# Interaction between GHG reduction path and technology availability
# -
# TIMES PanEU analysis for EMF-28

**Markus Blesl**

Institute for Energy Economics and the Rational Use of Energy (IER),
University of Stuttgart

ETSAP Regular Workshop, University of Cape Town
June 22, 2012

Universität Stuttgart
Institut für Energiewirtschaft und Rationelle Energieanwendung IER

## Outline

- TIMES PanEU
- Scenario Definition

- Net Electricity Supply

- Focus: Electricity Import
- Focus: CCS
- Focus: Energy Efficiency
- Focus: $CO_2$ Emissions
- Focus: Renewables
- Focus: Energy system cost

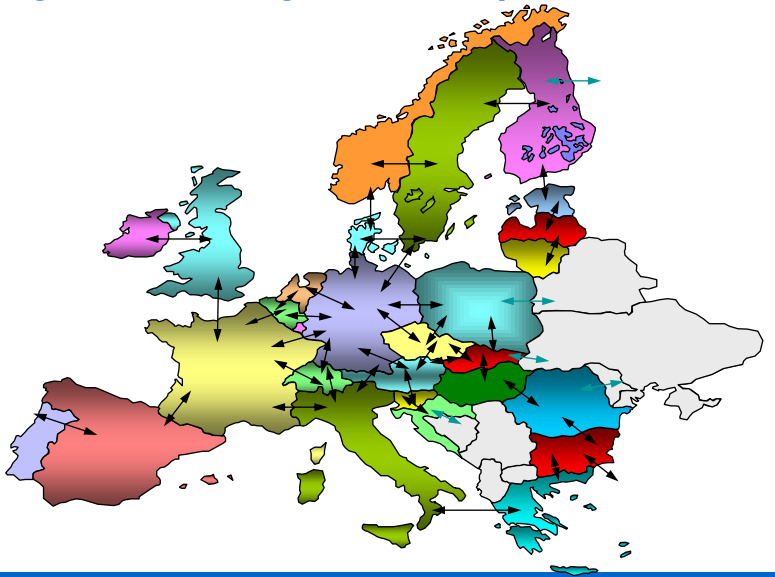
# Characterization of TIMES PanEU

- 30 region model (EU 27, No, CH, IS)
- 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, storages
  - 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, heavy and light trucks, passenger trains, freight trains), aviation and navigation
- Country specific differences for characterisation of new conversion and end-use technologies
- Trade: Electricity, Biomass, Biofuels
- Time horizon 2000 - 2050
- GHG: $CO_2$, $CH_4$, $N_2O$, $SF_6$ /Others pollutants: $SO_2$, $NO_x$, CO, NMVOC, $PM_{2.5}$, $PM_{10}$



Universität Stuttgart
Institut für Energiewirtschaft und Rationelle Energieanwendung IER

