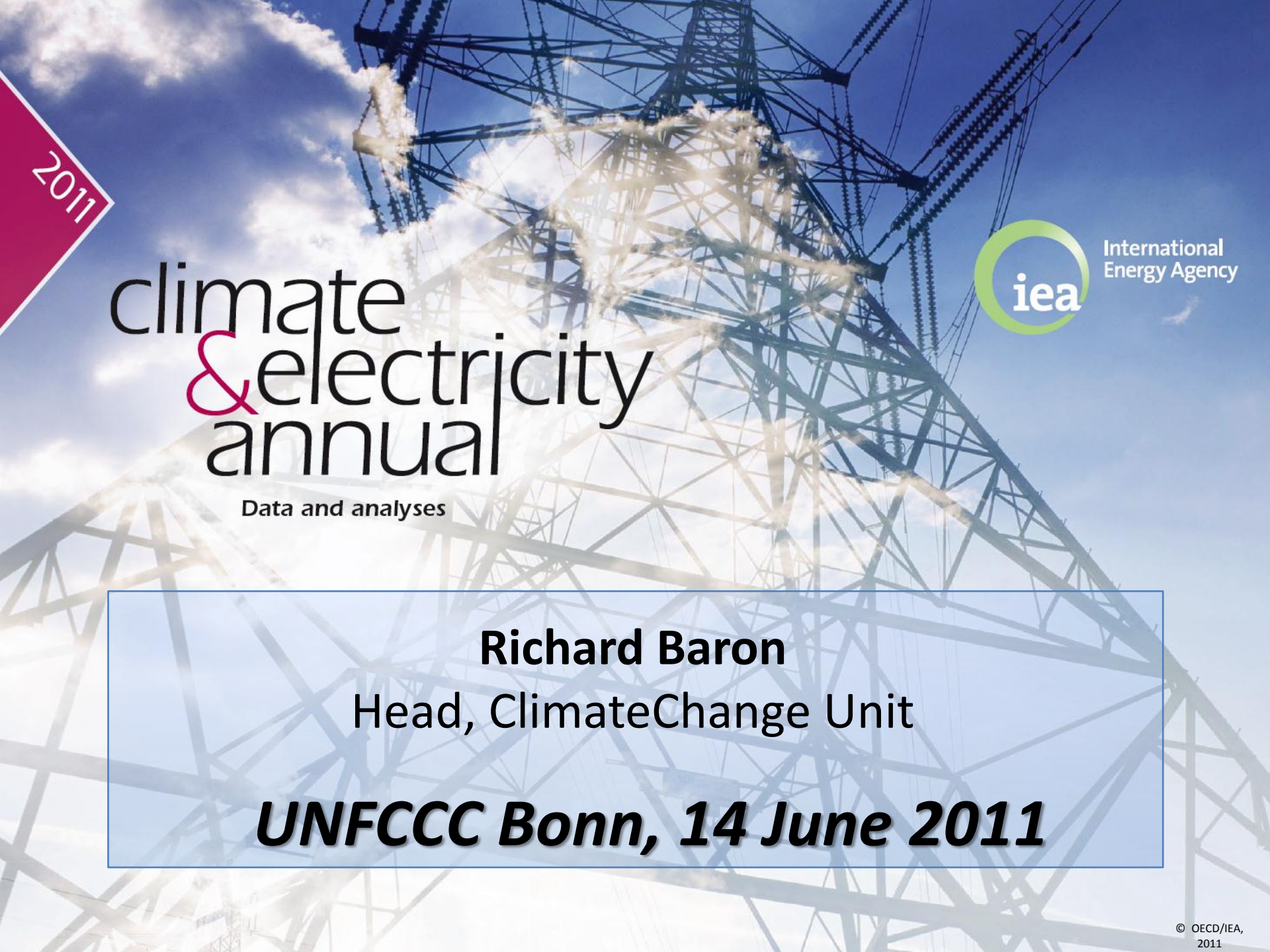

Richard Baron

Head, ClimateChange Unit

UNFCCC Bonn, 14 June 2011

Climate and electricity challenge
The goals

- Decarbonisation of electricity generation in the second half of the century

- Enhanced electrification of end-uses to improve energy efficiency performance

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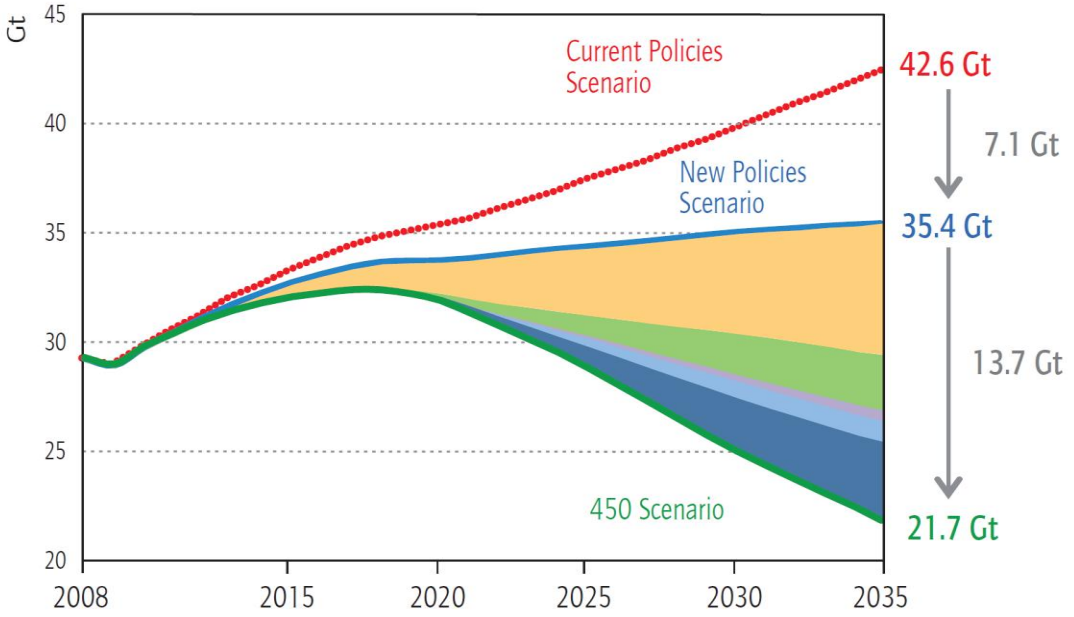
Low-carbon power generation could deliver about half of CO_2 reductions needed globally

World energy-related CO_2 emission savings by technology in the IEA *World Energy Outlook 2010* 450 Scenario relative to the New Policies Scenario*



Share of cumulative abatement between 2010-2035

Efficiency	50%
Renewables	18%
Biofuels	4%
Nuclear	9%
CCS	20%

** The 450 Scenario describes an evolution of the global energy systems consistent with the 2°C goal, through limitation of greenhouse gas concentration to around 450 parts per million of CO_2 equivalent. The New Policies Scenario reflects national energy plans and pledges made by countries, including on their future emissions of greenhouse gases.*

Source: IEA, 2010b.

