

# Pathway to Reach a 2° C Climate Stabilisation

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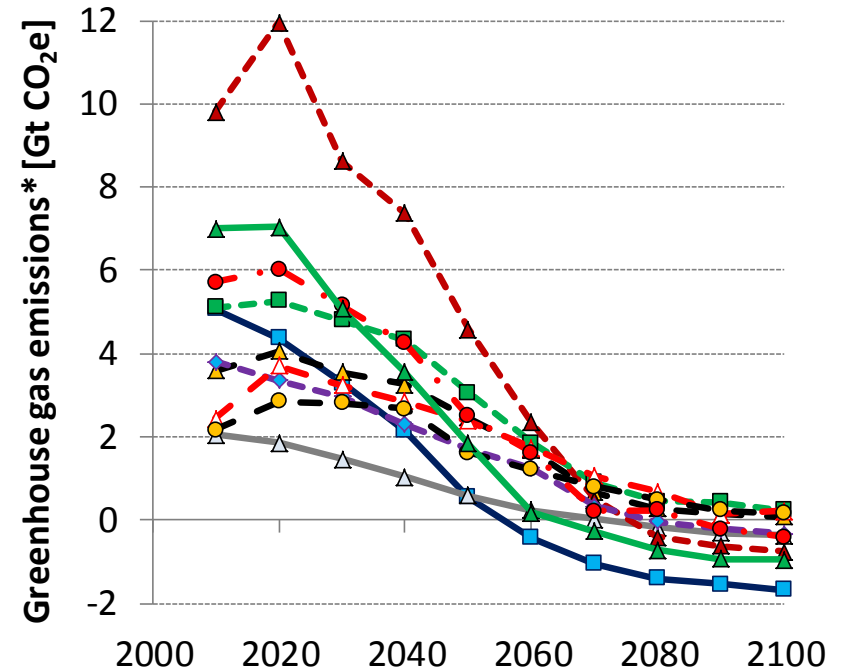
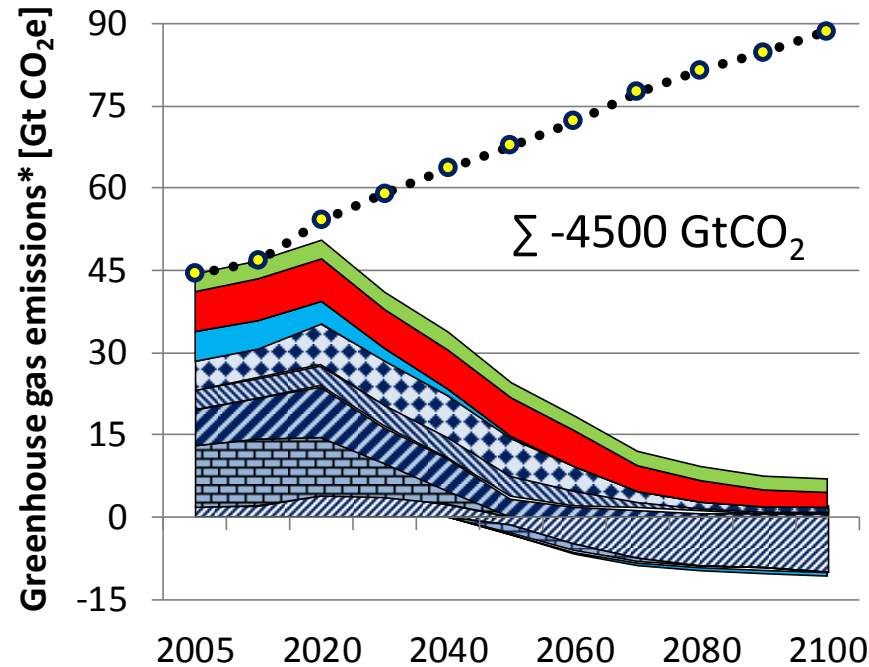
# Scenario definition

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- 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/m<sup>2</sup> 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](http://www.ecn.nl/units/ps/themes/energy-and-emission-scenarios/global-european-projections/limits)

# Global GHG emission development

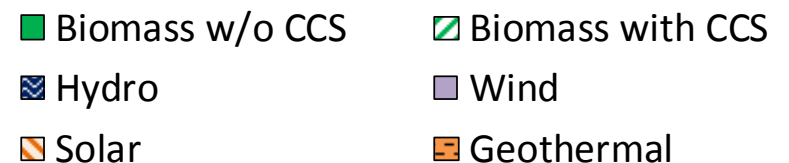
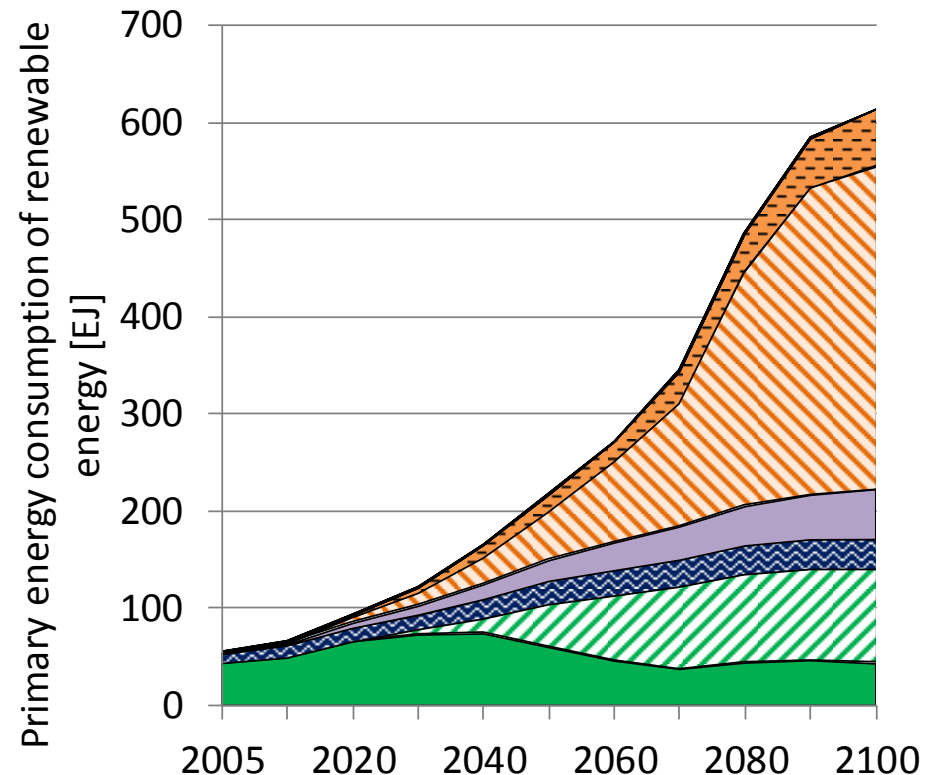
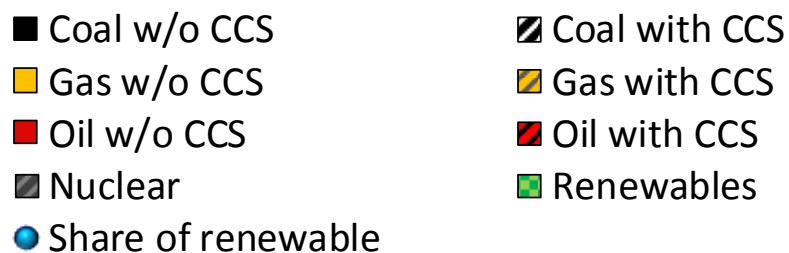
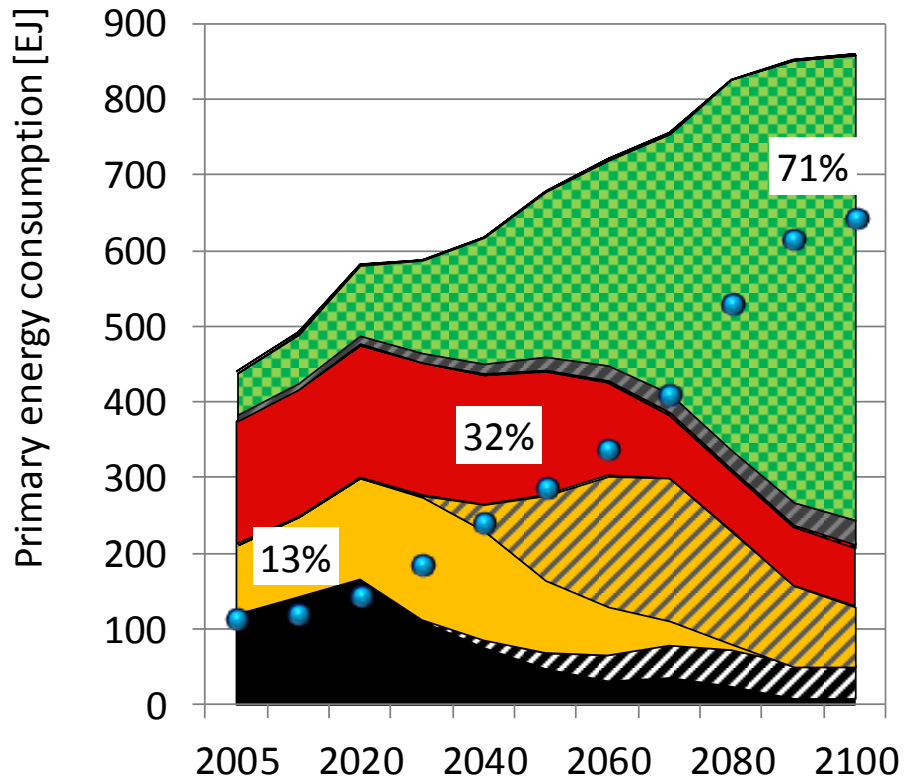


