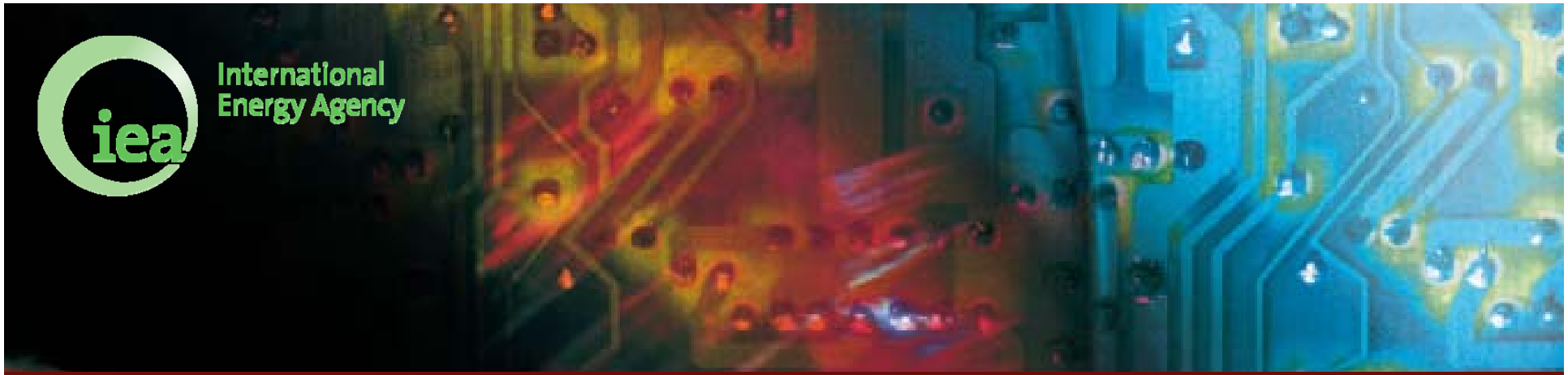


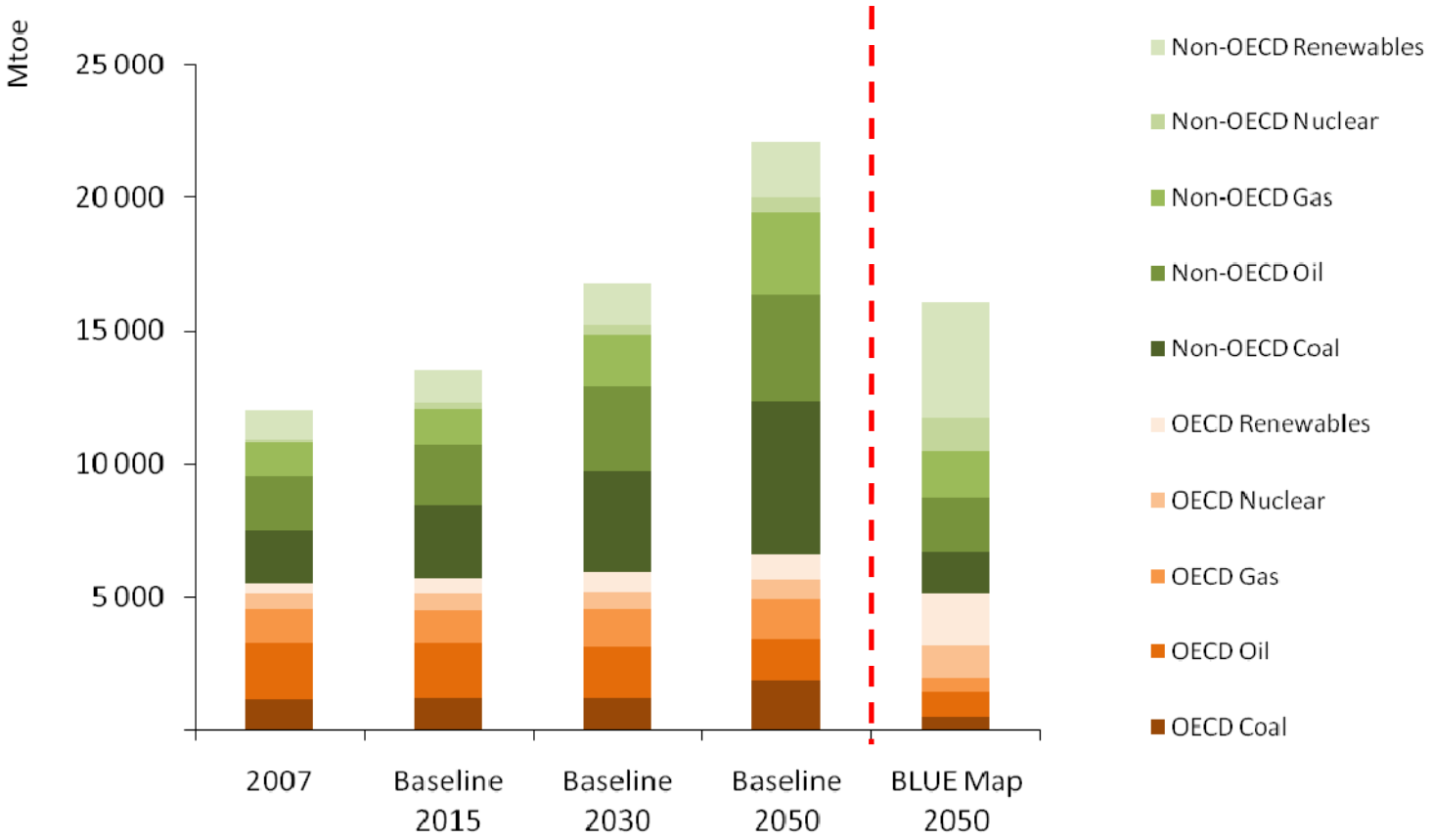
Energy Technology Perspectives 2010

Bilbao, 10 November 2011

The context

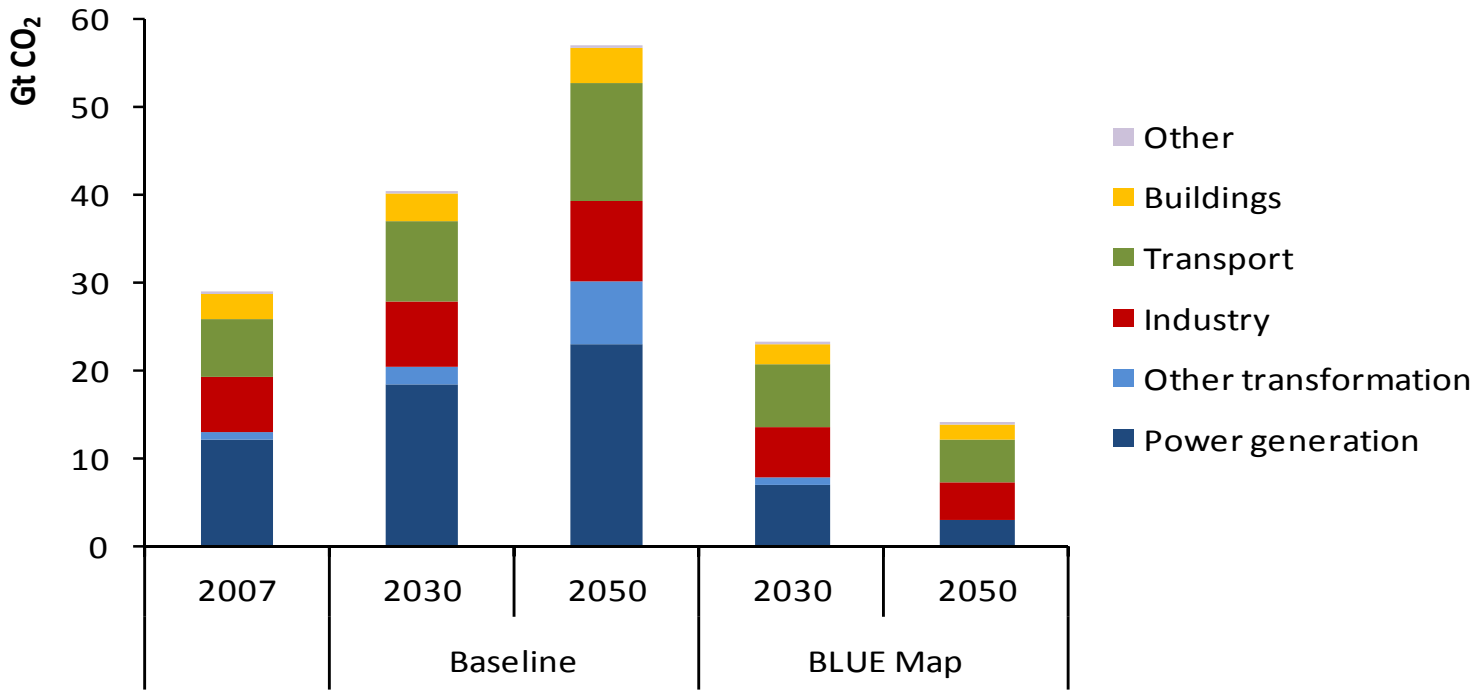
- **Need a global energy technology revolution to meet climate change and energy security challenges.**
- **Some early signs of progress, but much more needs to be done.**
  - **Which technologies can play a role?**
  - **What are the costs and benefits?**
  - **What policies are needed?**

OECD and non-OECD primary energy demand



Primary energy demand in non-OECD countries is projected to increase much faster than in OECD countries.

