Business from technology

Risks and opportunities for renewable energy caused by climate change

Future Climate and Renewable Energy

Oslo 31.5.-2.6.2010

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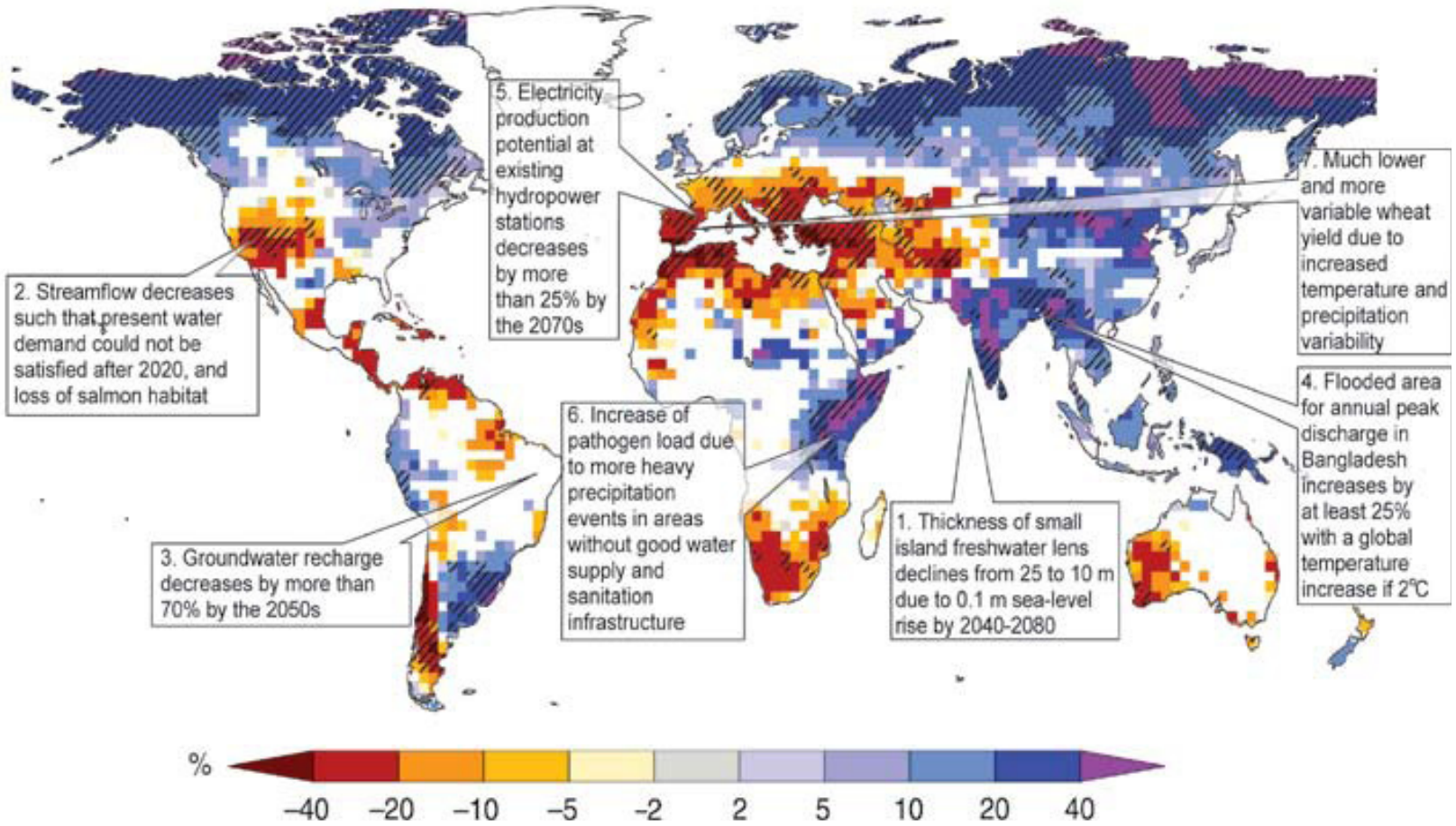
Risks due to climate change

Discussed quite widely in this conference

Changing frequences of extreme weather events (e.g. floods and draughts)
Long term changes in rainfall patterns (run-off, soil humidity)

Risks concerning decision making (policy risks)



Illustrative map of future climate change impacts related to freshwater which threaten the sustainable development of the affected regions. Ensemble mean change in annual runoff (%) between present (1980–1999) and 2090–2099 for the SRES A1B emissions scenario. Areas with blue (red) colours indicate the increase (decrease) of annual runoff. (Bates et al. 2008.)