- N<sub>2</sub>O Total
- CO<sub>2</sub> Land-use
- CO<sub>2</sub> Households + commercial
- CO<sub>2</sub> Electricity production
- Baseline w/o climate policy
- CH<sub>4</sub> Total
- CO<sub>2</sub> Transport
- CO<sub>2</sub> Industry
- CO<sub>2</sub> Upstream

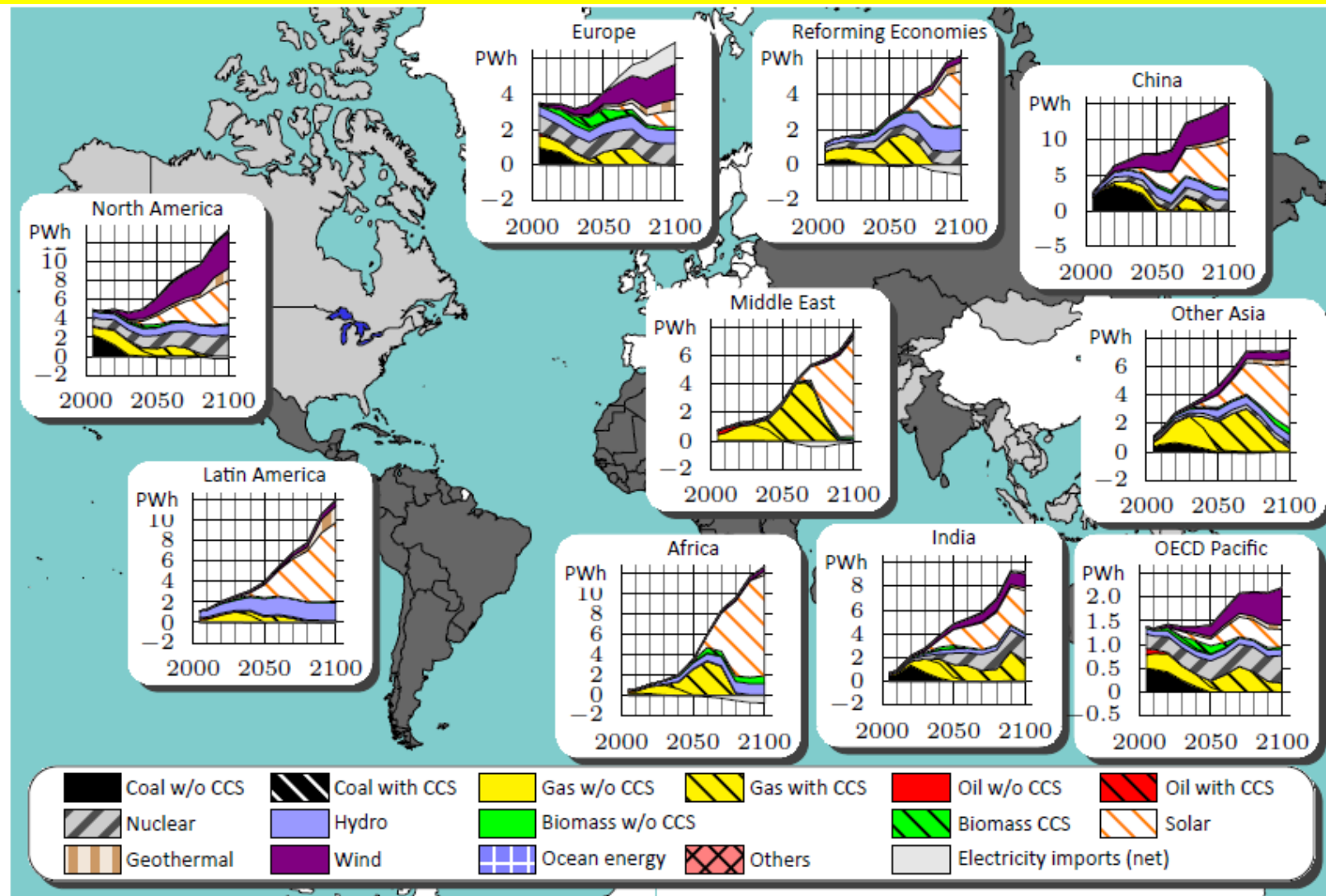
- Europe
- Pacific OECD
- Africa
- China
- Latin America
- Reforming Economies
- India
- Middle East
- Other Asia
- North America

\* CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O

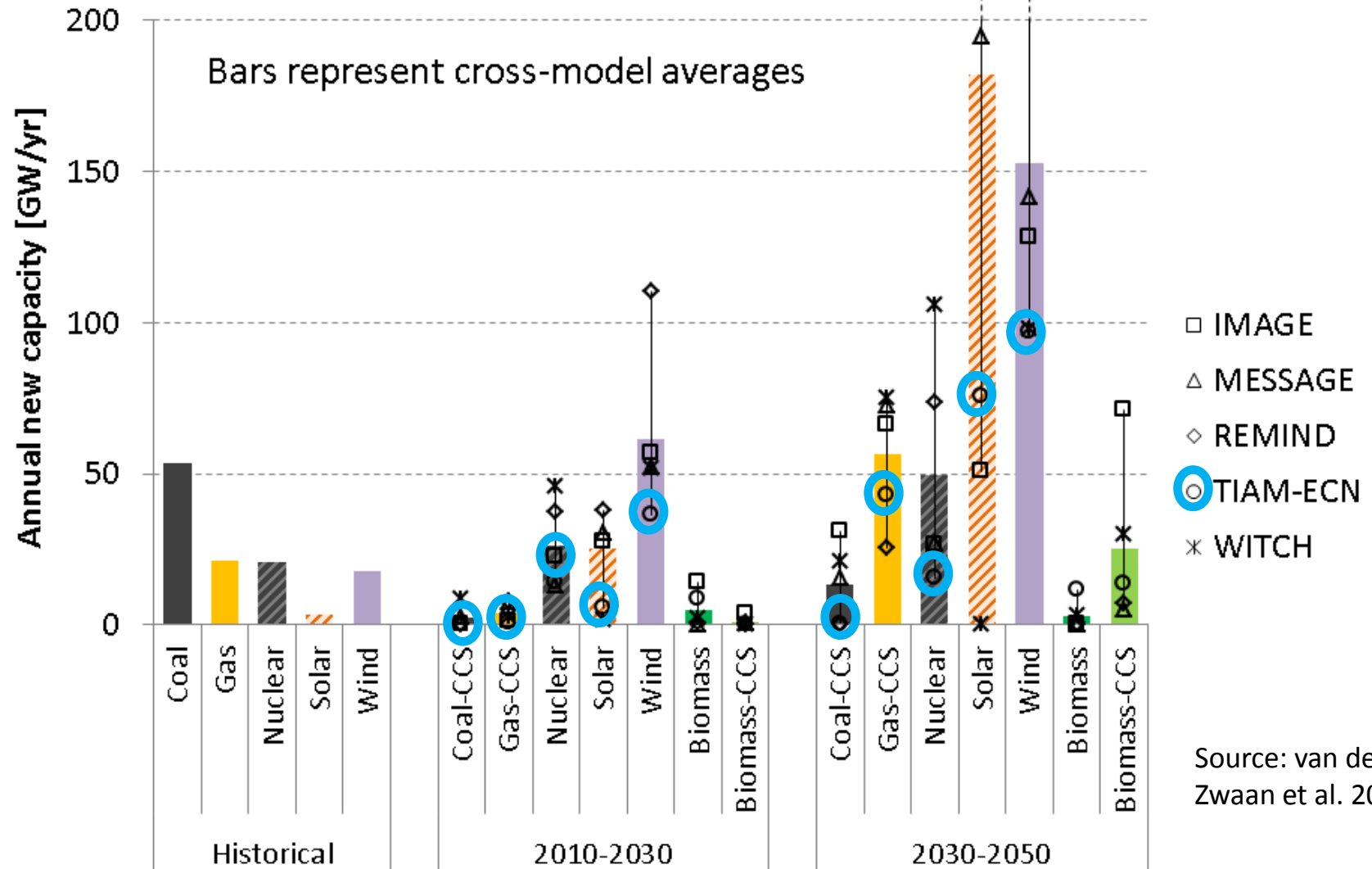
# Primary energy consumption



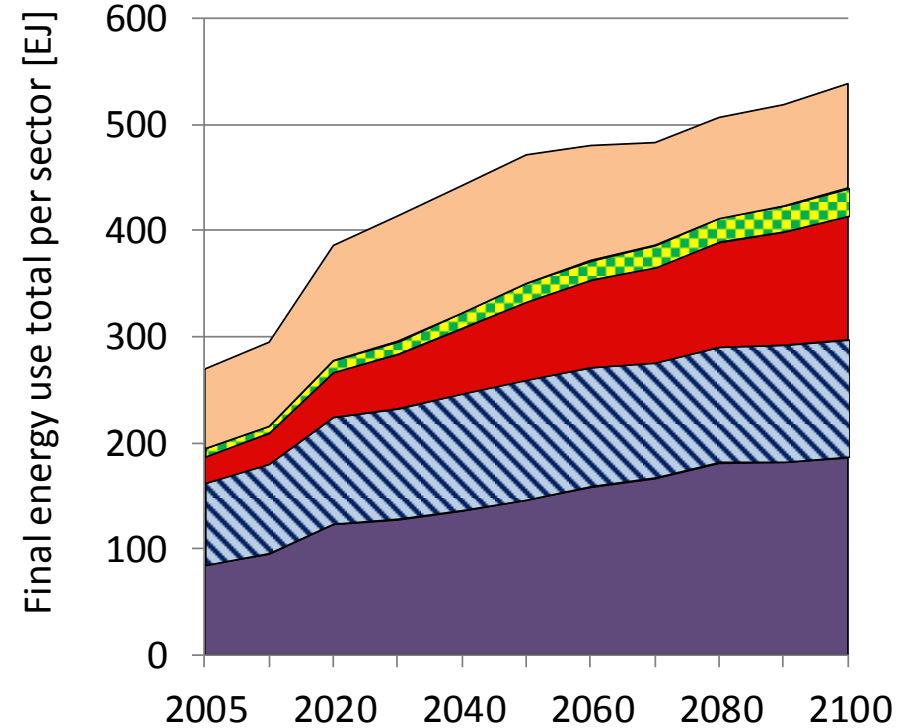
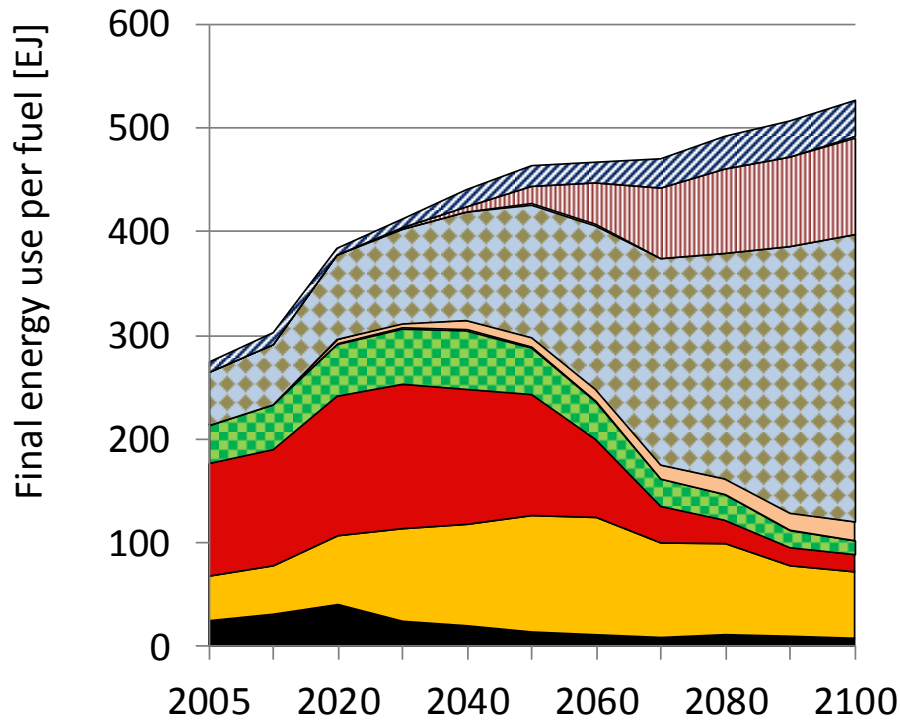
# Regional electricity generation



