

# IEA Energy Technology Roadmaps and RD&D Mapping

*From Roadmaps to Implementation*

Experts' Group on R&D Priority Setting

2 & 3 November 2009

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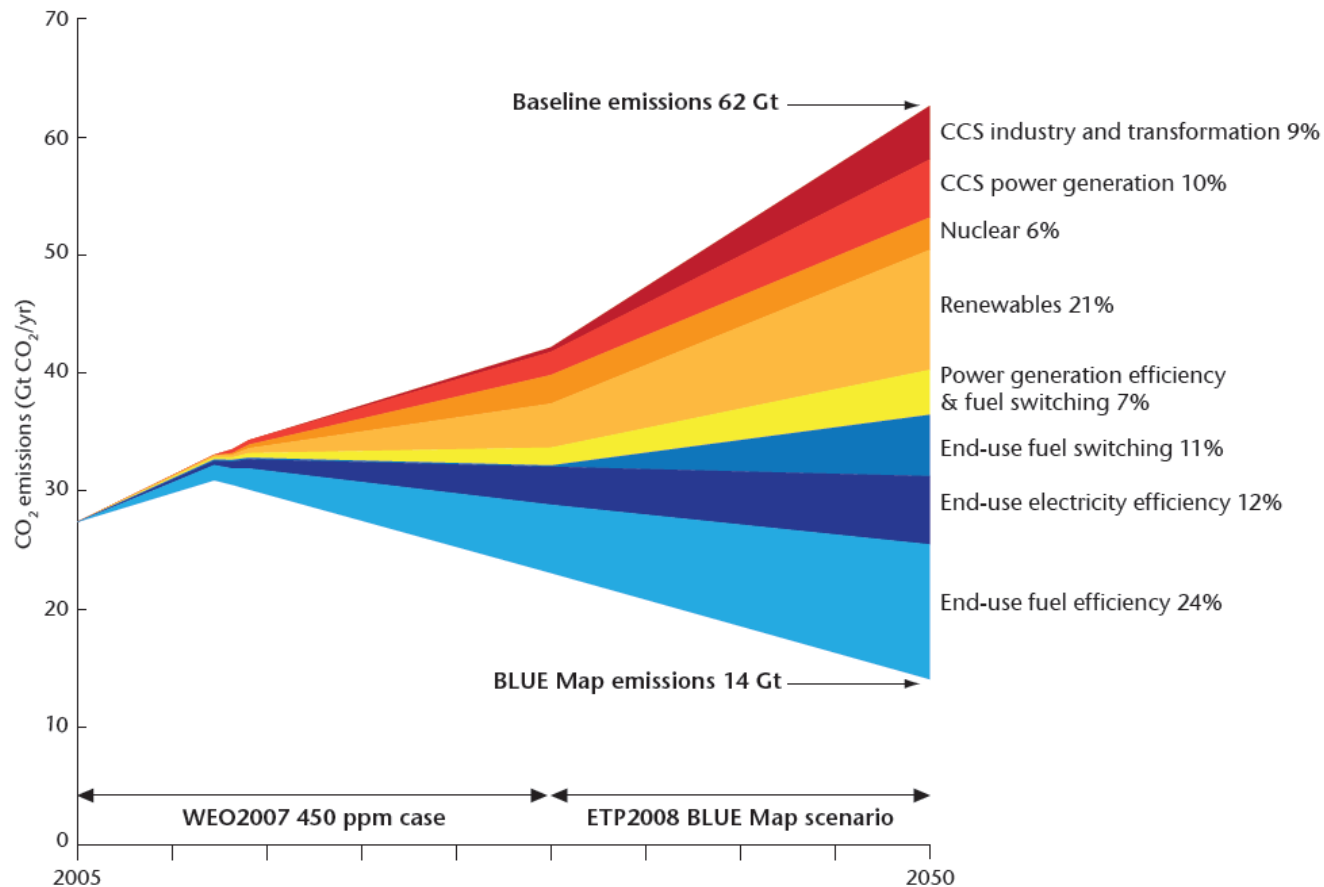
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# Overview

- The energy technology challenge
- Background to the technology roadmaps
- Results from the first roadmaps and next steps
- RD&D mapping
- Conclusions

# The Energy Technology Challenge

Contribution of technology options to CO<sub>2</sub> reduction under the IEA ETP2008 BLUE Map scenario



