



**WTO Workshop on
Environmental Goods and Services
Geneva, 23-35 September, 2009**

Developing Markets for Renewable Energy Technologies

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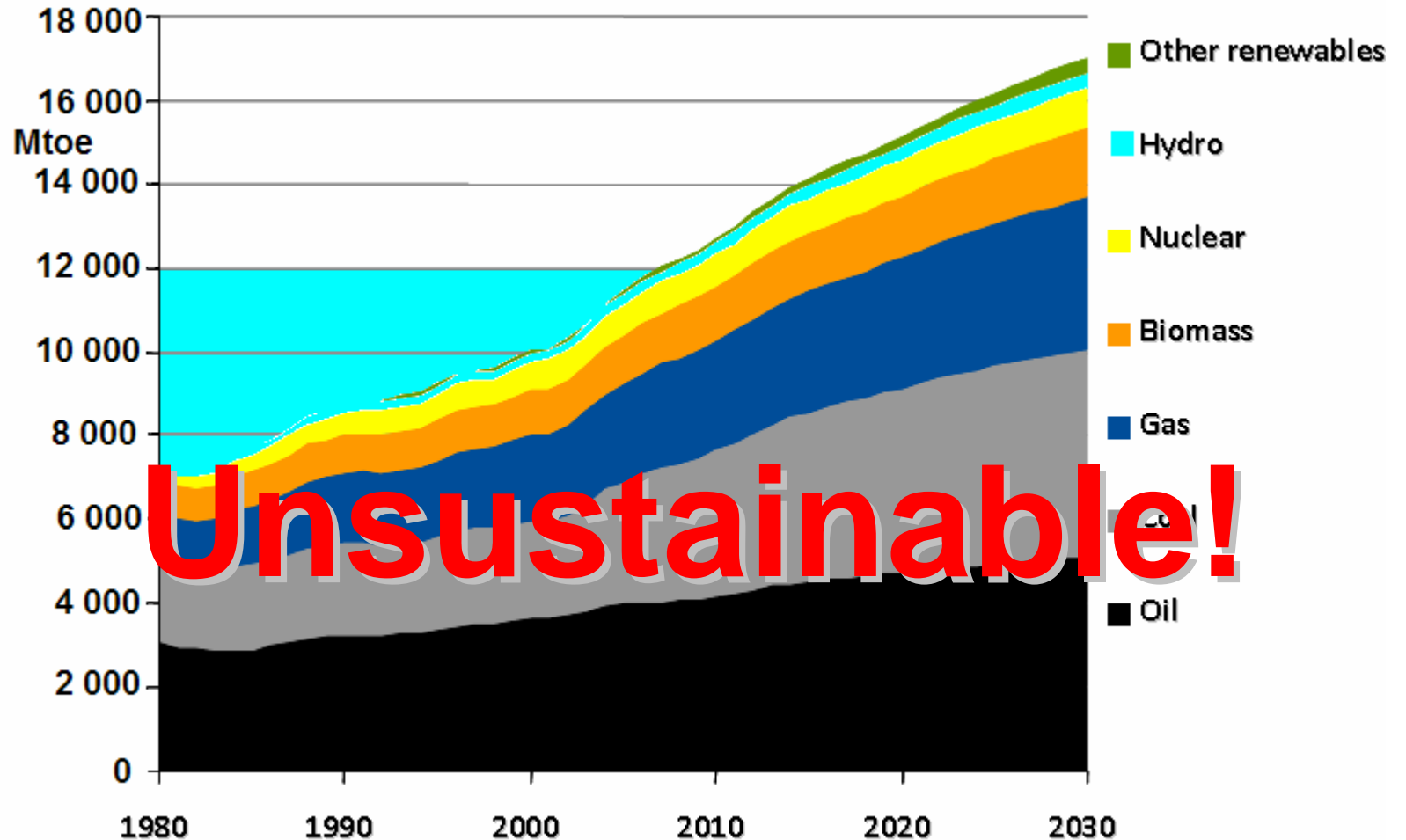
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Aims in the next 20 minutes.....

- **To review the growing importance for renewable energy deployment.**
- **To outline the markets for renewable energy technologies with emphasis on solar and wind, but also bioenergy.**
- **To consider market drivers and growth prospects.**



World primary energy demand in the IEA WEO 2008 Reference Scenario 1980-2030



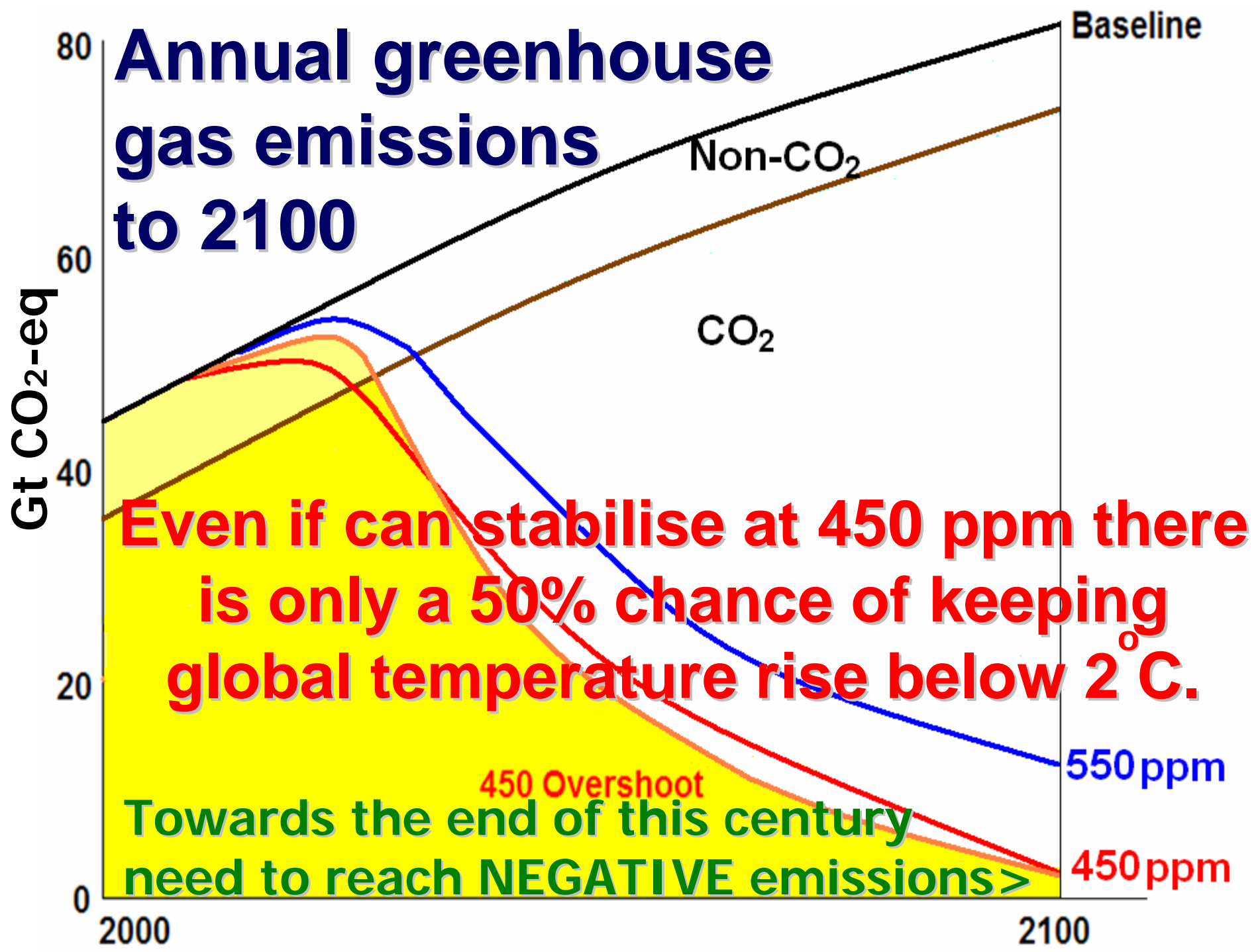
Unsustainable!

Current policies will lead to growth of 45% in energy demand by 2030 and a fossil fuel future.

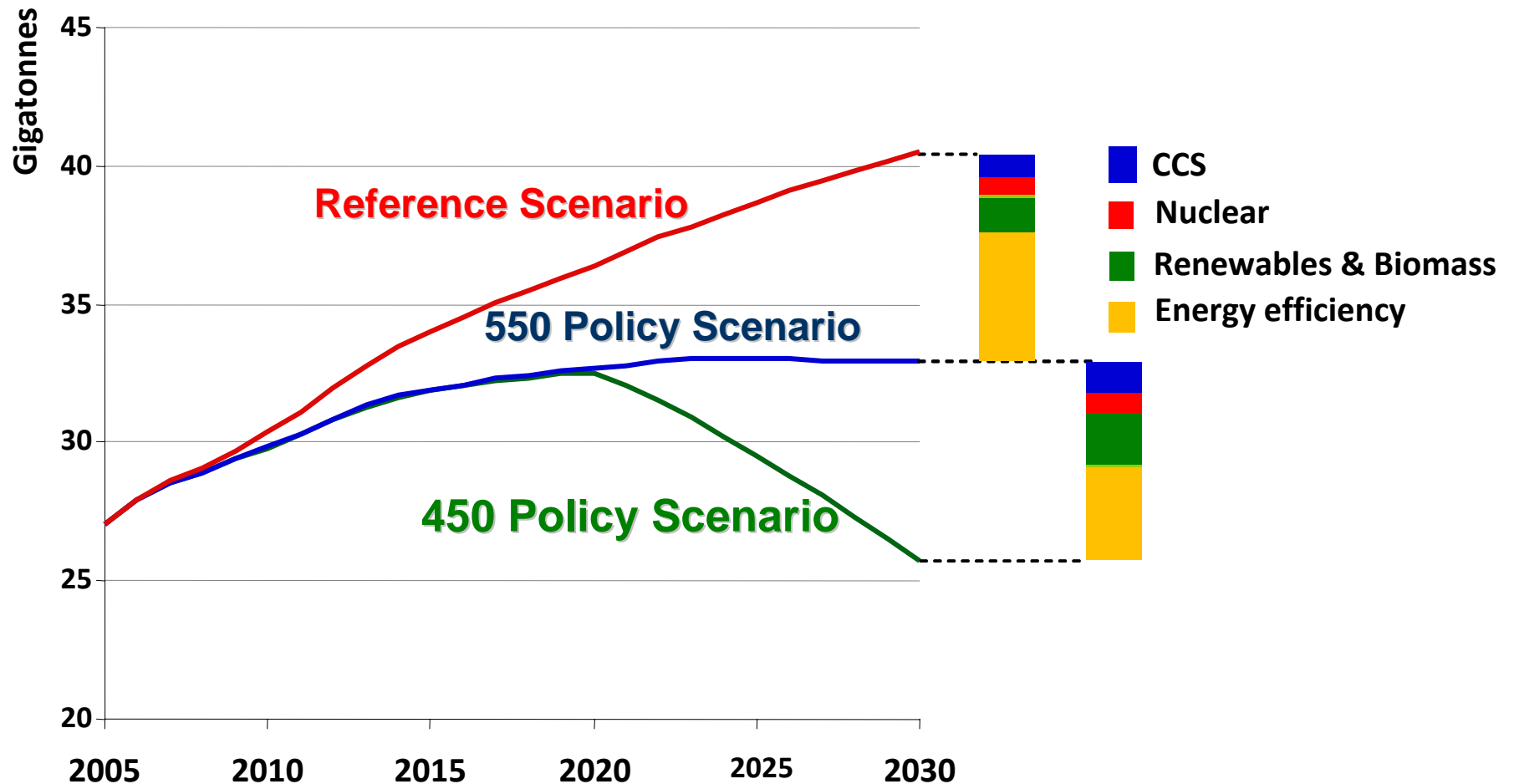


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Annual greenhouse gas emissions to 2100



