



International
Energy Agency

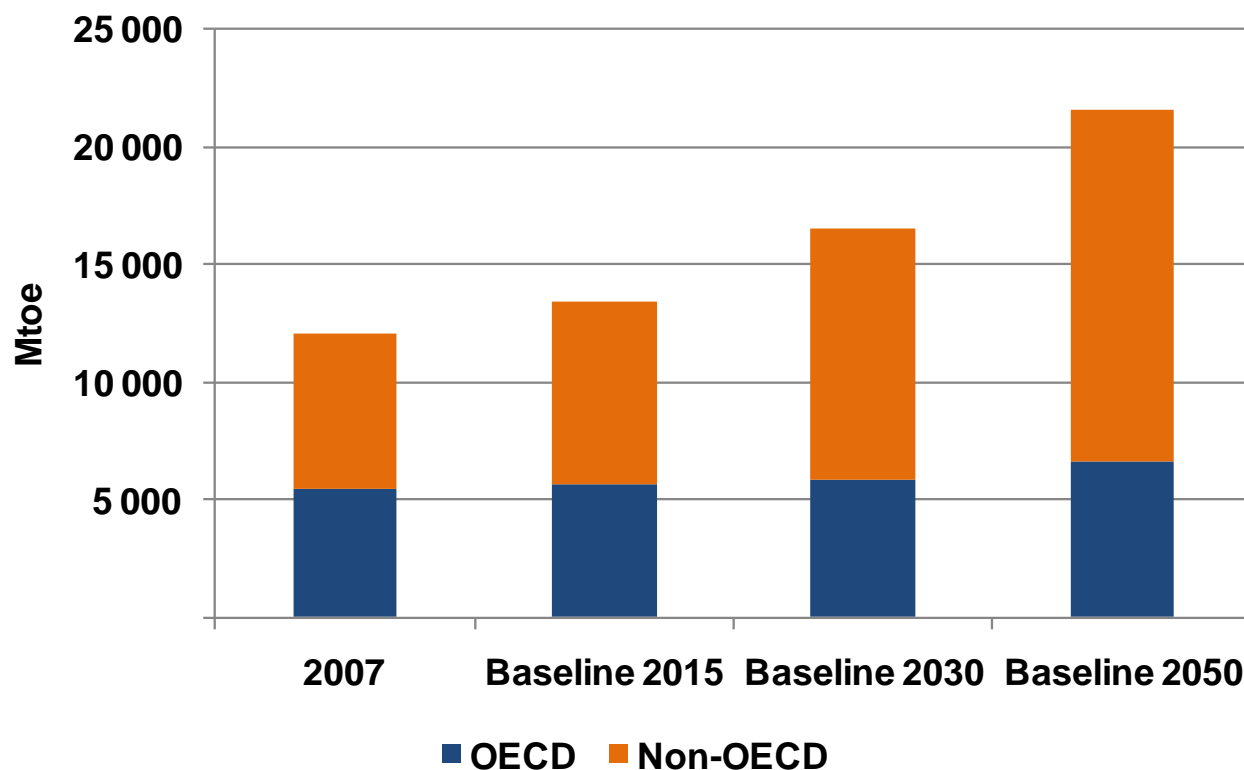
Energy Technology Perspectives 2010

Beijing, 15 July 2010

The context

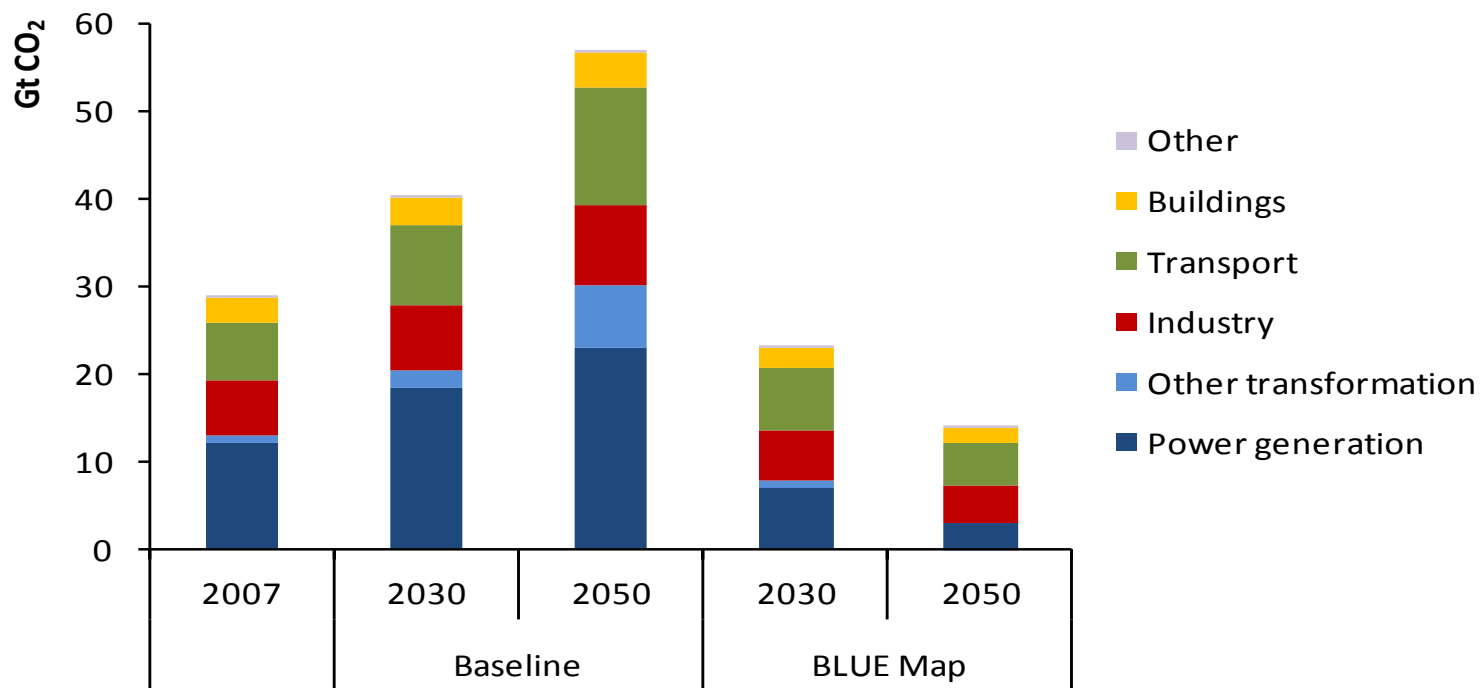
- **Need a global energy technology revolution to meet climate change and energy security challenges.**
- **Some early signs of progress, but much more needs to be done.**
 - **Which technologies can play a role?**
 - **What are the costs and benefits?**
 - **What policies are needed?**

OECD and non-OECD primary energy demand in the Baseline scenario



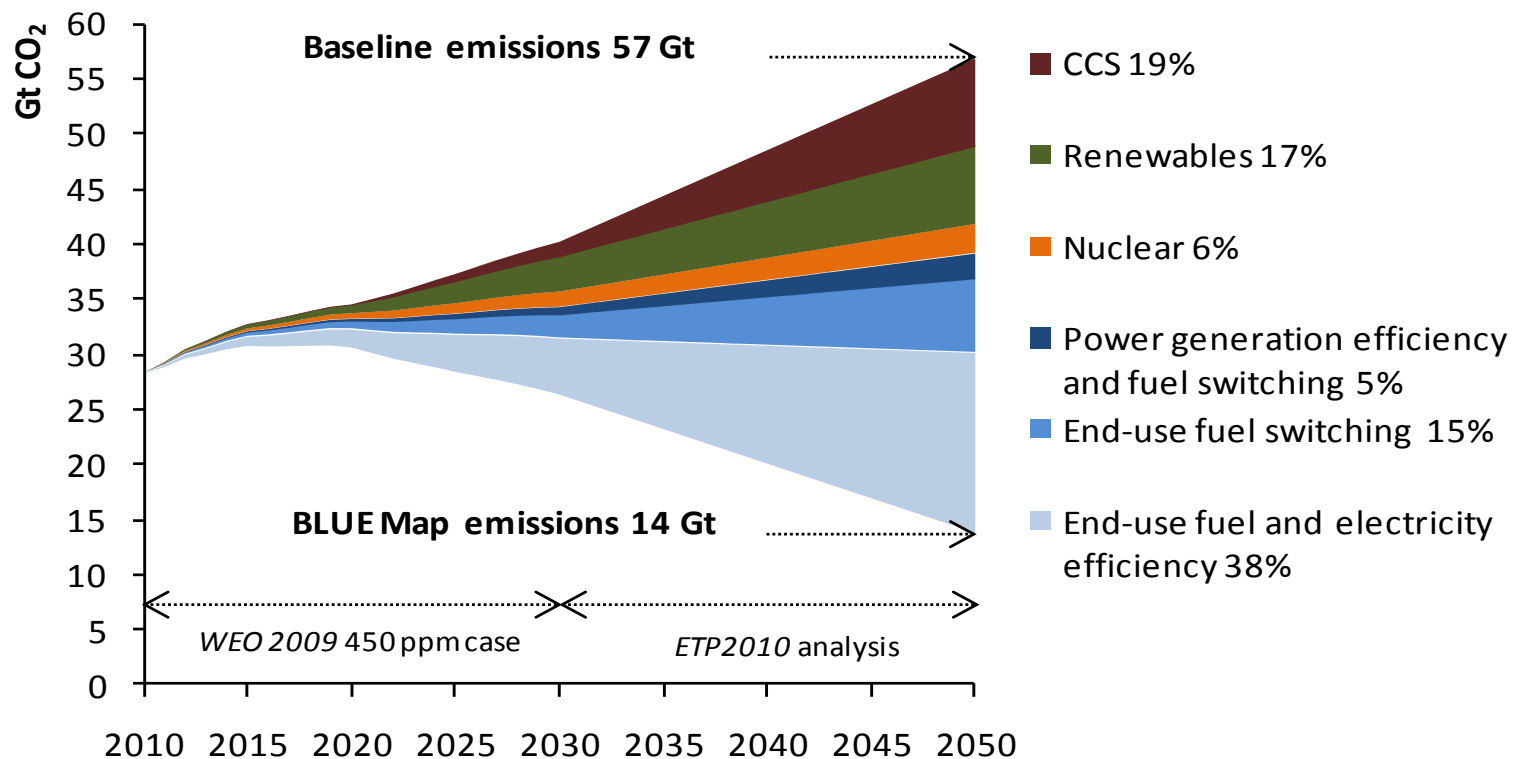
Primary energy demand in non-OECD countries is projected to increase much faster than in OECD countries in the Baseline scenario.