Global energy-related CO_2 emissions in the Baseline and BLUE Map scenarios

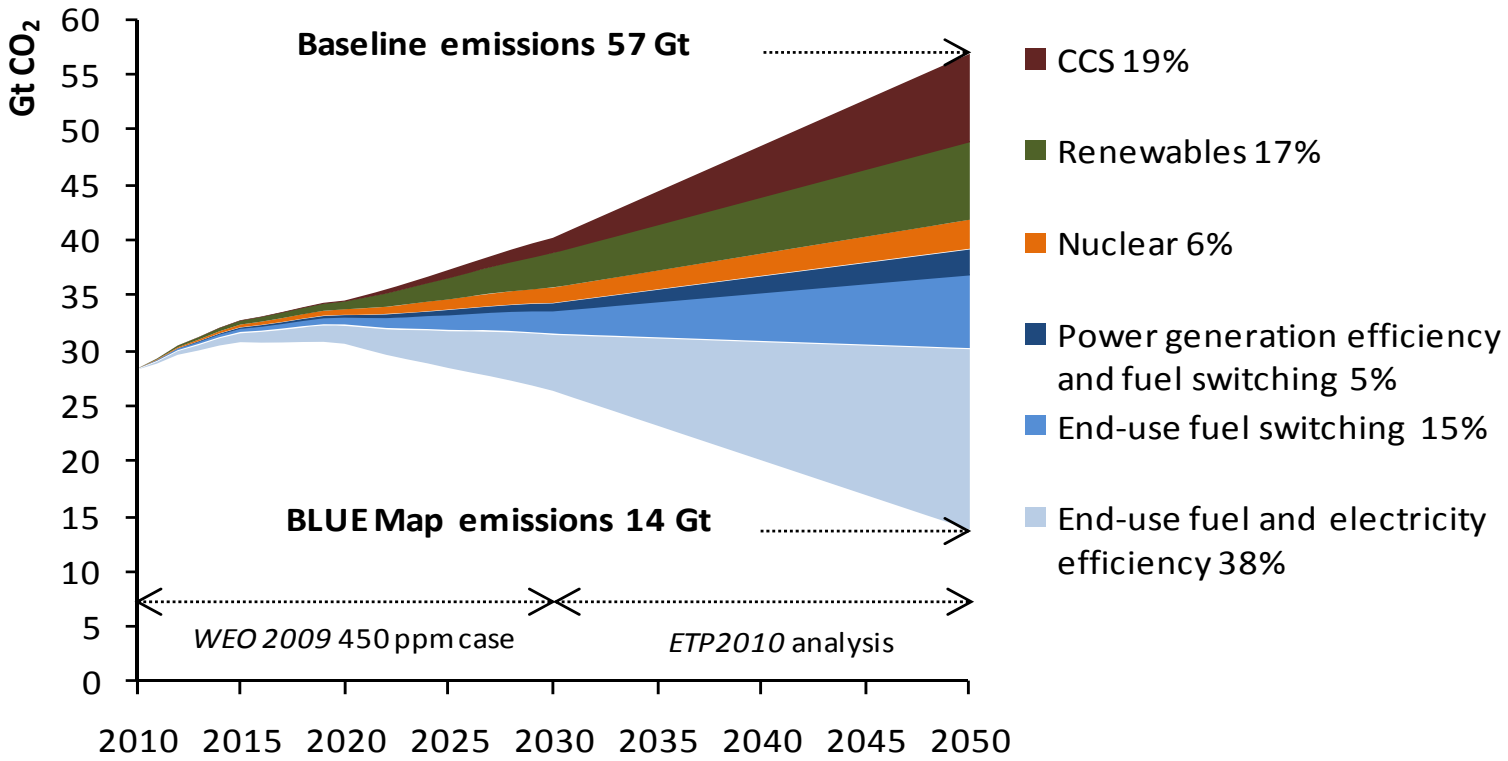


Global CO_2 emissions double in the Baseline, but in the BLUE Map scenario abatement across all sectors reduces emissions to half 2005 levels by 2050.

ENERGY TECHNOLOGY PERSPECTIVES 2010

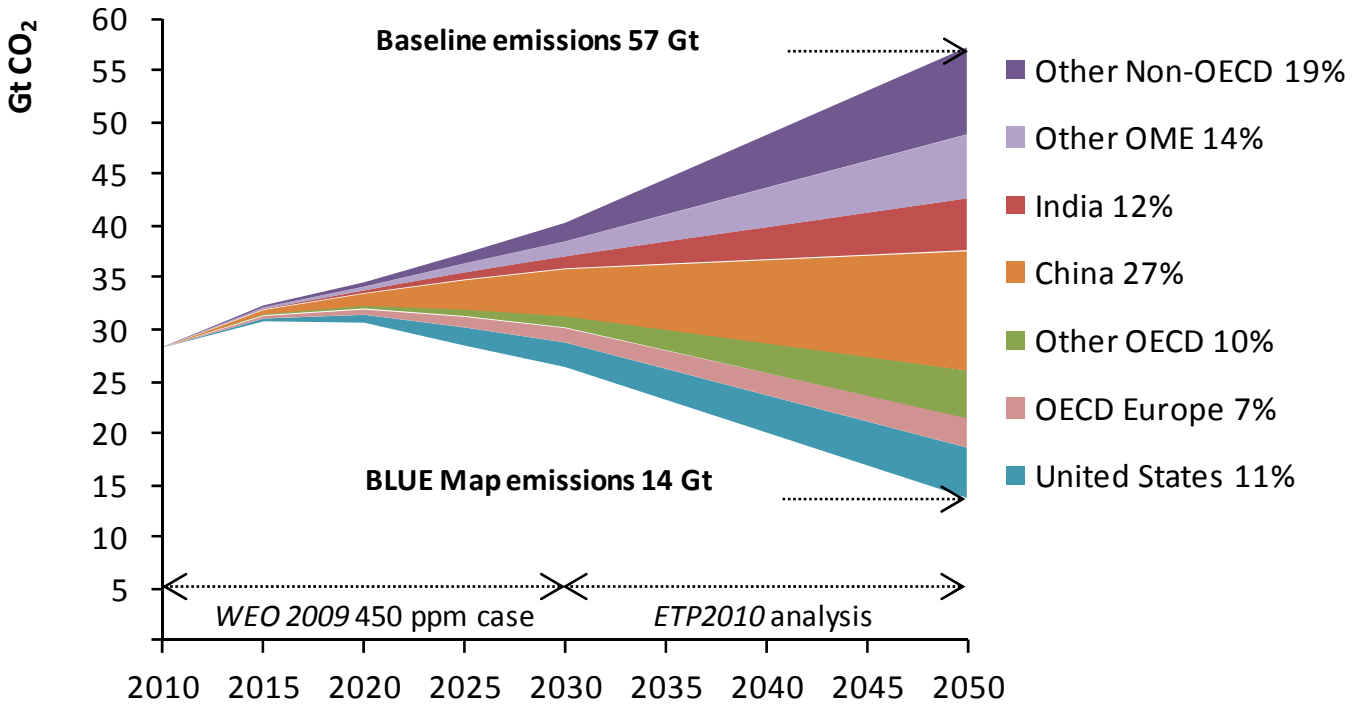
Scenarios & Strategies to 2050

Key technologies for reducing global CO_2 emissions



A wide range of technologies will be necessary to reduce energy-related CO_2 emissions substantially.

