



energy [r]evolution

A Sustainable World Energy Outlook


Wolfram Krewitt

GREENPEACE

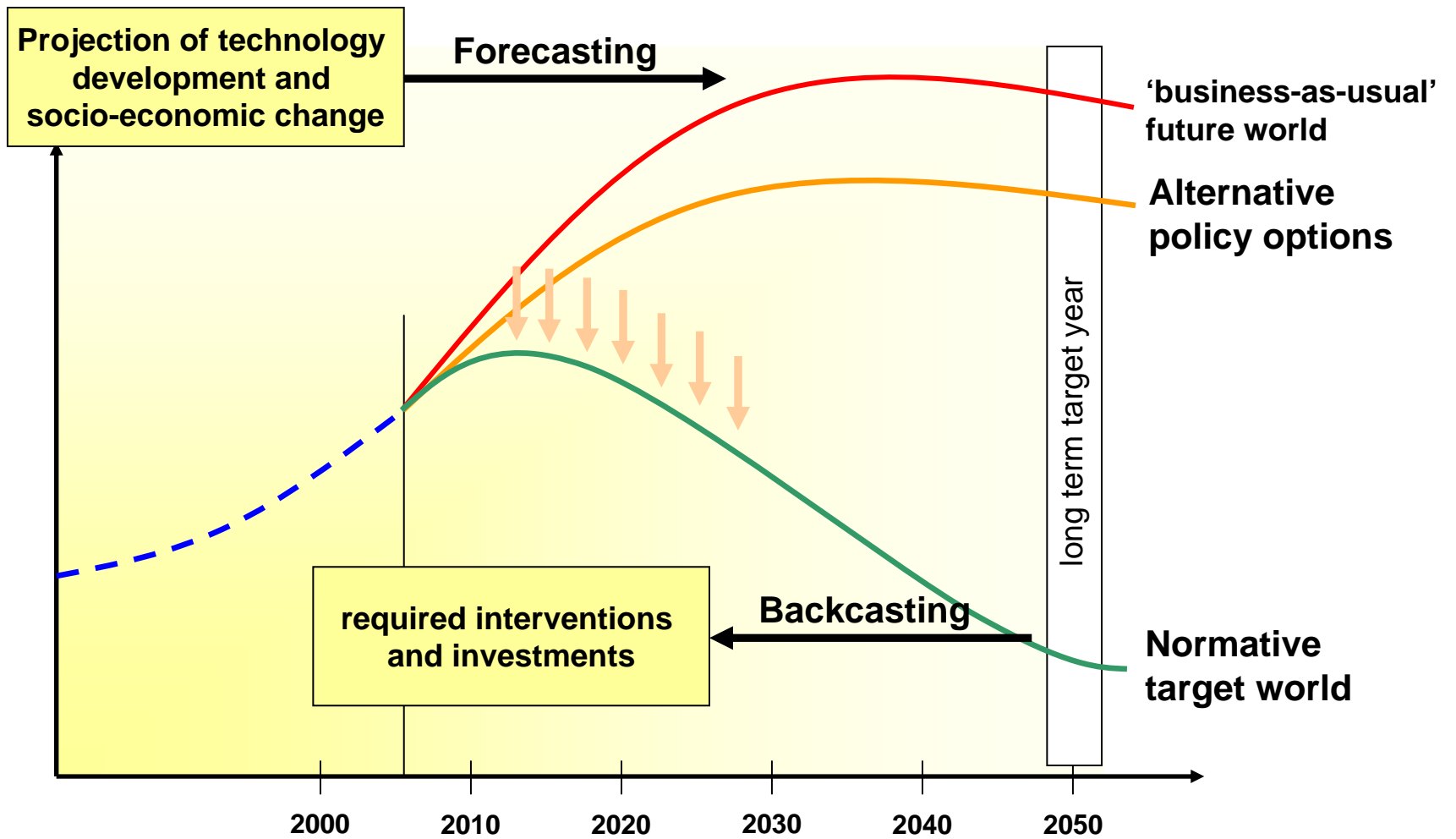


10th Annual Renewable Energy and Energy Efficiency Expo
June 14, 2007
Washington





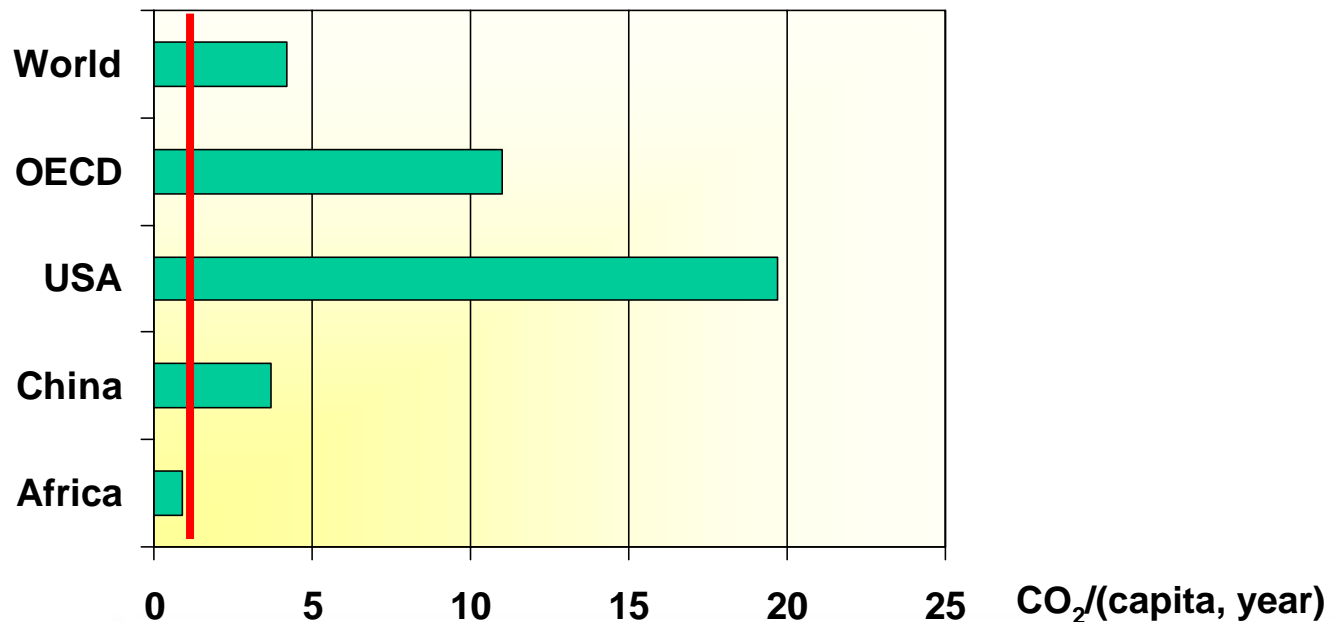
***It is not important to predict future,
but it is important to be prepared for the future.
Perikles, 500 B.C.***



source: anonymous

EU target: to limit average global temperature increase to a maximum of 2°C compared to pre-industrial level.

- ↪ **Stabilisation of global CO₂-concentration below 450 ppm**
- ↪ **reduce energy related CO₂-emissions from 27 Gt/a today to ~ 10 Gt_{CO₂}/a in 2050**
- ↪ **per-capita emission rights in 2050: ~ 1 t_{CO₂}/a**