Global energy-related CO₂ emissions in the Baseline and BLUE Map scenarios



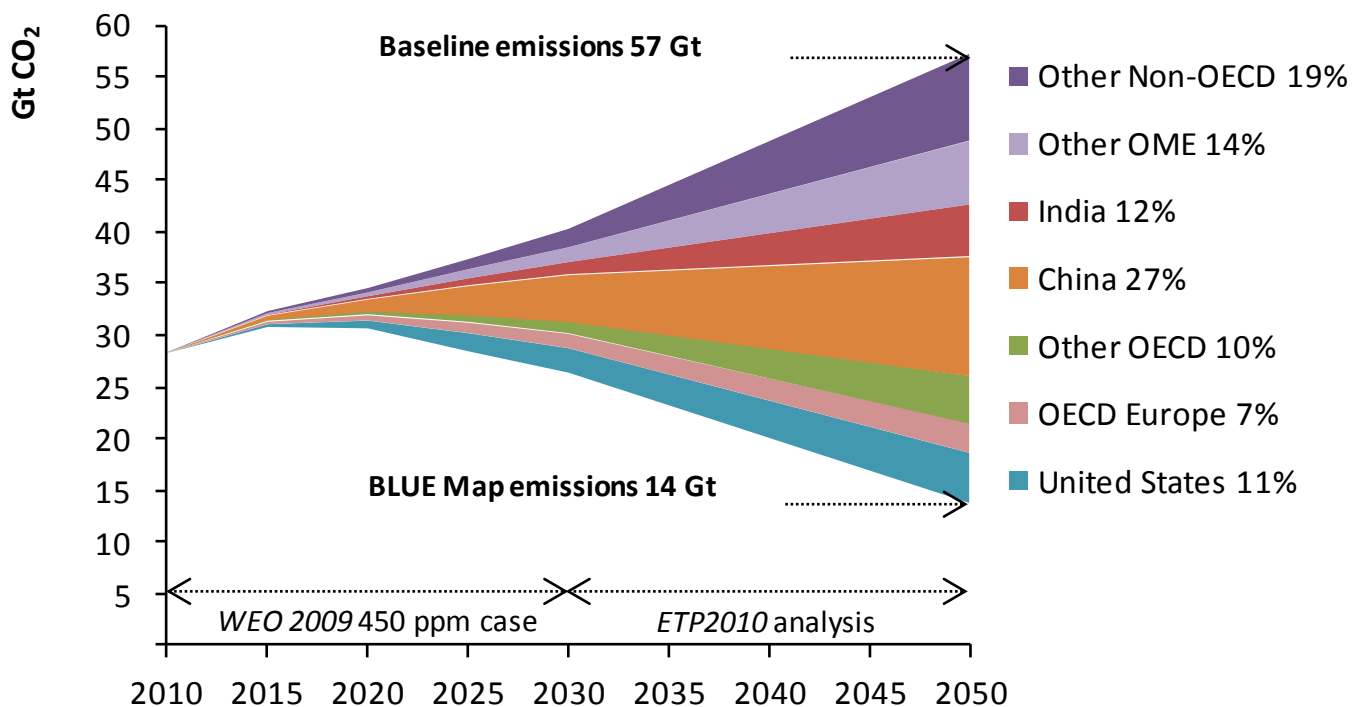
Global CO₂ emissions double in the Baseline, but in the BLUE Map scenario abatement across all sectors reduces emissions to half 2005 levels by 2050.

Key technologies for reducing global CO₂ emissions



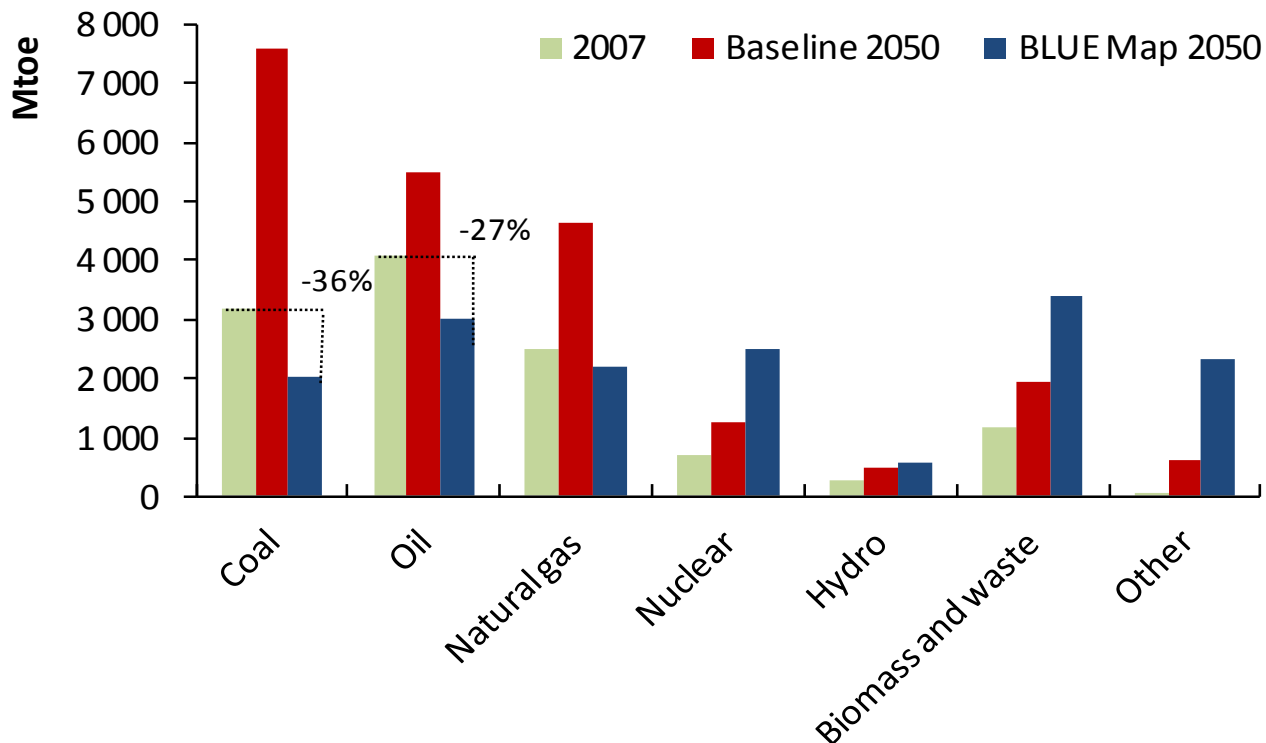
A wide range of technologies will be necessary to reduce energy-related CO₂ emissions substantially.

World energy-related CO₂ emissions abatement by region



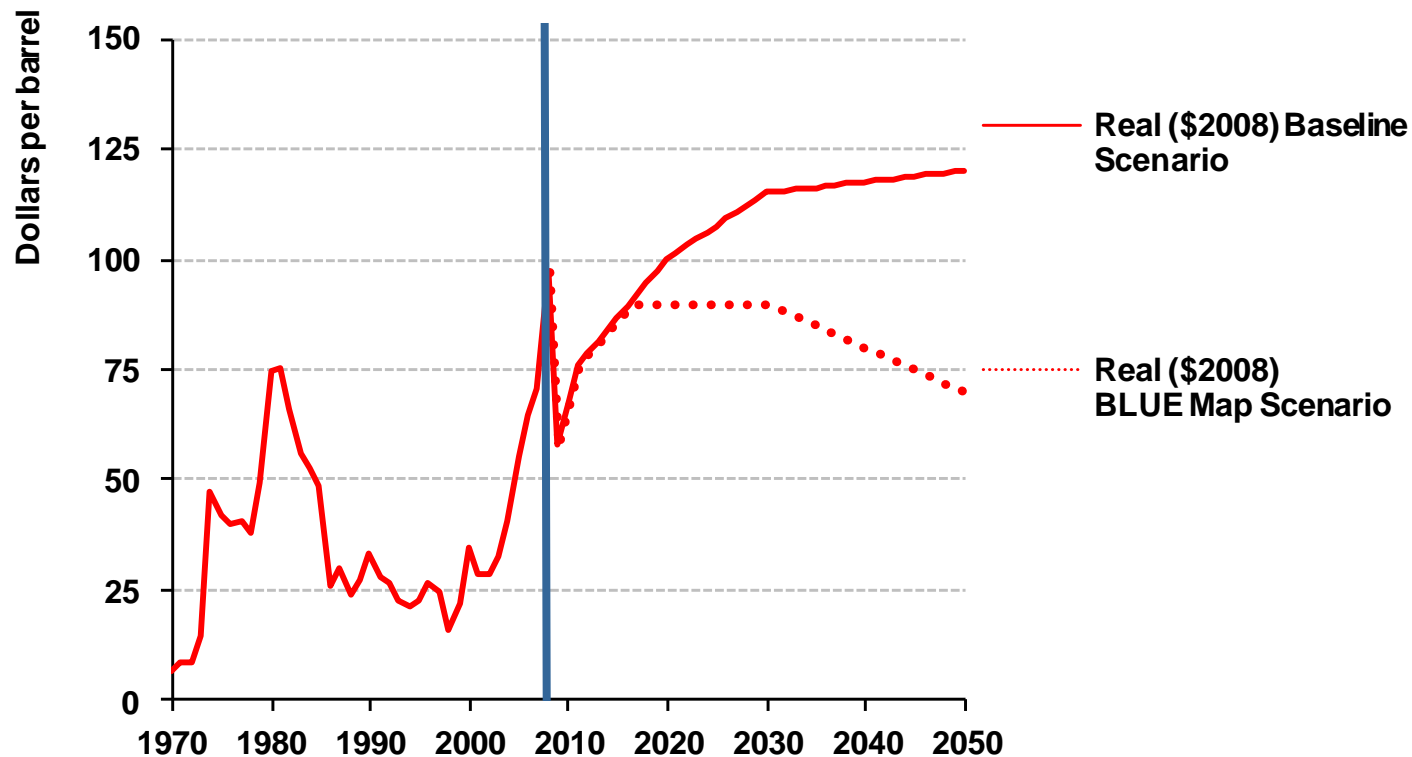
In the BLUE Map scenario, most of the reductions in energy-related CO₂ emissions are in non-OECD countries.

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.