# Annual capacity additions



# Global final energy consumption

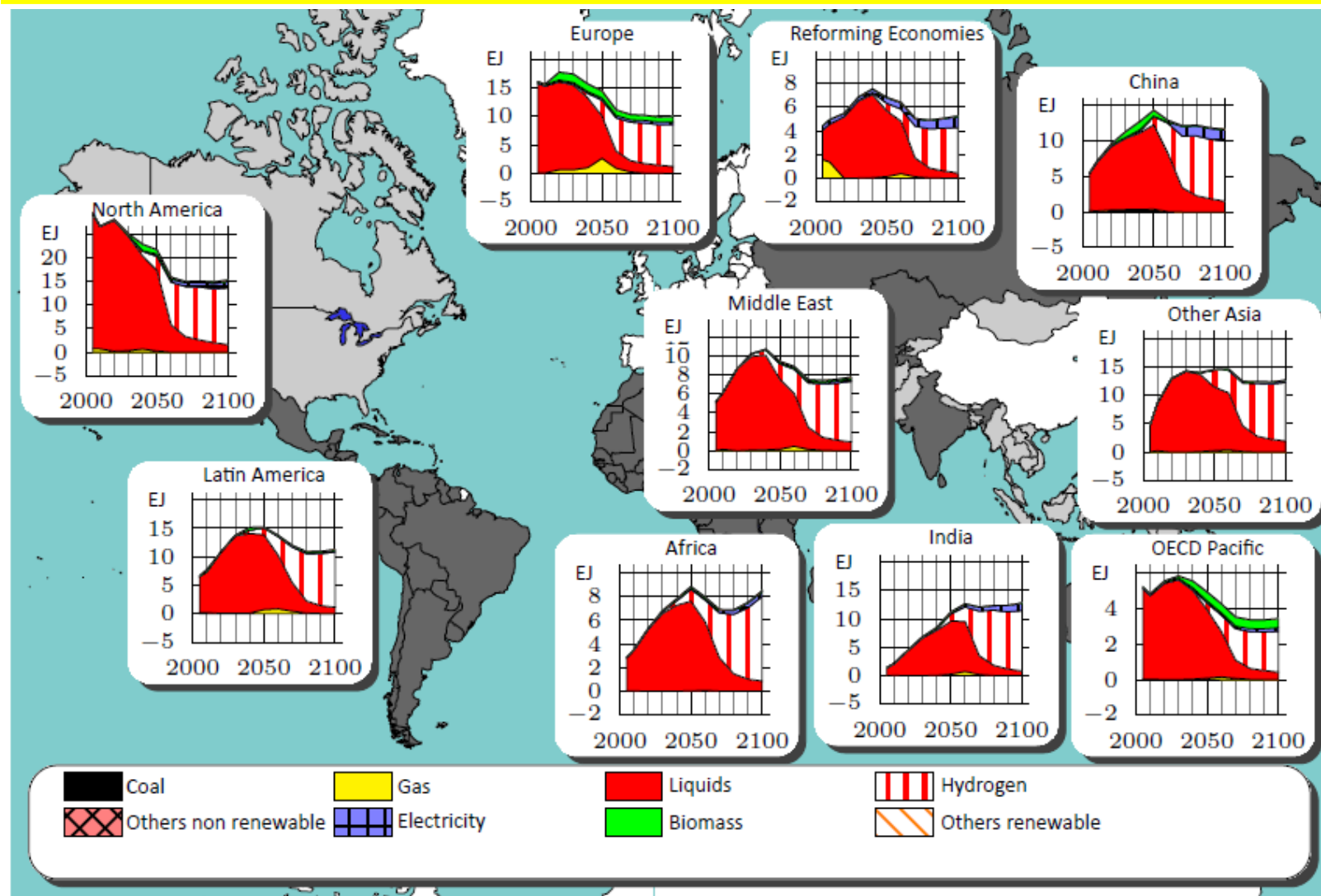


- Coal
- Gas
- Petroleum products
- Biomass
- Others
- Electricity
- Hydrogen
- Heat incl. geothermal