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Climate and electricity challenge
The current status

- Electricity is the largest and fastest-growing source of CO_2 emissions

  40% of total in 2008

  + 65% between 1990 and 2008

- CO_2 intensity of power has been *increasing* globally (+6% 1990-2008)
- But new renewable sources of electricity had highest growth rate in recent years

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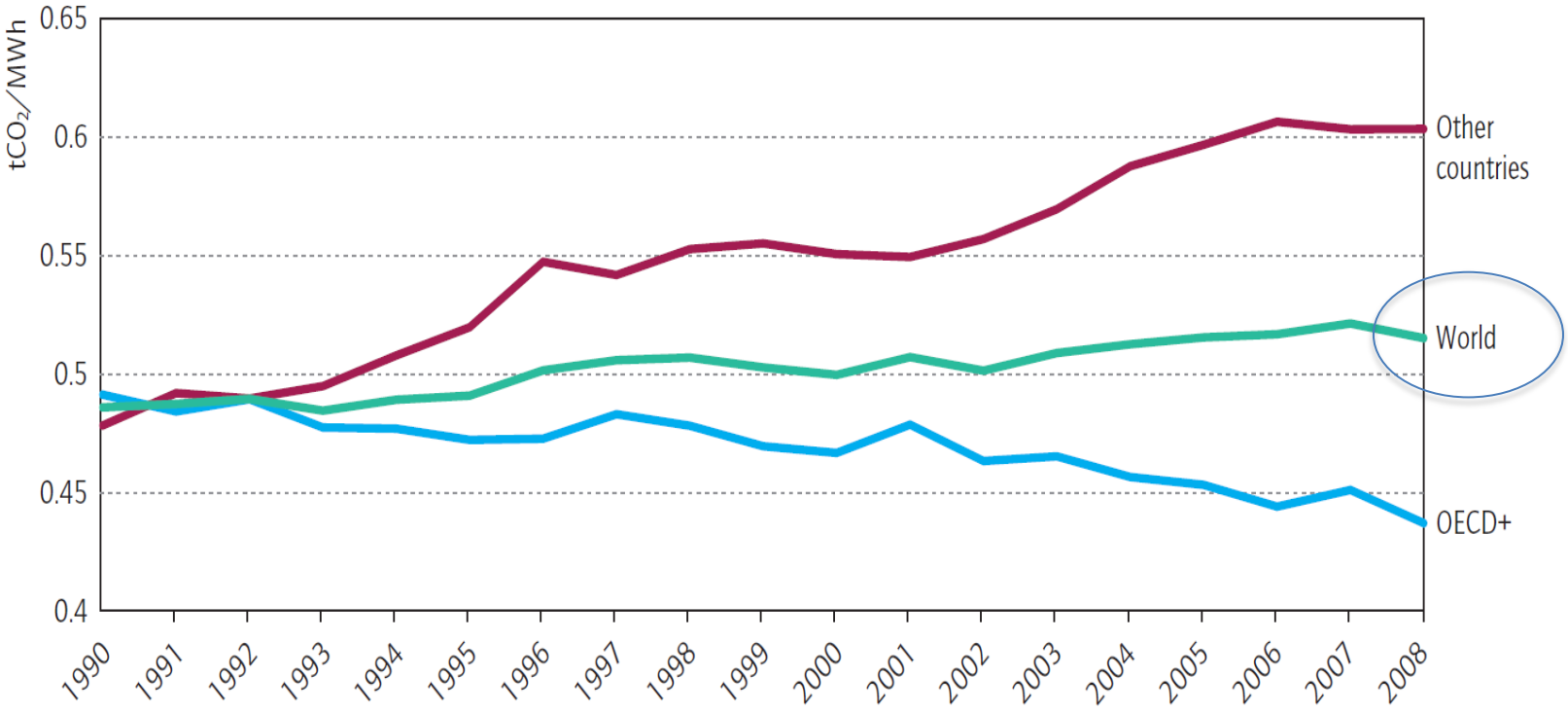
The CO_2 content of electricity is still increasing globally

Global evolution of the CO_2 intensity of power generation (1990-2008)



Note: OECD+ includes all OECD member countries as of 2009 and non-OECD European countries (see section on geographical coverage).

Source: IEA statistics, 2011.

