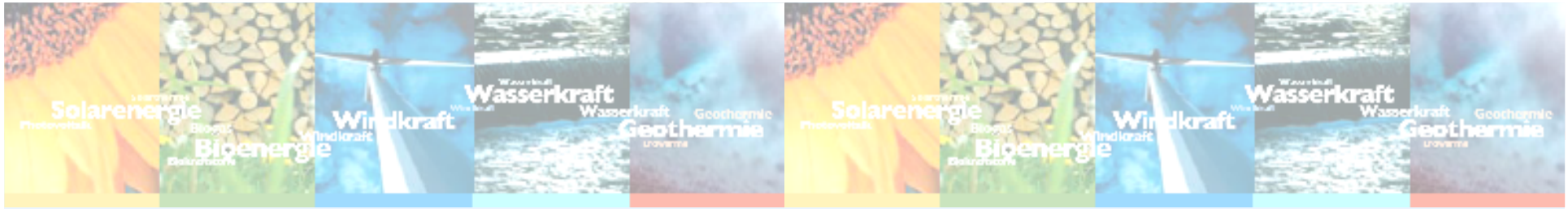


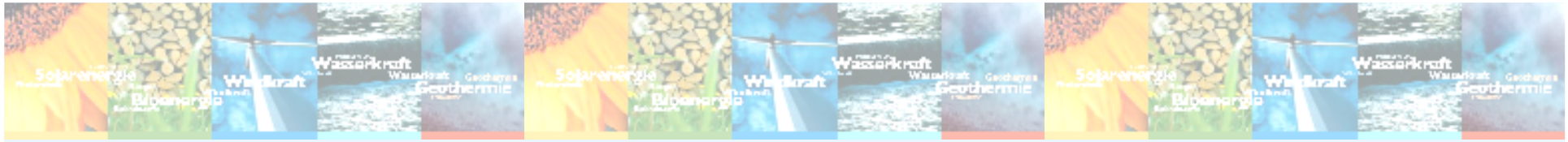
The Changing Energy Landscape

From Fossil and Nuclear to Renewable Energy

Frankfurt/Main, 2008-04-22
Conference „Protecting the Climate – A World Joint Strategy“

Rainer Hinrichs-Rahlwes, Board Member

- German Renewable Energy Federation -
Bundesverband Erneuerbare Energie e.V. (BEE)



Bundesverband Erneuerbare Energie e.V.

German Renewable Energy Federation

- **Umbrella organisation** of the RES-associations **since 1991**
- **Task and mission:** Political consulting → stable and reliable framework conditions for RES
- **20 Member associations:**
  hydro, wind, solar, biomass, and geothermal energy.
- **Representing**
  > 30,000 members, including > **5,000 enterprises**.
- **Parliamentary board:**
  all Bundestag-Parties represented → link to politics.

Energy Sources of the 20th Century

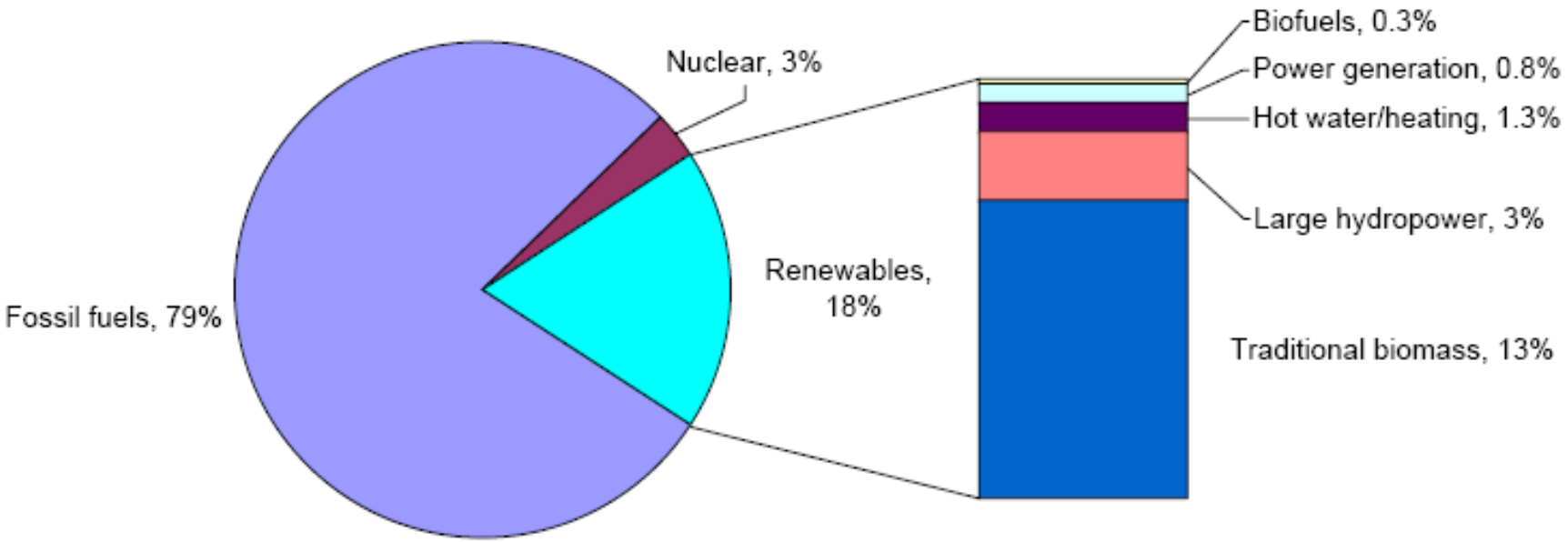
- Coal, oil and gas have been the dominant sources of energy of the 20th century – and of greenhouse gas emissions accelerating global warming.
- Nuclear became a major source of electricity in the second half of the 20th century - and of unsolved problems: waste disposal, proliferation risk and catastrophic accidents.

Challenges for the 21st Century

- **Renewable sources** offer unlimited potential for sustainable and secure energy supply - and for reduction of greenhouse gas emissions and mitigation of global warming.
- **Transition** from fossil and nuclear sources is necessary and possible within a few decades, without any energy gap – if we manage to remove the global policy gap.

The World in 2007:
RES in Global Final Energy Consumption

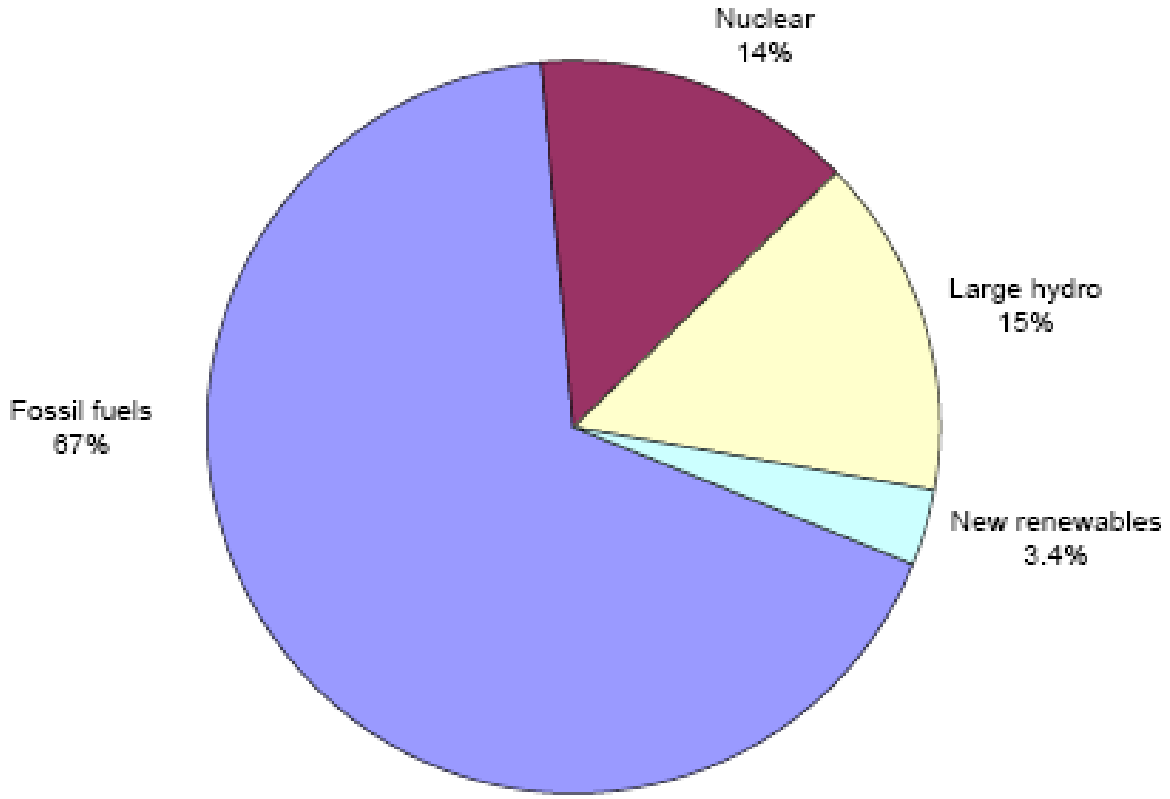
Figure 1. Renewable Energy Share of Global Final Energy Consumption, 2006



Source: REN21 Renewables 2007 Global Status Report, www.ren21.net

The World in 2007:
RES in Global Electricity Consumption

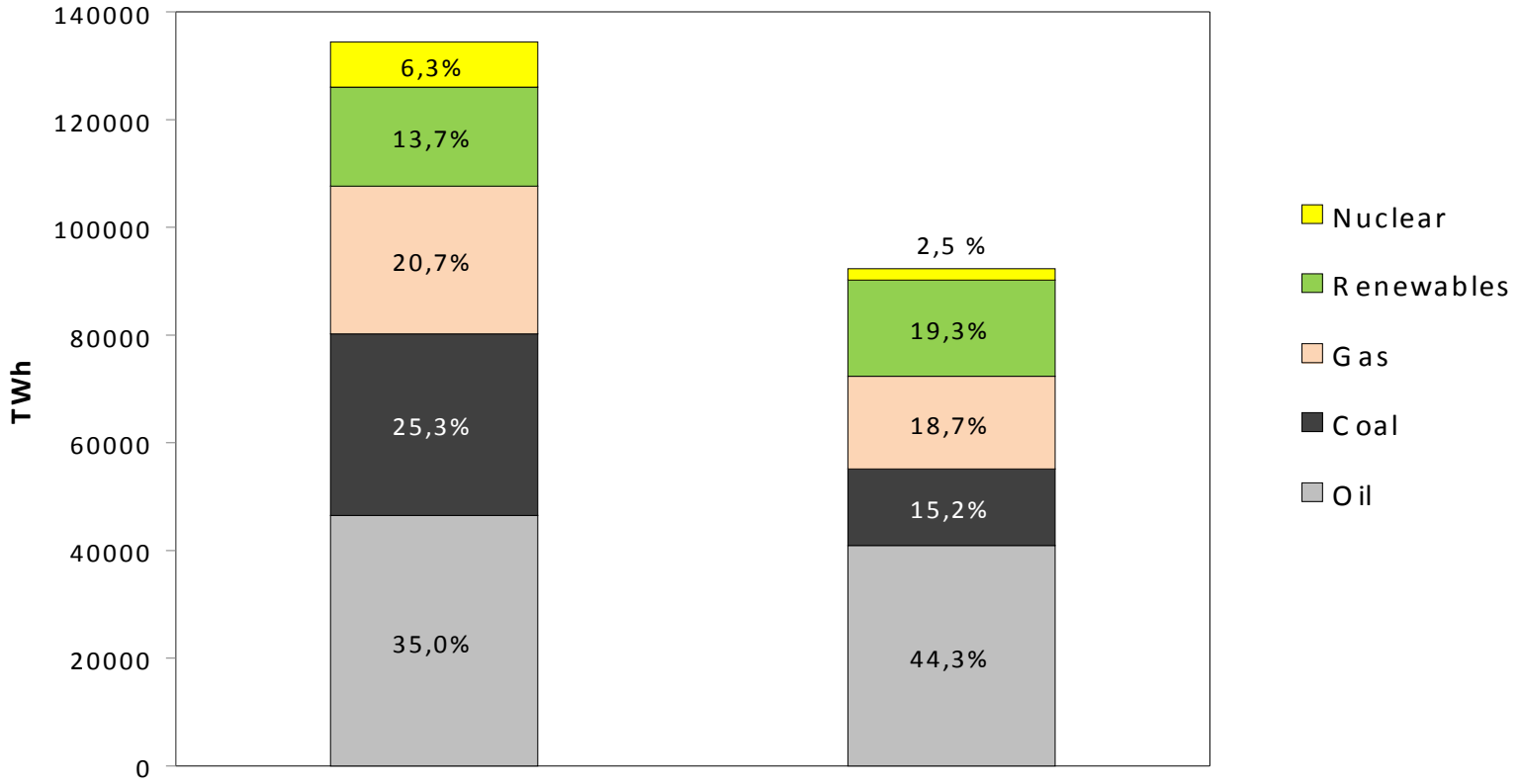
Figure 2. Share of Global Electricity from Renewable Energy, 2006



Source: REN21 Renewables 2007 Global Status Report, www.ren21.net

Renewables in final energy consumption:

more important than nuclear, gas and coal

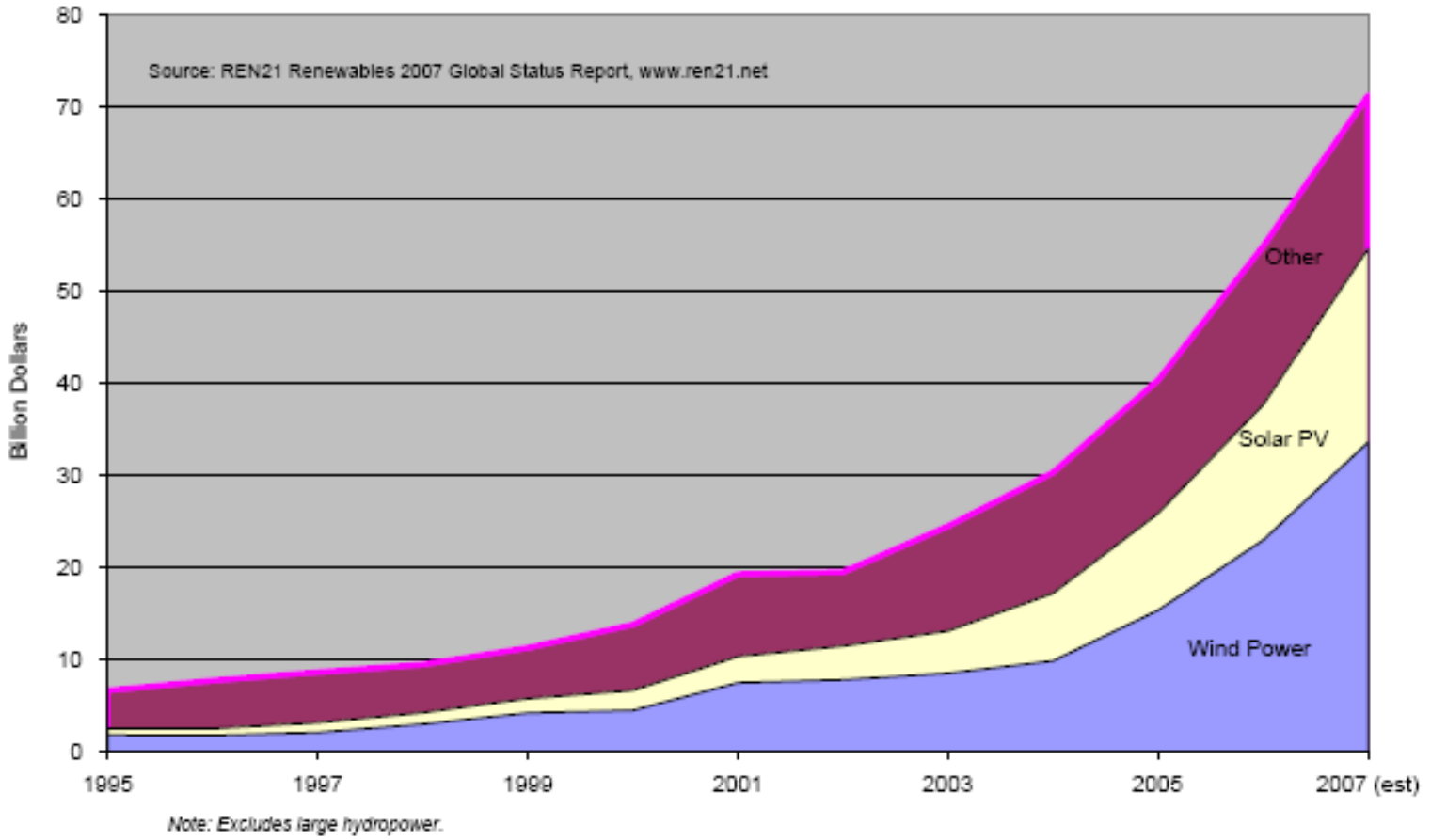


Primary energy consumption final energy consumption

Source: IEA 2007: world in 2006

Strong Growth of Investment in RE

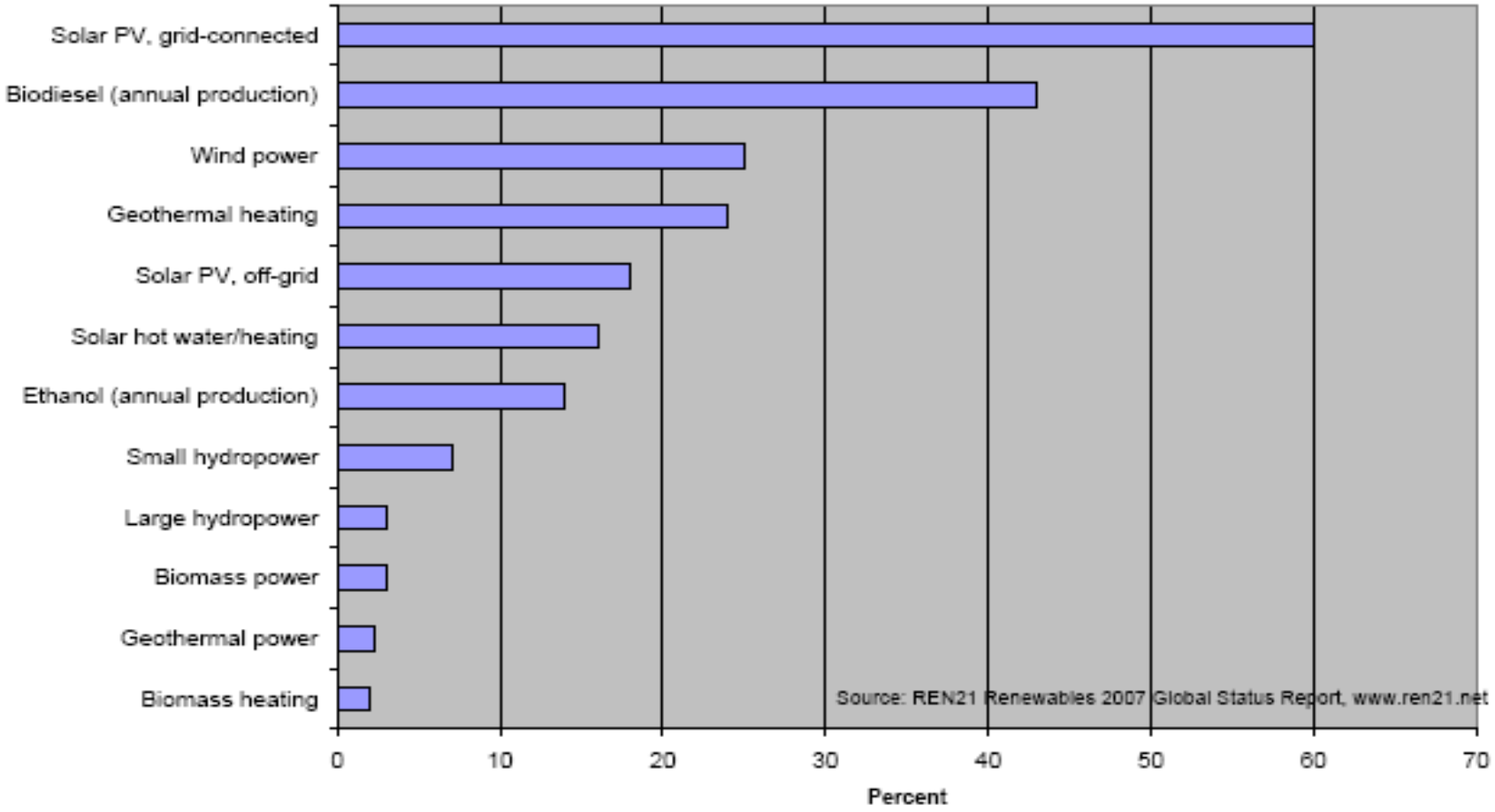
Figure 11. Annual Investment in New Renewable Energy Capacity, 1995–2007



Note: Excludes large hydropower.