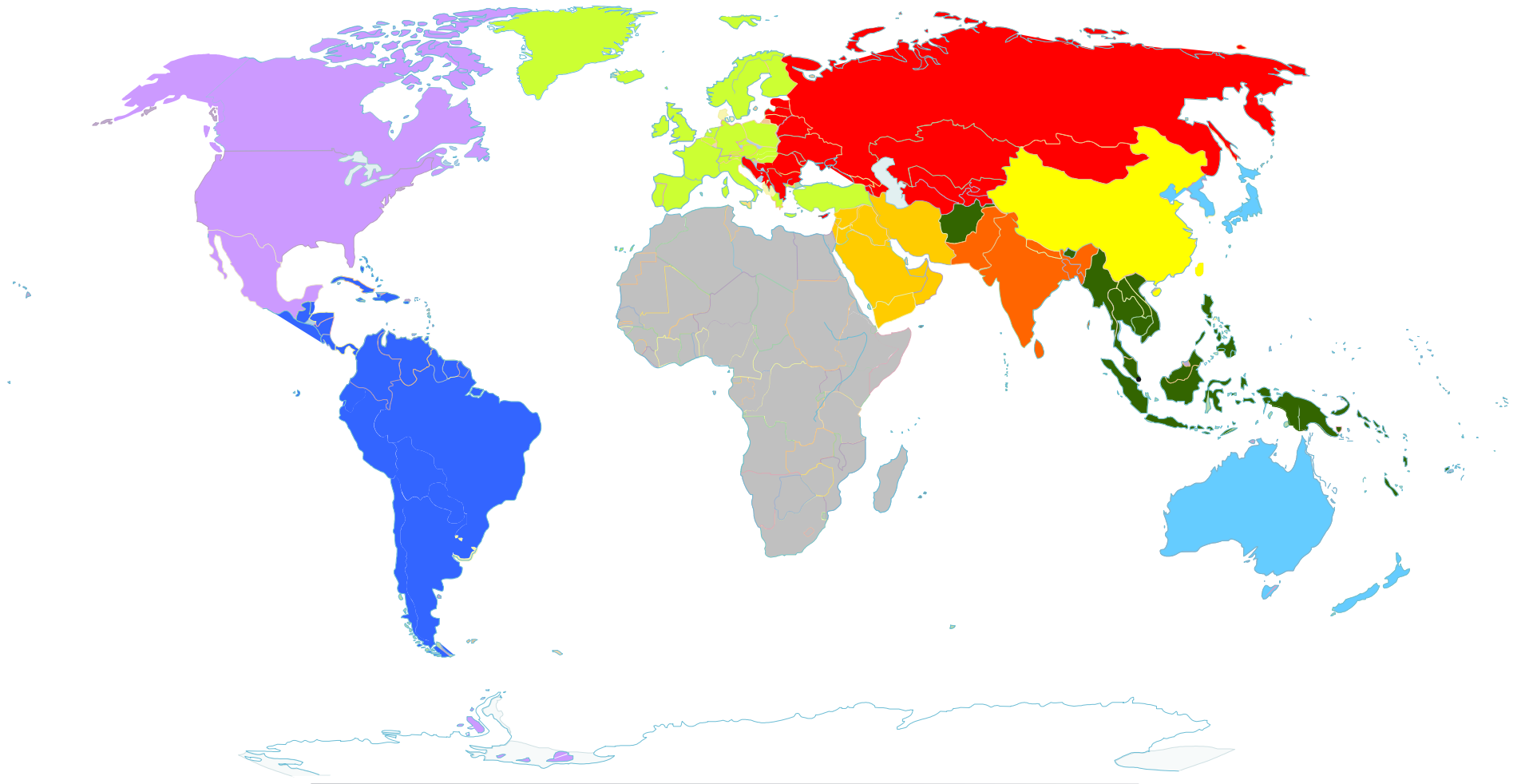


a sustainable world energy outlook: the energy [r]evolution scenario

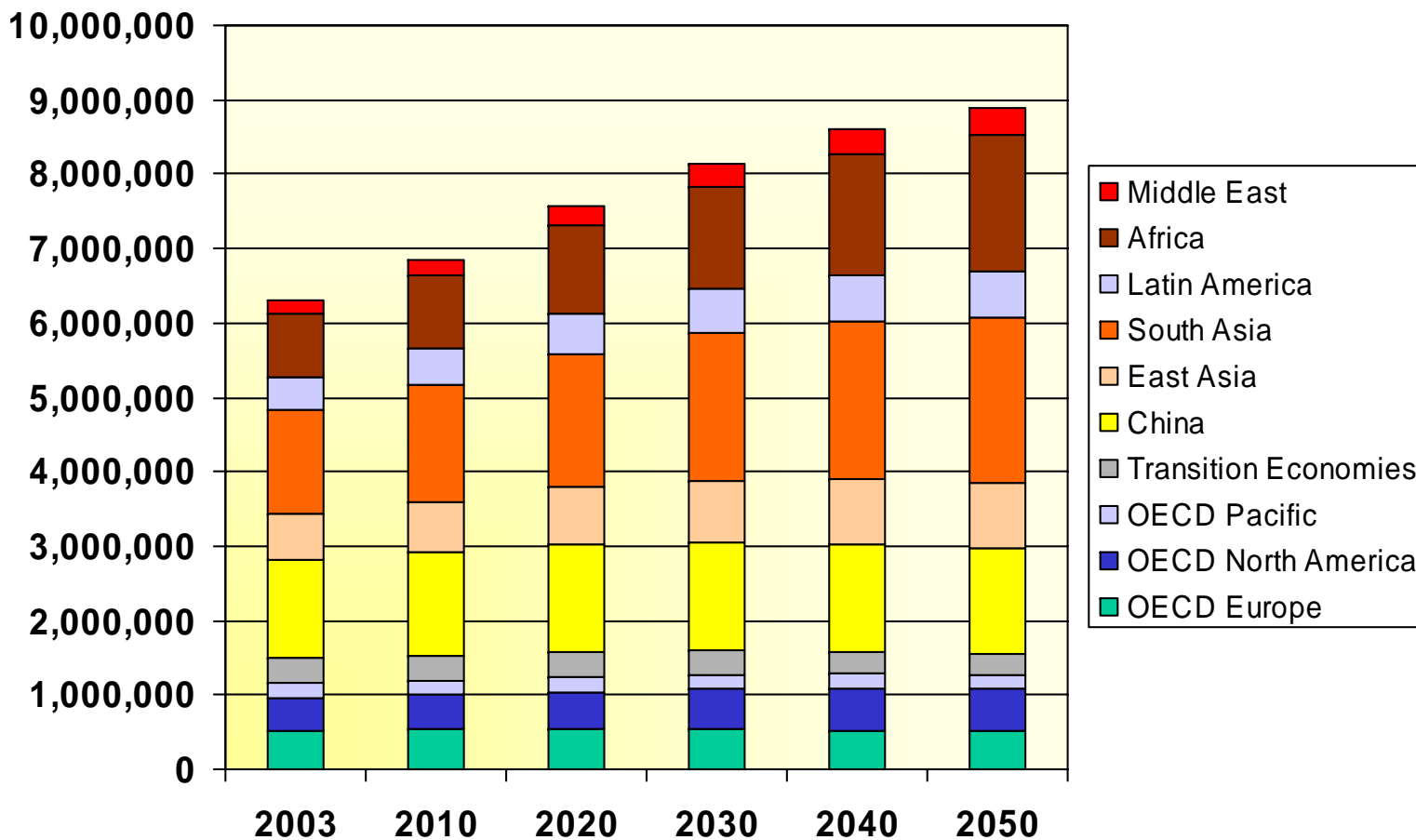
key targets:

- climate change: limit global mean temperature rise to less than 2° C**
- phasing out of nuclear energy on a global level**
- incentives for sustainable economic development**

