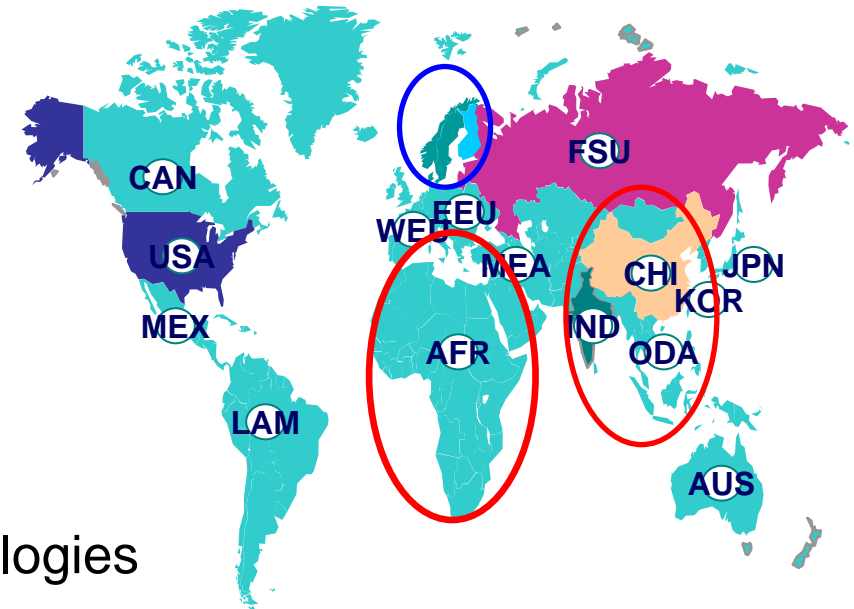
Nordic Energy Futures, March 17, 2009
Radisson SAS Airport Hotel, Oslo



Business from technology

OUTLINE

1. Modelling approach
2. Energy and emission scenarios
3. Survey of the Nordic CleanTech companies
4. Export opportunities of clean energy technologies
 - to Africa
 - to developing Asia.

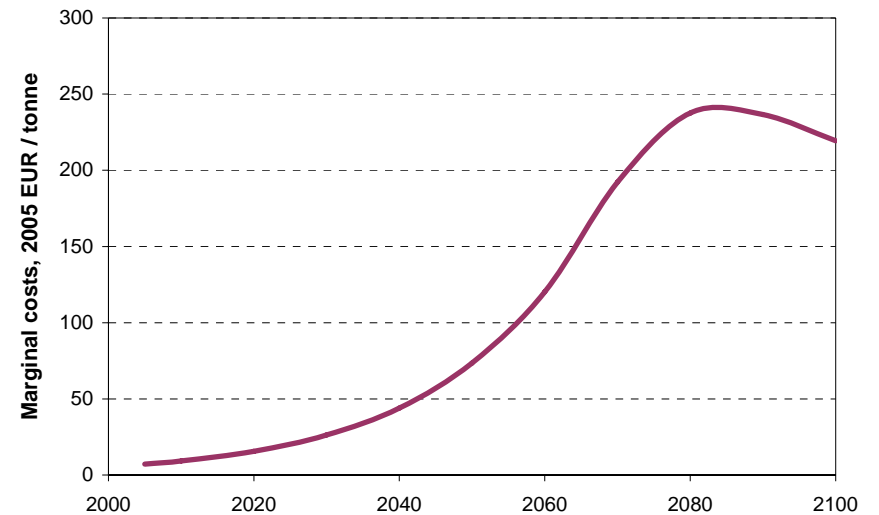


Global TIMES Model



- Partial equilibrium model
 - Supply-demand equilibrium for quantities and prices at each level
 - Maximization of the total surplus (suppliers+consumers)
 - Supply and demand curves are endogenously generated
- Long term (2100), multi-period (12)
- Based on the 15-region ETSAP TIAM model
- Technology rich, technology explicit
 - 1000s of processes, hundreds of commodities
- Includes all Kyoto gases (CO₂, CH₄, N₂O, F-gases)
- Detailed accounting of costs

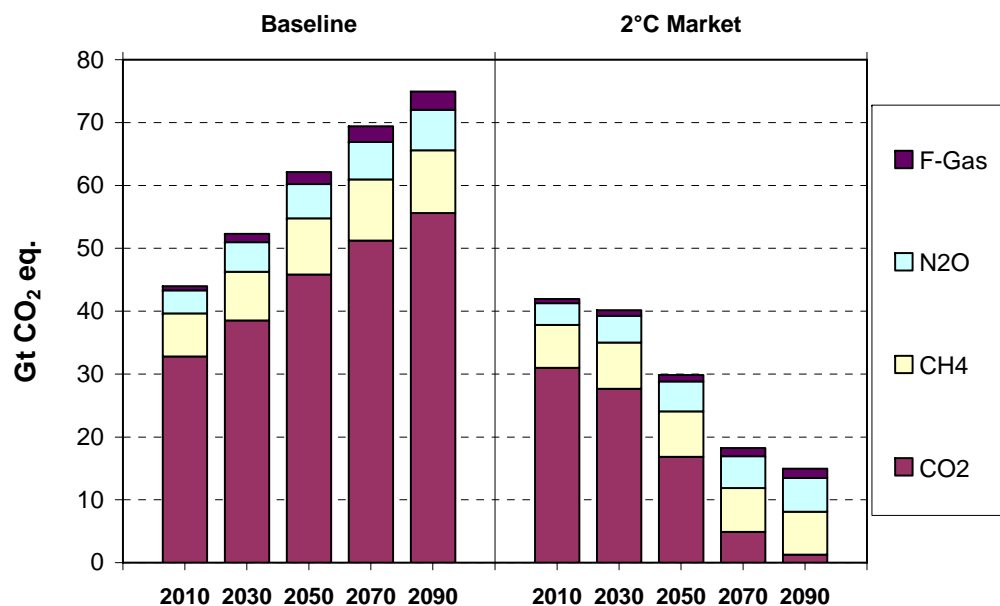
CO₂ price: Marginal cost of GHG abatement



