

World Energy Model: Focus on Power Generation Modeling

Parallel Session 9: Power Generation
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The World Energy Outlook

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- Annual publication by the Office of the Chief Economist of the IEA
- World Energy Outlook Series:
 - World Energy Outlook 2002
 - World Energy Outlook 2003 Insights: World Energy Investment Outlook
 - World Energy Outlook 2004
 - World Energy Outlook 2005: Middle East & North Africa Insights
 - World Energy Outlook 2006
 - World Energy Outlook 2007: China and India Insights
 - World Energy Outlook 2008 : Oil prospect and Climate Change Analysis
 - World Energy Outlook 2009 : Climate Change Analysis, Gas prospect and ASEAN Focus
(to be release in November 2009)

World Energy Model (WEM) - 1

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- **WEO projections are based on the World Energy Model (WEM)**

- > *Based on key assumptions*
 - > *GDP growth by region*
 - > *Fuel prices*
 - > *Population growth*
 - > *Technology developments*
- > *Allows for scenario analysis*
 - > *Reference Scenario*
 - > *450 Policy Scenario*
- > *Developed through several modules*

<http://www.worldenergyoutlook.org/model.asp>

World Energy Model (WEM) - 2

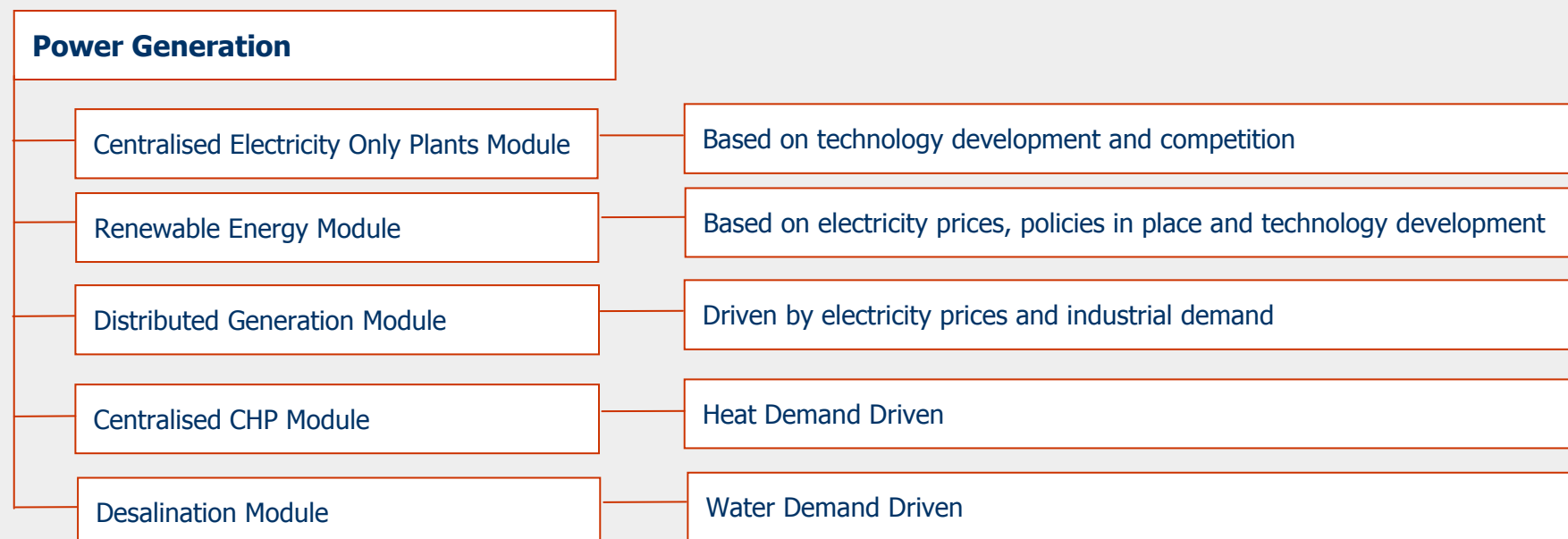
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- **Partial equilibrium model that allows scenario analysis**
 - > *Detailed sectoral and regional energy demand balances*
 - > *Regional supply of all fuels and trade matrixes*
 - > *CO2 emissions from fuel combustion*
 - > *Investment need in the supply and end-use technologies*
- **Time horizon to 2030, with annual data – complete update every year (e.g. this year the last data point will be 2007)**
- **Regional resolution: 27 regional models (of which 11 country models, including US, China, India, Japan, Russia, Brazil...)**
- **Demand part of the model consists of eight main modules**
 - > *Industry, Transport, Residential, Services, Agriculture, Power Generation, Heat Production, Other Transformation & Non-Energy Use*

Power Generation Module

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● Power Generation Module consists of five main sub-modules