Opportunities for renewables

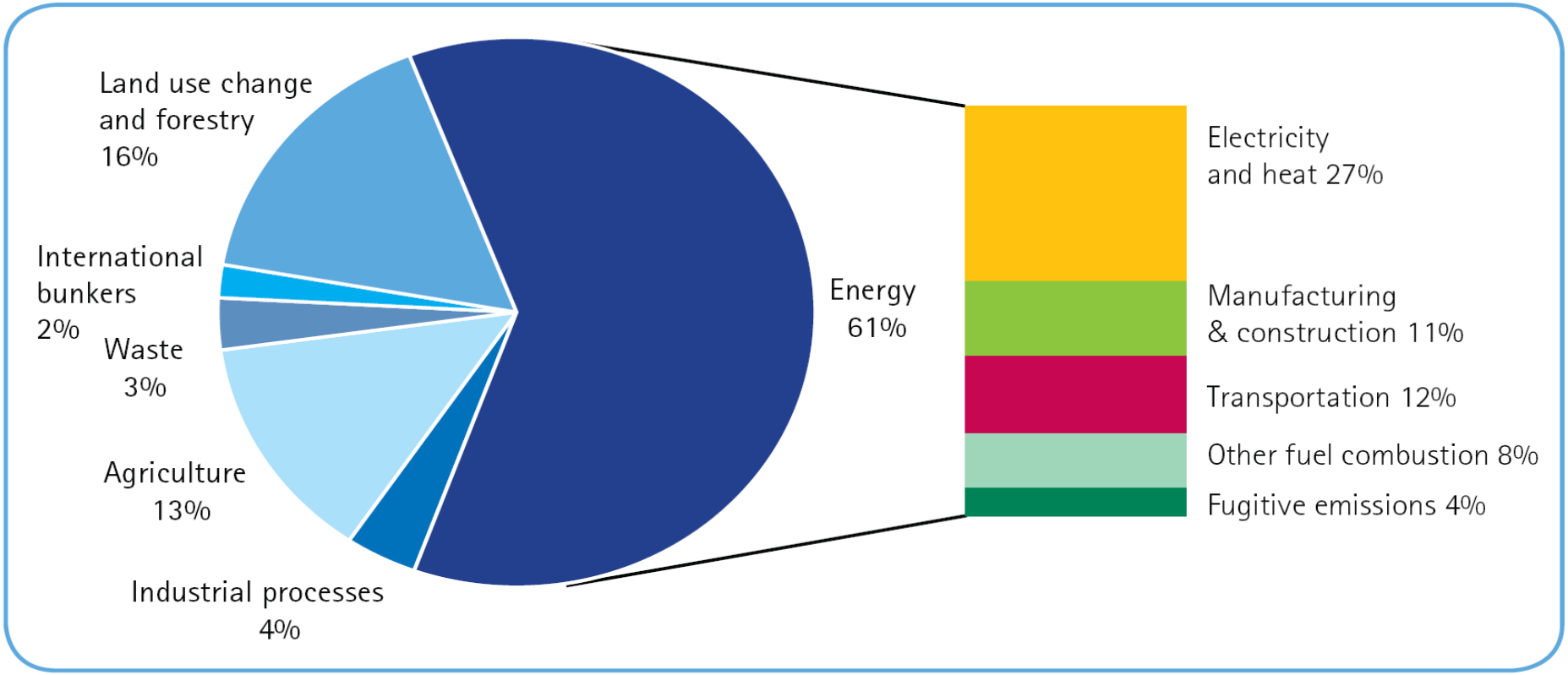
Energy efficiency improvement and renewables are most important alternatives for the reductions of greenhouse gas emissions

Other alternatives

- Carbon capture and storage (CCS)
- Nuclear power
- Increase of biospheric carbon sinks
- Emission reduction concerning other sectors (waste, agriculture, industry) and other gases

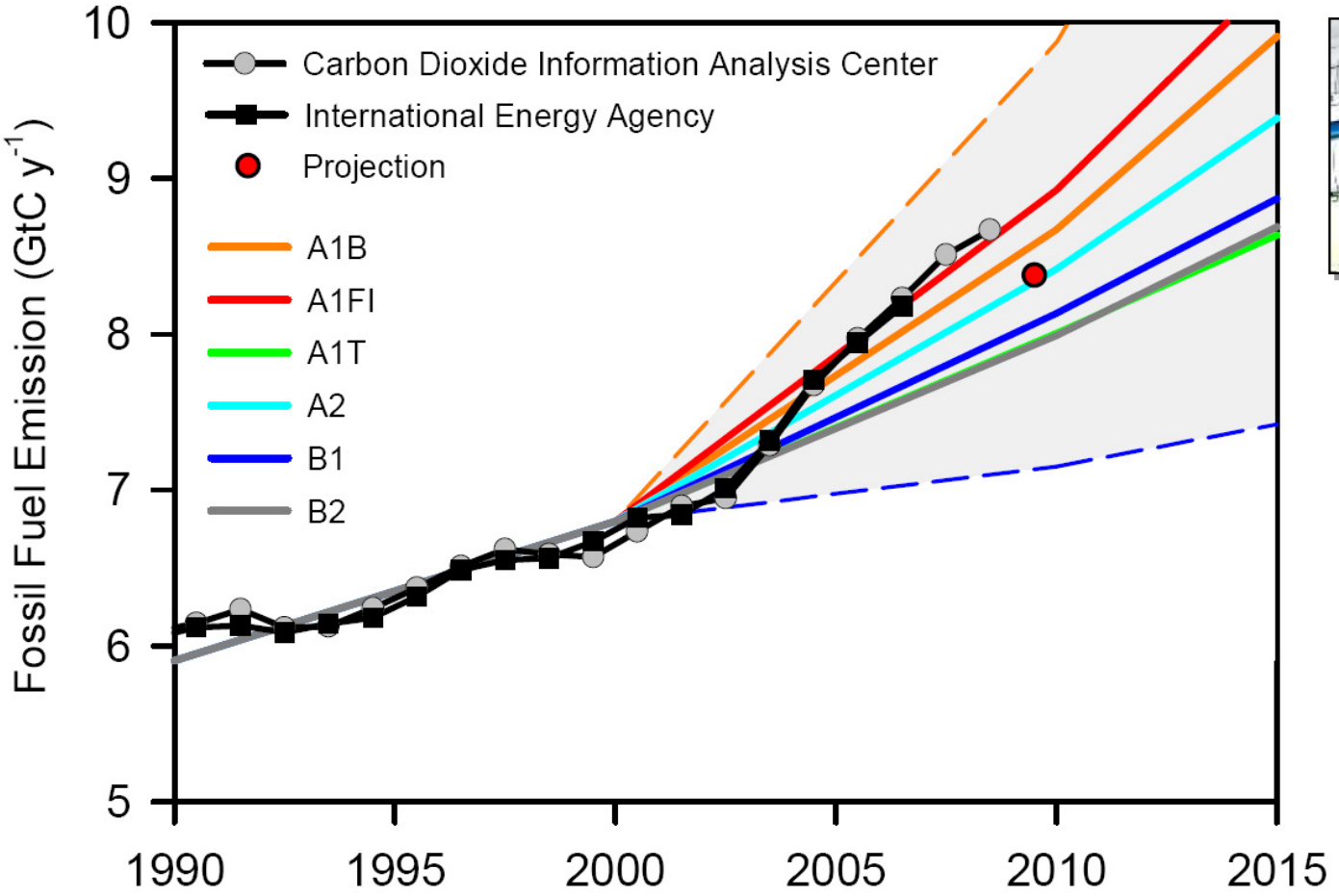
A wide spectrum of measures needed in order to reach deep enough emission reductions

