INTERNATIONAL ENERGY AGENCY

The role of CSP in IEA climate change mitigating scenarios

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SolarPACES 2009

Energy Technology Perspectives Publication 2008

- **How to get there**
  - **Short and medium term technology policy needs**
  - **Special attention for technology roadmaps**
- **Scenario analysis**
  - **Baseline WEO2007 Reference Scenario**
  - **Global stabilization by 2050 (ACT)**
  - **Global 50% reduction by 2050 (BLUE) – *consistent with WEO2007 450 ppm case***
- **Technology chapters:**
  - **Power sector**
  - **End-use sectors**

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IPCC 4th Assessment Report
Conclusions approved by all UNFCCC signatory countries

Temperature increase	All GHG	CO_2	CO_2 emissions 2050 (% of 2000 emissions)
(ºC)	(ppm CO_2 eq.)	(ppm CO_2)	(%)
2.0-2.4	445-490	350-400	-85 to -50
2.4-2.8	490-535	400-440	-60 to -30
2.8-3.2	535-590	440-485	-30 to +5
3.2-4.0	590-710	485-570	+10 to +60

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BLUE Scenarios

- -50% energy related CO_2 in 2050, compared to 2005
- This could be consistent with 450 ppm (depending on post-2050 emissions trends)
- Options with a marginal cost of up to USD 200/t CO_2 needed (*model outcome*)
  - Significantly higher cost with less optimistic assumptions
- BLUE is uncertain, therefore a number of cases needed
- BLUE is only possible if the whole world participates fully
- This implies a revolution in today's energy system

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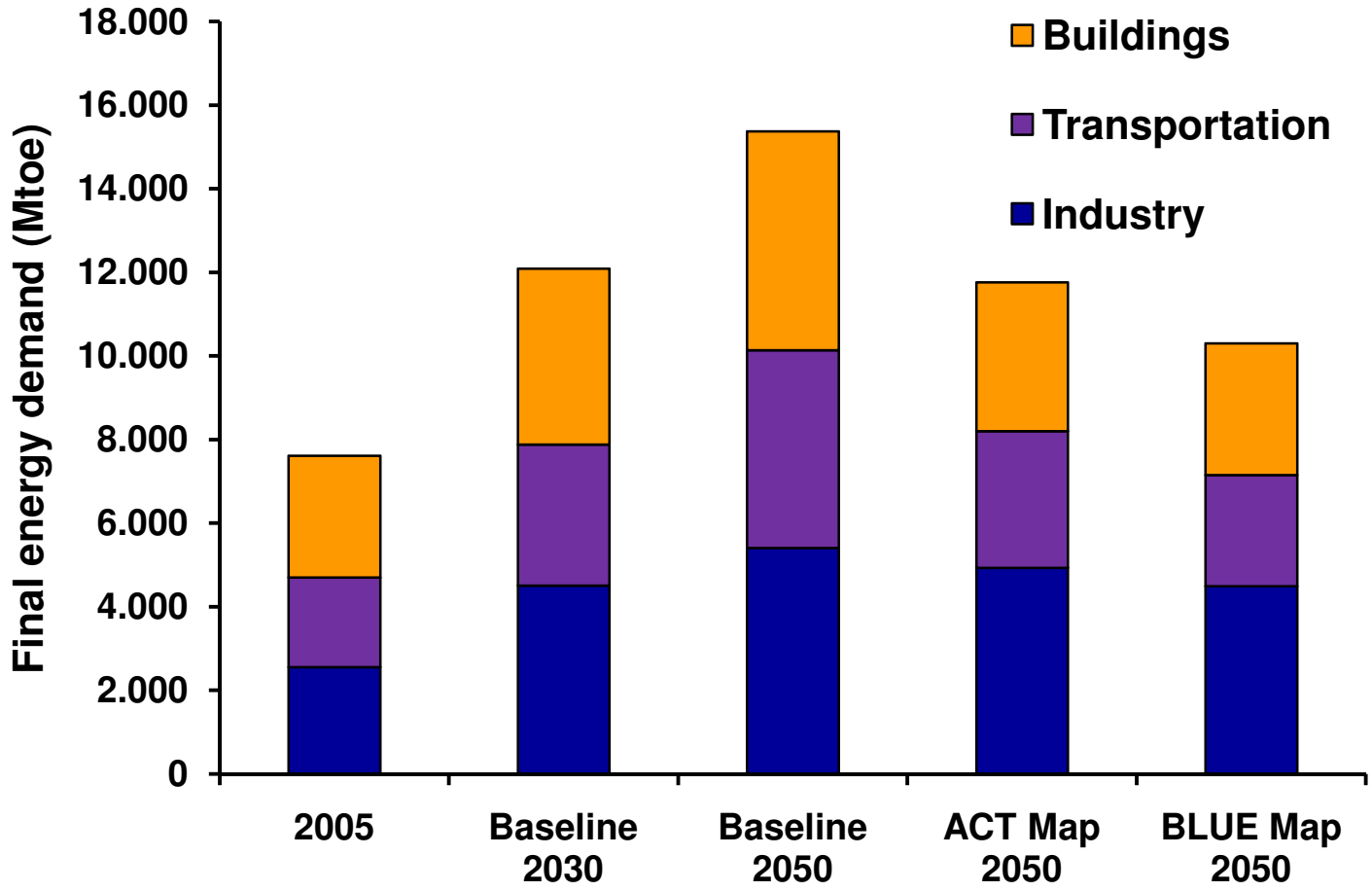
Final Energy Use