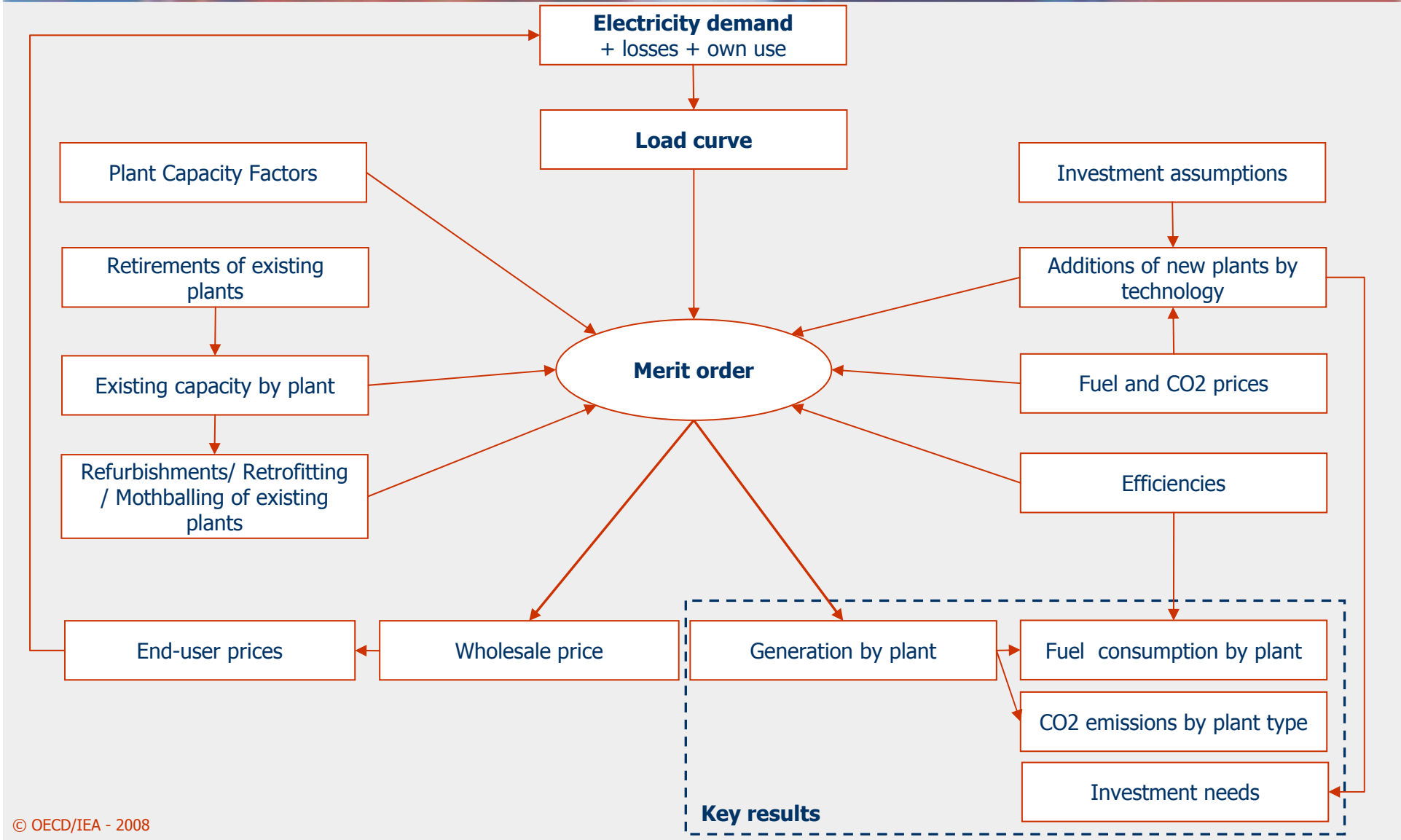


- > *Based on comprehensive analysis on existing power plants by region*
 - *Platt's UDI database*
- > *Assumptions on developments of investment costs and efficiencies of all technologies*
- > *Technology rich*
- > *Resulting electricity prices used in final demand sectors*

Power Generation Module - Scheme

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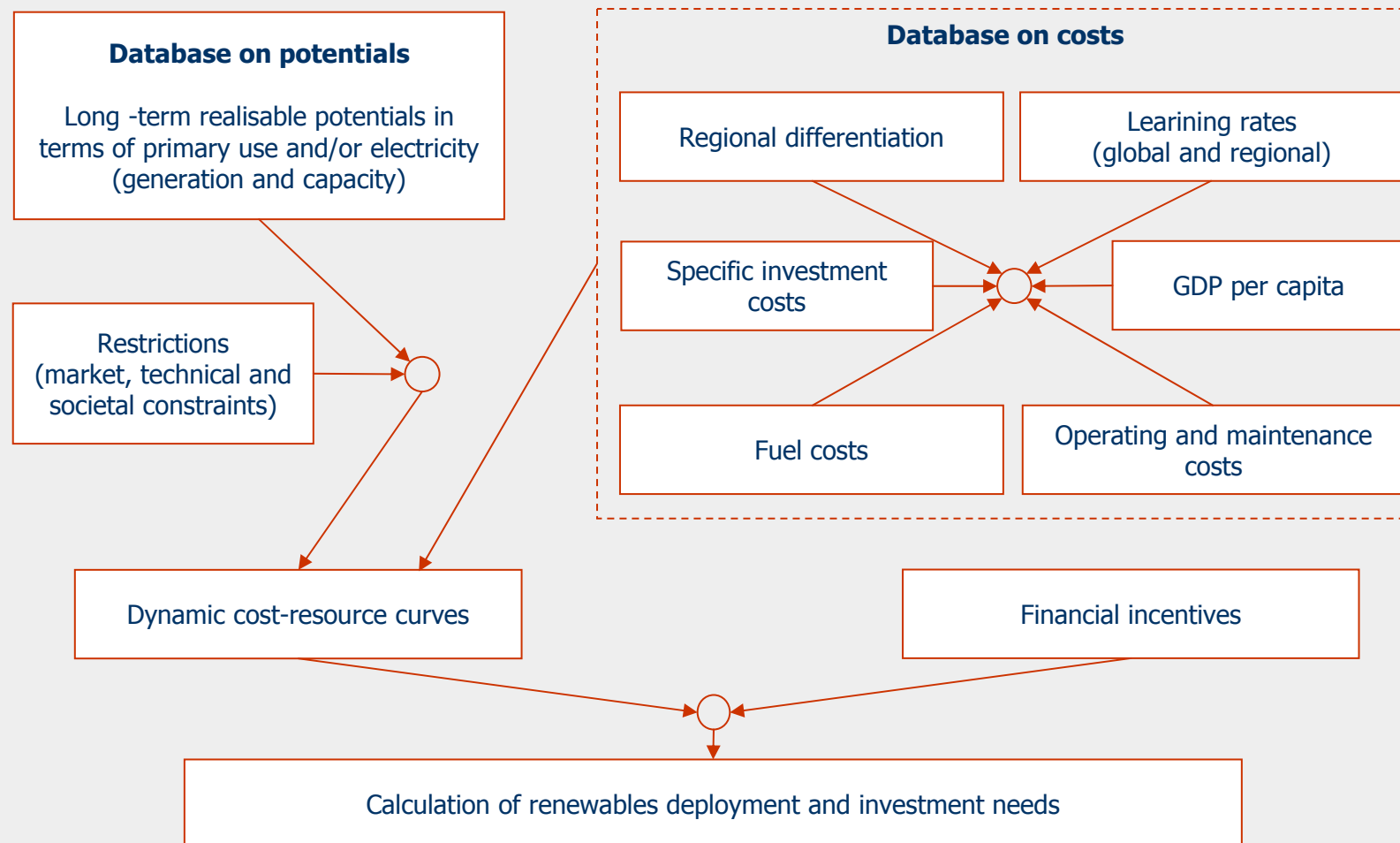
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- **First developed by the Technical University of Vienna for the IEA**
 - > *Based on the Green-X / WorldRES methodology*
- **Based on potentials for each technology and region**
 - > *All costs/potentials-bands are sorted in a least cost way*
 - > *Sites with similar characteristics described by one band (six bands for each technology)*
- **Simulates the impact of policies**
- **Addresses future technological changes, e.g. a reduction of investment costs or efficiency improvements due to technological learning**
 - > *Experience curves*
- **Technology diffusion – i.e. the impact of non-economic barriers**