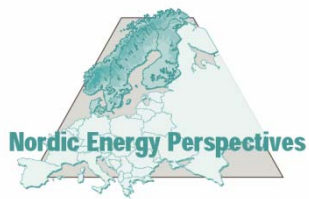
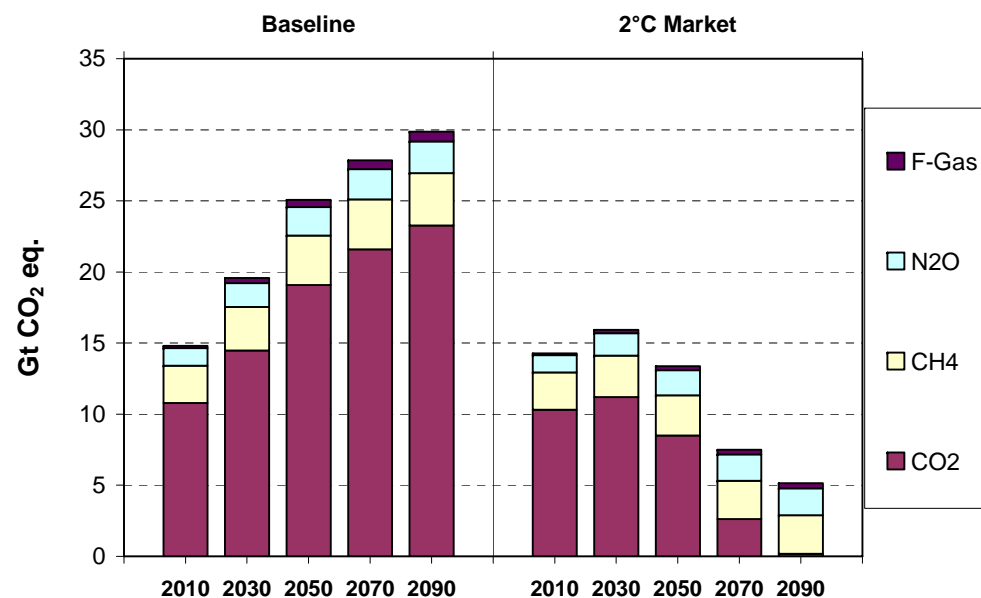
Longterm emission scenarios for the Baseline and 2 C Market

40-50% of GHG emissions from developing Asia in 2050

Global

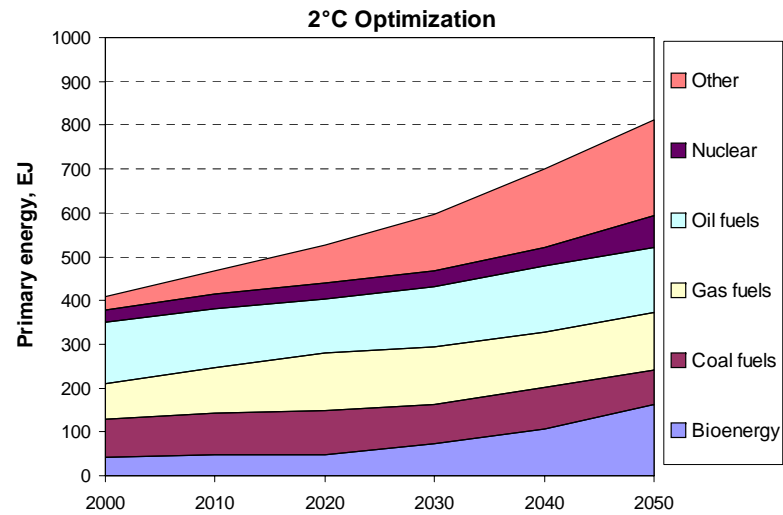
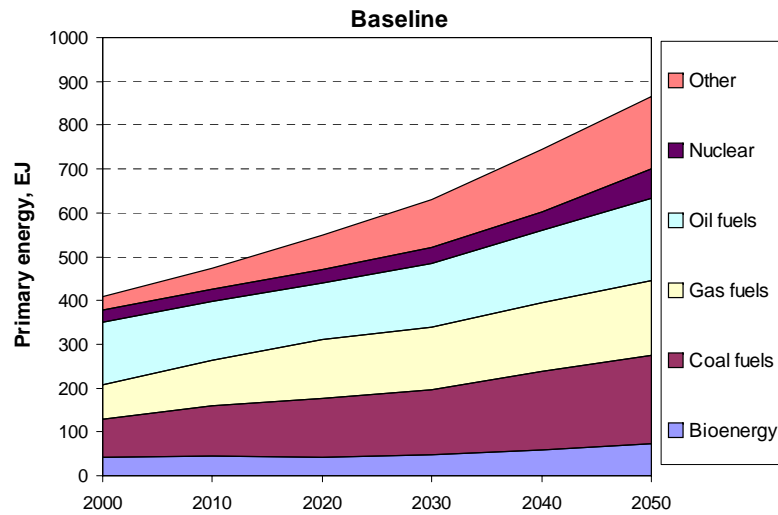


Developing Asia

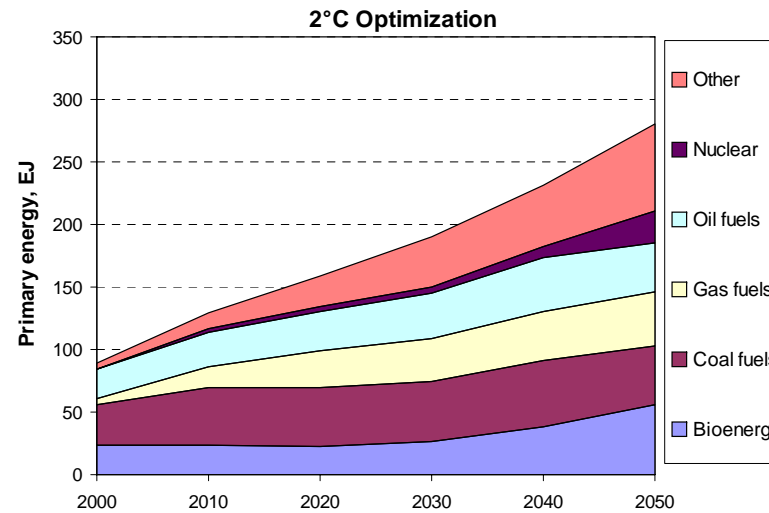
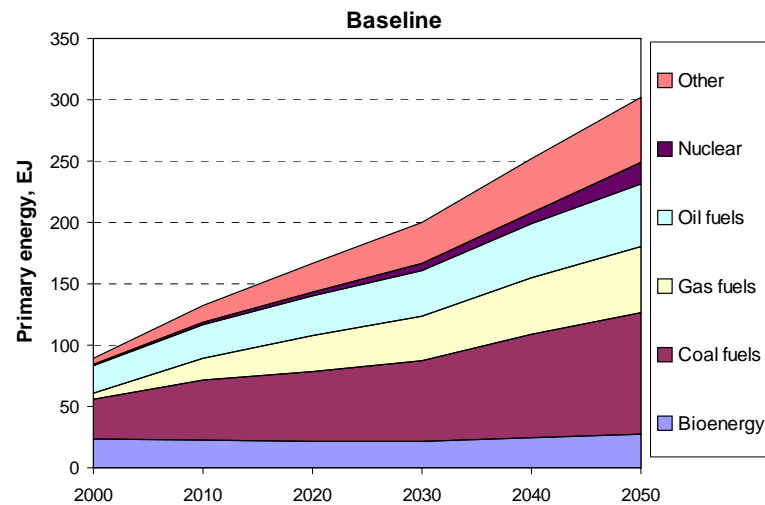