Crude oil price



Impact of CO₂ price on costs for crude oil:

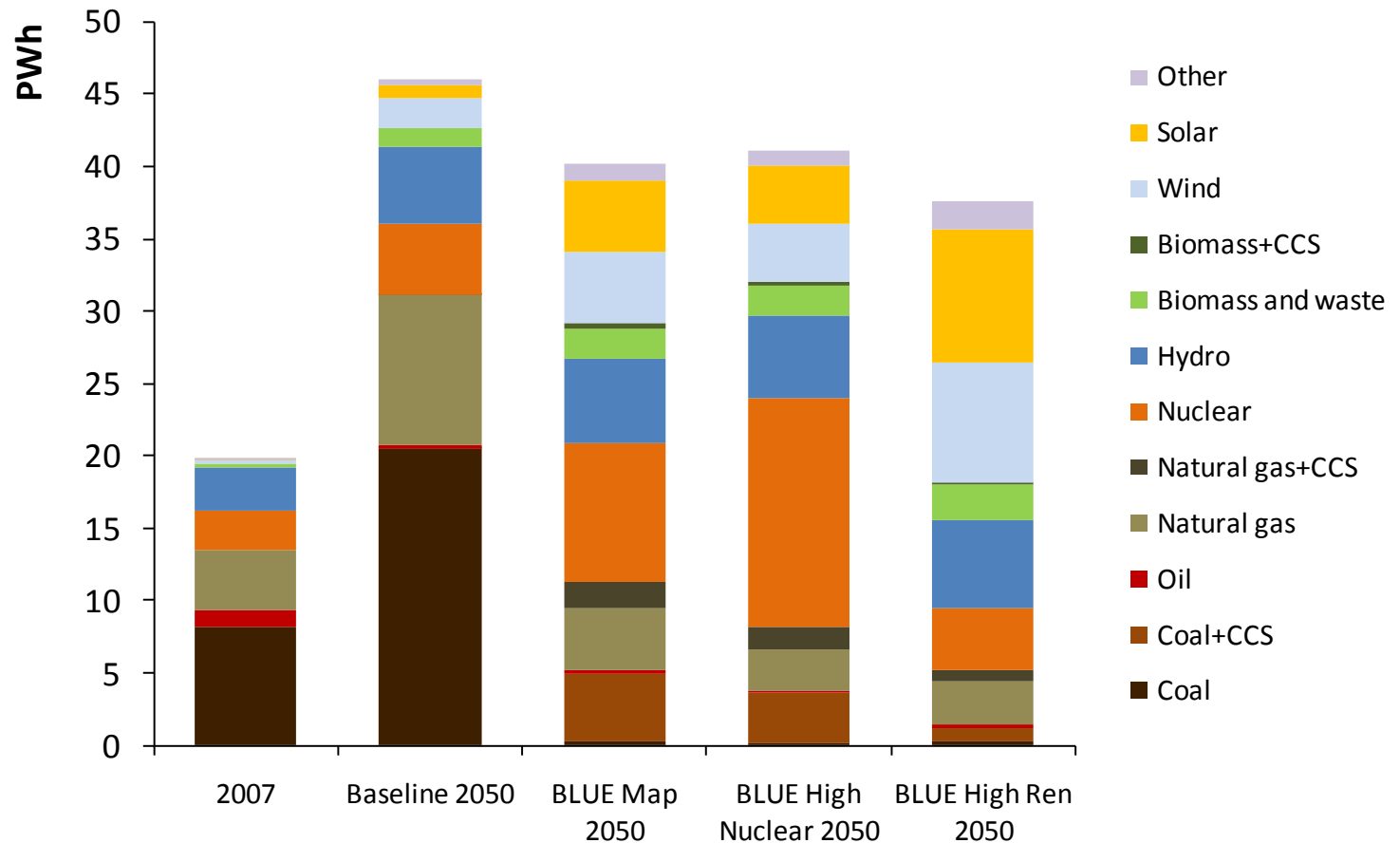
2020 50 USD/t CO₂ = 21 USD/bbl: 90+21 = 111 USD/bbl

2030 110 USD/t CO₂ = 43 USD/bbl: 90+43 = 133 USD/bbl

2050 175 USD/t CO₂ = 73 USD/bbl: 70+73 = 143 USD/bbl

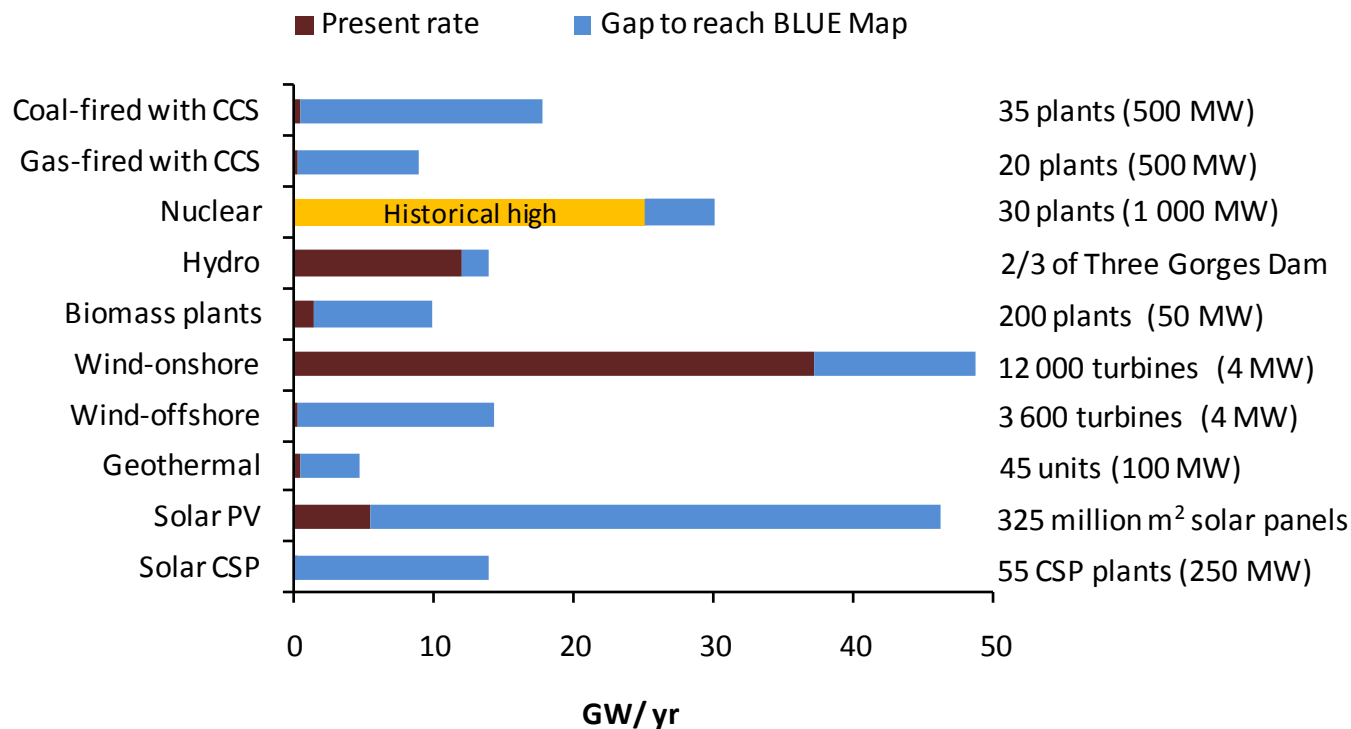


Decarbonising the power sector – a new age of electrification?



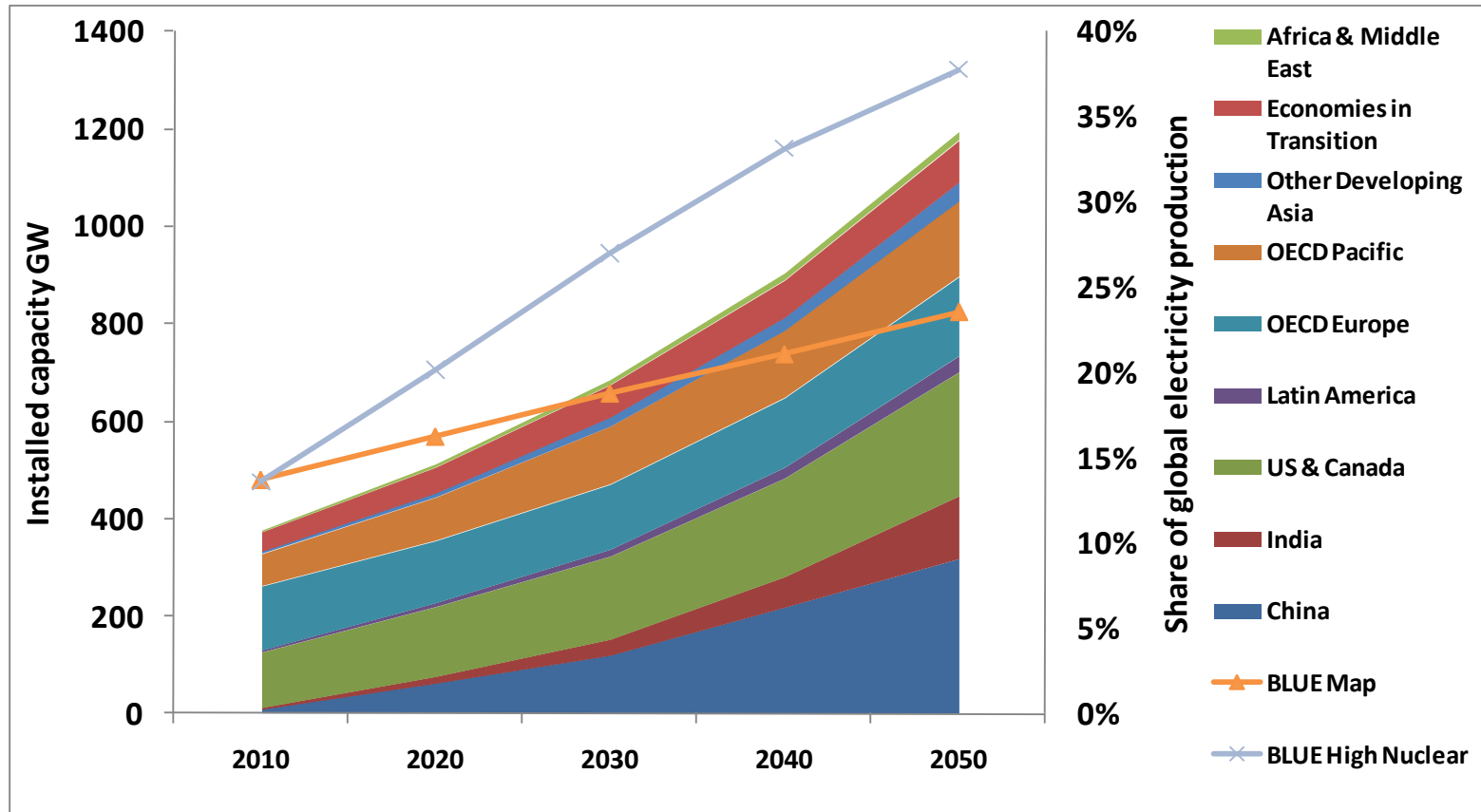
A mix of renewables, nuclear and fossil-fuels with CCS will be needed to decarbonise the electricity sector.

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.