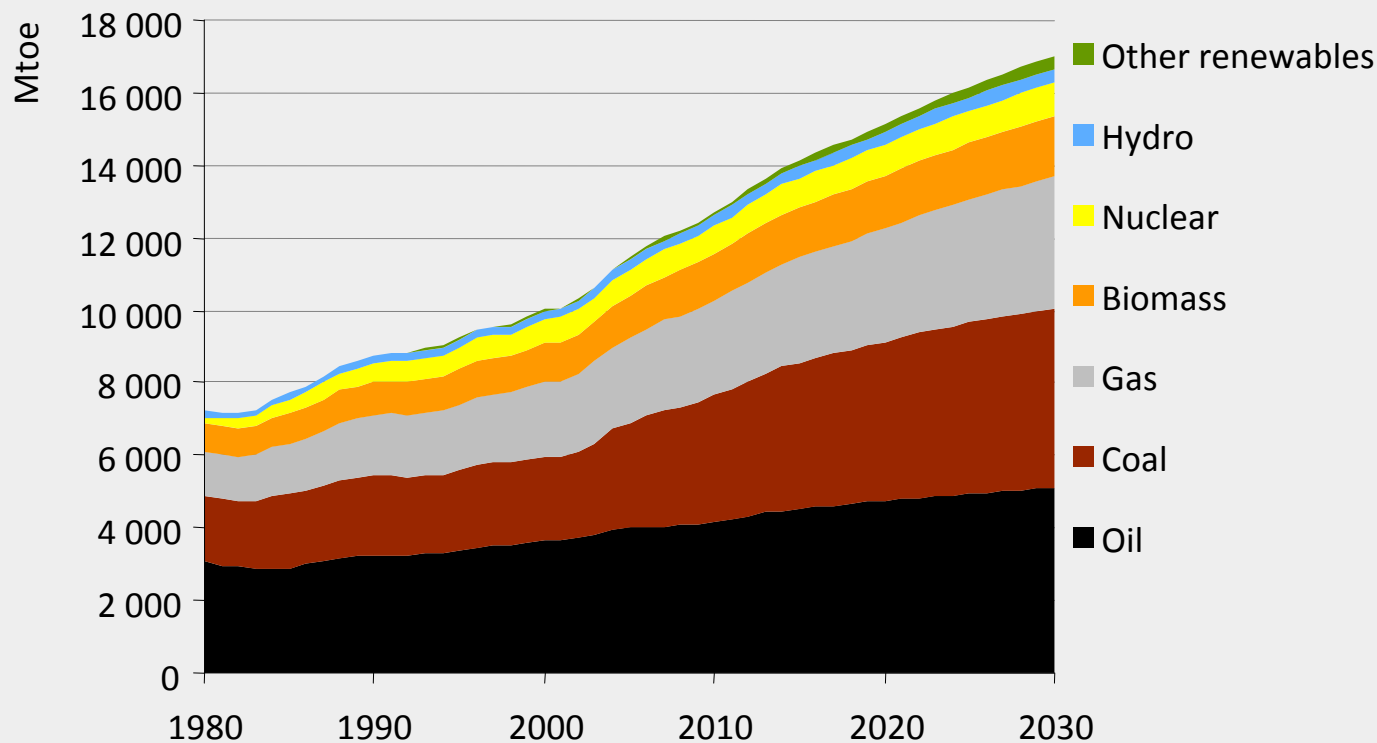
Renewable Module - Scheme

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World primary energy demand in the Reference Scenario: this is unsustainable!