# Request for Technology Roadmaps

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 energy technologies.”*

# How Do We Get There? The Role of Roadmaps

- Engage cross-section of stakeholders
- Identify a baseline – where is technology today?
- Use ETP BLUE Map results for target deployment in 2050
- Identify barriers – technical, regulatory, policy, financial, public acceptance
- Special outreach to developing countries
- Develop implementation action items for each stakeholder

# Roadmap Status

## 2009 Releases

- Wind
- Solar photovoltaic
- Carbon capture & storage
- Electric / plug-in hybrid vehicles
- Cement

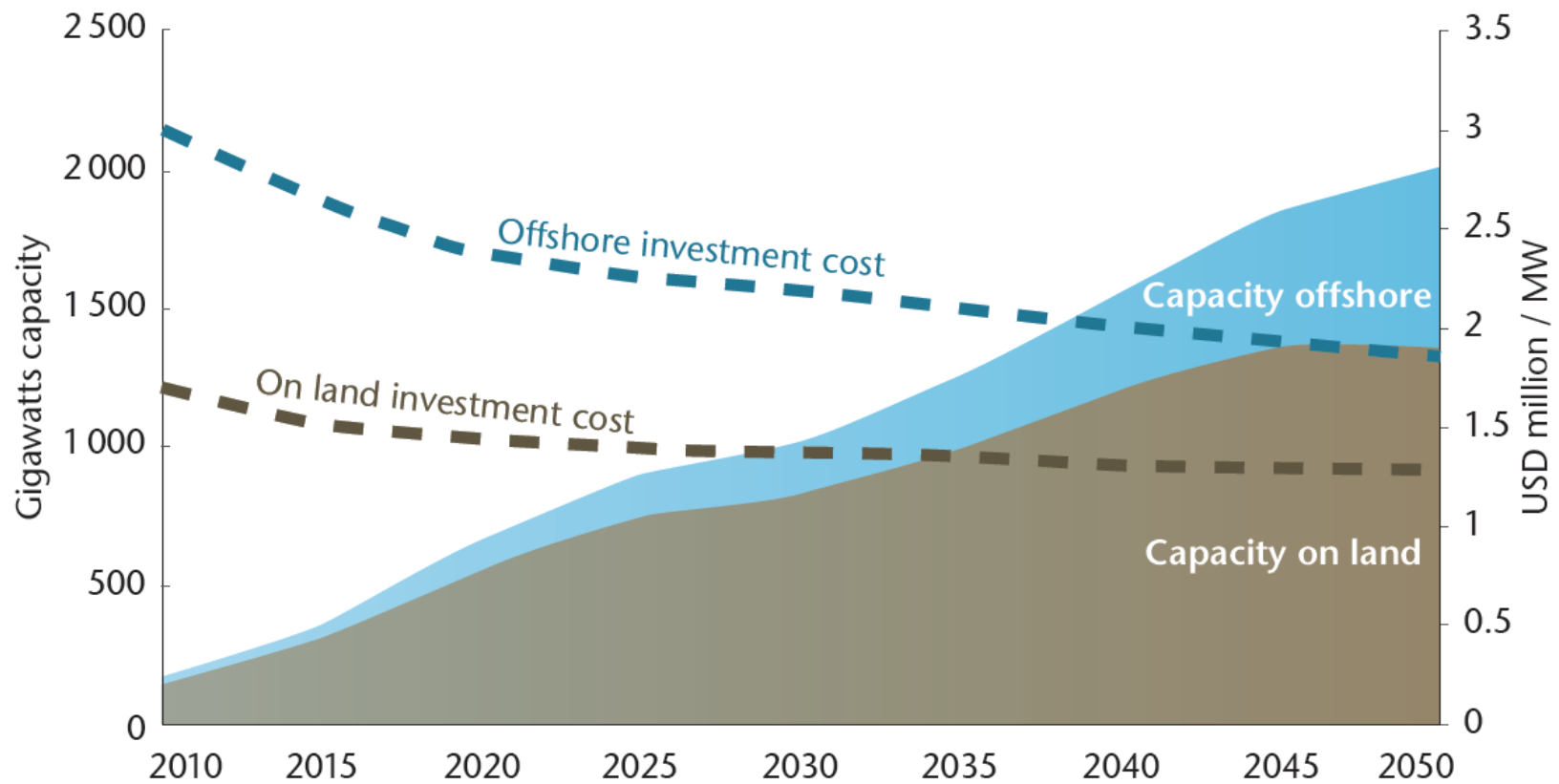
## 2010 Releases

- Concentrating solar power
- Efficient heating and cooling
- Nuclear power
- Smart grids
- Biofuels
- Efficient ICE vehicles