Global greenhouse gas emissions by sectors in 2005



The emissions sum up to approximately 46,000 $MtCO_2eq$.
*Data source: CAIT, cait.wri.org. *) The estimated effect of land use change & forestry, 8,000 $MtCO_2$, is for the year 2000.*

Fossil Fuel Emissions: Actual vs. IPCC Scenarios



Projection **2009**
Emissions: -2.8%
GDP: -1.1%
C intensity: -1.7%

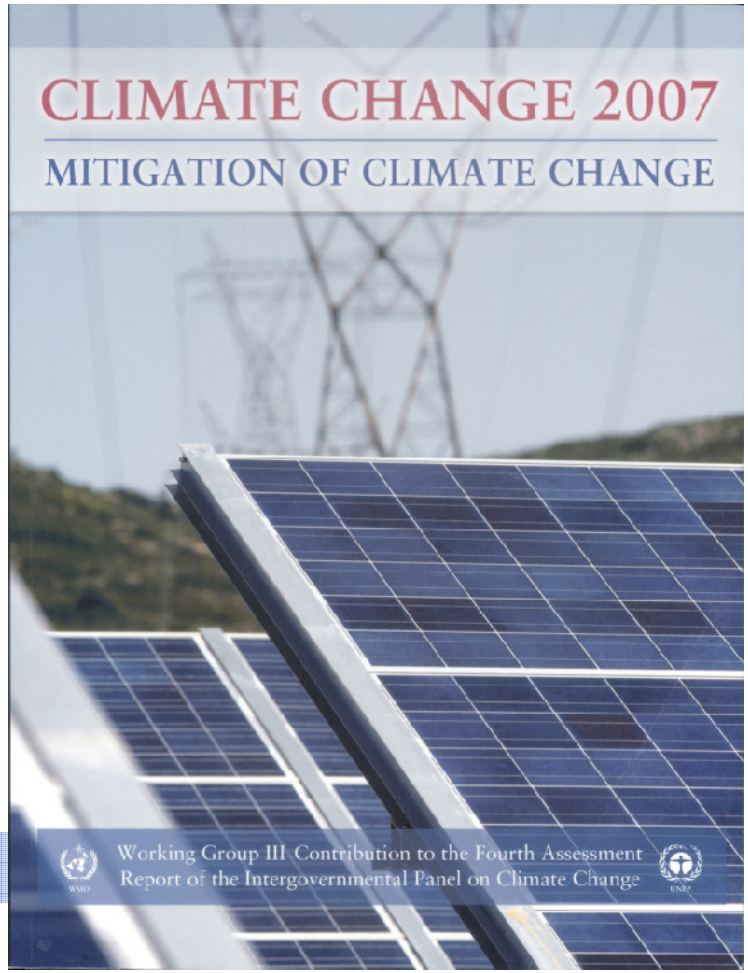
Raupach et al 2007; Le Quere et al. 2009

IPCC report (2007)