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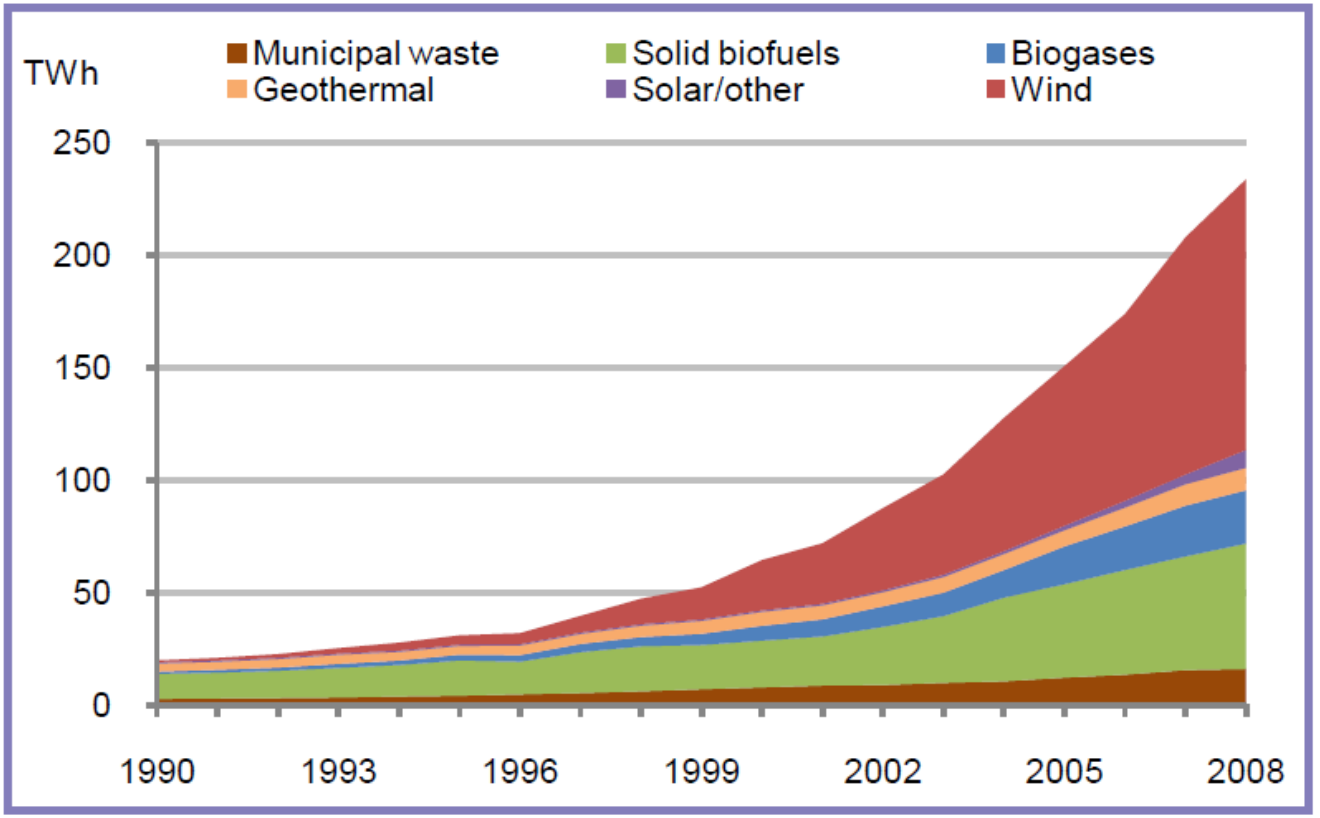
DATA

Europe

Electricity from renewables (excluding hydro)



Source: IEA, 2010.

- Largest source excluding hydro (2008) 51.4% (Wind)
- Largest growth over the last decade 108.9 TWh (Wind)
- Growth (annual rate): 1998-2008 17.3%
  1990-1998 11.4%

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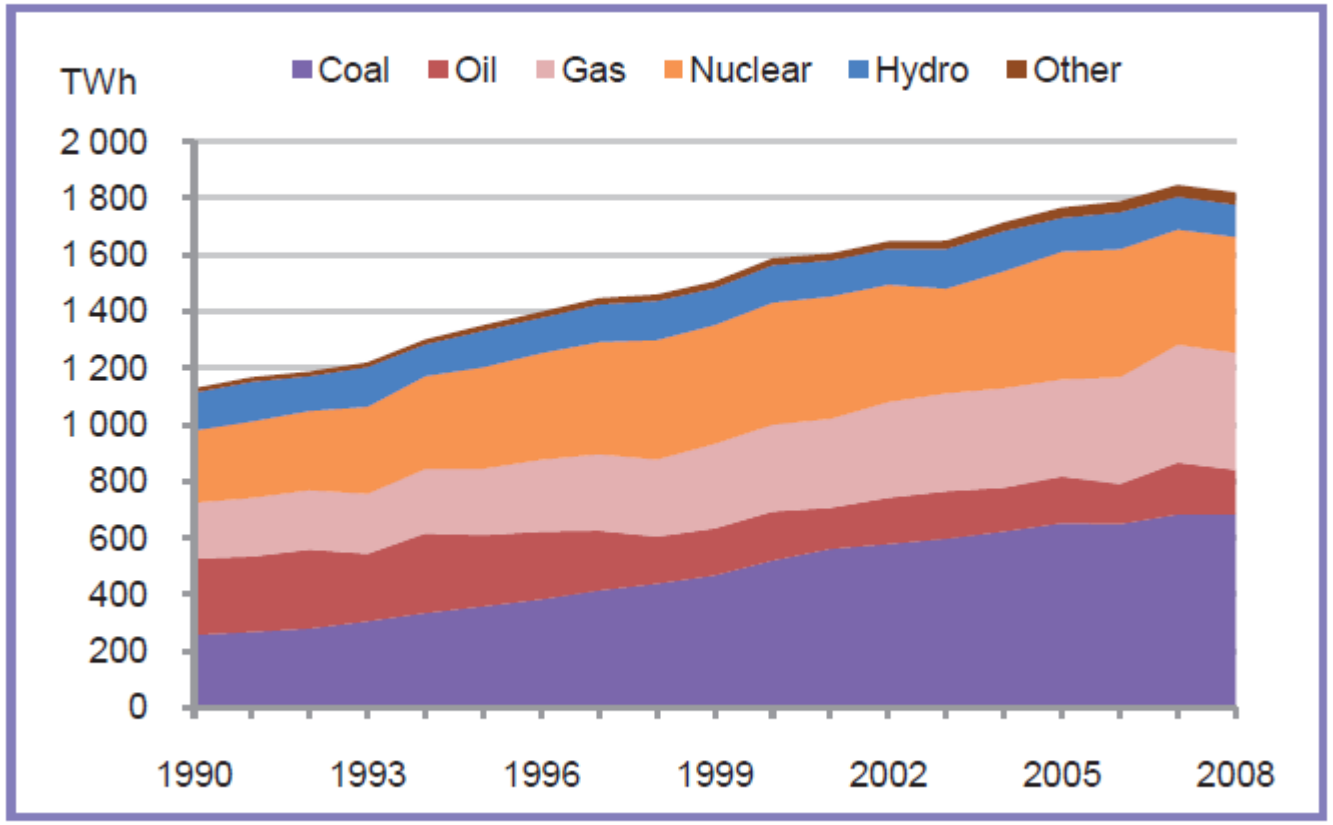
OECD Pacific

Generation mix in power sector



Source: IEA, 2010.