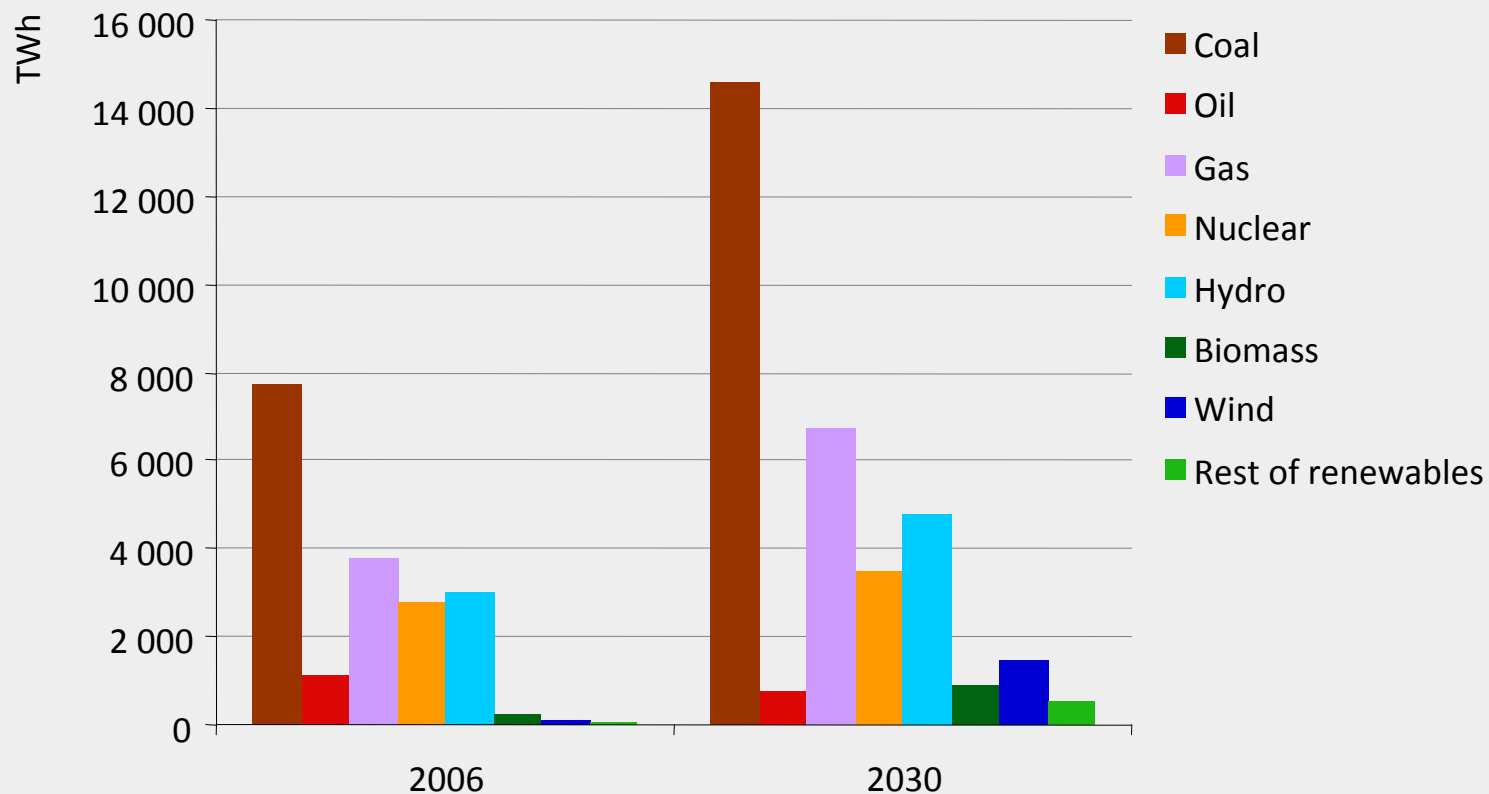
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World energy demand expands by 45% between now and 2030 – an average rate of increase of 1.6% per year – with coal accounting for more than a third of the overall rise