Nuclear Energy Roadmap



Nuclear is a proven technology and can play an important role in a low-carbon strategy



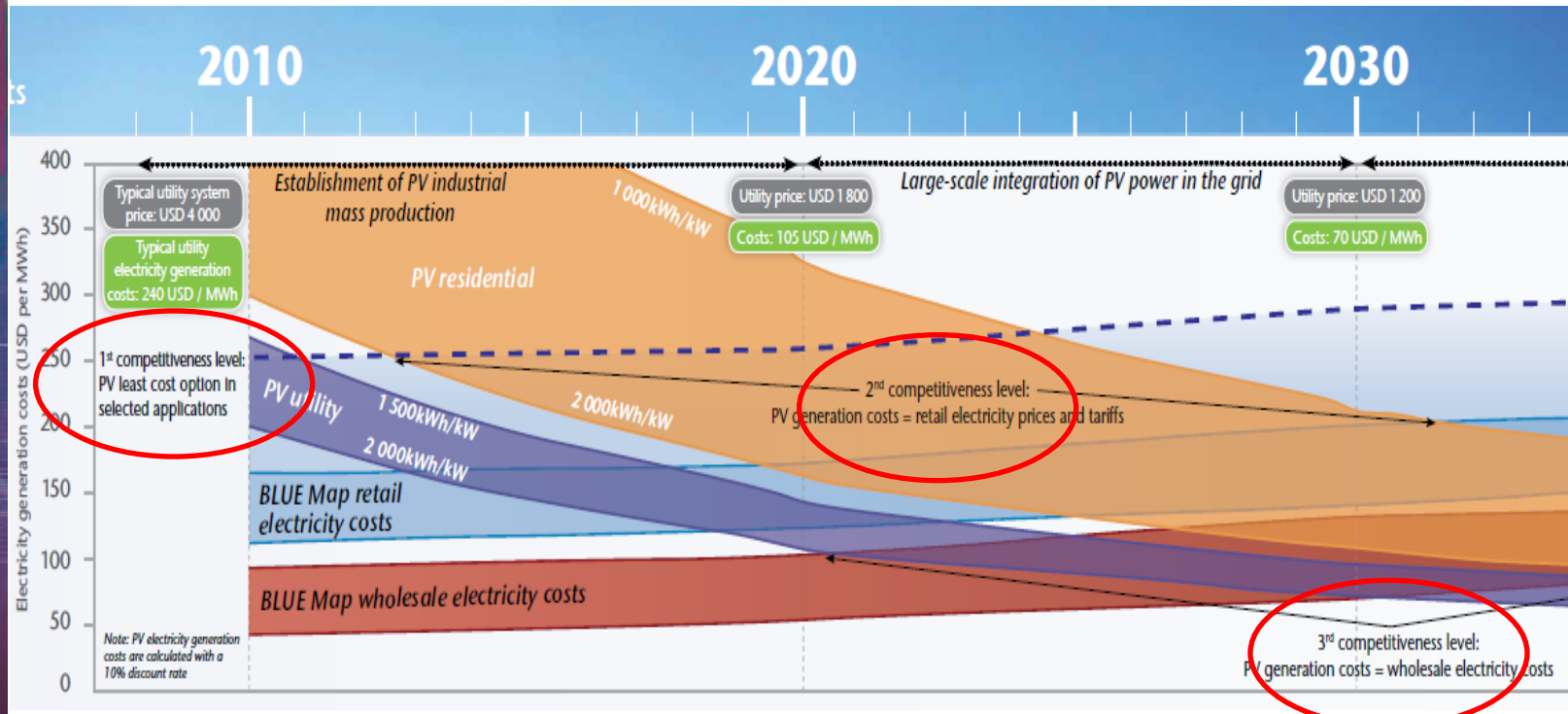
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PV Roadmap

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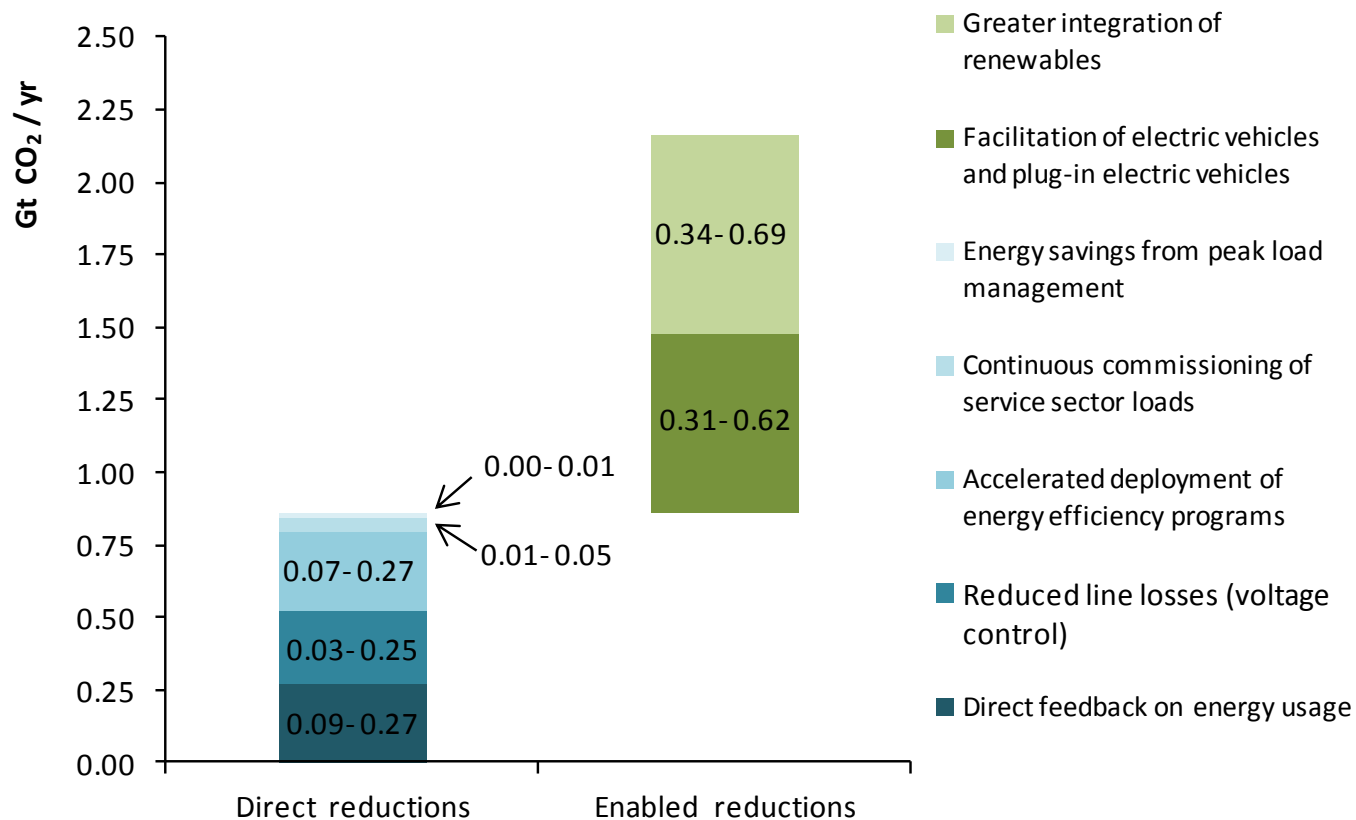
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PV can provide 5% of global electricity generation in 2030, 11% in 2050



Smart grid CO₂ reductions in 2050

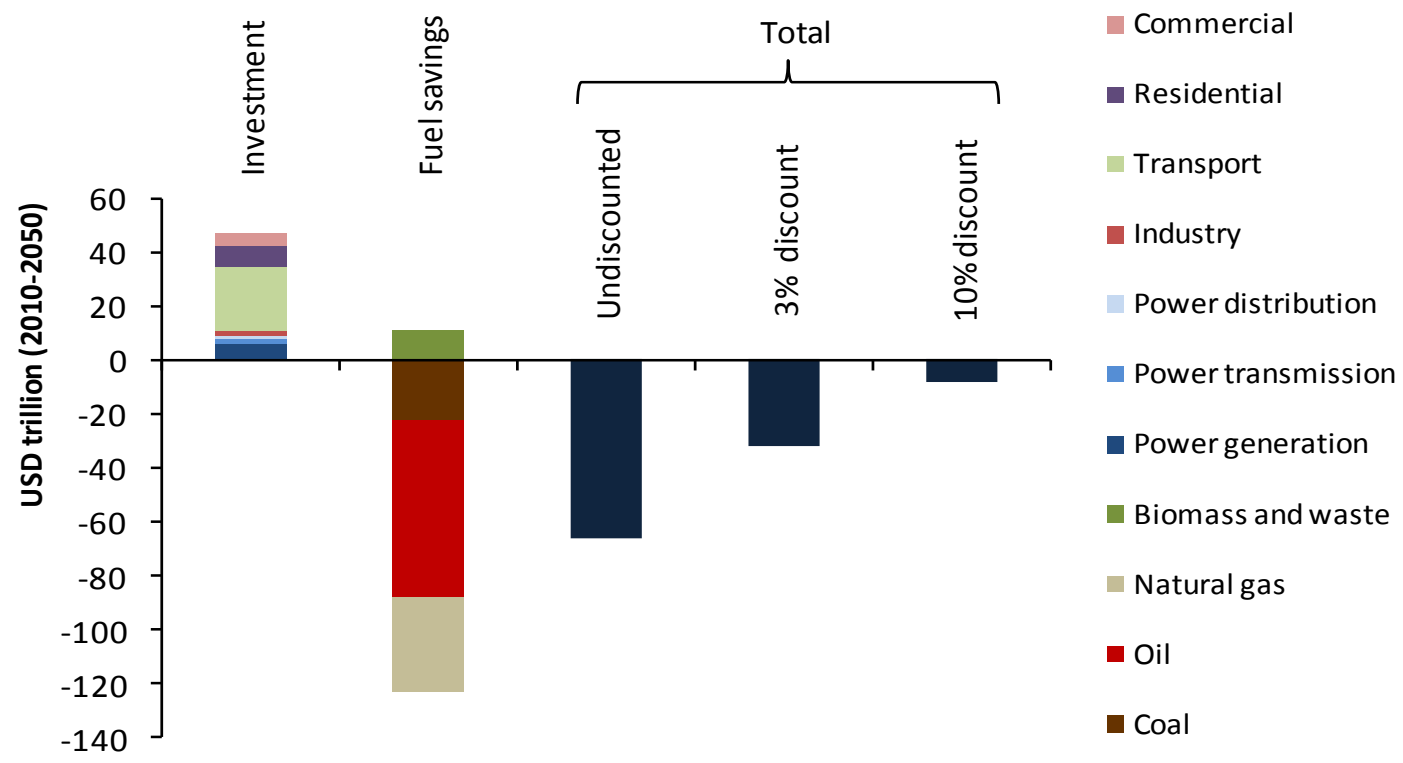


Smart grids allow better management of the grid and can facilitate the deployment of low-carbon technologies, such as renewables and electric vehicles.

Additional investment and fuel savings, 2010-2050

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



Environmental co-impacts of electricity generation technologies

Energy Technologies	Life Cycle Impacts (Pre- and Post-Generation)			Power Generation Impacts			CO ₂ Emissions t/MWh
	Air	Water	Land	Air	Water	Land	
Coal - USC	<i>Baseline Technology for Relative Assessments Below</i>						0.777
Coal - Biomass	Positive	Positive	Variable / Uncertain	Variable / Uncertain	Minimal	Minimal	0.622
Coal - CCS	Negative	Negative	Negative	Variable / Uncertain	Negative	Minimal	0.142
Coal - IGCC	Minimal	Variable / Uncertain	Minimal	Positive	Positive	Minimal	0.708
NGCC	Positive	Positive	Positive	Positive	Positive	Positive	0.403
Nuclear	Positive	Variable / Uncertain	Variable / Uncertain	Positive	Negative	Positive	0.005
Solar - CSP	Positive	Positive	Positive	Positive	Negative	Minimal	0.017
Solar - PV	Positive	Positive	Positive	Positive	Positive	Minimal	0.009
Wind	Positive	Positive	Positive	Positive	Positive	Variable / Uncertain	0.002

Most renewable technologies have positive environmental co-impacts.