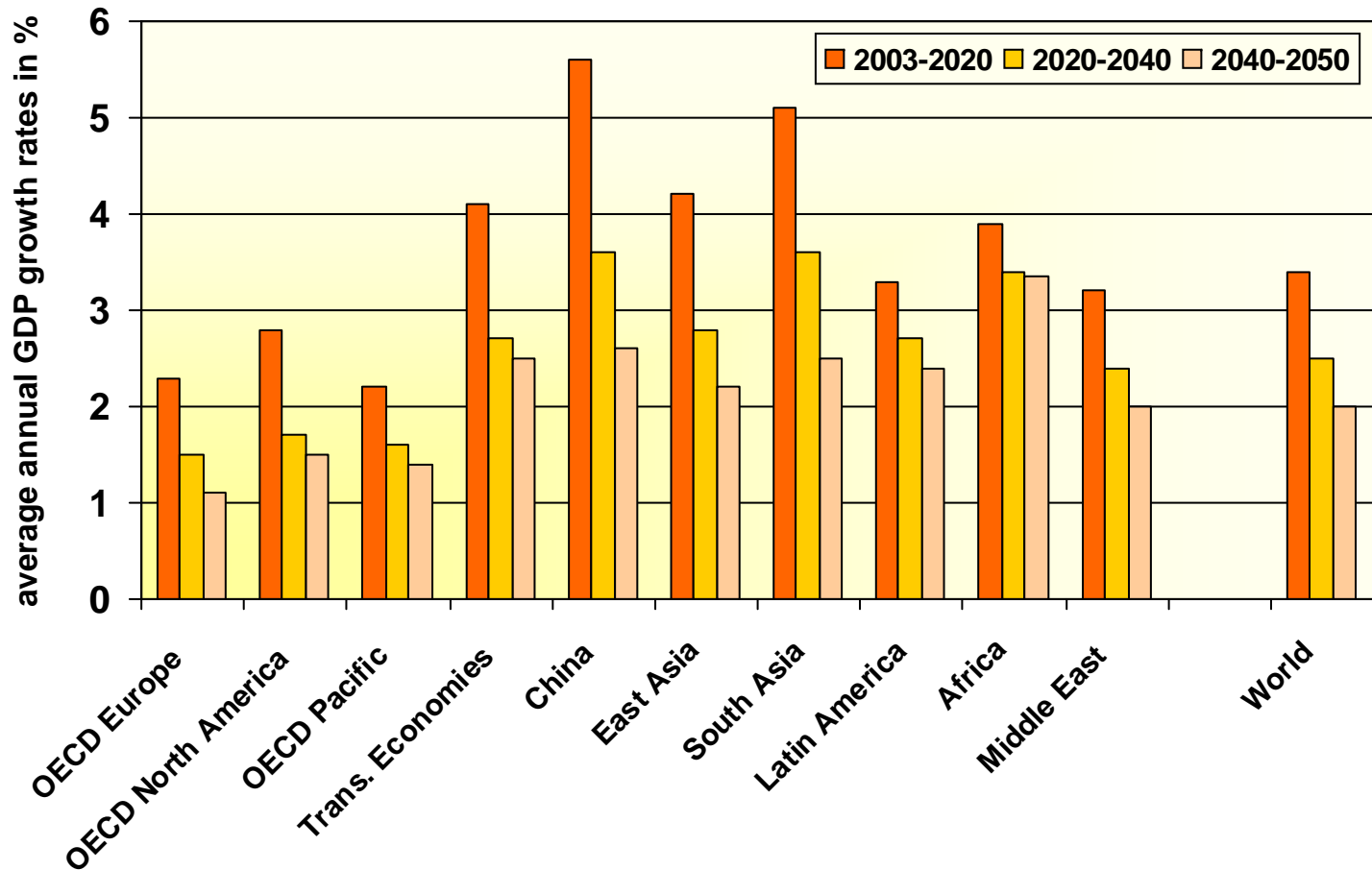
10 world regions



population development

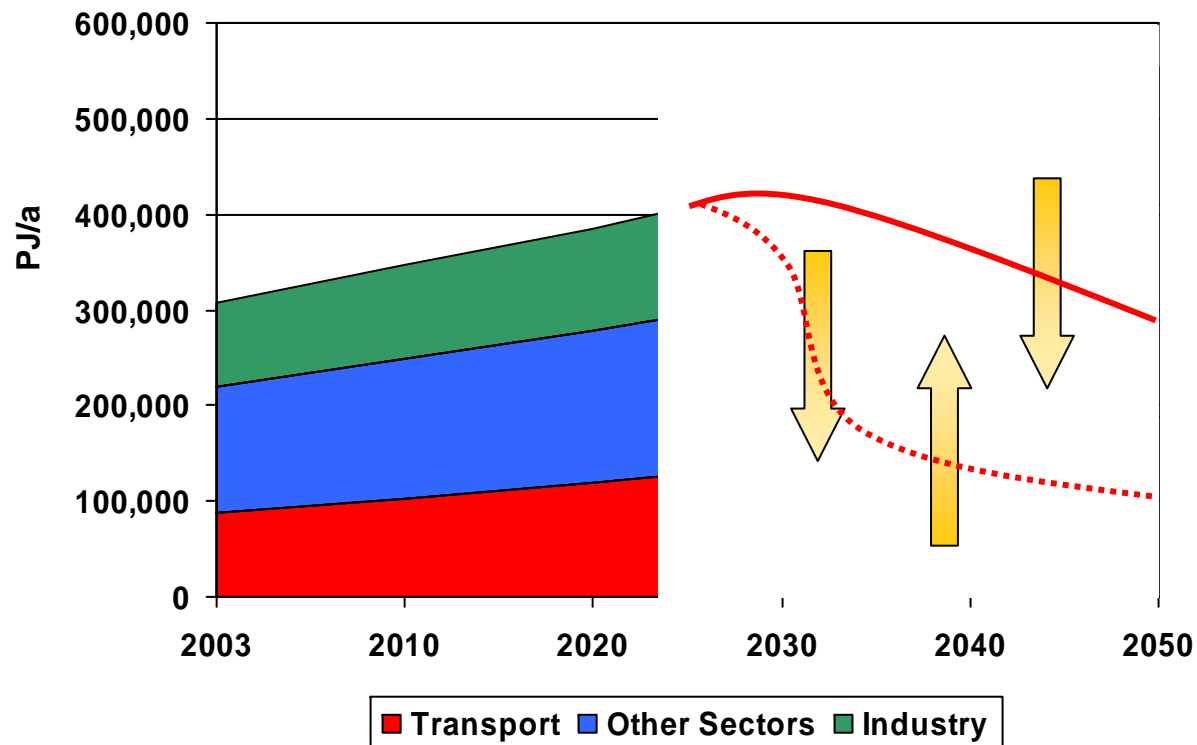


GDP development projection

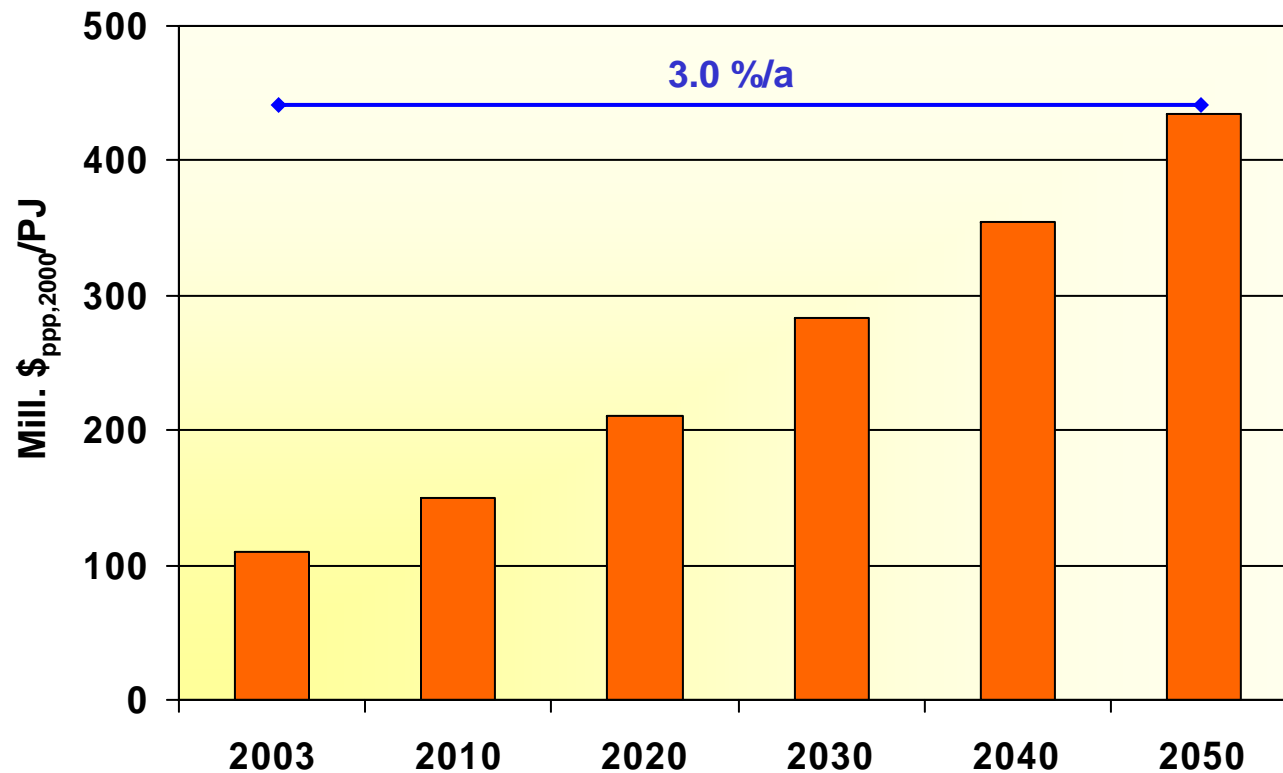


development of global final energy demand

'Business as Usual' – extrapolation based on IEA-WEO 2004 Reference Scenario

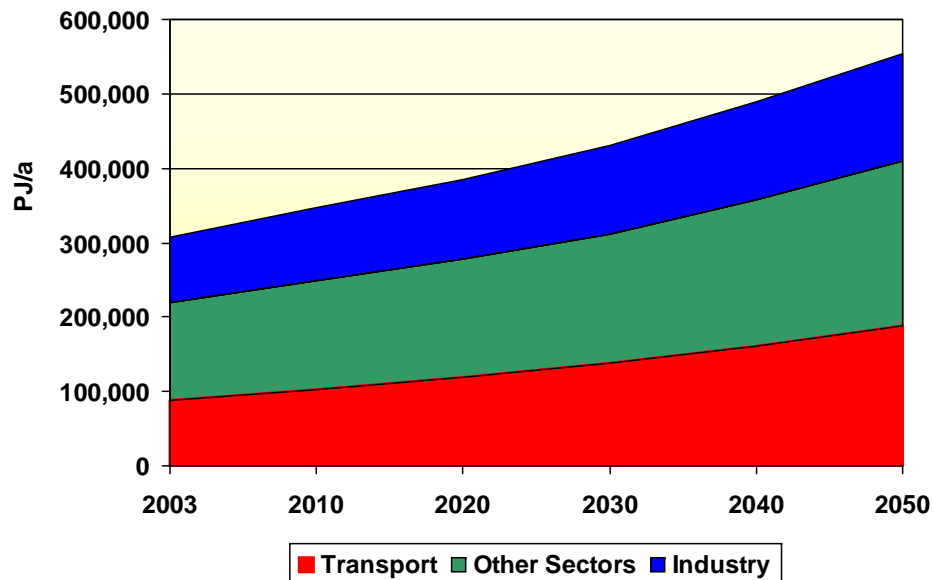


increase in global energy productivity by factor 4

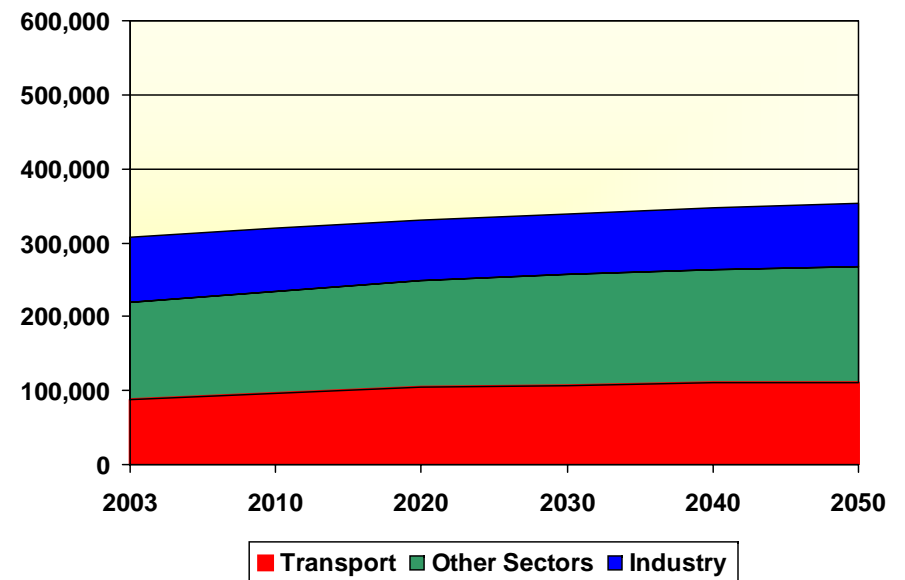


global final energy demand by sector

Reference Scenario

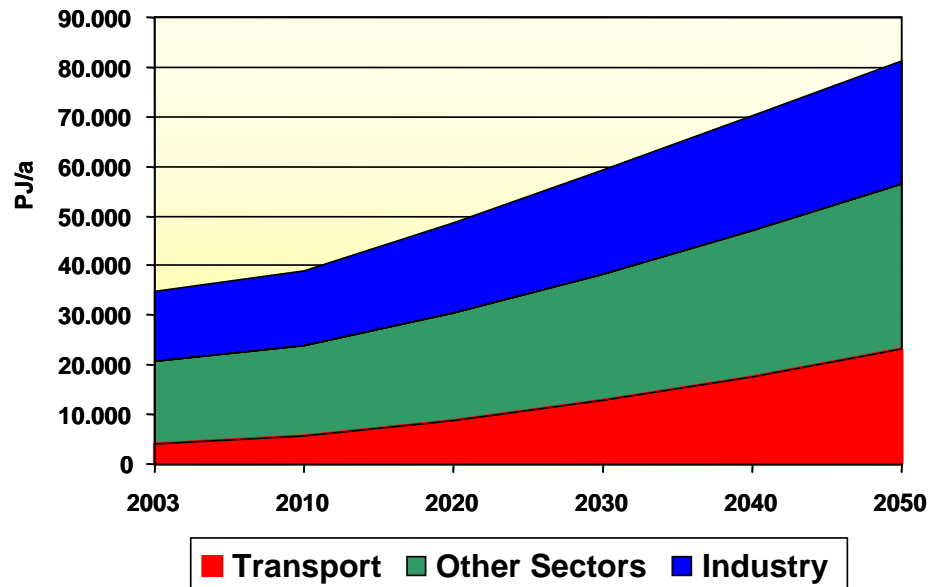


energy [r]evolution Scenario

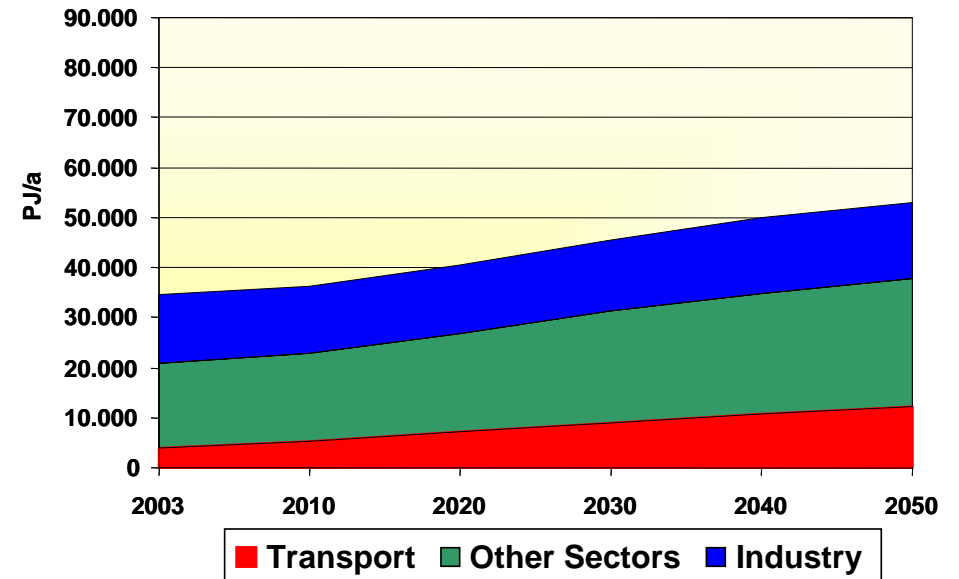


