

Pathway to Reach a 2° C Climate Stabilisation

Tom Kober

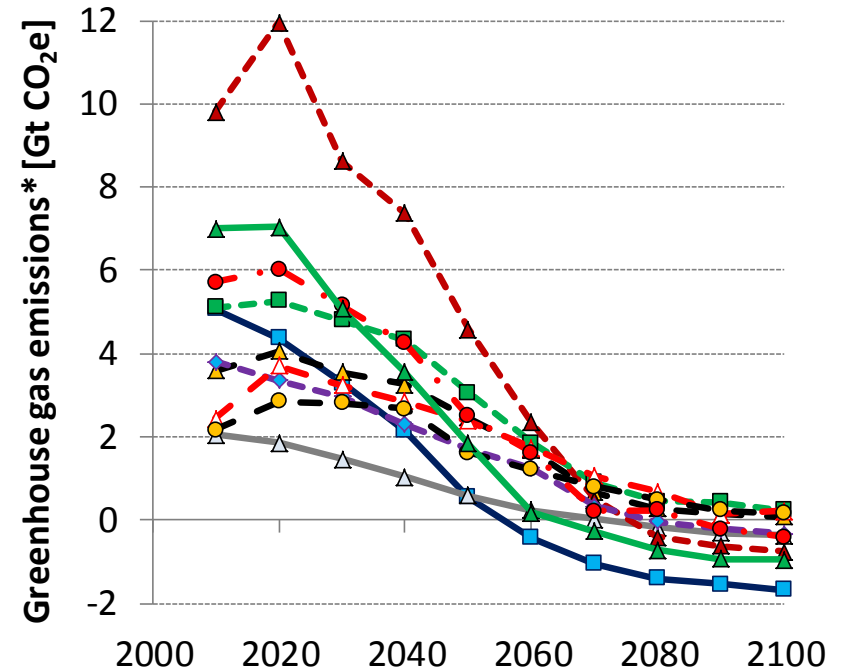
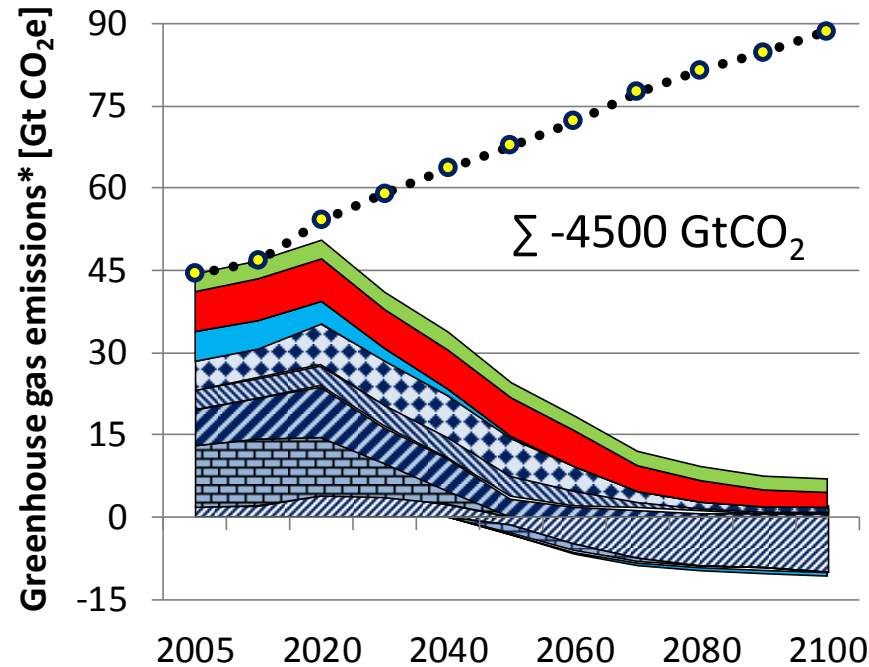
Paris
June 18th , 2013

Scenario definition

- Fragmented action in the near term (beginning in 2020)
 - National GHG reduction targets according to Copenhagen pledges and extrapolation of national targets
 - Policy on renewable and nuclear energy
- Beginning in 2030 global coordinated action to reach the 2° C climate target (implemented via 2.8 W/m² radiative forcing target for Kyoto gases)

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- Analysis conducted within LIMITS EU-FP 7 project
www.ecn.nl/units/ps/themes/energy-and-emission-scenarios/global-european-projections/limits

