



Workshop: Climate Change & Electricity Prices in Key International Property Markets

Presented by
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Regulation

Market Entry

Restructuring

Carbon Management

Market Modelling

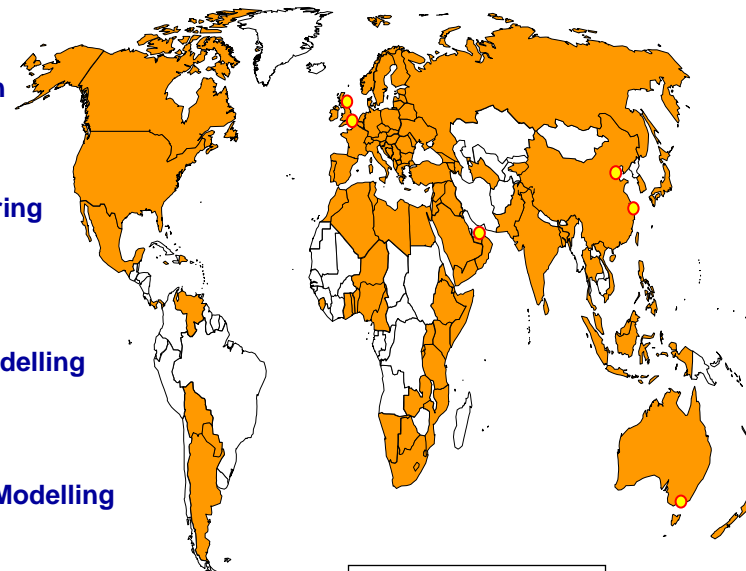
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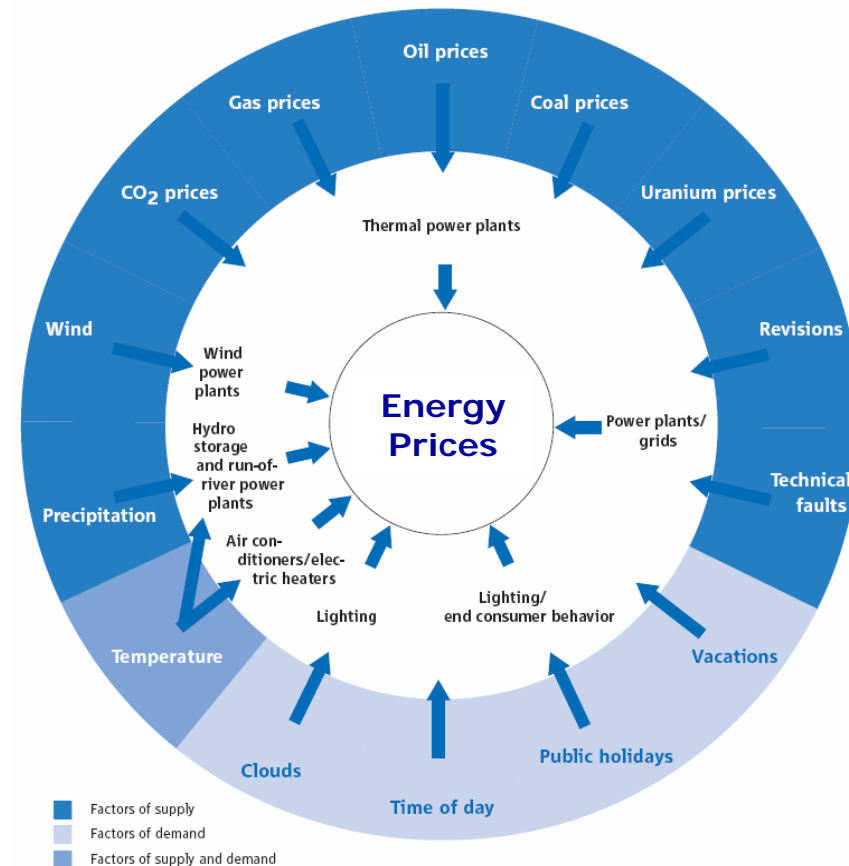
Introduction