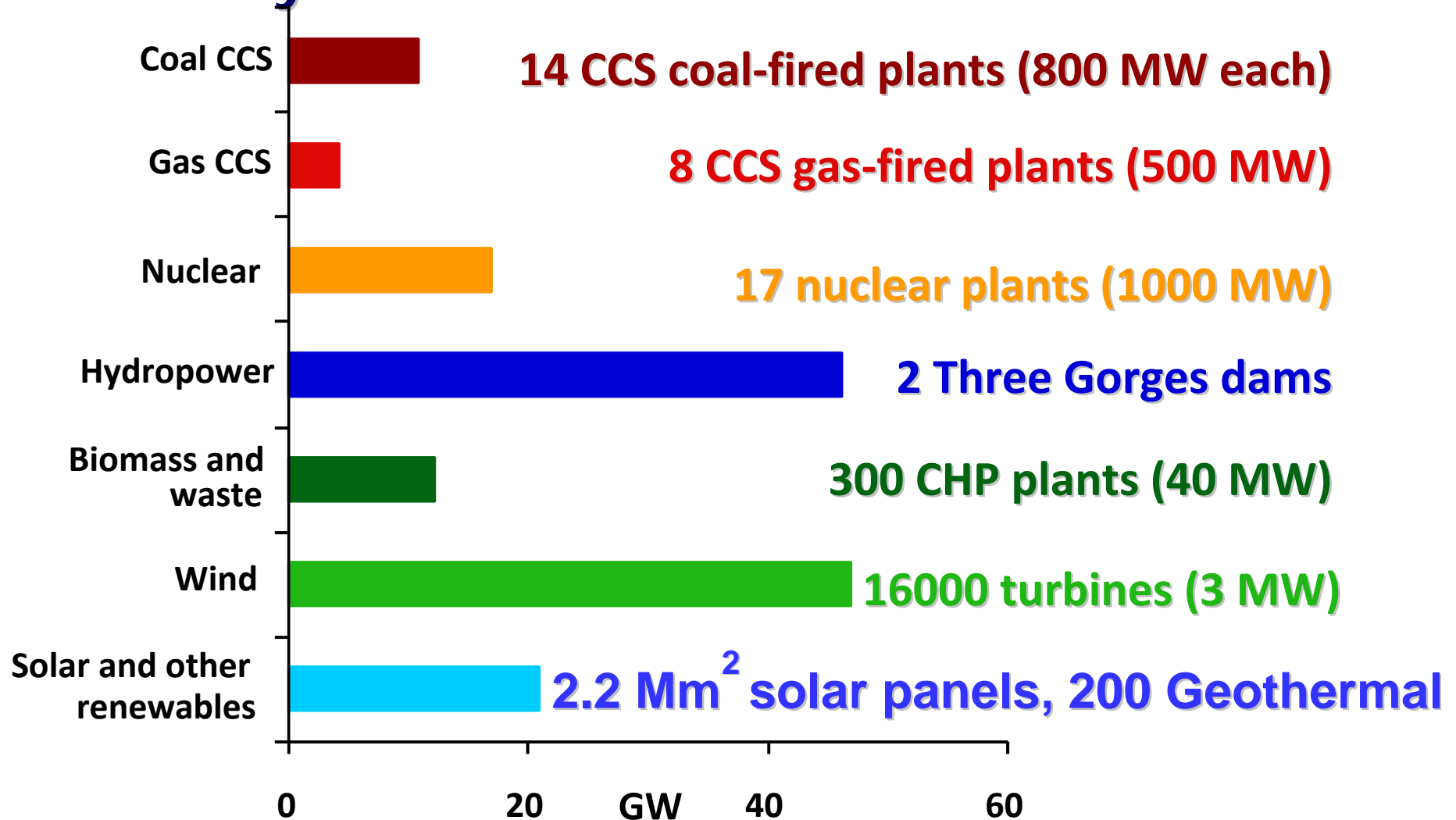
IEA WEO 2008 climate-policy scenarios. Reductions in annual energy-related CO₂ emissions



For 450 ppm CO₂-eq *additional* deployment of existing *and* *new* low-carbon technologies accounts for most savings at

US\$ 180 /t CO₂

Annual power capacity additions needed for the 450 Policy Scenario – from 2012-2030.



All new generating capacity built after 2012 has to be “carbon-free” and 15% of existing capacity is retired early.



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ENERGY TECHNOLOGY PERSPECTIVES

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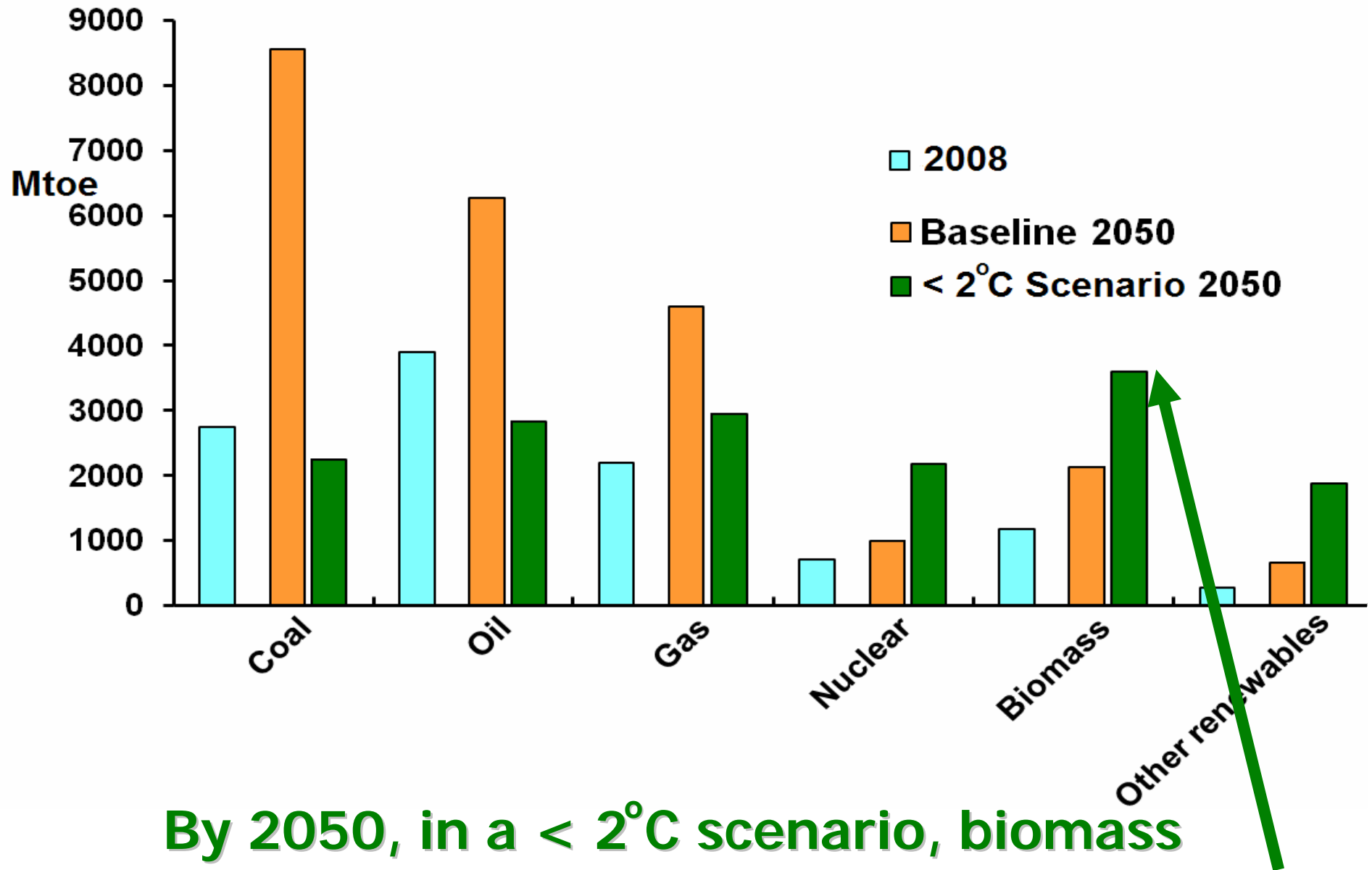
In support of the G8 Plan of Action