World energy-related CO_2 emissions abatement by region

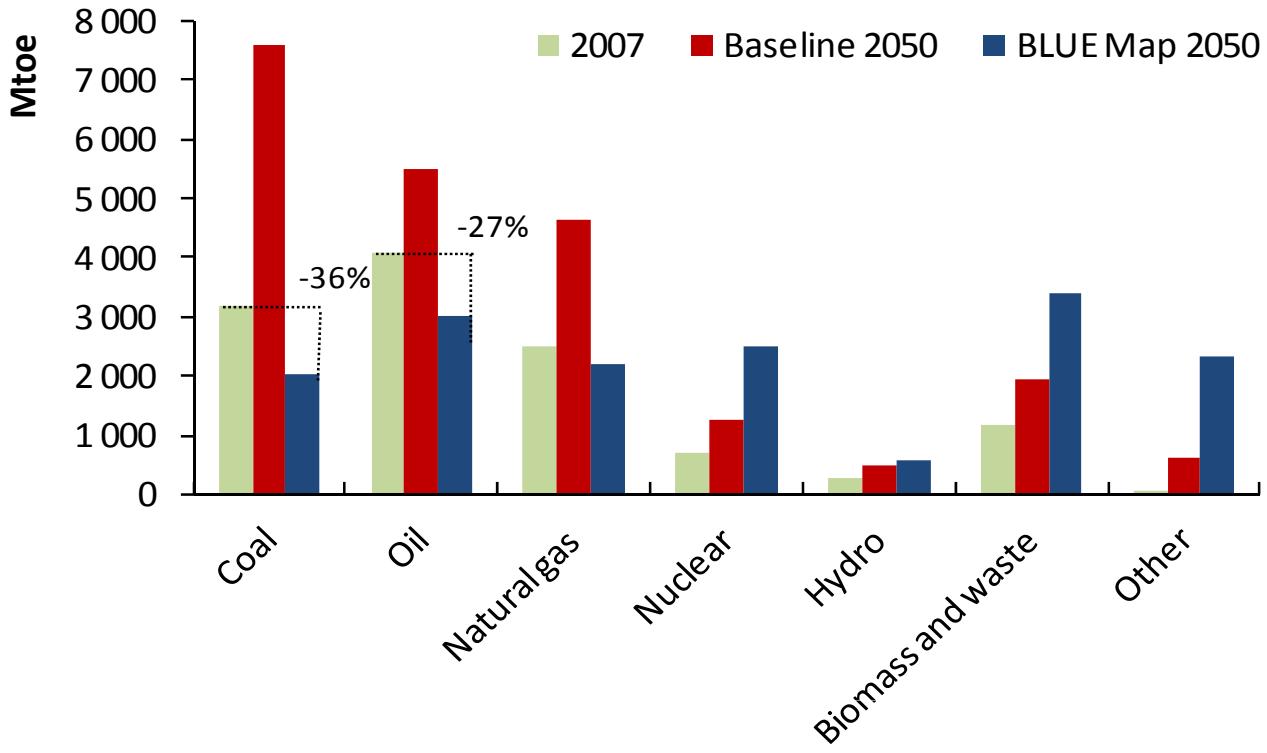


In the BLUE Map scenario, most of the reductions in energy-related CO_2 emissions are in non-OECD countries.

ENERGY TECHNOLOGY PERSPECTIVES 2010

Scenarios & Strategies to 2050

Primary energy demand by fuel and by scenario



By 2050, coal, oil and gas demand are all lower than today under the BLUE Map scenario.

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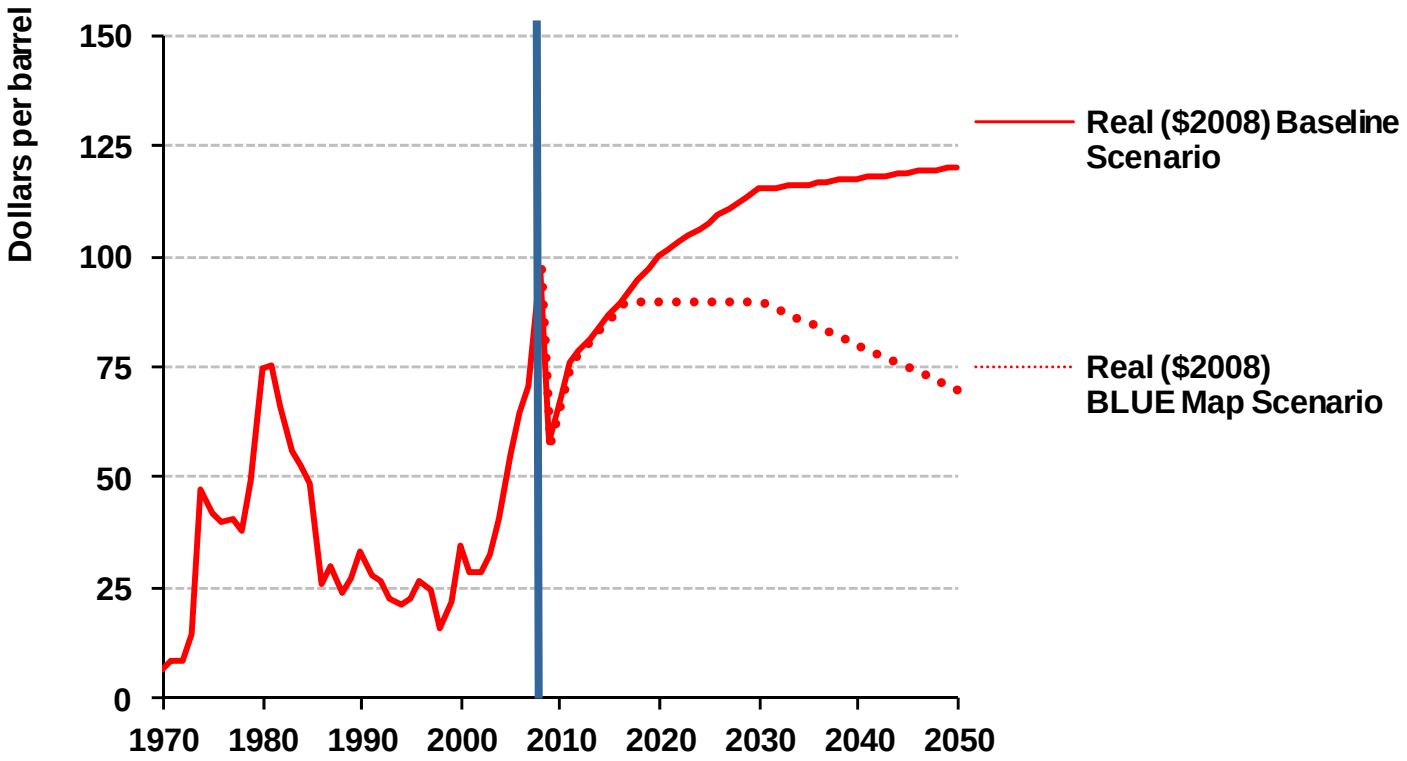
Scenarios & Strategies to 2050

Crude oil price



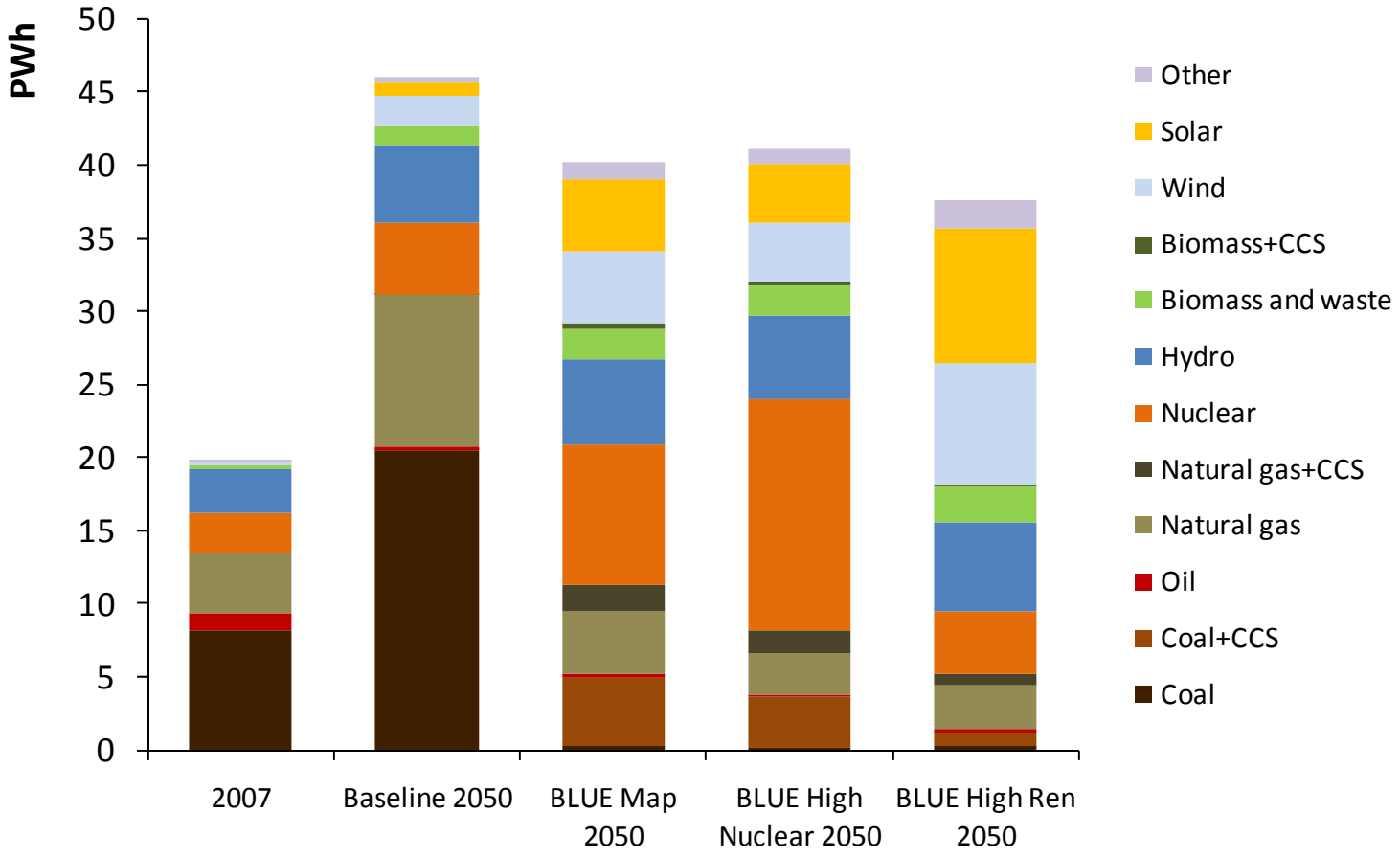
Impact of CO_2 price on costs for crude oil:

2020 50 USD/t CO_2 = 21 USD/bbl: 90+21 =111 USD/bbl

2030 110 USD/t CO_2 = 43 USD/bbl: 90+43 =133 USD/bbl

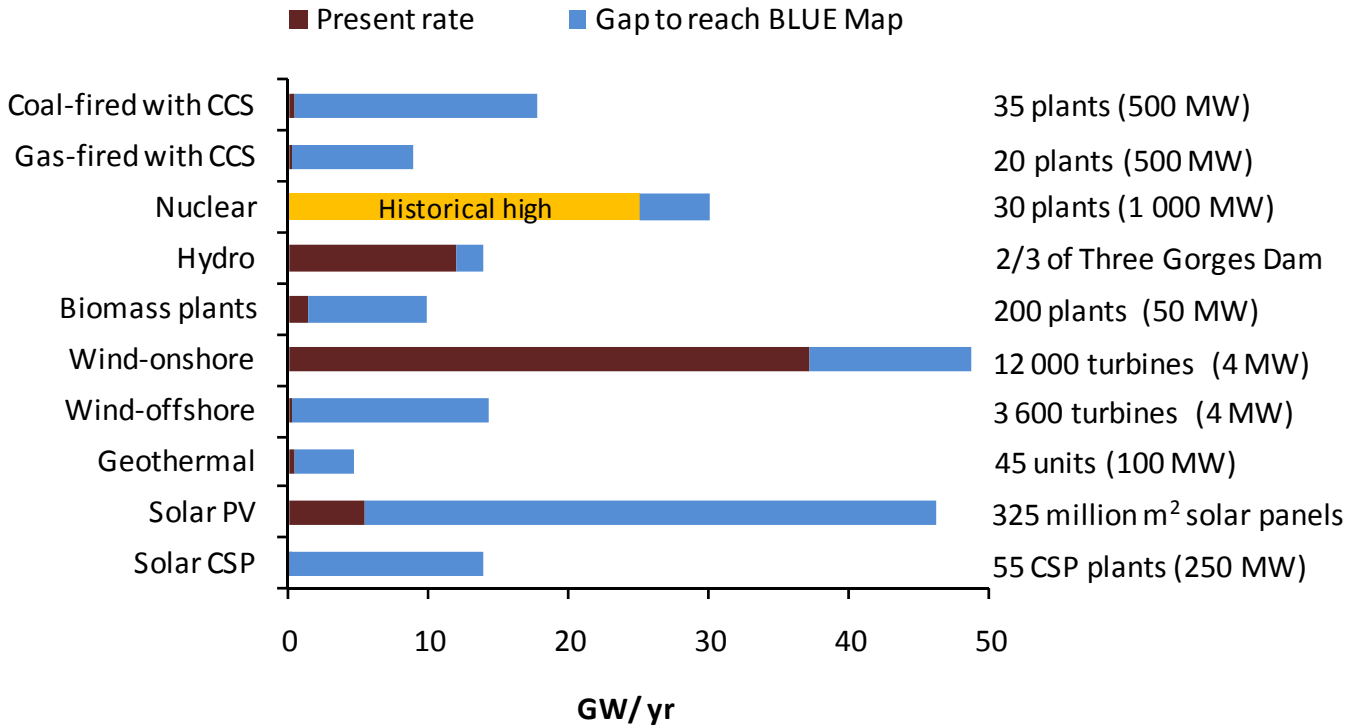
2050 175 USD/t CO_2 = 73 USD/bbl: 70+73 =143 USD/bbl

Decarbonising the power sector – a new age of electrification?



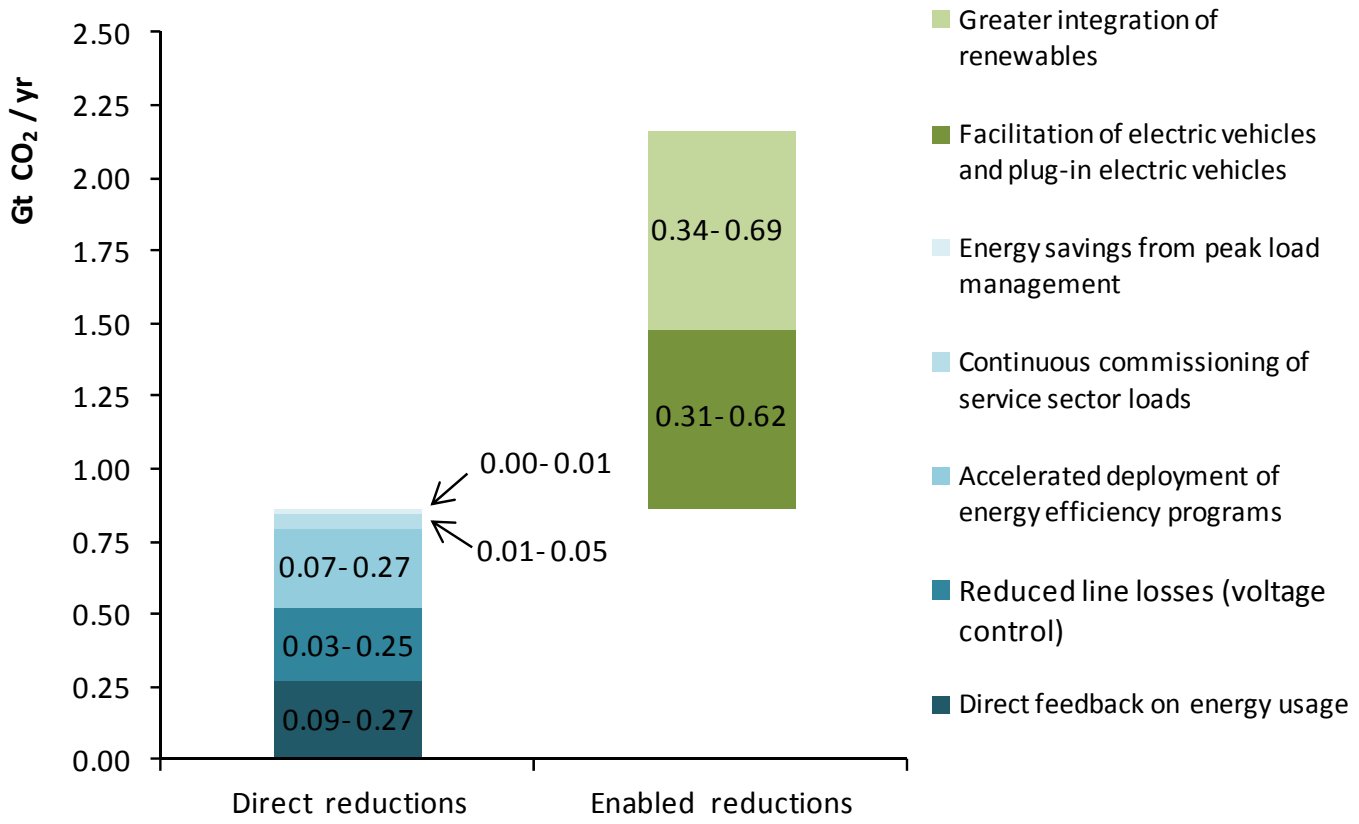
A mix of renewables, nuclear and fossil-fuels with CCS will be needed to decarbonise the electricity sector.

Average annual electricity capacity additions to 2050, BLUE Map scenario



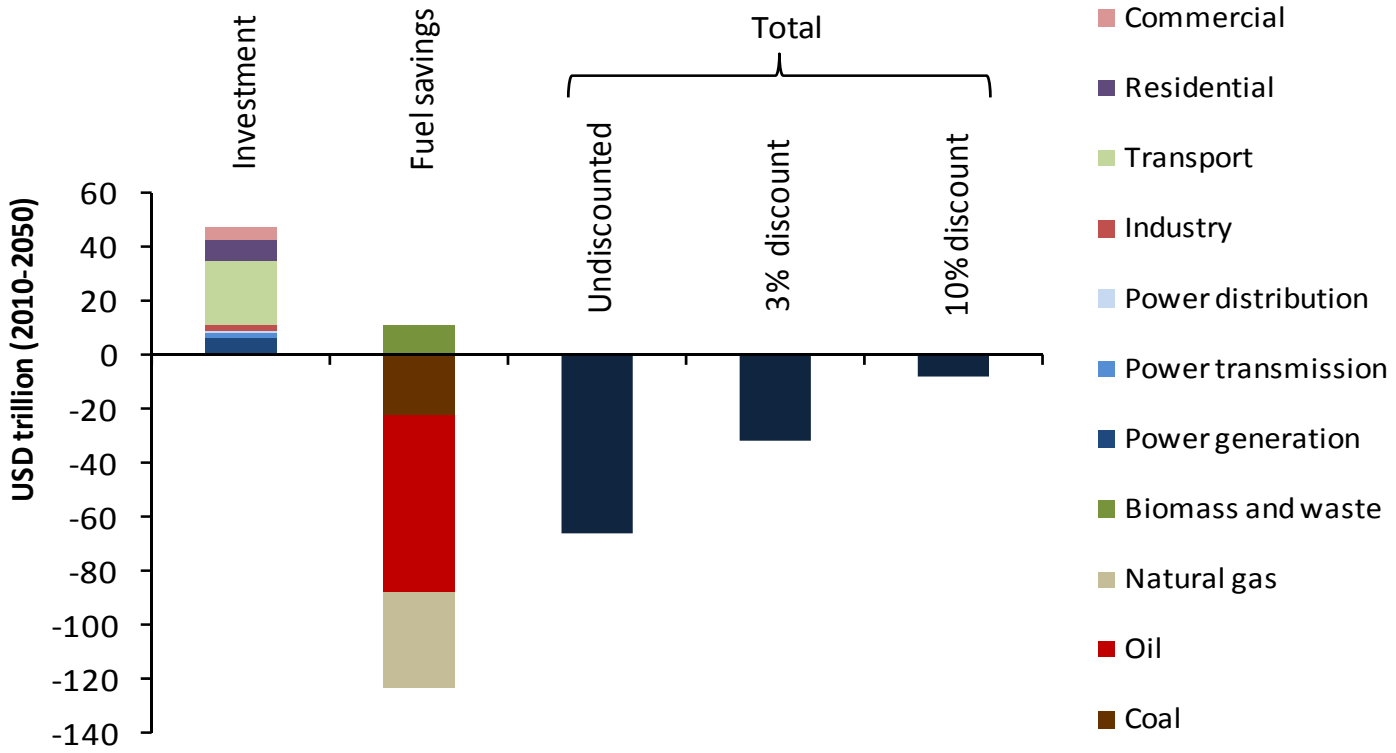
Annual rates of investment in many low-carbon technologies must be massively increased from today's levels.