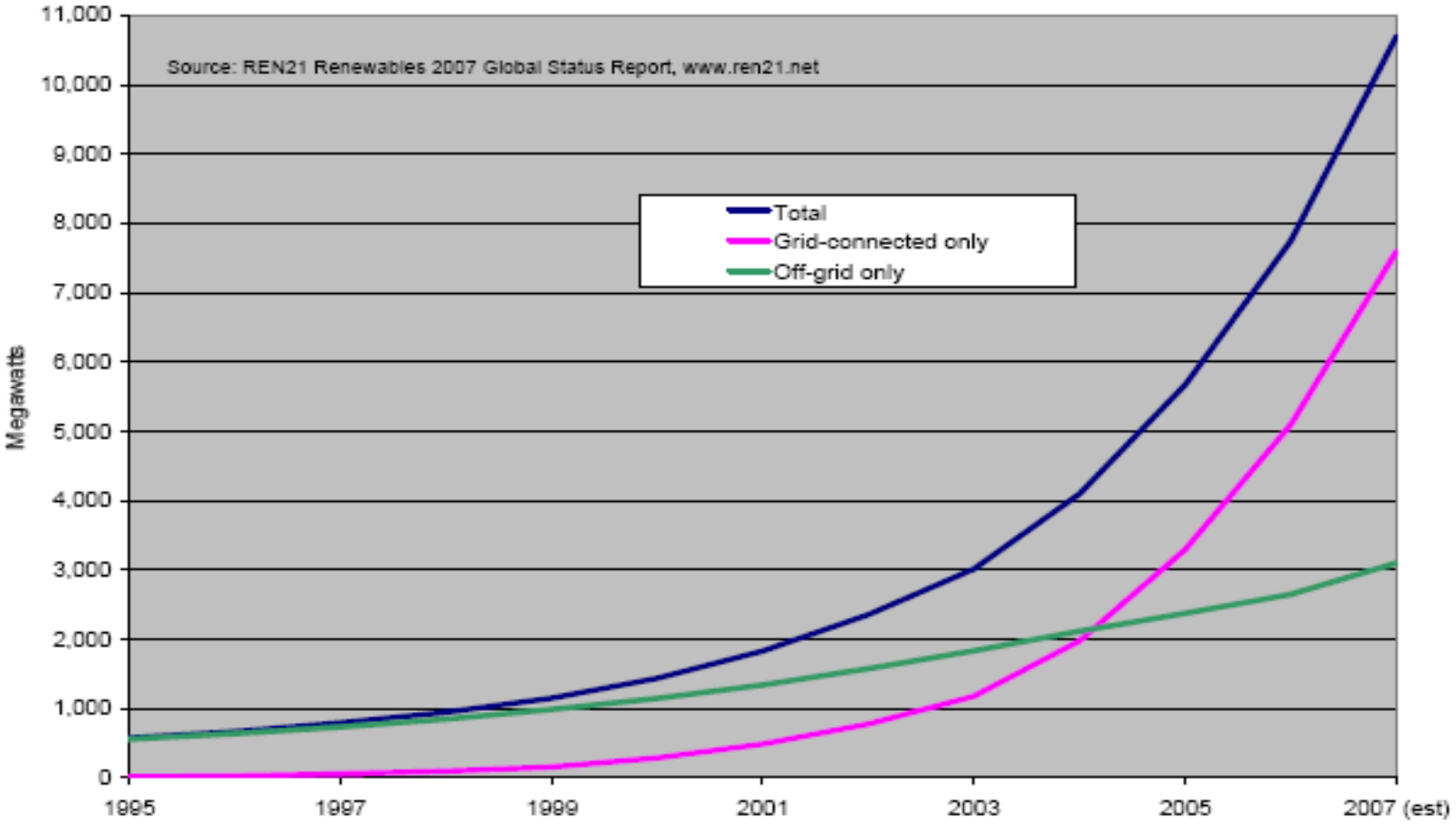
Growth of Different Technologies

Figure 3. Average Annual Growth Rates of Renewable Energy Capacity, 2002–2006



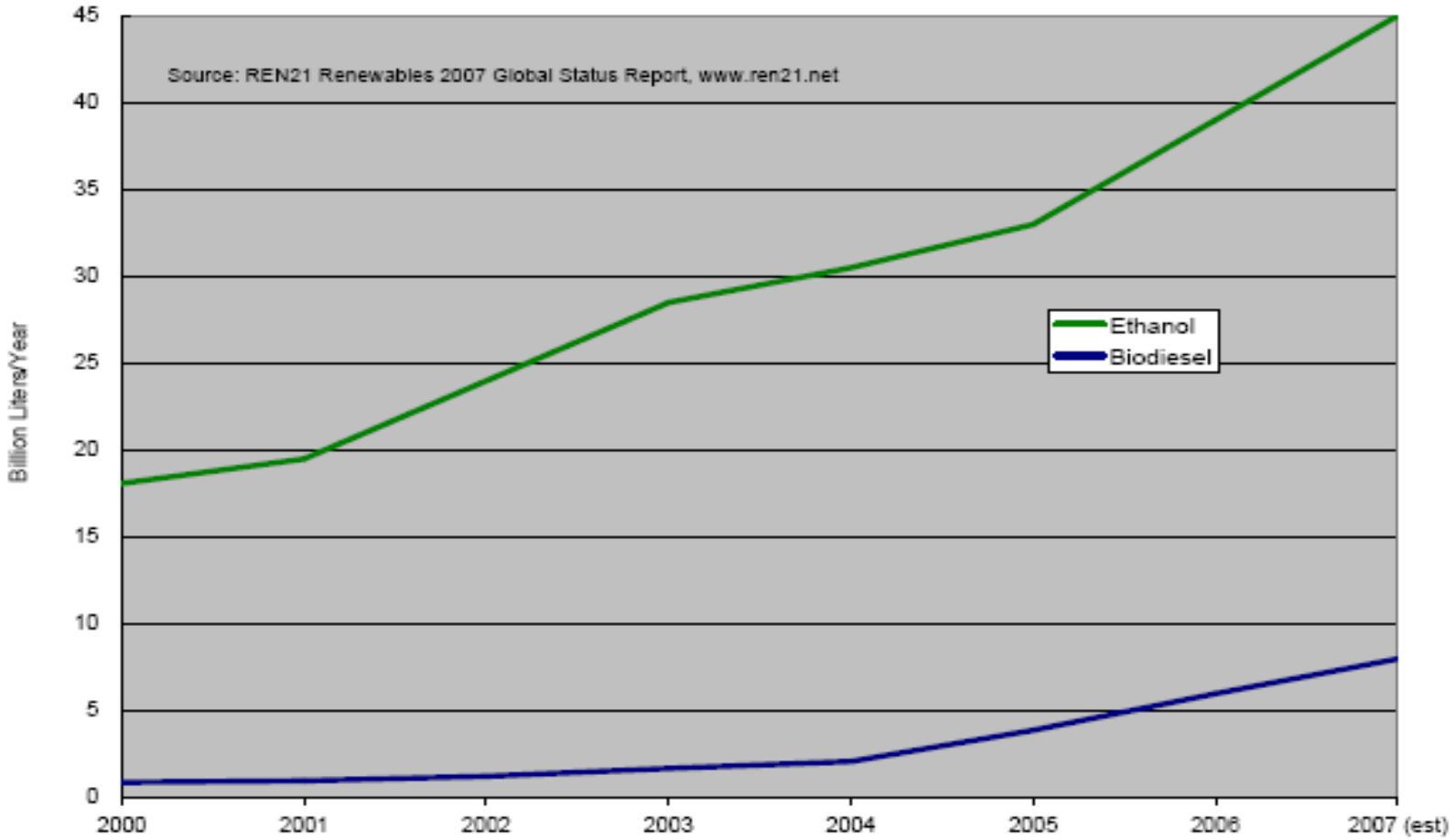
Growing Global Solar PV Market

Figure 6. Solar PV, Existing World Capacity, 1995–2007



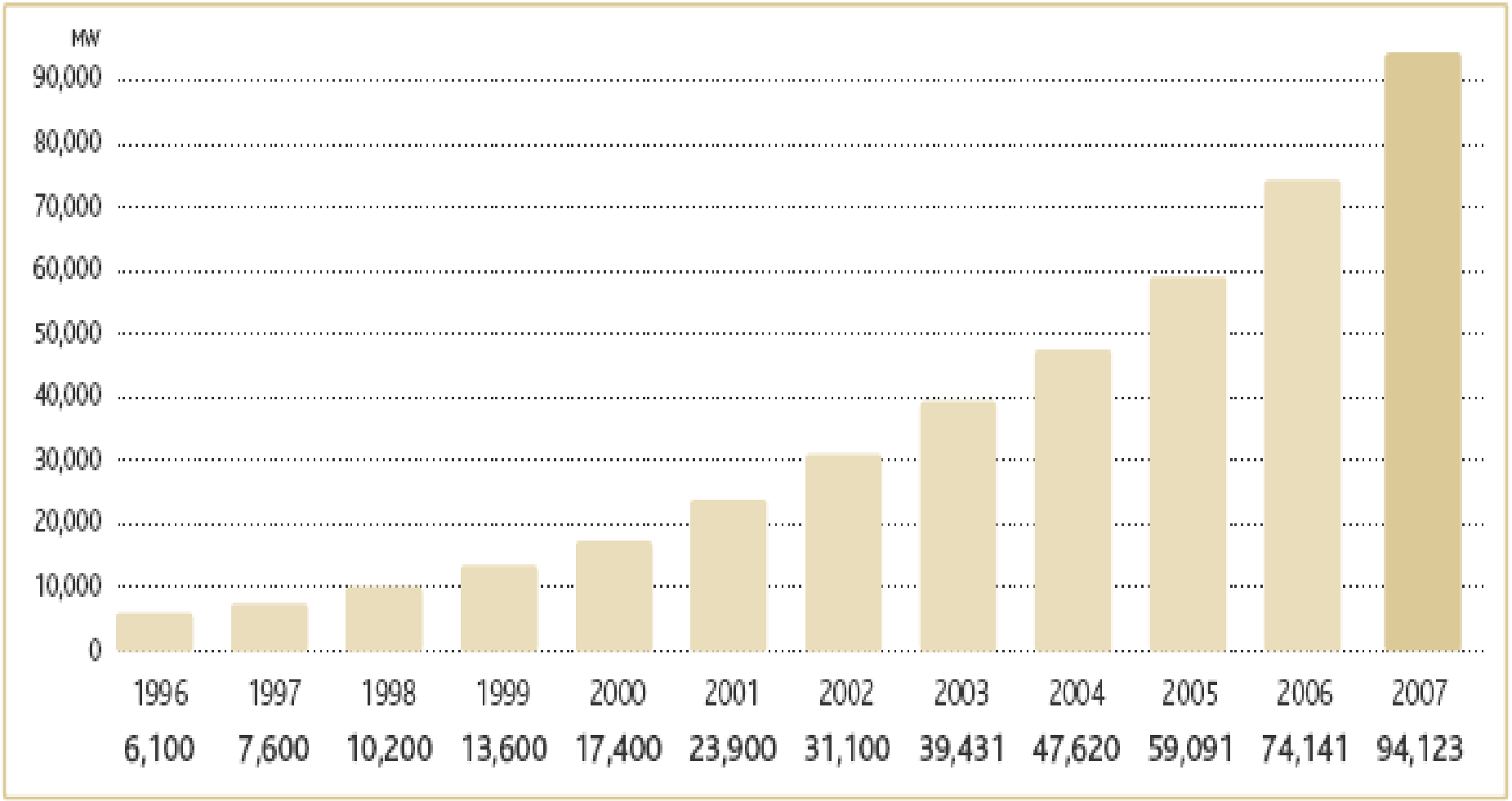
Growing Global Biofuels Market

Figure 10. Ethanol and Biodiesel Production, 2000–2007



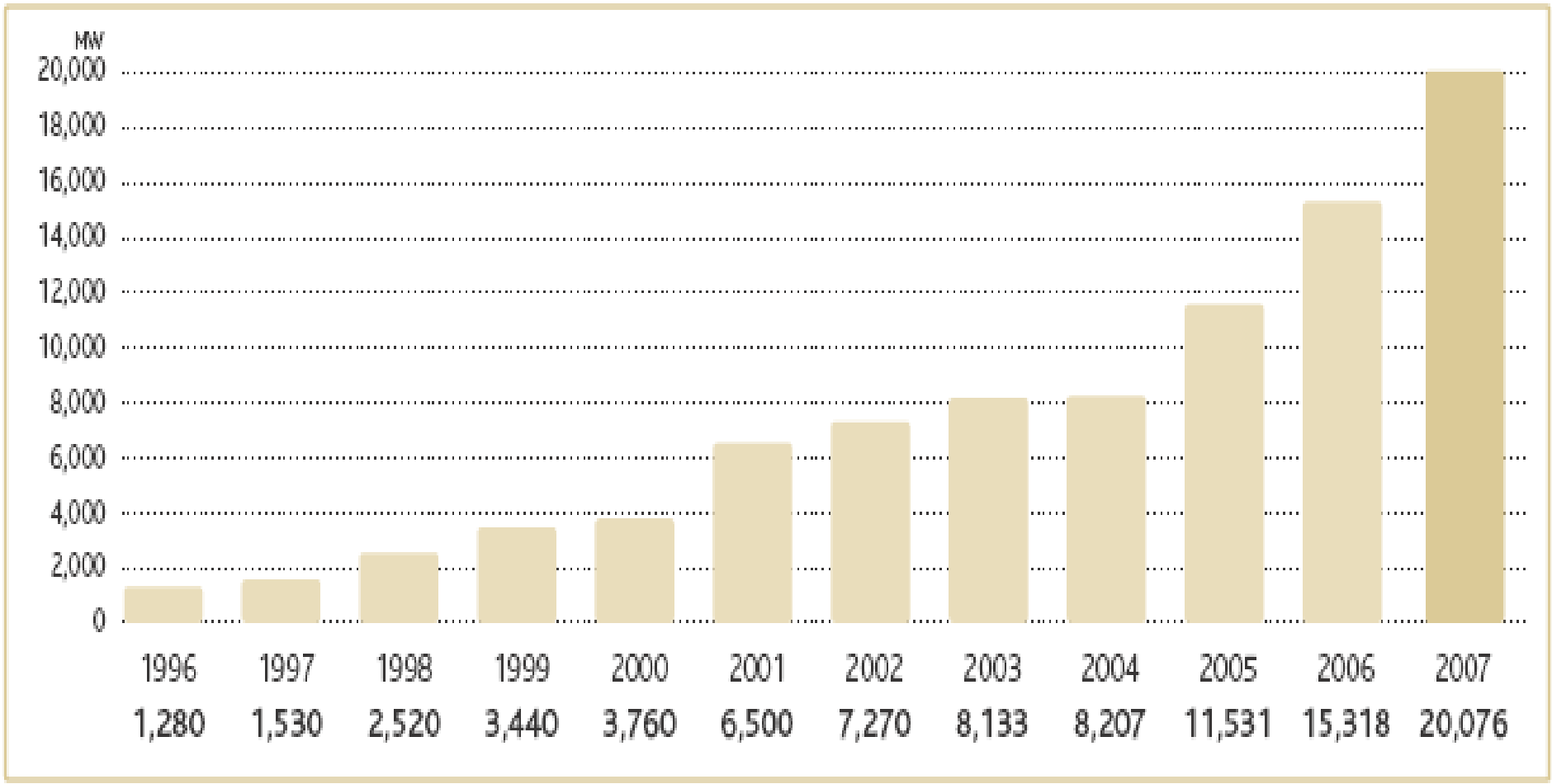
Growing Global Wind Market - cumulated

GLOBAL CUMULATIVE INSTALLED CAPACITY 1996-2007



Source: Global Wind 2007 Report

Growing Global Wind Market - annual

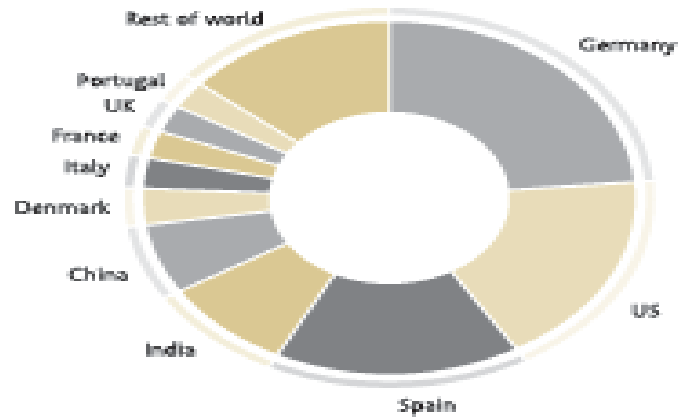


Source: Global Wind 2007 Report

Regional Shares in Global Wind Market

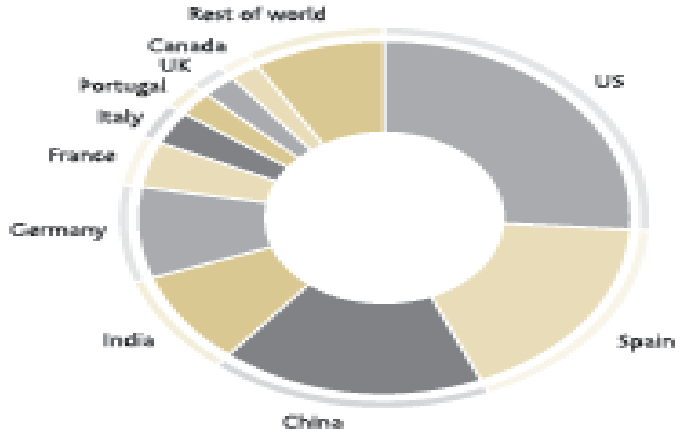
BEE

TOP 10 TOTAL INSTALLED CAPACITY



	MW	%
Germany	22,247	23.6
US	16,818	17.9
Spain	15,145	16.1
India	8,000	8.5
China	6,050	6.4
Denmark	3,125	3.3
Italy	2,726	2.9
France	2,454	2.6
UK	2,389	2.5
Portugal	2,150	2.3
Rest of world	13,019	13.8
Total top 10	**81,104**	**86.2**
Total	**94,123**	**100.0**

TOP 10 NEW CAPACITY



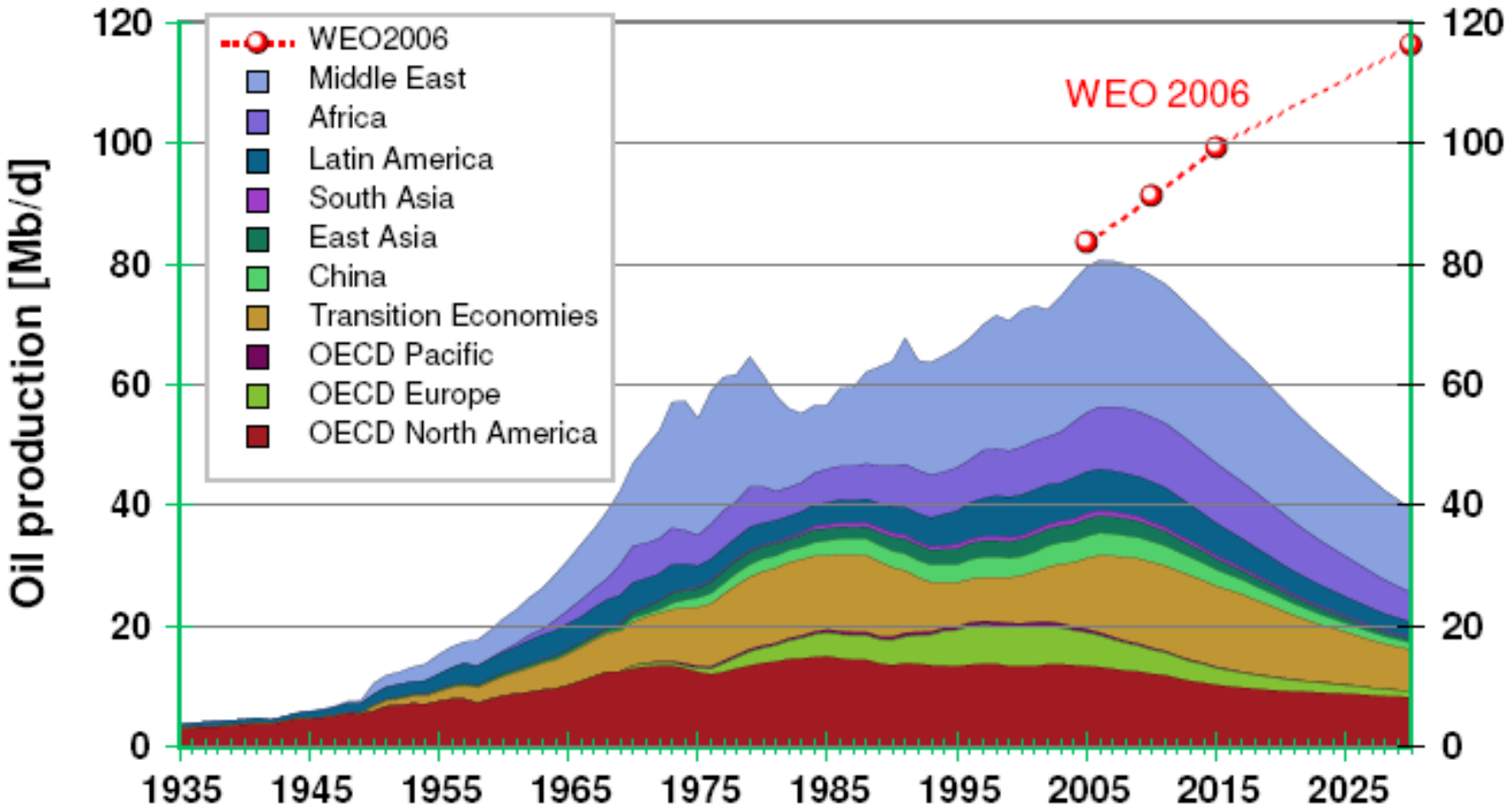
	MW	%
US	5,244	26.1
Spain	3,522	17.5
China	3,449	17.2
India	1,730	8.6
Germany	1,667	8.3
France	888	4.4
Italy	603	3.0
Portugal	434	2.2
UK	427	2.1
Canada	386	1.9
Rest of world	1,726	8.6
Total top 10	**18,350**	**91.4**
Total	**20,076**	**100.0**

Fossil and Nuclear Fuels will fade away

- Coal, oil, gas and uranium will peak in the next decades and then rapidly decline.
- Prices for fossil and nuclear fuels will rise due to scarcity but also due to political risks.
- Renewable energies will be competitive soon. They are already competitive today, if external costs are included in the price.

The Oil Gap will increase

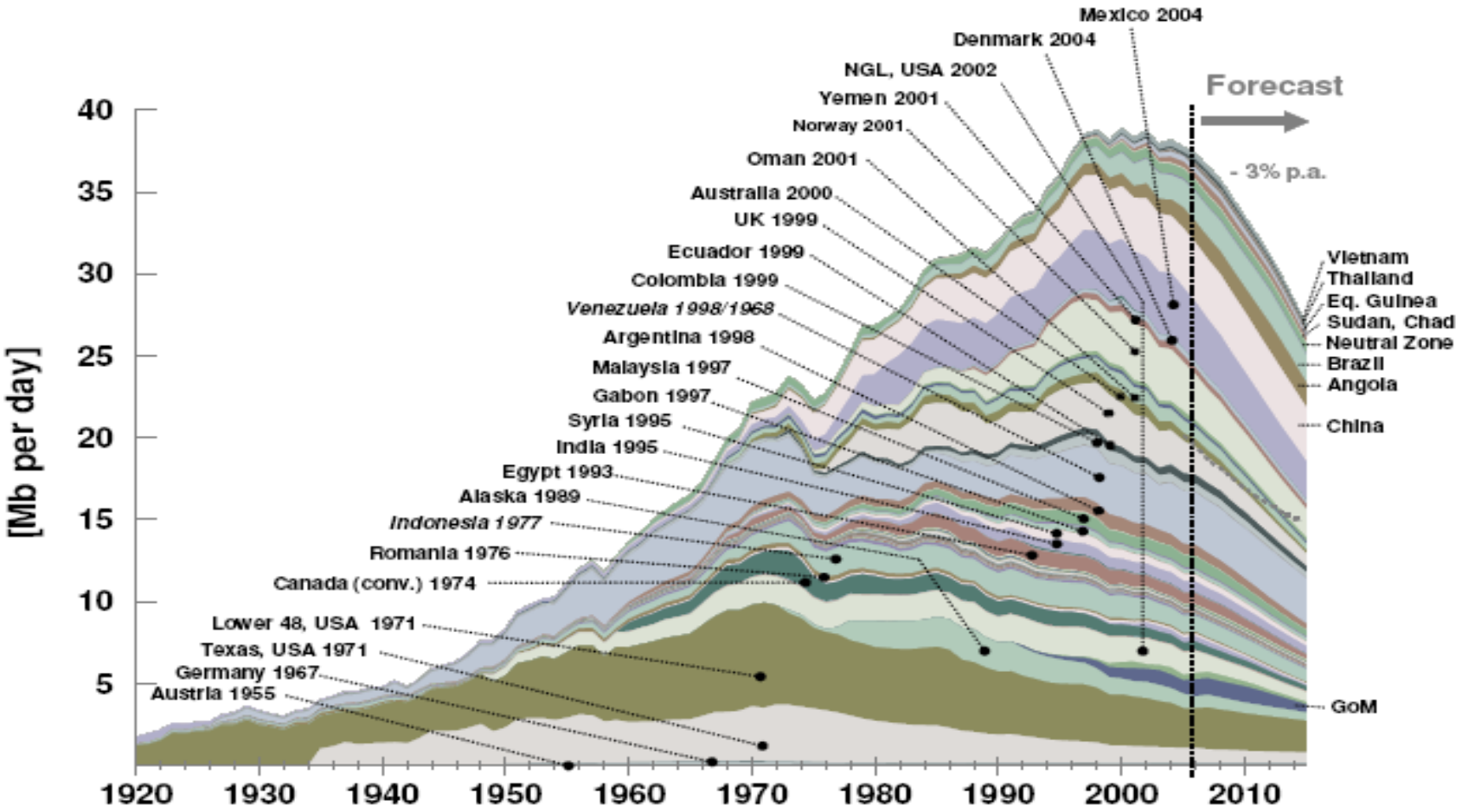
Figure 7: Oil production world summary



Source: EnergyWatchGroup: Oil Report, October 2007

Peak oil: a matter of fact

Figure 5: Oil producing countries past peak

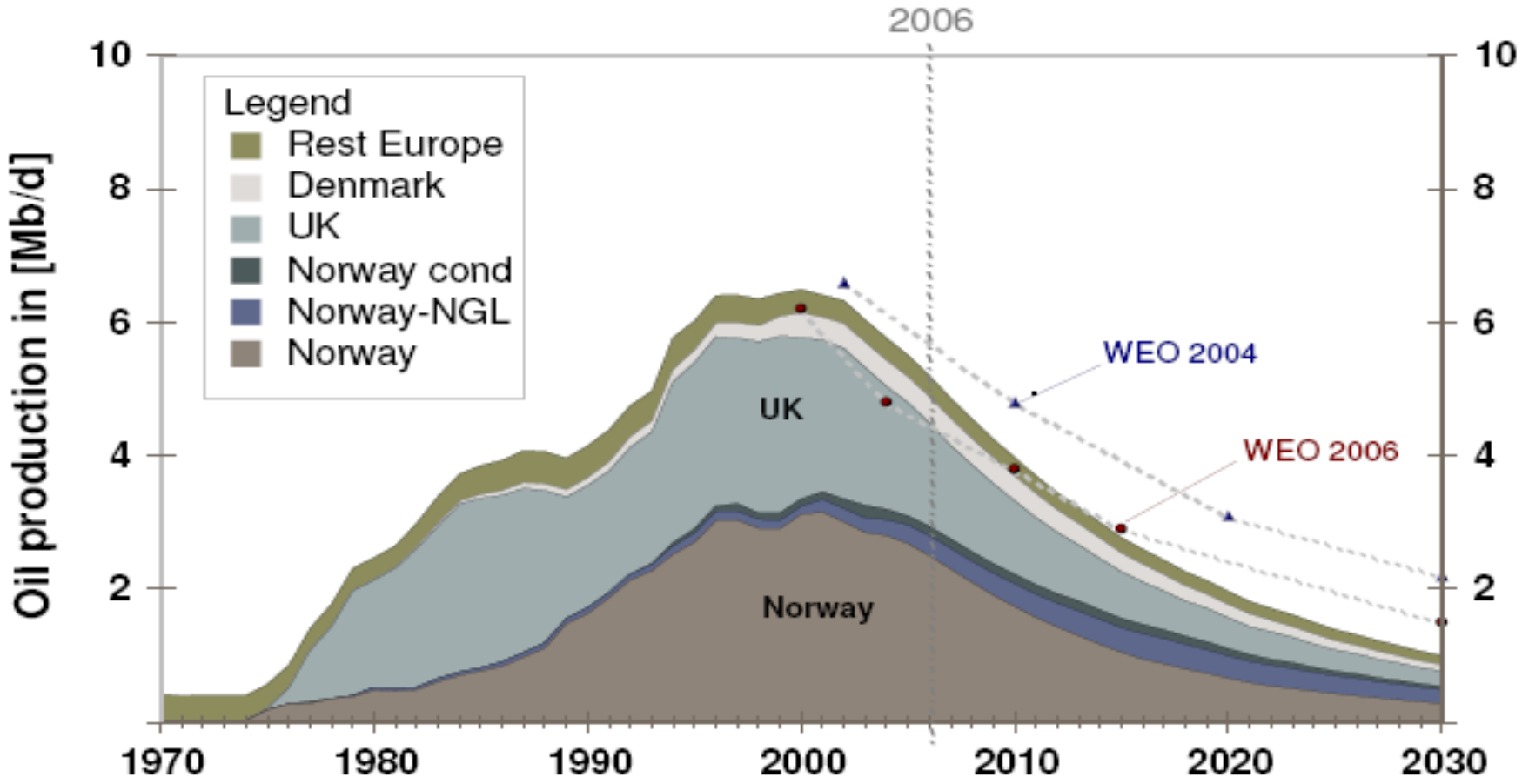


Ludwig-Bölkow-Systemtechnik GmbH, 2007
Source: IHS 2006; PEMEX, petrobras ; NPD, DTI, ENS(Dk), NEB, RRC, US-EIA, January 2007
Forecast: LBST estimate, 25 January 2007