The Reference Scenario: World electricity generation

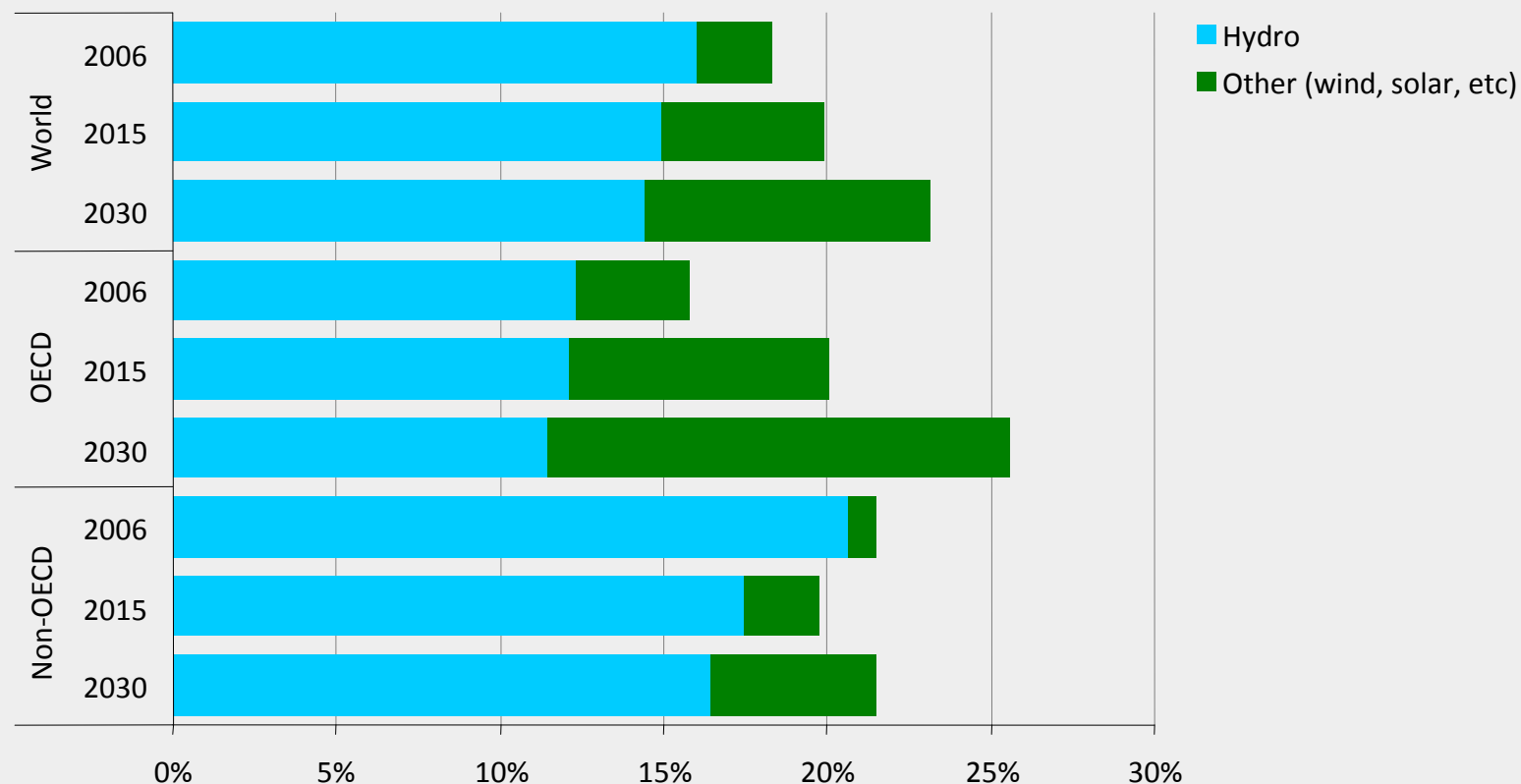
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***The shares of coal & renewables in the power-generation fuel mix increase to 2030
– mainly at the expense of natural gas & nuclear power***

Share of renewables in electricity generation in the Reference Scenario

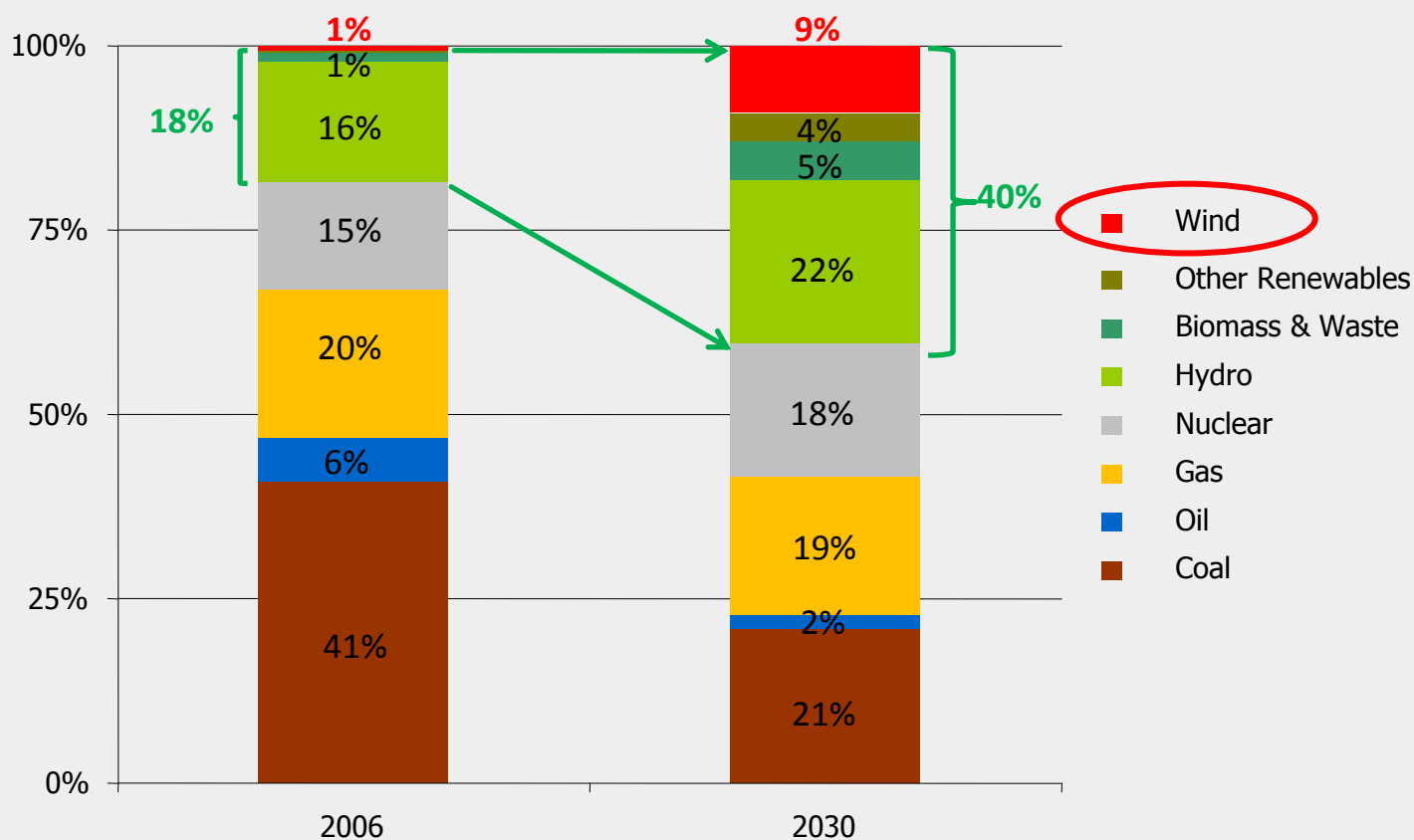
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Soon after 2010, renewables become the 2nd-largest source of electricity behind coal, thanks to government support, prospects for higher fossil-fuel prices & declining investment costs