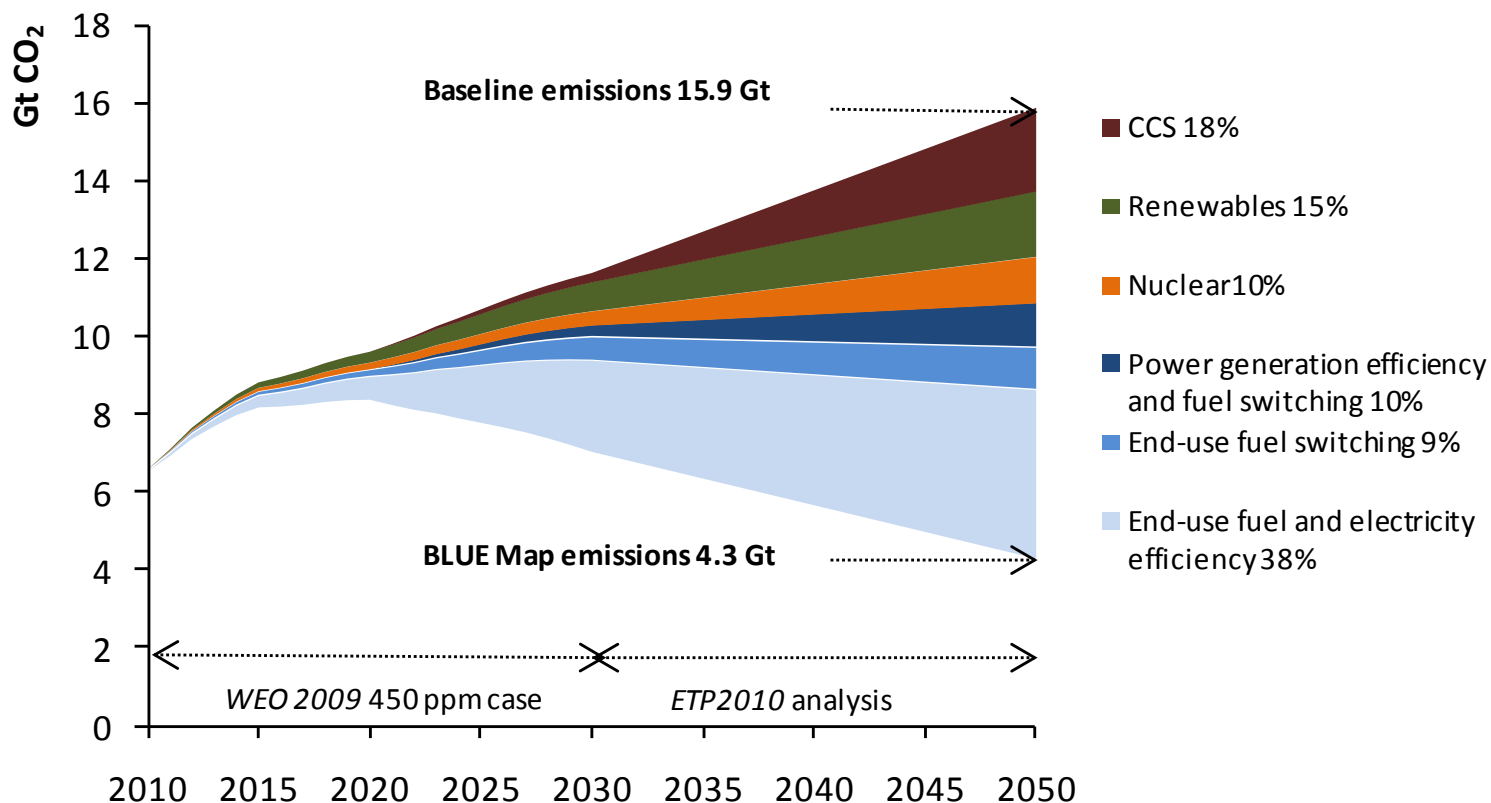
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CHINA

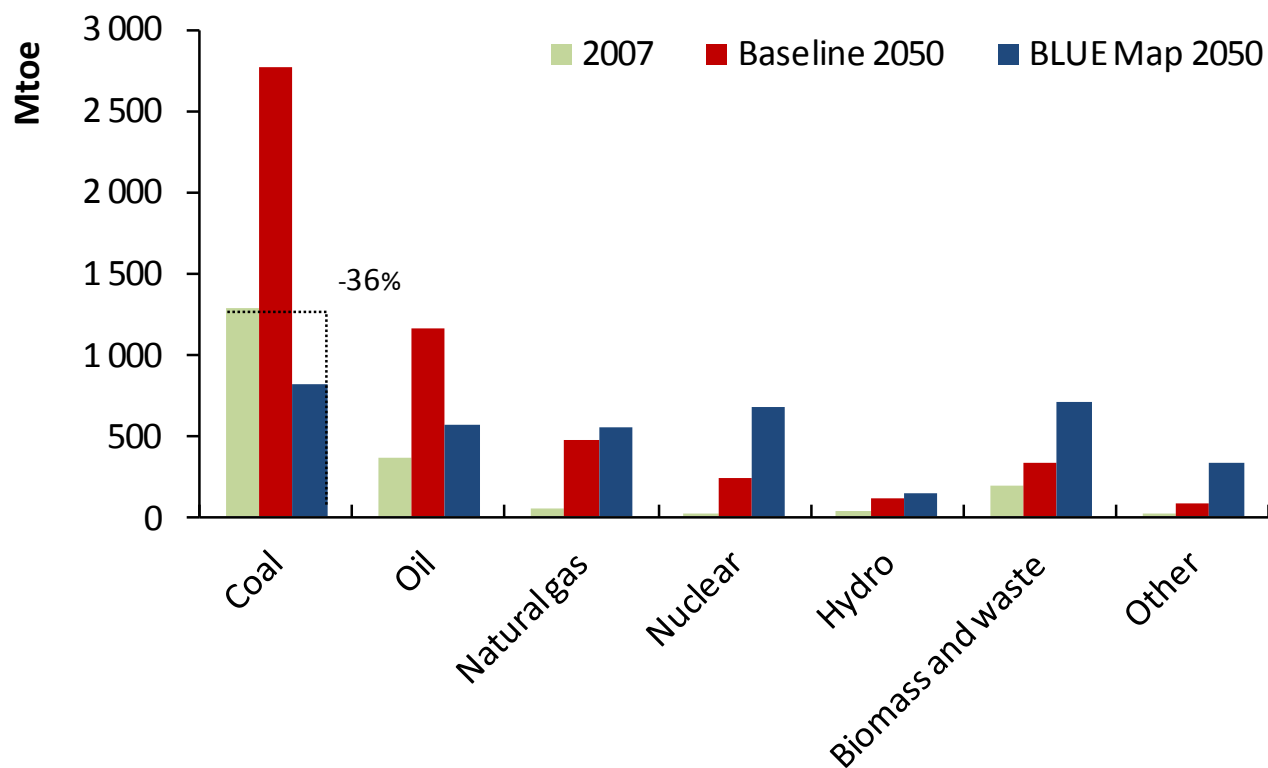


Contributions to emissions reductions in China



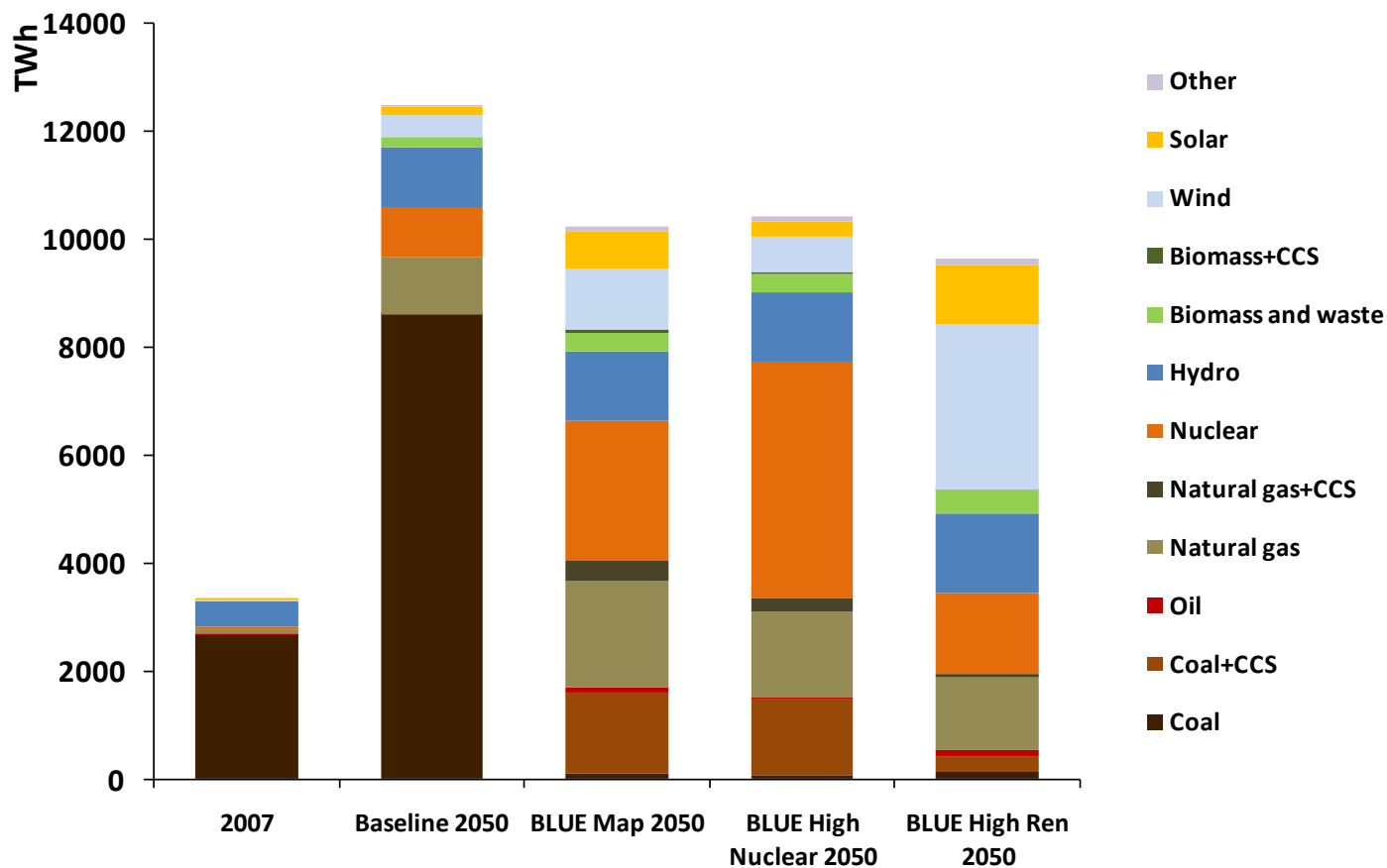
End-use efficiency savings and CCS are the largest contributors to emissions reduction in China; nuclear and renewables are also important.

Primary energy demand by fuel and by scenario in China



Coal demand is reduced substantially under the BLUE Map scenario.