Global GHG emission development

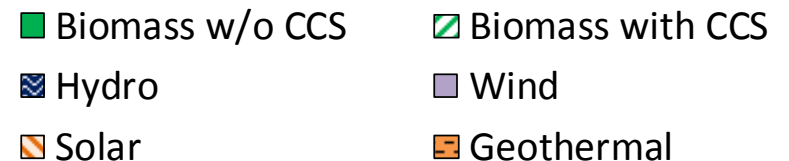
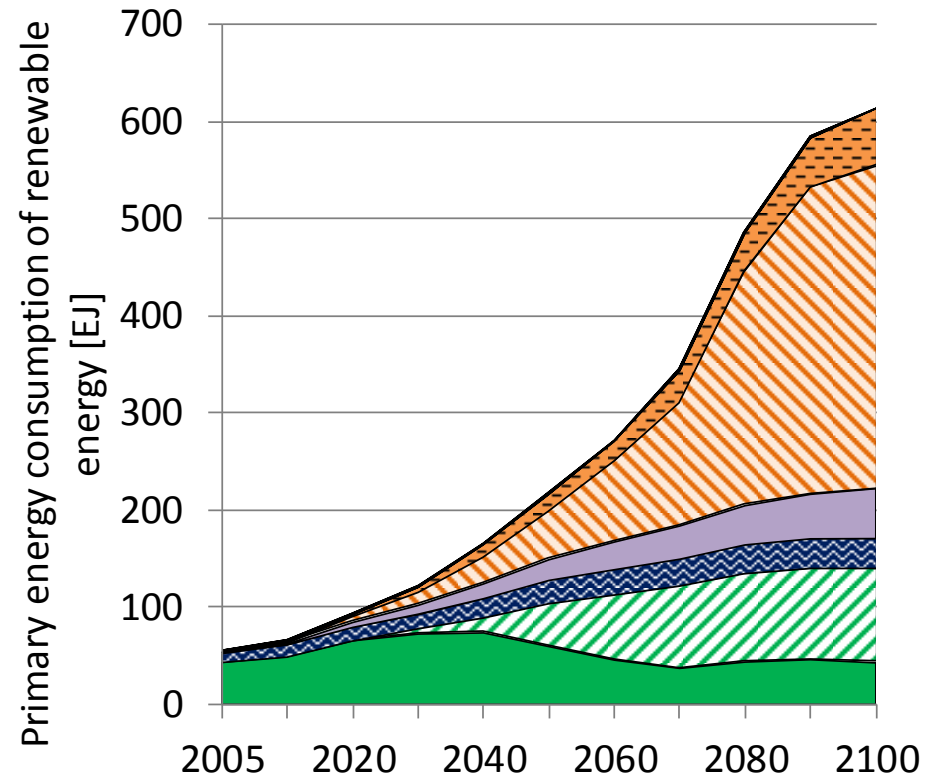
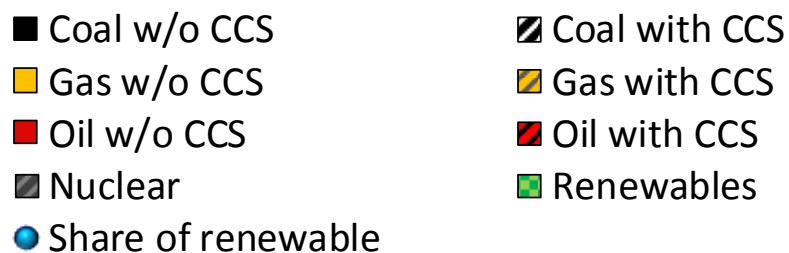
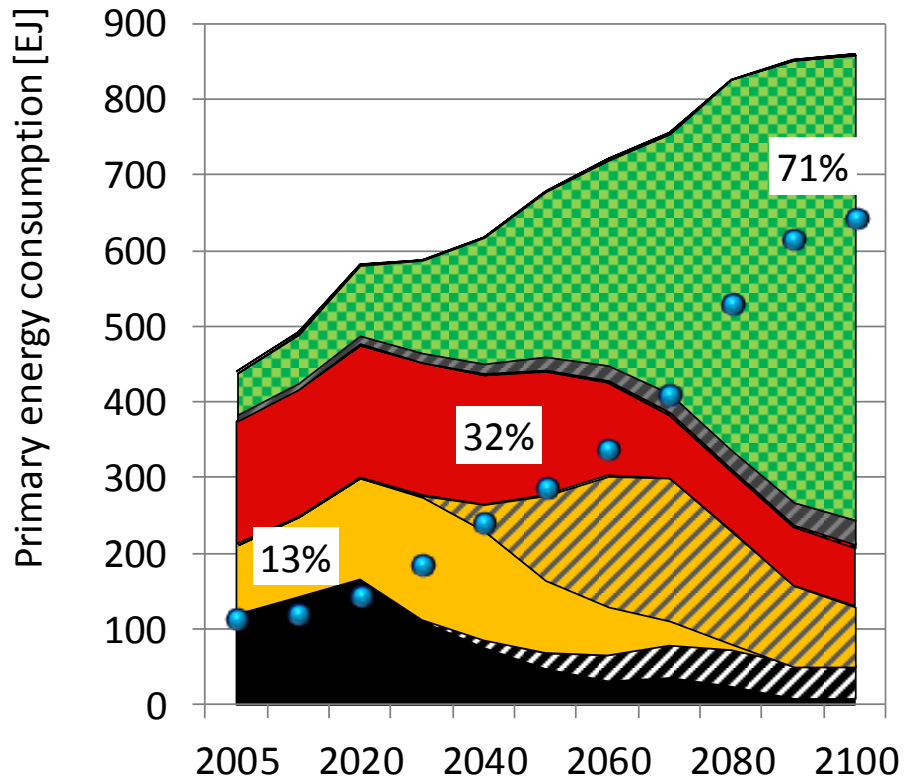


- N2O Total
- CO2 Land-use
- CO2 Households + commercial
- CO2 Electricity production
- Baseline w/o climate policy
- CH4 Total
- CO2 Transport
- CO2 Industry
- CO2 Upstream

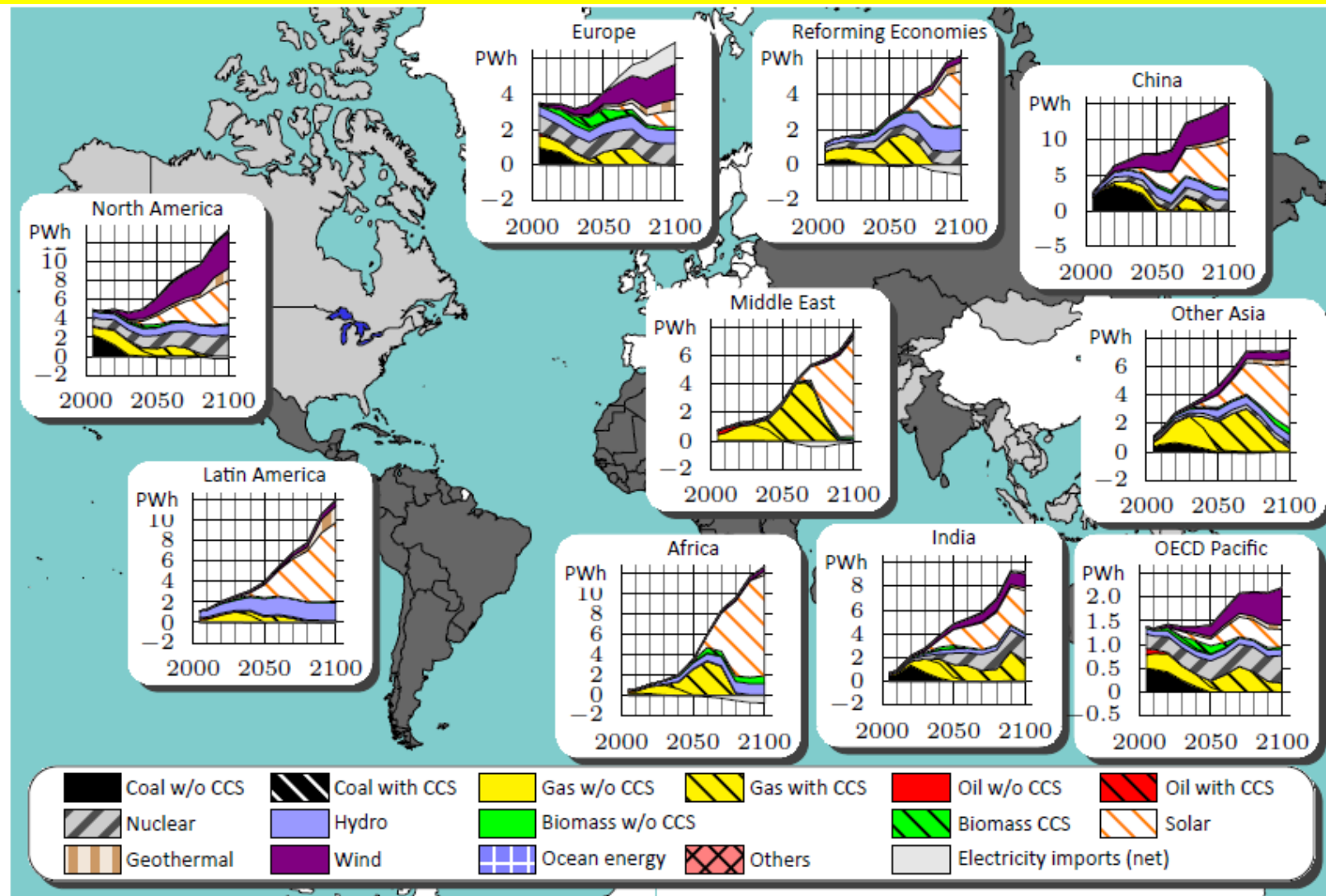
* CO₂, CH₄, N₂O

- Europe
- Pacific OECD
- Africa
- China
- India
- Latin America
- Reforming Economies
- Middle East
- Other Asia
- North America