- Energy is a critical part of any economy, powering the operation of business, industry, and homes and making our way of life possible
- Because energy is such an omnipresent commodity, **changes in price** can have significant direct and indirect impacts on a broad range of sectors
- However, the factors influencing energy prices are **opaque and complex**, making it difficult to think constructively about future developments
- The goal of this presentation, therefore, is provide better understanding of **electricity and fuel markets** and shed light on the underlying drivers shaping past, current, and future prices

Drivers of Electricity Prices

- Both in the short- and long-term, energy prices will be determined by the balance of **supply and demand**
- The influences on supply and demand are different for different timeframes

Time Frame	Supply Influences	Demand Influences
Short-Term	Weather	
	Fuel and emission prices	Work schedules
Long-Term	Changing climate conditions	
	Infrastructure costs	Economic growth
	Technological improvement	Consumer lifestyles



Source: RWE

Meeting Electricity Demand

- The cost of generating electricity at the plant is made up of several components
 - Short-term
 - **Fuel costs** – cost of fuel used to generate electricity (coal, gas, uranium)
 - **Variable operations and maintenance** – any costs incurred in proportion to the amount of electricity produced: cost of emissions (CO₂, NO_x, SO₂), consumables, added maintenance
 - Long-term
 - **Capital costs** – cost of constructing the plant
 - **Fixed operations and maintenance** – fixed annual costs of keeping a plant operational: standard maintenance, base labour, permitting
- For each type of plant, the proportion of each of these costs is different, making different types of plant useful for different roles
- Capital-intensive plants often require long-term contracts to ensure the investment is paid off, whereas less capital intensive plants may be built without a contract and take whatever price the electricity market supports
- The next slide briefly introduces the different types of generating capacity and their characteristics