# Regional Coverage Pan-European TIMES model



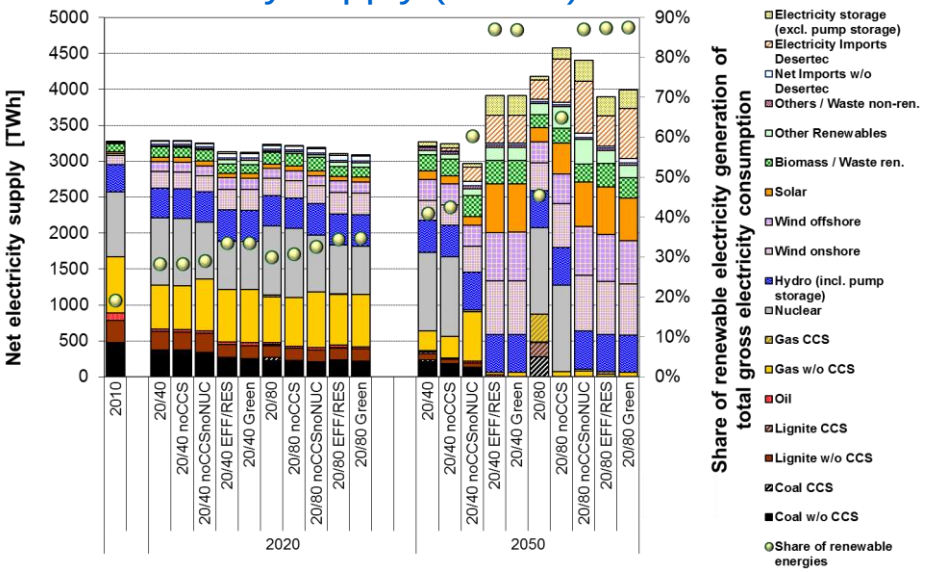
# Scenario Definition

| Technology dimension | Default w CCS | Default w/o CCS | Pessimistic | Optimistic | Green |
|---|---|---|---|---|---|
| CCS | on | off | off | on | off |
| Nuclear energy | ref | ref | low | ref | low |
| Energy efficiency | ref | ref | ref | high | high |
| Renewable energies | ref | ref | ref | opt | opt |
| **Policy dimension for the EU** | | | | | |
| **Reference:** including the 2020 targets and 40% GHG reduction by 2050 | „20/40“ **EU1** | „20/40 noCCS“ **EU2** | „20/40 noCCS noNUC“ **EU3** | „20/40 EFF/RES“ **EU4** | „20/40 Green“ **EU5** |
| **Mitigation1:** 80% GHG reduction by 2050 (with Cap&Trade within the EU) | „20/80“ **EU6** | „20/80 noCCS“ **EU7** | „20/80 noCCS noNUC“ **EU8** | „20/80 EFF/RES“ **EU9** | „20/80 Green“ **EU10** |