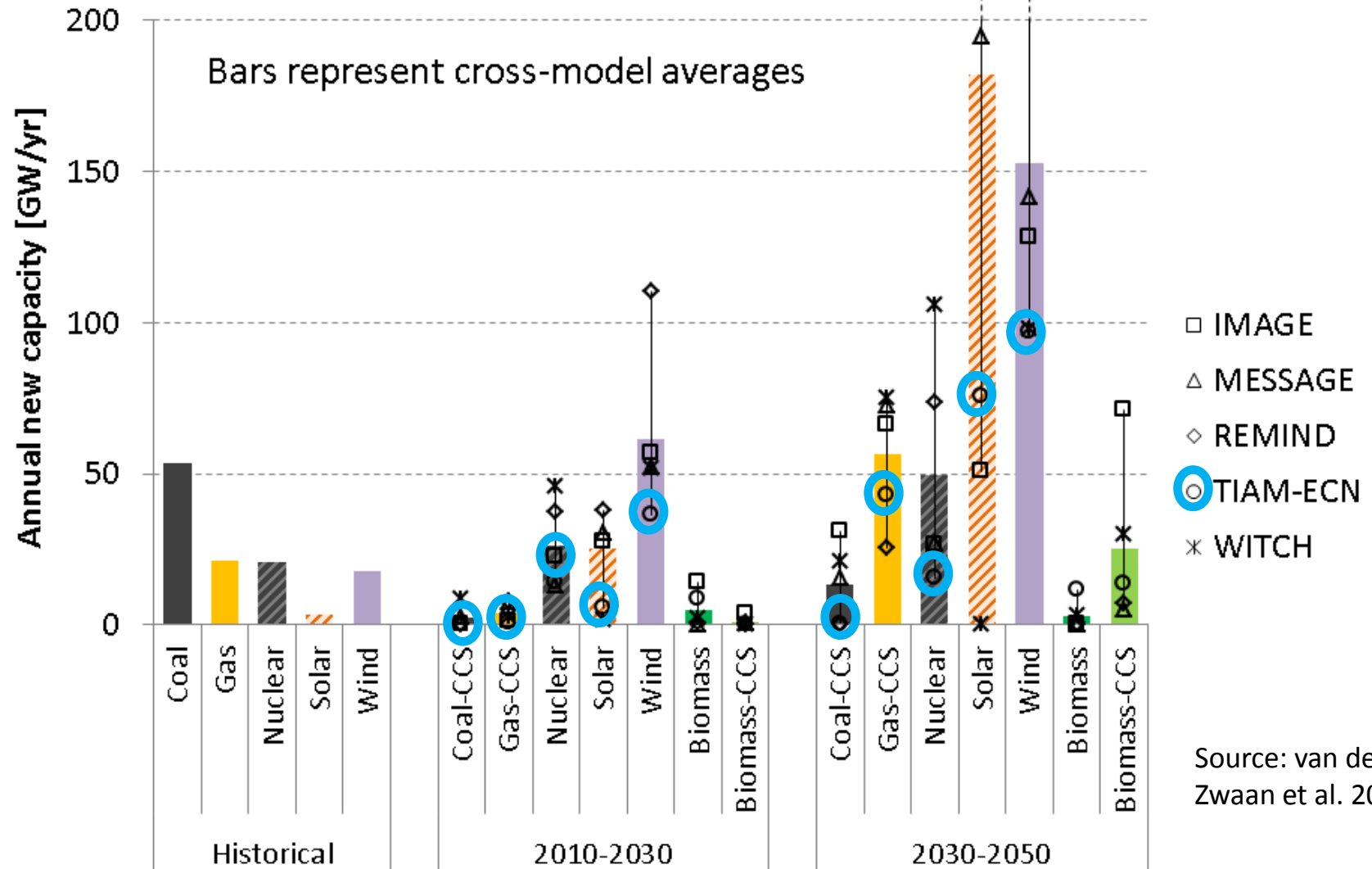
Primary energy consumption



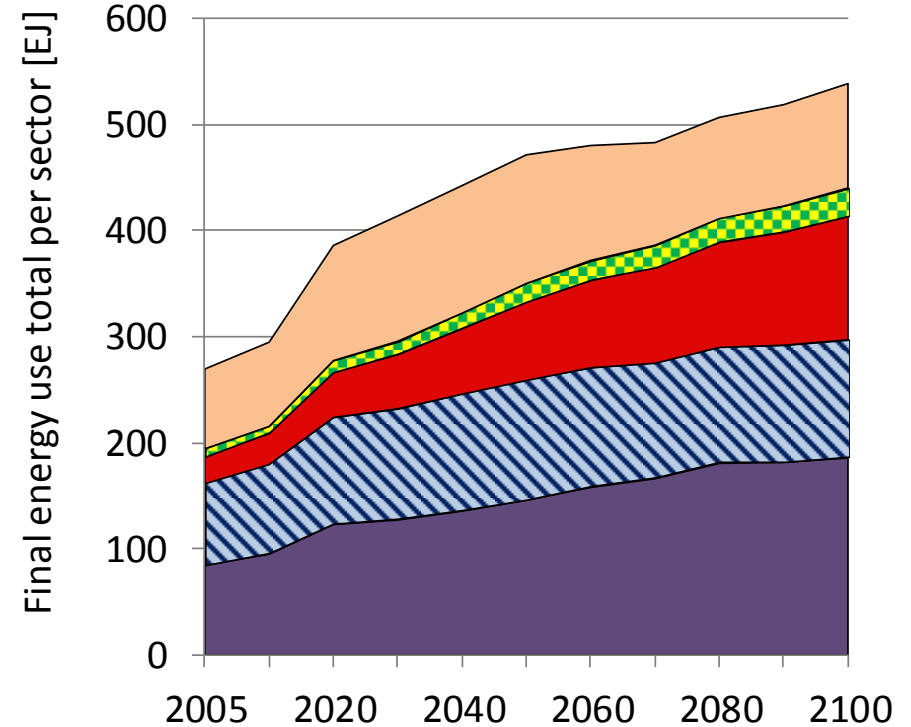
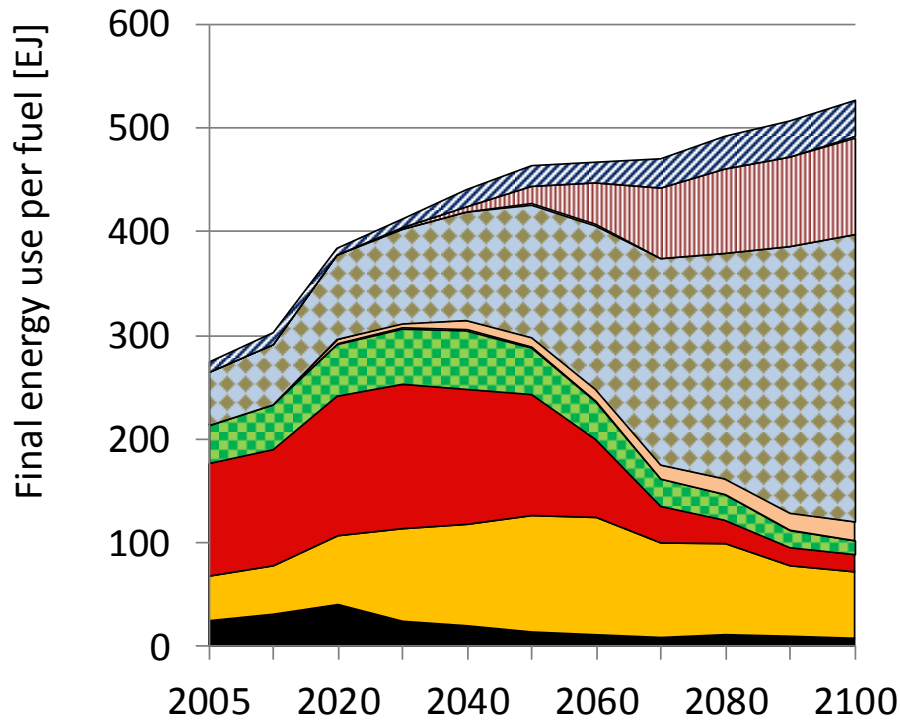
Regional electricity generation