Types of Generation

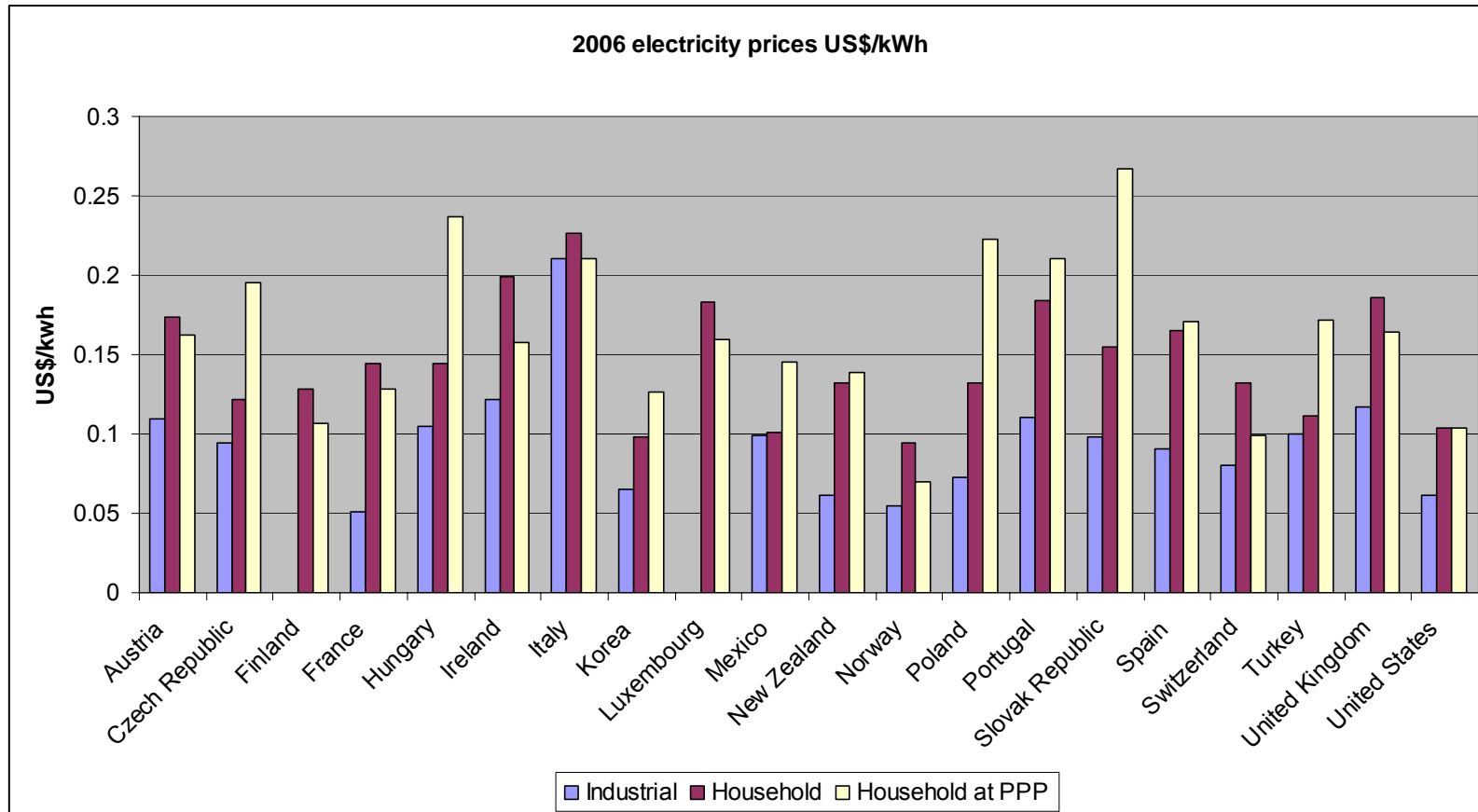
Generation Type	Description	Typical Thermal Efficiency	Tonnes CO ₂ per MWh	Capital Costs £/kW	Fuel Costs £/MWh	Contract
Hydropower	Free-flowing or dammed water to drive water turbine	-	-	High	None	Long-Term
Wind	Wind to drive wind turbines on land or at sea	-	-	Very High	None	Long-Term
Other Renewables	Variety: solar, biomass, tidal	-	-	Very High	Low/None	Long-Term
Nuclear	Uranium fission to drive steam turbine	34%	-	Very High	Low	Long-Term
Coal	Coal combustion to drive steam turbine	36%	0.89	High	Low	Mid-Term
Gas – Combined cycle (CCGT)	Gas combustion to drive gas turbine & steam turbine (more efficient than SGT)	47%	0.37	Mid	Mid	Mid-Term
Gas/Distillate – Single cycle (SGT)	Gas/distillate combustion to drive gas turbine (similar to jet engine)	30%	0.60/ 0.85	Low	High	Short/ None
Oil	Oil combustion to drive gas or steam turbine	34%	0.61	Mid	High	Short/ None

Electricity Prices vary widely

- Industrial Prices in OECD countries:
 - lowest in France (5.1 US cents per kWh in 2006)
 - highest in Italy (21 US cents per kWh in 2006).
 - In 2006, the average industry price for available OECD countries was 9.4 US cents per kWh.
- Residential prices in OECD countries:
 - lowest in Norway (9.4 US cents per kWh)
 - highest in Netherlands (25.8 US cents per kWh)
 - In 2006, the average household price for available OECD countries was 15.1 US cents per kWh.