- Industry
- Residential
- Commercial
- Agriculture
- Transportation

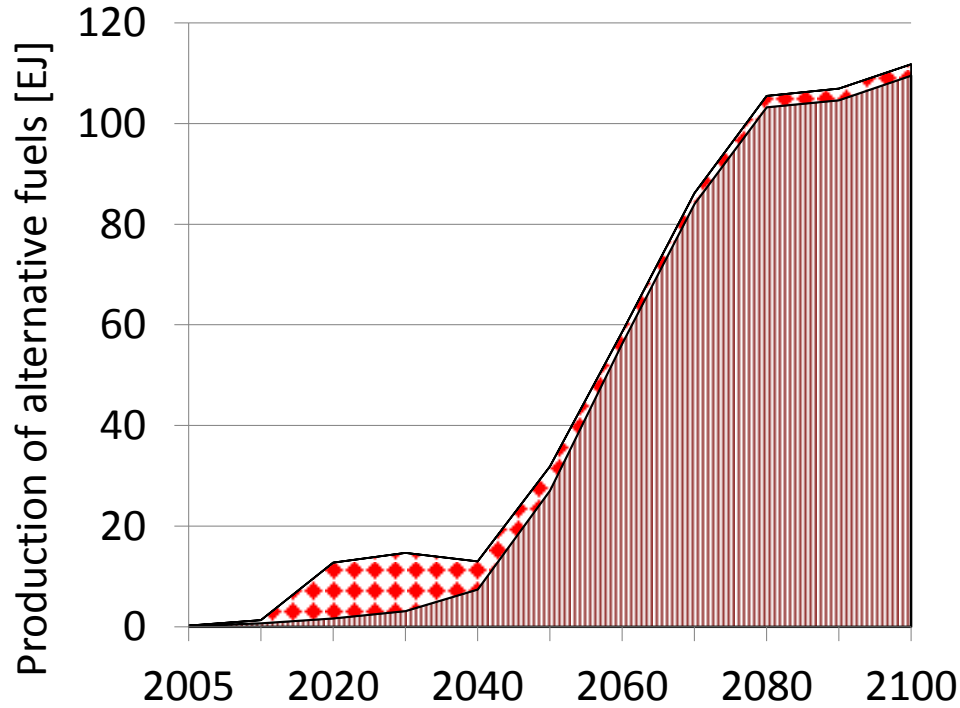


# Final energy consumption transport

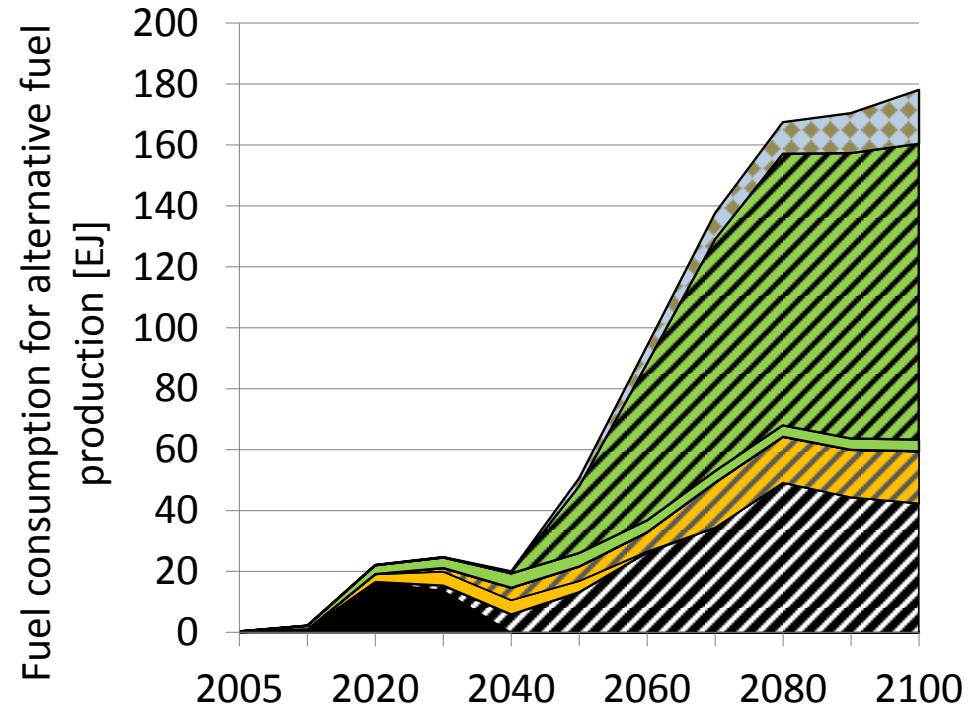




# Global hydrogen and synthetic fuel production

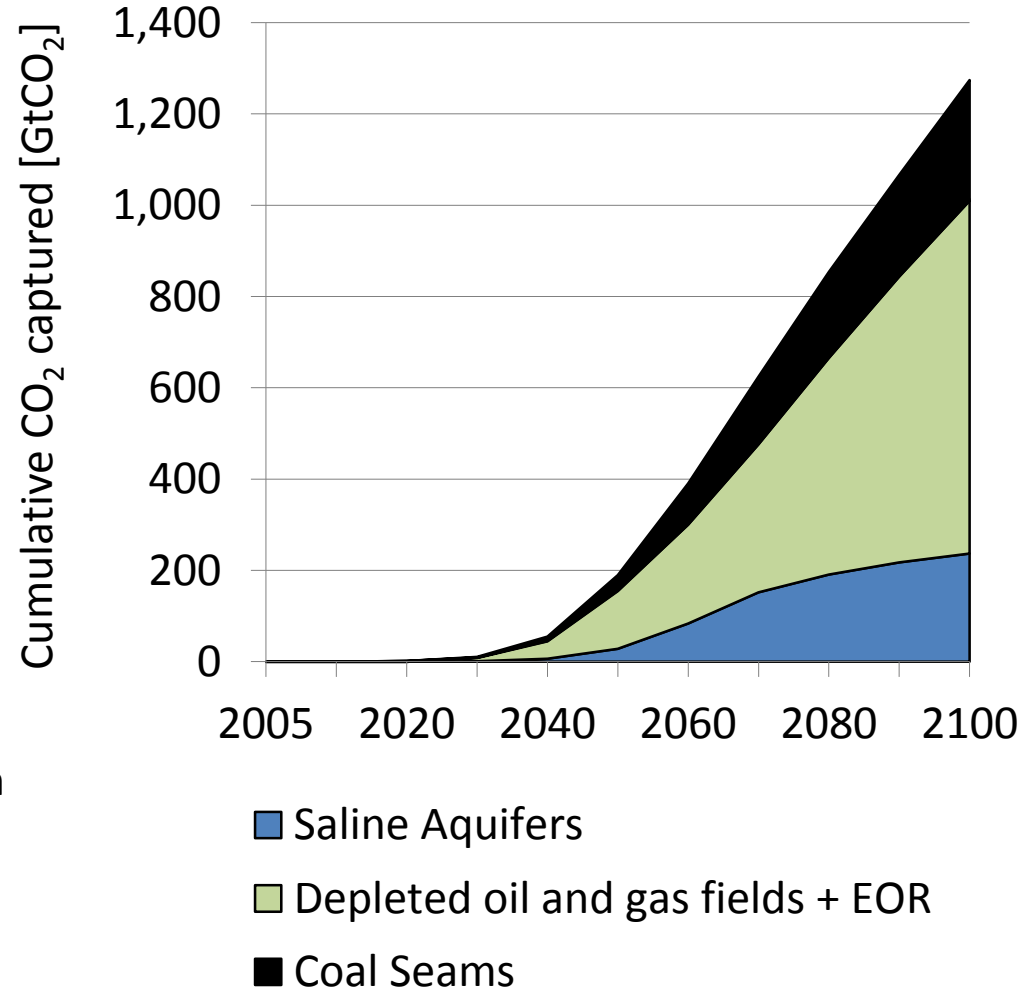
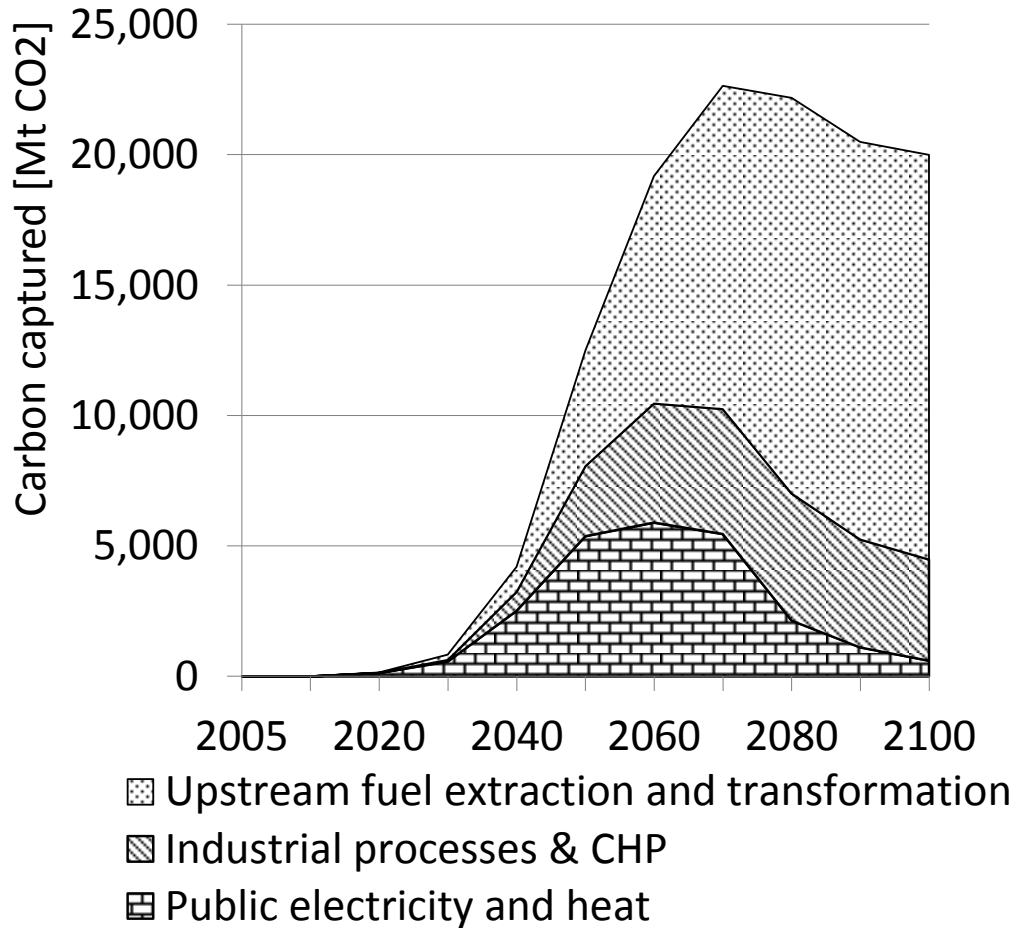