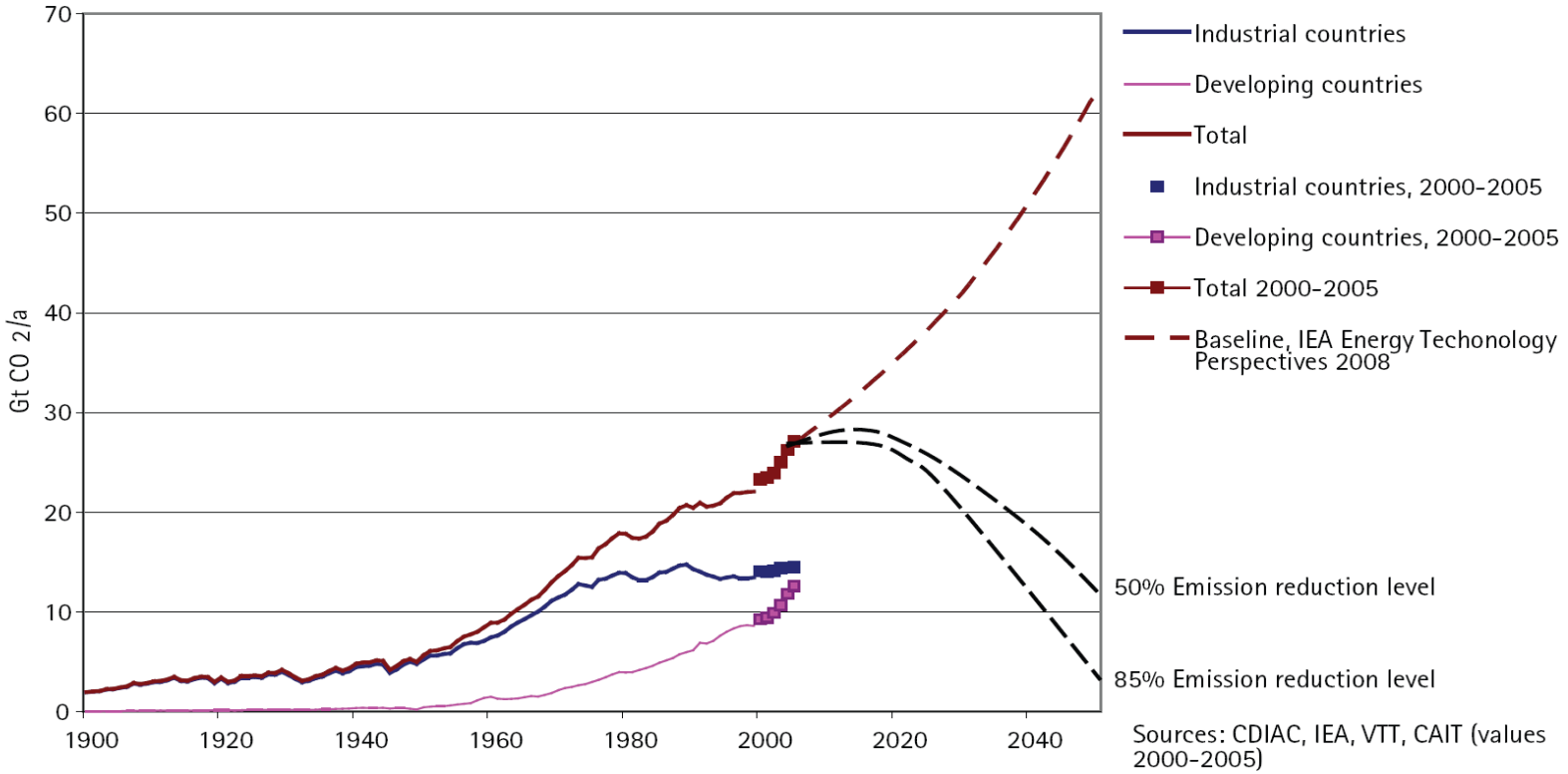
If the objective is to limit the temperature rise to 2ºC

- Global emissions should peak within ten years,
- Global emissions should be 50-85% lower than 2000 by 2050,
- Emissions from the developed countries should be 25-40% lower by 2020, 80-95% lower by 2050.