Source: IEA Statistics: Electricity Information 2007

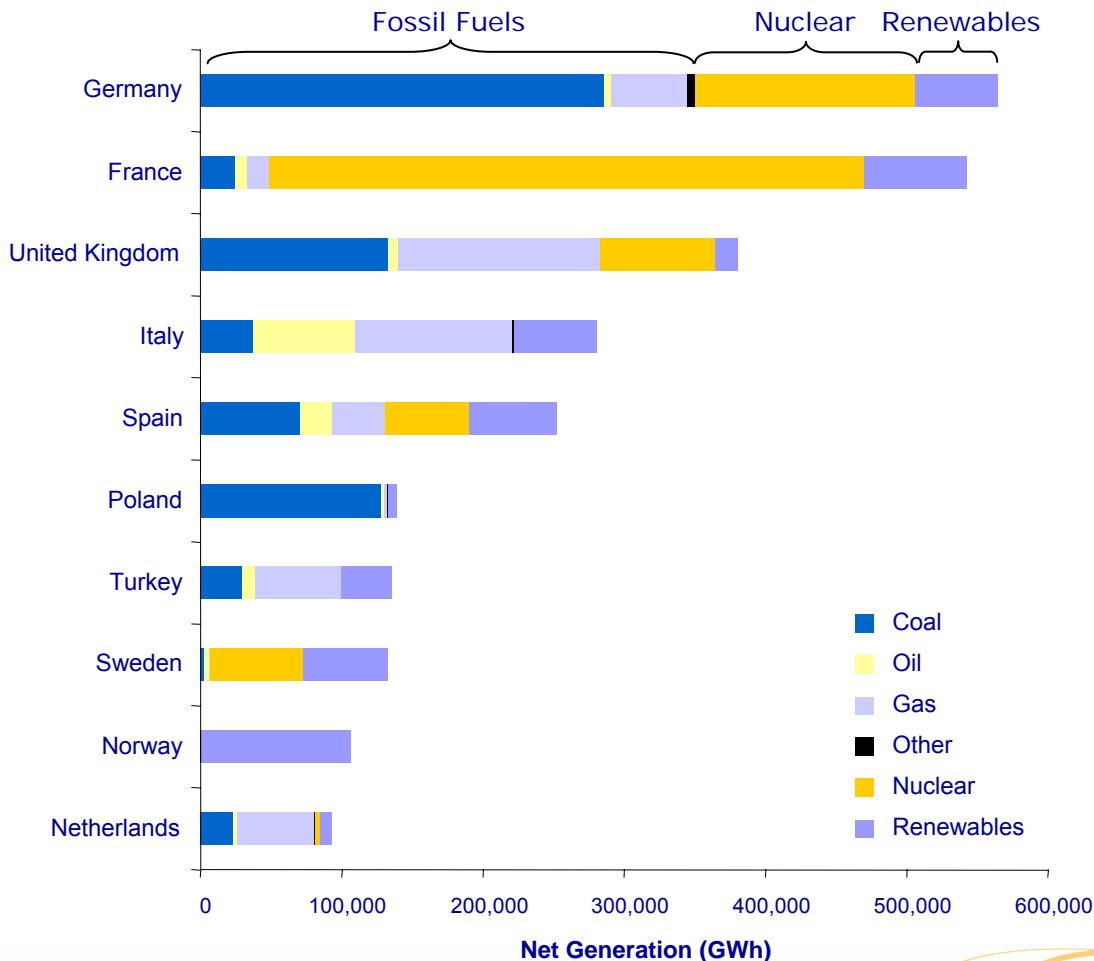
Electricity prices for selected countries



Source: IEA Statistics: Electricity Information 2007

Will CO2 costs be passed on to consumers?

Generation by Fuel (GWh)



- Those countries that rely more heavily on power stations that have a high CO2 emissions can be expected to experience higher increases in power prices, **other things constant**
- CO2 prices and the degree of cost pass-through are affected by a large number of factors that complicate the analysis

Fact is that other things are not constant!

Demand-side factors

- Kyoto Targets
 - Annex 1
 - Non-Annex 1
- Caps and allocation
- Current and future level of emissions
- Economic growth, demand growth
- Fuel and commodity prices
- Any other external shocks that affect economic output and emissions, e.g. natural disasters, wars, etc.