Primary energy consumption

About 30 % of primary energy would be used in the developing Asia in 2050



Global

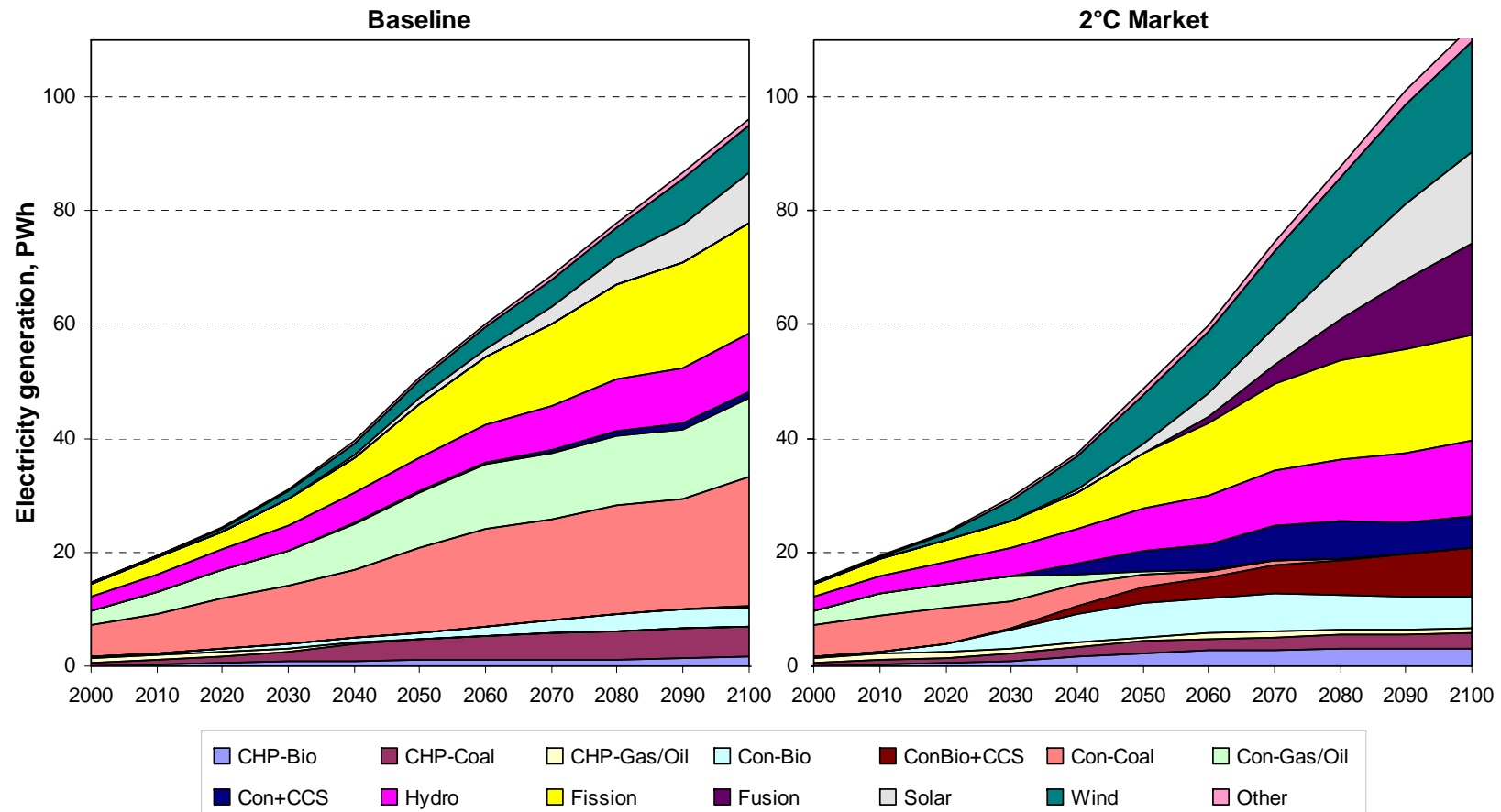


Developing Asia



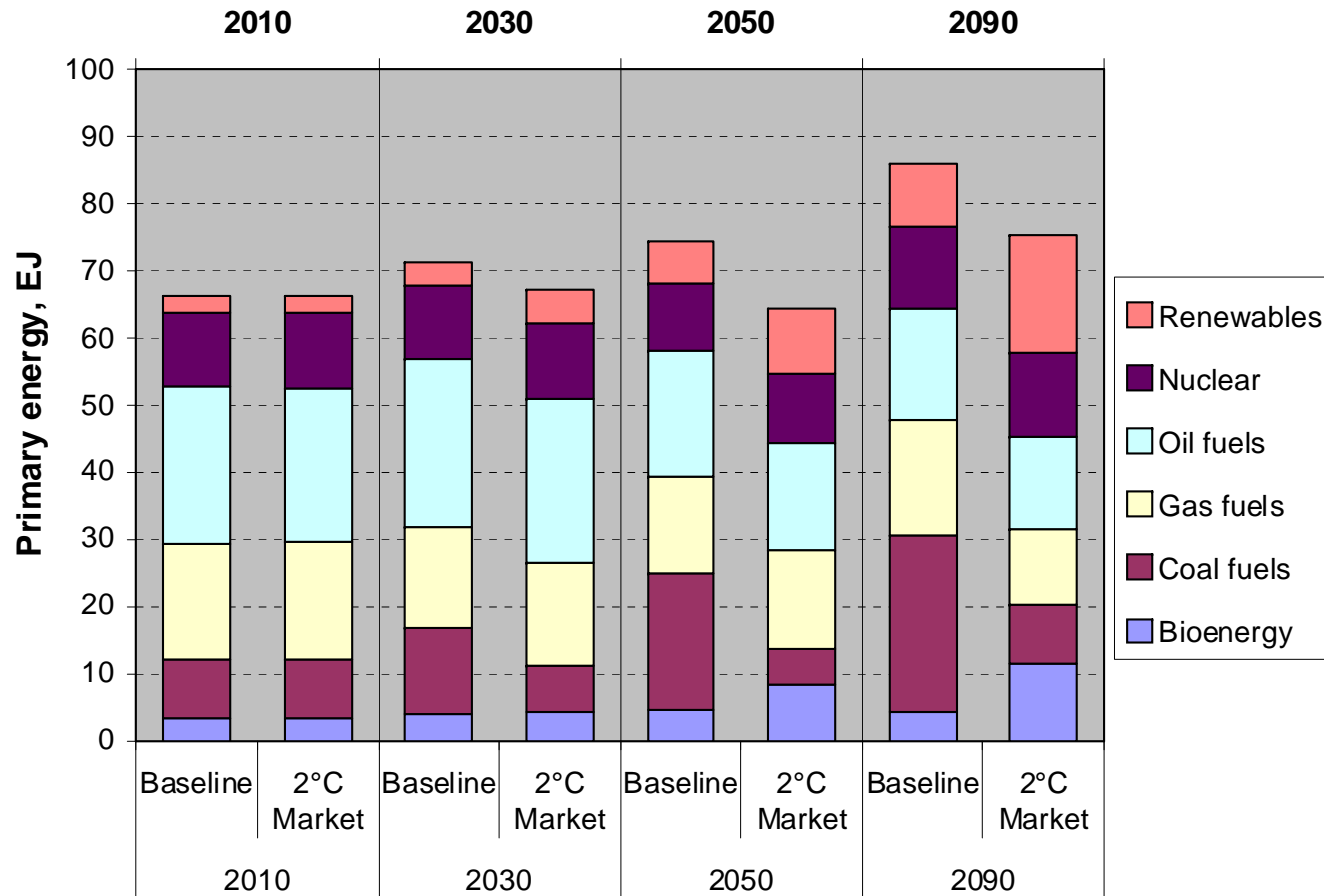