final energy demand: China

Reference Scenario

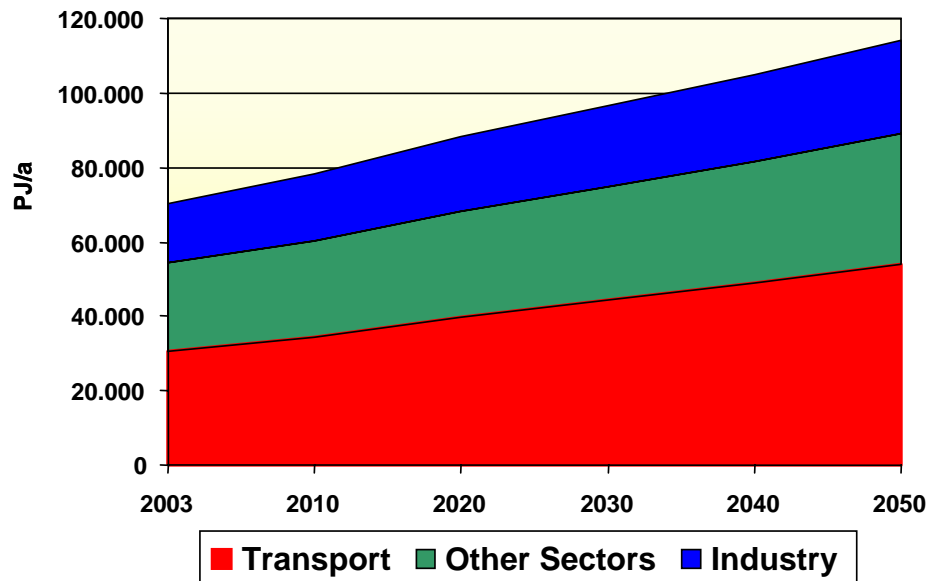


energy [r]evolution Scenario

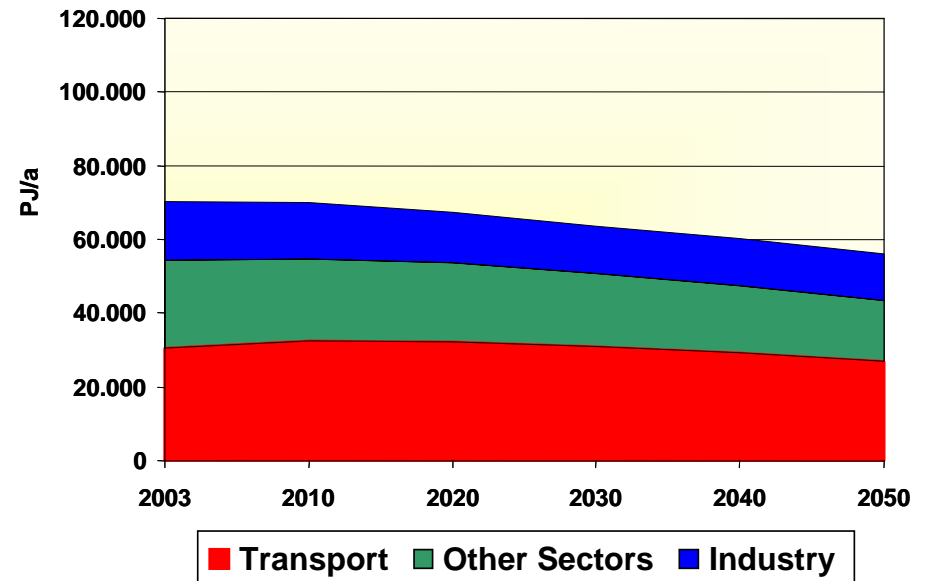


final energy demand: OECD North America

Reference Scenario



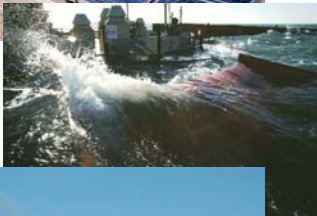
energy [r]evolution Scenario



a broad range of renewable energy technology options is available



PV – boosting global markets, high innovation potential



Ocean energy – variety of successful demo projects in place, huge potentials



Concentrating solar thermal power – new incentives triggered market in Spain, base load RES electricity