Supply-side factors

- Short-term fuel switch
- Fuel switch via new capacity
- Credits via projects abroad
- Increase energy efficiency
- Invest and develop new technologies to broaden emission reduction options above

Policy to reduce emissions

Caps minus Emission Level

Quantity Demanded for Emission Reductions

Demand Function for Emission Reductions

Options to reduce emissions

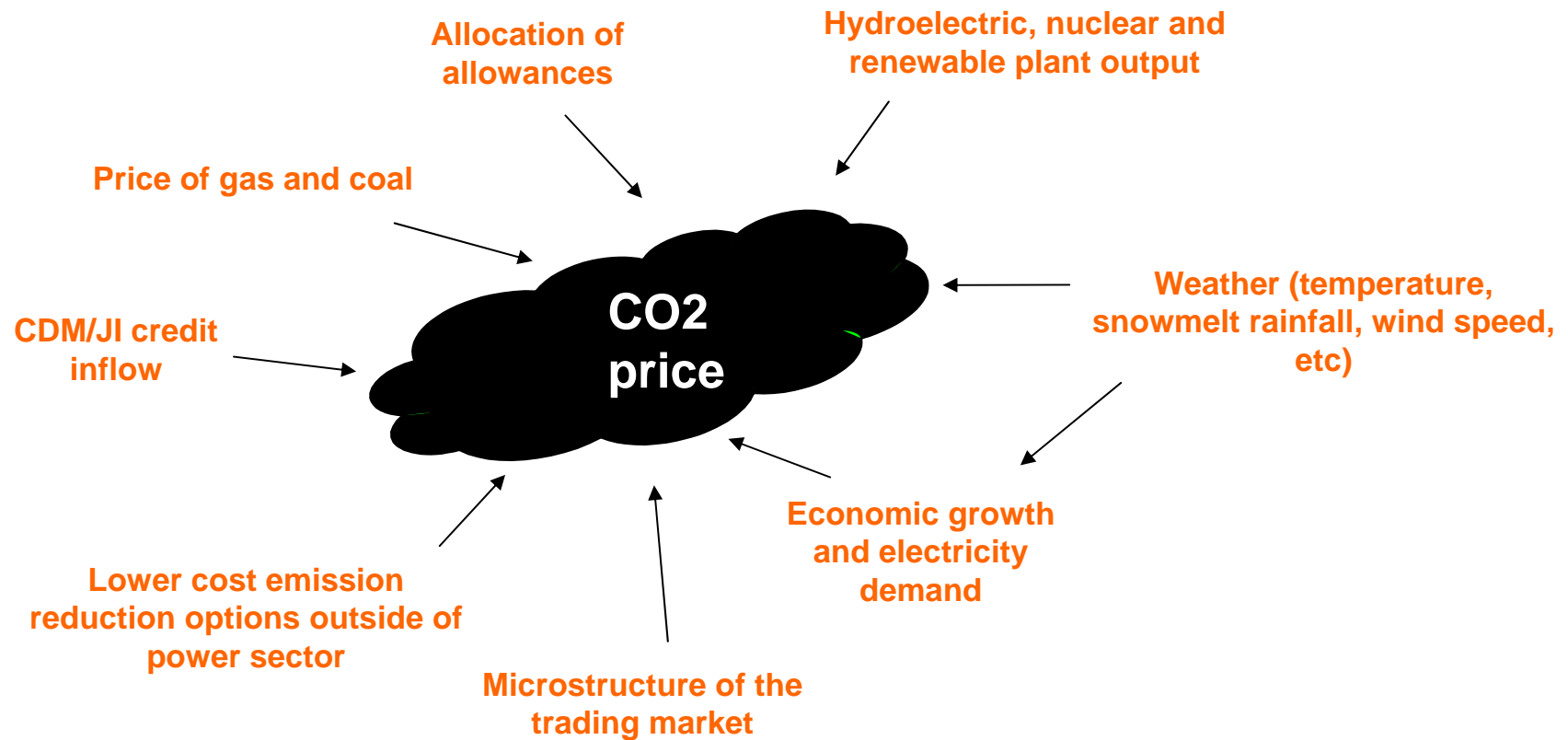
Fuel Switch Cost and Quantity

Energy Efficiency Measures Cost and Quantity

Energy Efficiency Measures Cost and Quantity

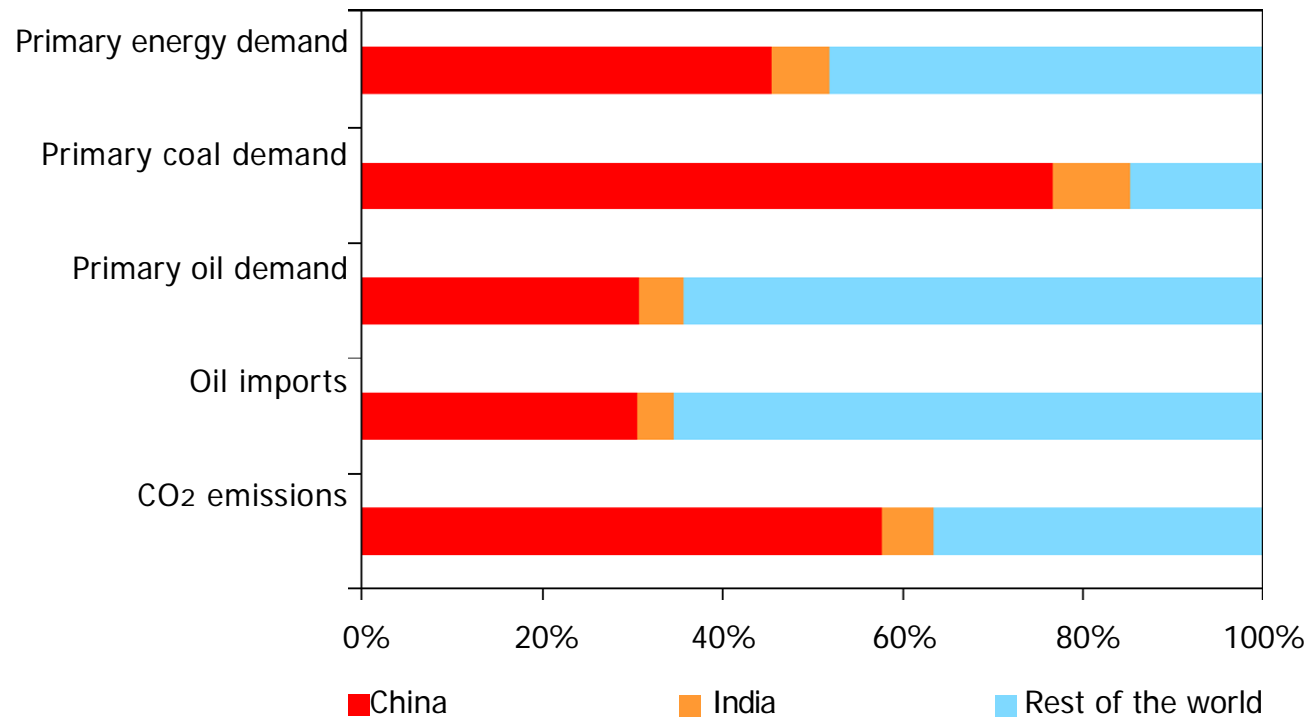
Supply Function of Emission Reductions

Fact is that other things are not constant!