ENERGY TECHNOLOGY PERSPECTIVES 2008

Scenarios & Strategies to 2050

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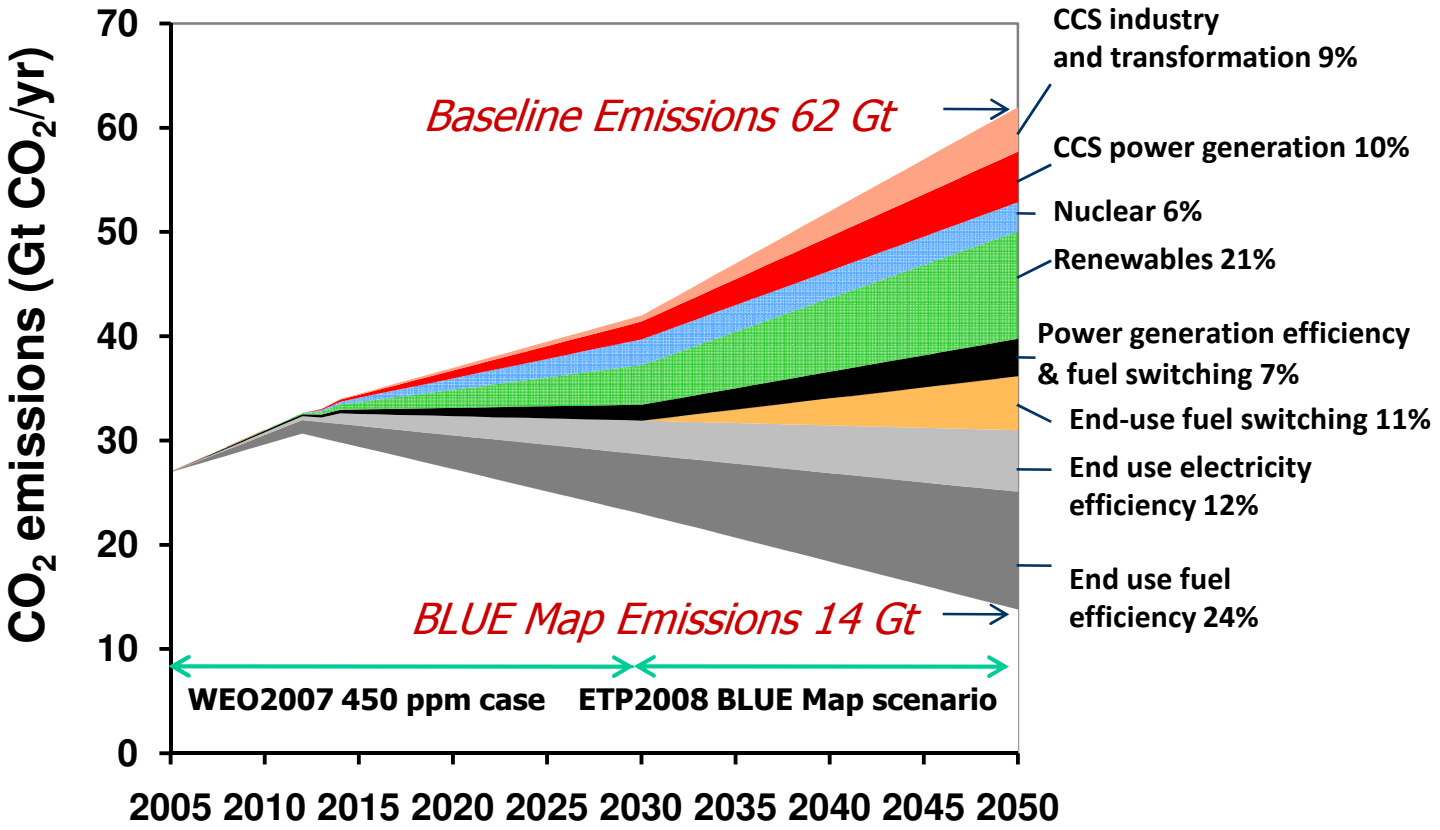
Contribution of Technology Options