Solar heating – high solar shares achievable with district heating networks & seasonal storage



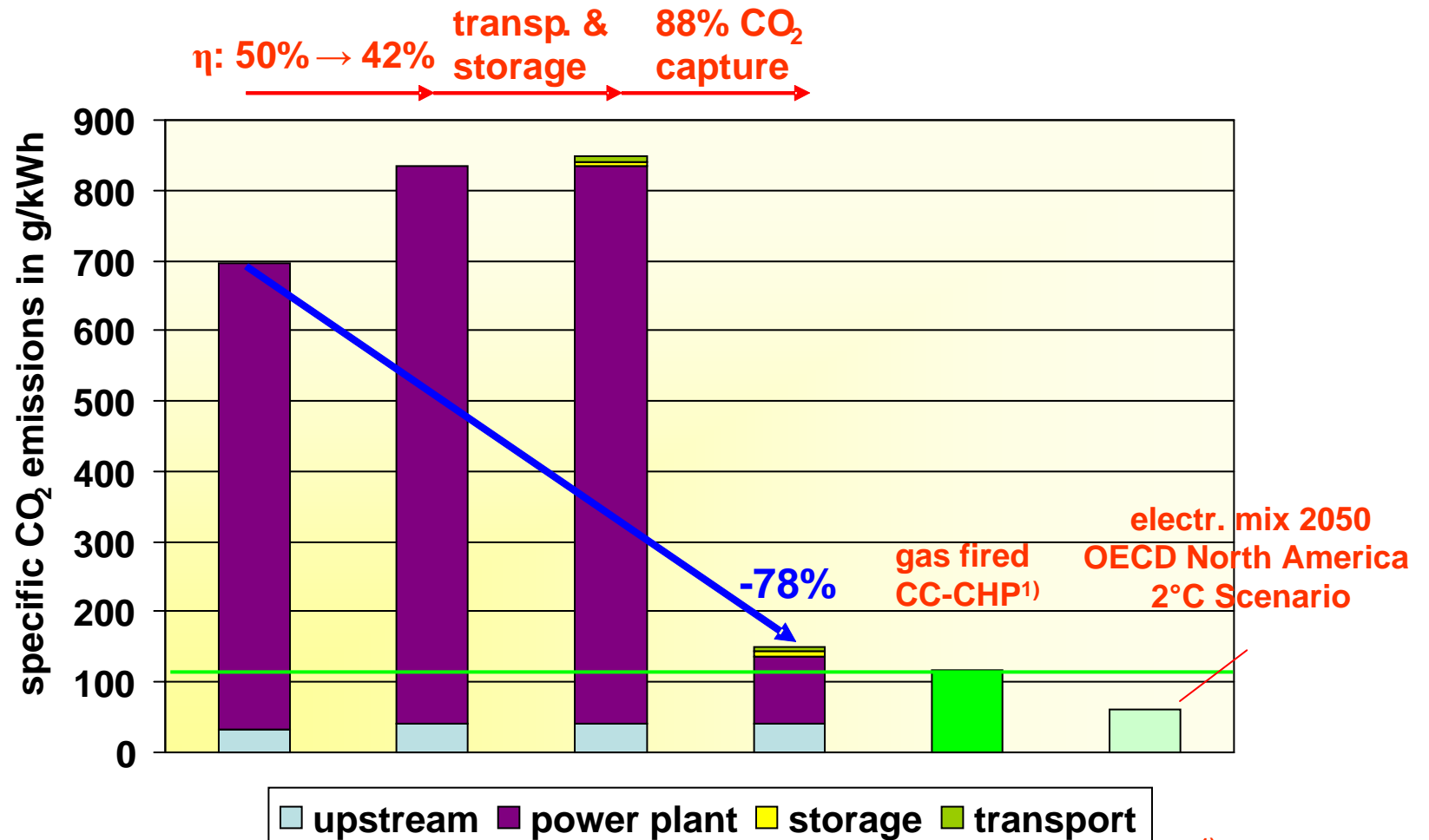
Off-shore wind – large scale commercialisation about to start



Biomass – efficient combined heat and power production

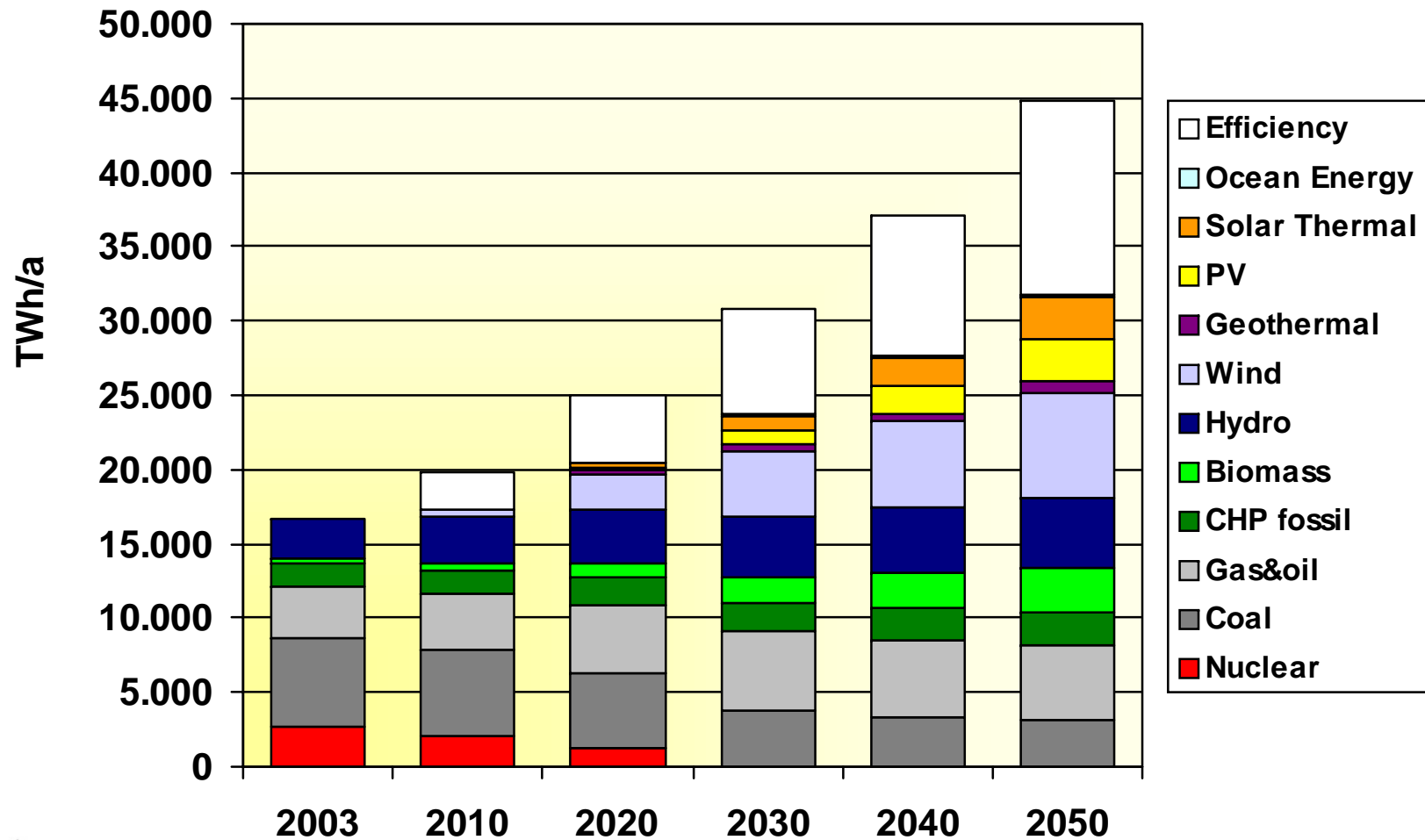
potential of CO₂ reduction by CCS technologies

(example: coal IGCC)