Global electricity production

Carbon neutral electricity system after 2050, electrification of the whole energy system



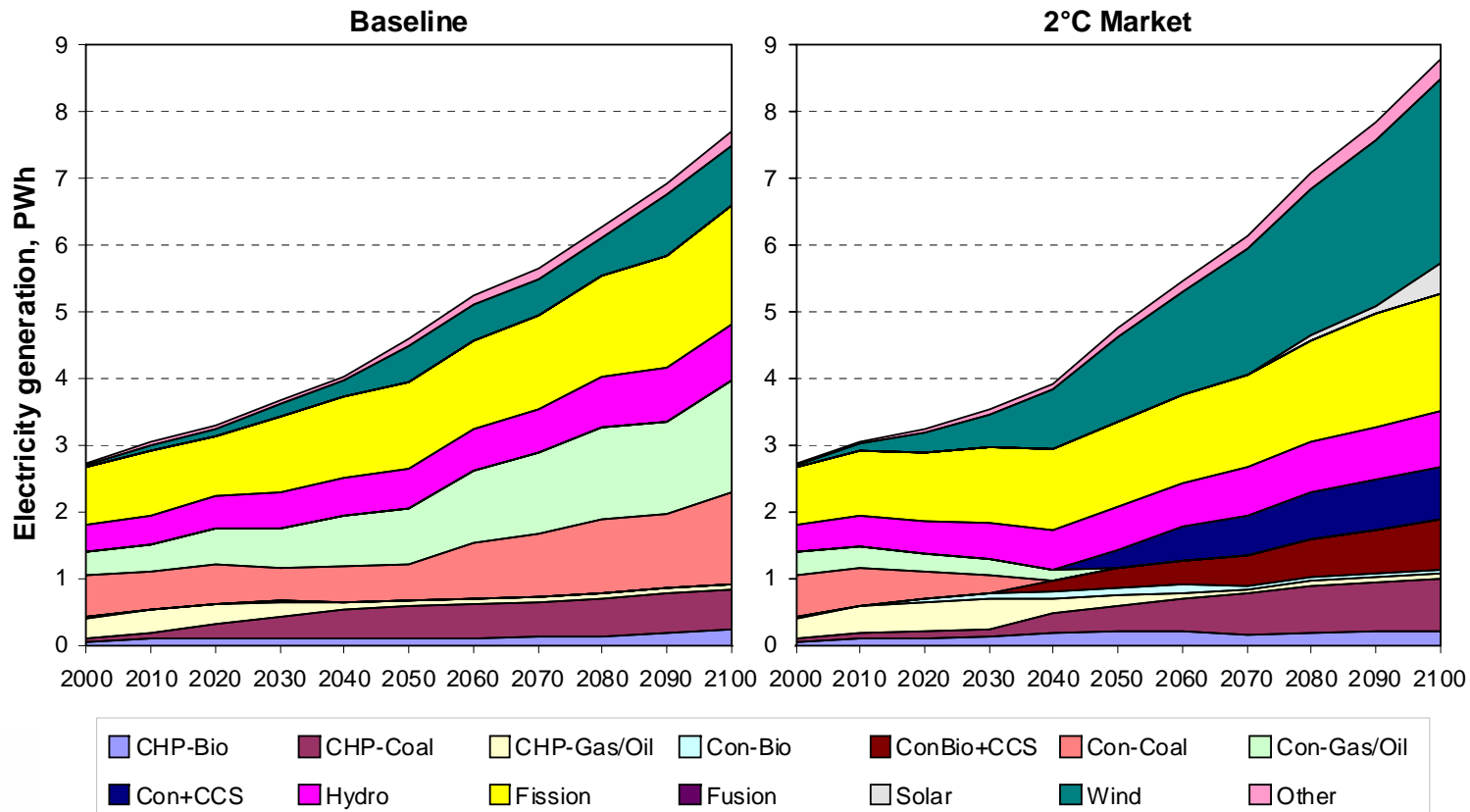
Primary energy consumption in the Western Europe