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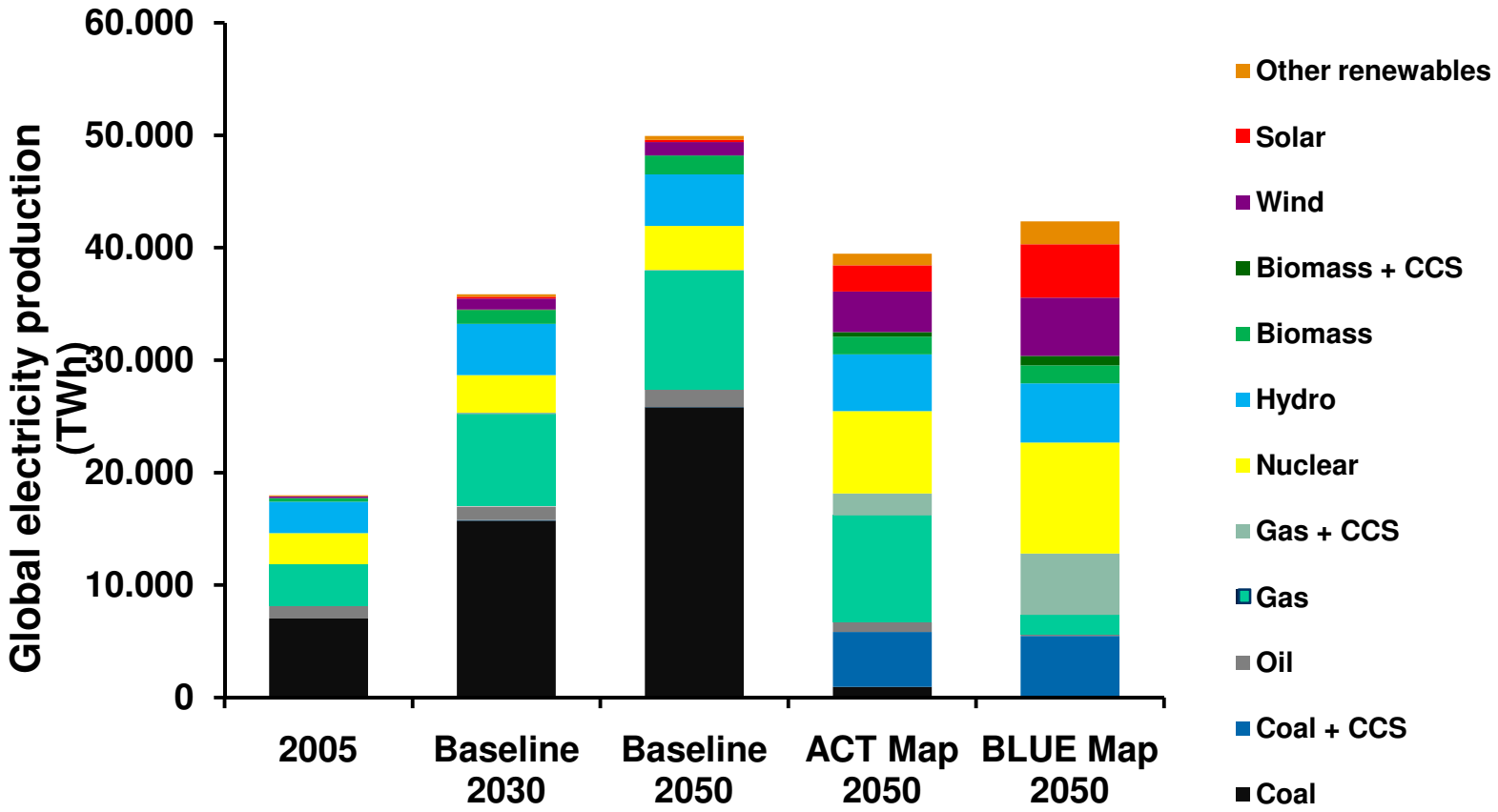
Power Generation Mix