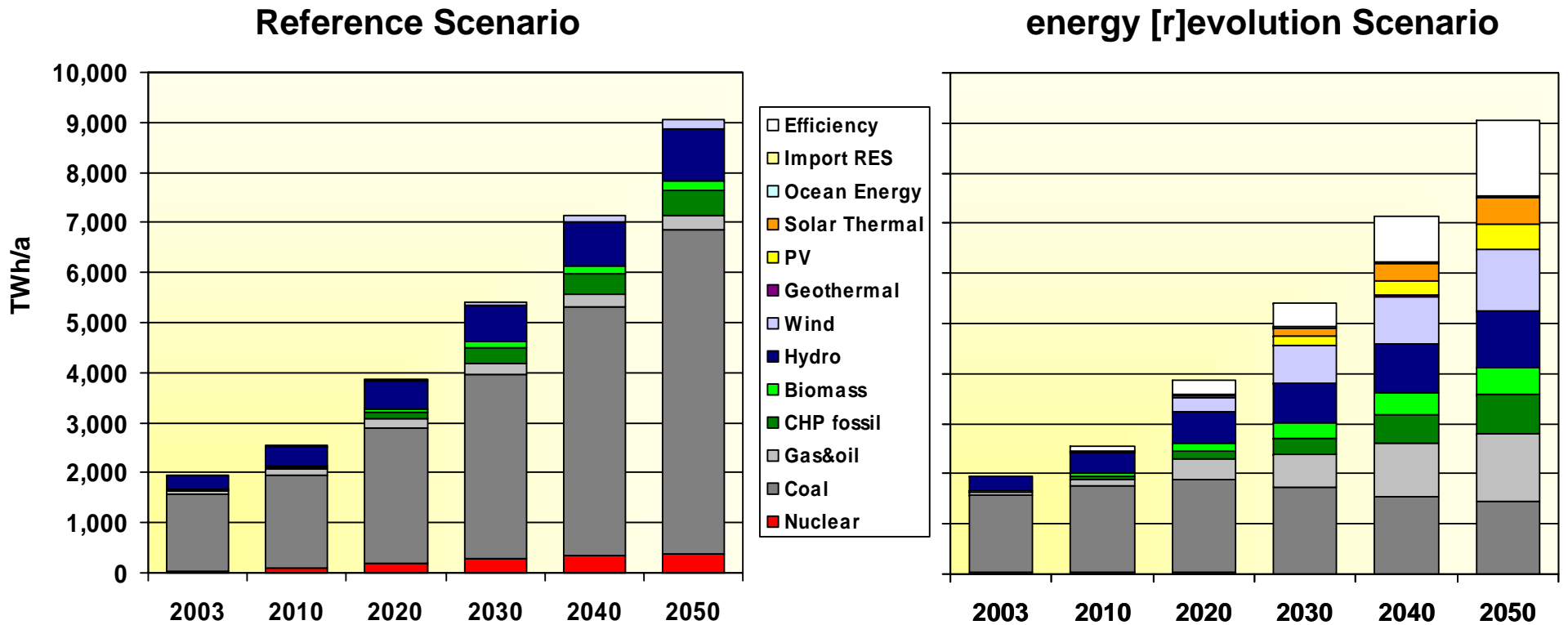


¹⁾ with heat credit

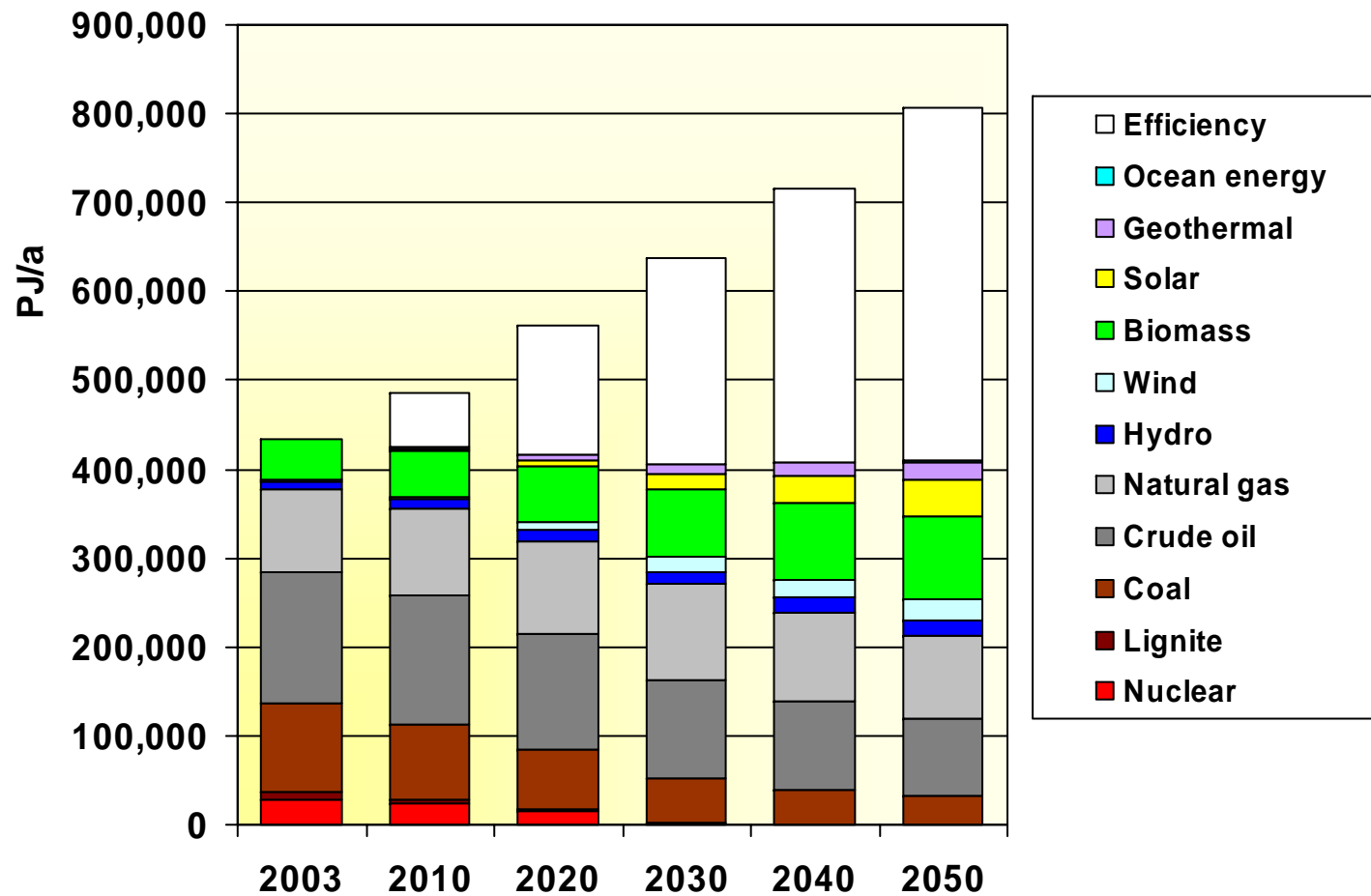
global electricity supply – 2° Scenario



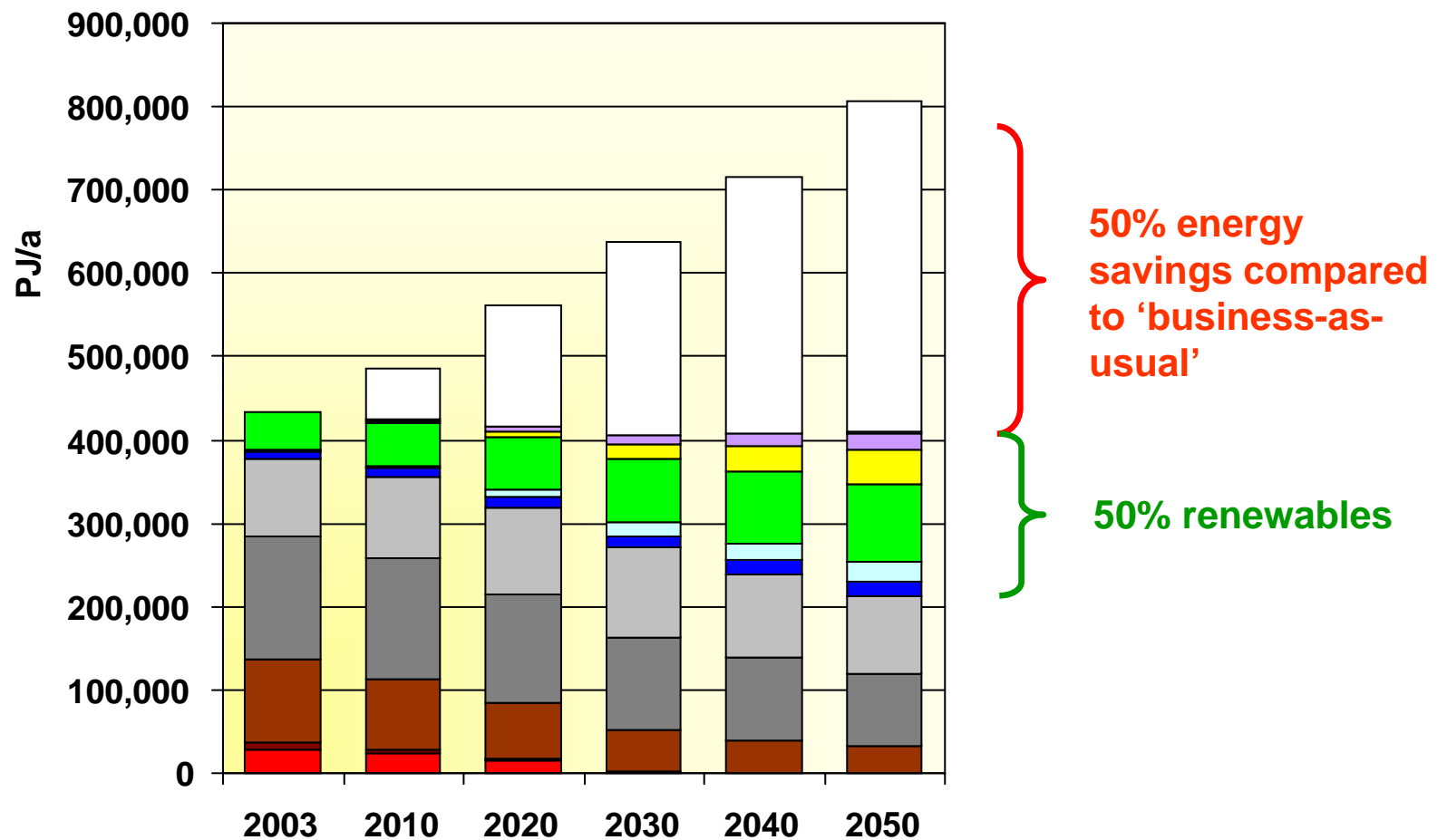
future electricity supply structure - China