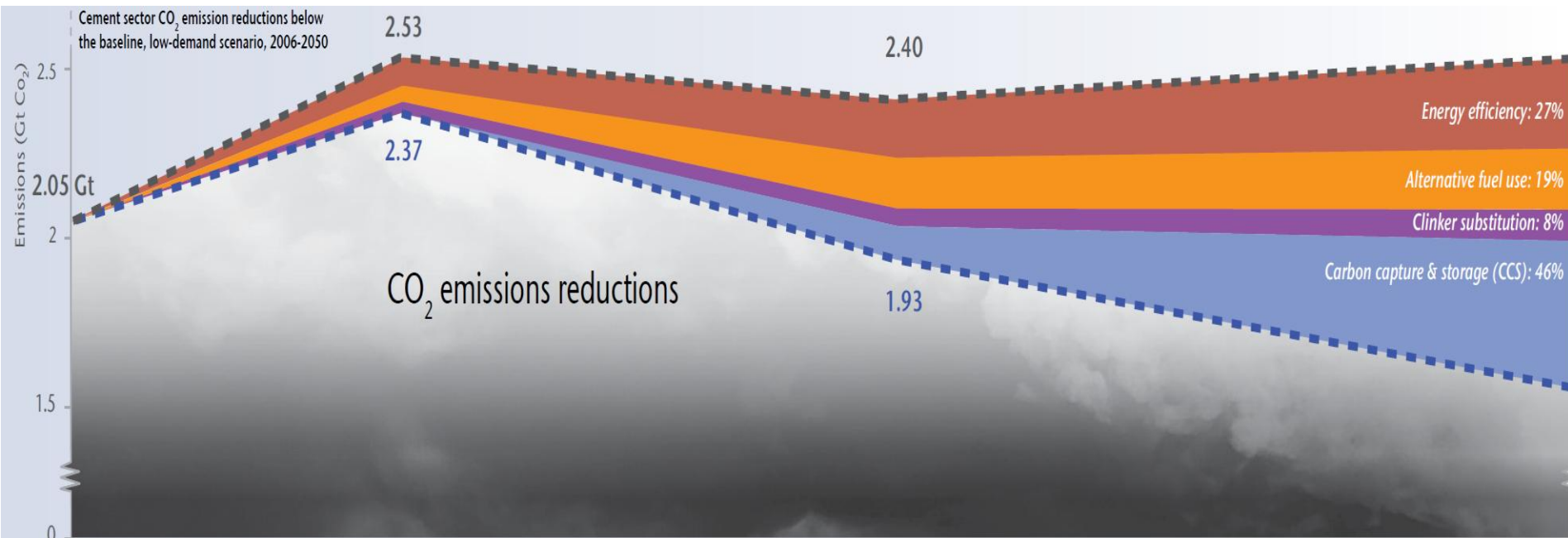
## Possible late 2010 / 2011

- Low energy building shells
- Iron and Steel
- Advanced coal (USCSC, IGCC)
- Biomass for power generation
- Fuel cell vehicles