www.ipcc.ch

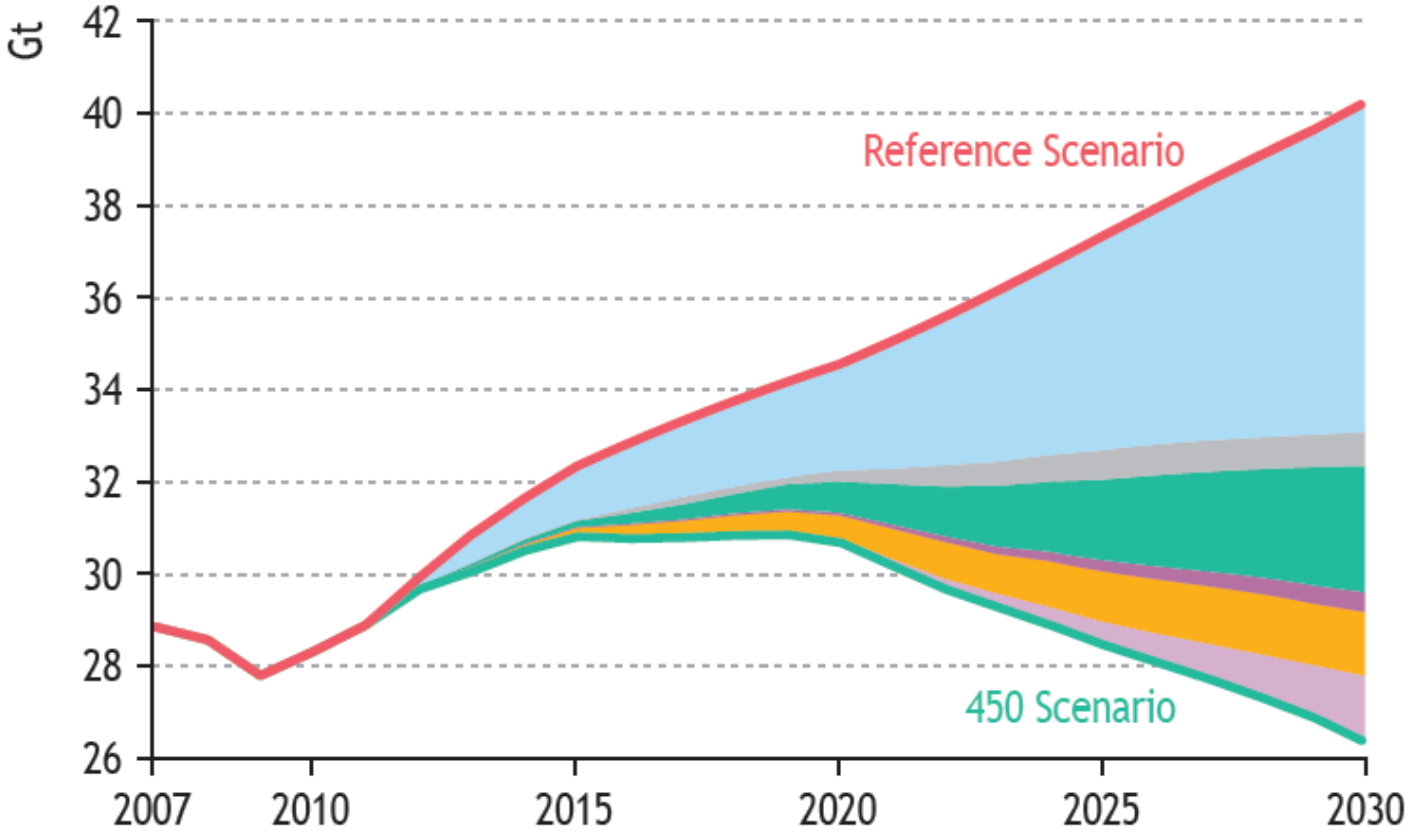


CO_2 emission from fossil energy use



Emission reduction scenarios for limiting the emission by 50% and by 85% corresponding the overlimit emissions and underlimit emission for a temperature rise level of 2 C.

Figure 5.8 • World energy-related CO_2 emission savings by policy measure in the 450 Scenario



	Abatement ($Mt CO_2$) 2020	2030
Efficiency	2 517	7 880
End-use	2 284	7 145
Power plants	233	735
Renewables	680	2 741
Biofuels	57	429
Nuclear	493	1 380
CCS	102	1 410

WEO 2009

IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN)

1) Introduction (Renewable energy and climate change) (5% share of the whole report)
2) Bioenergy (15 %)
3) Direct solar energy (10 %)
4) Geothermal energy (5 %)
5) Hydro power (5 %)
6) Ocean energy (5 %)
7) Wind power (5 %)
8) Integration of renewable energy into energy systems (15 %)
9) Renewable energy in the context of sustainable development (10 %)
10) Mitigation potential and costs (10 %)
11) Policy, financing and implementation (15 %)

Way of work

Start of work in Jan 2009 (First meeting of authors)

Two commenting reviews for the draft report

Executive summary (of about 20 pages) will discussed and accepted by line by line procedure by government delegations early in 2011