global primary energy demand

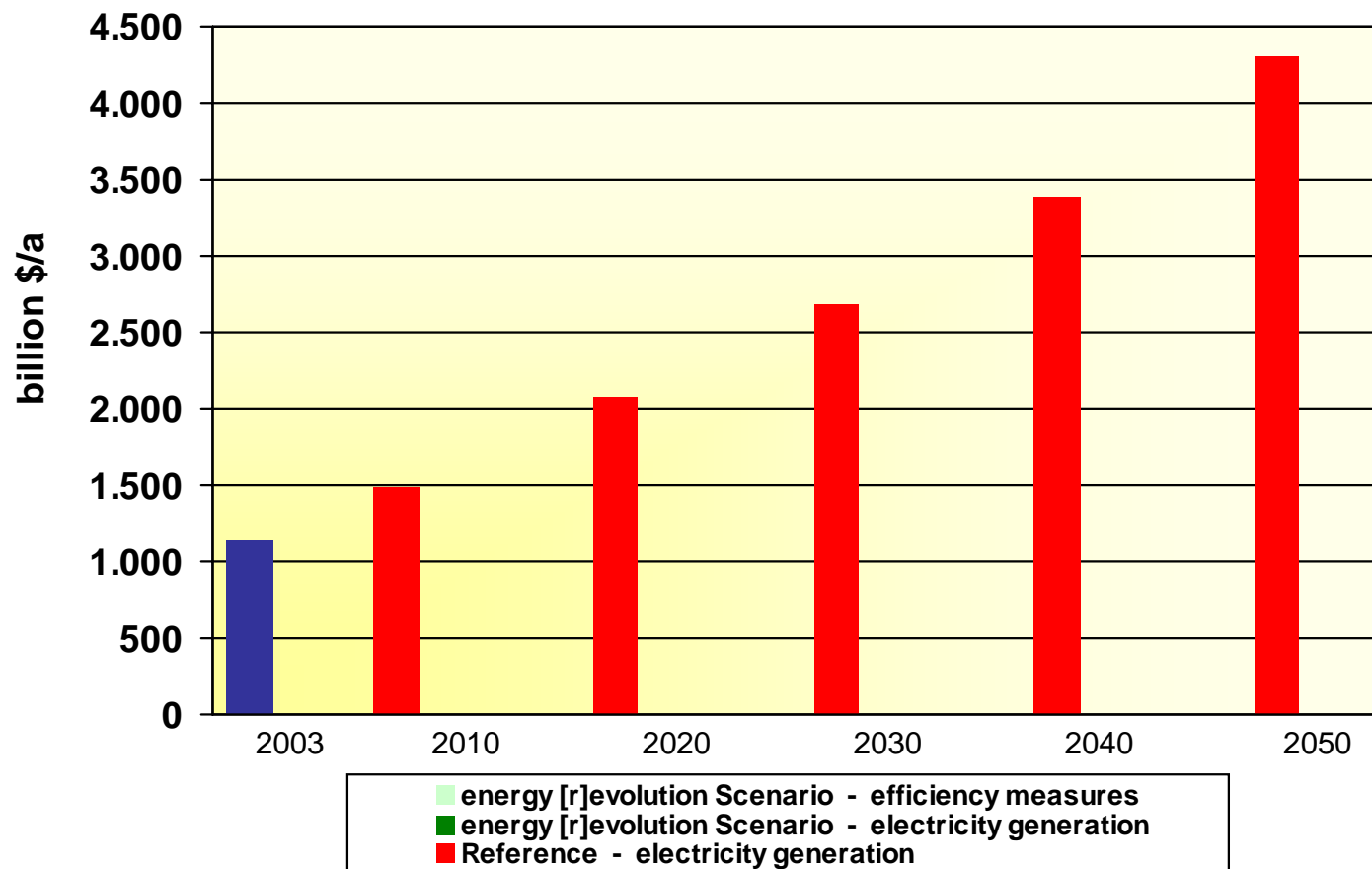


global primary energy demand



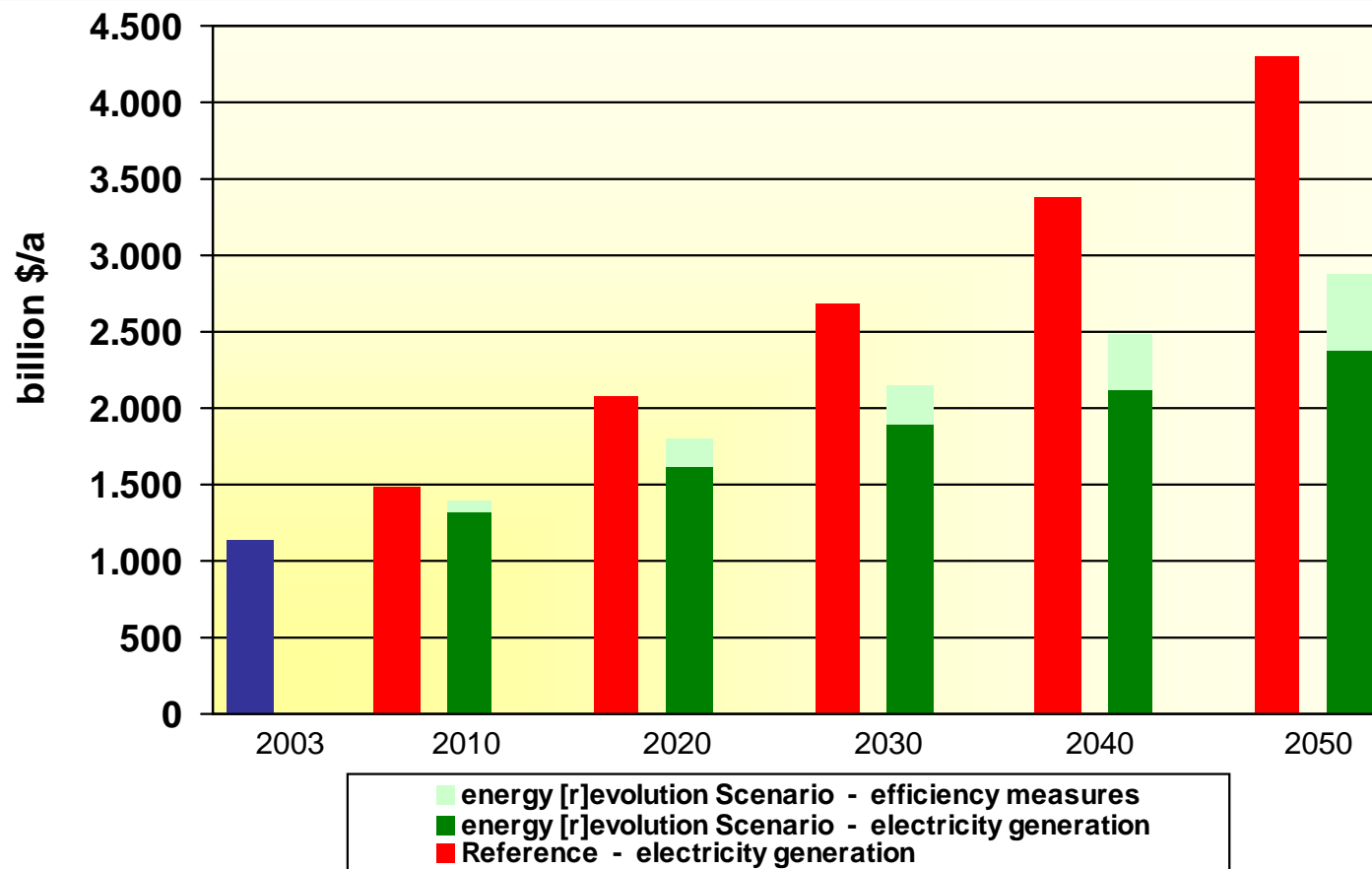
costs of global electricity supply

crude oil \$ ₂₀₀₀ /bbl	62	75	85	93	100
CO ₂ \$/t	10	20	30	40	50

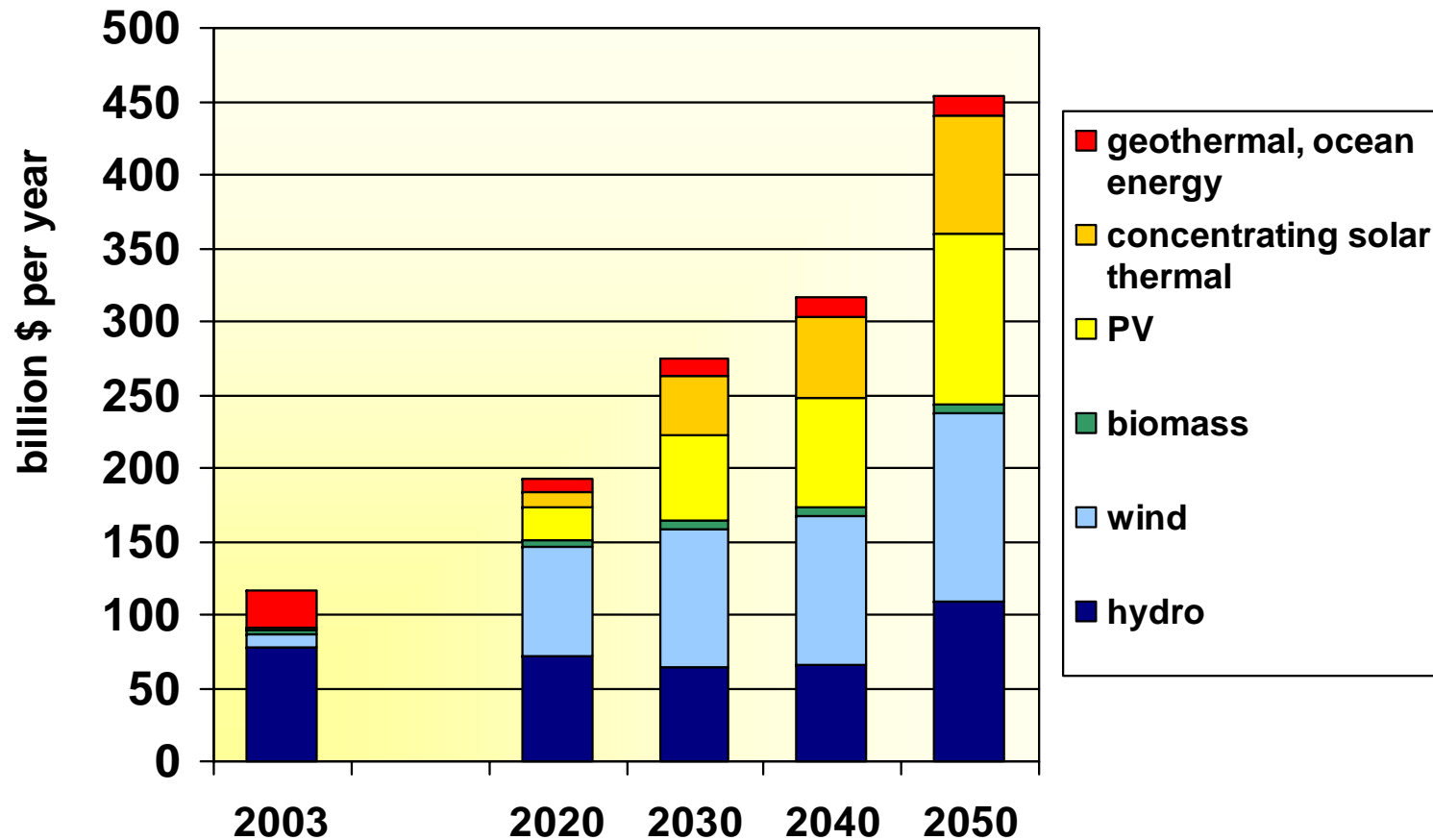


costs of global electricity supply

crude oil \$ ₂₀₀₀ /bbl	62	75	85	93	100
CO ₂ \$/t	10	20	30	40	50



global investment in renewable electricity technologies – energy [r]evolution scenario





Discussion

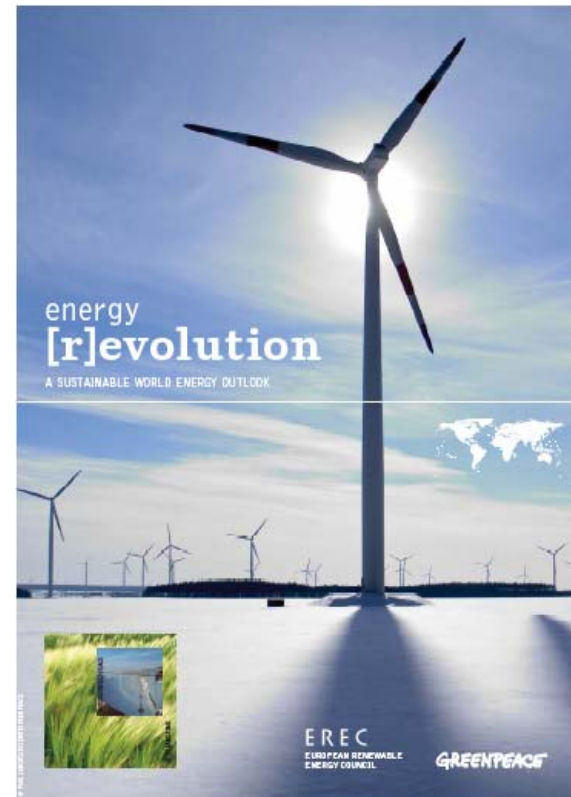
- **achieving the 2°C target is technically feasible**