Scenarios &
Strategies
to 2050



www.iea.org

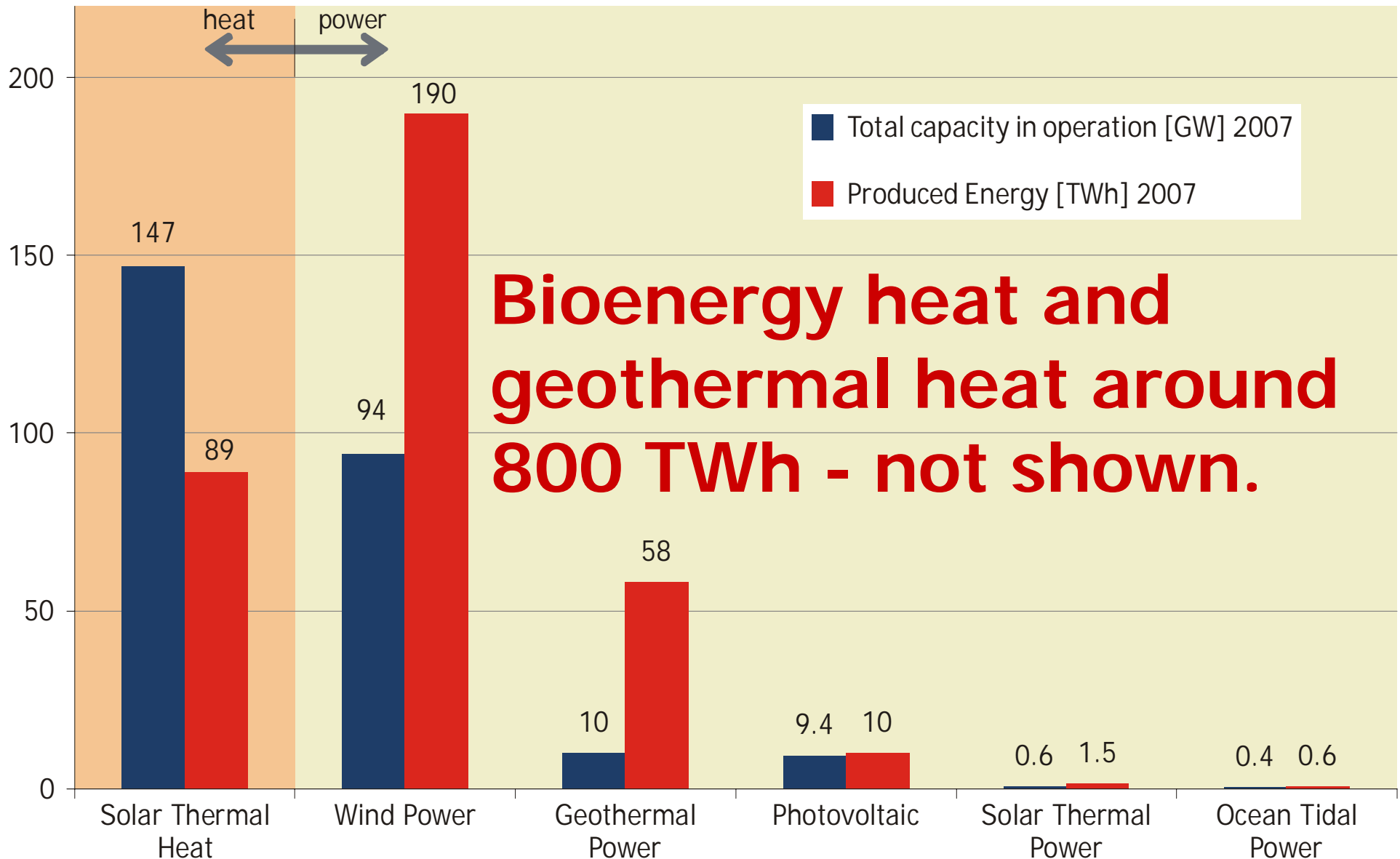
Primary energy supply by 2050.



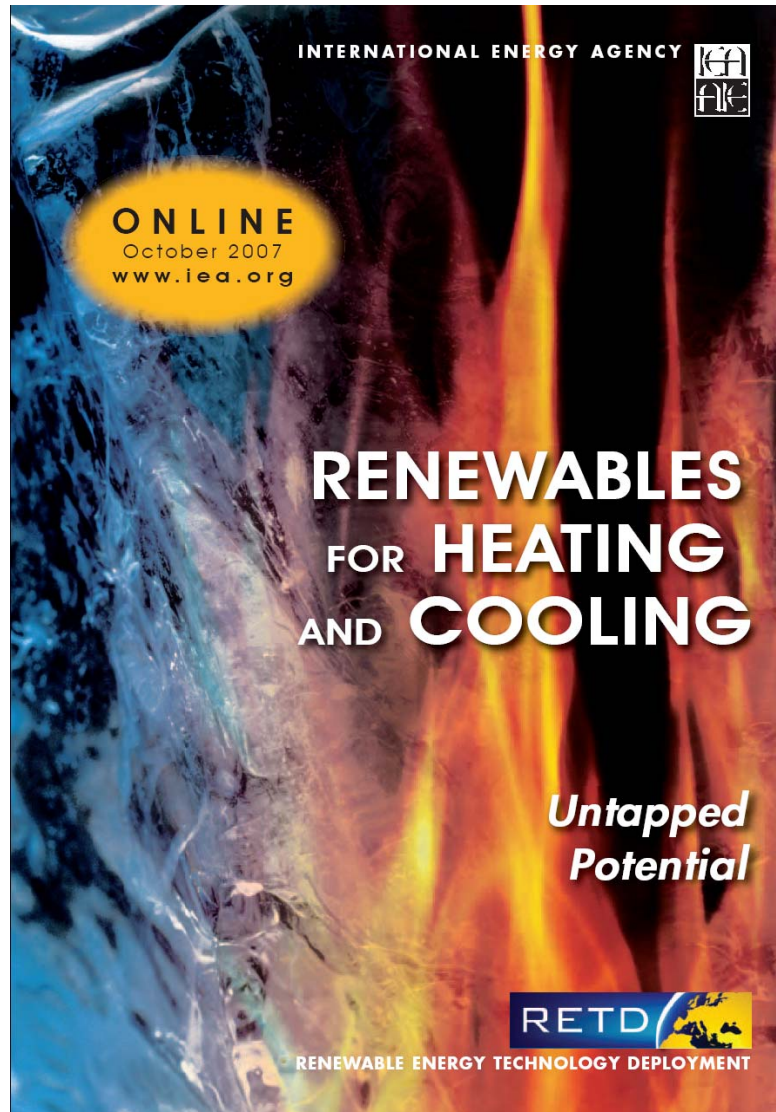
By 2050, in a < 2°C scenario, biomass becomes the greatest source of primary energy

Capacity and energy from renewables

Total Capacity in Operation [GW_{el}], [GW_{th}] and Produced Energy [TWh_{el}], [TWh_{th}], 2007



Renewables for Heating and Cooling – the sleeping giant!



40% of our energy use is for heat!

Biomass provides much of it.

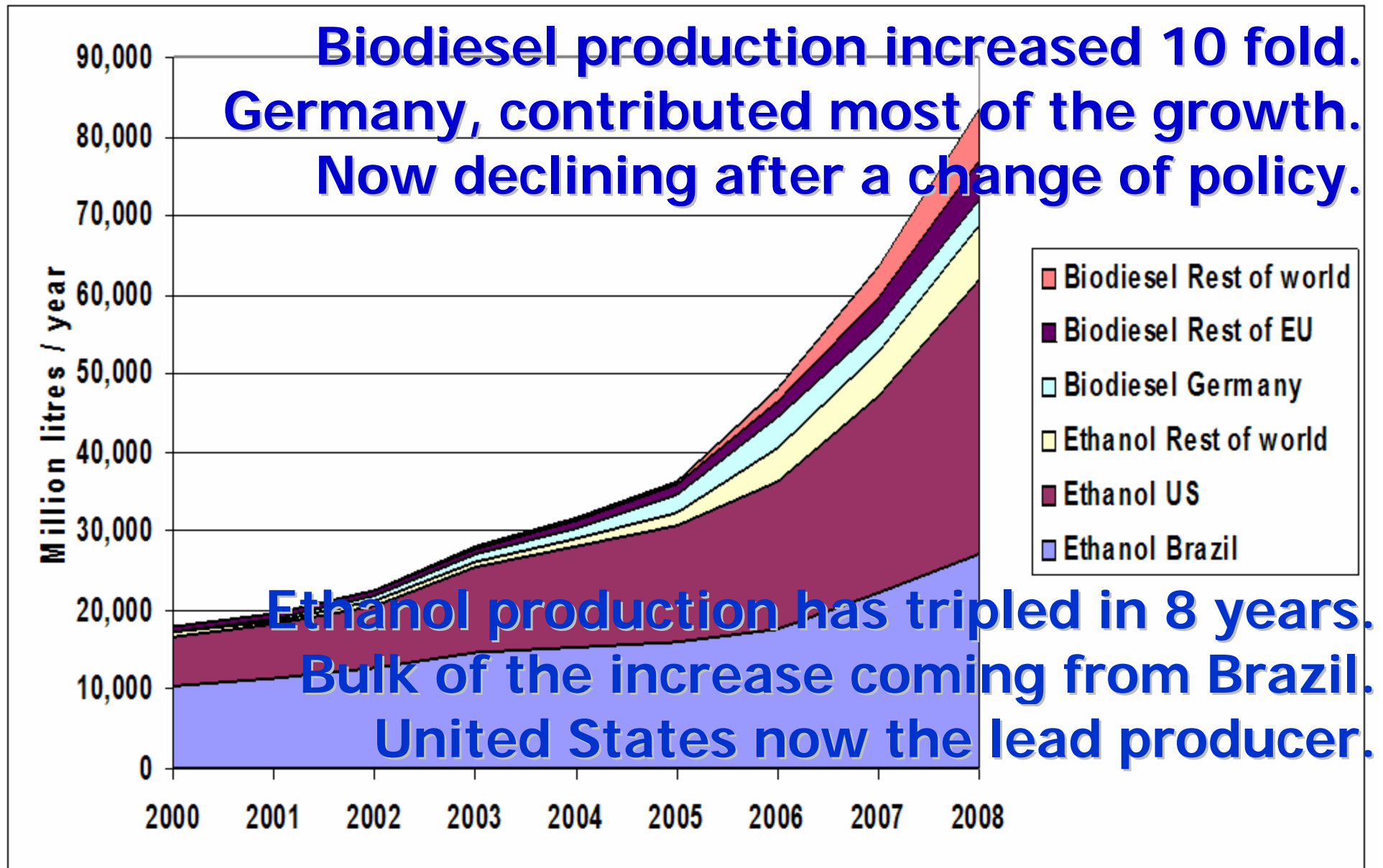
Free download of the 200 page report from www.iea.org