- Hydrogen
- Synfuel

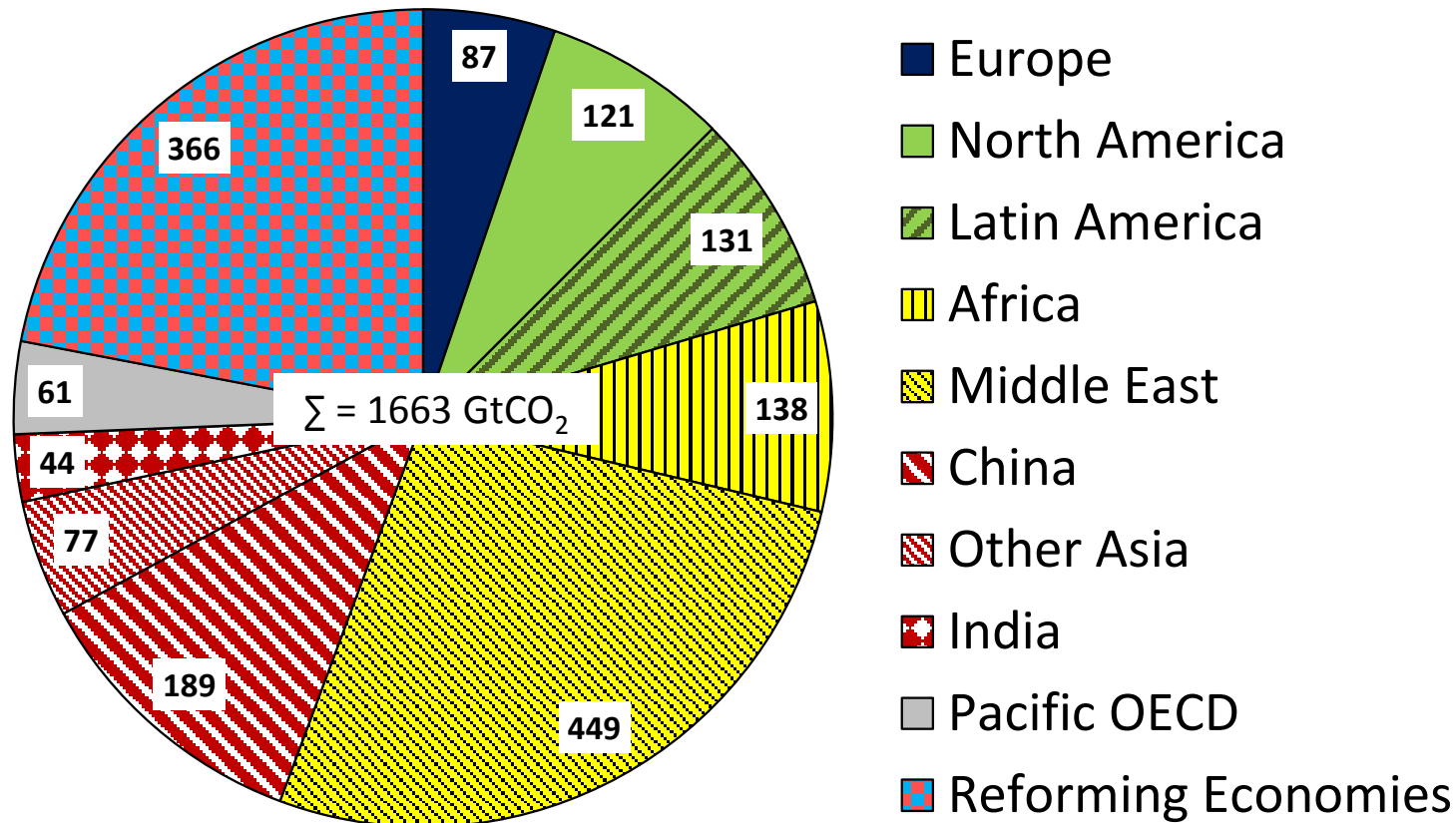


- Coal w/o CCS
- Coal with CCS
- Natural Gas w/o CCS
- Natural gas with CCS
- Liquids w/o CCS
- Liquids with CCS
- Biomass w/o CCS
- Biomass with CCS
- Electricity