Increased efficiency stagnate the increase in energy demand



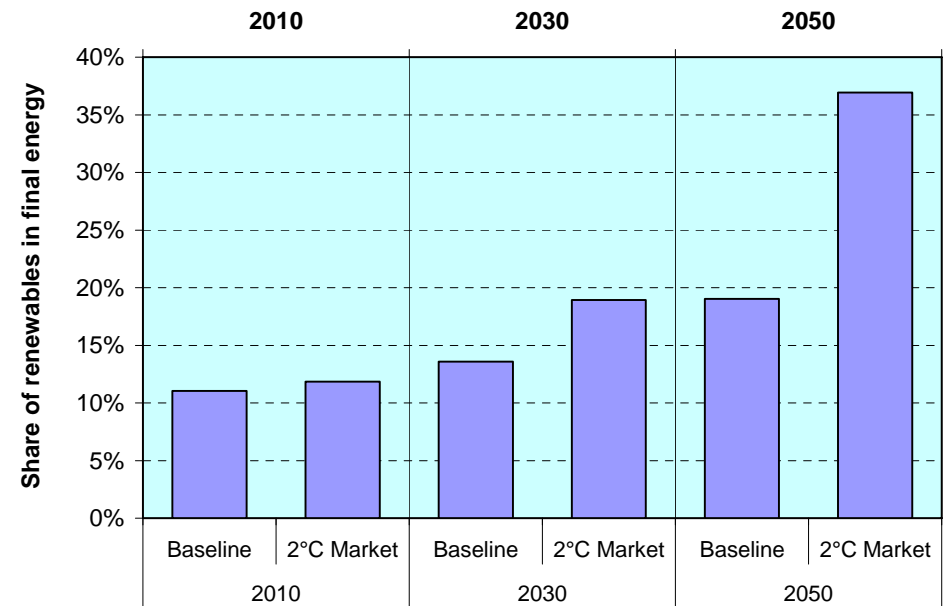
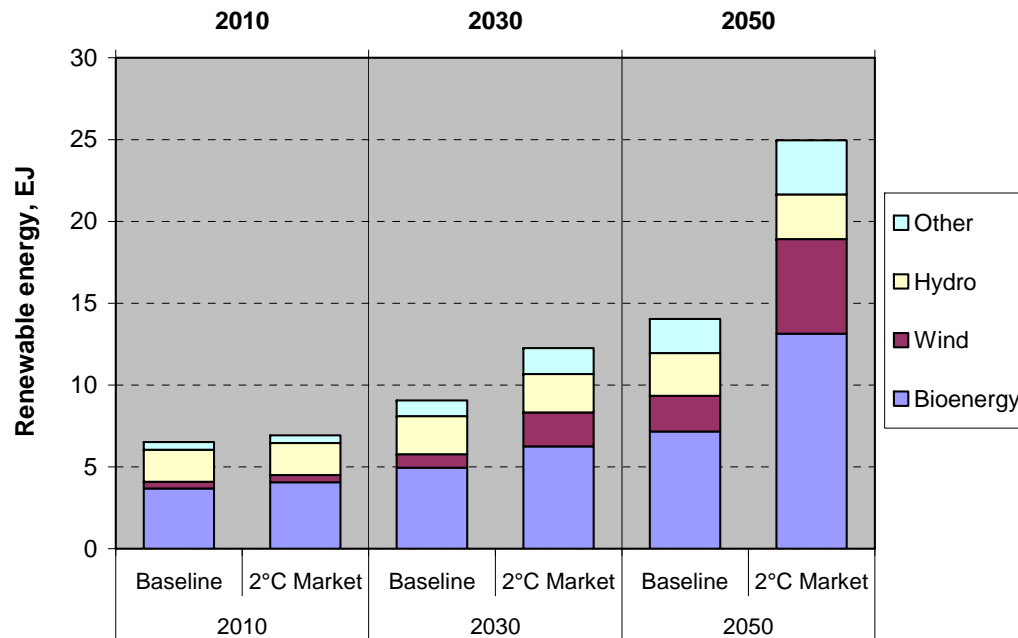
Electricity production scenario for the Westen Europe

High penetration of wind power, CCS after 2020, maximum use of biomass



Renewables in the EU-30* area

Achieving the 20 % target in 2020 seems extremely challenging due to the assumed long life time of the existing energy system