Transport biofuel options

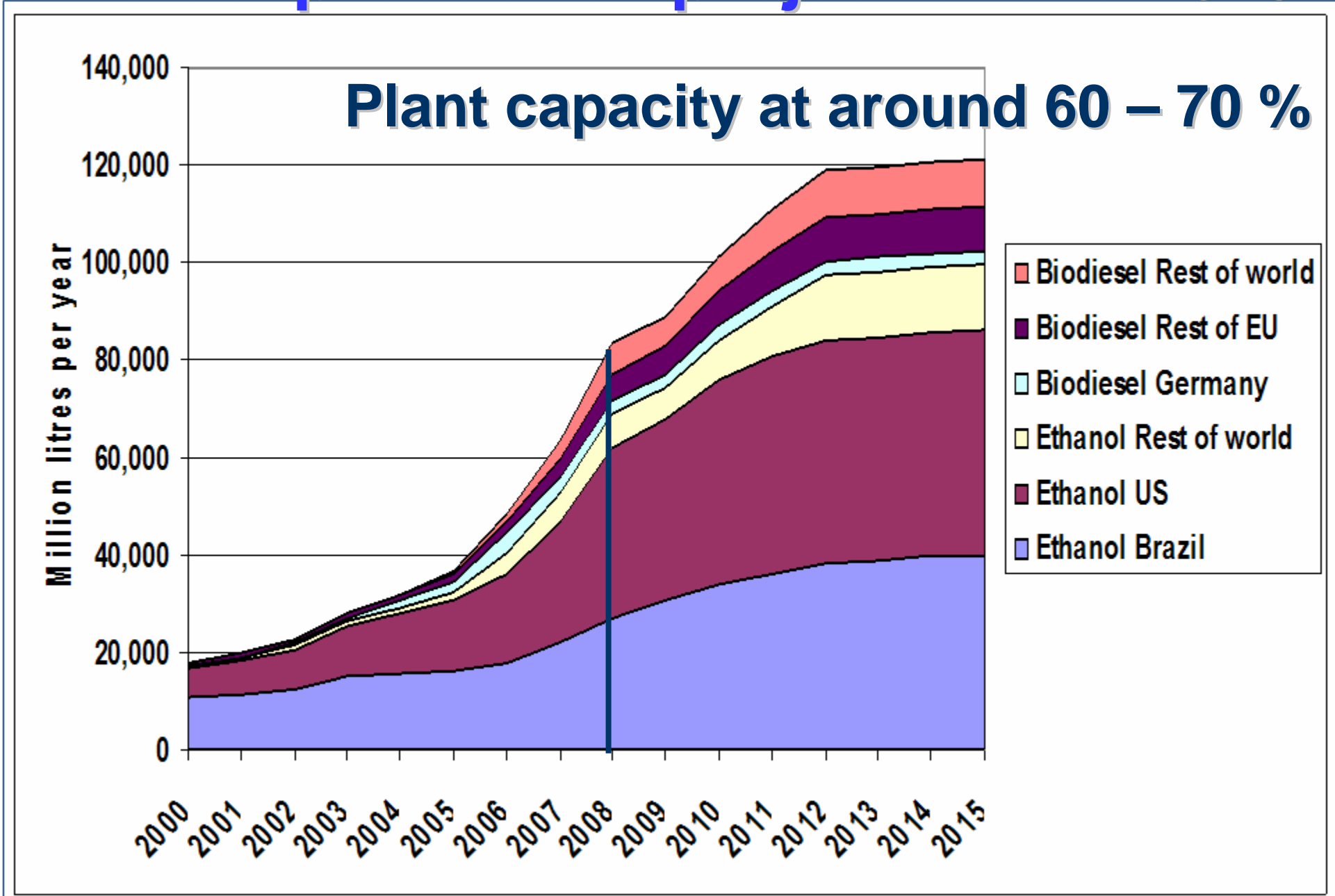


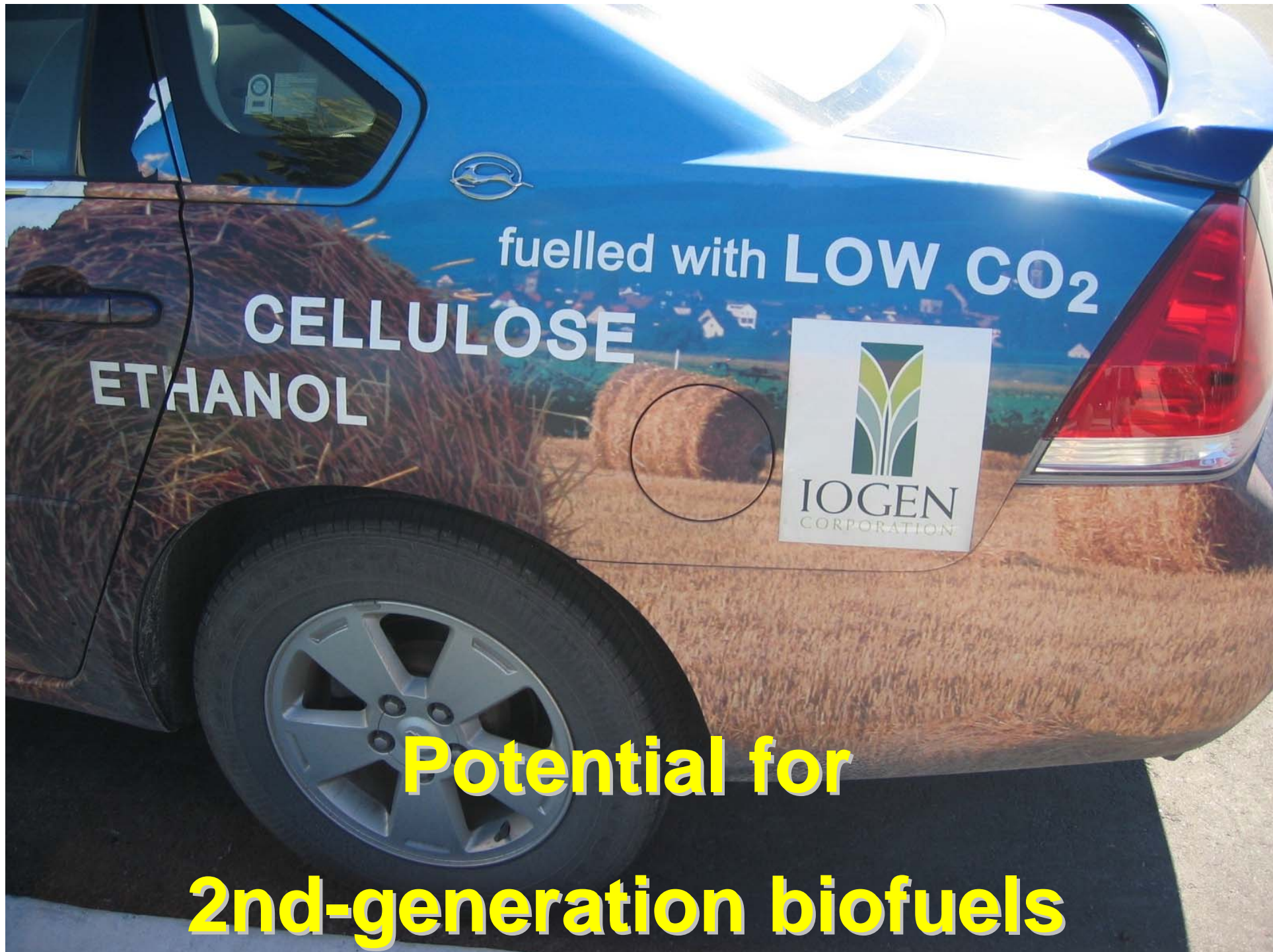
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Recent trends in biofuel production



Biofuel production projections to 2015





fuelled with **LOW CO₂**
CELLULOSE
ETHANOL



Potential for
2nd-generation biofuels

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AGENCE INTERNATIONALE DE L'ENERGIE



FROM 1st- TO 2nd-GENERATION BIOFUEL TECHNOLOGIES

*An overview of current
industry and RD&D activities*

RALPH SIMS, MICHAEL TAYLOR
INTERNATIONAL ENERGY AGENCY
AND JACK SADDLER, WARREN MABEE

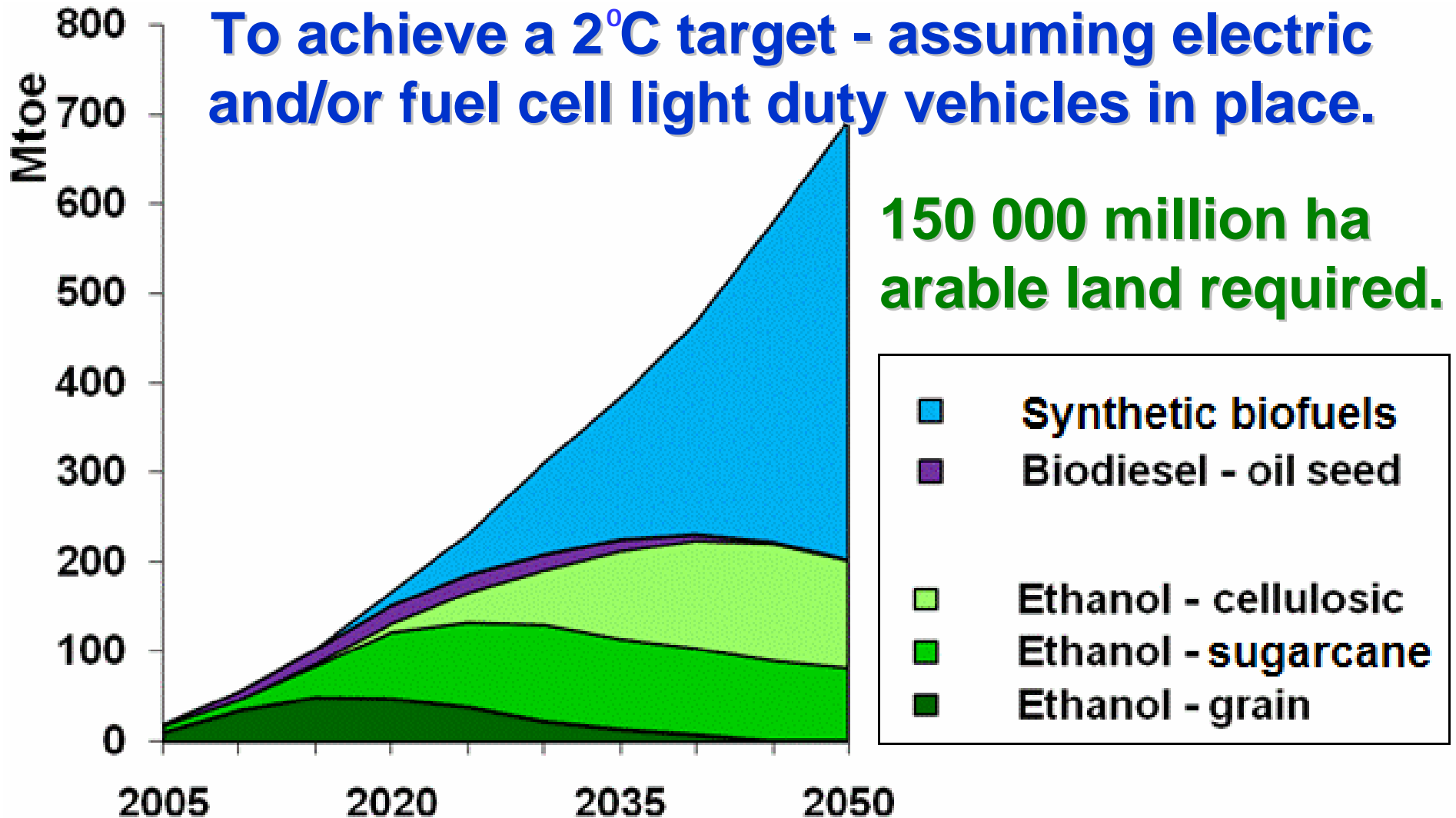
IEA Bioenergy

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Biofuels in 2050 – IEA “ETP” scenario

To achieve a 2°C target - assuming electric and/or fuel cell light duty vehicles in place.