Peak oil: Europe

OECD Europe

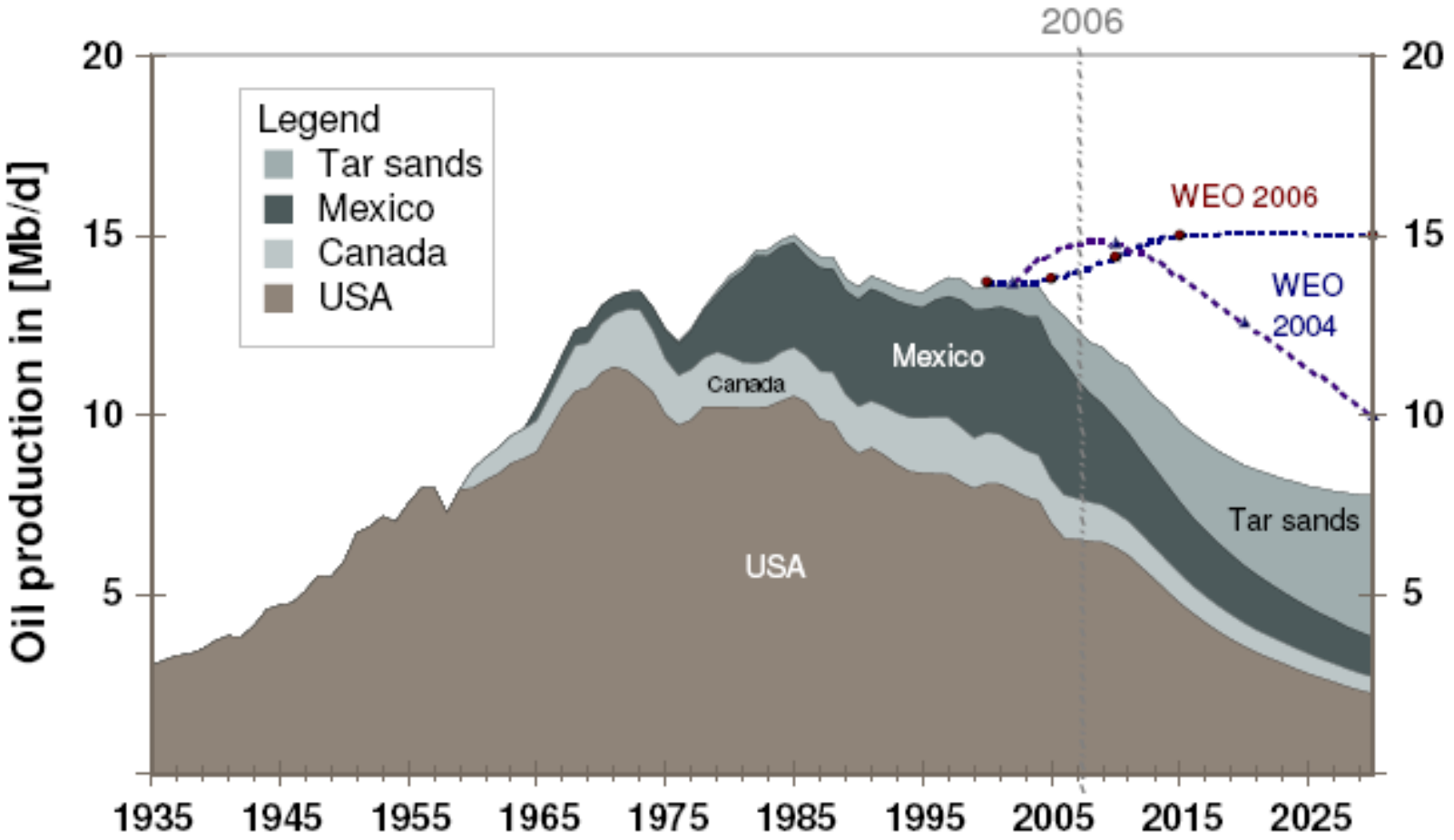
Figure 8: Oil production in OECD Europe



Source: EnergyWatchGroup: Oil Report, October 2007

Peak oil: North America

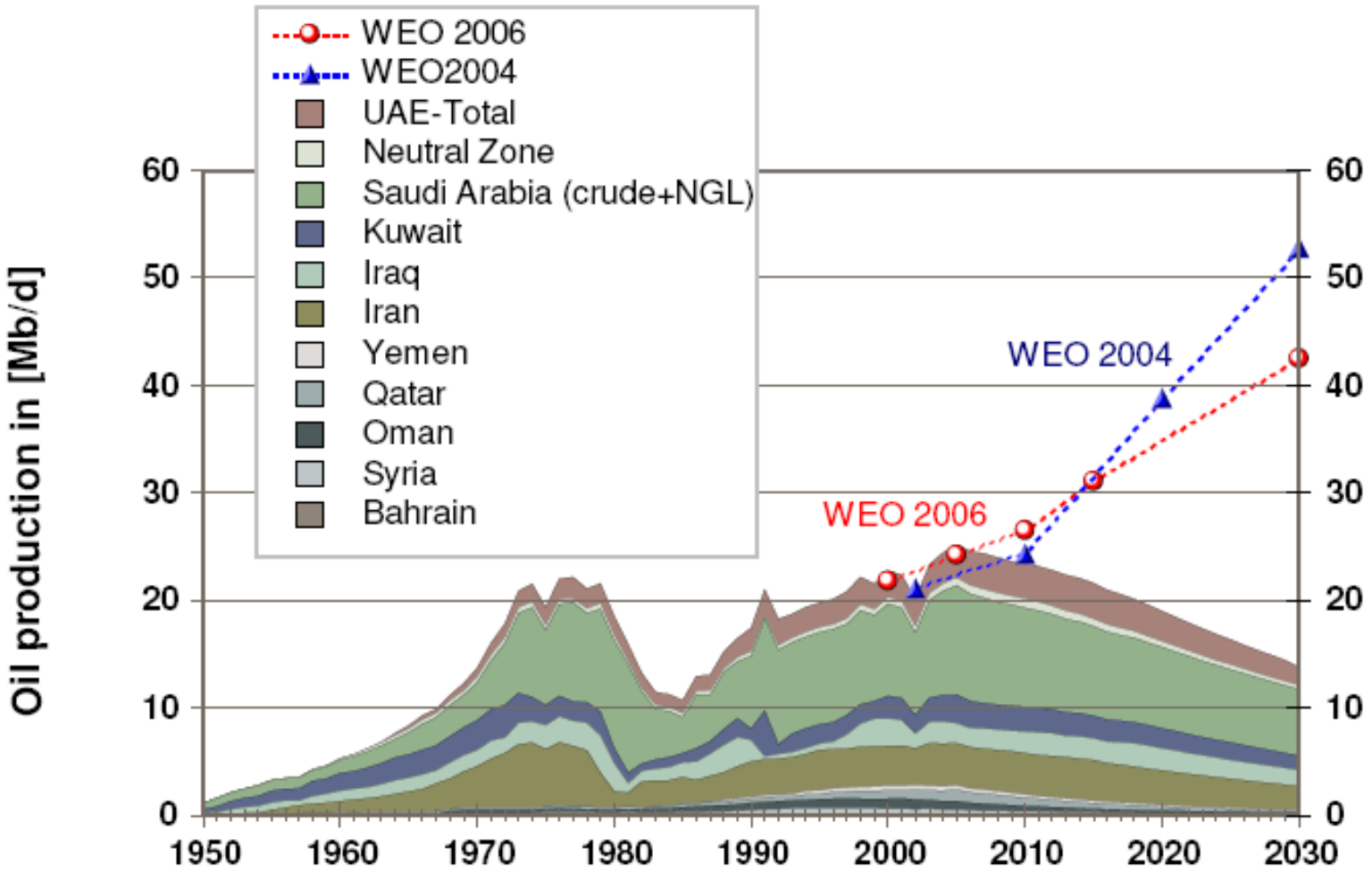
Figure 9: Oil production in OECD North America



Source: EnergyWatchGroup: Oil Report, October 2007

Peak oil: Middle East

Figure 10: Oil production in the Middle East



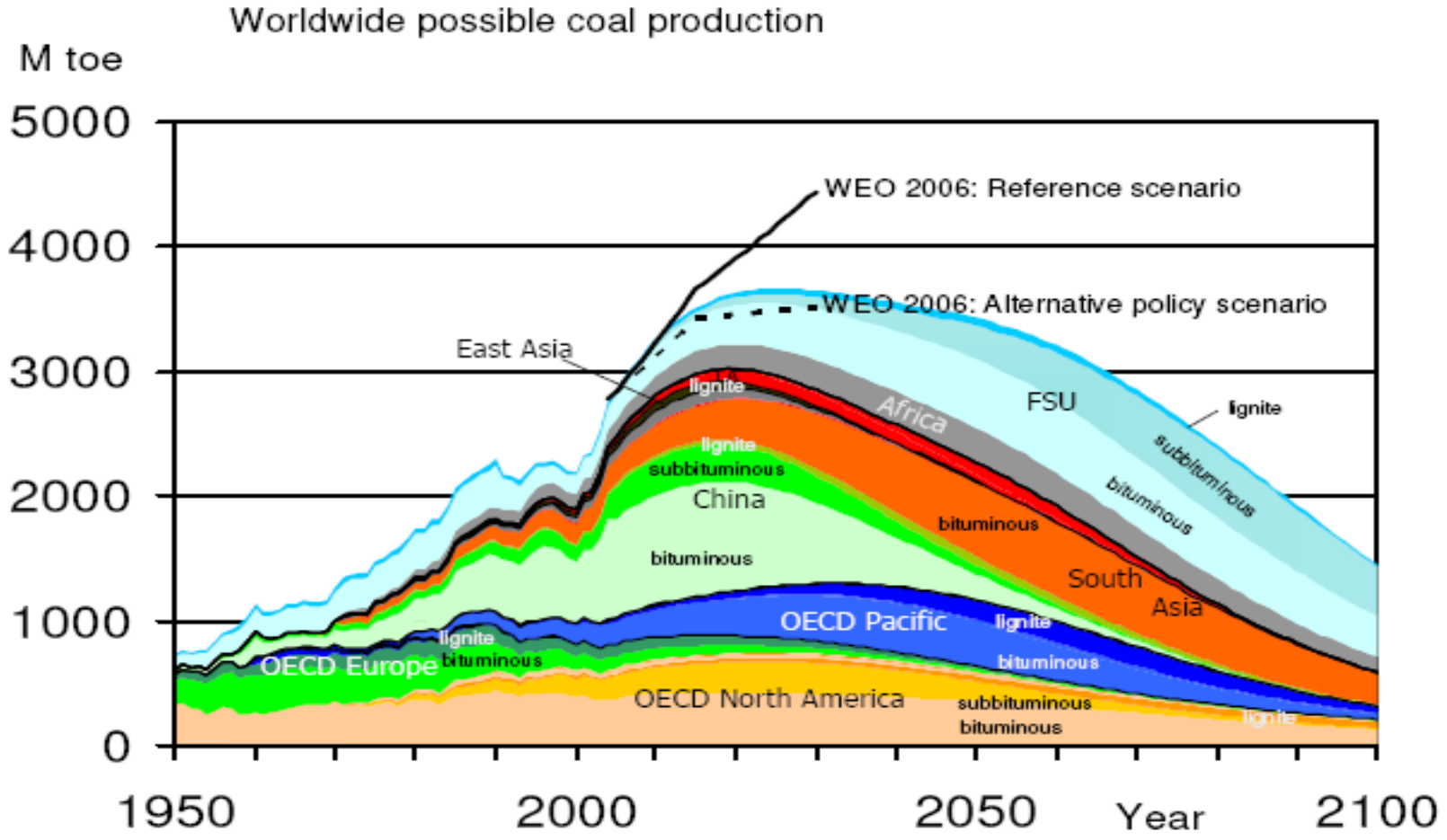
Source: EnergyWatchGroup: Oil Report, October 2007

Soaring Oil Prices
→ Further Increase of Import Costs

Source: Spiegel Online 2008-04-18: Brent Spot

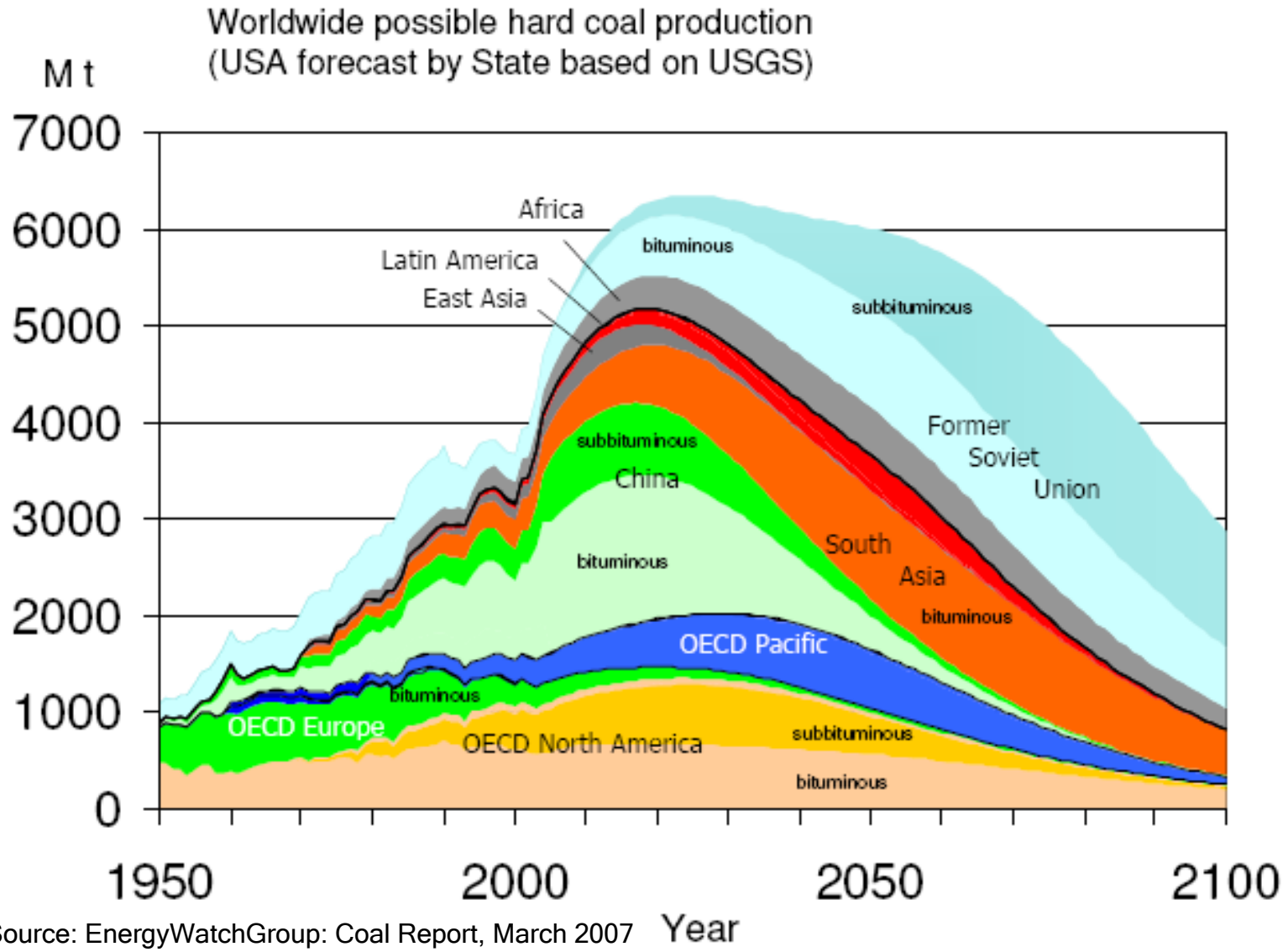
Peak coal: just a few years later

Figure 5: World coal production in the equivalent of a million tons of oil as calculated in this study based on proved recoverable reserves.