• Largest source of supply (2008)		37.5% (Coal)
• Fastest growth over the last decade		90.3% (Other)
• Slowest growth over the last decade		-17.4% (Hydro)
• Growth (annual rate):	1998-2008	2.2%
	1990-1998	3.3%

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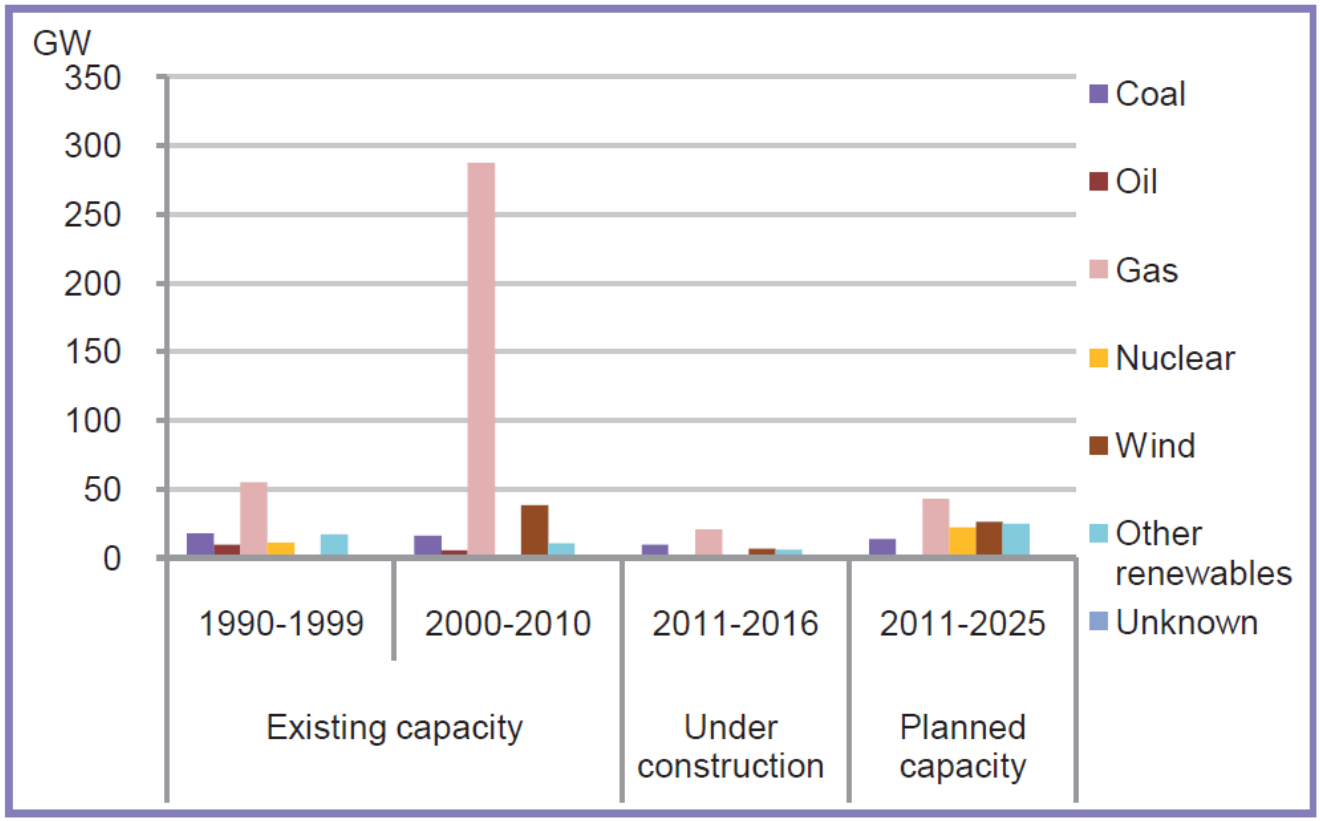
OECD North America

New capacity by installation date



Source: Platts, 2010.

- Largest additions in 1990-2010 — 72.5% (Gas)
- Largest additions under construction — 44.8% (Gas)
- Largest additions planned — 32.4% (Gas)

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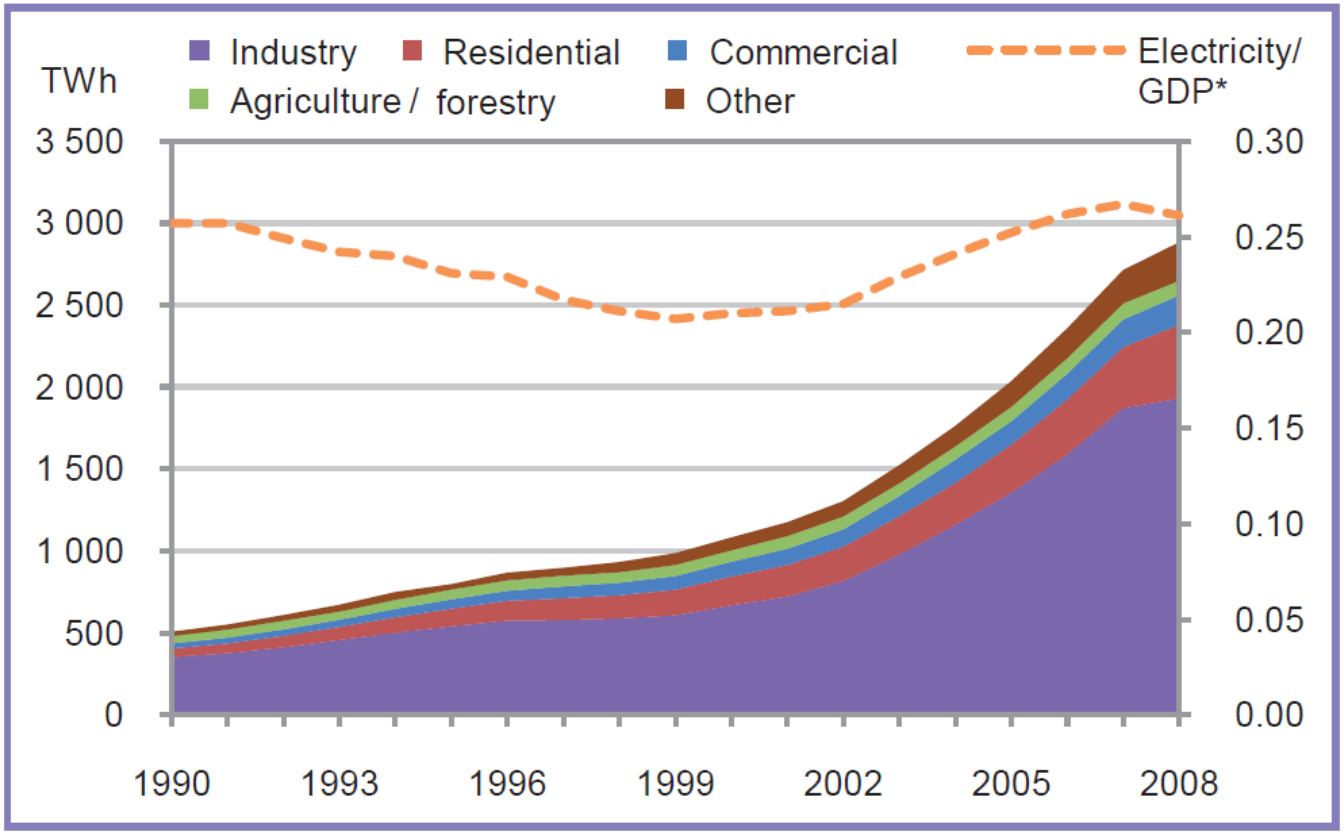
China