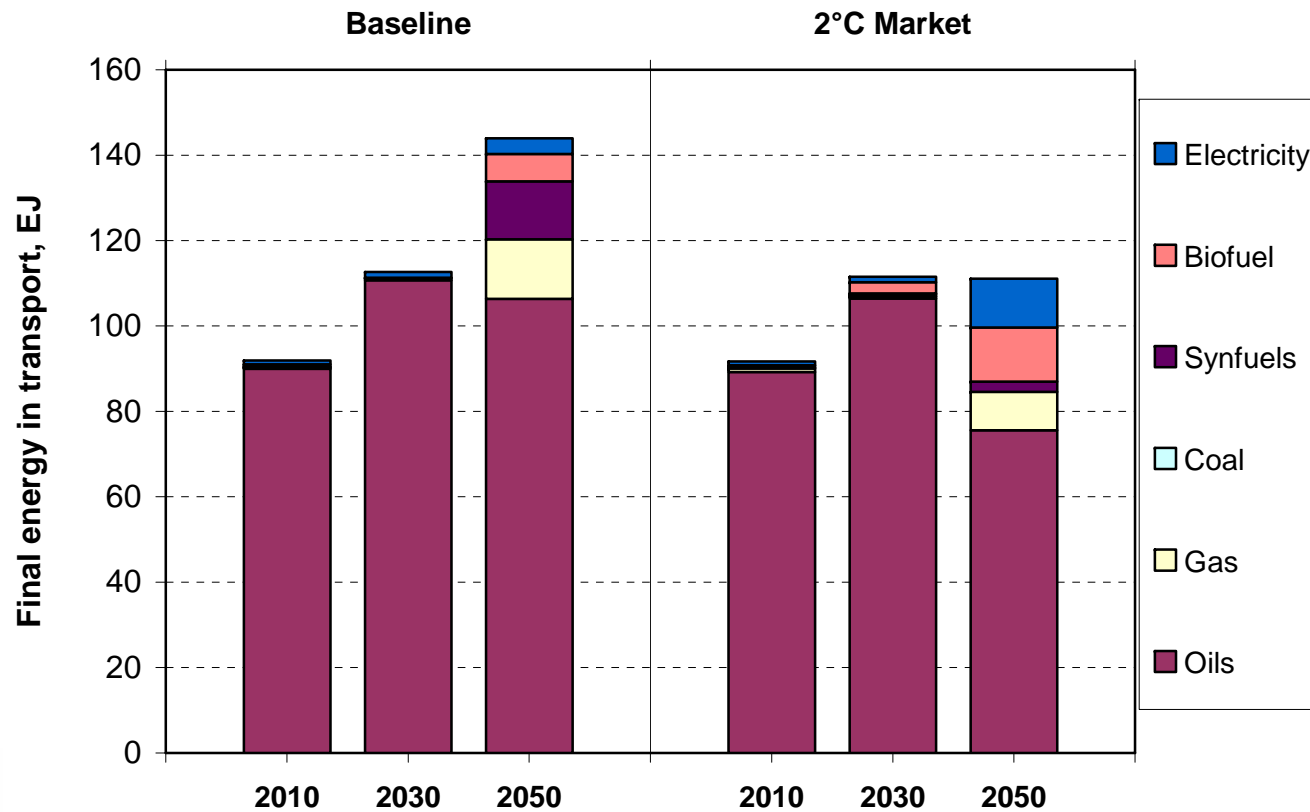


*EU-30 area includes WEU + EEU



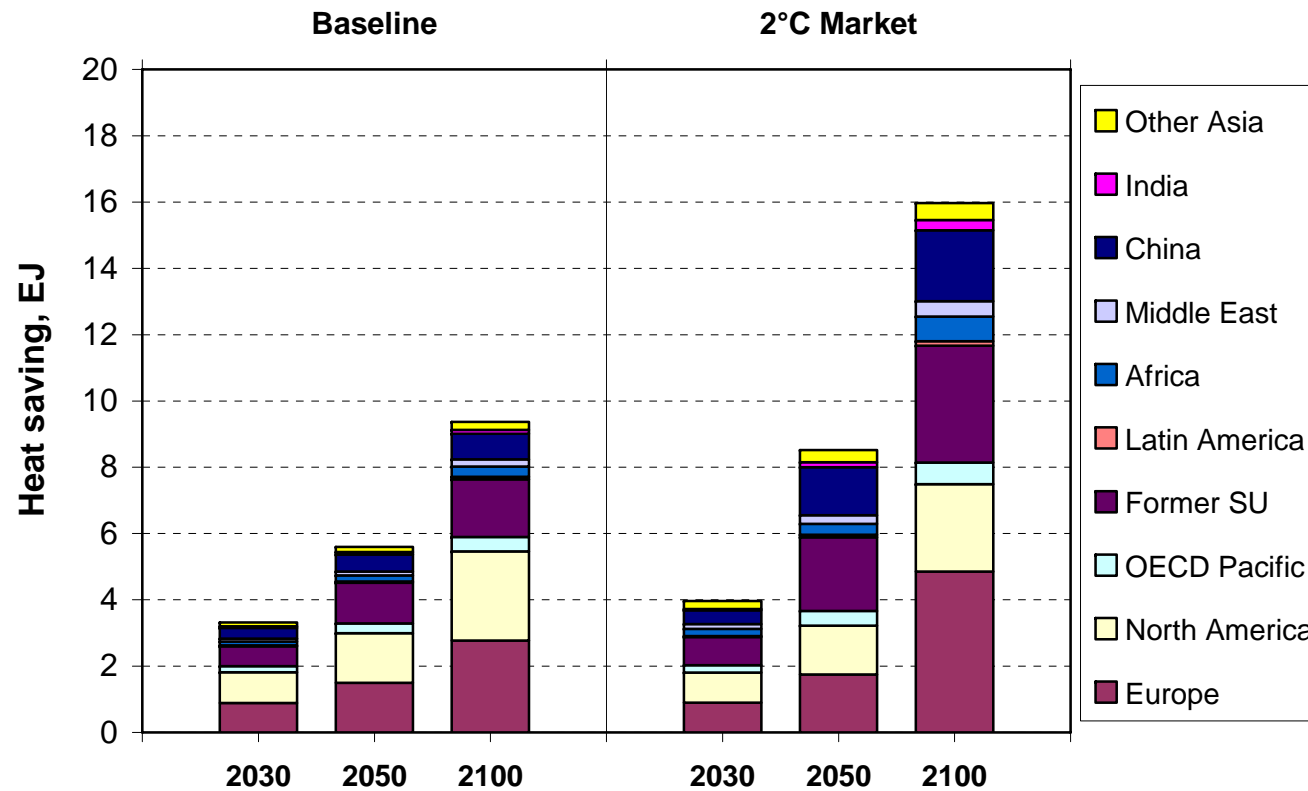
Transportation global final energy demand in the scenarios