# Global CO<sub>2</sub> capture and storage

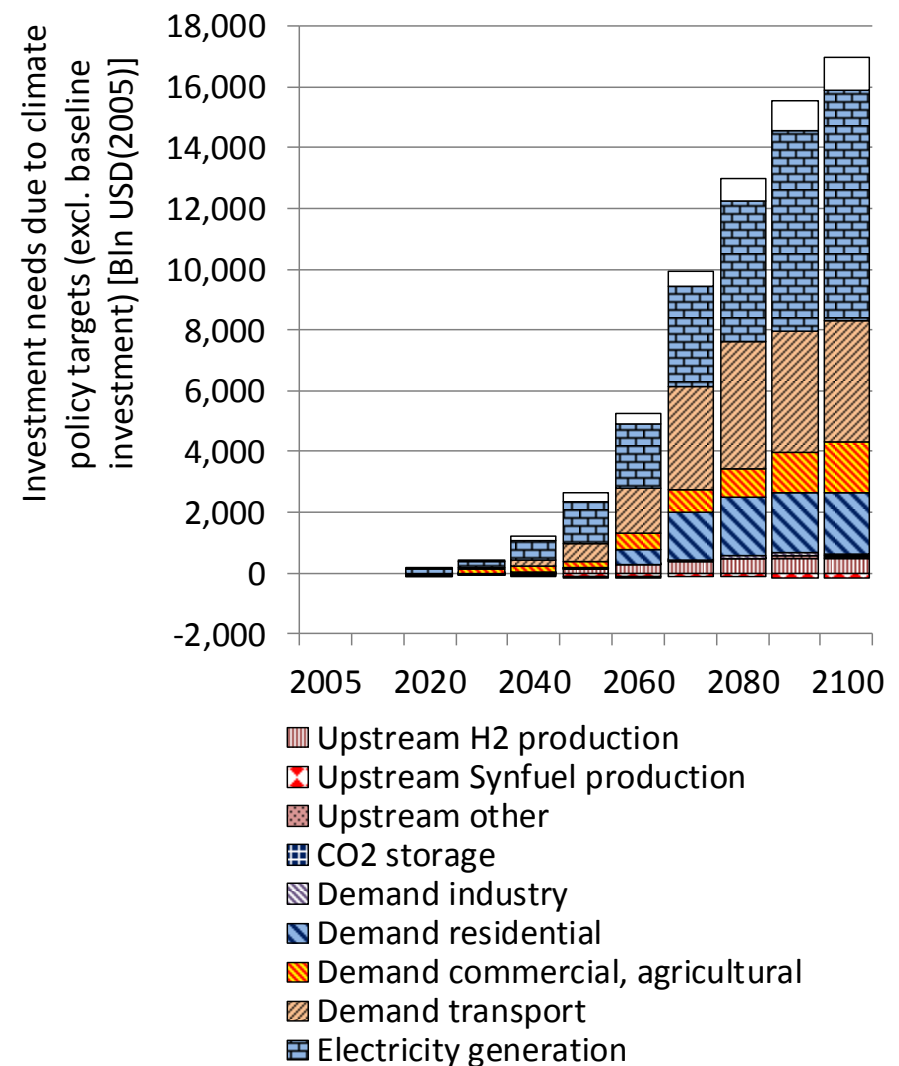
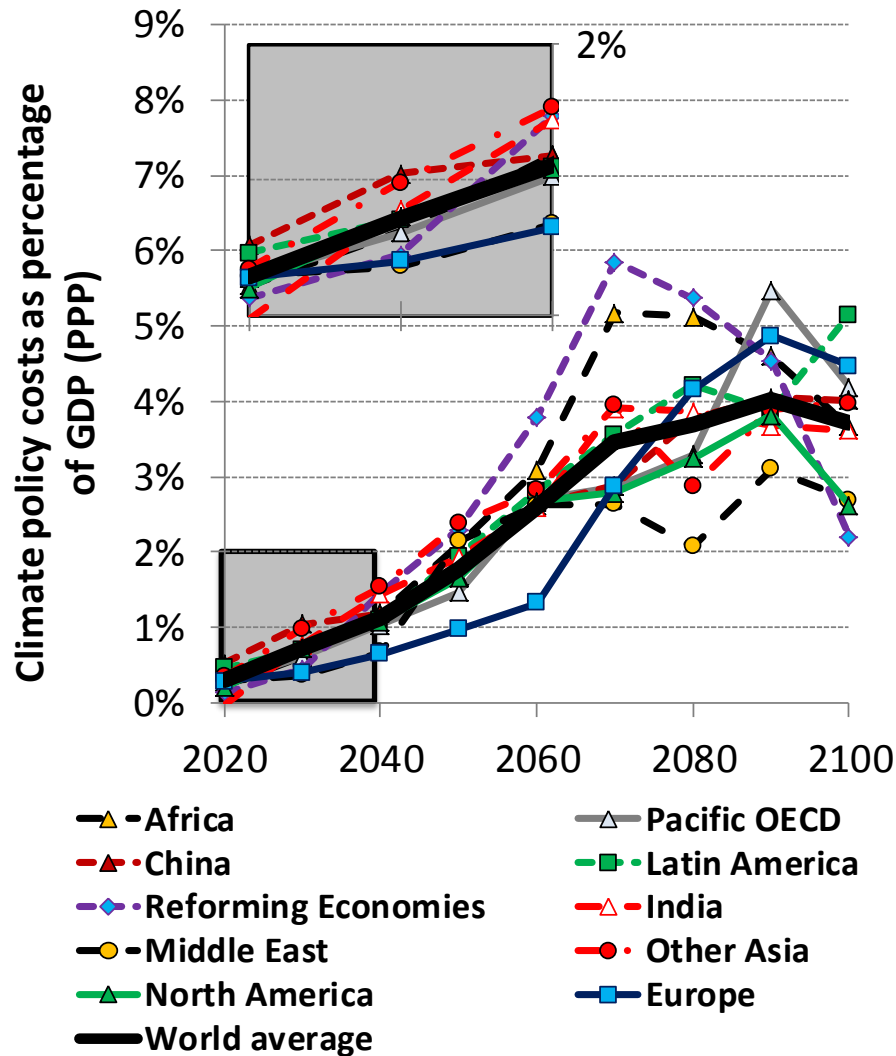


# CO<sub>2</sub> storage potential



Source: Hendriks et al. 2004

# Climate policy costs and investments



# Conclusions

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- Reaching 2°C climate stabilisation requires avoidance of about 4500 GtCO<sub>2</sub>e in the 21<sup>st</sup> 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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# References