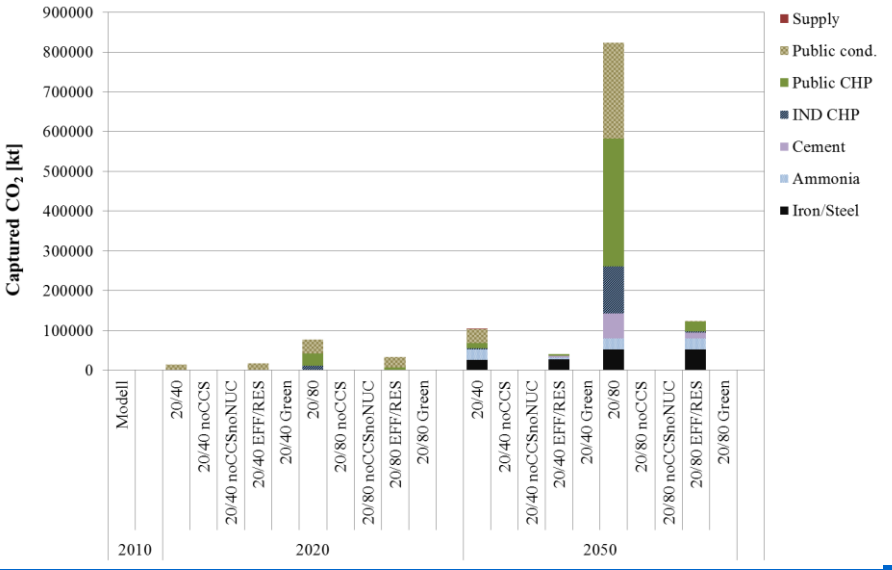




# Net Electricity supply (EU-27)



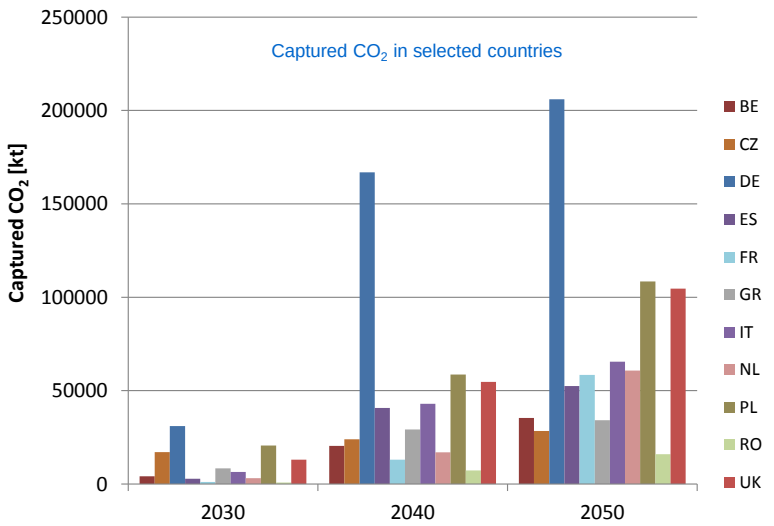
# Focus: CCS (EU-27)