Relative position within innovation chain

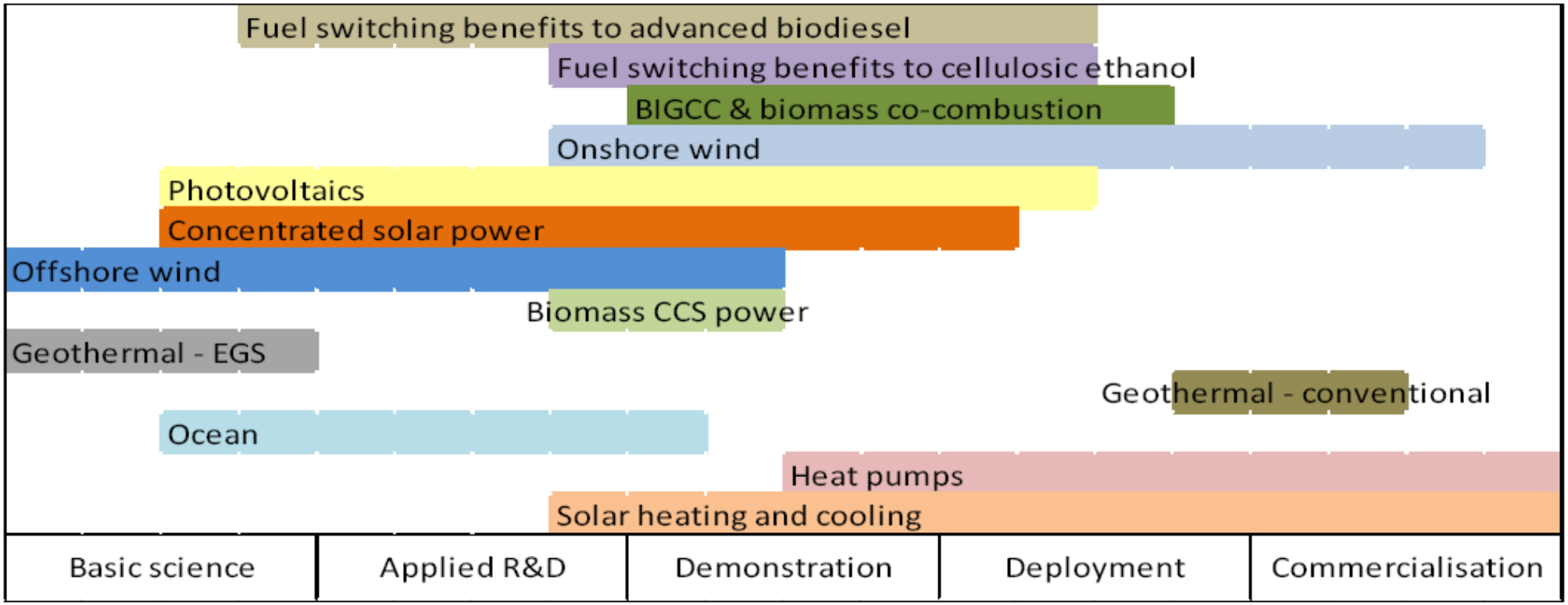
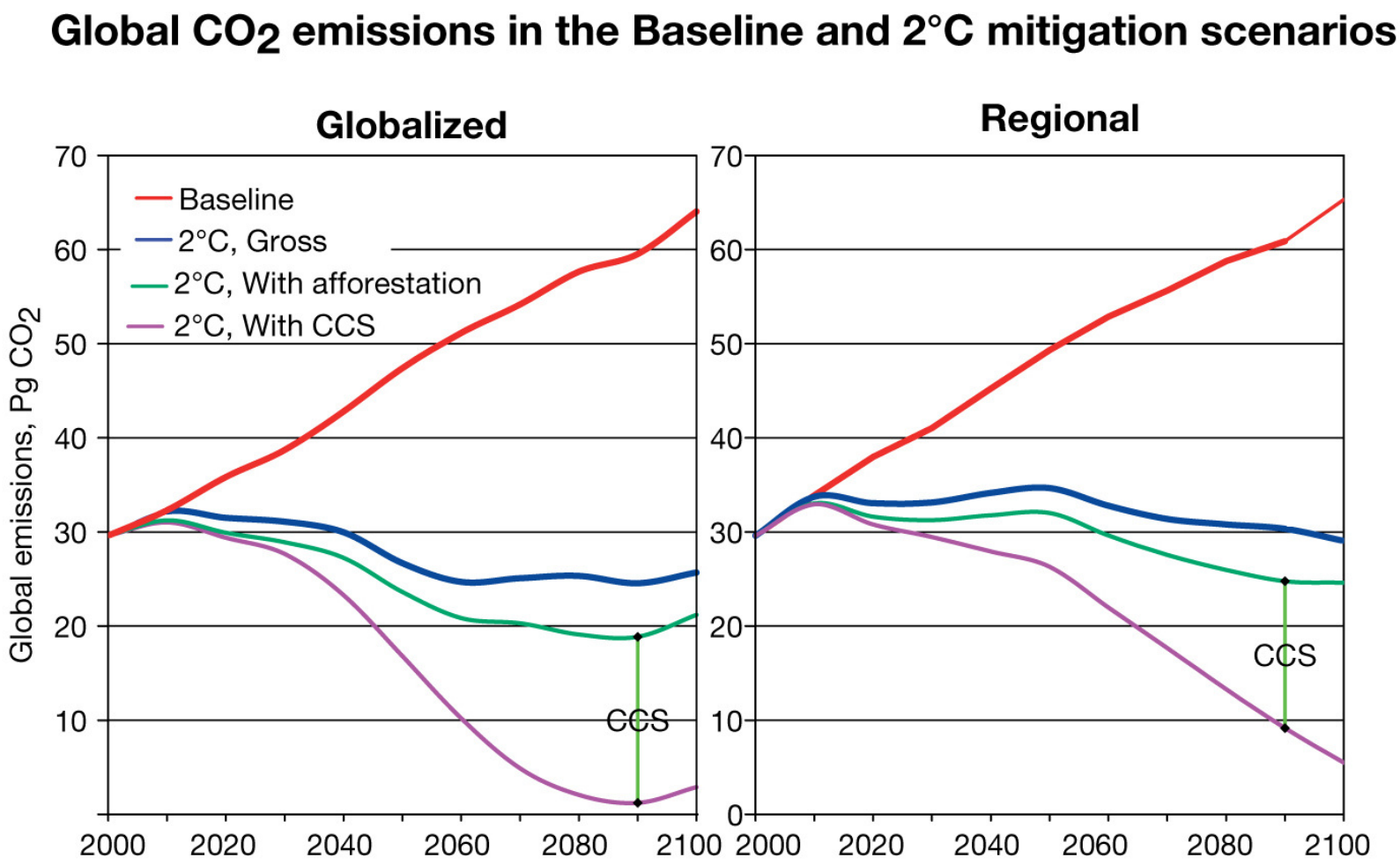
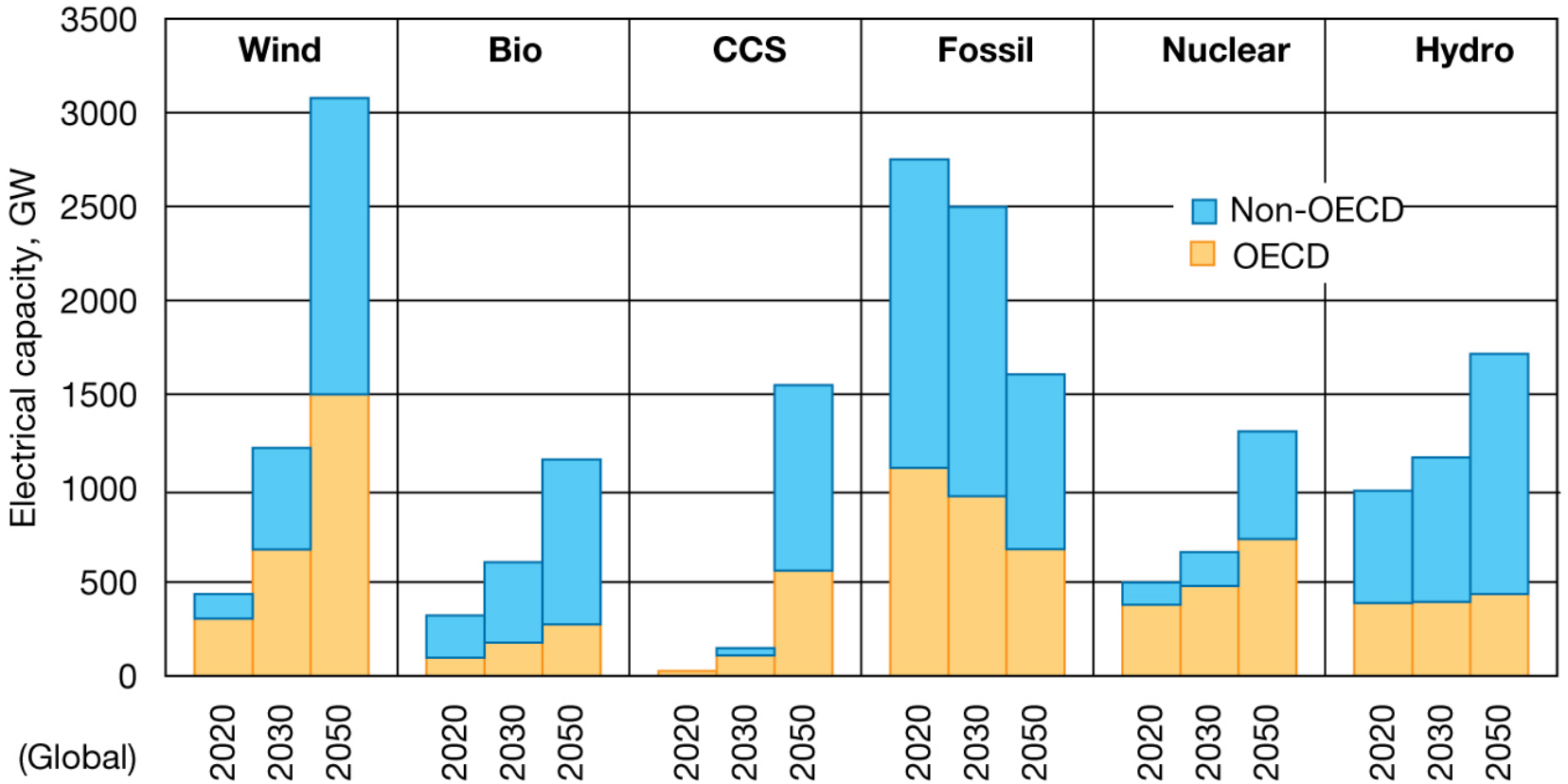