Smart grid CO_2 reductions in 2050



Smart grids allow better management of the grid and can facilitate the deployment of low-carbon technologies, such as renewables and electric vehicles.

Additional investment and fuel savings, 2010-2050



Even using a 10% discount rate, fuel savings in the BLUE Map scenario more than offset the additional investment required.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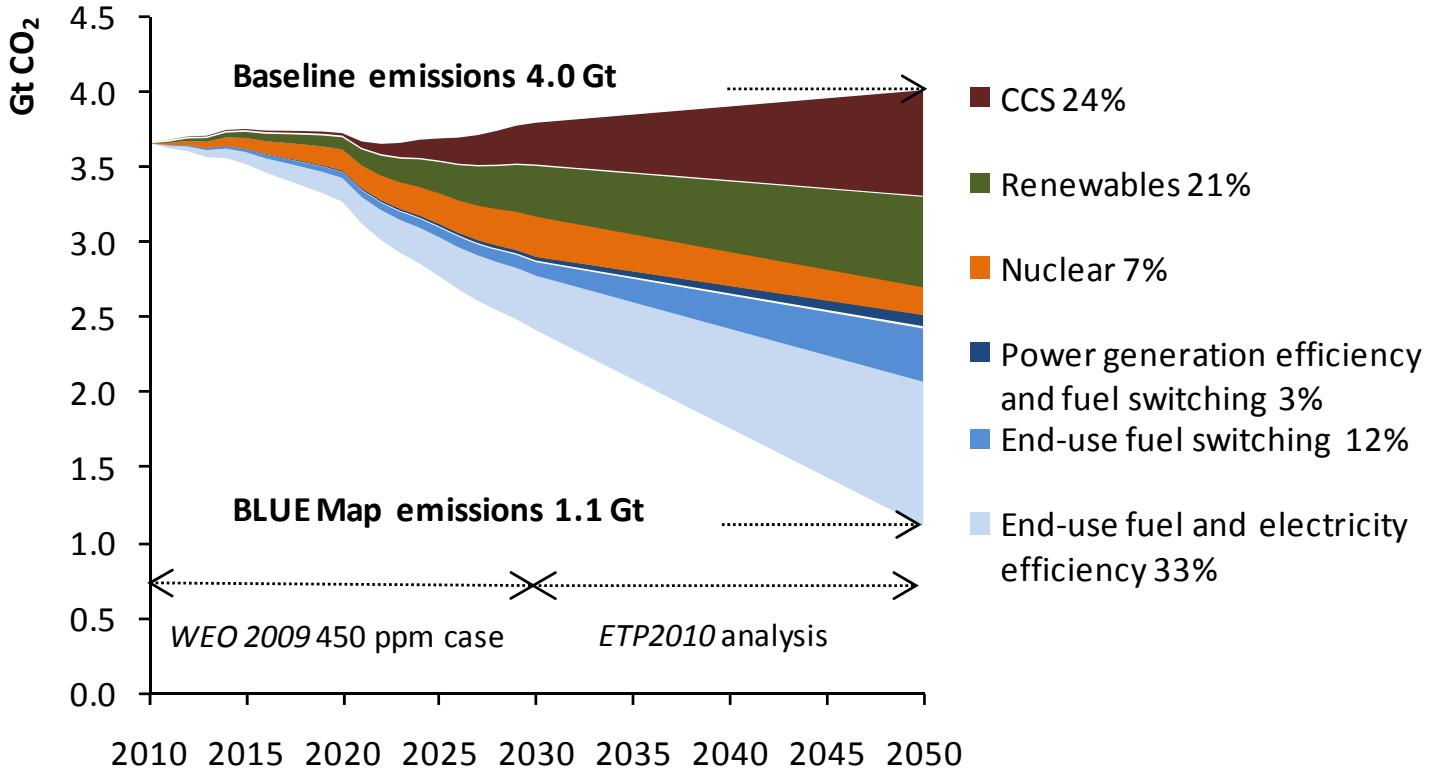
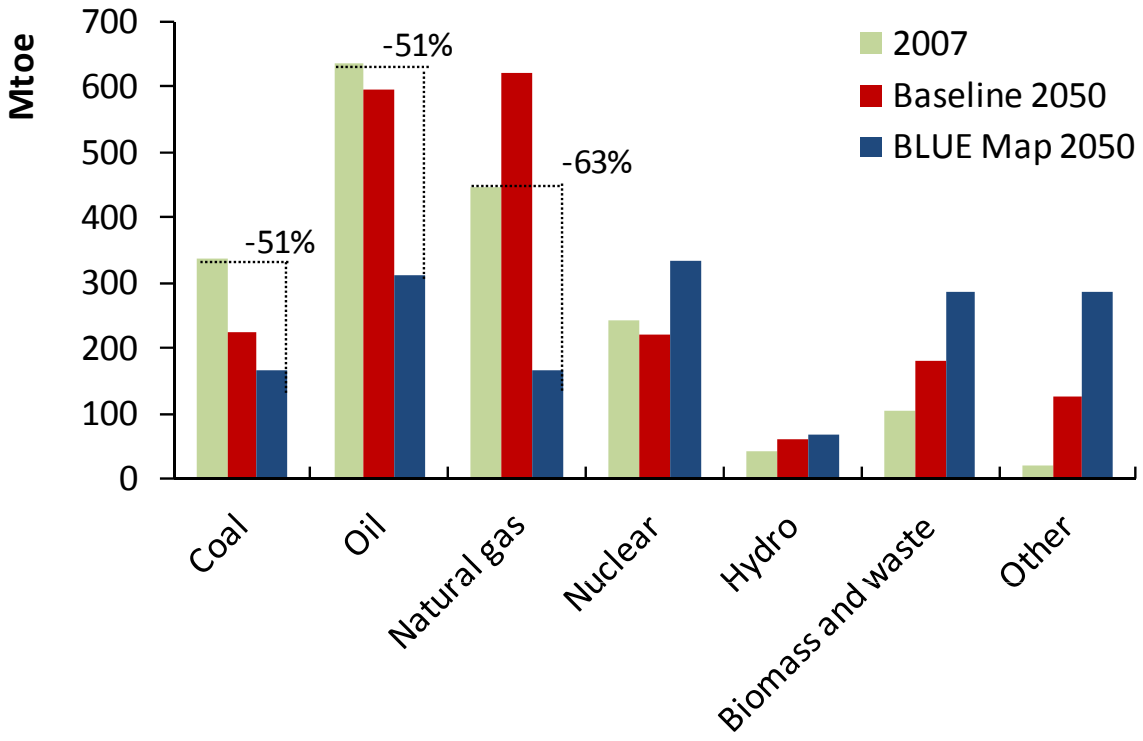
OECD EUROPE