Fuel efficient cars cost efficient also in the baseline

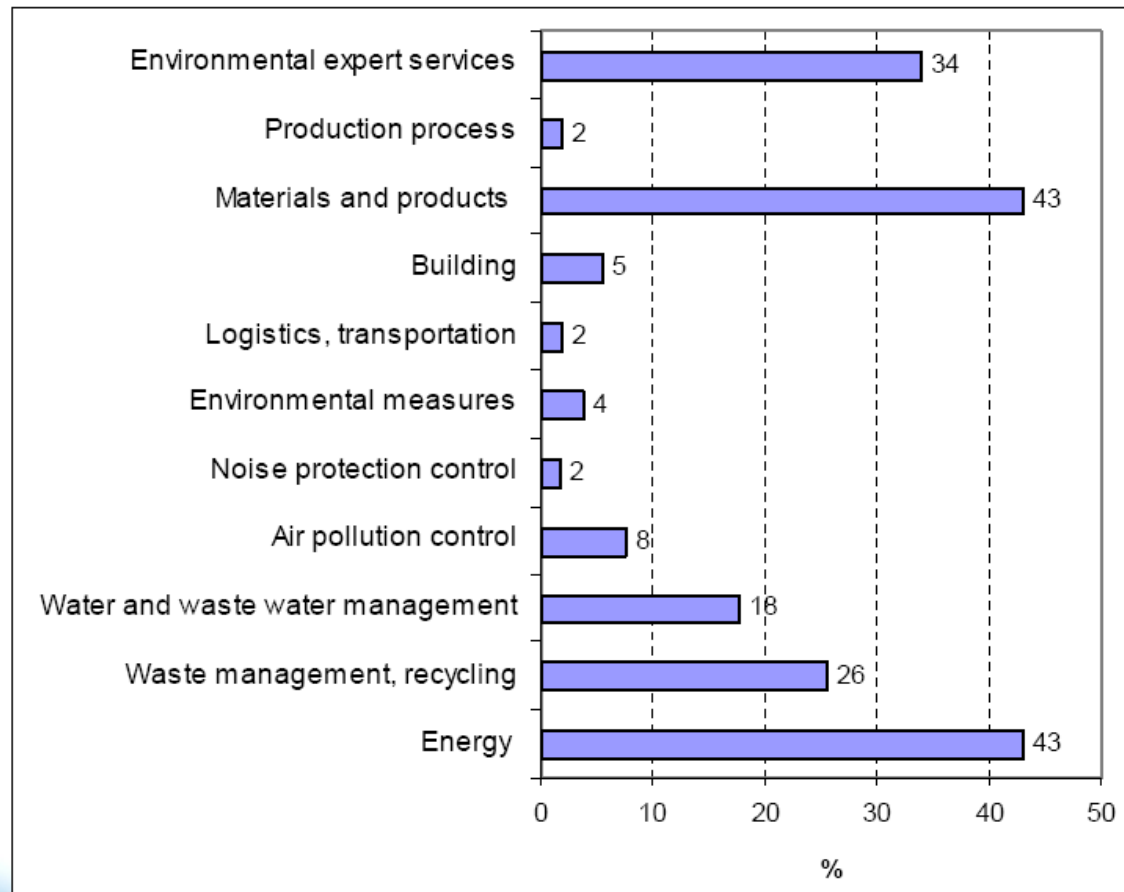


Improvements in the energy efficiency of buildings

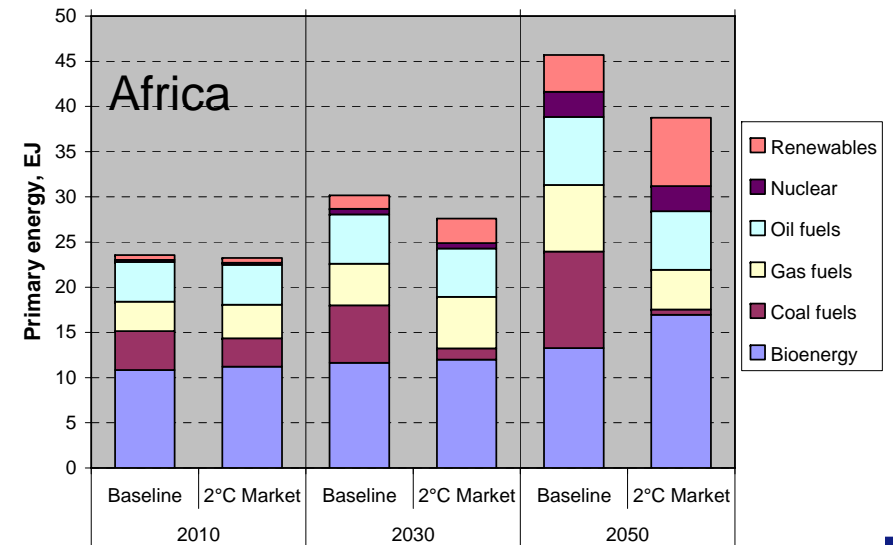
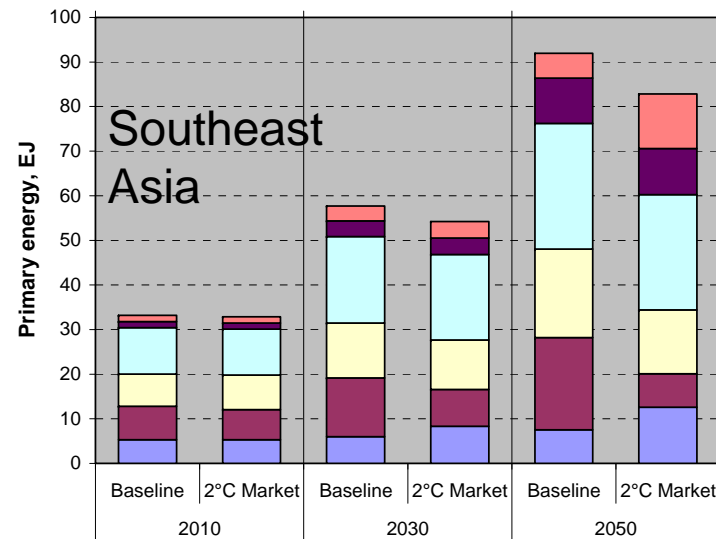
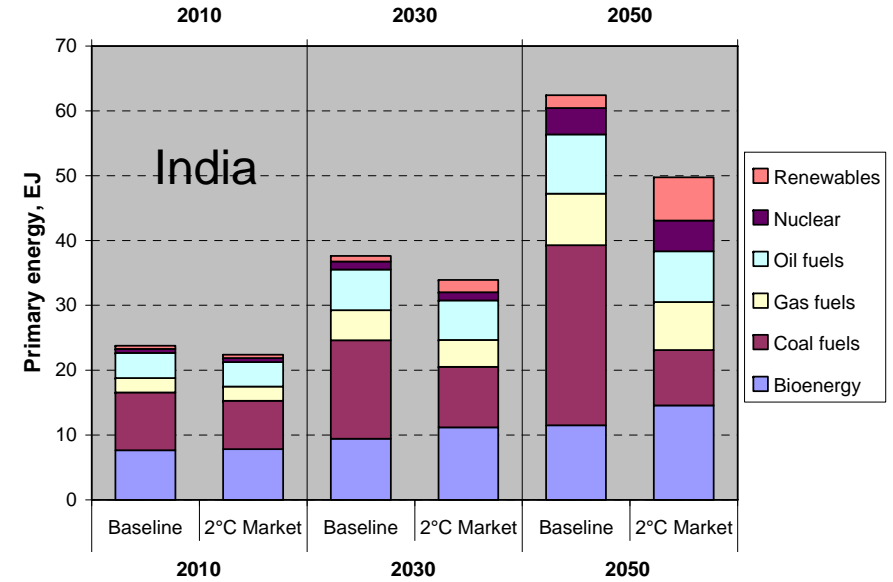
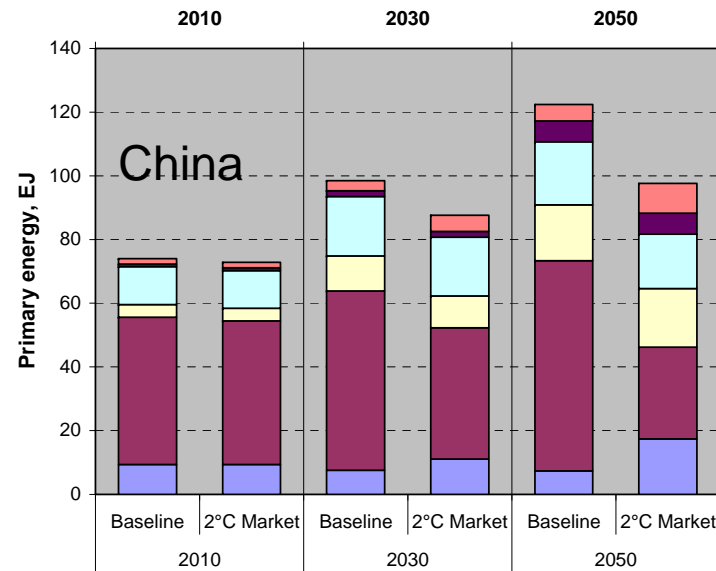
Potential is high but the change is slow due to slow renewal rate of the building stock