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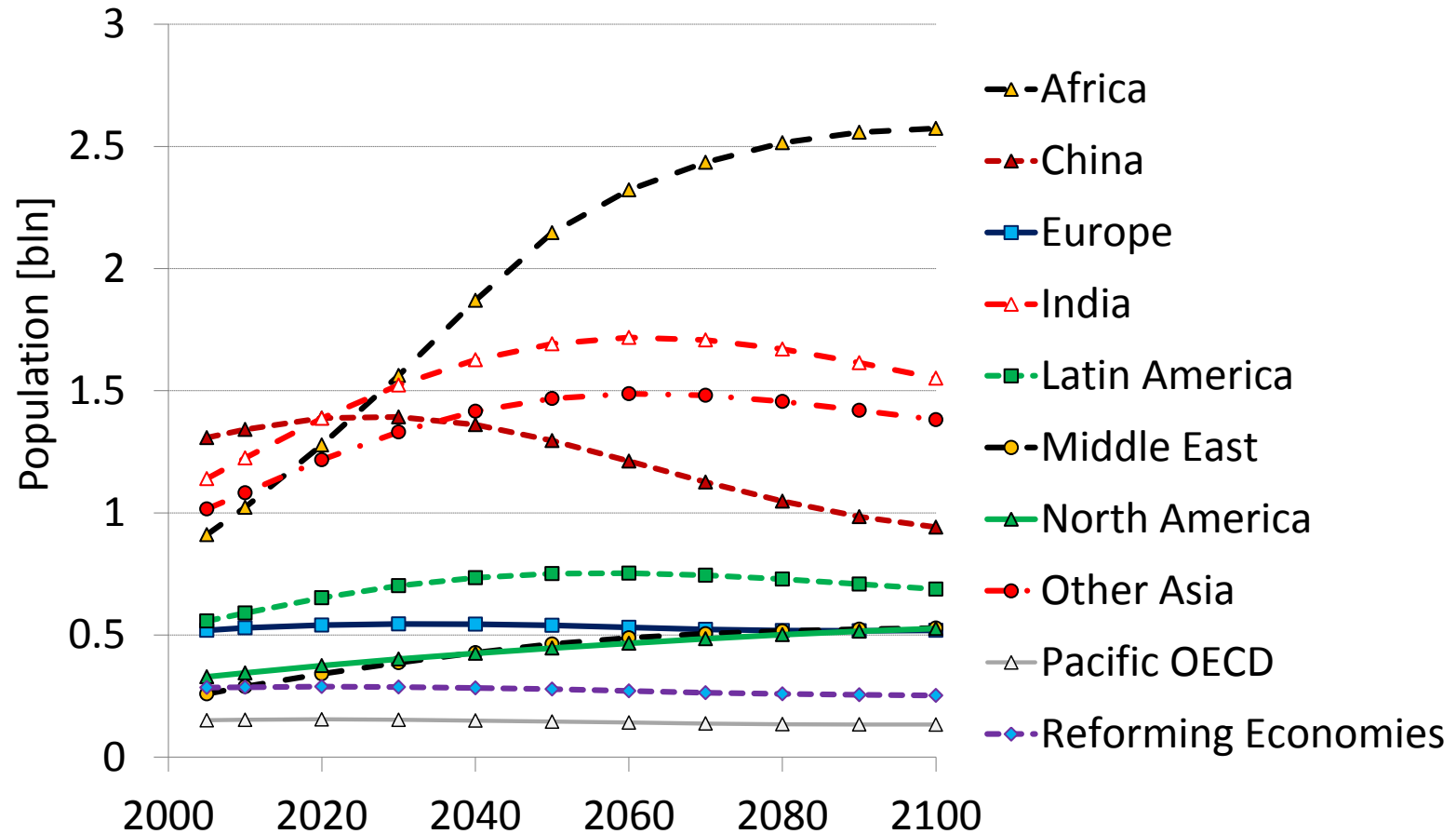


# TIAM-ECN model approach

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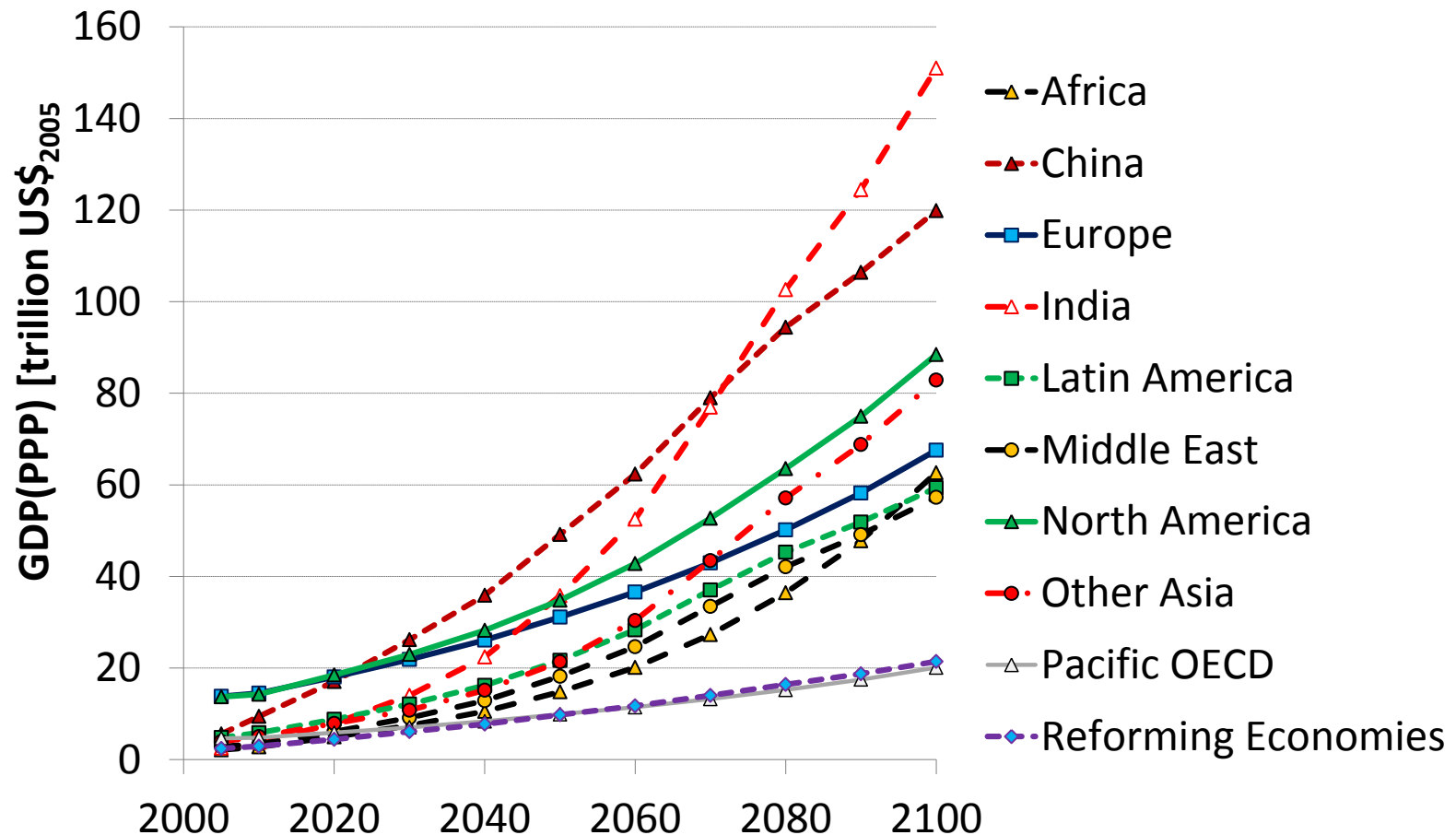
- Global energy system model
  - 15 world regions
  - Time horizon: 2005 – 2100 (10-year intervalls)
  - 6 time slices per year (day/night and seasonal)
  - Supply and demand sectors, representing various energy conversion pathways and climate change mitigation measures
  - Endogenous trade of energy, emission certificates and captured CO<sub>2</sub>
- 
- Analysis conducted within LIMITS EU-FP 7 project  
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# Population development



Source: UN 2011, own calculations

# Development of GDP (PPP)



Source: IEA 2012, own calculations