Renewable share of global electricity (450 ppm Scenario)

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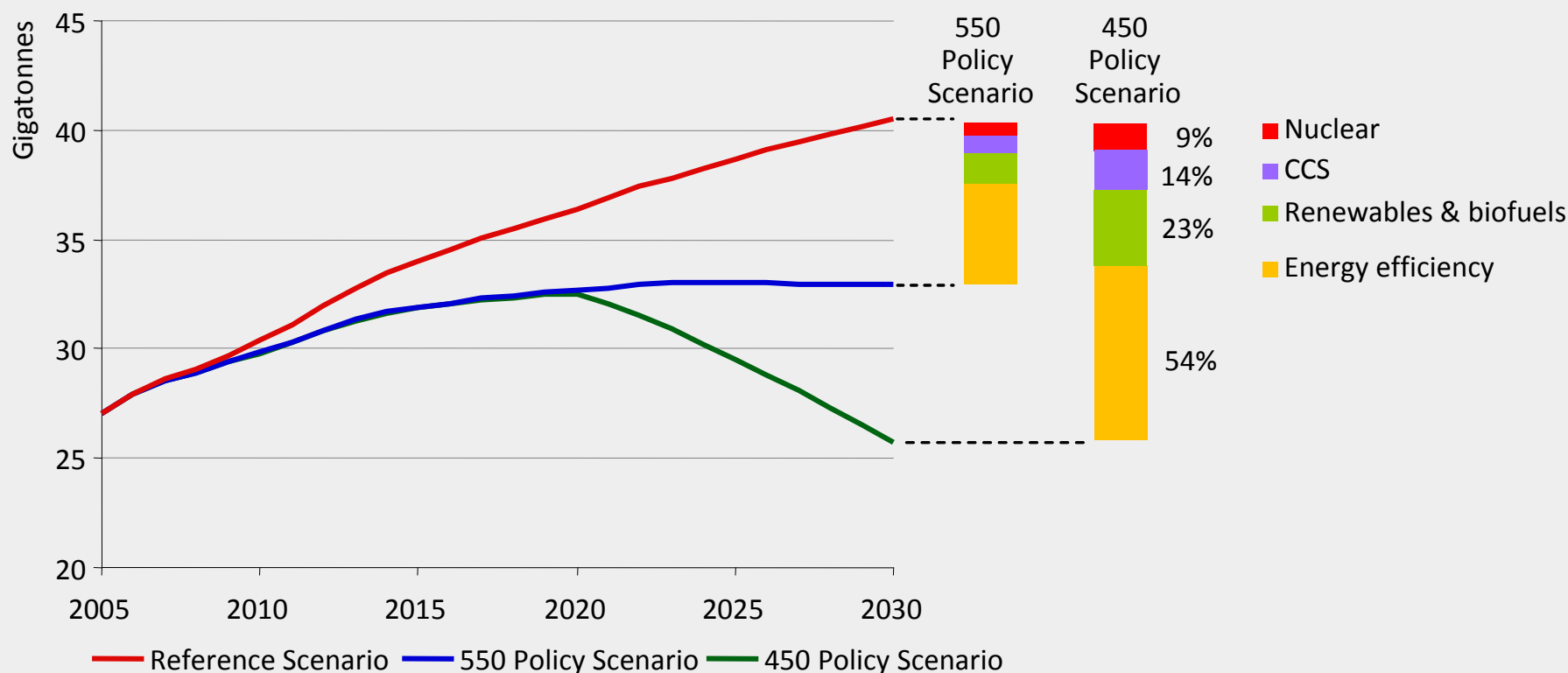