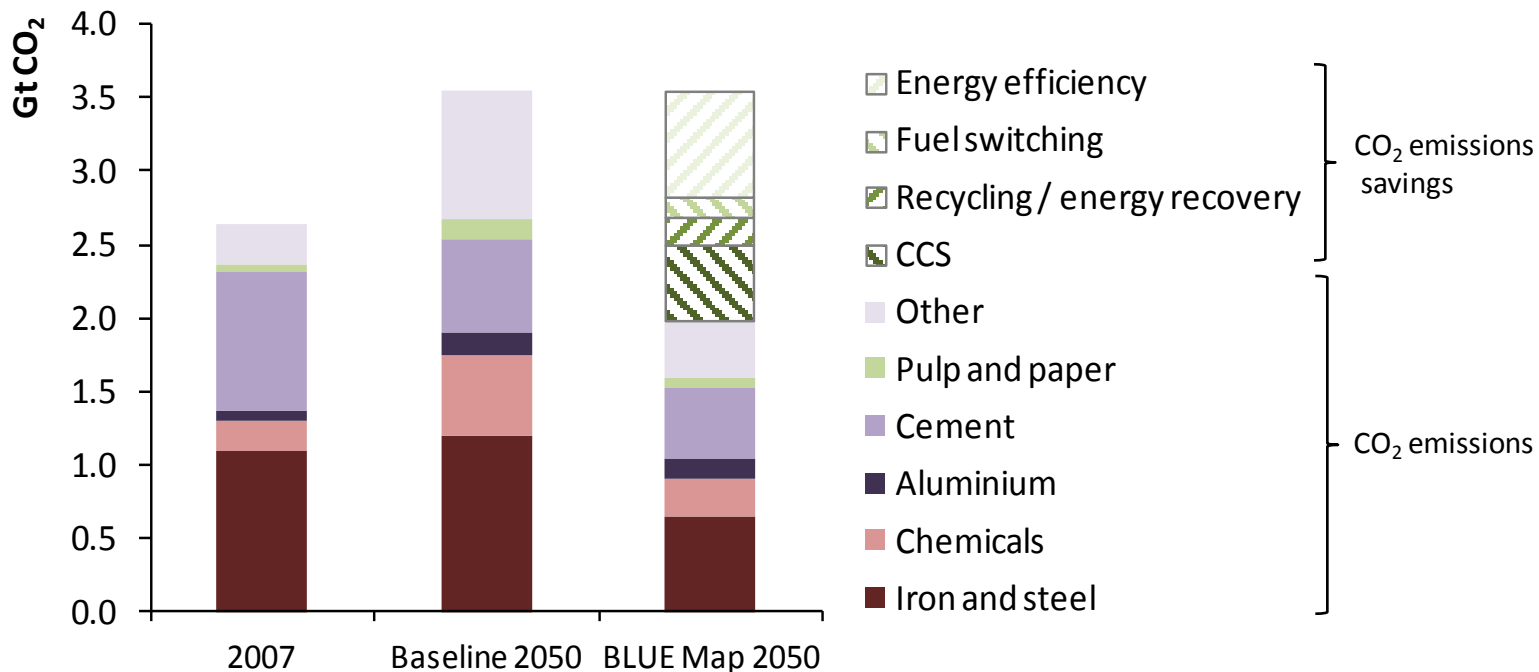
Decarbonisation of power generation in China



Renewables, CCS and nuclear are needed to decarbonise the electricity sector.



Direct energy and process CO₂ emissions in industry by sector in China



Energy efficiency and CCS are the two most important abatement options in industry.

Projected electric and plug-in hybrid vehicle sales through 2020, based on national targets

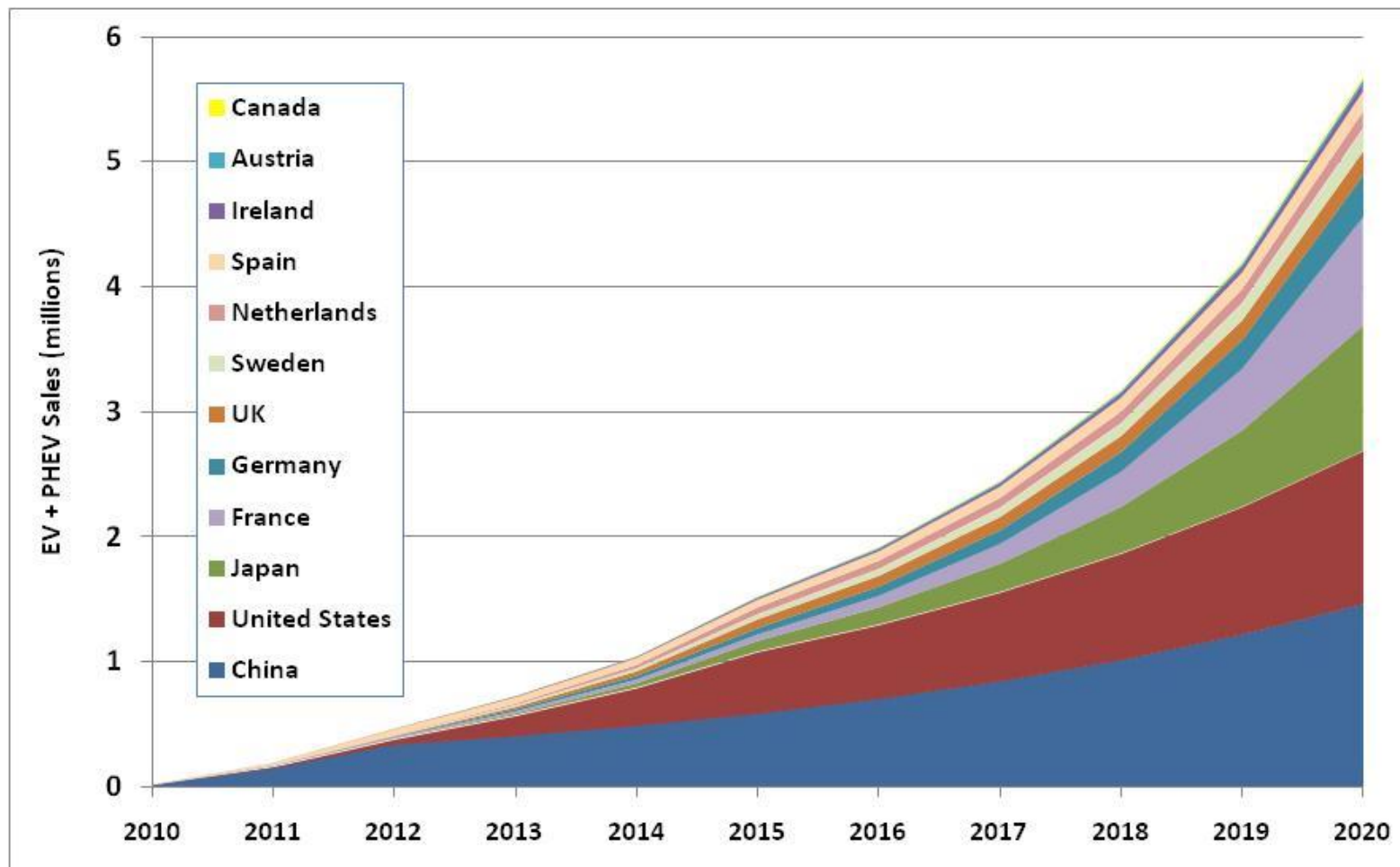


Figure based on announced national sales and stock targets, with assumed 20% annual sales growth after target is met, if target is before 2020 (e.g. China's target is for end of 2011).

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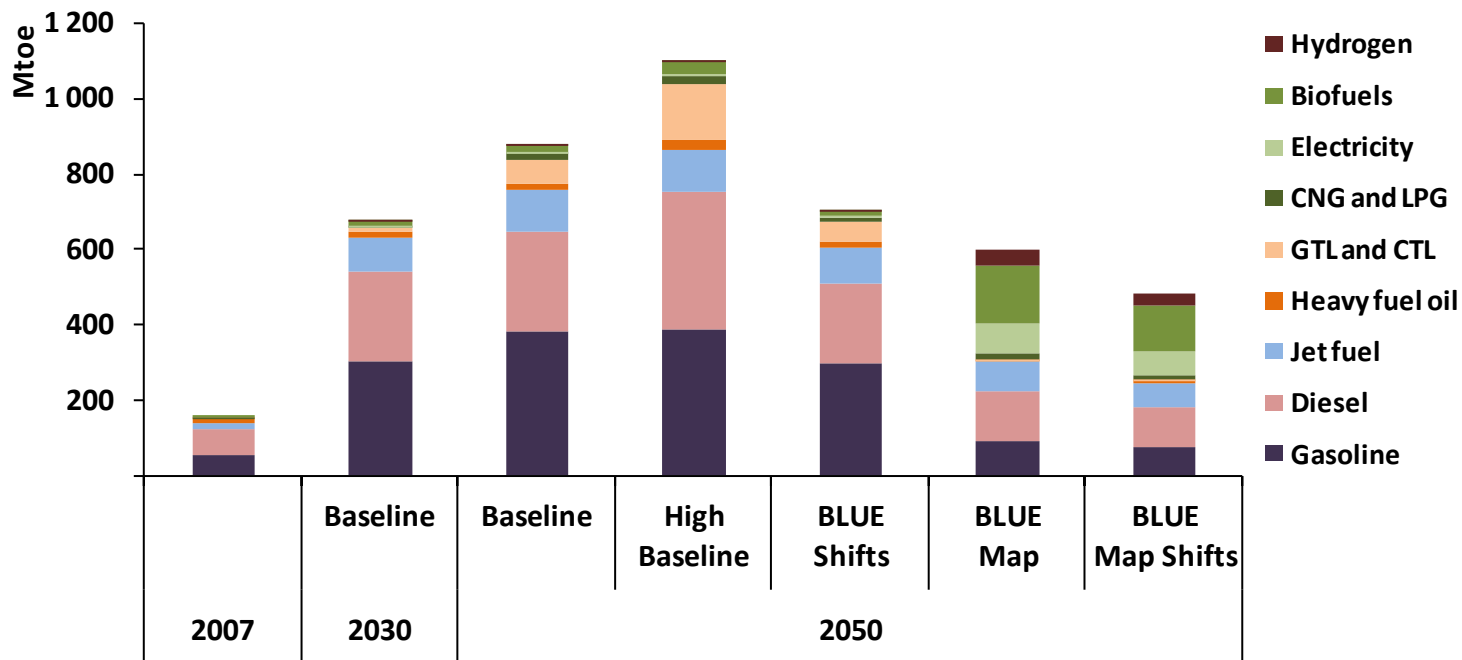
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Fuel use in the transport in China