Annual capacity additions



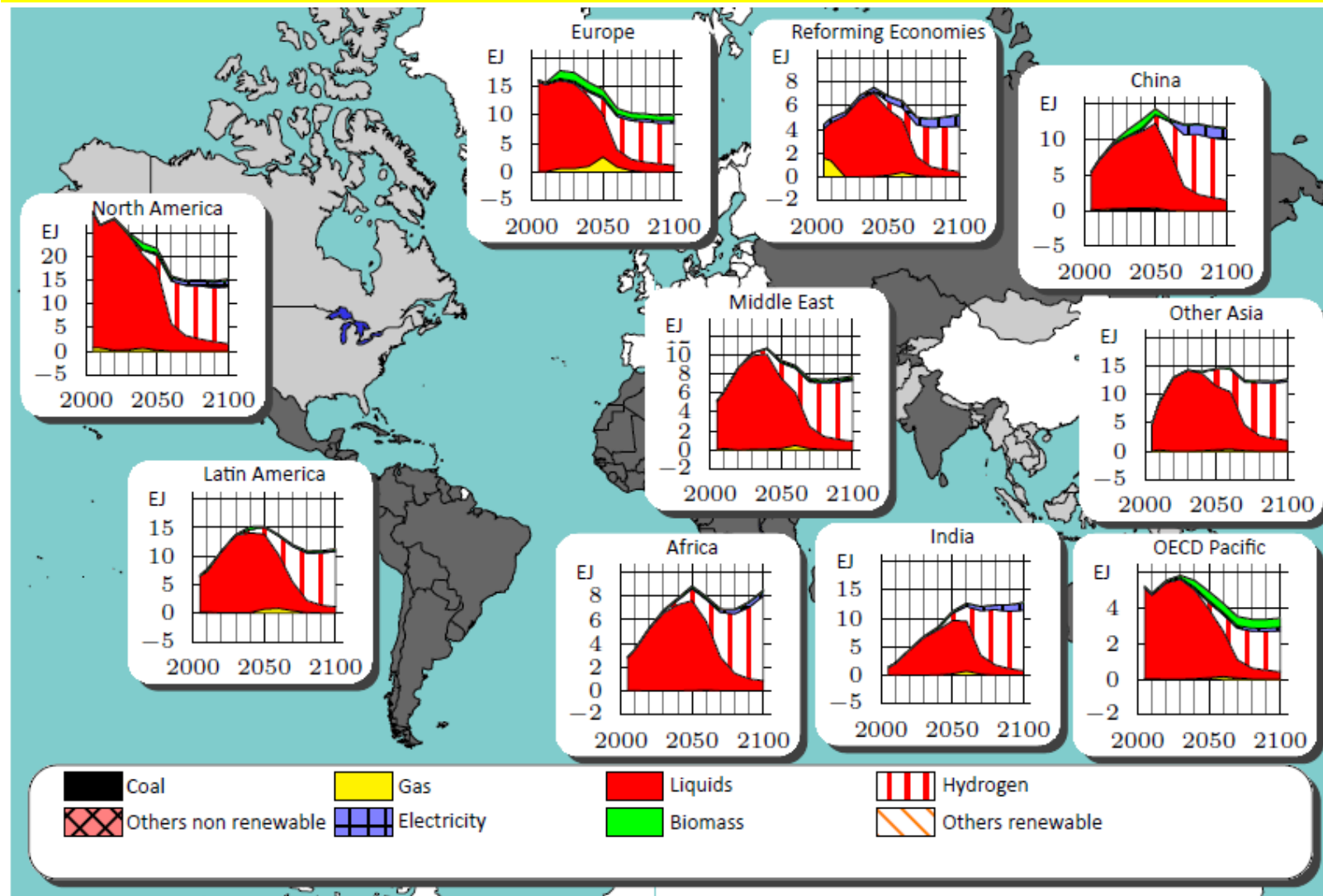
Global final energy consumption



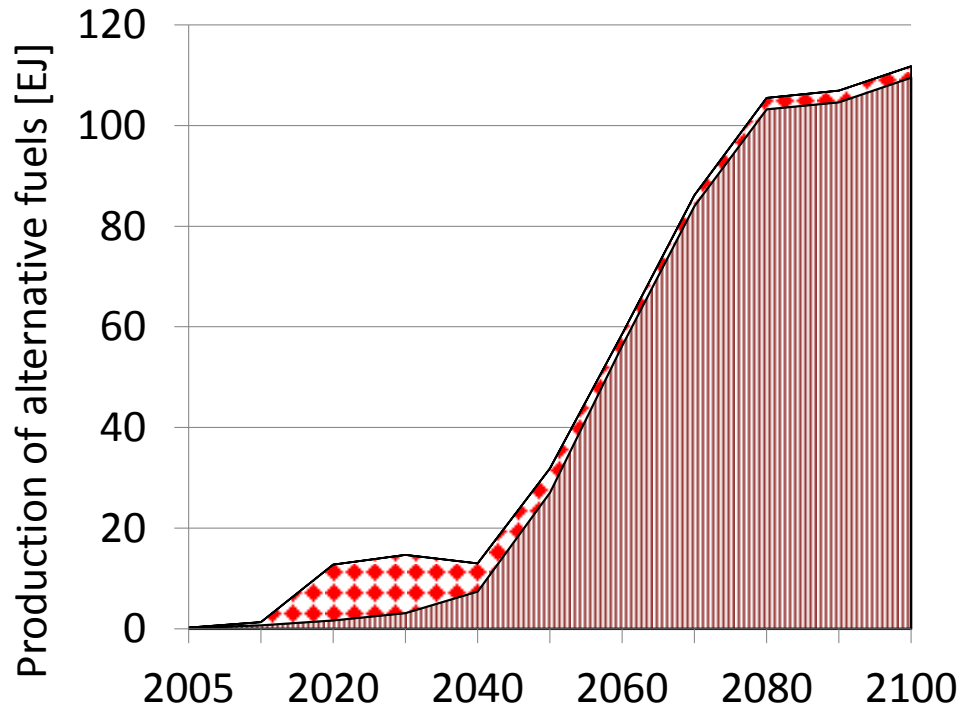
- Coal
- Gas
- Petroleum products
- Biomass
- Others
- Electricity
- Hydrogen
- Heat incl. geothermal