Electricity use by sector and per unit of GDP



* *Electricity/GDP measured in kWh per 2000 USD PPP.*
Source: IEA, 2010.

- Largest sector of consumption (2008) 66.9% (Industry)
- Fastest growth over the last decade 274.8% (Other)
- Slowest growth over the last decade 39.8% (Agriculture/forestry)
- Final electricity growth (annual rate): 1998-2008 12%
  1990-1998 7.9%
- Final electricity intensity (annual rate, 1990-2008) 0.1%

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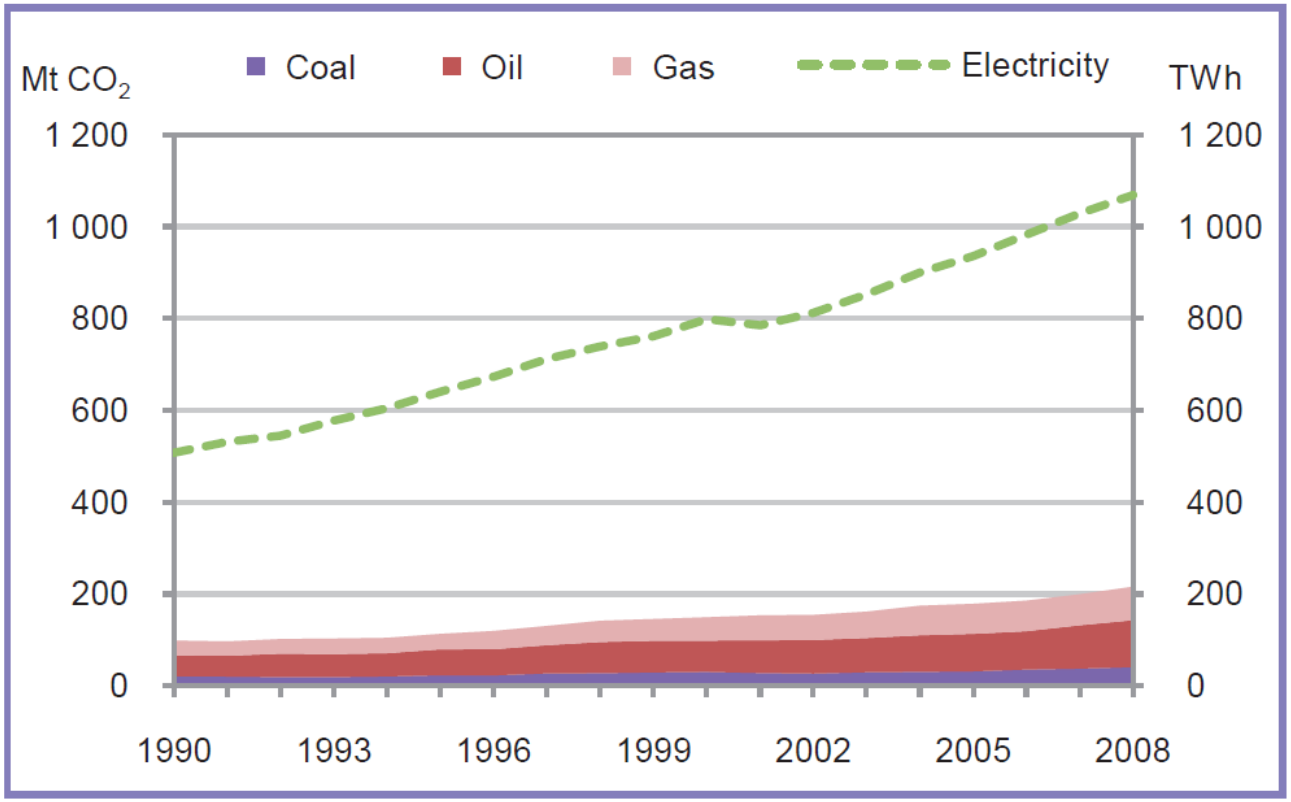
Latin America

CO_2 emissions by fuel in electricity generation



Source: IEA, 2010.

- Largest source of emissions (2008) 47.4% (Oil)
- Fastest growth over the last decade 57.9% (Gas)
- Slowest growth over the last decade 48.5% (Coal)
- Emissions (annual rate): 1998-2008 4.3%
  1990-1998 4.6%