Source: EnergyWatchGroup: Coal Report, March 2007

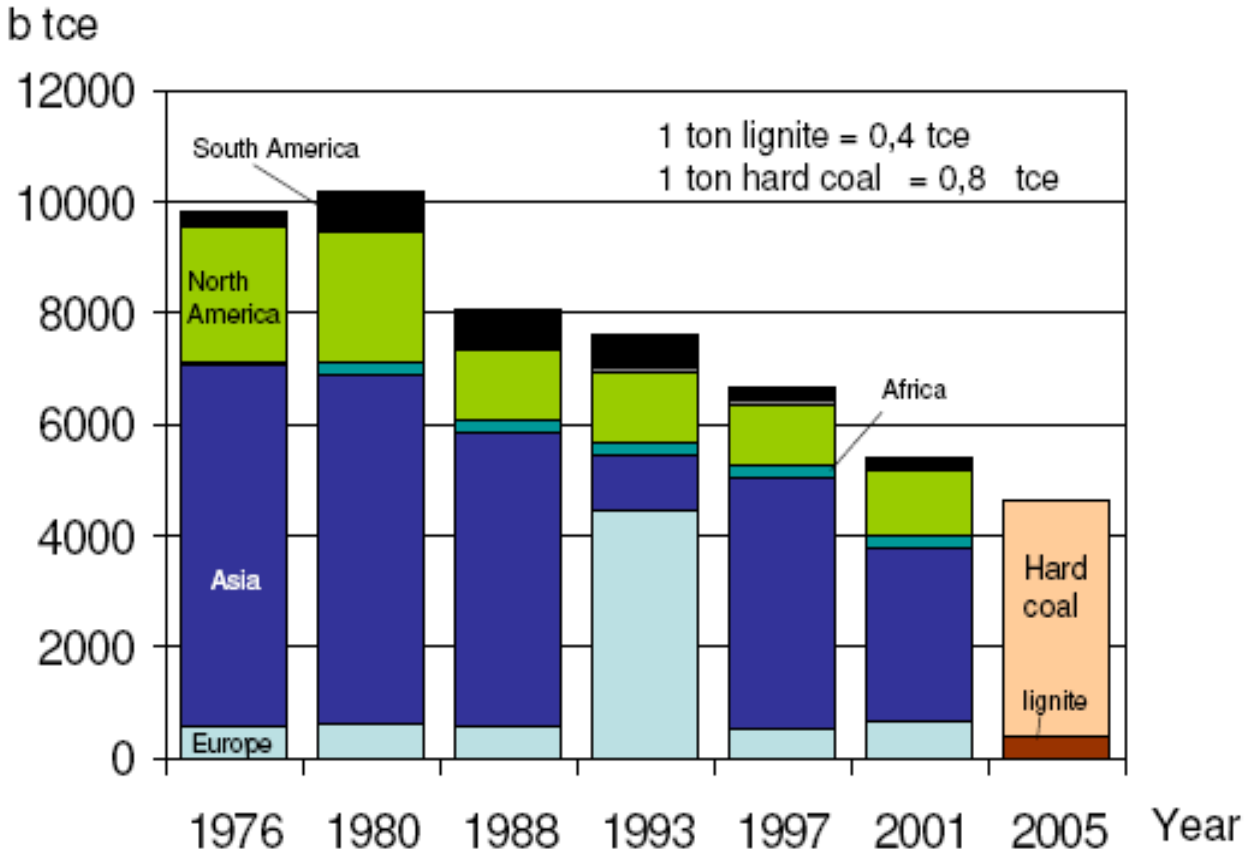
Peak coal as seen by USGS



Source: EnergyWatchGroup: Coal Report, March 2007

Peak coal: decreasing forecasts

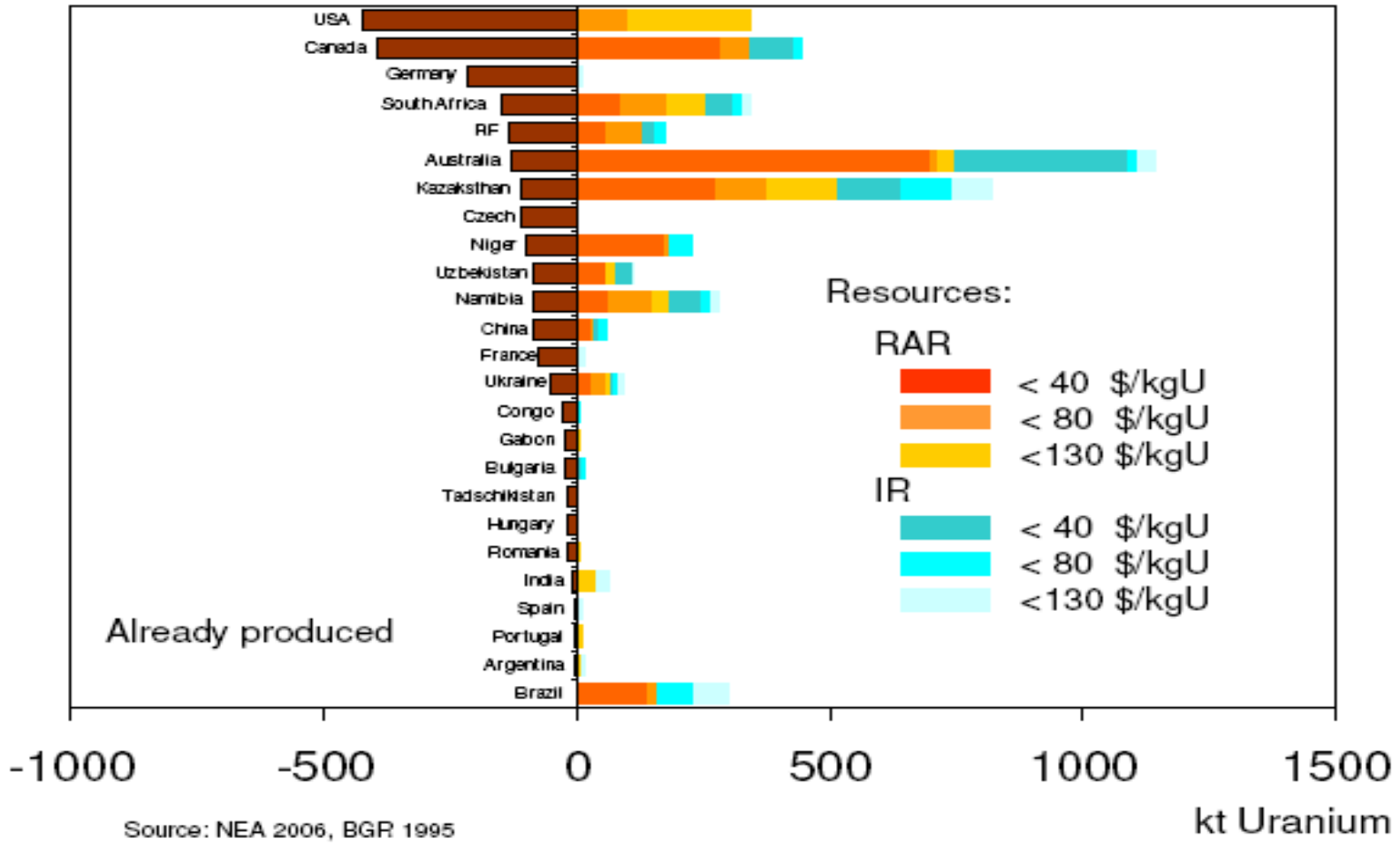
History of Assessment of world coal resources



Source: BGR, 1995/1998/2002/2006
Analysis: LBST 2006

Uranium: Few sources left

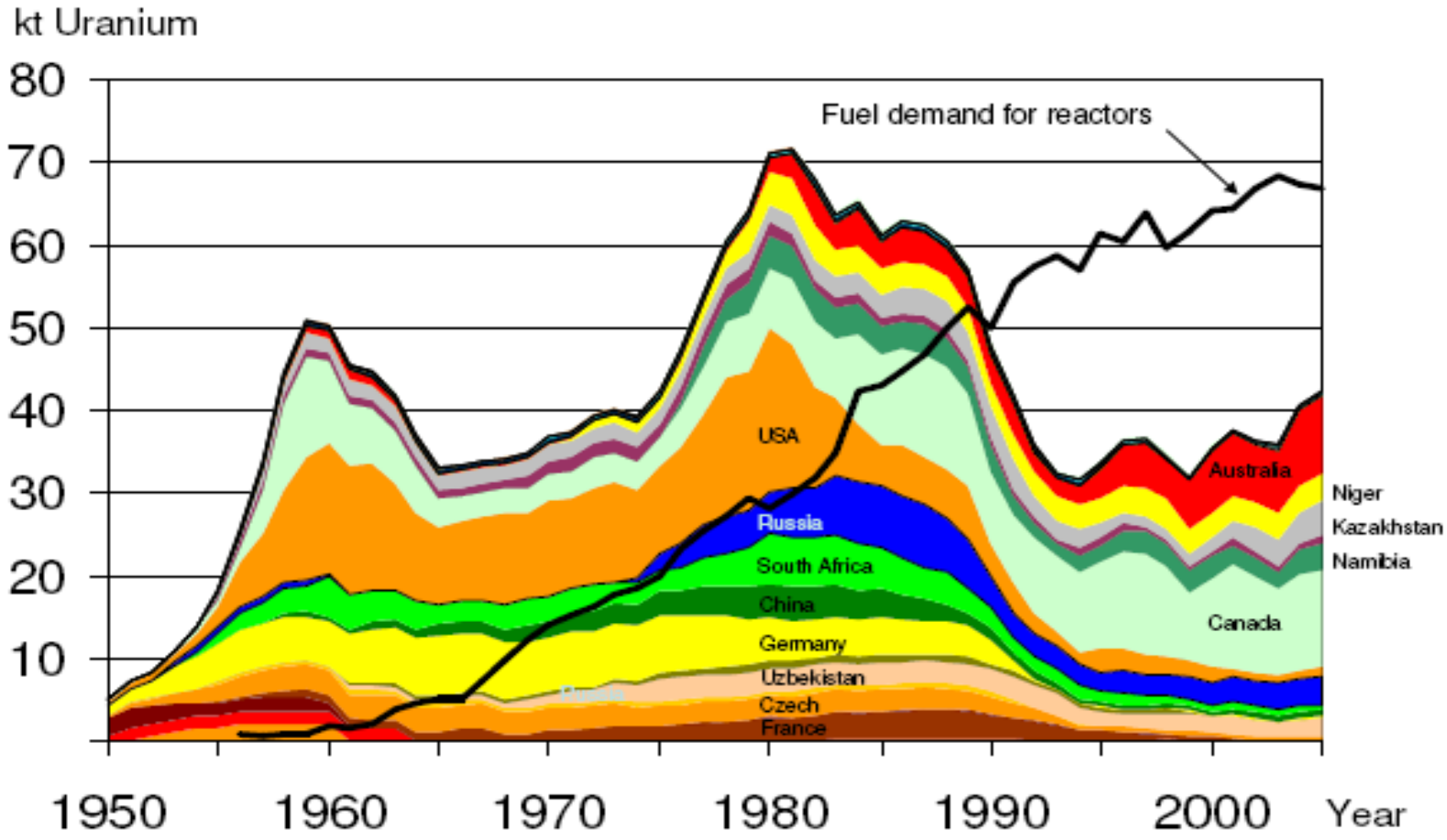
Figure 3: *cumulative produced uranium and reasonably assured and inferred resources of the most important countries.*