- Industry
- Residential
- Commercial
- Agriculture
- Transportation

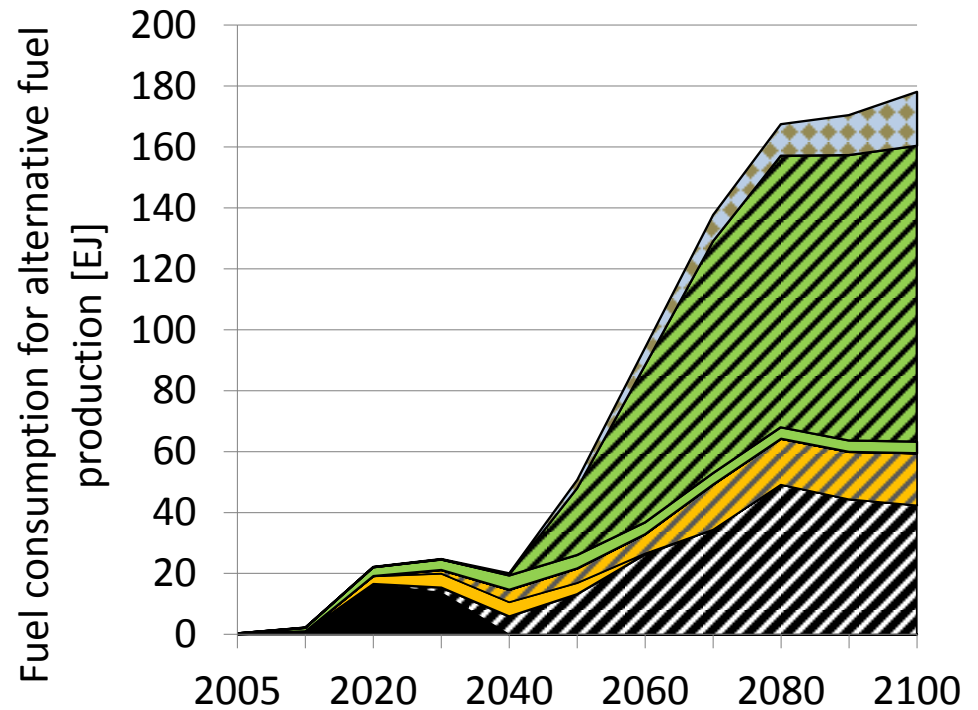
Final energy consumption transport



Global hydrogen and synthetic fuel production

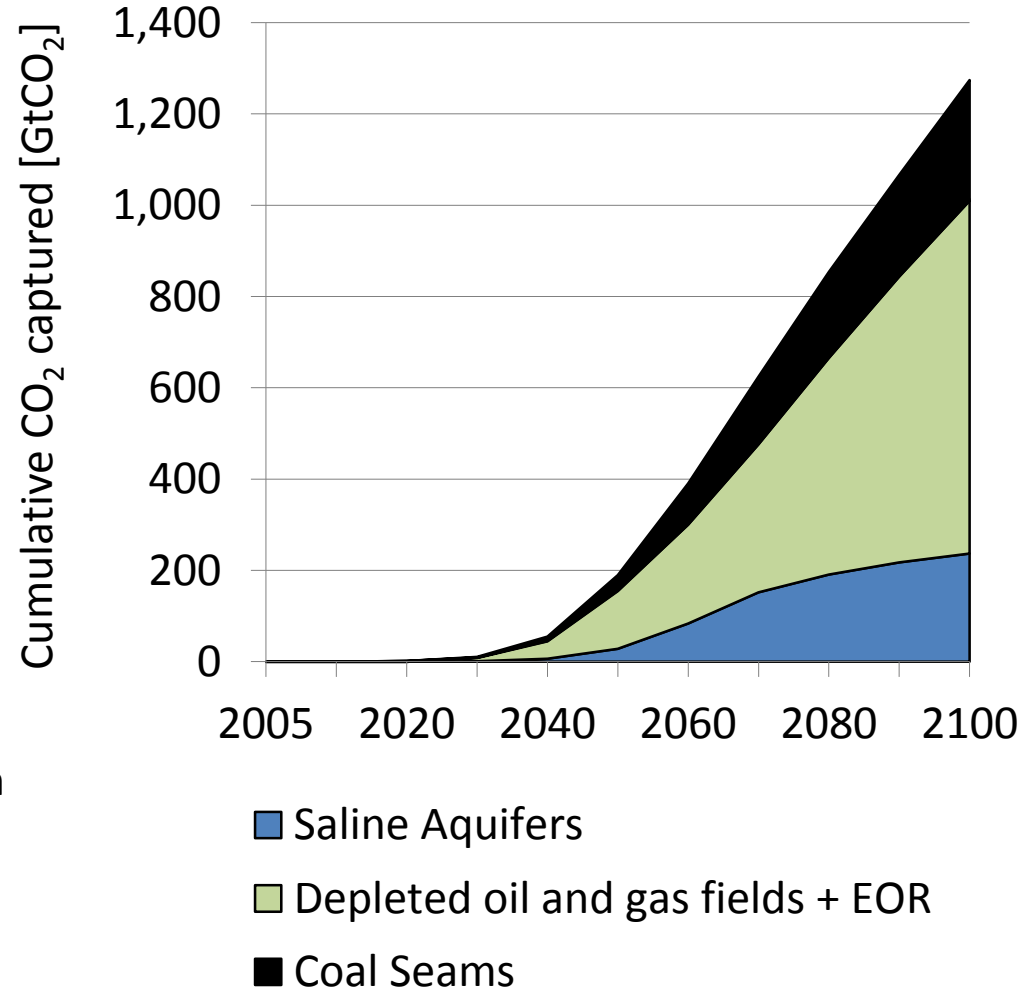
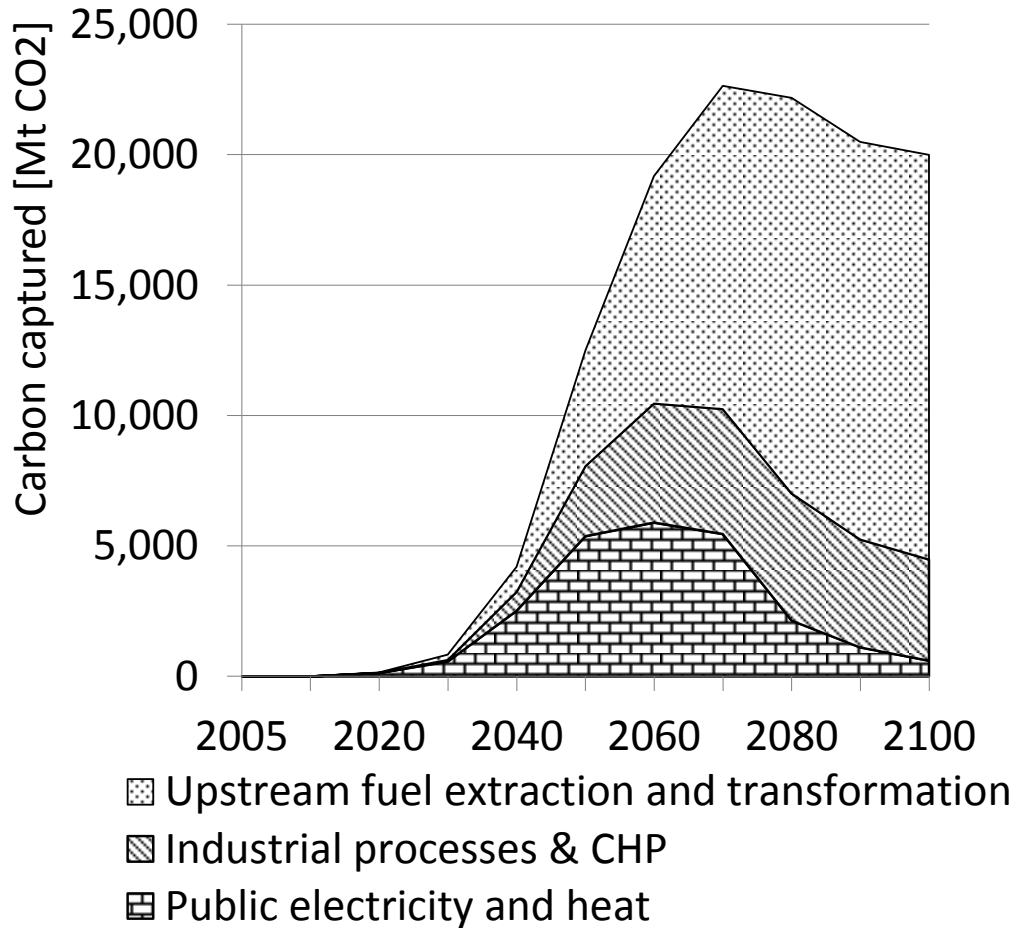