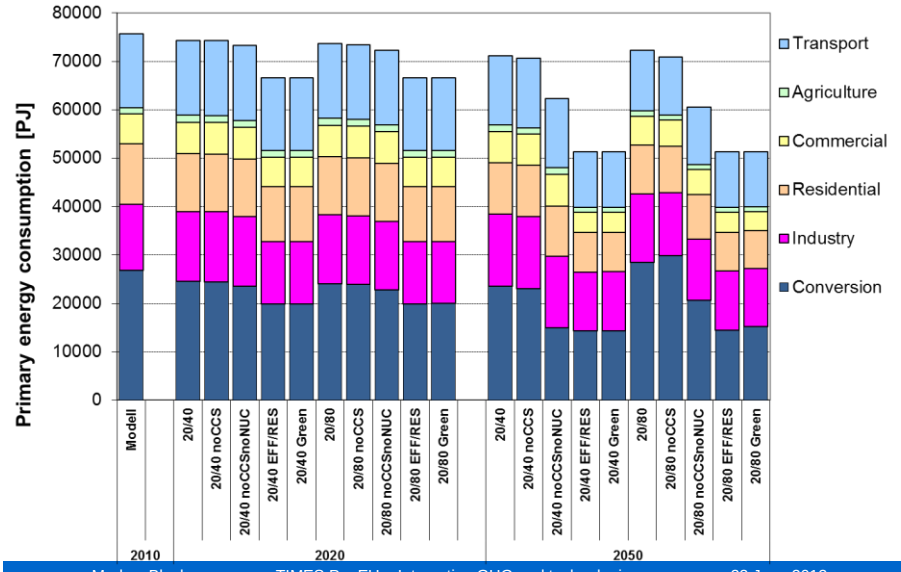





# Focus: CCS by country in EU 6: “20/80”



# Focus: Energy Efficiency (EU-27)

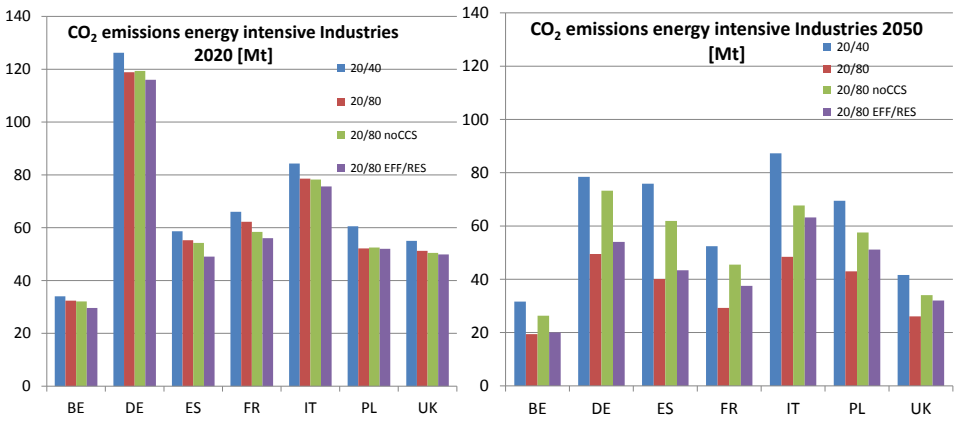




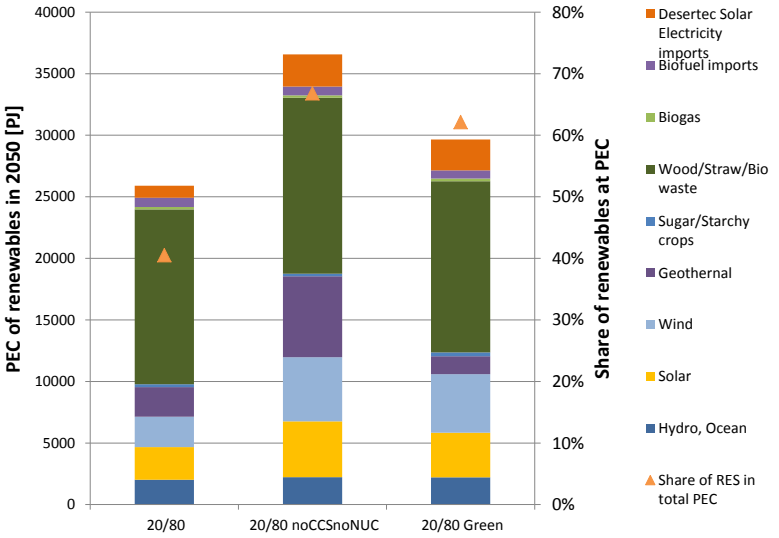



# Focus: $CO_2$ Emissions

Energy and process related $CO_2$ of energy intensive Industries by country and scenario



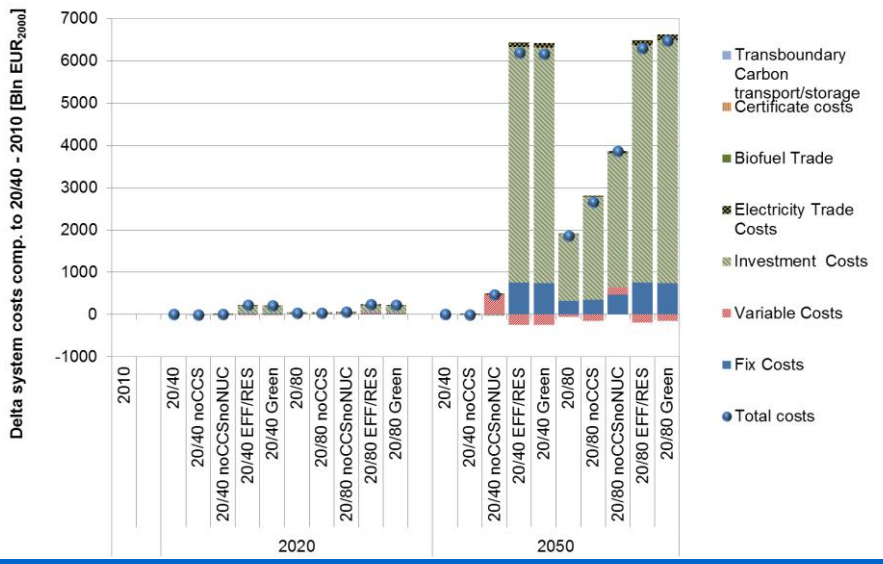
# Focus: Renewables (EU-27)








# Cumulative undiscounted energy system cost



# Conclusion

- Technology availability has a big impact on the structure of the energy system of the future.
- The quota of Greenhousegas emission reduction targets, a high share of renewable, energy efficiency improvements are not going automatically in the same extreme directions.
- The world got more complex, the search for intelligent energy systems starts again to find cost efficiency solution based on renewable and energy efficiency systems or part of them.