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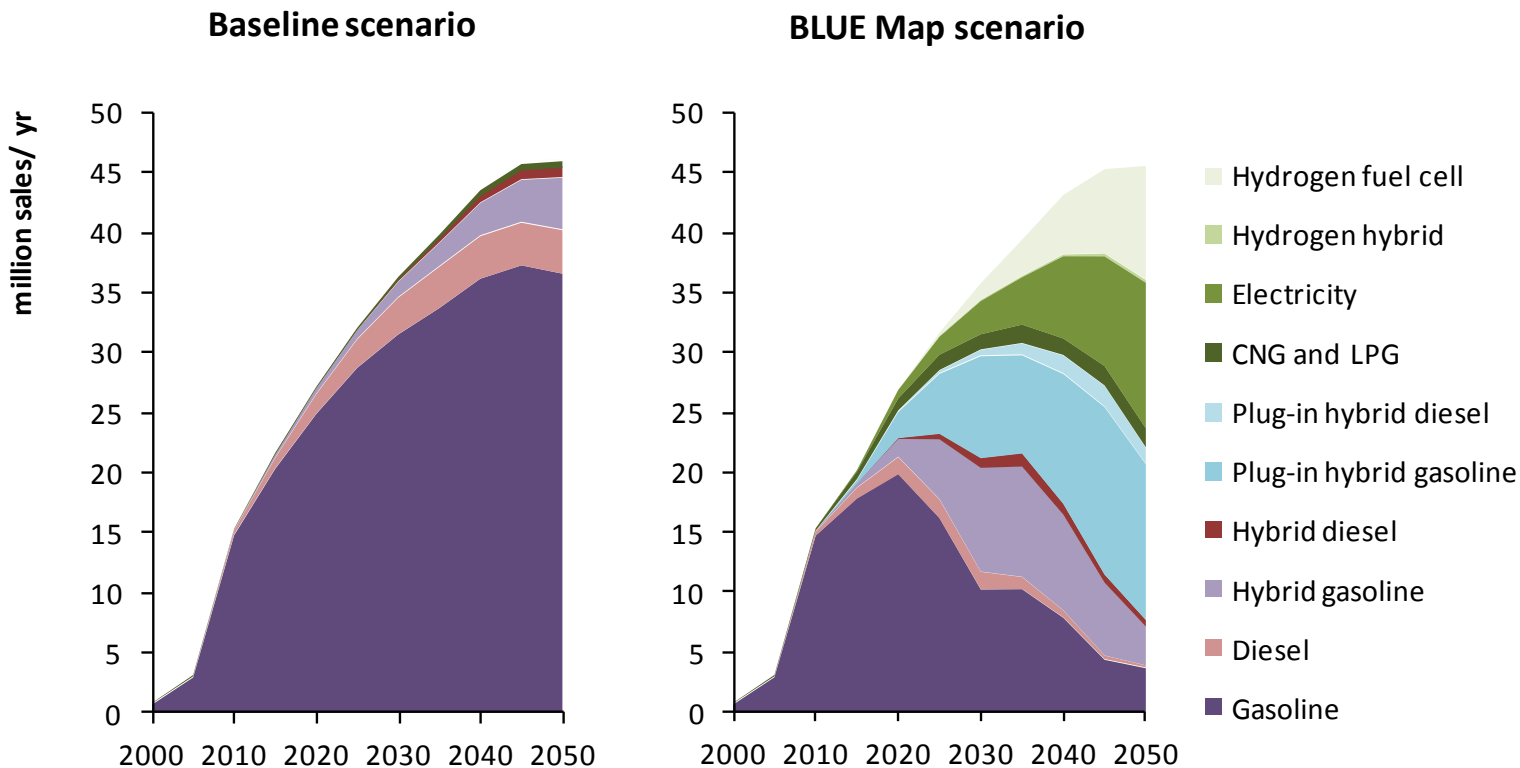



BLUE scenarios could reduce transport energy demand by 20%-56% compared to the Baseline scenarios

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

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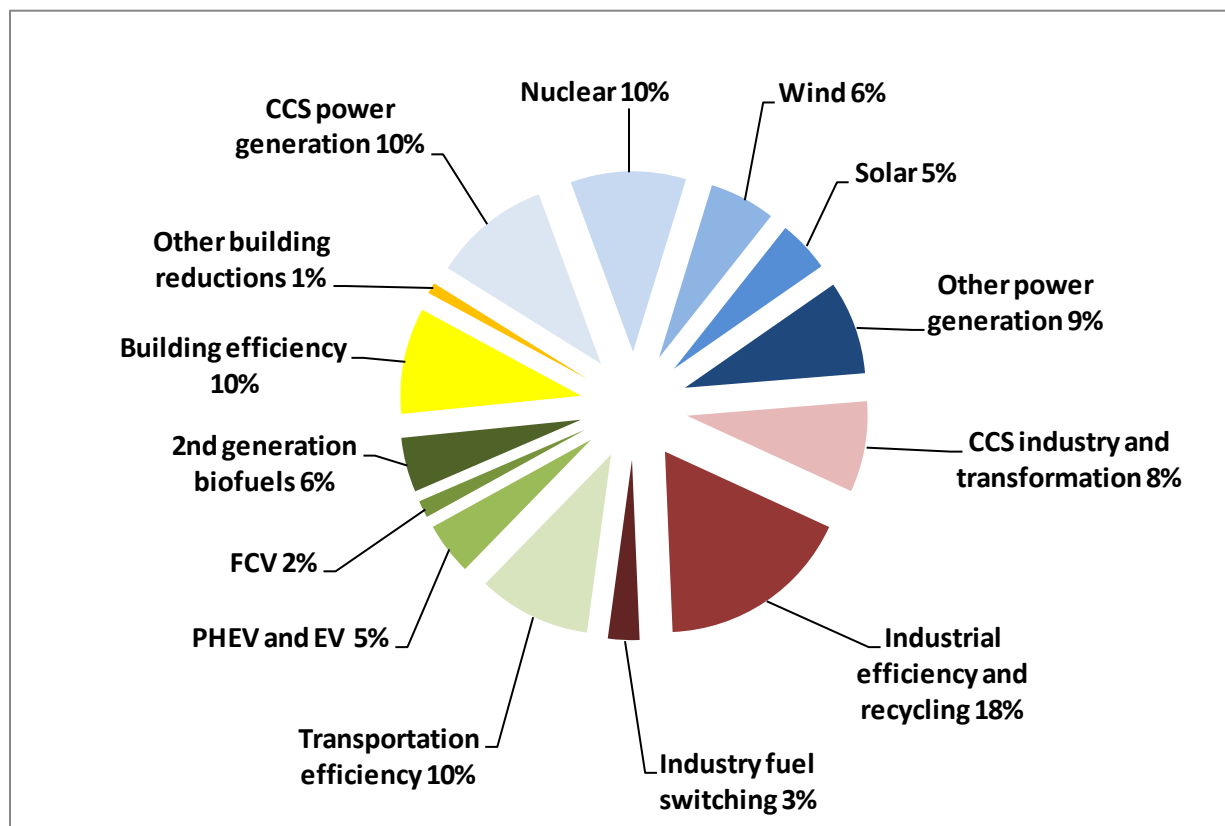
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The BLUE Map scenario envisions rapid successive introduction of new generations of advanced vehicles in China's rapidly growing market.



Contributions to emissions reductions in China

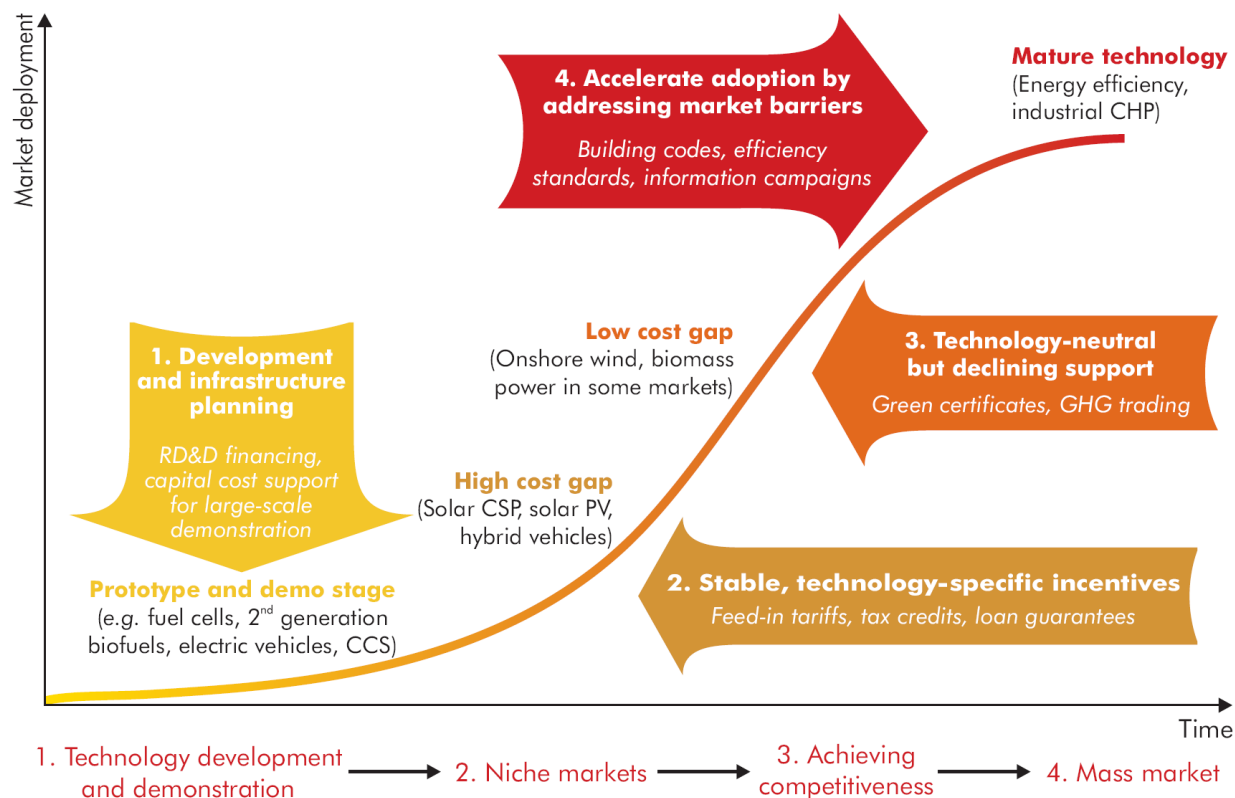


Energy efficiency and decarbonising the power sector offer the largest emissions reductions.