Contributions to emissions reductions in OECD Europe



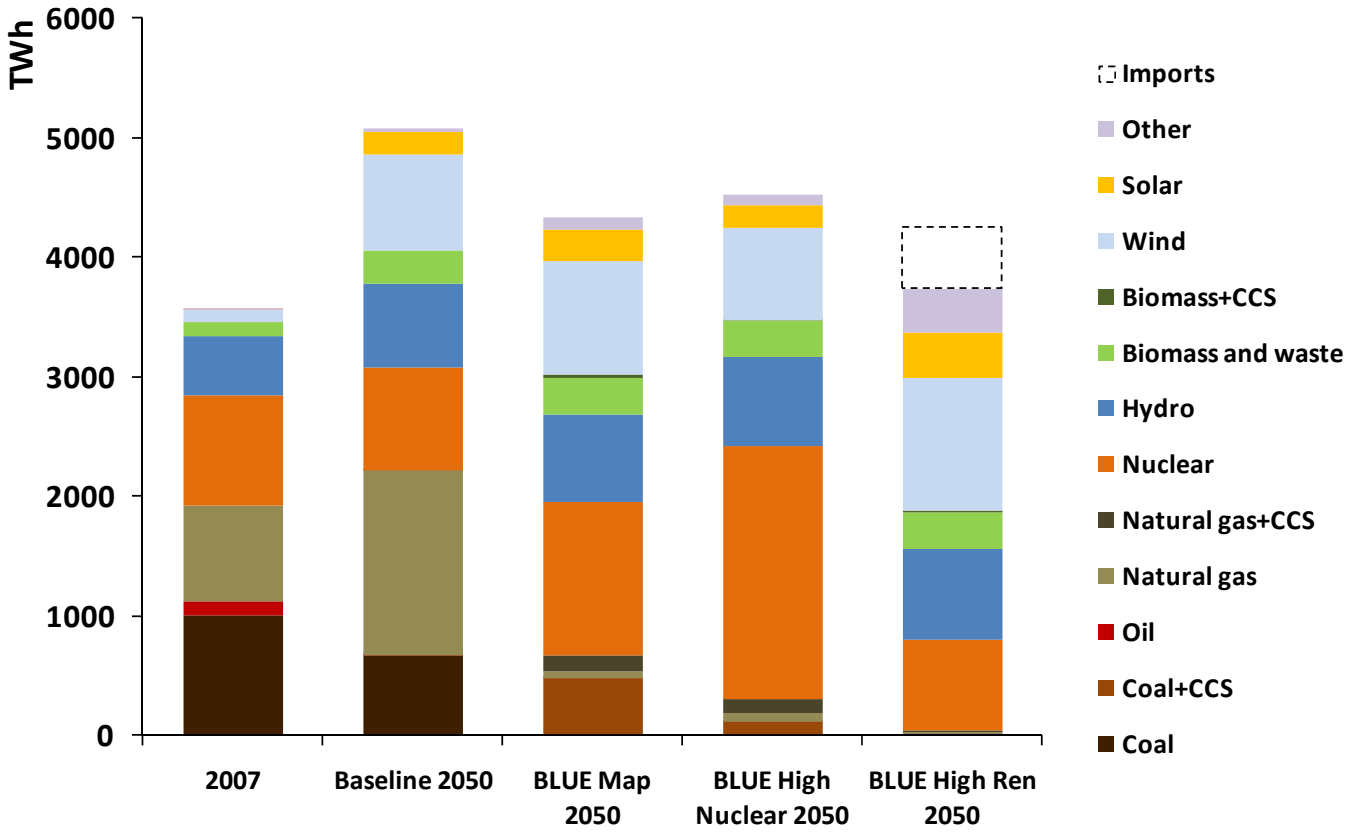
End-use sector measures contribute nearly two-thirds of the emissions reductions between the Baseline and BLUE scenarios in 2050.

Primary energy demand by fuel and by scenario in OECD Europe



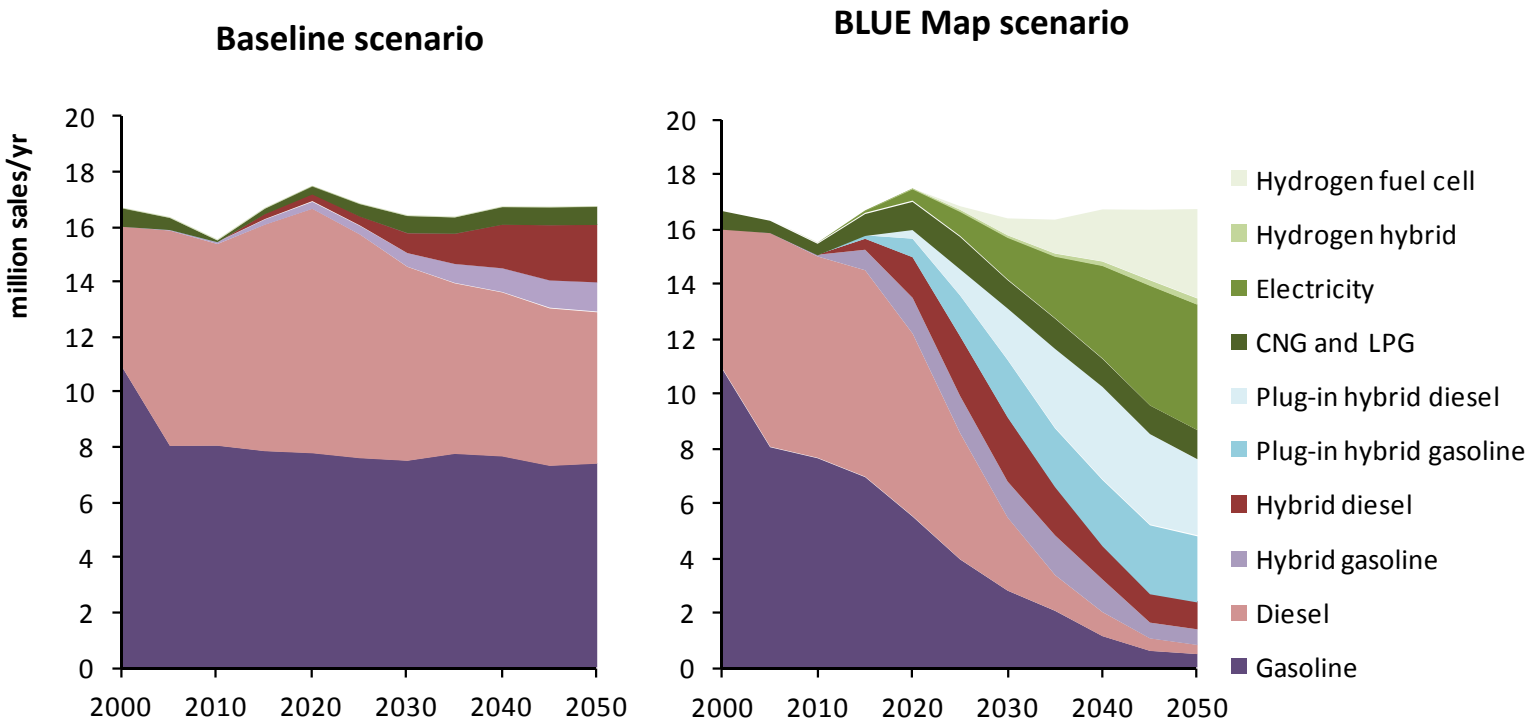
Fossil fuel demand is reduced to one half under the BLUE Map scenario.

Decarbonisation of power generation in OECD Europe



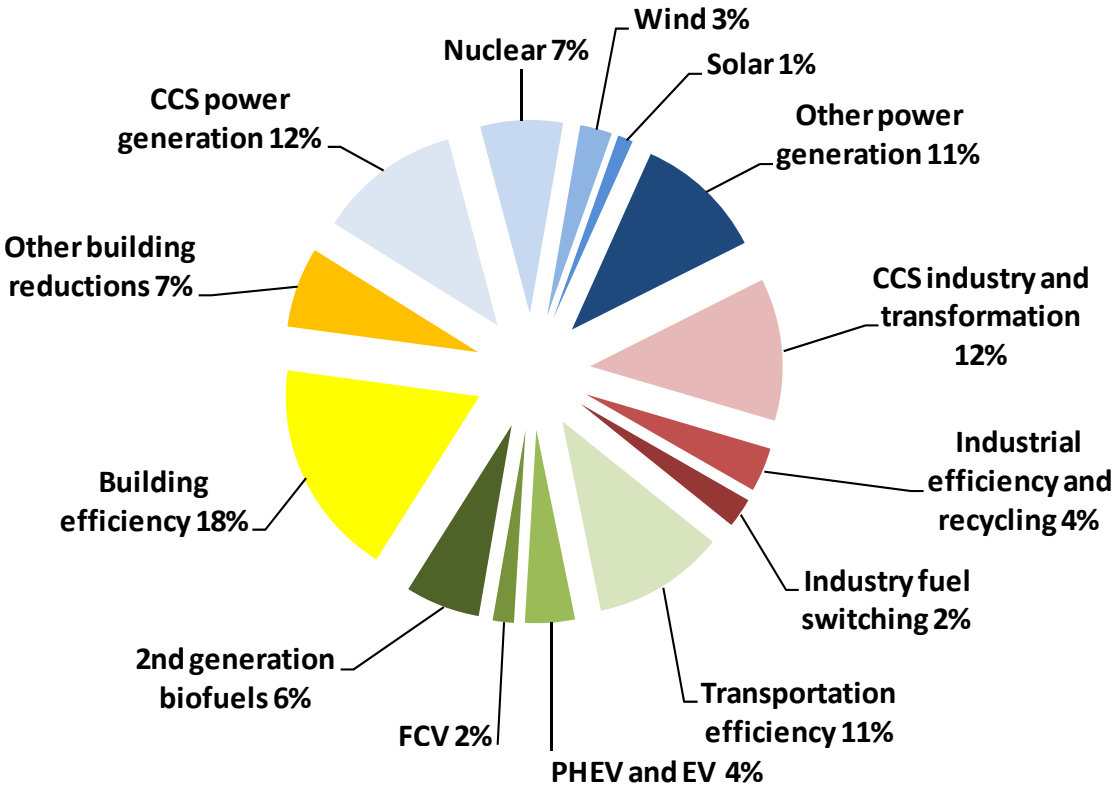
A mix of nuclear, renewables and fossil-fuels with CCS will be needed to decarbonise the electricity sector.