Source: NEA 2006, BGR 1995

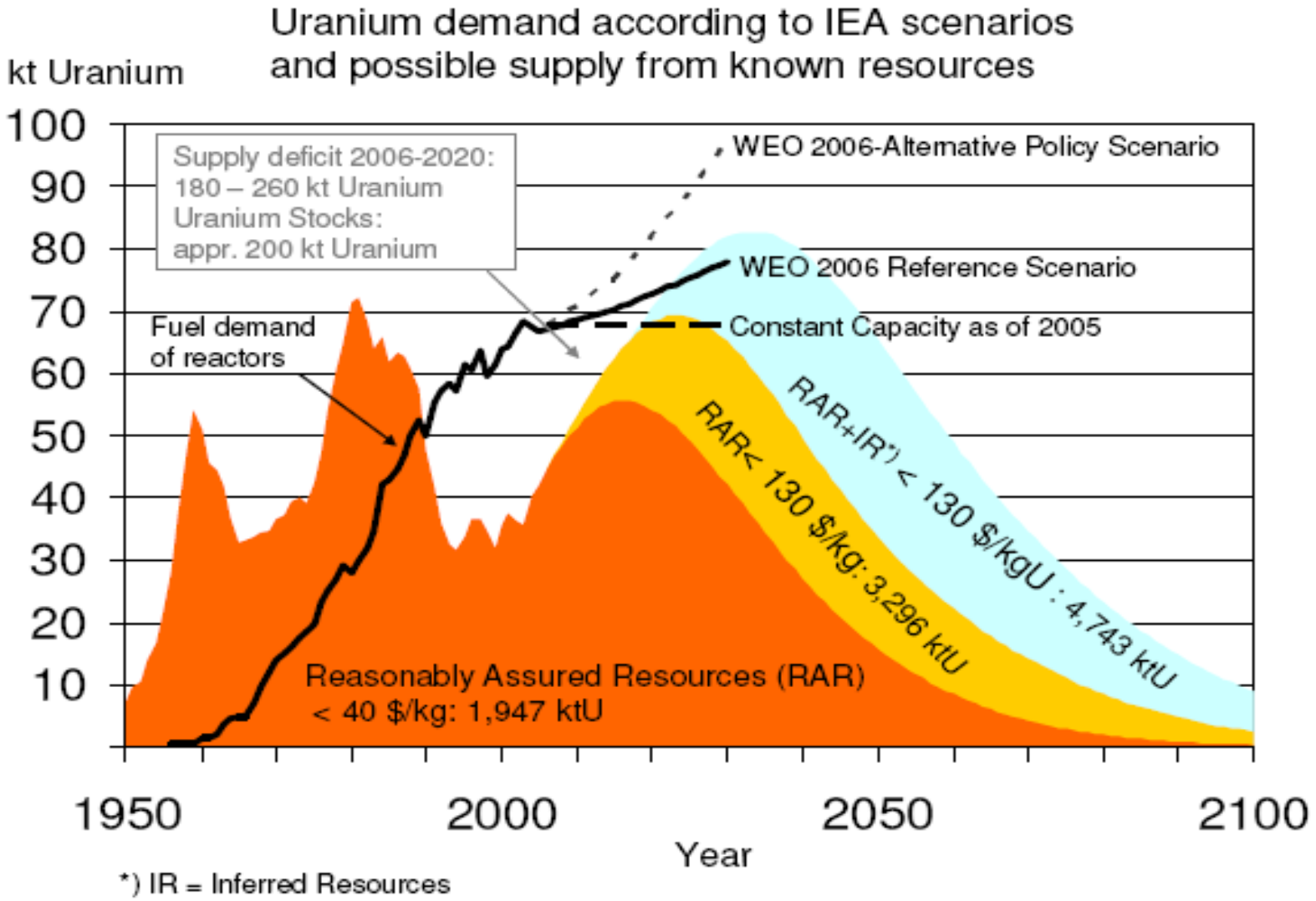
Uranium: the fuel gap

Figure 4: *Uranium production and demand*



Source: EnergyWatchGroup: Uranium Report, December 2006

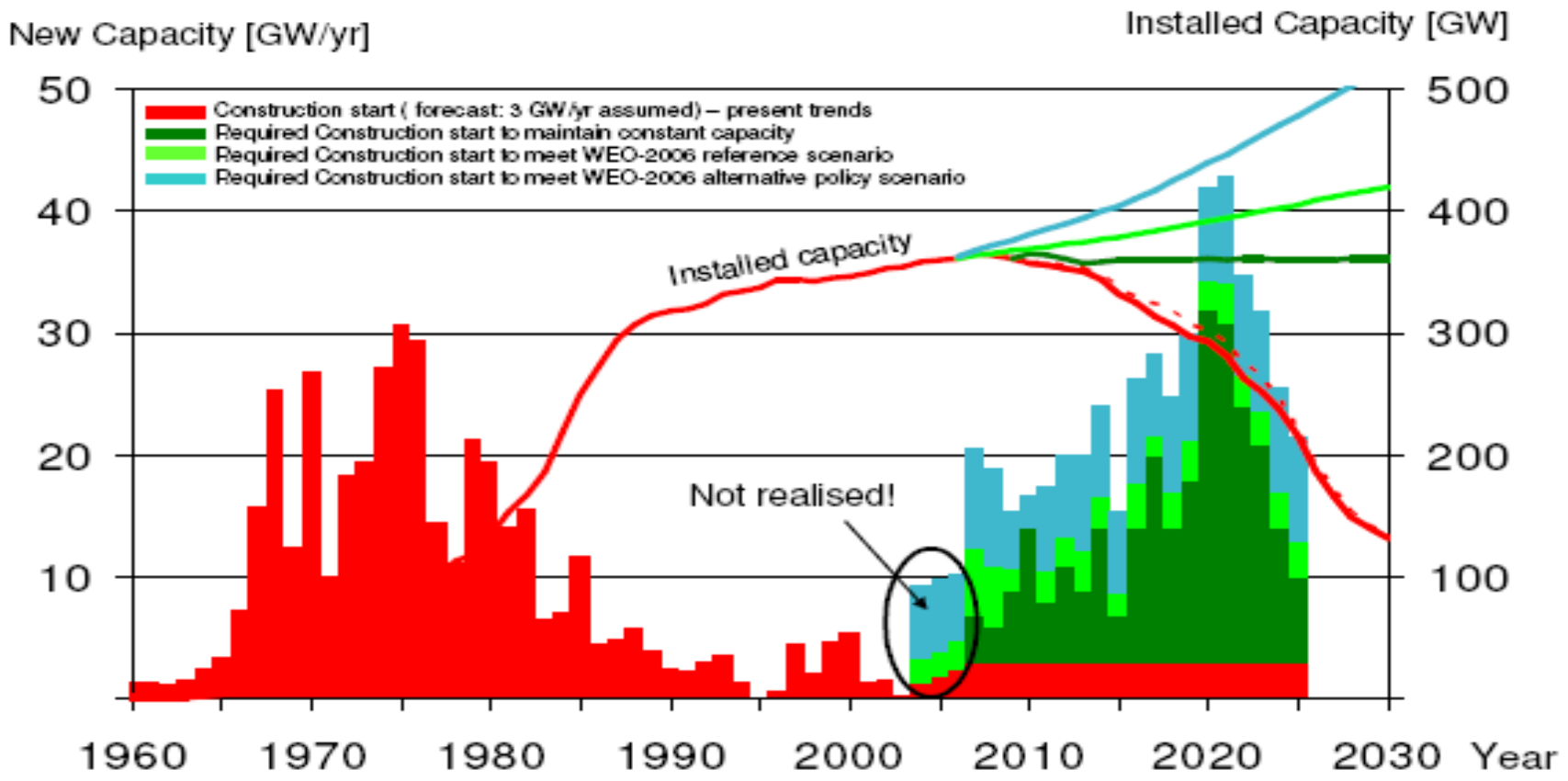
Uranium: running out of supply



Source: EnergyWatchGroup: Uranium Report, December 2006

Nuclear: far from reality

Figure 11: Projections of nuclear capacity



Source: International Atomic Energy Agency

October 2006

Renewable energies can deliver

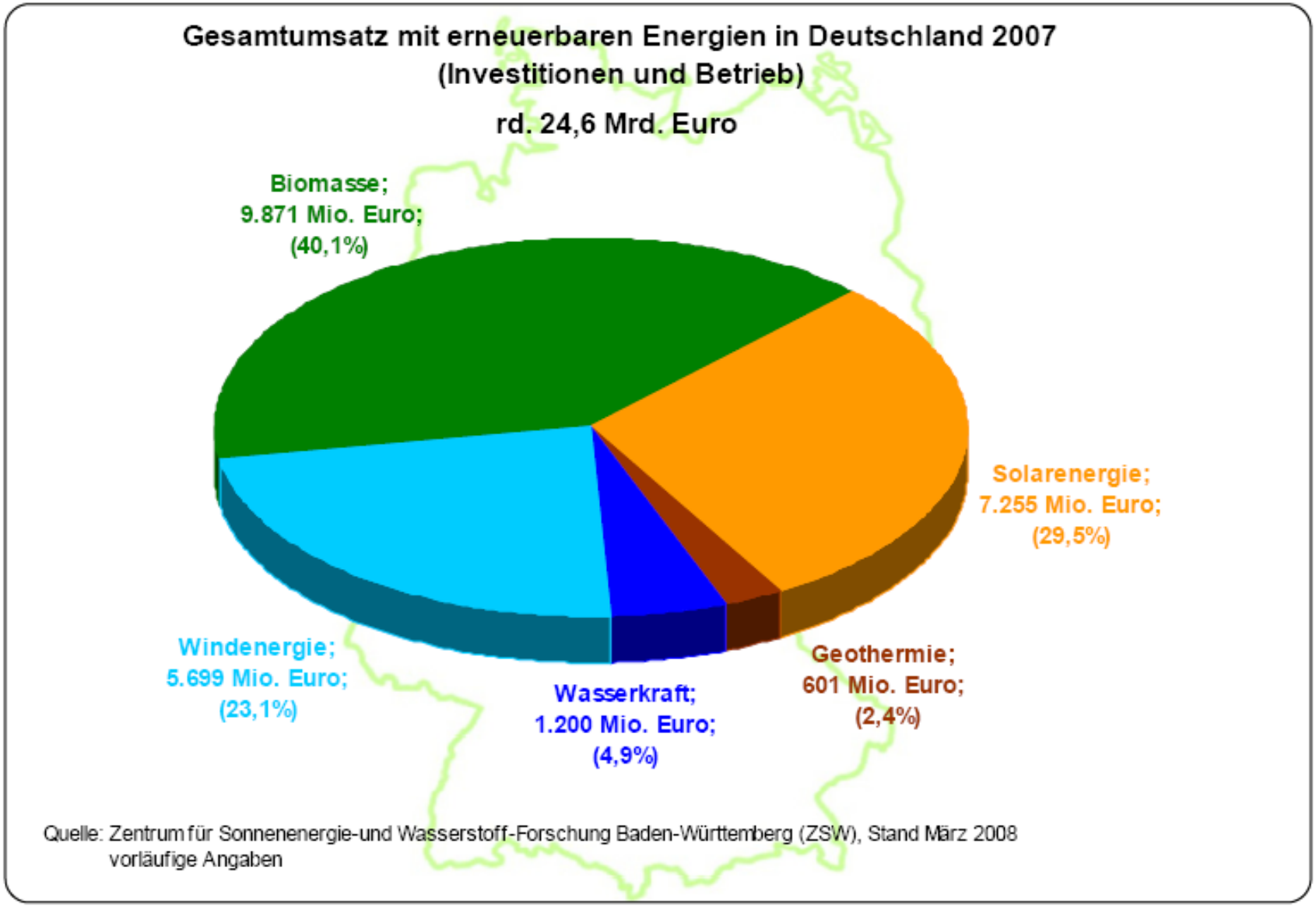
- **Market distortions, market dominance** by incumbent industry and **lack of internalising externalities** are the main reasons for relatively slow market penetration of renewable energy.
- **Support schemes** and **strong political support** are necessary to overcome these barriers.
- **Cost reductions** through steep learning curves and economies of scale make renewable energies economically viable – one by one.

The German Case:

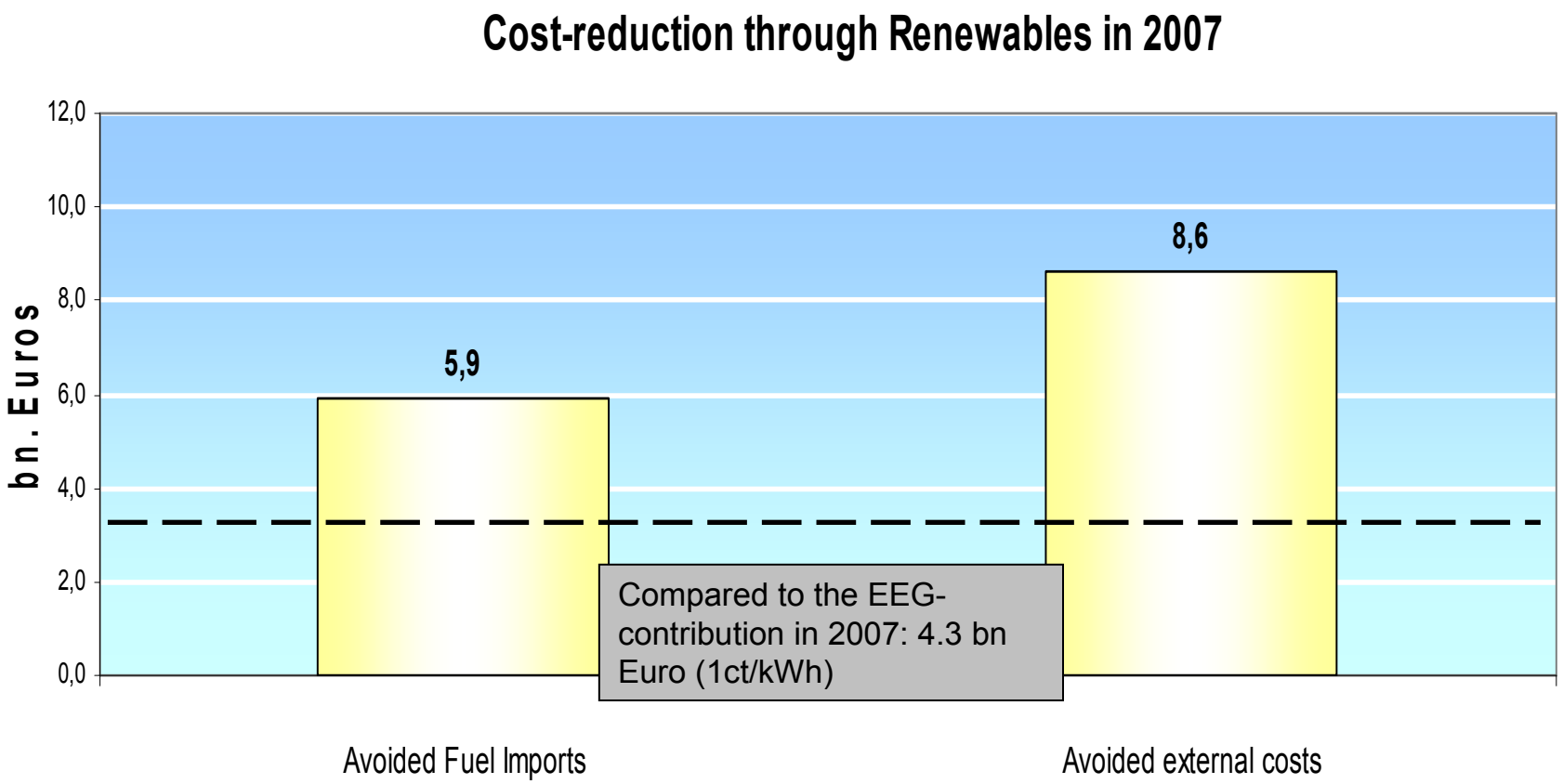
Strong commitment triggers development

- A **stable and reliable support framework** was established - based on strong public support and overwhelming commitment of political parties, government and NGOs.
- New market players – mostly SME – compete with incumbent utilities, fostering **technology development** in various sectors and creating economic **growth**.
- Renewable energies are a major element of **supply security**, **greenhouse gas savings**, **job creation**, and **cost reduction** for consumers.

Turnover of the German RE-Industry (2007): 24.6 bn €

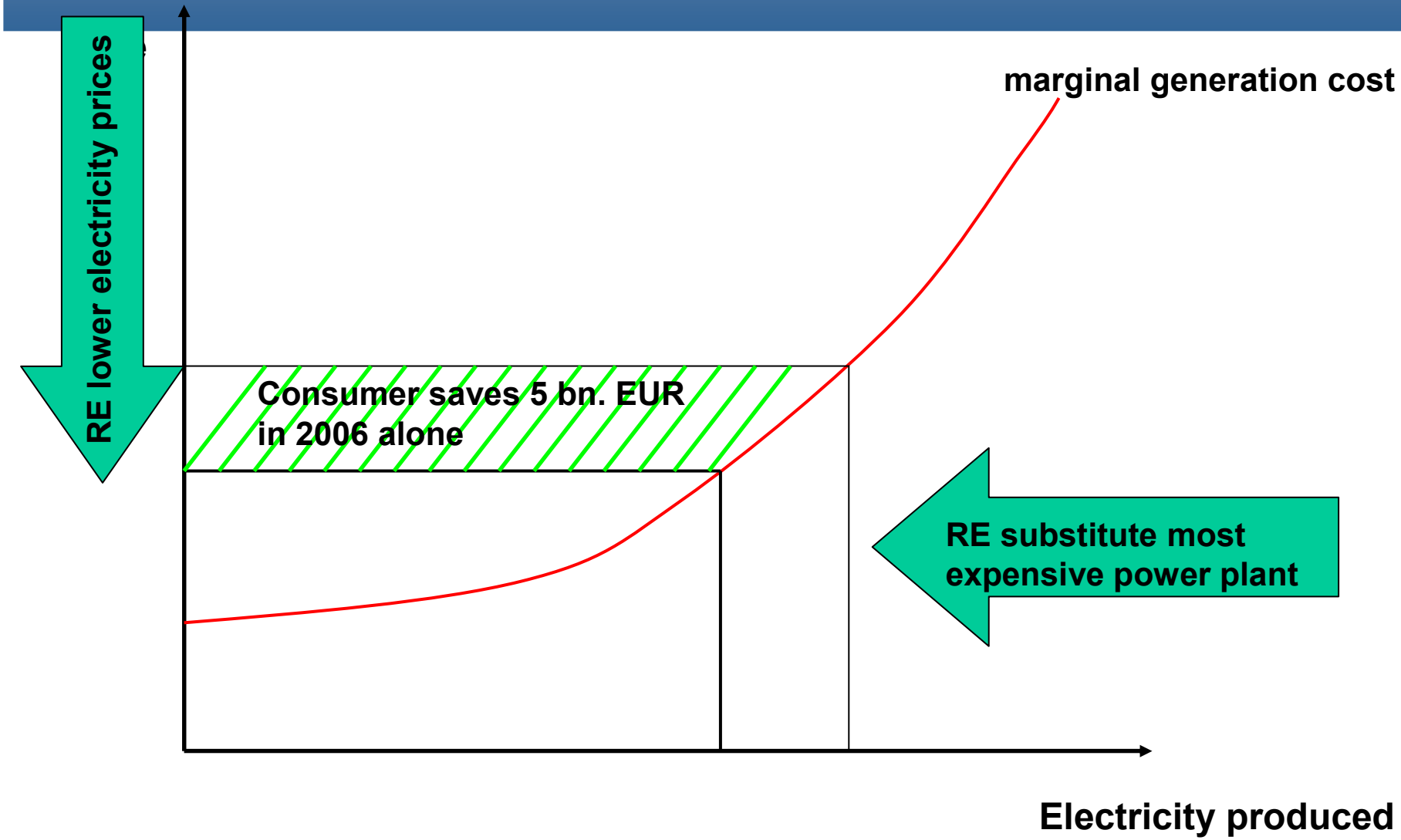


Public benefit: Avoided costs

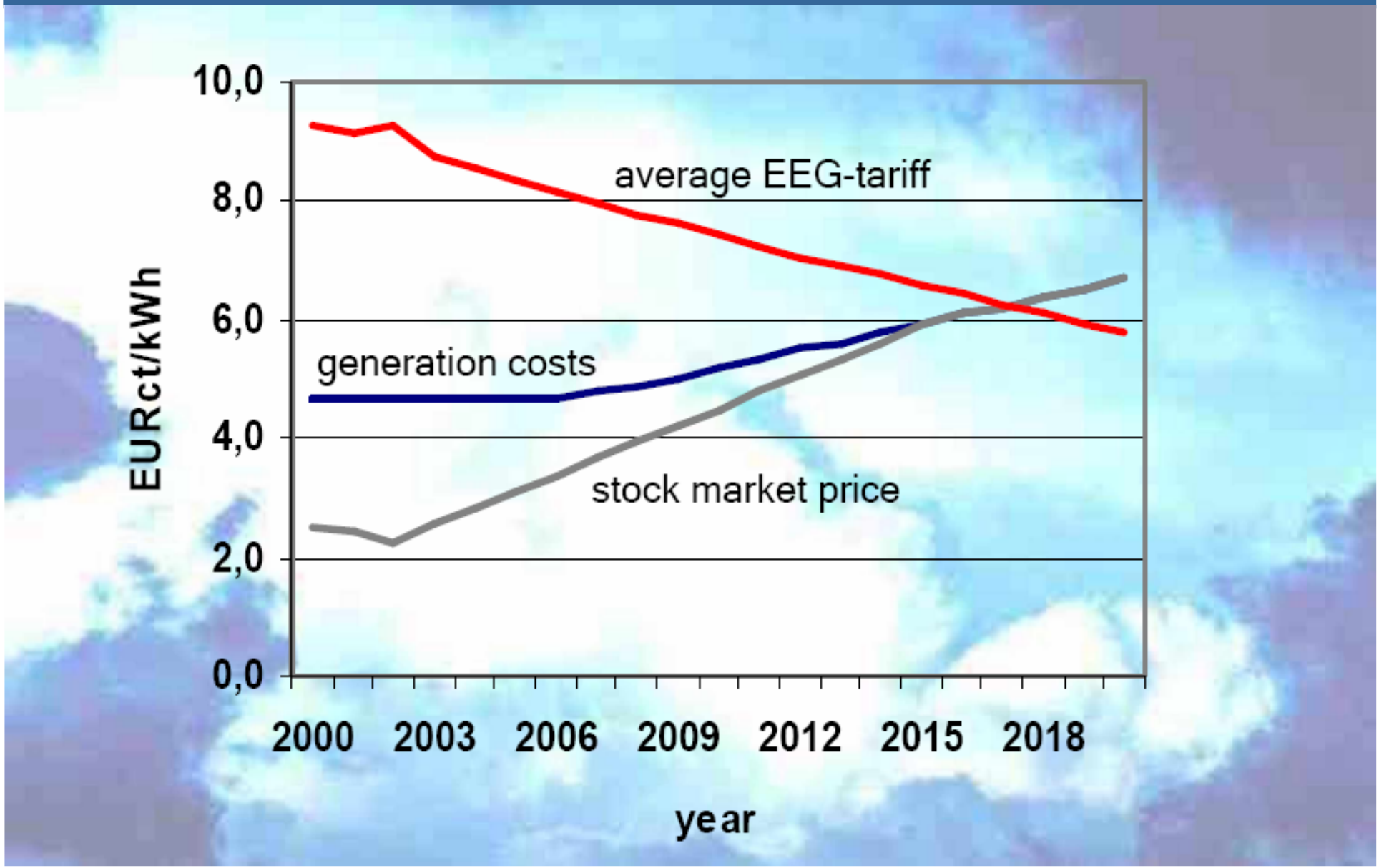


Sources: BEE based on member associations, BAFA, Fraunhofer ISI; growth rates rounded