Technology policies

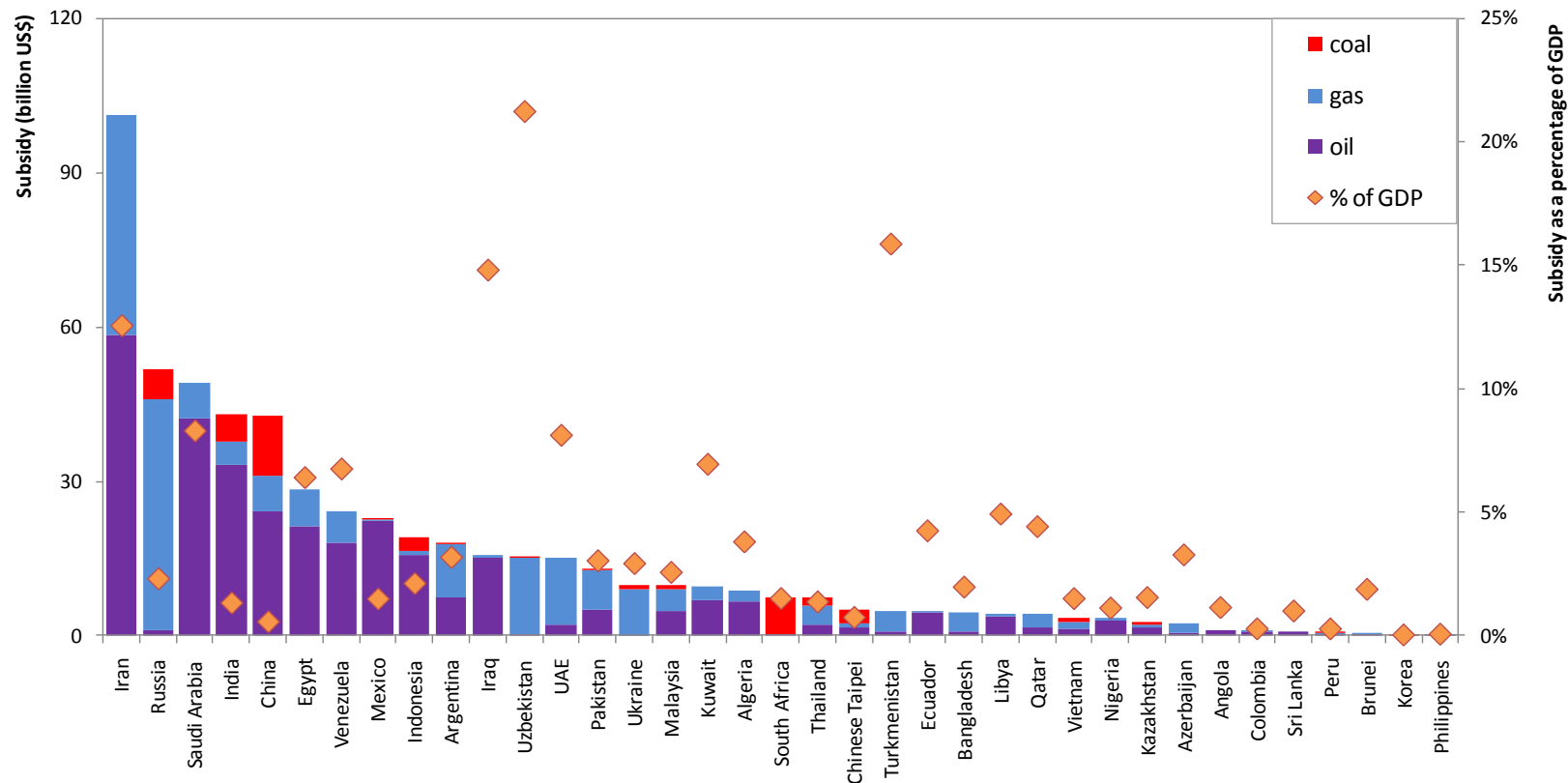
- Carbon pricing is important, but should be complemented by other policies
- Policies must be tailored to the technology's stage of development and reflect good design principles
- Public RD&D spending must at least double
- Governments need to implement best practices in energy RD&D
- A number of enabling actions are also needed:
 - Private sector leadership
 - Expanded human capacity
 - Greater government outreach and planning on infrastructure needs
 - Expanded, more effective international collaboration

Policies for supporting low-carbon technologies



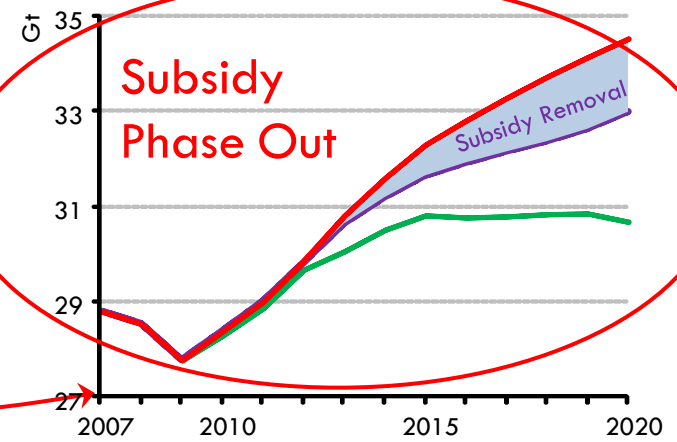
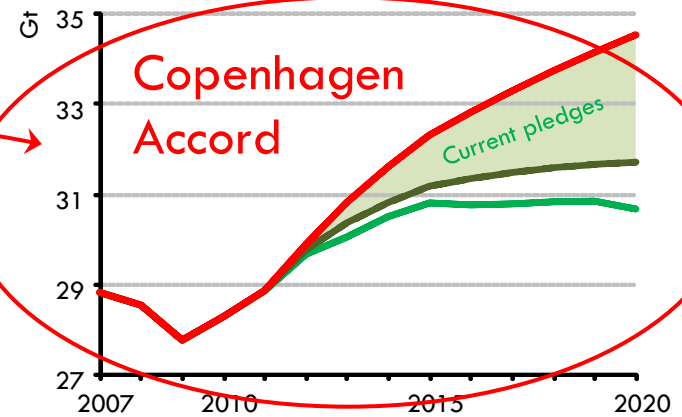
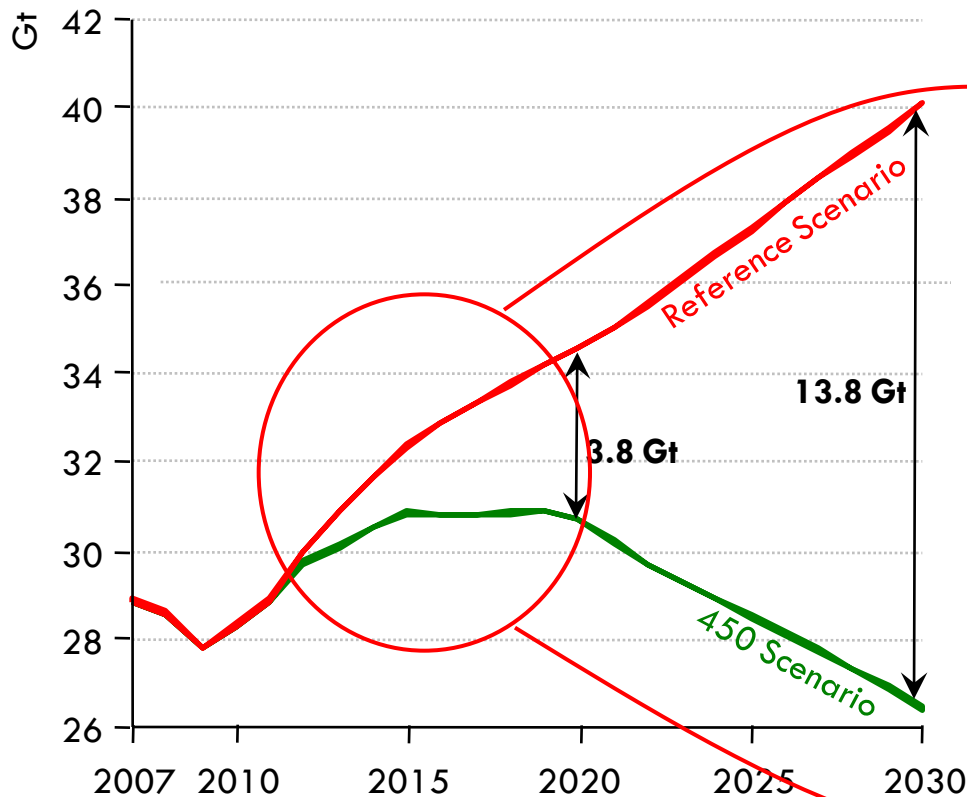
Government support policies need to be appropriately tailored to the stage(s) of technological development.

Fossil fuel subsidies – by country and as a share of GDP, 2008



Global subsidized consumption of fossil fuels amounted to US\$ 557 billion in 2008.

World abatement of energy-related CO₂ emissions



Although the savings are not strictly cumulative, the Copenhagen Accord and the G-20 commitment to phase out subsidies are complementary steps towards the 450 Scenario

The first green shoots

of an energy technology revolution...

46 GW of PV per year until 2050

Over 1 billion plug-in and electric vehicles in 2050

Over 3 000 plants operational by 2050

200 GW of solar thermal added in 2050

Increase funding by 2 to 5 times current levels

Investments

6 GW of PV installed in 2009

1 million hybrid and electric vehicles by 2020

80% of some regulated markets being developed

20 GW of solar thermal added in 2007

1/3 funding increase between 2005 and 2008

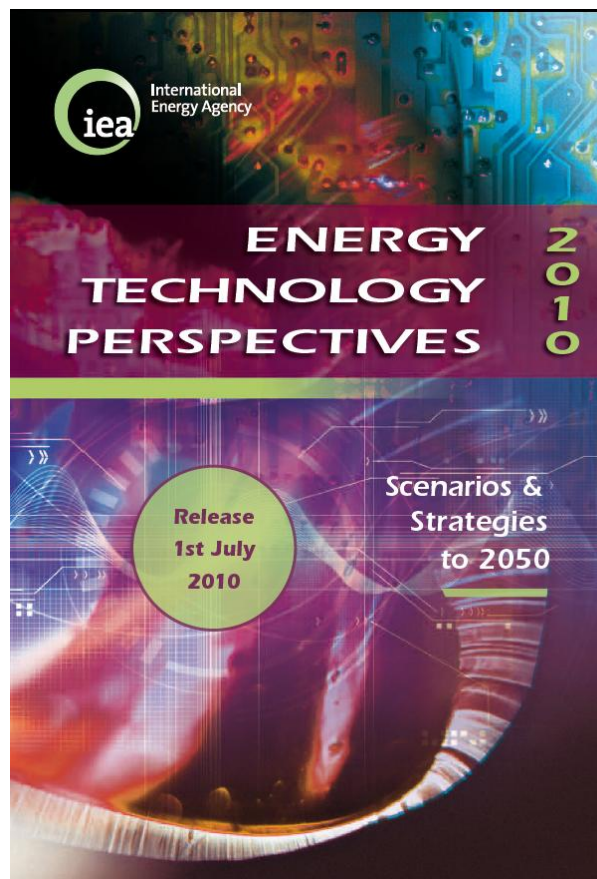
Renewables

Transport

Carbon capture and storage

Energy efficiency

Research and development



Thank You

www.iea.org/techno/etp/index.asp



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ANNEX



GDP projects

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	2007-2015	2015-2030	2030-2050
OECD	1.4	1.9	1.2
OECD North America	1.8	2.3	1.4
United States	1.8	2.2	1.3
OECD Europe	1.0	1.8	0.7
OECD Pacific	1.3	1.3	1.7
Non-OECD	5.7	4.1	3.4
Economies in transition and non-OECD Europe	3.3	3.3	3.5
Middle East	4.5	4.0	2.5
Africa	4.7	3.1	3.1
Latin America	3.1	2.5	2.5
China	8.8	4.4	3.8
India	7.0	5.9	3.3
Other developing Asia	3.2	3.5	2.6
World	3.3	3.0	2.6

(% per year based on purchasing power parity)



Oil, gas and coal price assumptions

	Unit	2008	2030	2050
IEA crude oil imports	Barrel	97	115	120
Natural gas				
<i>United States imports</i>	<i>MBtu</i>	8.3	11.4	11.9
<i>European imports</i>	<i>MBtu</i>	10.3	14.0	14.7
<i>Japanese imports</i>	<i>MBtu</i>	12.6	15.9	16.7
OECD steam coal imports	Tonne	121	109	115

For the Baseline Scenario (in USD per unit)

	Unit	2008	2030	2050
IEA crude oil imports	Barrel	97	90	70
Natural gas				
<i>United States imports</i>	<i>MBtu</i>	8.3	10.2	7.9
<i>European imports</i>	<i>MBtu</i>	10.3	11.0	8.6
<i>Japanese imports</i>	<i>MBtu</i>	12.6	12.5	9.7
OECD steam coal imports	Tonne	121	65	58

For the BLUE Scenario (in USD per unit)

Carbon Price in the BLUE Map scenario

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USD / t CO ₂	2020	2030	2050
OECD	50	110	175
Non-OECD	0	65	175