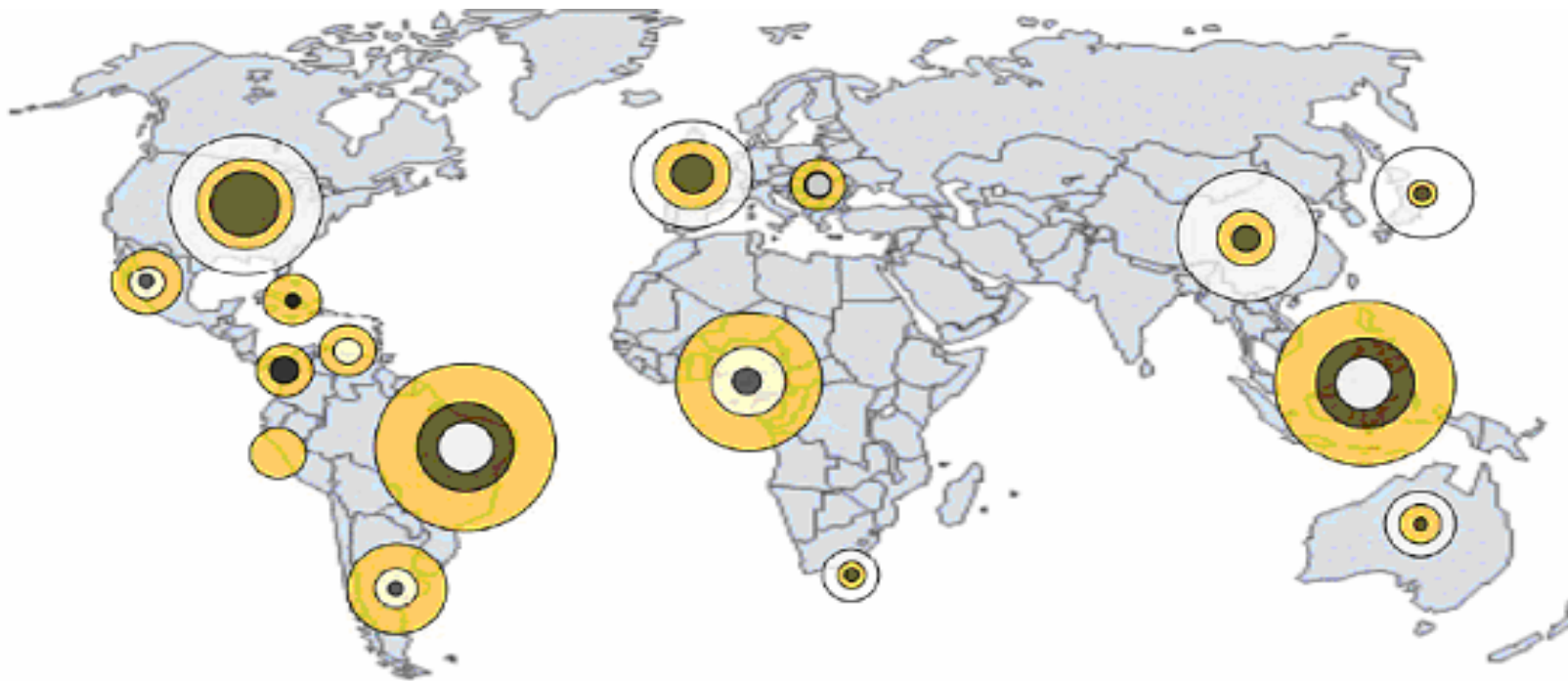


Most biofuel growth after 2020 will be 2nd-generation.

Synthetic biofuels after 2030 needed mainly for aviation, heavy trucks and marine purposes.

Sustainable Biofuels Consensus

Rockefeller Foundation Centre, Bellagio.



- Feedstock potential based on land available for devotion to first generation biofuel feedstocks.
- Theoretical biofuel demand, assessed to be ~30% of liquid transport fuel consumption in 2006.
- Biofuel production capacity in place at year end 2006.

- Feedstock potential exceeds biofuel demand and surplus production capacity - so export.
- Capacity less than biofuel demand so investment in infrastructure warranted to encourage export potential.
- Feedstock constrained and capacity less than demand - so import.

Source: New Energy Finance www.newenergyfinance.com

www.renewableenergyworld.com/rea/news/reinsider/story?id=52328



Biomass trade

A regime for the growing trade of solid biomass (pellets, chips) and liquid biofuels is needed.

Adoption of sustainability criteria in the international arena would need to be a part of this process.



Biofuels and the WTO

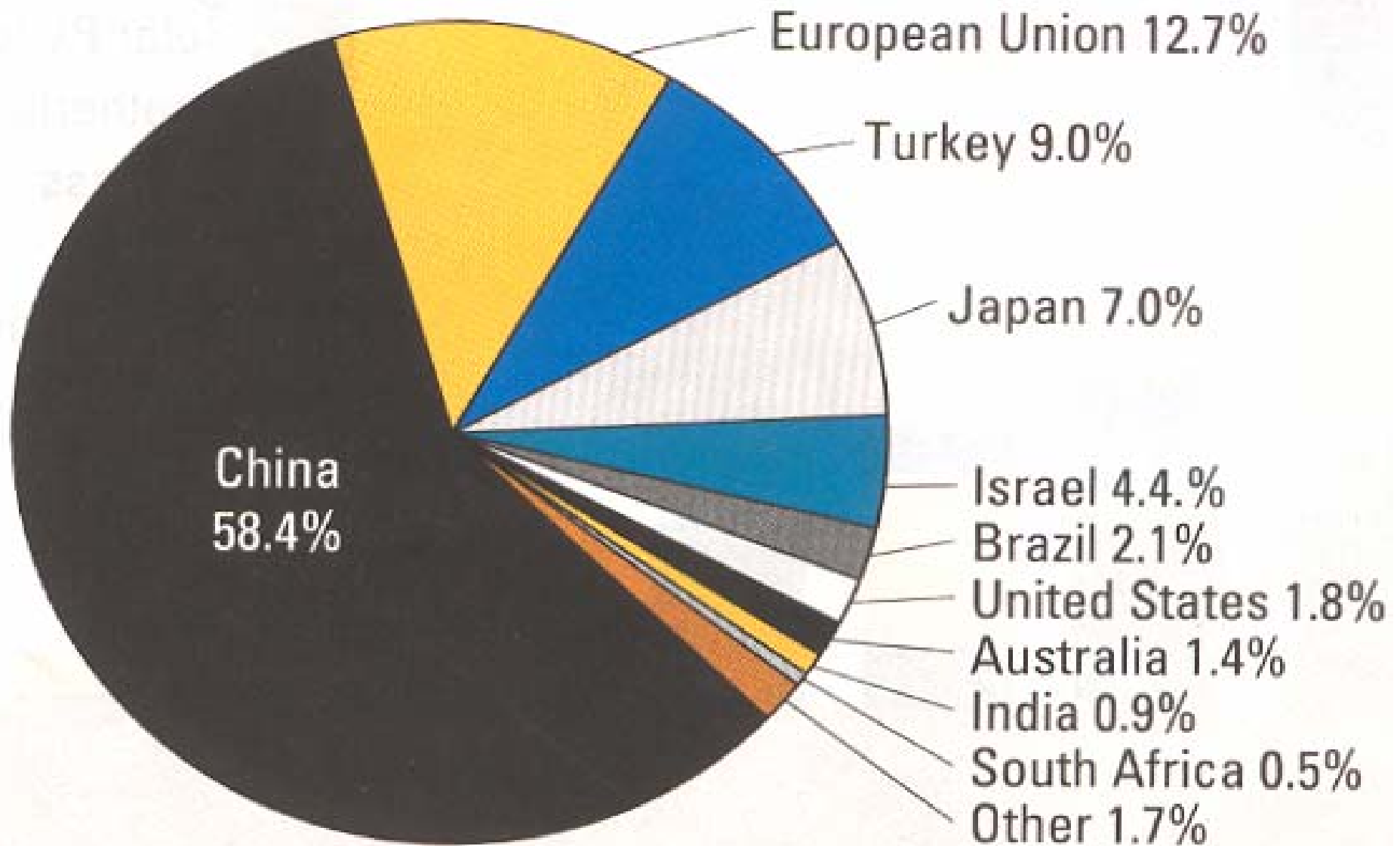
- The WTO does not currently have a trade regime specific to biofuels.
- International trade in biofuels falls under the rules of the General Agreement on Tariffs and Trade (GATT, 1994), which covers trade in all goods, as well as other relevant WTO Agreements such as the Agreement on Agriculture (AoA).
- Ethanol is considered an agricultural product and is therefore subject to Annex 1 of the WTO AoA.
- Biodiesel is considered an industrial product and is therefore not subject to the disciplines of the AoA. Paragraph 31 (iii) of the Doha Development Agenda has launched negotiations on “the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services”.
- Some WTO Members have suggested that renewable energy products, including ethanol and biodiesel, should be classified as “environmental goods” and therefore subject to negotiations under the “Environmental Goods and Services” cluster.



Solar thermal technologies

- **Passive solar architecture**
- **Active solar technologies**
 - ◆ **Industrial process heat**
 - ◆ **Cooking**
 - ◆ **Cooling**
 - ◆ **Space heating**
 - ◆ **Heating water**