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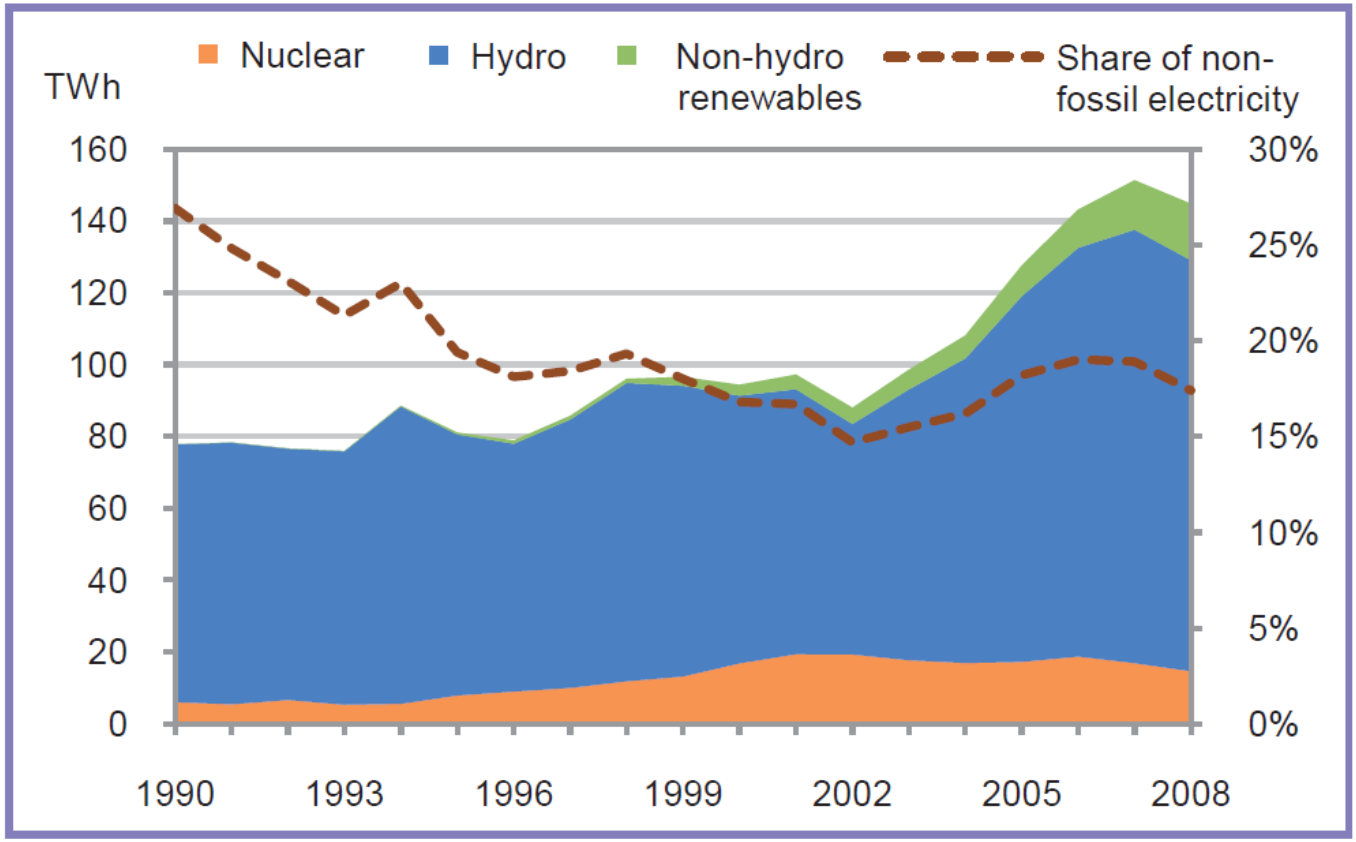
India

Electricity generation by non-fossil fuels



Source: IEA, 2010.

- Share of non-fossil sources in total electricity (2008) 17.4%
- Largest source (2008) 79% (Hydro)
- TWh growth (annual rate): 1998-2008 3.6%
  1990-1998 0.6%

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ANALYSES

- Electricity markets and decarbonisation
- Financing schemes for energy efficiency
- Early decommissioning of coal
- Renewables and CO_2 policy interactions
- Electric vehicles and electricity
- The status of carbon capture and storage
- Carbon leakage in electricity?
- Estimating fuel-switching potential

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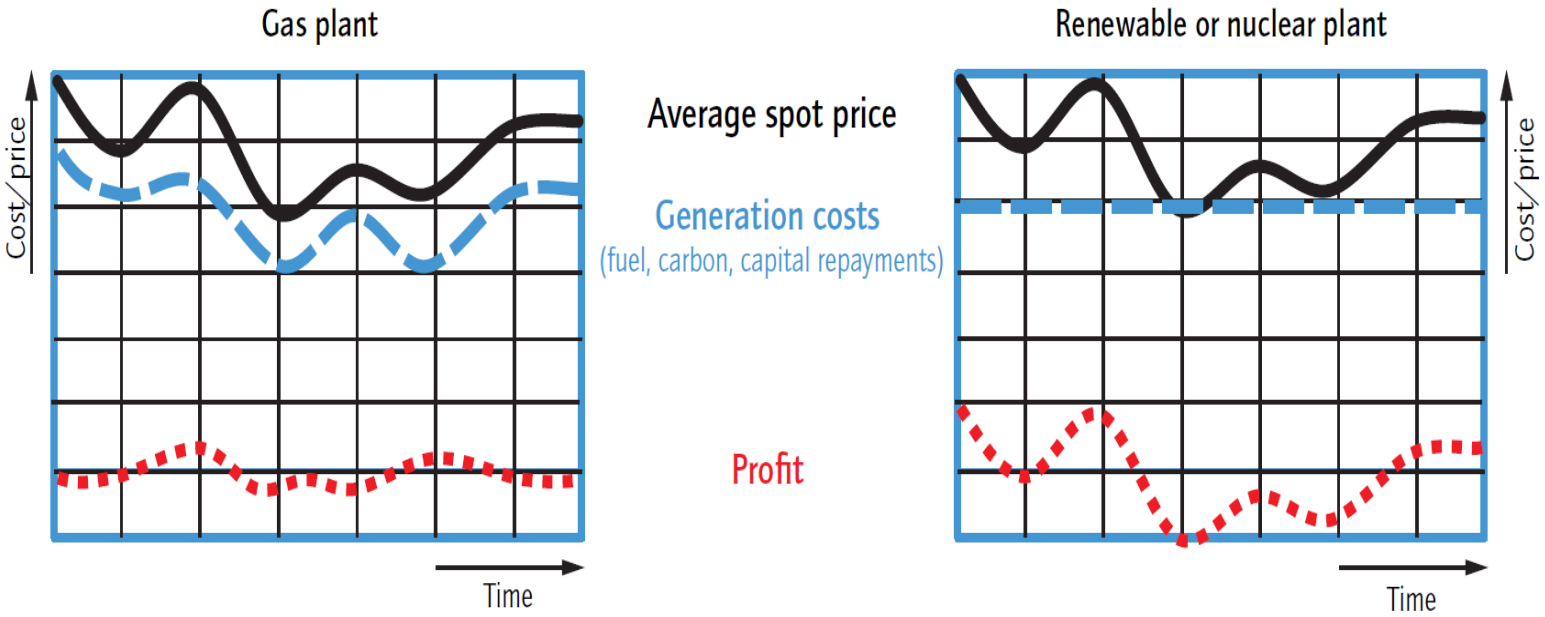
Electricity markets and decarbonisation

- Wholesale electricity markets set price on the basis of the last, most expensive supplier of electricity, based on its fuel cost
- Other (cheaper) suppliers get a rent that will eventually cover capital and other costs
- Downsides: price volatility, uncertainty for investors, dis-incentive to investment in high-capital (low-CO_2) supply technologies
- Is a new reform of electricity markets needed to align investments with decarbonisation?