Renewables account for 40% of global electricity in 2030

Wind alone would provide 9%

Reductions in energy-related CO₂ emissions in the climate-policy scenarios

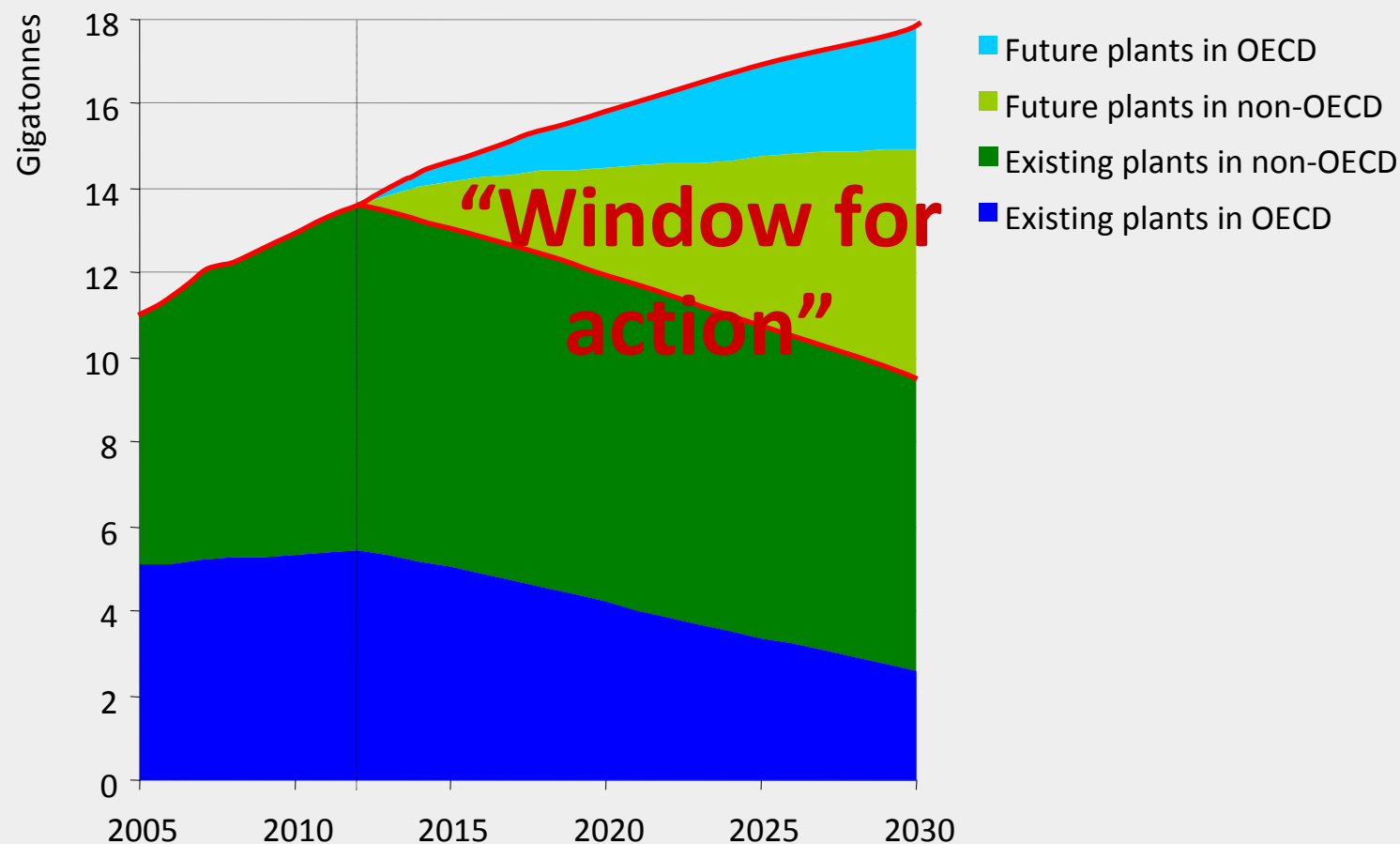
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While technological progress is needed to achieve some emissions reductions, efficiency gains and deployment of existing low-carbon energy accounts for most of the savings

Energy-related CO₂ emissions from existing & future power plants in the Reference Scenario

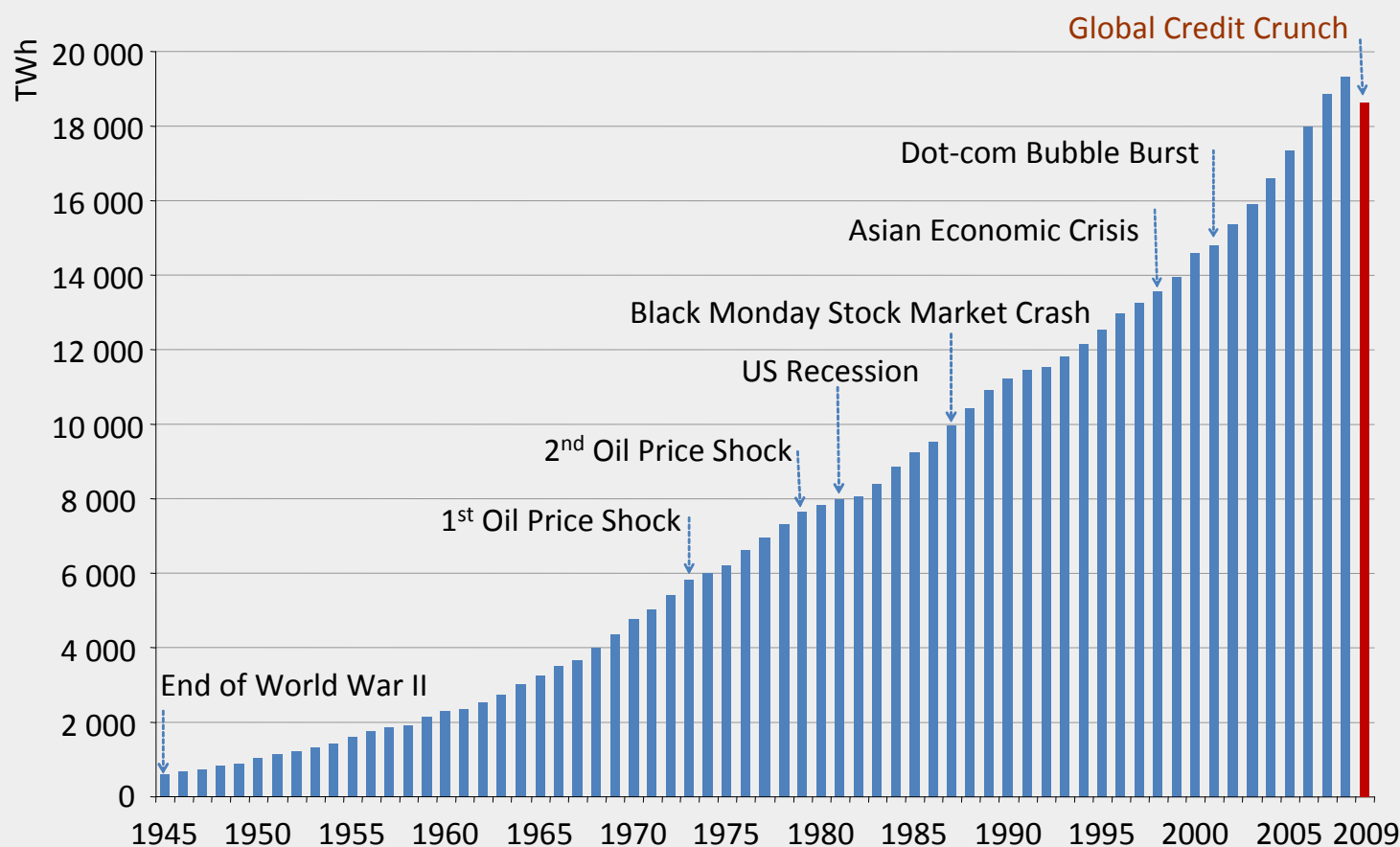
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Although 75% of power sector CO₂ emissions in 2020 are already “locked-in”, investments in the next decade will be critical to a low-carbon future in the longer term