Solar water heating - 150 GW_{th} installed on 40 million dwellings

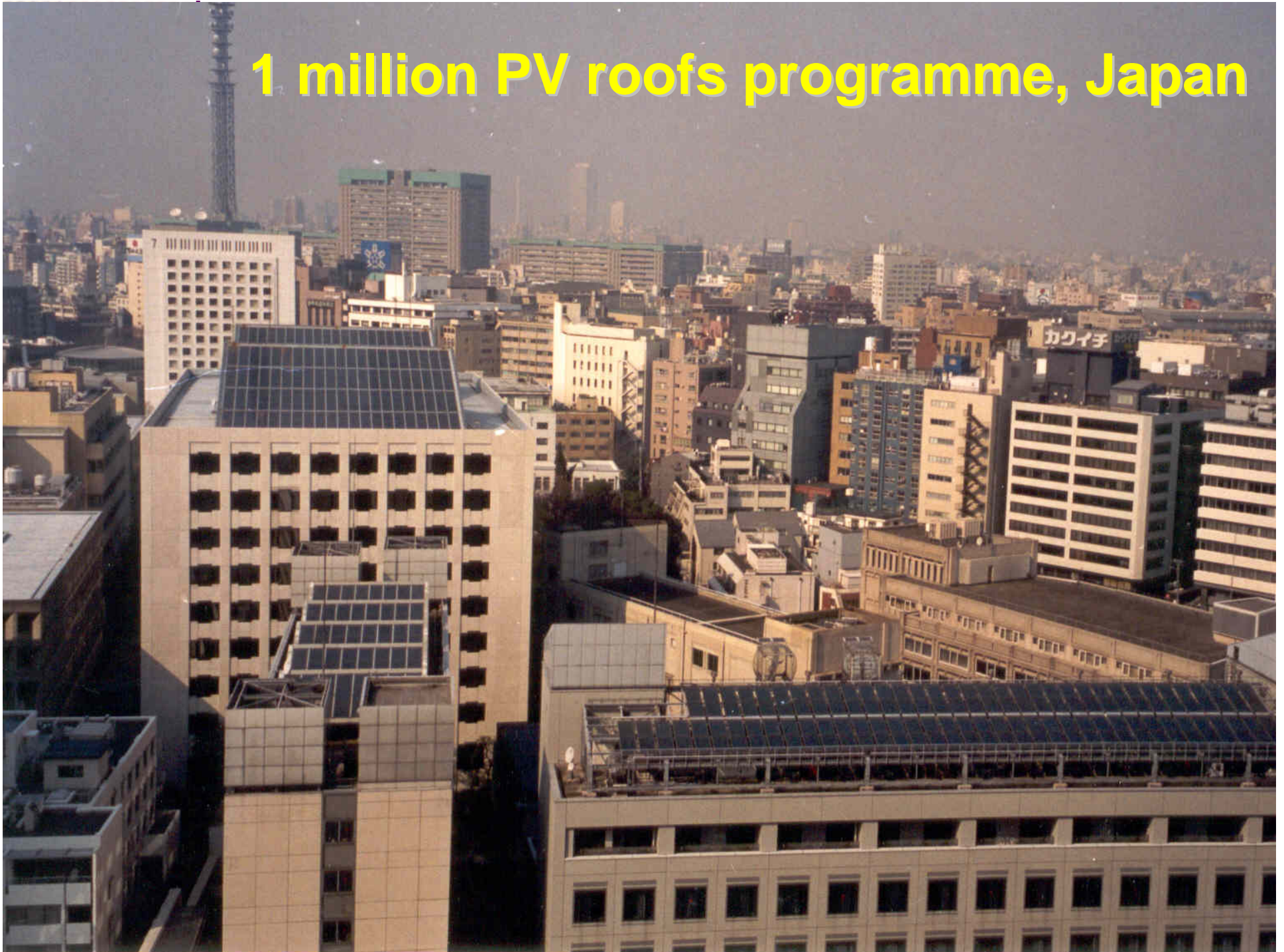


PHOTOVOLTAICS

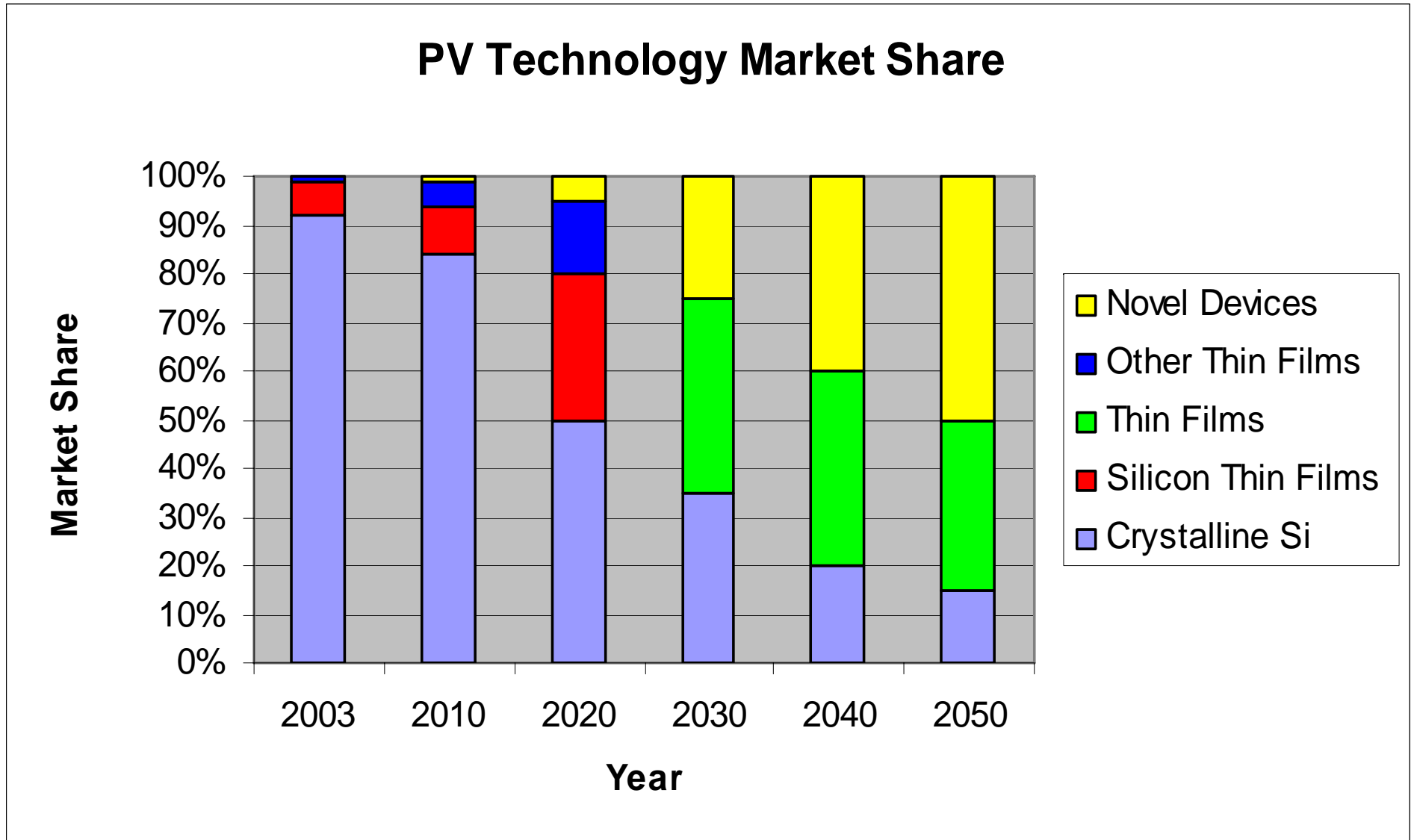
Current market trends

- **PV market growing quickly**
 - **1.5 GW in 2006; 2.5 GW in 2007; 5.8 GW in 2008**
- **In 2005-06 market almost entirely pulled by Germany and Japan plus US and Spain in 2007-2008.**
- **Industry market forecast for 2010 ranges between 6 – 14 GW/y.**
- **IEA ETP assumptions 10GW/y out to 2050.**

1 million PV roofs programme, Japan



Expected technology evolution



Source: NEEDS (2006)

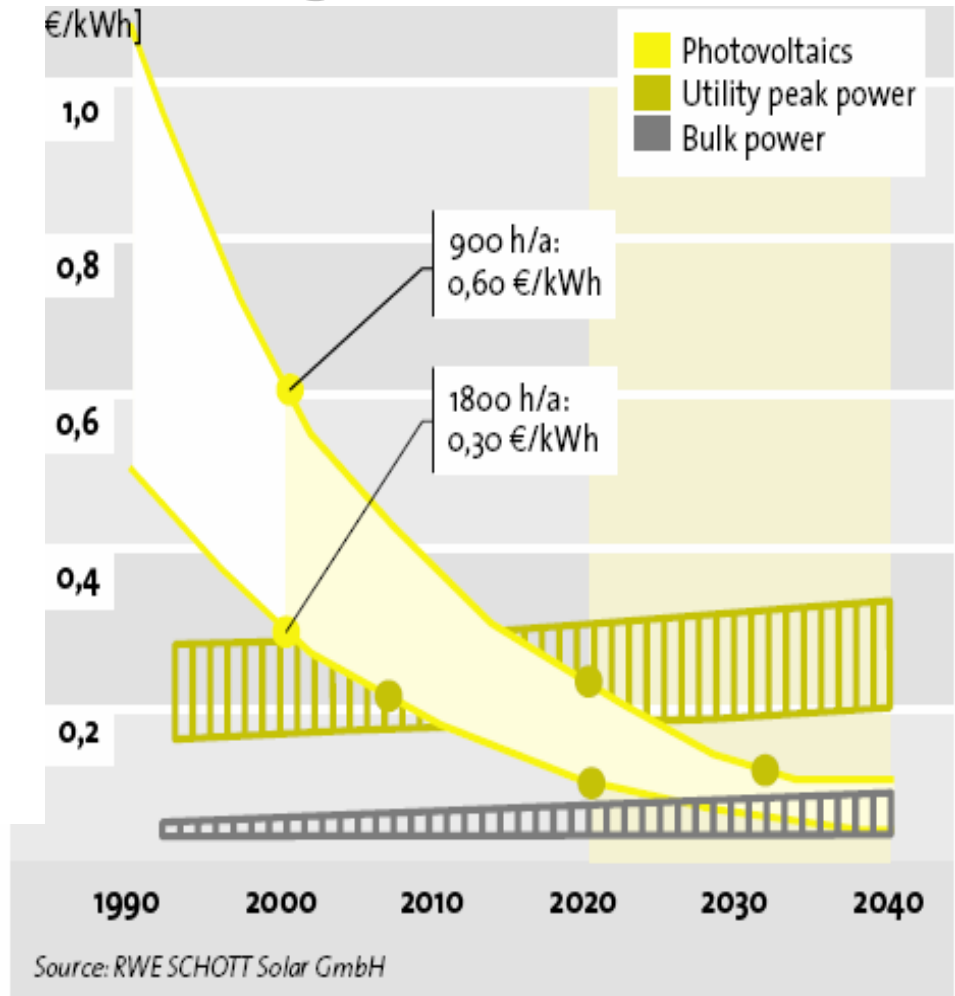
Will PV become competitive?

● Off-grid?

Already competitive in remote areas for telecom, lighting, water pumping and electricity for development in rural areas.



● On-grid?





**A forthcoming
IEA report**



Cities, Towns and Renewable Energy



YIMFY

Yes In My Front Yard!