How electricity markets affect the profitability of various generation technologies

Schematic representation of profit variability from electricity generation



- Risk 1: Investor exposure to uncertainty in fossil fuel and carbon prices (*see above figure*)
- Risk 2: Investor exposure to low market price driven by decarbonisation (near zero and negative prices)
- Risk 3: Rising consumer prices (CO_2 intensive generation sets the price whereas it accounts for a dwindling share of supply…)

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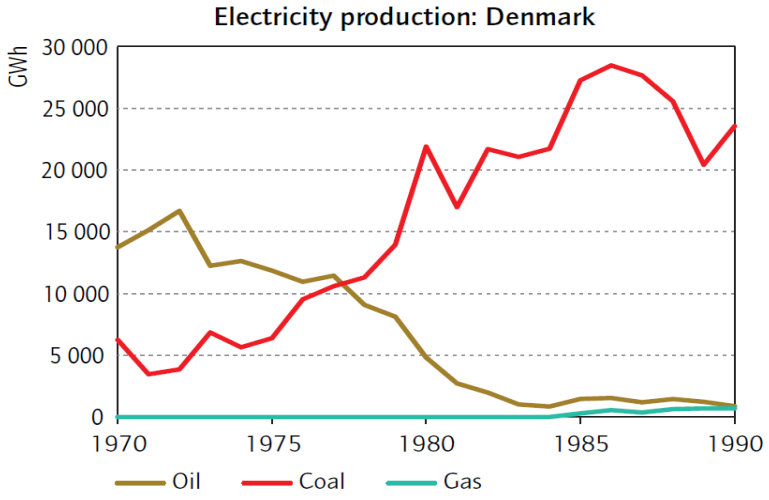
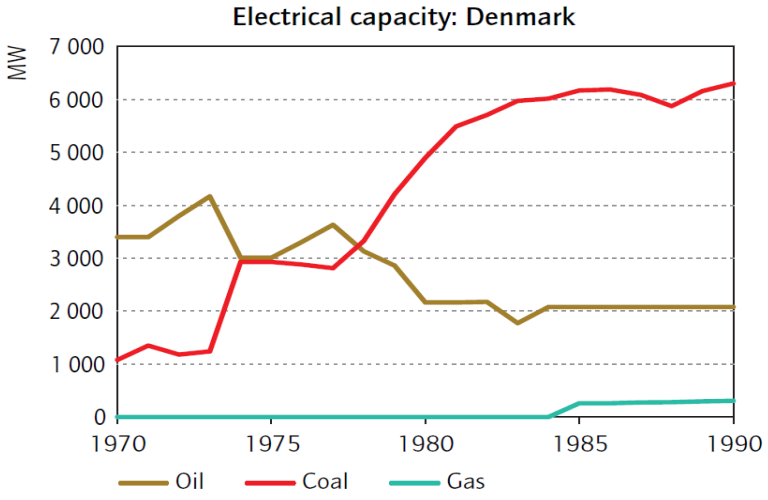
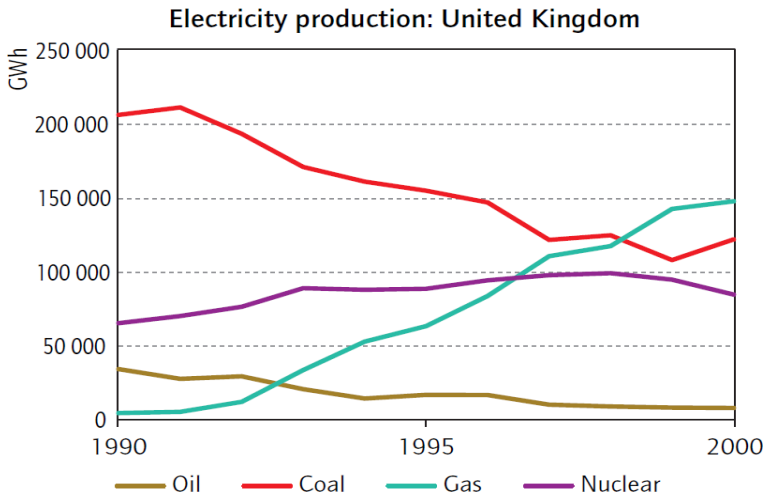
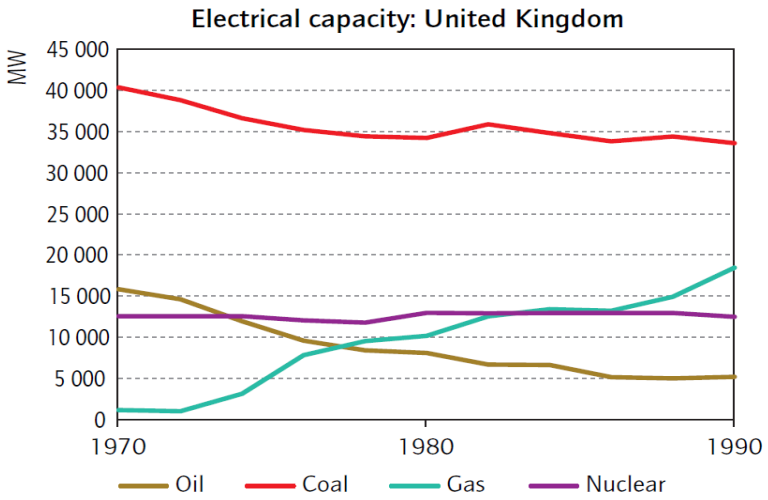
Early retirement of coal-fired generation

Historical electricity production and electrical capacity by fuel in Denmark and the United Kingdom









Source: IEA statistics, 2011.