Figure 10.5.3: Relative position of various renewable energy technologies w
chain. (Source: IEA, 2008a, p. 181).

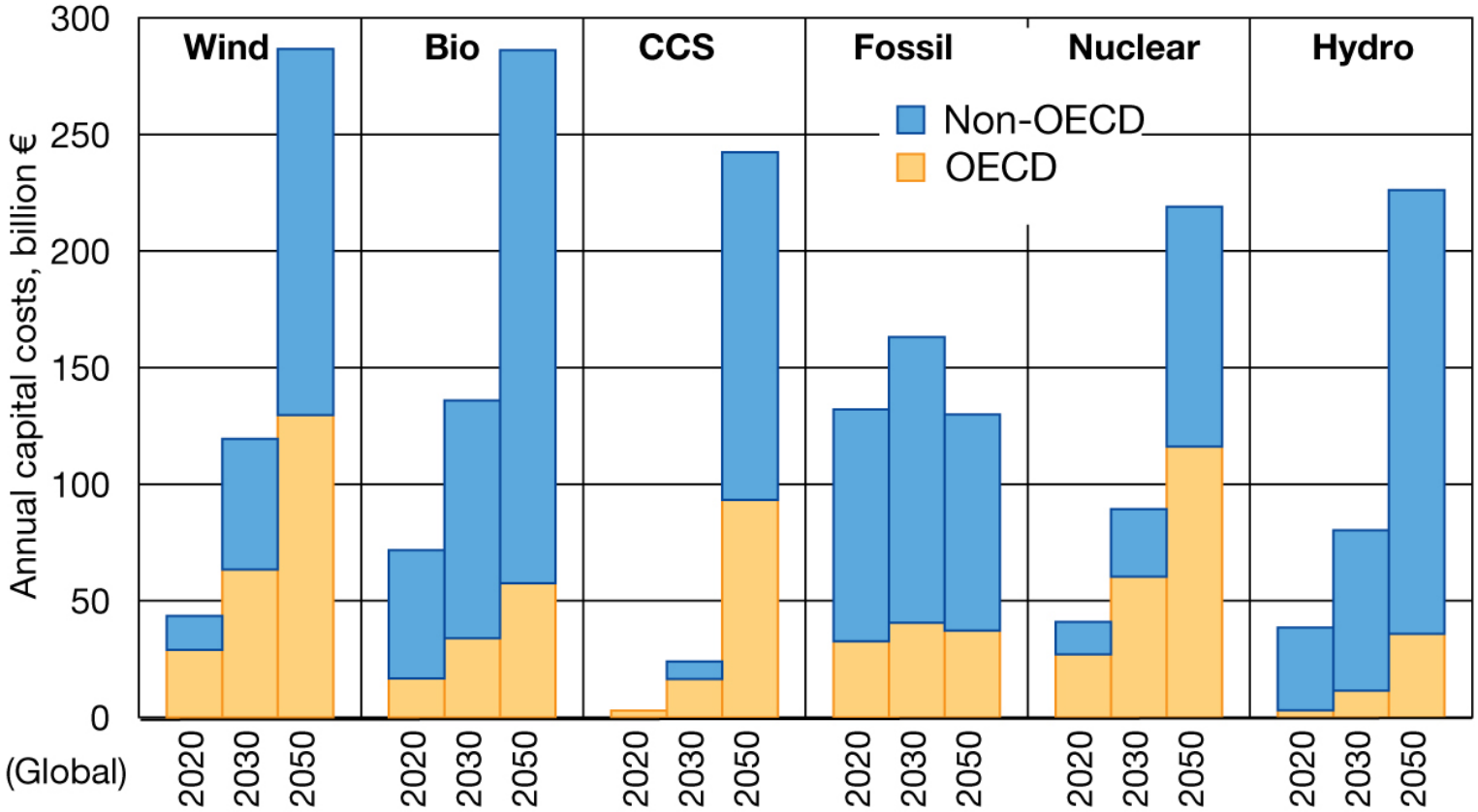
Book: Energy Vision 2050, VTT 2009



Total power generation capacities in 2020–2050 in the World, 2°C Market skenario



Annual capital expenditures on new power and heat generation capacity in the World in 2020–2050, 2°C Market scenario



Total investments needed by 2050 are huge

In addition to electricity generation,

large investment are needed in transmission capacity

heat generation capacity and

especially in energy efficiency (producing energy services with smaller amount of energy).