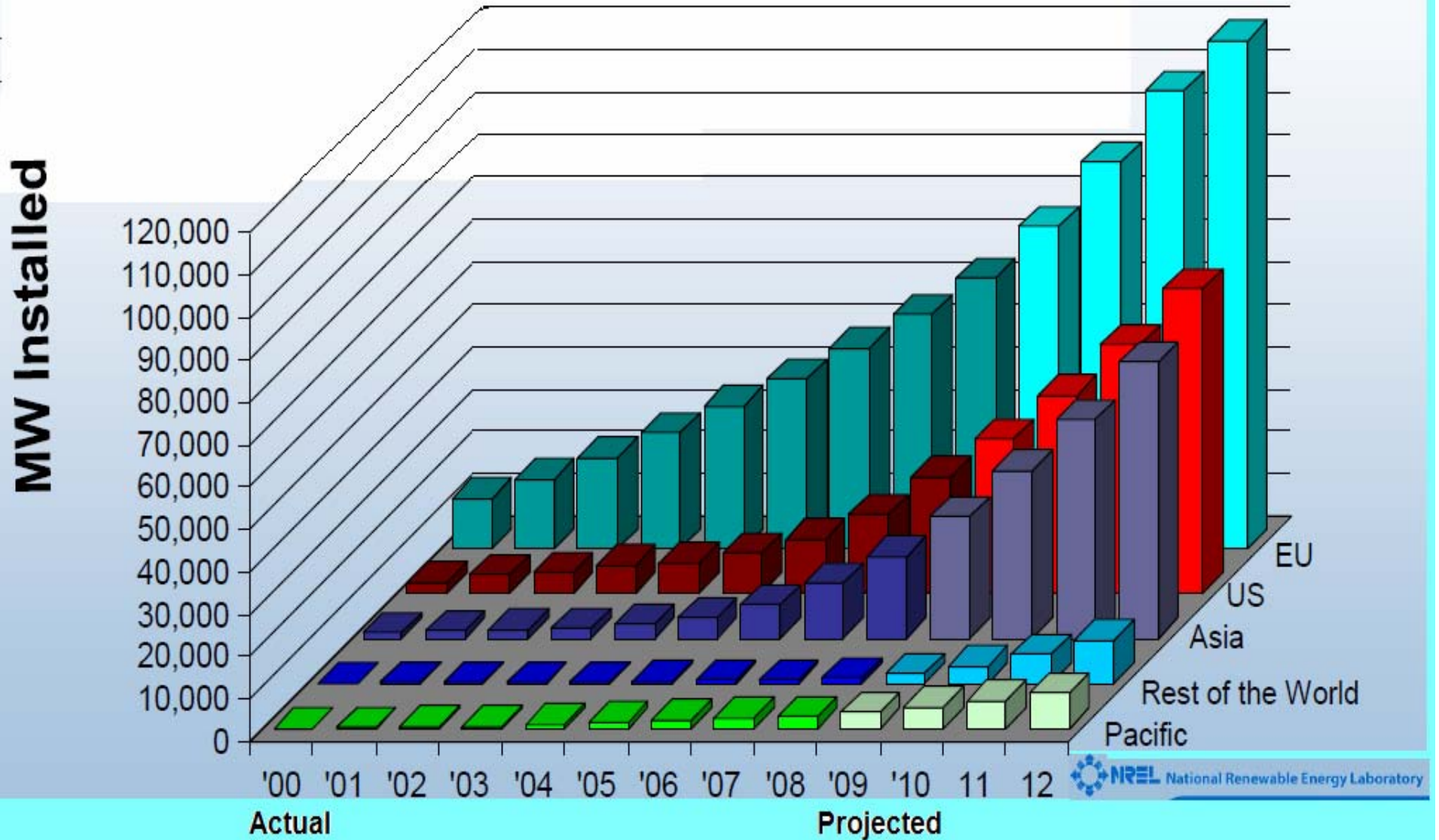
Concentrating solar power -a maturing technology

- 354 MWe since 1989 on Los Angeles grid.
- Concentrating solar power plants cheaper than PV in sunny areas.
- Fossil fuel back-up or heat storage guarantees power.
- Newly-built plants and on-going projects in Spain, Australia, US, Algeria, Egypt, United Arab Emirates, Iran, Israel, Italy, Jordan, Mexico, Morocco, South Africa.

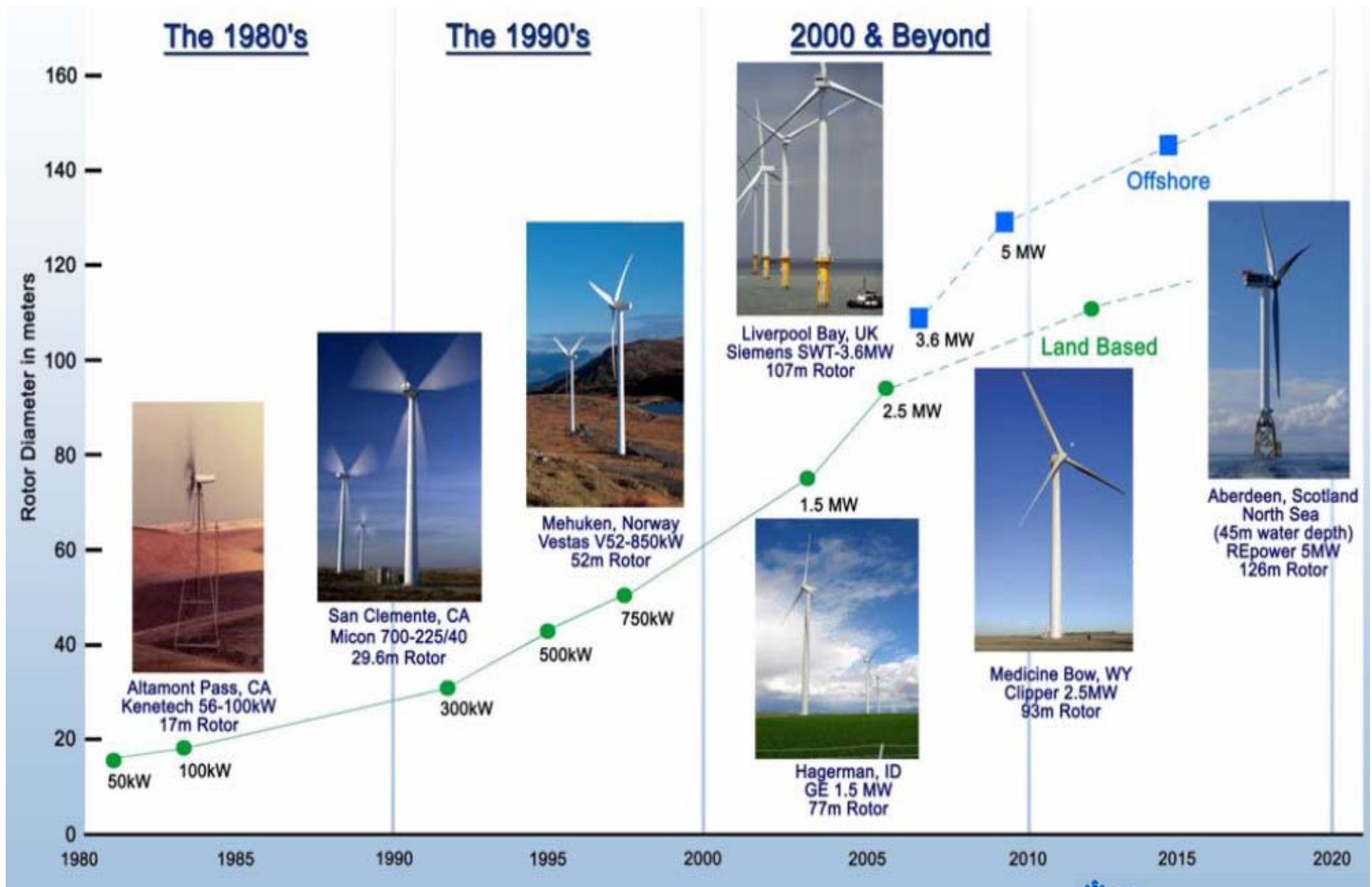


Wind power capacity.

115,000 MW installed January 2009



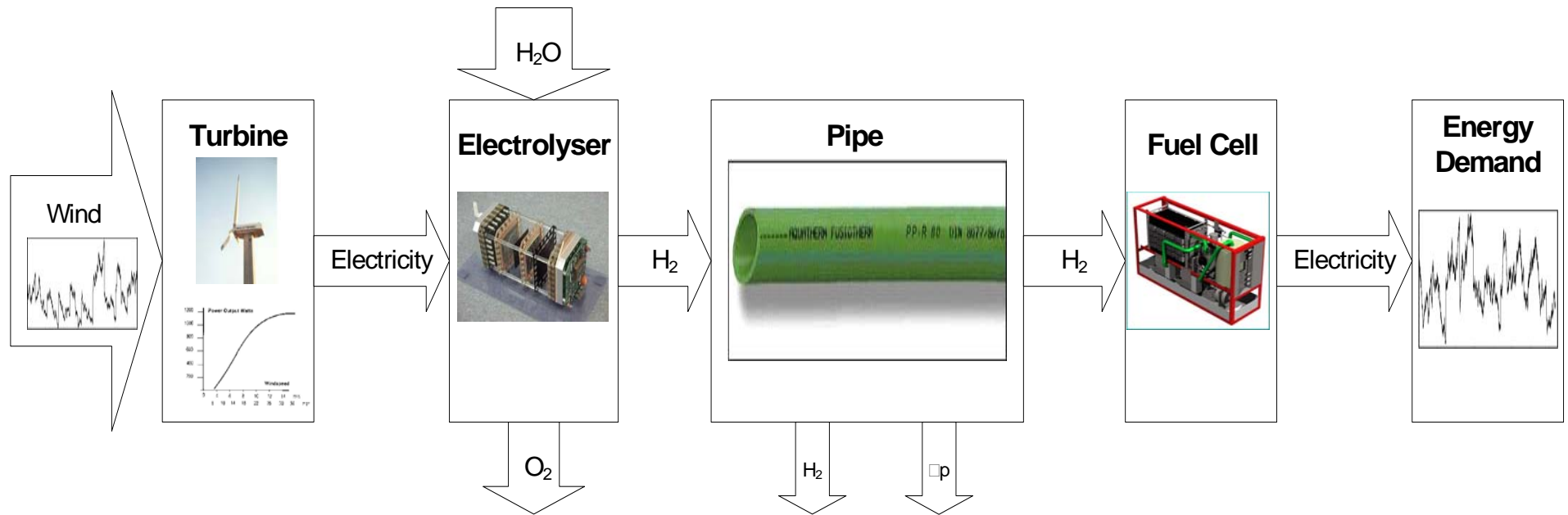
Evolution of wind turbine technologies.