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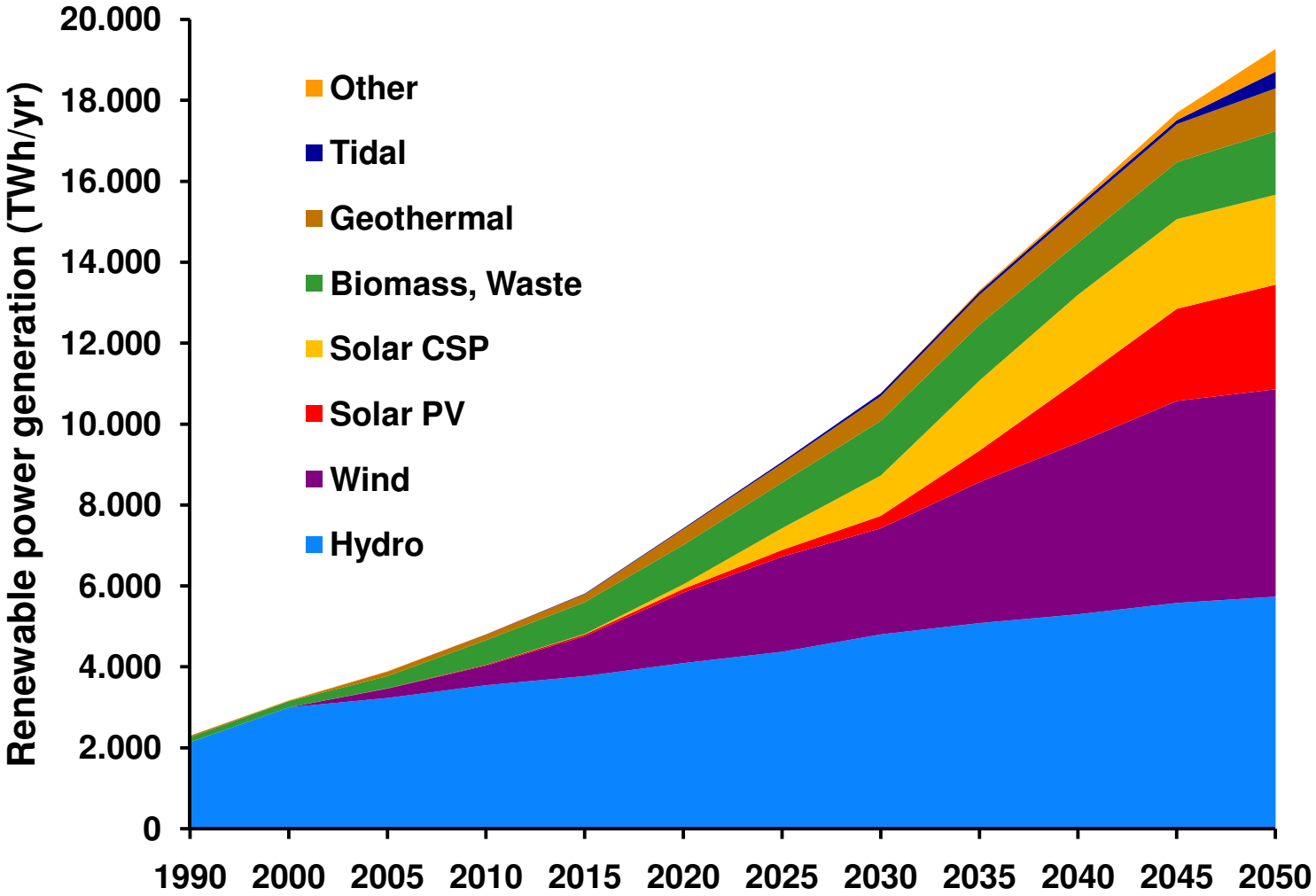
Growth of Renewables in BLUE