Passenger light-duty vehicles sales by technology in OECD Europe in the Baseline and BLUE Map scenarios



A wide range of new LDV technologies contribute to emissions reductions under the BLUE scenario.

Contributions to emissions reductions in OECD Europe



Reductions in the buildings and power sector represent the largest savings

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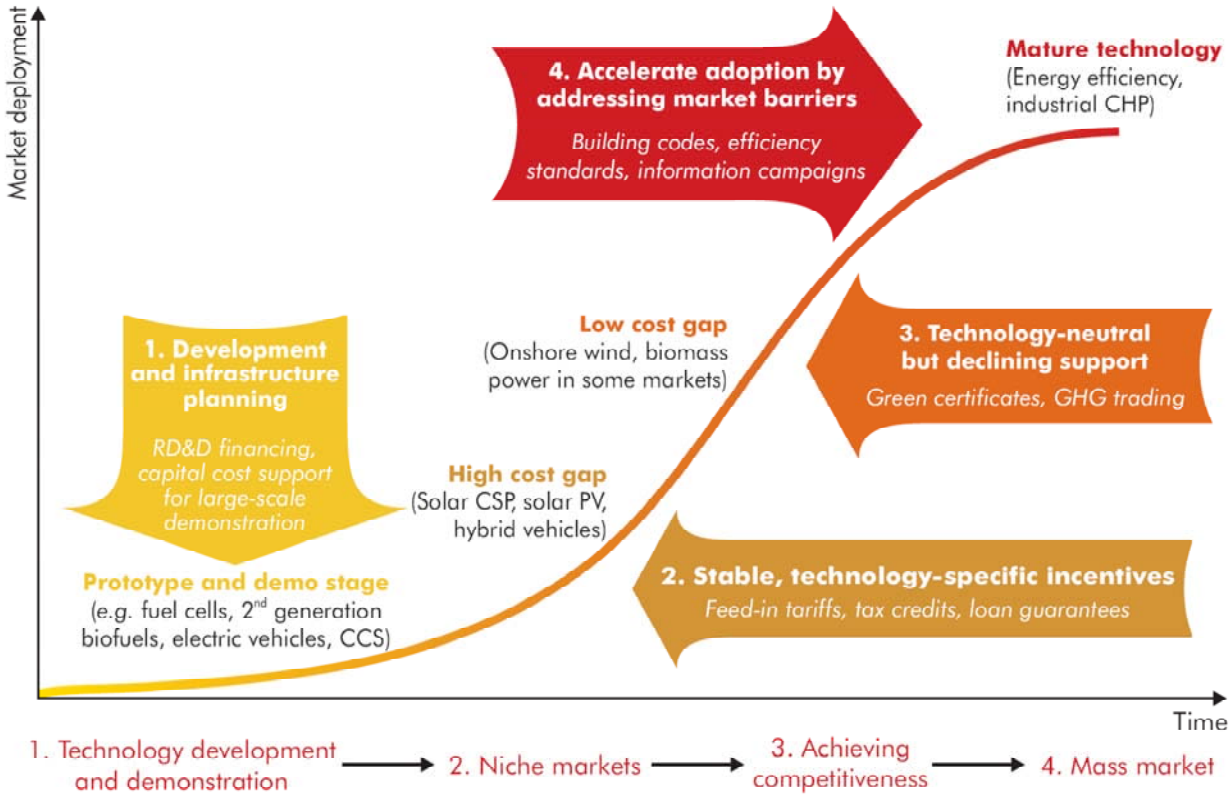
Scenarios & Strategies to 2050

Policies for supporting low-carbon technologies



Government support policies need to be appropriately tailored to the stage(s) of technological development.

The importance of energy technology policy

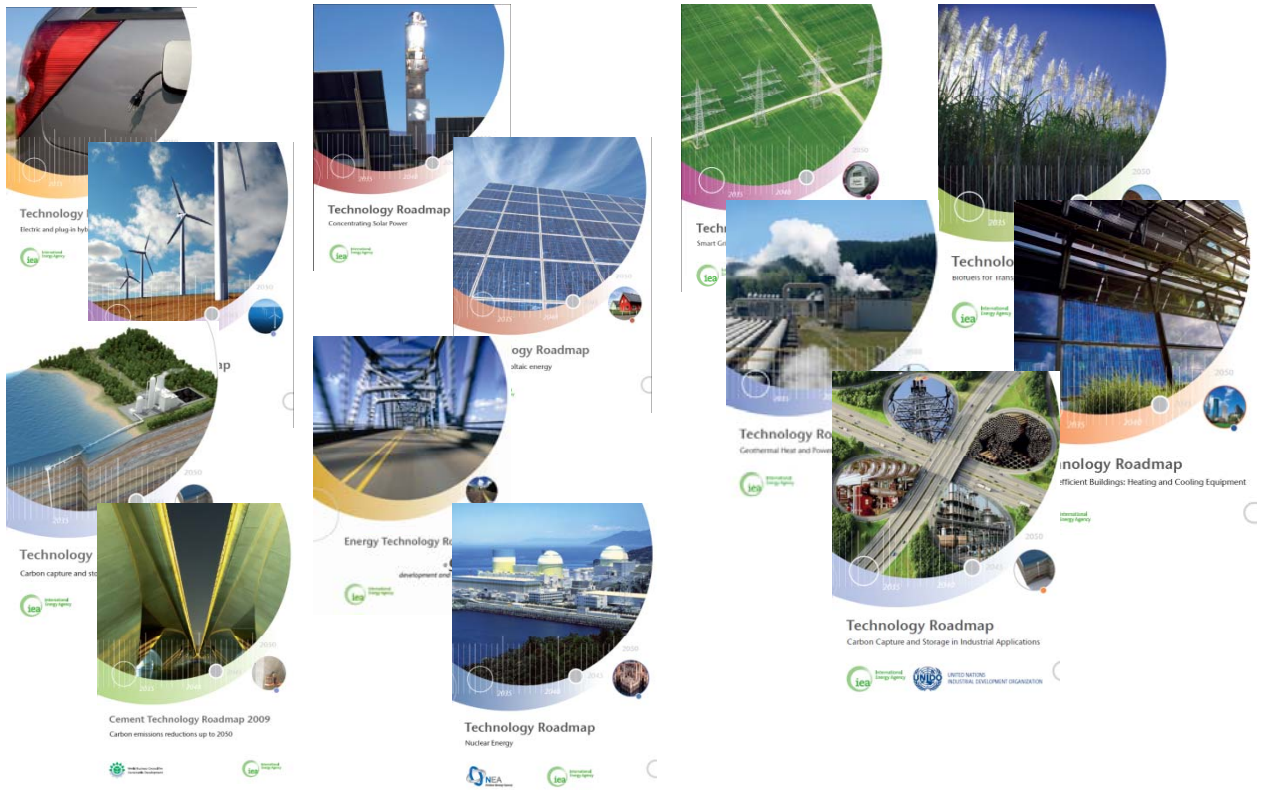
- A global price for carbon is necessary
  - …but by itself insufficient to accelerate the needed energy technology advancements in time
- Greater focus on energy technology policies needed
- Technology roadmaps can support GHG goals by:
  - Identifying and addressing technology-specific barriers
  - Highlighting necessary deployment policies and incentives
  - Directing increased RD&D funding for new technologies
  - Supporting technology diffusion, knowledge sharing among countries

Technology roadmaps provide answers

- **Where is technology today?**
  - GW installed capacity/kWh of savings
  - Leading countries/regions
  - Cost, efficiency
- **What is the deployment pathway needed to achieve 2050 goals?**
  - Use IEA Energy Technology Perspectives BLUE Map scenarios
- **What are the priority near-term actions?**
  - R&D gaps and how to fill them
  - Identify barriers and obstacles and how to overcome
  - Market requirements and policy needs
  - Technology diffusion/transfer and international collaboration needs