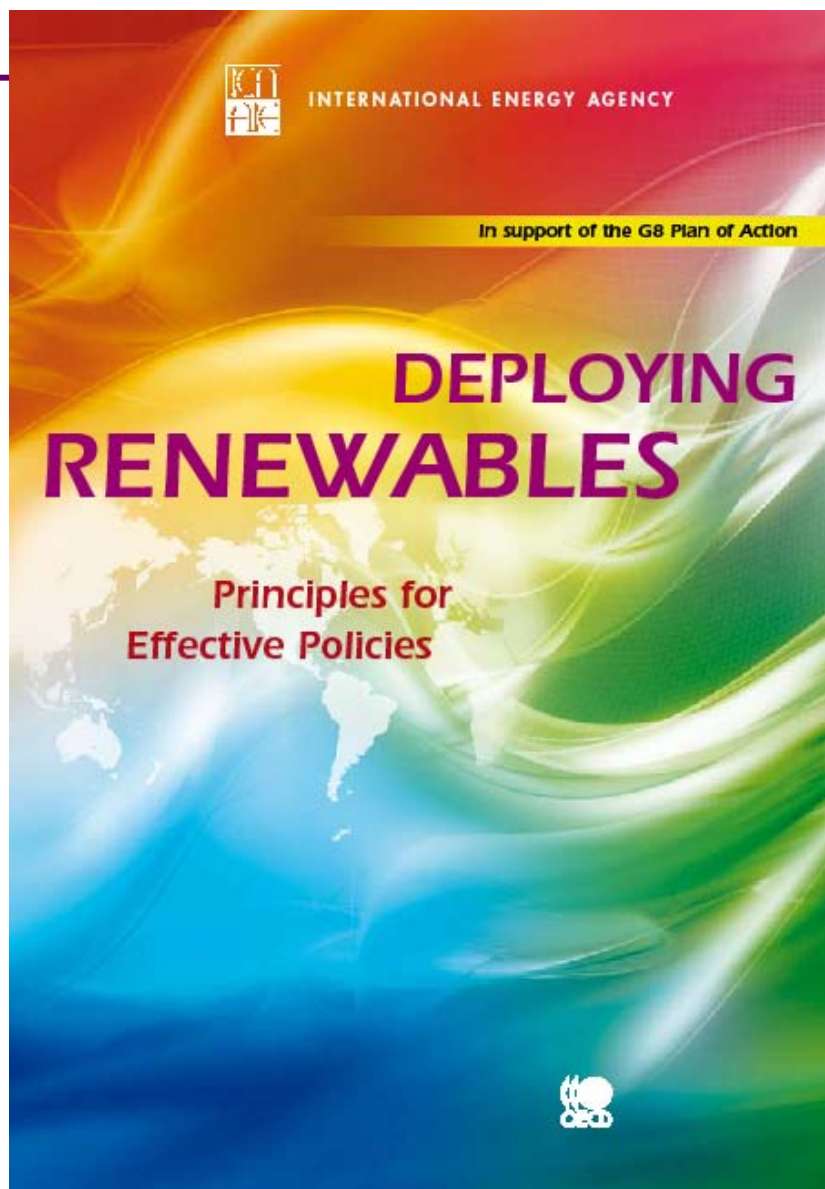


Wind /hydrogen energy system



The problem is that the wind does not always blow when the energy services are needed – so storage is required in the pipe.

Deploying Renewables



**Global renewable
energy markets
and policies
programme**

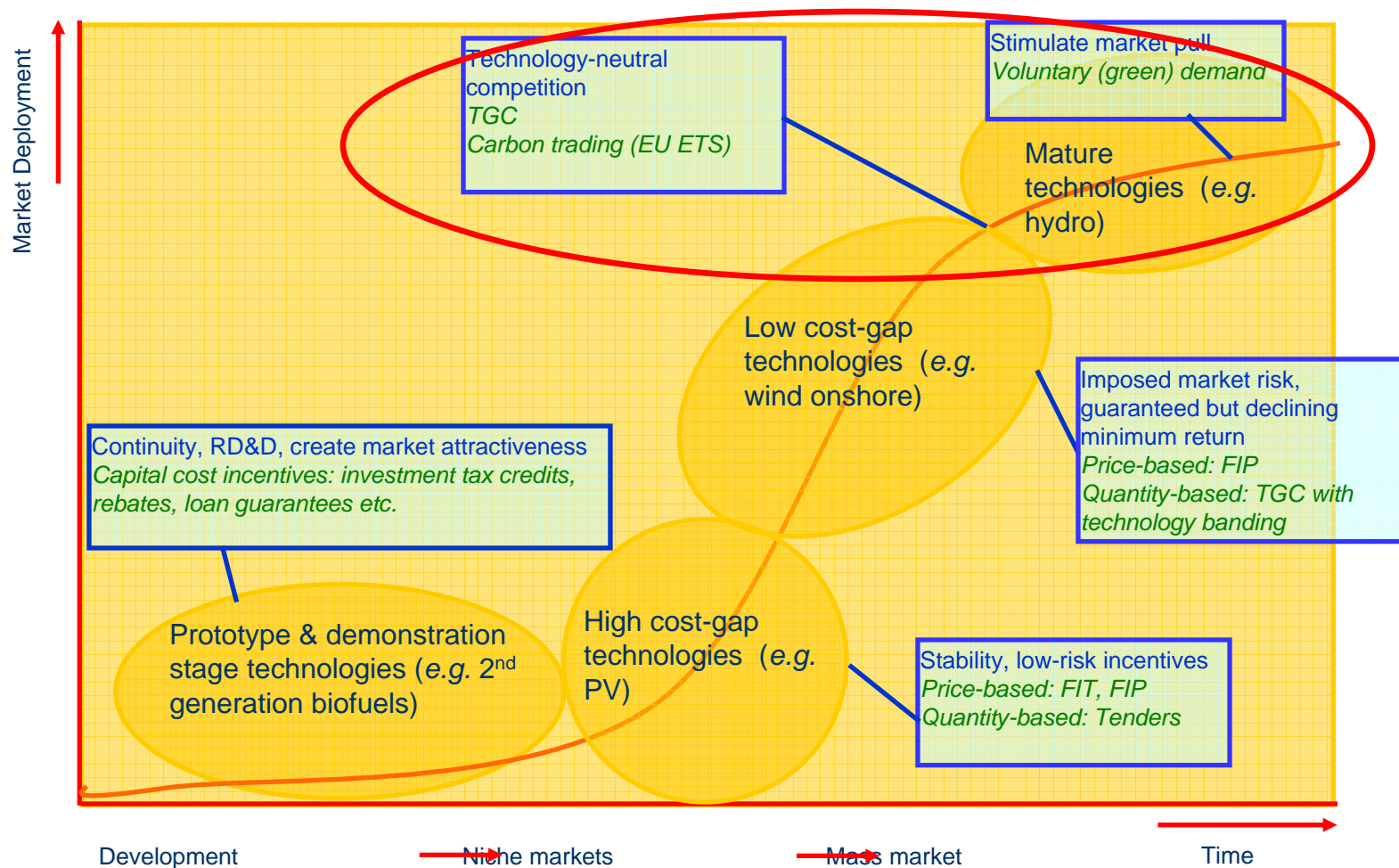
Download at
www.iea.org/G8/index.asp

Deploying Renewables

- **Assessment of policy experience across OECD and the BRICS countries (Brazil, Russia, India, China, S. Africa)**
- **Effectiveness of RE support policies assessed through market deployment and RD&D investment.**
- **Distillation of the best policy practices and of main challenges encountered.**
- **Learning experience gained from success stories - but also from failures.**
- **Several key principles recommended.**



Fostering the transition of Renewables towards mass market integration



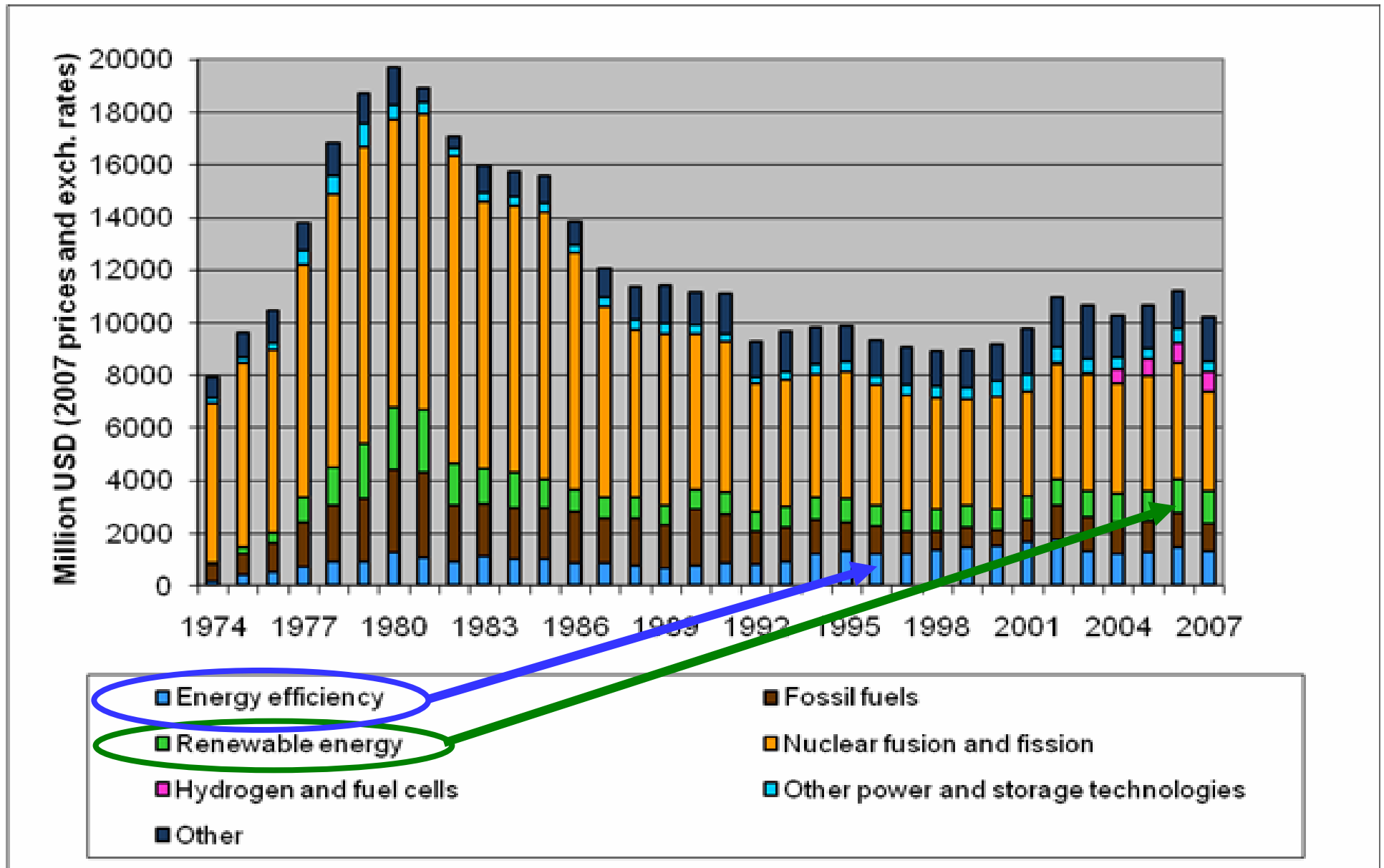
Note: The positions of the various technologies and incentive schemes along the S-curve are an indicative example at a given moment. The actual optimal mix and timing of policy incentives will depend on specific national circumstances. The level of competitiveness will also change in function of the evolving prices of competing technologies.



In summary

- **Climate change is real and adaptation is inevitable.**
 - **All national, provincial and municipal governments need to participate in the mitigation solutions to keep global mean temperature rise below 2°C.**
 - **All renewable energy technologies will have growth in international trade.**
 - **However....**
- we are running out of time.....**

Public RD&D budgets for energy - IEA member countries 1974-2007.



Public RD&D budgets for Renewable energy - IEA member countries 1974-2007.