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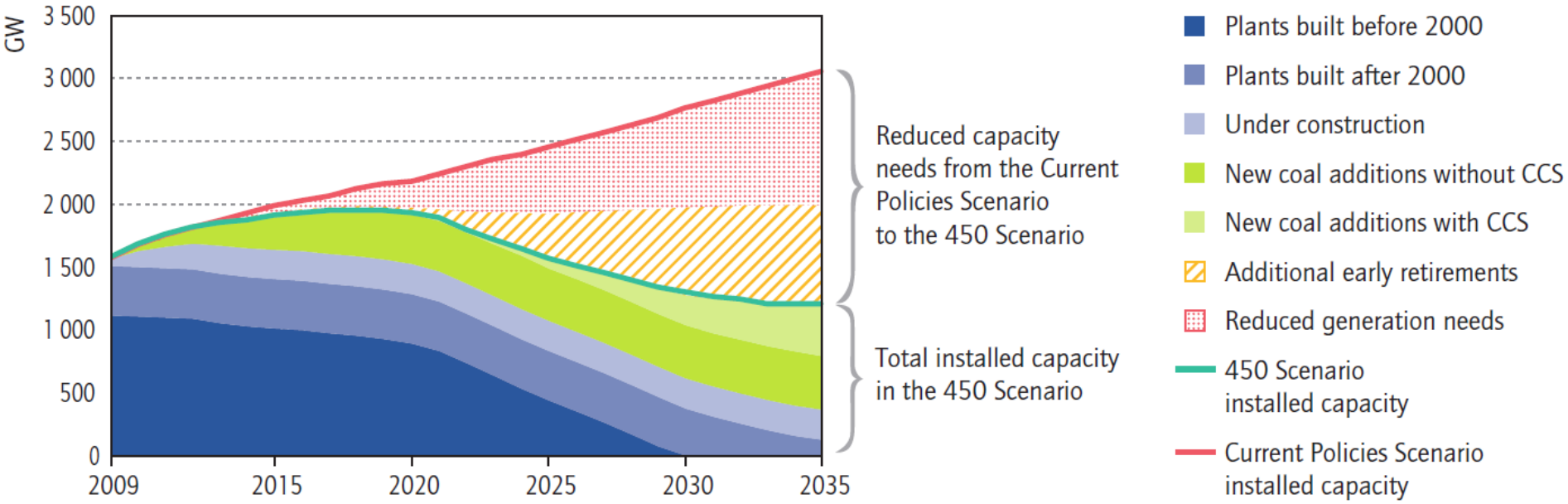
Early retirement of coal-fired generation

Global installed coal-fired generation capacity to 2035 in the 450 Scenario relative to the Current Policies Scenario from *WEO 2010*



Source: IEA, 2010.

Note: CCS = carbon capture and storage.

- Will market factors , a CO_2 price and demand side savings drive old coal plants out of the market? At what cost?
- What other measures could be envisioned to target decommissioning of old inefficient fossil-fuel plants?
- Should compensation measures be envisioned to mitigate 'stranded costs'?

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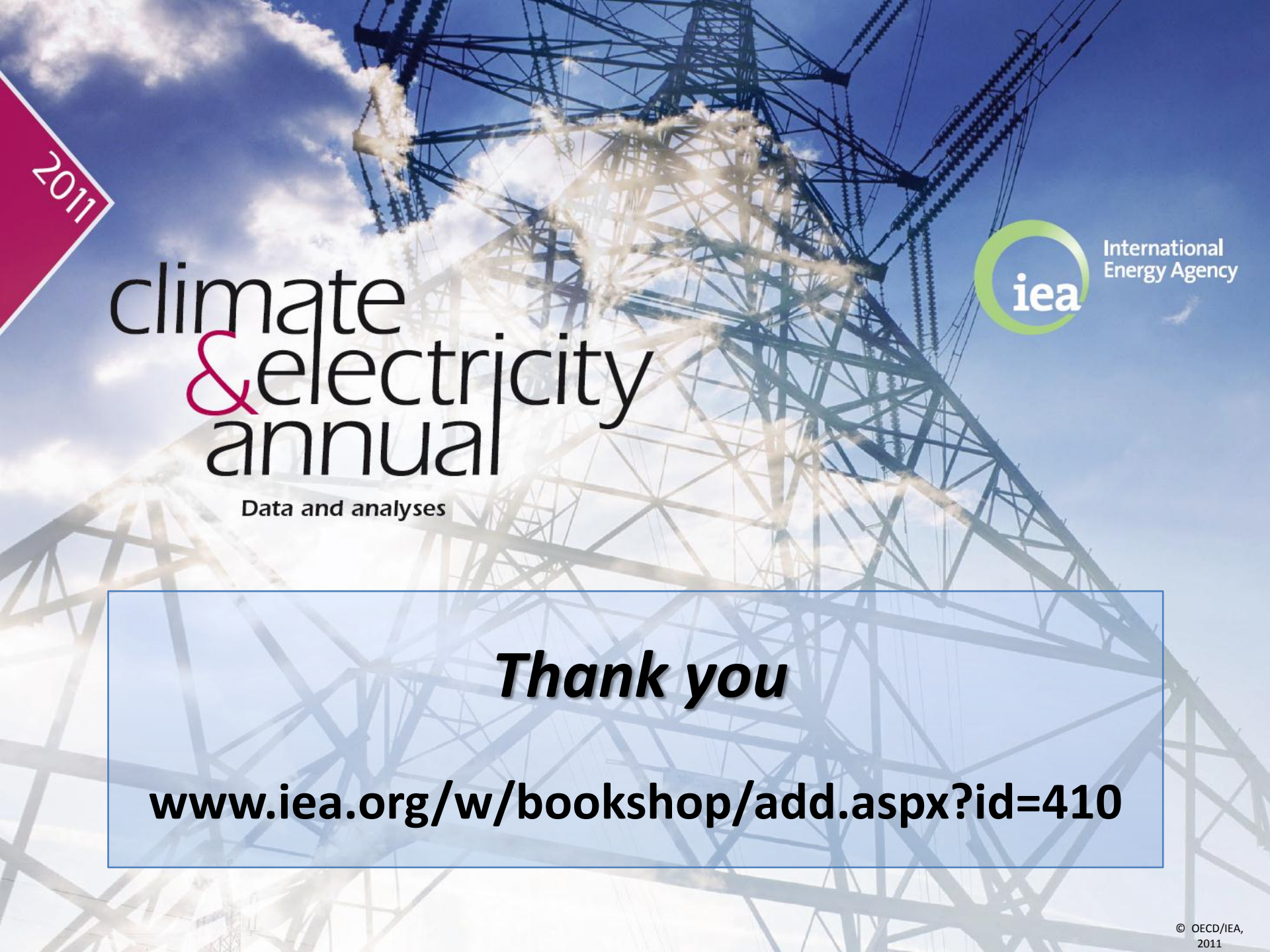

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