- **societal and structural innovation is required to facilitate the transformation process**
- **exploitation of energy efficiency potentials is a huge challenge**
- **adaptation of energy supply infrastructure**
- **investment in renewable energy technologies offers industrial development options**
- **current 'real world'-trends deviate from 2°C-Scenario → strong policy action is required!**
- **use a target oriented scenario as a policy benchmark!**



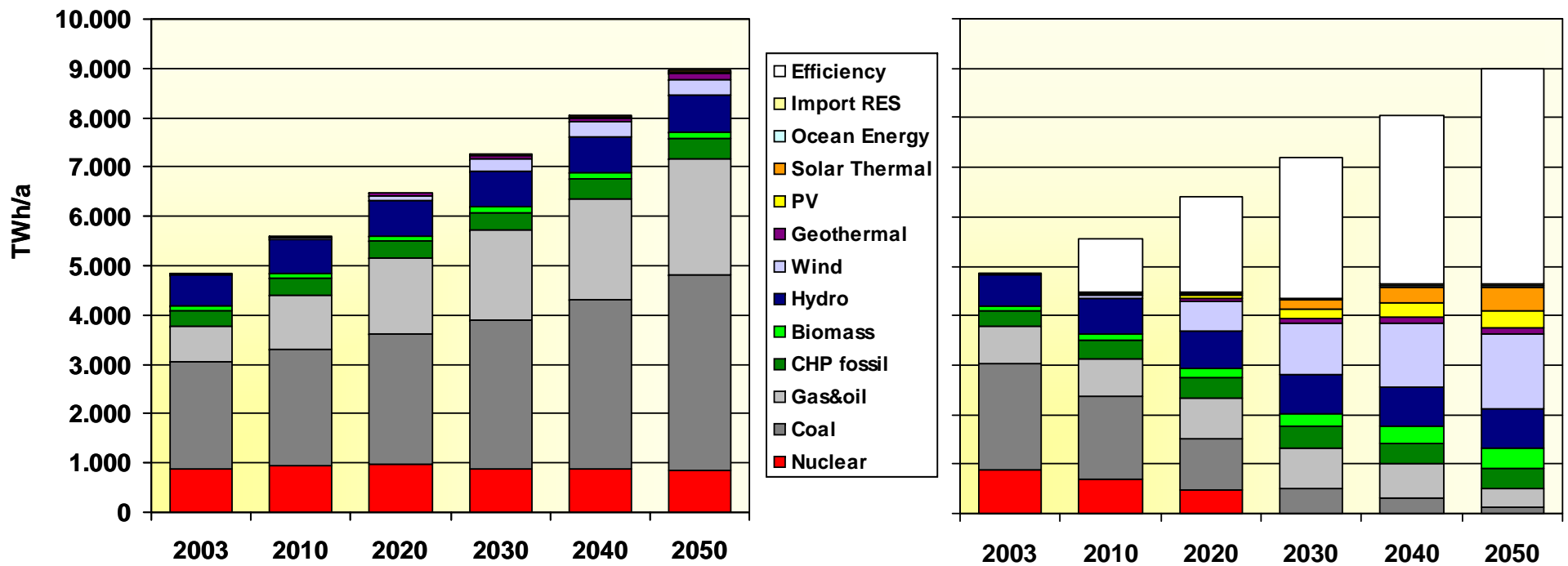
www.energyblueprint.info

www.dlr.de/tt/system

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electricity supply OECD North America



Energy savings per measure in 2050