- Hydrogen
- Synfuel

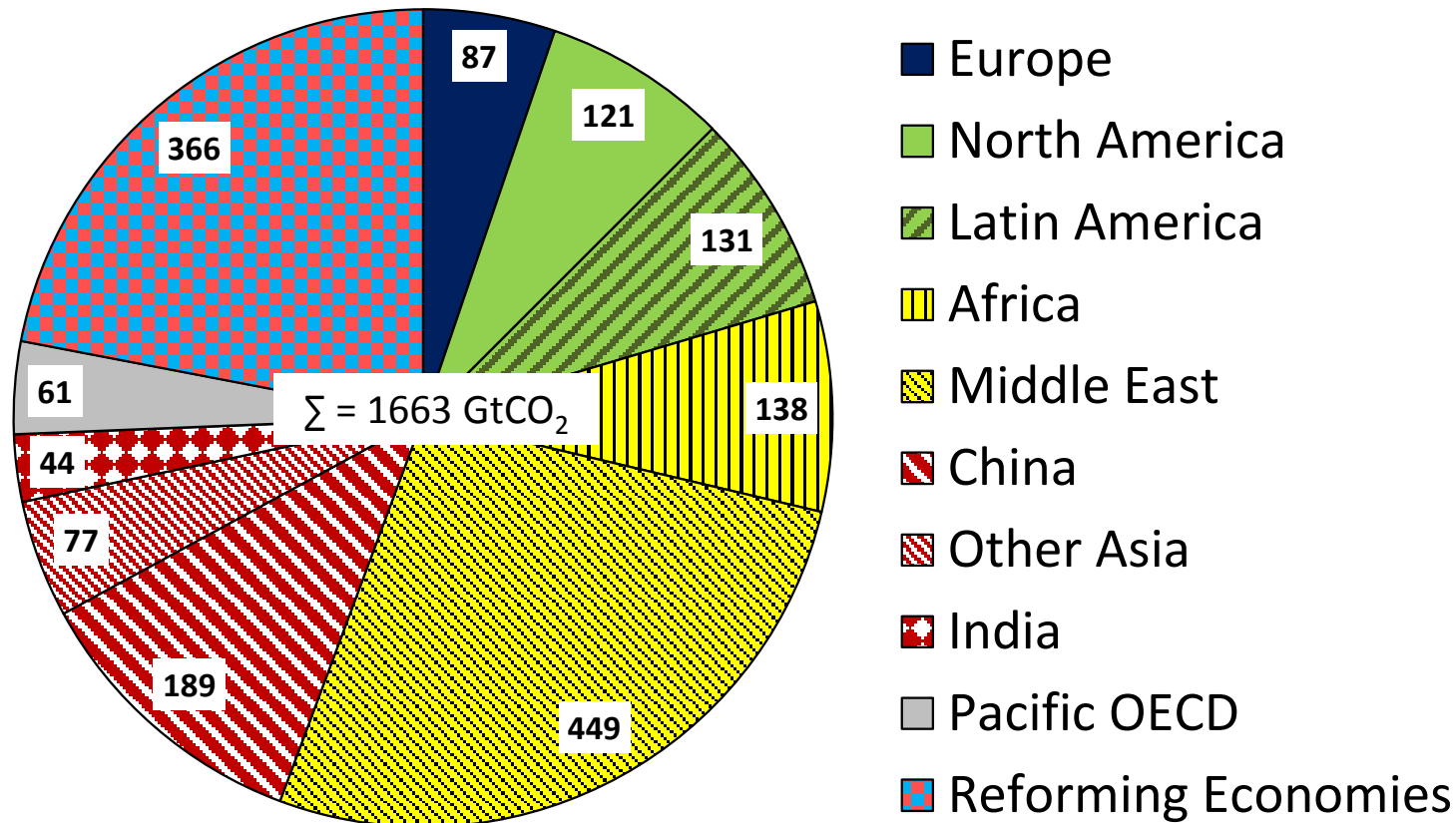


- Coal w/o CCS
- Coal with CCS
- Natural Gas w/o CCS
- Natural gas with CCS
- Liquids w/o CCS
- Liquids with CCS
- Biomass w/o CCS
- Biomass with CCS
- Electricity