Technology roadmaps

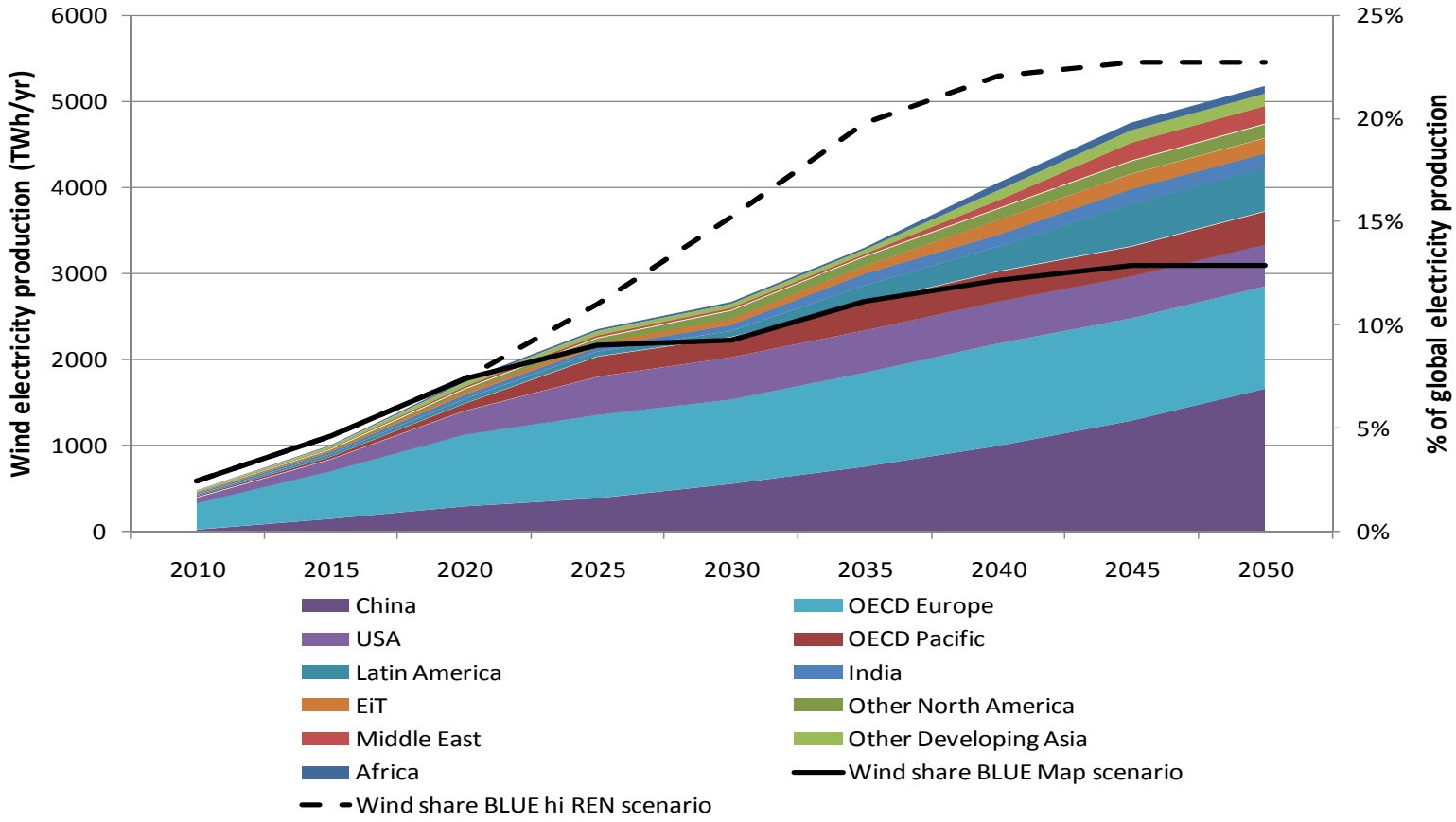
2009 **2010** **2011**



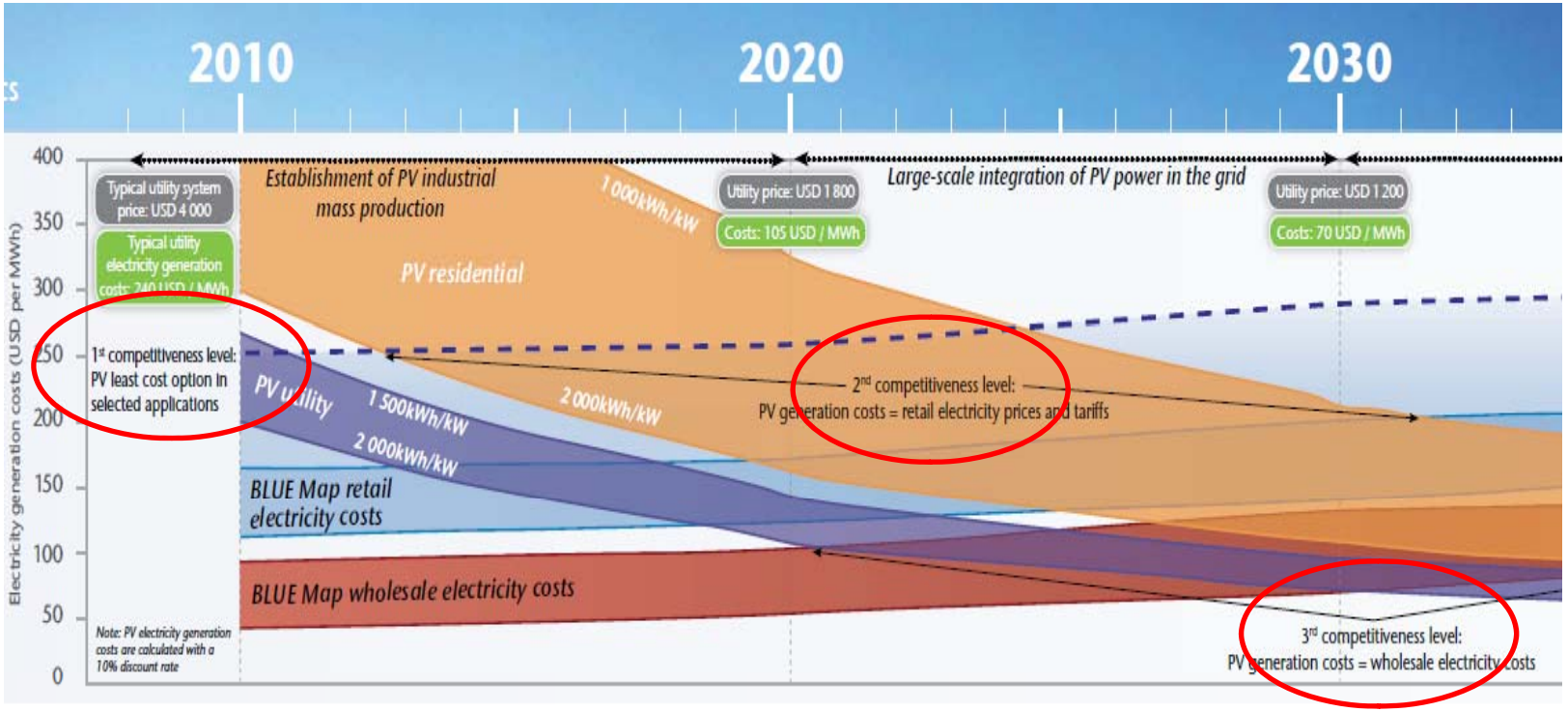
2012

- **Vehicle Fuel Economy**
- **High efficiency, low emissions coal**
- **Hydropower**
- **Bioenergy**
- **Solar heating & cooling**
- **Energy efficient building envelopes**
- **Chemical catalysis**

Roadmap example:
Wind - an ambitious growth pathway



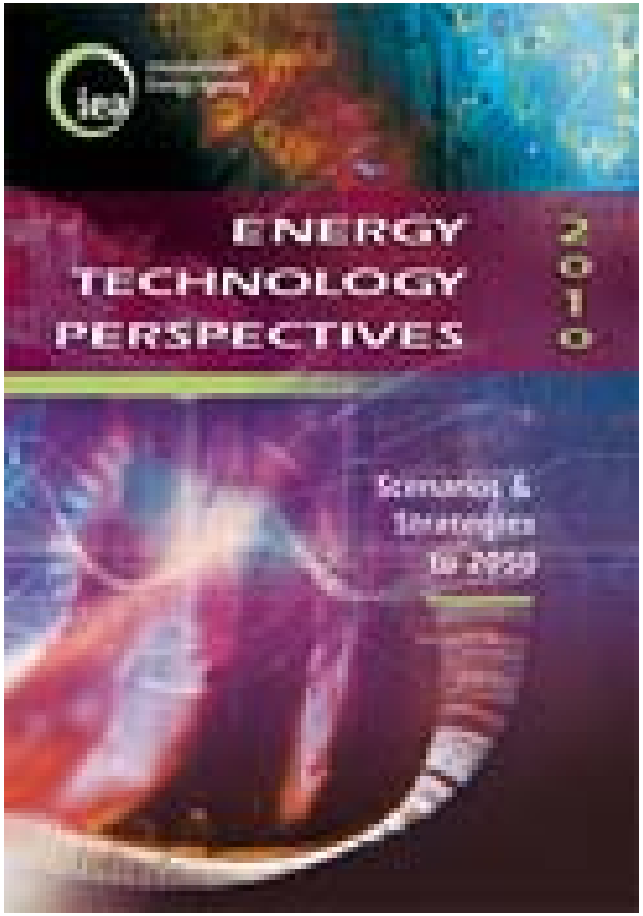
PV Roadmap



PV can provide 5% of global electricity generation in 2030, 11% in 2050

EV/PHEV roadmap example: milestones

Milestones:	2010-2012	2012-2015	2015-2020
Policy framework	Develop policy frameworks focused on early adopters with incentives for consumers / manufacturers		Review of policies and updates to reflect best practices; support for expansion of infrastructure and to ensure EV/PHEV sales are on track
Vehicles / batteries	Begin production of EV and PHEV models, low-production volume demonstrations to test batteries and controls, and assist design optimizations		Rapidly increase numbers of models offered and average production volumes; battery and other costs begin to decline
Codes / standards	Create common standards for plugs and recharging protocols in each major region		Ensure that smart metering is available for home recharging with dual tariffs in early adopter areas
Recharging / electricity infrastructure	Focus on areas likely to require recharging infrastructure through 2015; target early adopter homes and public locations		Begin major investments in increased street/office daytime commercial recharging, including rapid charging where possible
RD&D	Ensure early vehicle/battery models are safe; achieve near-term technical targets; continue RD&D on advanced battery designs		Progress toward battery cost targets of USD 300/ kWh; incorporate lessons learned from early experiences



Thank You

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