# Wind Roadmap Example: Cost and Deployment Targets

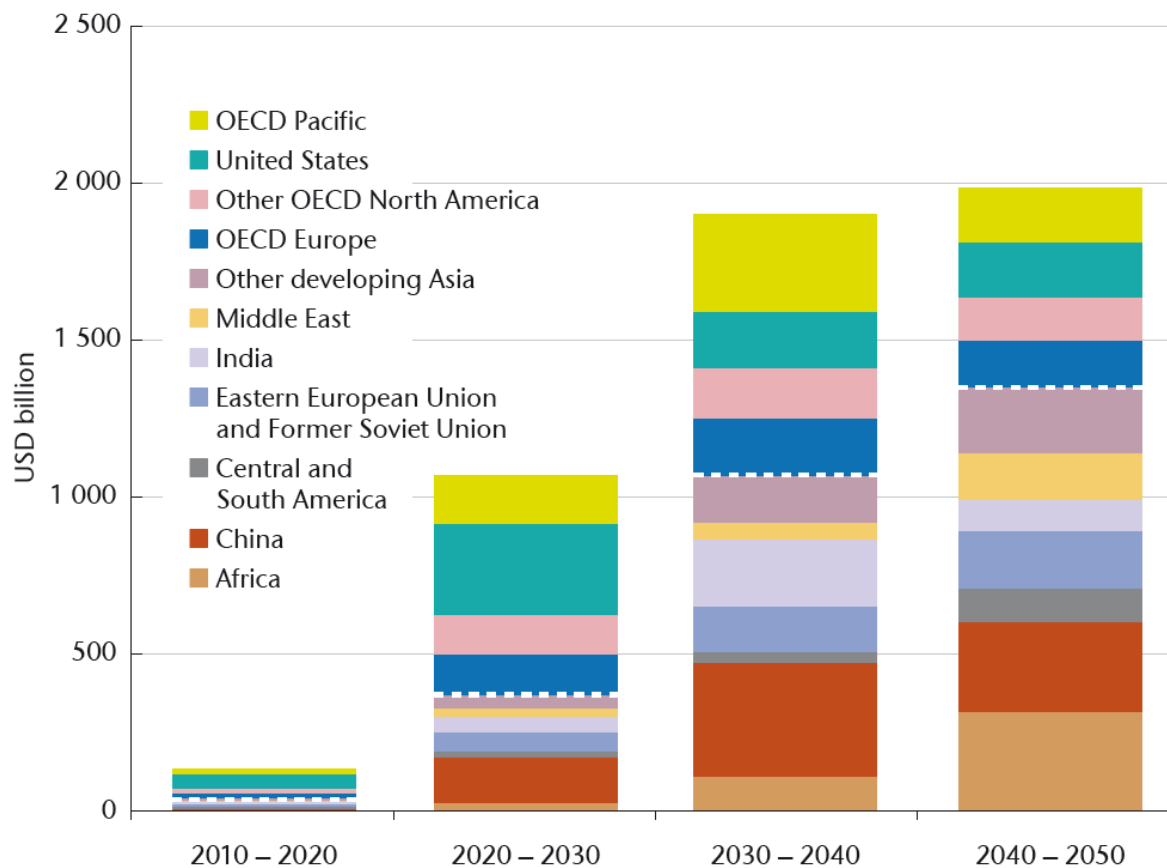


# Cement Roadmap Example: CO<sub>2</sub> reduction opportunities





# CCS Roadmap Example: Investment Needs



# Solar PV Roadmap Example: Technology Performance Milestones

Crystalline Silicon Technologies	2010 - 2015	2015 - 2020	2020 - 2030 / 2050
<i>Efficiency targets in %</i>	<ul style="list-style-type: none"> <li>• Single-crystalline: 21%</li> <li>• Multi-crystalline: 16%</li> </ul>	<ul style="list-style-type: none"> <li>• Single-crystalline: 23%</li> <li>• Multi-crystalline: 18%</li> </ul>	<ul style="list-style-type: none"> <li>• Single-crystalline: 27%</li> <li>• Multi-crystalline: 21%</li> </ul>
<i>Industry manufacturing aspects</i>	<ul style="list-style-type: none"> <li>• Si consumption &lt;5g/Wp</li> </ul>	<ul style="list-style-type: none"> <li>• Si consumption &lt;3g/Wp</li> </ul>	<ul style="list-style-type: none"> <li>• Si consumption &lt;2g/Wp</li> </ul>
<i>R&amp;D aspects</i>	<ul style="list-style-type: none"> <li>• New silicon materials and processing</li> <li>• Cell contacts, emitters and passivation</li> </ul>	<ul style="list-style-type: none"> <li>• Low defect silicon wafers</li> <li>• Improved device structures</li> </ul>	<ul style="list-style-type: none"> <li>• Wafer equivalent technologies</li> <li>• New device structures with novel concepts</li> </ul>
Thin Film Technologies	2010 - 2015	2015 - 2020	2020 - 2030
<i>Efficiency targets in %</i>	<ul style="list-style-type: none"> <li>• Thin film Si: 10%</li> <li>• CIGS: 14%</li> <li>• CdTe: 12%</li> </ul>	<ul style="list-style-type: none"> <li>• Thin film Si: 12%</li> <li>• CIGS: 15%</li> <li>• CdTe: 15%</li> </ul>	<ul style="list-style-type: none"> <li>• Thin film Si: 15%</li> <li>• CIGS: 18%</li> <li>• CdTe: 18%</li> </ul>
<i>Industry manufacturing aspects</i>	<ul style="list-style-type: none"> <li>• High rate deposition</li> <li>• Roll-to-roll manufacturing</li> <li>• Packaging</li> </ul>	<ul style="list-style-type: none"> <li>• Simplified production processes</li> <li>• Low cost packaging</li> </ul>	<ul style="list-style-type: none"> <li>• Large high-efficiency production units</li> </ul>
<i>R&amp;D aspects</i>	<ul style="list-style-type: none"> <li>• Large area deposition processes</li> <li>• Improved substrates and transparent conductive oxides</li> </ul>	<ul style="list-style-type: none"> <li>• Improved cell structures</li> <li>• Improved deposition techniques</li> </ul>	<ul style="list-style-type: none"> <li>• Advances materials and concepts</li> </ul>