Historical global electricity consumption

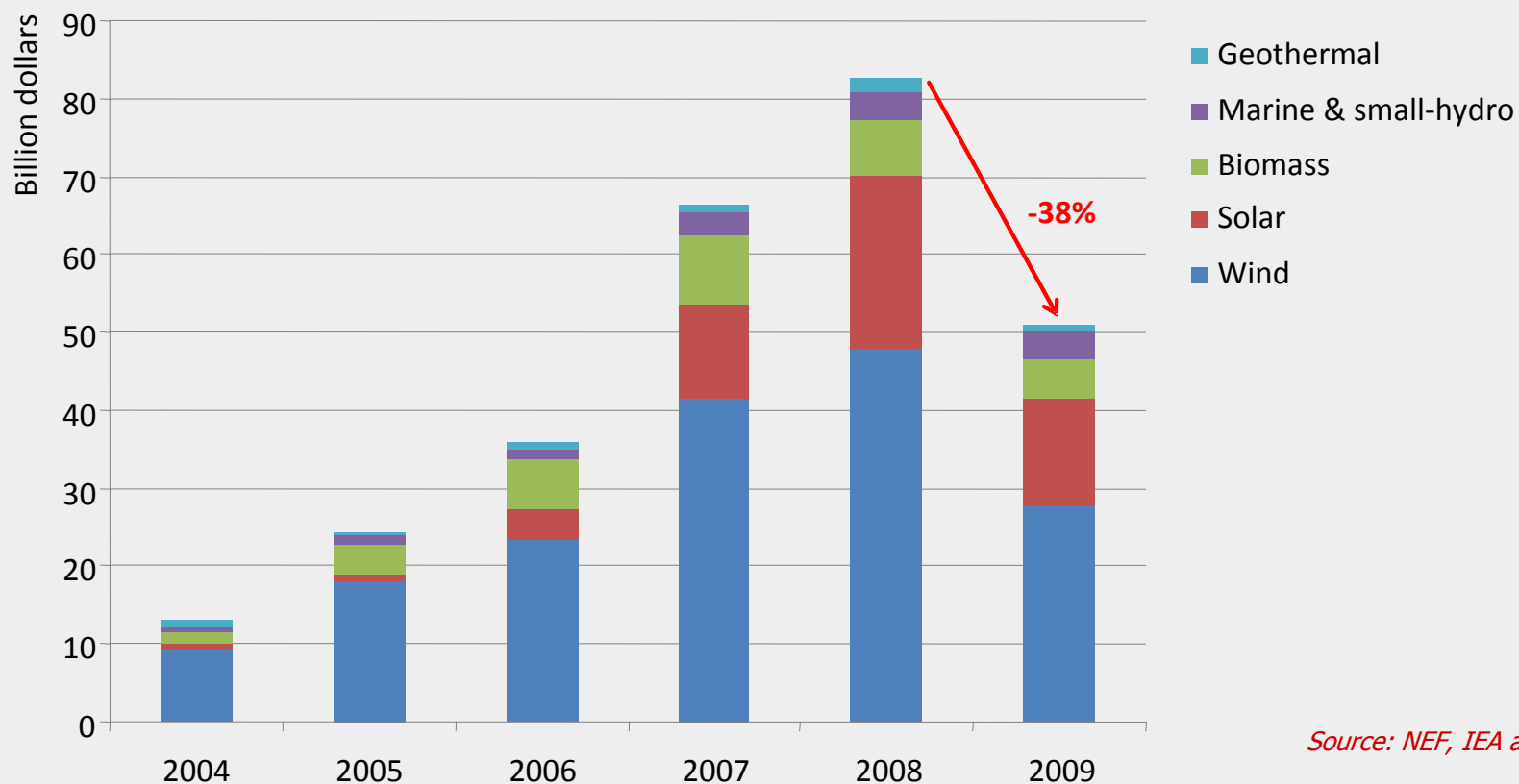
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***Global electricity consumption could drop by as much as 3.5% in 2009
– the first annual contraction since the end of the Second World War***

Asset financing for new build renewable assets

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Source: NEF, IEA analysis

Renewable energy investment has collapsed due to lower fossil-fuel prices and the financial crisis – which has dried up sources of project finance

World Energy Outlook 2009: Outline

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- **WEO 2009: in-depth analysis and modelling of headline issues**
 - > *Post-2012 climate change policy scenarios*
 - > *Gas supply and demand prospects*
 - > *Focus on ASEAN countries*
- **World Energy Outlook Series:**
 - **World Energy Outlook 2008 : Oil prospect and Climate Change Analysis**
 - **World Energy Outlook 2009 : Gas prospect and Climate Change Analysis** *(to be release in November 2009)*
 - **World Energy Outlook 2010 : Renewable Energy Prospects**

Thank you

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