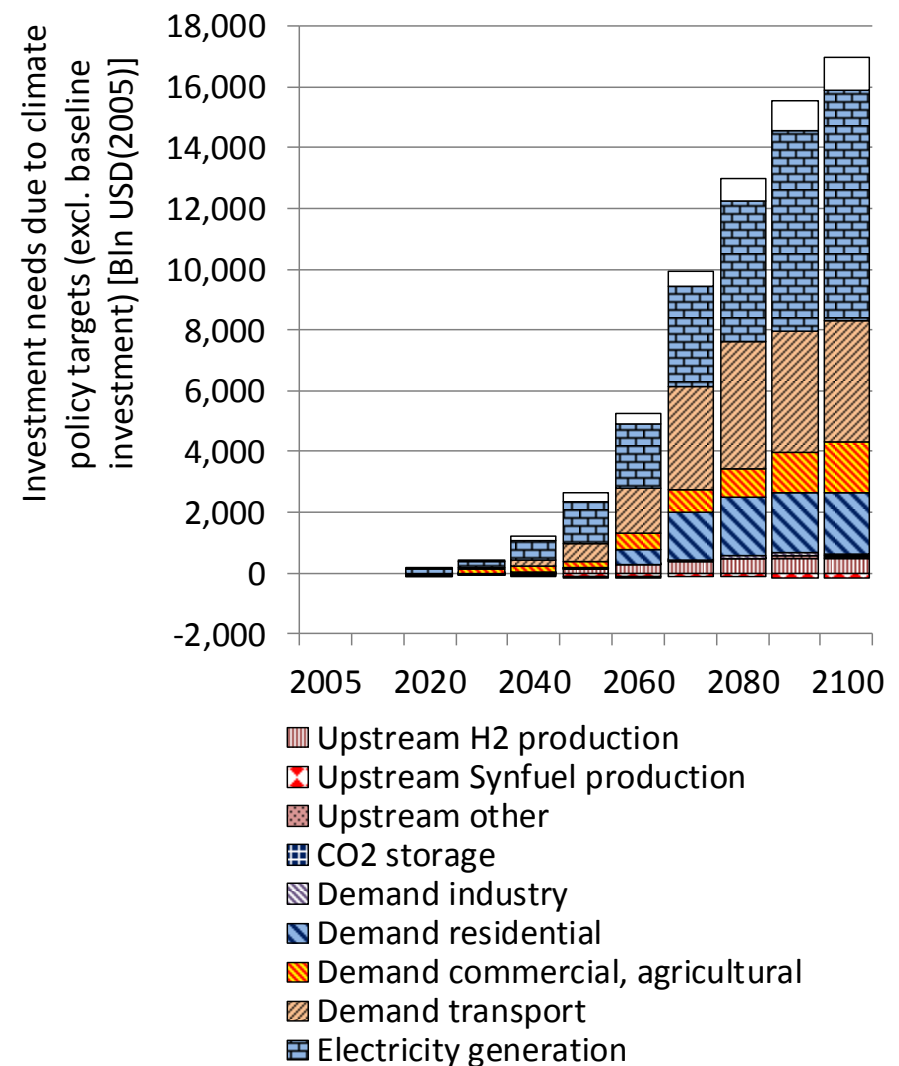
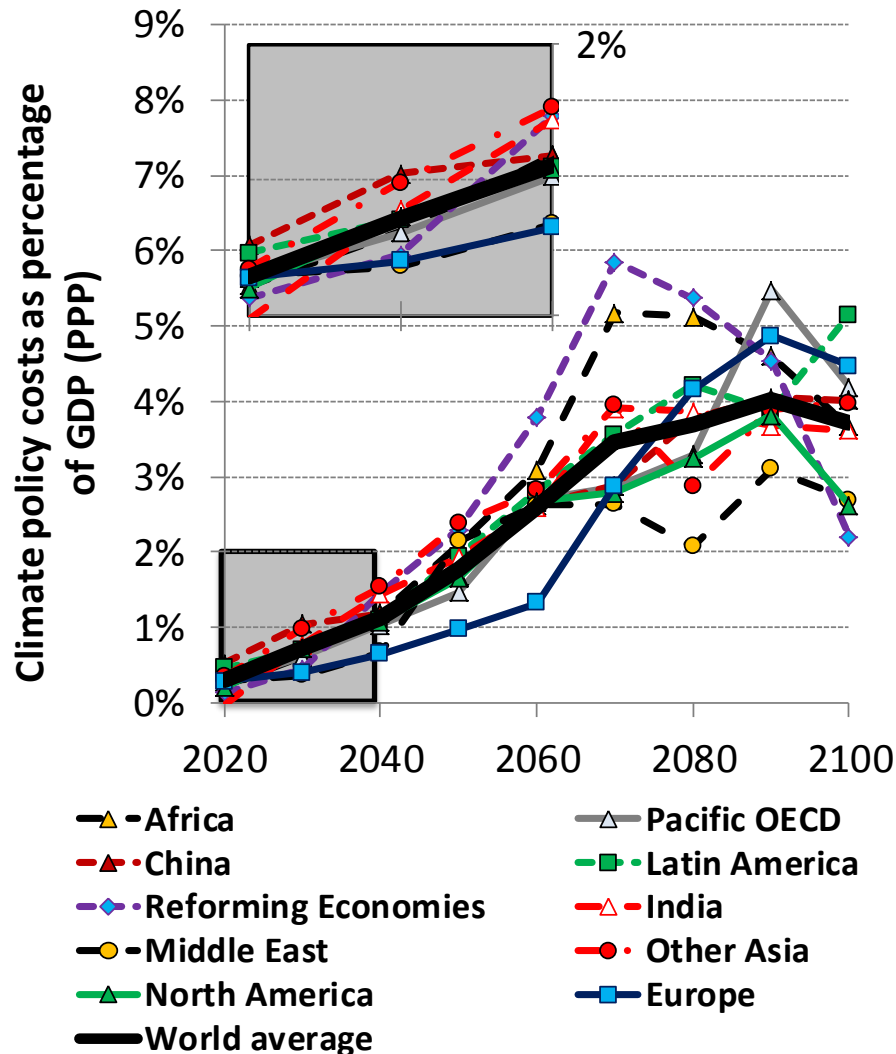
Global CO₂ capture and storage



CO₂ storage potential



Climate policy costs and investments



Conclusions

- Reaching 2°C climate stabilisation requires avoidance of about 4500 GtCO₂e in the 21st century
- GHG emissions peak in 2020, and joined efforts of industrialised and emerging economies necessary to achieve deep emission cuts in all sectors and even negative net GHG emissions where possible
- Renewable technology diffusion in the power sector higher than historic levels for fossil and nuclear power plants
- Decarbonisation of the transport sector with hydrogen, which is mainly produced from biomass with CCS
- Climate policy costs to reach 2°C climate stabilisation accumulate up to 4% of GDP worldwide, and up to 6% on regional level

Thank you!