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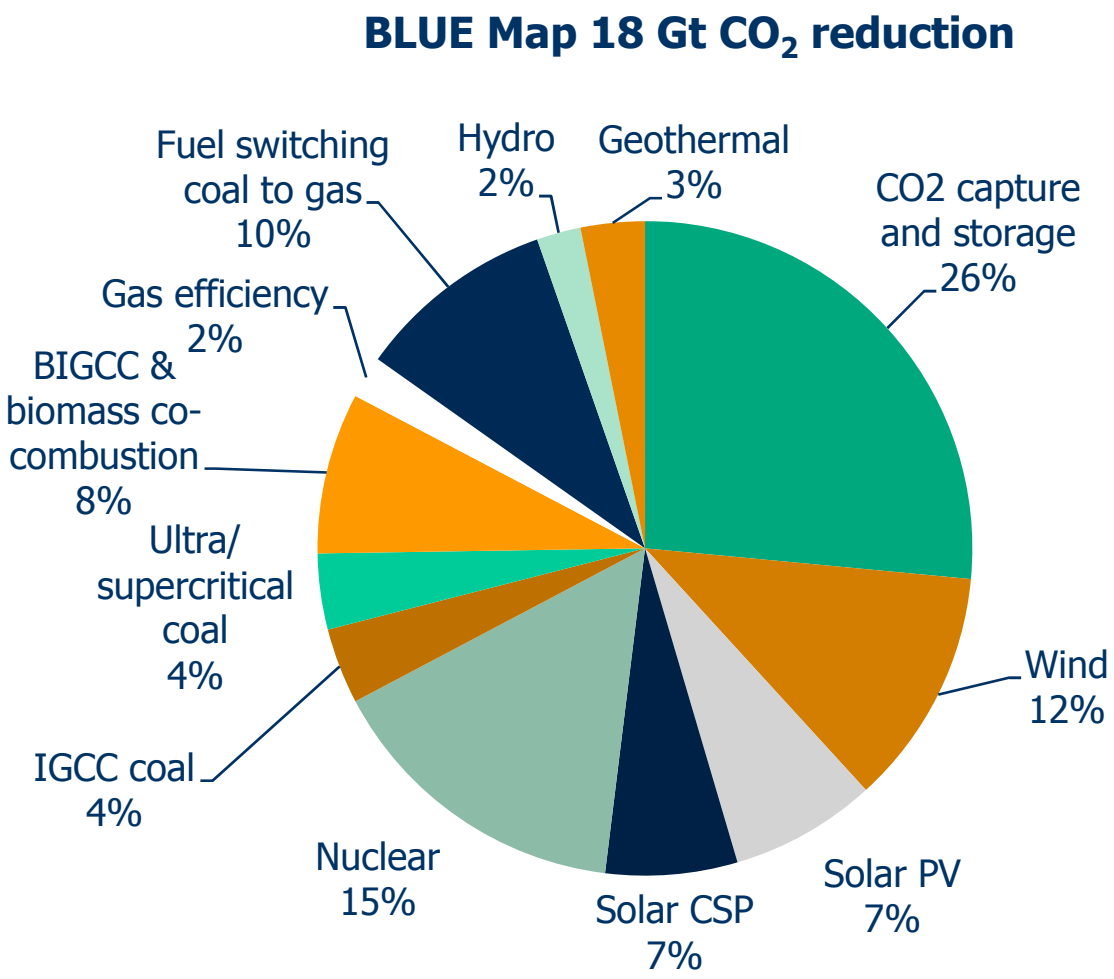
Power sector CO_2 reductions