Globally, about 1.5 billion people are without modern energy services.

Renewables dominate in investments in EU

Investments in electricity generation capacity in EU in 2009

Wind energy	39%
Natural gas	26
Solar	16

Environmental and social concerns related to energy sources - all sources have some concerns in some cases

Fossil fuels

- Greenhouse gases, particulate emissions etc.
- Fluctuating oil and gas prices, security of supply

Nuclear

- Radioactive wastes, risk of proliferation and accidents

Bioenergy

- Land use changes with impacts on ghg emissions, water usage, food supply and biodiversity, particulate emissions

Hydro

- Harm to fish migration, loss of biodiversity, human population displacement

Wind

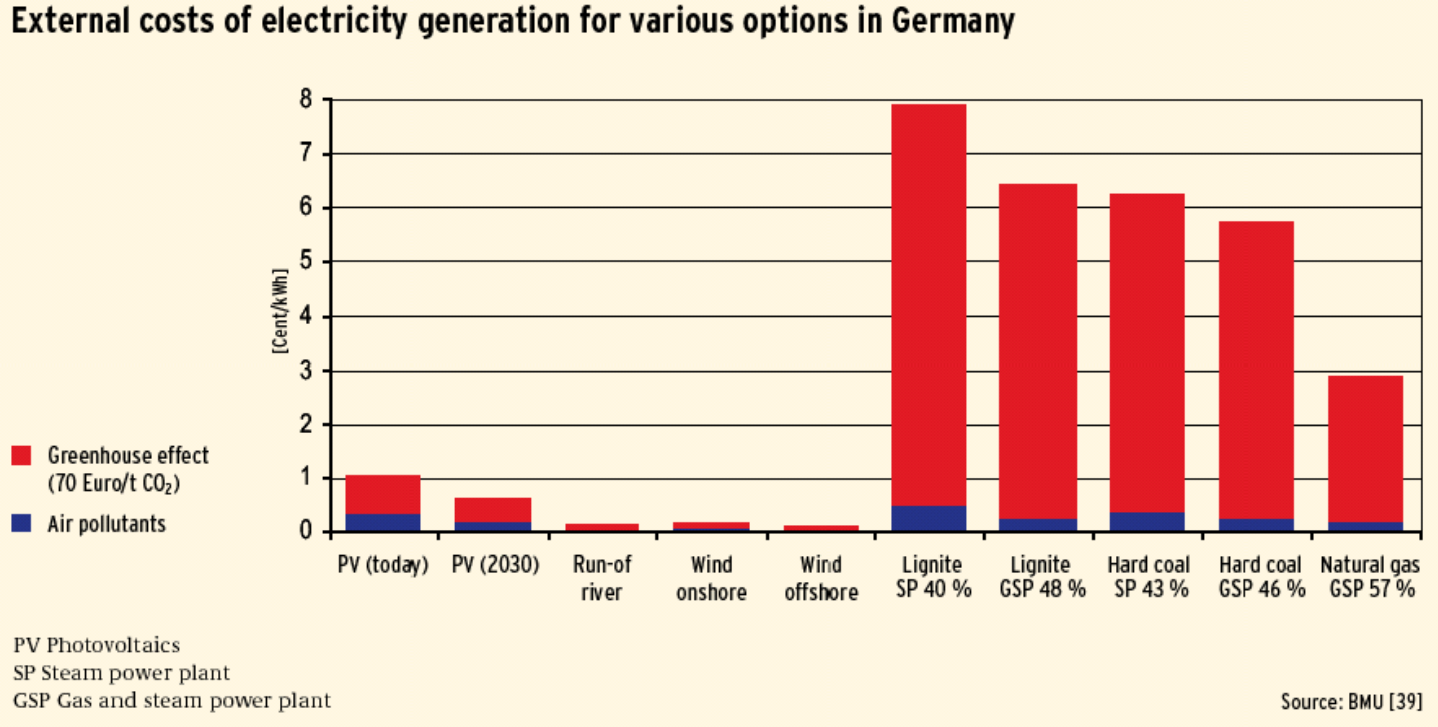
- Bird fatalities, visibility of wind turbines, noise

Direct solar

- Water usage by CSP plants in arid areas, waste created in PV manufacture and disposal

External Costs can give a picture on relative importance

- Uncertainty range of external costs is large
- Decrease of emissions in the power system depends heavily on the system



Challenges

- Energy efficiengy improvement and increase of the share of renewable energy have central role in the reduction of emissions (Both measures also improve energy security and contribute to sustainable development)
- Renewable energy potentials have great regional differences, regional information needed.
- Different renewable energy sources are in different state of technological maturity (Best deployment potential have hydro, biomass and wind, breakthrough of solar is coming. Geothermal and ocean energy are in developmental state.)
- Integration of renewable energy in existing and future energy systems is a central challenge.
- In the assessment of changes, several viewpoints are needed, e.g.: life-cycle, cost-efficiency and systems approach (Ghg emission reduction depends on the whole (energy) system, not only on the increase of renewables)
- Well designed policy measures are needed in the deployment of renewable energy sources

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