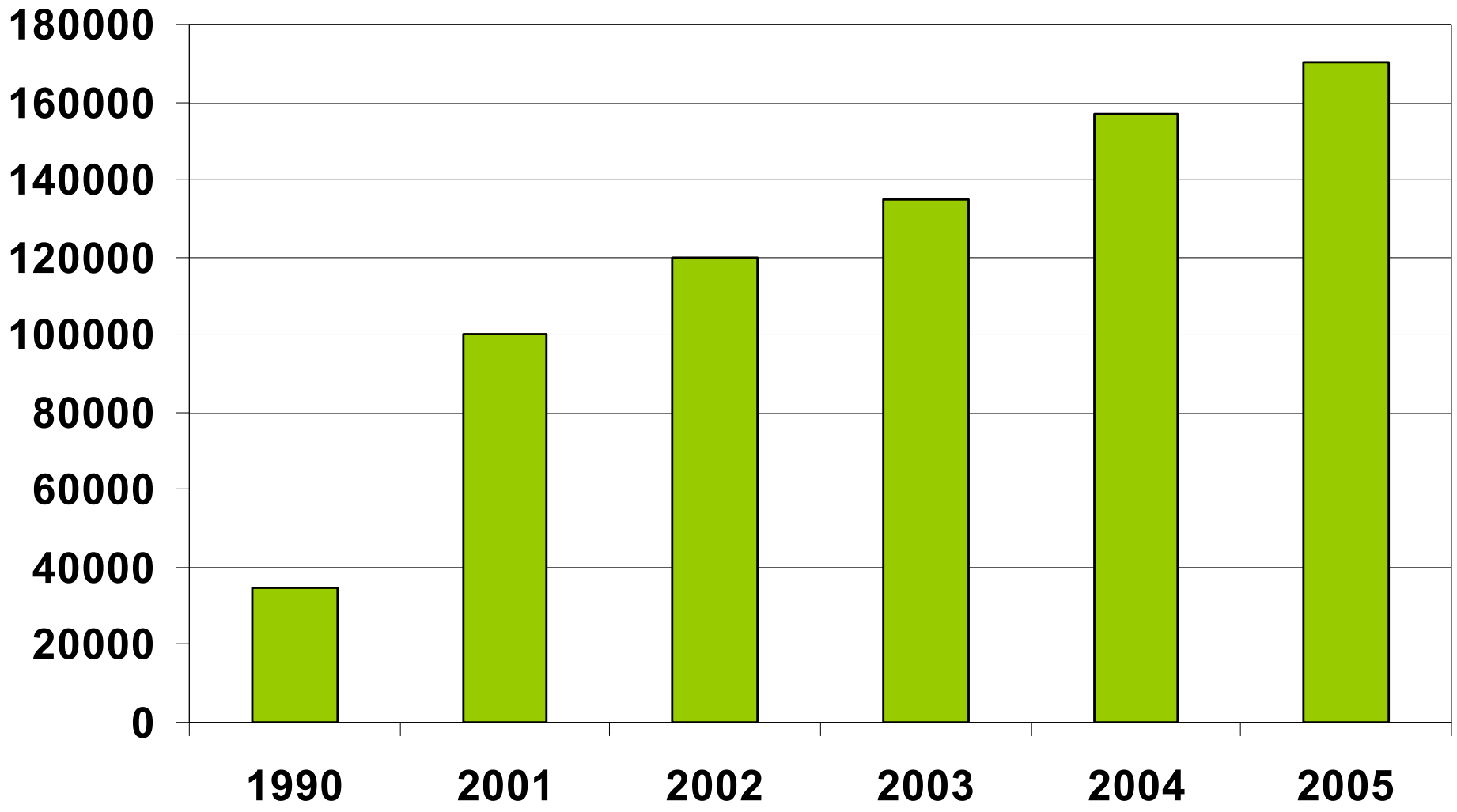
Public benefit: Merit order effect



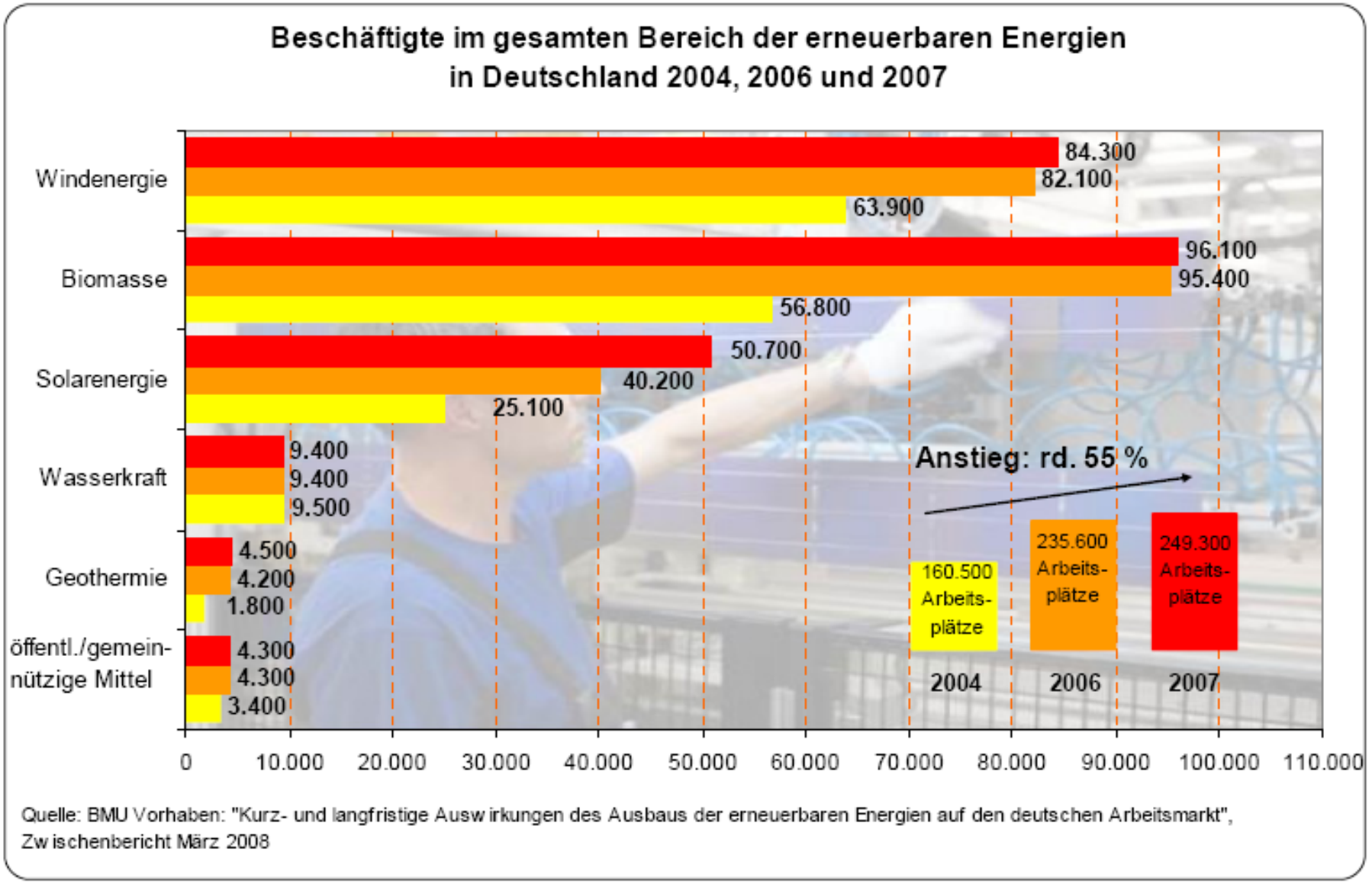
RE will be the cheapest energies



Jobs in the RE-Sector: 170.000 in 2005

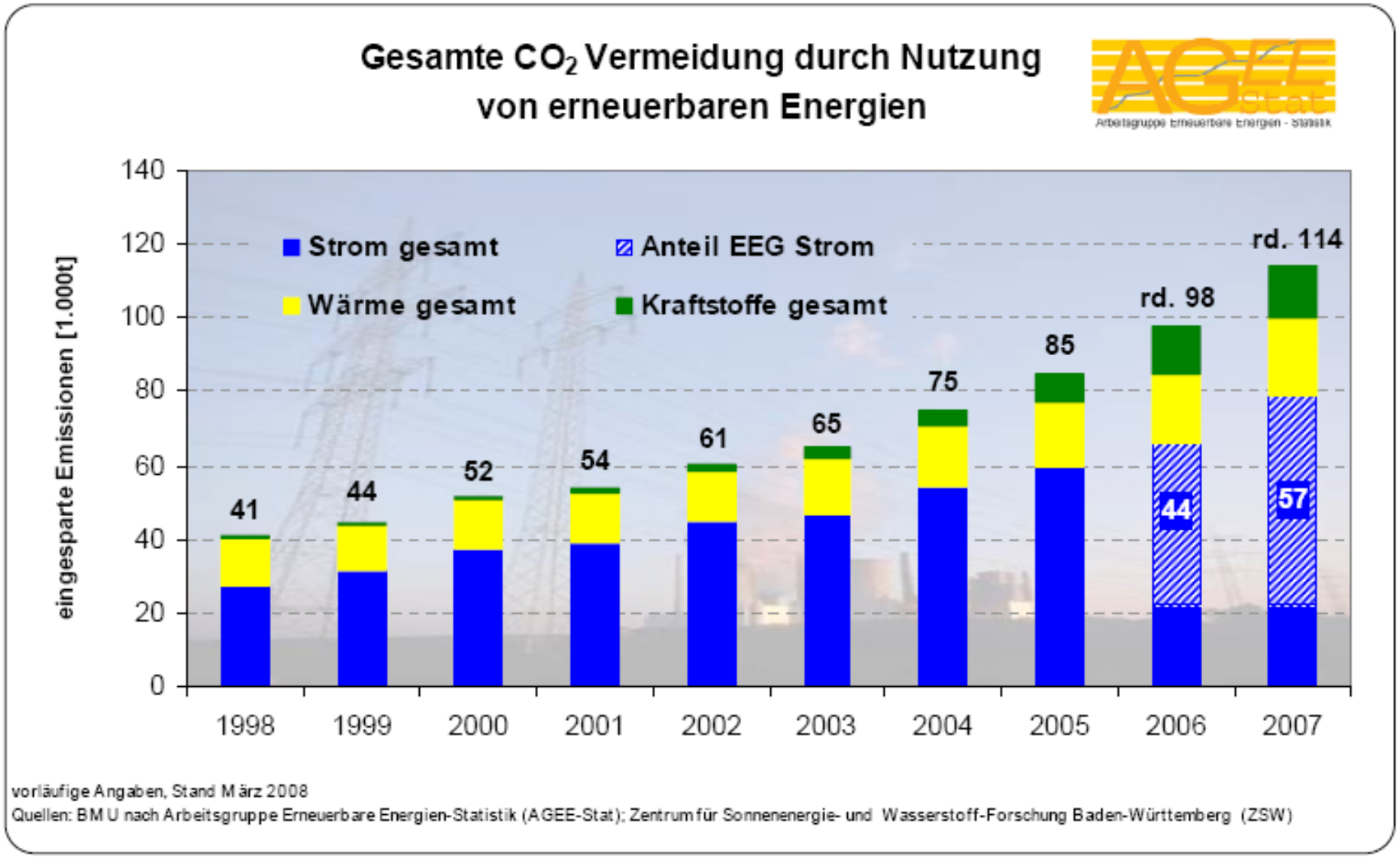


Jobs in the RE-Sector: 250,000 in 2007

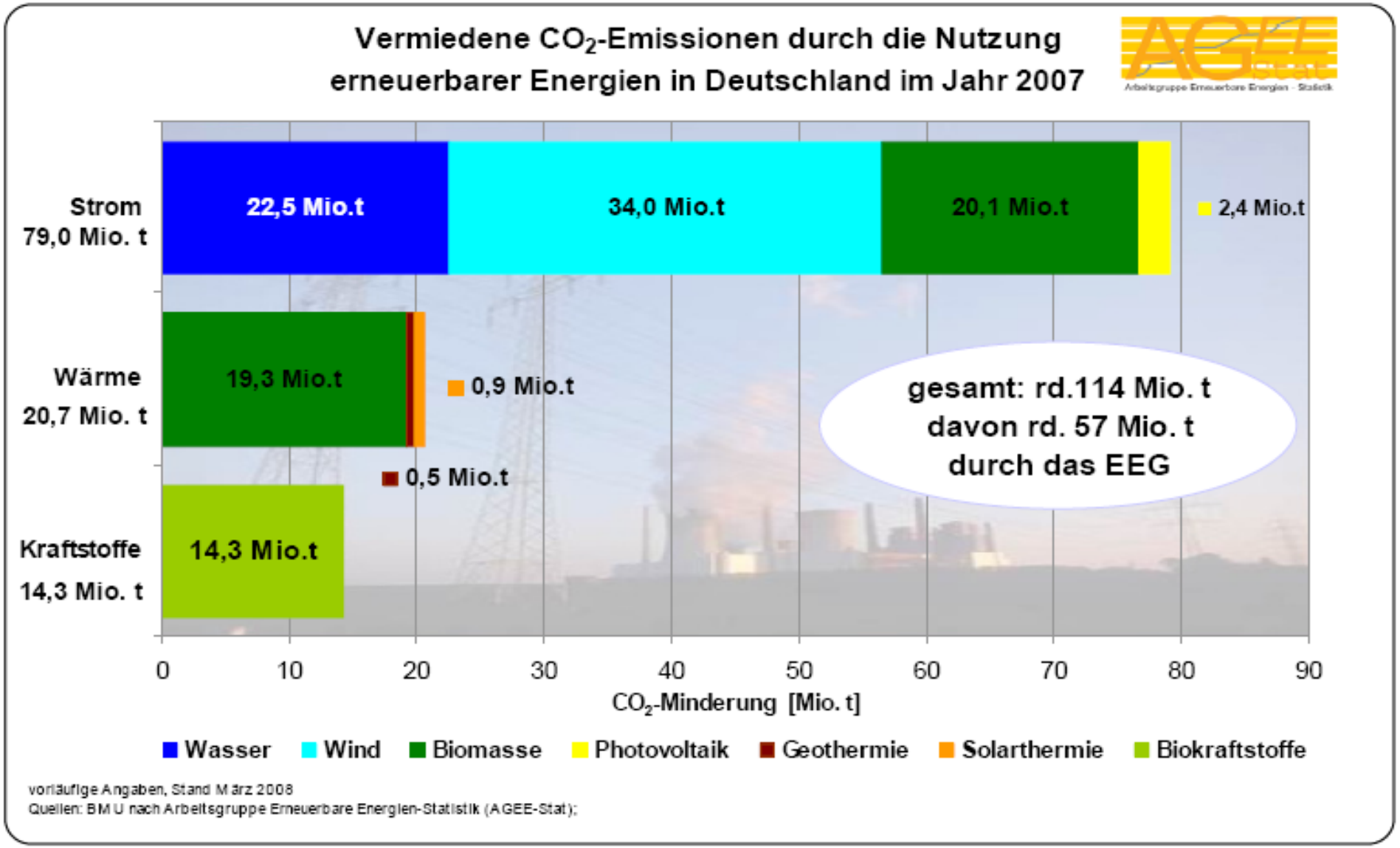


Quelle: BMU Vorhaben: "Kurz- und langfristige Auswirkungen des Ausbaus der erneuerbaren Energien auf den deutschen Arbeitsmarkt", Zwischenbericht März 2008