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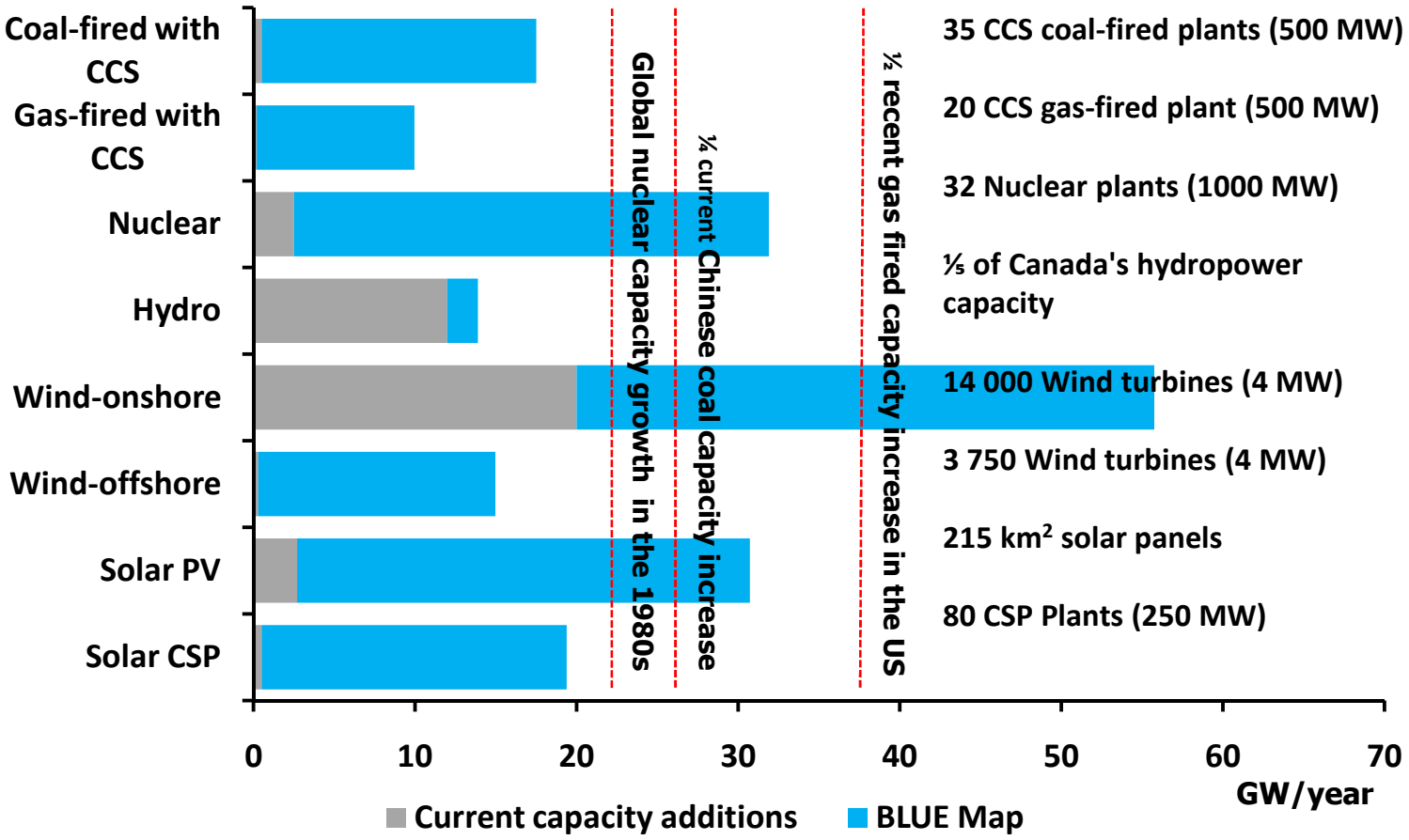
Annual Investment in New Generating Capacity BLUE Map



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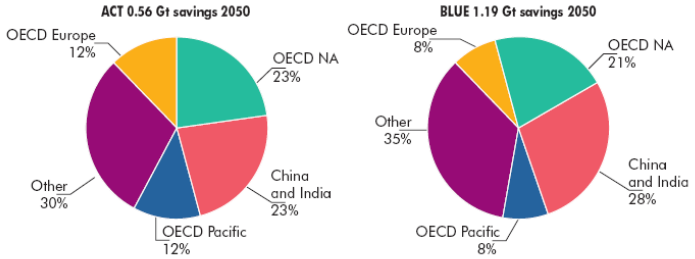
Roadmaps – Example CSP
3% of CO_2 reduction potential in BLUE Map