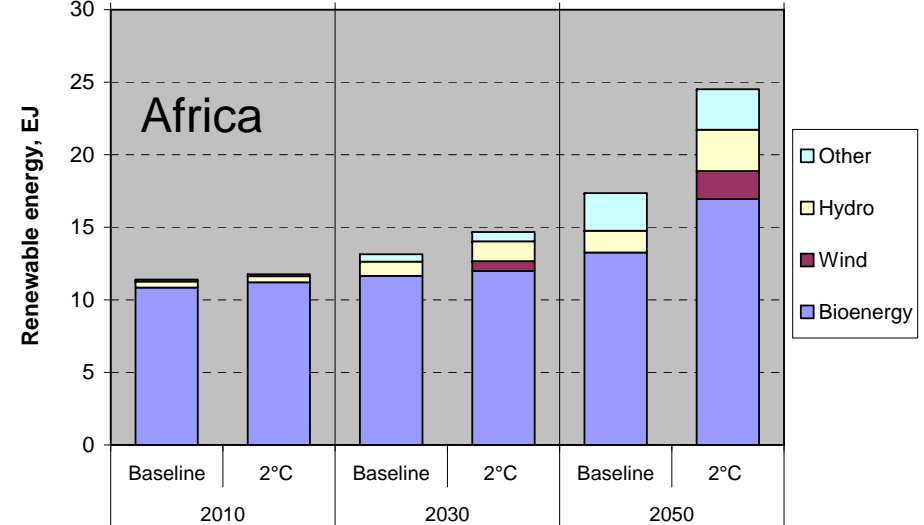
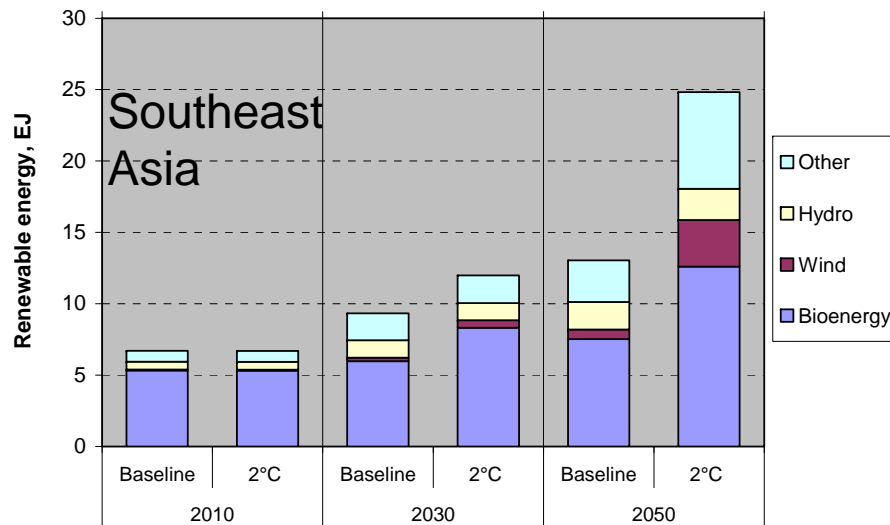
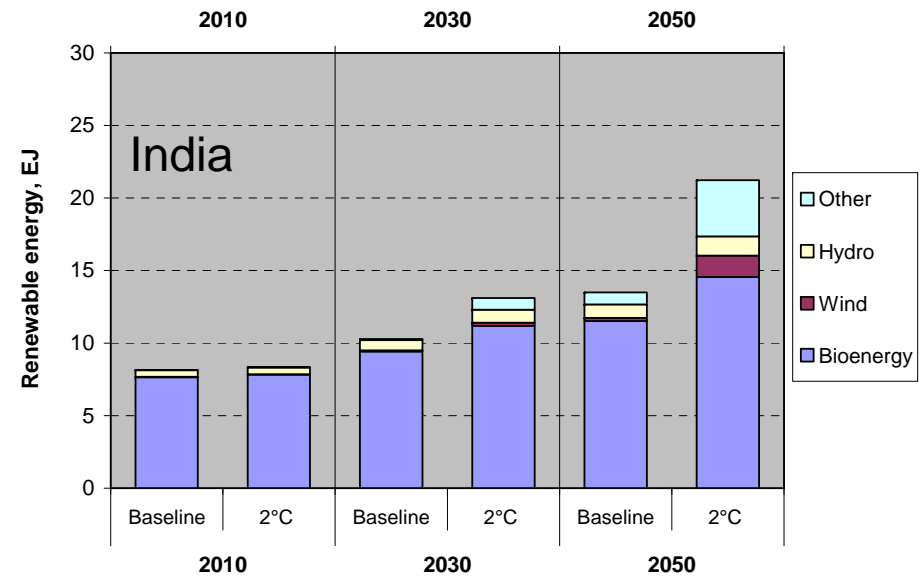
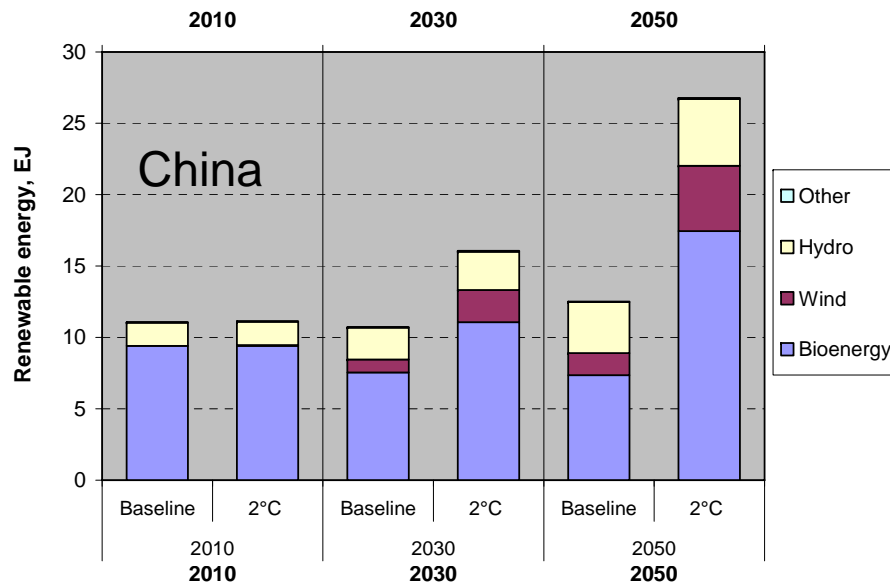
About 700 Nordic CleanTech companies identified



Primary energy consumption in the developing countries



Renewable energy consumption in the developing economies



Conclusions

- Achieving the EU's 2 degree target would require
 - ⇒ Transforming to the carbon free energy systems after 2050
 - ⇒ Electricification of the energy system
 - ⇒ Technology transfer to the developing countries
- Huge opportunities for the Nordic CleanTech export, especially
 - ⇒ Renewables (the whole value chain)
 - ⇒ Technologies to increase energy efficiency
 - ⇒ Building and construction
 - ⇒ Transport
 - Services