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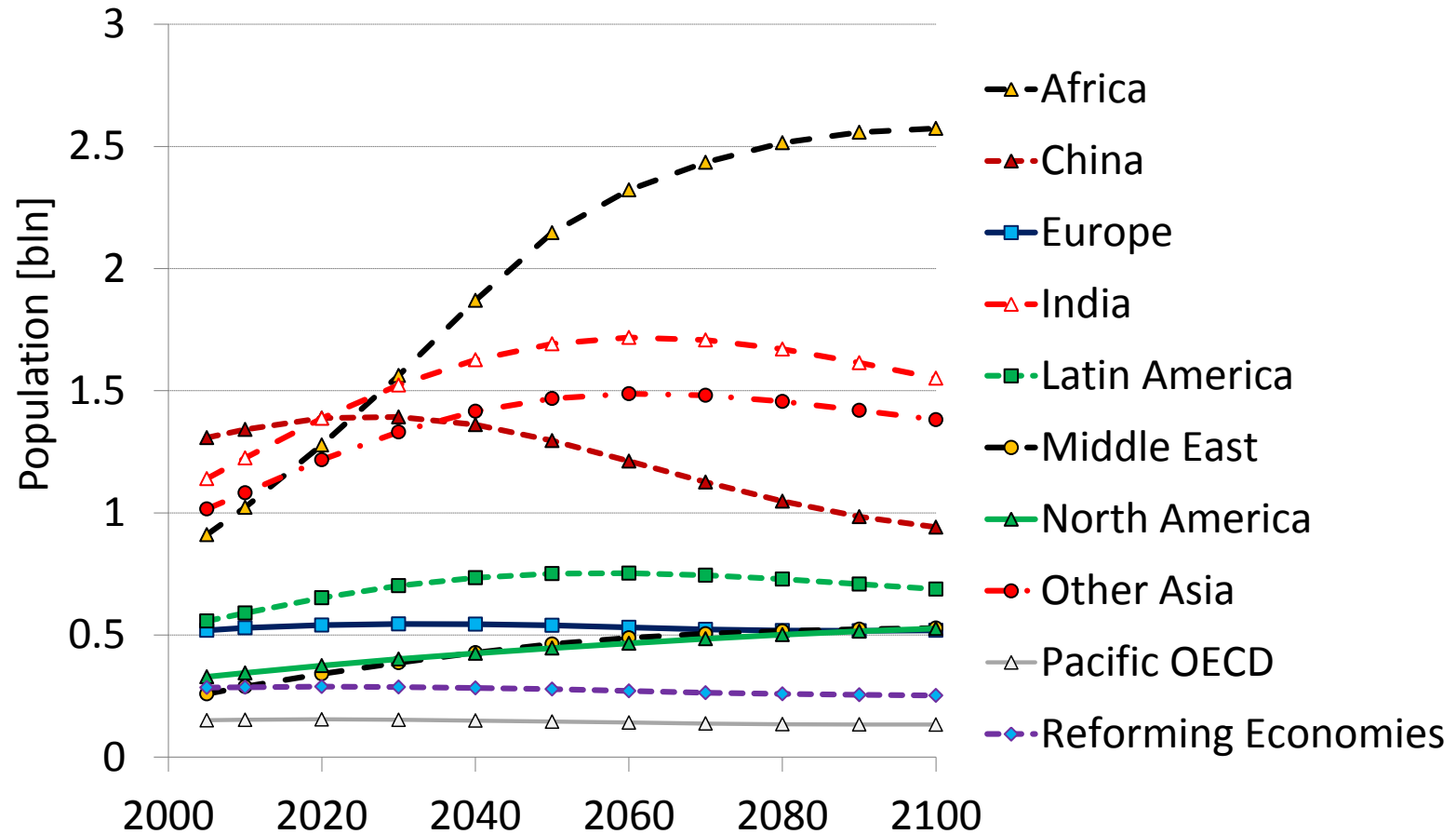
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TIAM-ECN model approach

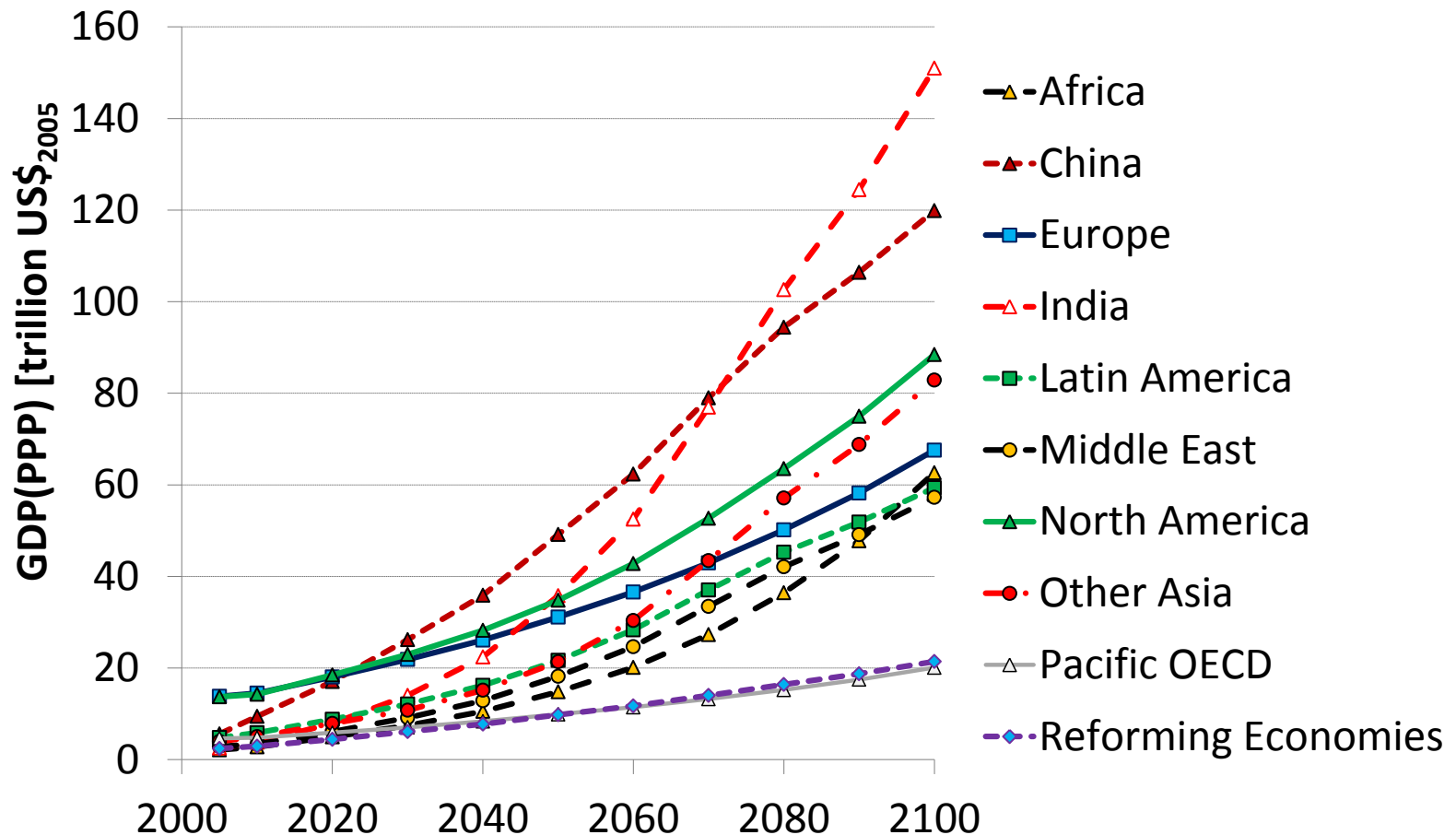
- Global energy system model
 - 15 world regions
 - Time horizon: 2005 – 2100 (10-year intervalls)
 - 6 time slices per year (day/night and seasonal)
 - Supply and demand sectors, representing various energy conversion pathways and climate change mitigation measures
 - Endogenous trade of energy, emission certificates and captured CO₂
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- Analysis conducted within LIMITS EU-FP 7 project
www.ecn.nl/units/ps/themes/energy-and-emission-scenarios/global-european-projections/limits

Population development



Source: UN 2011, own calculations

Development of GDP (PPP)



Source: IEA 2012, own calculations