Concentrating solar power



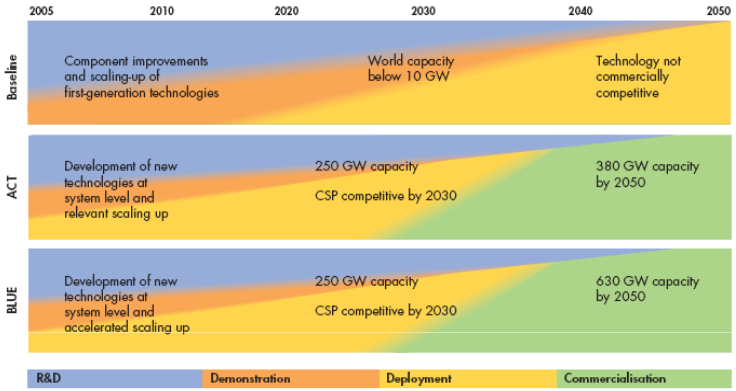
	Global Deployment Share 2030	RDD&D Inv. Cost USD bn 2005-2030	Commercial Inv. Cost USD bn 2030-2050
OECD NA	25%	65-75	45-50
OECD Europe	15%	40-50	25-30
OECD Pacific	15%	40-50	25-30
China & India	25%	65-75	45-50
Other	20%	55-65	50-55

	Global Deployment Share 2030	RDD&D Inv. Cost USD bn 2005-2030	Commercial Inv. Cost USD bn 2030-2050
OECD NA	23%	60-70	60-70
OECD Europe	14%	35-40	25-30
OECD Pacific	14%	35-40	25-30
China & India	24%	65-75	80-90
Other	25%	65-75	100-110

Technology targets

	ACT: Emissions Stabilisation	BLUE: 50% Emissions Reduction
RD&D		
System efficiency	Increase efficiency of systems to reduce costs	
Trough plants	Development of direct steam generation for trough plants	
Development of new technologies at system level for trough, dishes and towers	• Towers with air receivers to significantly increase working temperatures and conversion rates, demo by 2012 • Combined power and desalination plants, demo by 2012	Solar production of hydrogen and other energy carriers, demo by 2020
Low-cost, high efficiency thermal storage	Storage costs to fall to USD 0.05/kWh and efficiencies greater than 95%	
Deployment		
• Cogeneration power desalination • Troughs + direct steam generation • Troughs + molten salts	Commercial deployment by 2020	
Towers + air receiver + gas turbine	Commercial deployment by 2030	

Technology timeline



Key actions needed

- Economies of scale, mass production, learning by doing, and incremental improvements of all system components (mirrors, infrastructures, sun-tracking, heat receivers, pipes, balance of plants, etc.) will combine to improve performances and reduce costs.
- The emergence of heat storage, as an alternative to back-up with fossil fuels, significantly increases the value of the electricity produced in making power capacities guaranteed or even dispatchable.
- The development of incremental improvements such as direct steam generation, use of molten salts in troughs, cogeneration of heat for desalination and power, and cheaper dishes will further help increase performance and reduce costs.
- Development of towers with air receivers will significantly increase working temperatures and conversion rates and reduce costs even further, but still requires important R&D efforts.
- Low-cost long-range DC transmission systems.

Key areas for international collaboration

- Continuing co-ordination of R&D efforts, outreach efforts sharing and information exchanges through IEA's SolarPACES Implementing Agreement.
- Effective financing of CSP plants in developing countries beyond the global environment facility-supported plants.
- Developing efficient interconnection via high-voltage, direct-current lines to feed important consuming areas from neighbouring sunny regions.

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The IEA roadmapping effort

Request from G8 leaders at Hokkaido Summit, July 2008

"We will establish an international initiative with the support of the IEA to develop roadmaps for innovative technologies and cooperate upon existing and new partnerships, including carbon capture and storage (CCS) and advanced technologies."

The role of roadmaps

- A stable international price for carbon is a first step…
  - …but is insufficient to accelerate the needed energy technology advancements in time
- An integrated and strategic policy approach is required
  - Initial emphasis on energy efficiency
  - Increase RD&D funding for new technologies
  - Identify and address technology-specific barriers
  - Develop tailored deployment policies
  - Ensure rapid technology diffusion to all major economies
- Energy technology roadmaps are a comprehensive way to address these issues; now exploring strategies for implementation (lead countries, tech. platform)

Forthcoming IEA roadmaps

- For publication at IEA Ministerial (October 2009)
  - CCS
  - EV/PHEV
  - Efficient industry processes (Cement)
  - Solar PV
  - Wind energy
- For publication in late 2009/2010
  - Concentrating solar power
  - Nuclear power
  - Energy efficiency/low-carbon buildings: heating & cooling technologies
  - Smart grids
  - Biofuels

Forthcoming publications