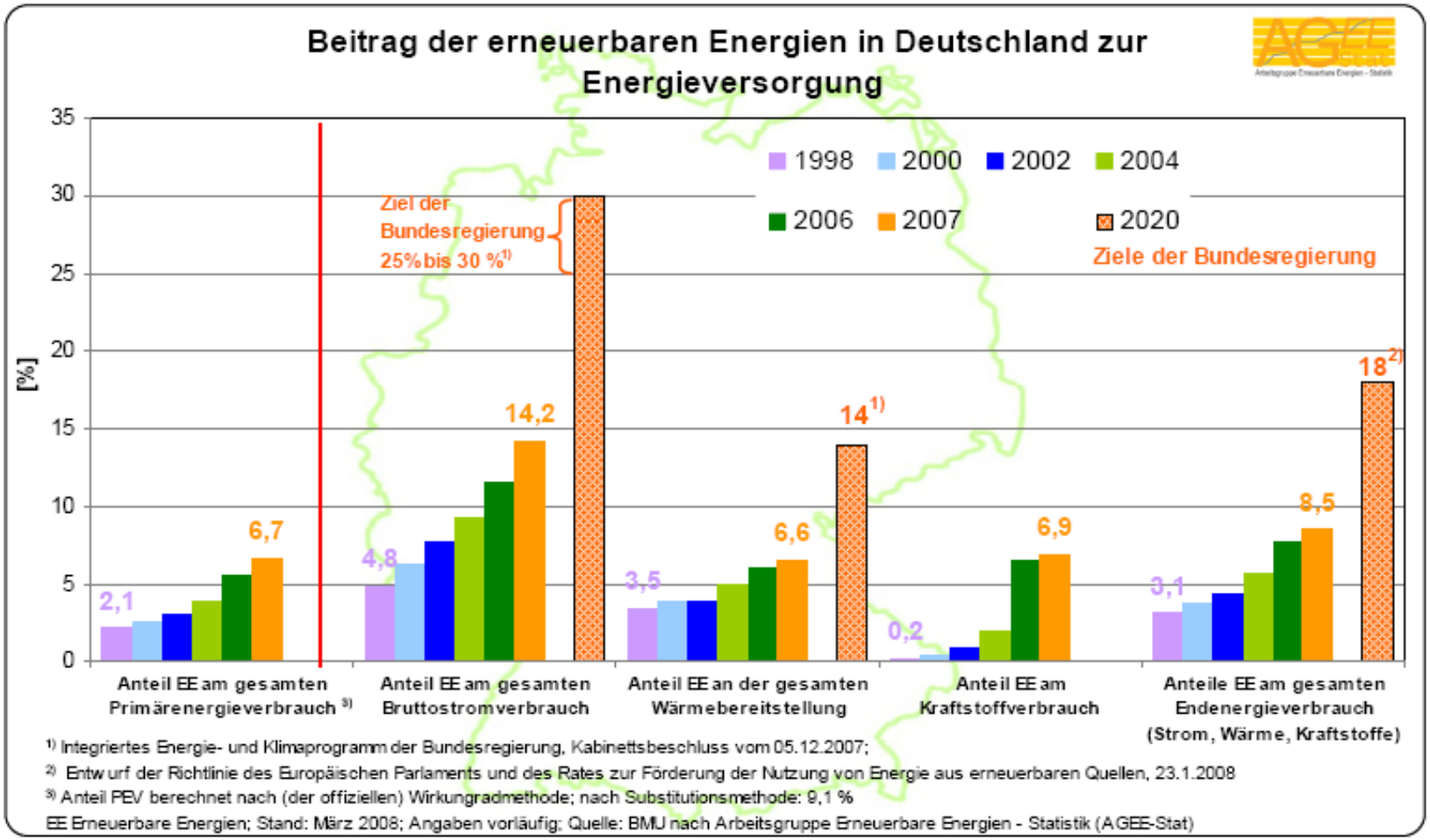
RE reduce CO2-Emissions: 114 million t in 2007



RE reduce CO2-Emissions: 79 million t in electricity

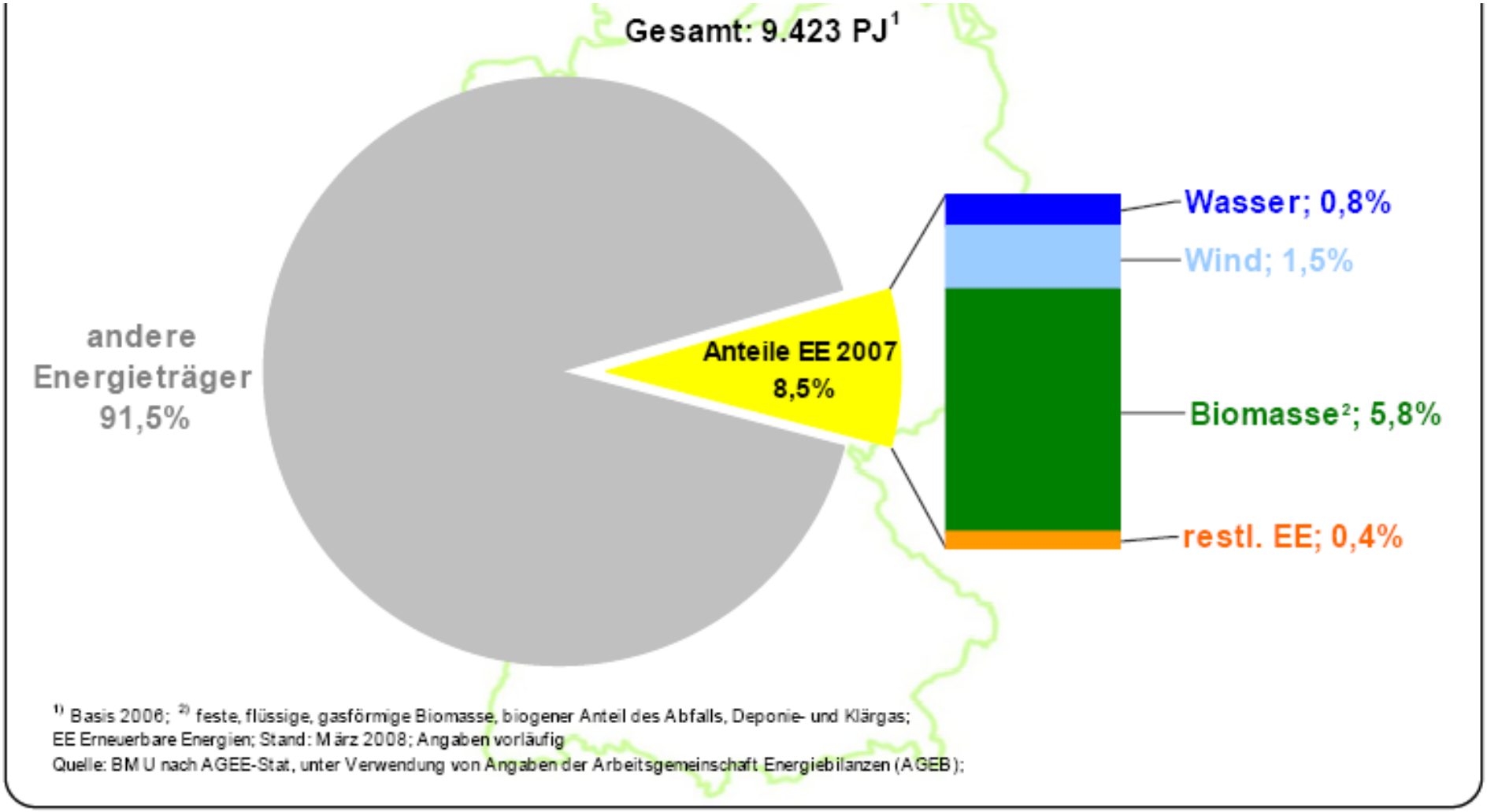


Contribution of RE to Germany‘s Total Energy Supply



Energy-generation from **Renewable Sources** (2007: 219.4 bn. kWh) was **more than** the overall energy consumption of **Portugal, Hungary or Norway**.

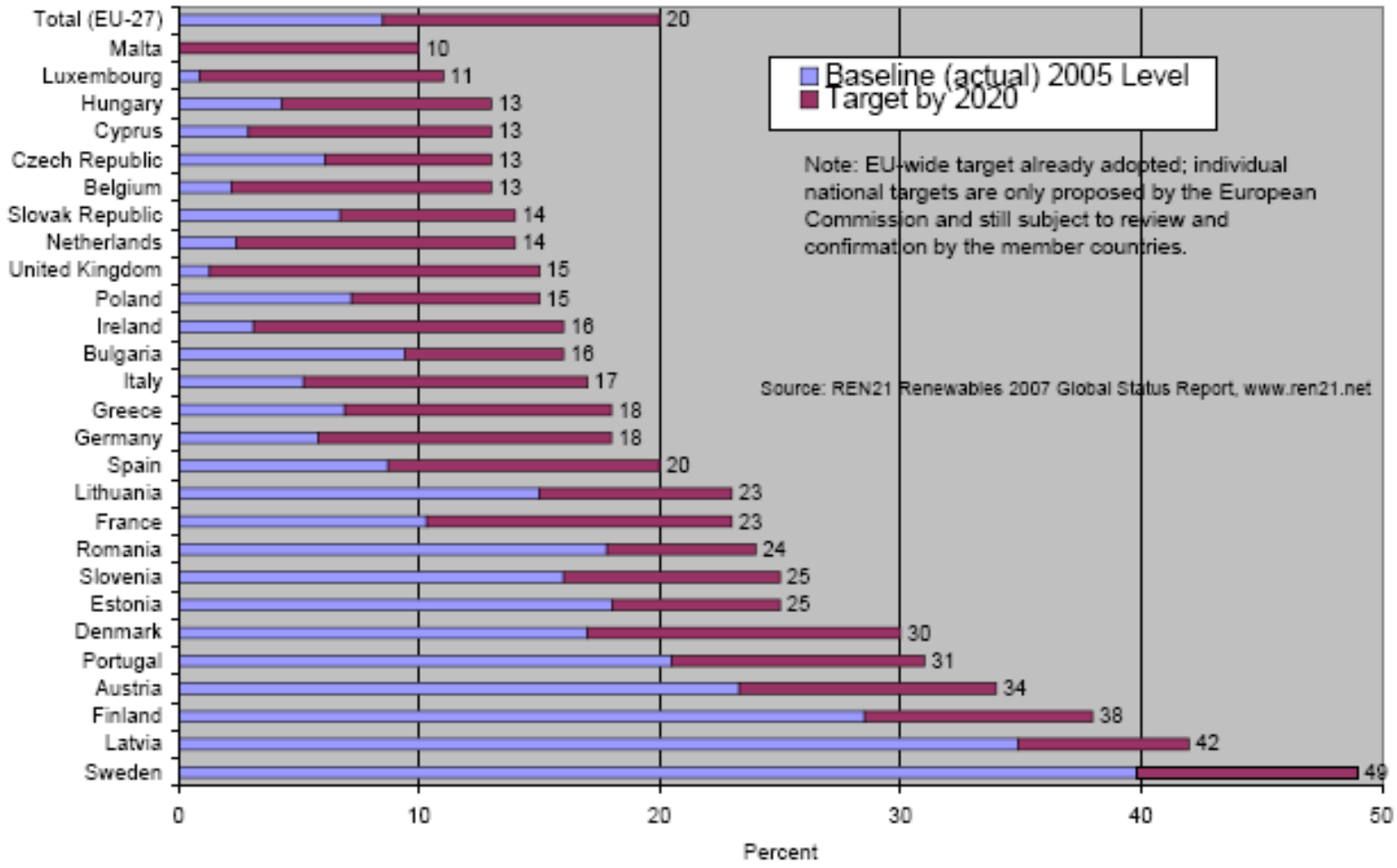
RES in Final Energy Consumption 2007 (Germany)



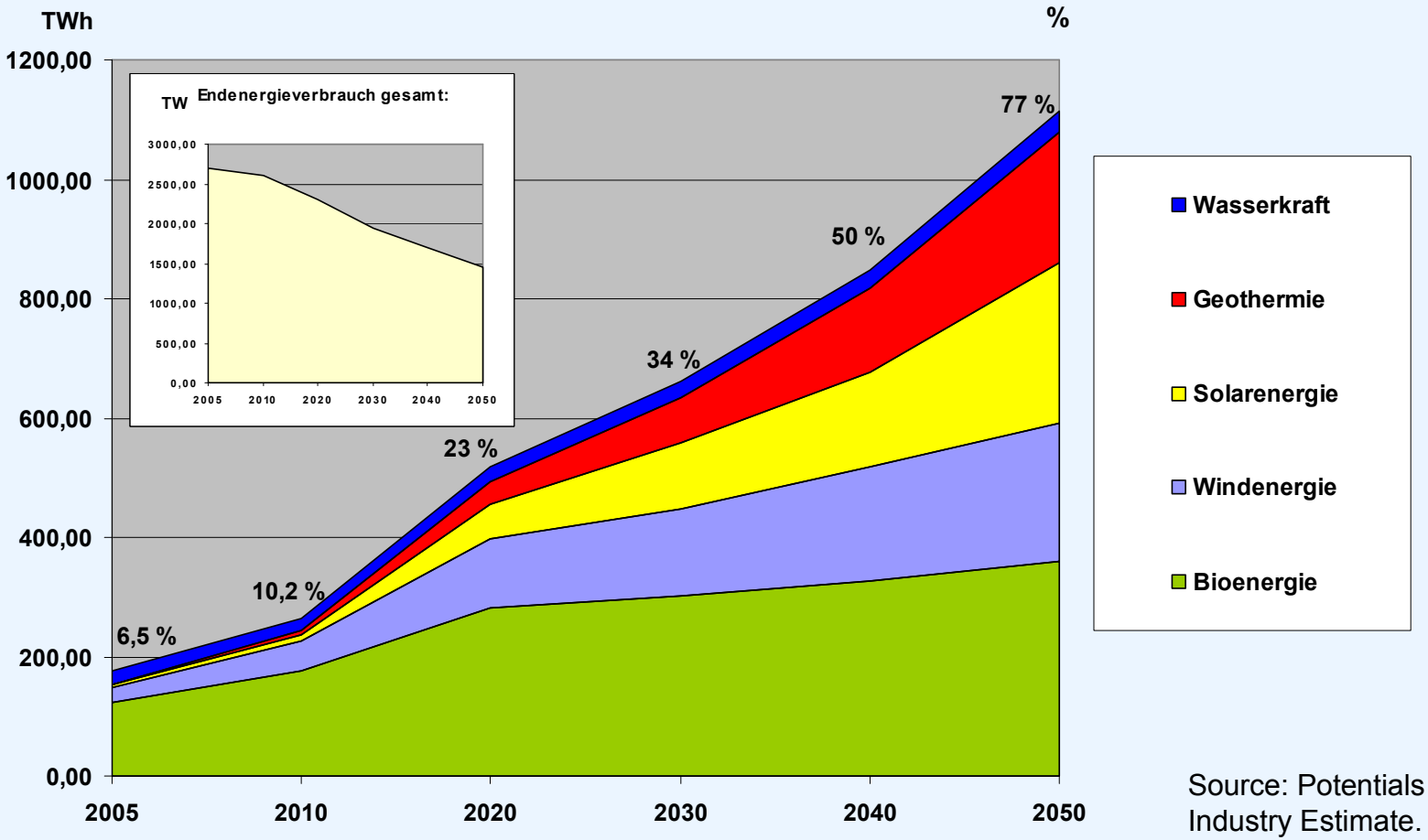
[1] Basis 2006; [2] feste, flüssige, gasförmige Biomasse, biogener Anteil des Abfalls, Deponie- und Klärgas;
EE Erneuerbare Energien; Stand: März 2008; Angaben vorläufig
Quelle: BMU nach AGEE-Stat, unter Verwendung von Angaben der Arbeitsgemeinschaft Energiebilanzen (AGEB);

EU: RE-targets for 2020

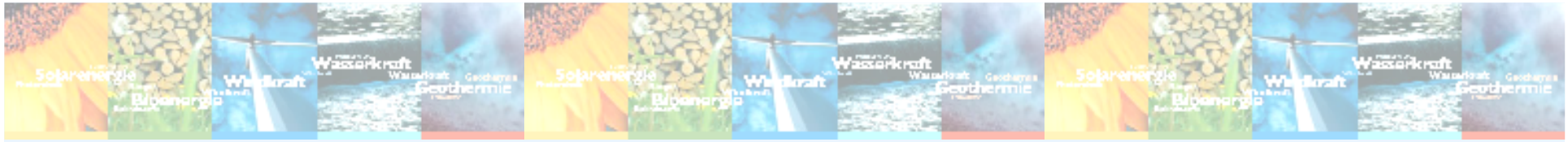
Figure 12. EU Renewable Energy Targets—Share of Final Energy by 2020



Potentials of renewable energies until 2050

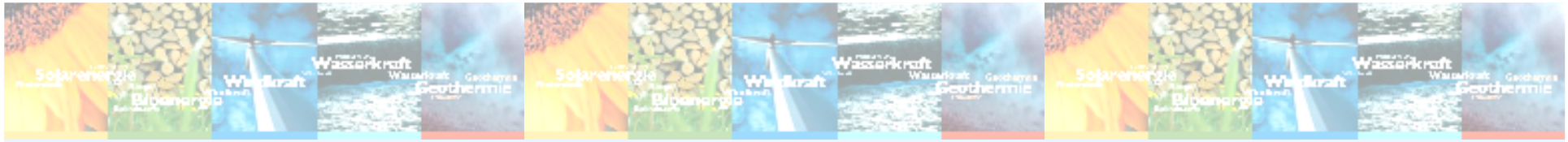


Source: Potentials of RE: Industry Estimate.
Total energy consumption: BMU 2004



Outlook: 1

- Due to rising costs and imminent depletion of resources, fossil and nuclear energies cannot be an option for supply security in the 21st century.
- Given the urgency to stop the increase of global GHG emissions within the next 15 years, “clean fossils” will not even be an interim solution.



Outlook: 2

- Renewable energies are domestic resources of unlimited availability.
- Different technologies will tap the potential, if enabling framework conditions foster their rapid development and large scale deployment.
- Renewables are the only realistic option for mitigation of climate change and for a sustainable energy future.

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