# EV/PHEV Roadmap Example: Policy Requirements

Vehicle-fuel price related	Not cost-related
<ul style="list-style-type: none"> <li>• Favourable financing terms – e.g., battery leasing to minimise up-front and monthly cost.</li> <li>• Feebate (vehicle fee/rebate) system at time of vehicle purchase, based on performance (e.g., life-cycle CO<sub>2</sub> emissions).</li> <li>• Differential CO<sub>2</sub>-based fuel taxes.</li> <li>• Reductions in highway tolls and other vehicle fees (annual registrations).</li> <li>• Incentives for providing recharging infrastructure in commercial/public areas.</li> <li>• Subsidisation of the cost of recharging infrastructure for households/apartment buildings.</li> </ul>	<ul style="list-style-type: none"> <li>• Differential treatment for EVs/PHEVs in terms of regulations, such as access to otherwise vehicle-restricted zones in city centres, preferential parking spots with charge points.</li> <li>• Guarantees for re-sale values, battery replacements.</li> <li>• Additional credits under regulatory systems (e.g., in EU vehicle CO<sub>2</sub> regulations, EVs/PHEVs are considered zero emissions, so automakers get an advantage for producing them; similar credits exist in the US Corporate Average Fuel Economy (CAFE) law).</li> <li>• Electric-drive vehicles would be favoured by strong regulations addressing pollutants (apart from CO<sub>2</sub>).</li> <li>• Initial introduction of EVs by government fleets to help spur manufacture.</li> <li>• Public transport vehicles, two/three-wheeled vehicles – exploit EVs in these segments to promote EVs for individual consumers and increase battery production scales.</li> <li>• Direct provision of recharging infrastructure in public areas.</li> </ul>

# Implementing the Roadmaps

- Identify industry, government, NGO partners to endorse roadmap and help track/implement
  - Working with MEF, international technology platform
  - Private sector: WBCSD, IEA Chief Technology Officer roundtable and others
  - Confirm roles of CSLF, IPEEC, IRENA, etc.
- Set timeline/format/process for reporting on progress
- Identify developing country needs/interests
  - Develop roadmaps in targeted countries

# RD&D Mapping for the Major Economies Forum

- Define current RD&D spending across 8 technology areas for MEF members
  - IEA data
  - Other sources for non-IEA countries
- Define RD&D priorities for 8 areas
  - IEA roadmaps, other studies
- Identify the “gap” between current levels of activity and BLUE Map 2050 technology targets
  - ETP 2008 estimates on RD&D spending

**MEF Members:** Australia, Brazil, Canada, China, the European Union, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Russia, South Africa, the United Kingdom, and the United States. Denmark, in its capacity as the President of the December 2009 Conference of the Parties to the UN Framework Convention on Climate Change, and the United Nations have also been invited to participate in this dialogue.

# RD&D Challenges and Next Steps

- IEA data lacking, non-comparable
  - New areas like smart grids
- Private sector data not available, but critical to understand RD&D for some technology areas
  - E.g., energy efficiency, advanced vehicles
- Incorporating new stimulus funding in a consistent manner
- Capturing different ways countries foster technology innovation
  - Not just levels of spending; policies play a role
- MEF will publish a report on 15 November with results and recommended next steps
- IEA would like to improve data quality and transparency – an area for EGRD cooperation?

# Conclusions: the role of roadmaps

- Agreement on GHG targets at Copenhagen is necessary...
  - ...but by itself will be insufficient to accelerate the needed energy technology advancements in time
- Technology Roadmaps can support countries GHG goals by:
  - Identifying and addressing technology-specific barriers
  - Highlighting necessary deployment policies and incentives
  - Directing increased RD&D funding for new technologies
  - Supporting technology diffusion in all major economies



# Thank You

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