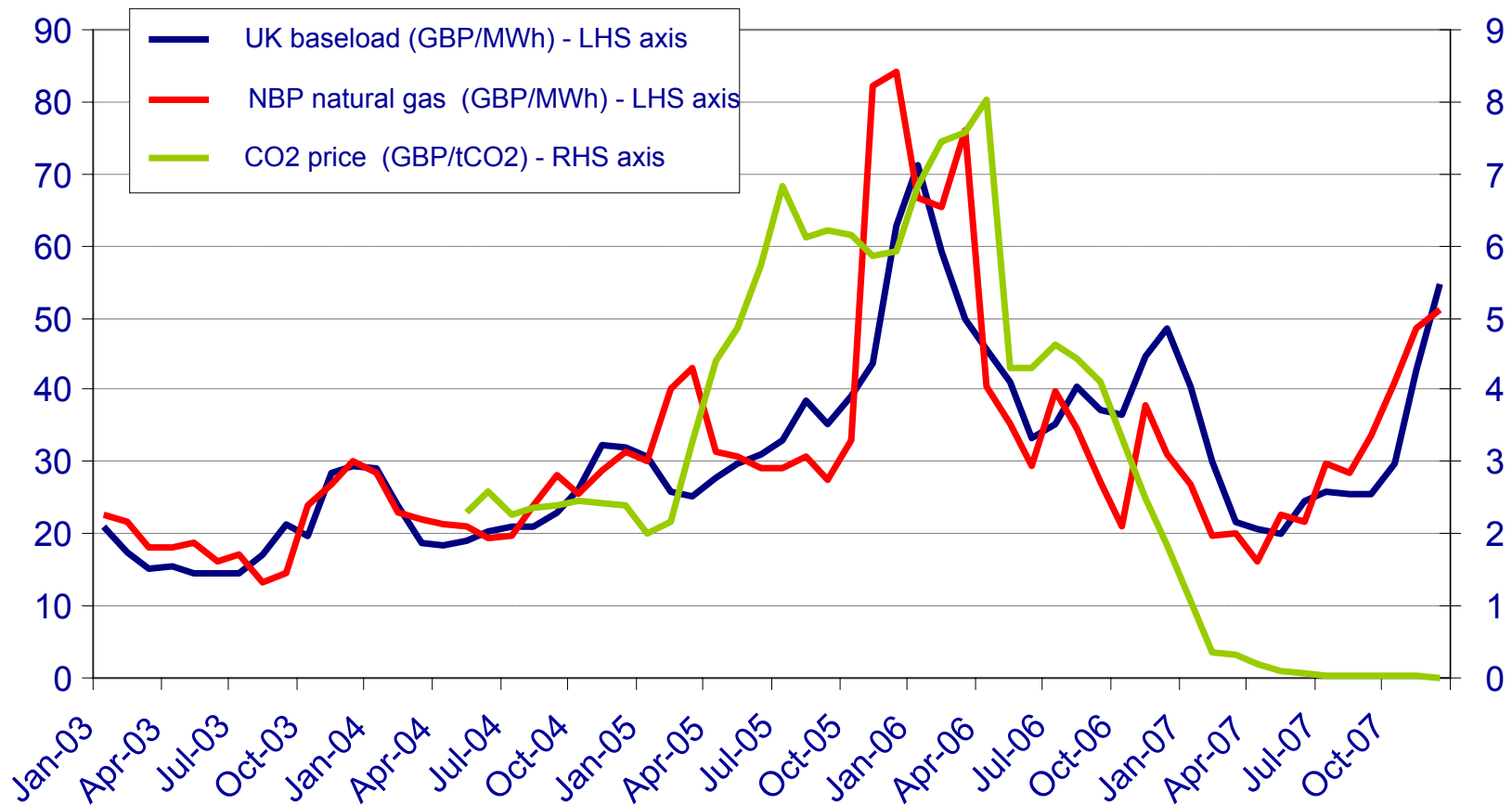
The Importance of China

Share of China and India in Incremental Energy Demand, Imports
and Energy-Related CO₂ Emissions, 2000-2006*

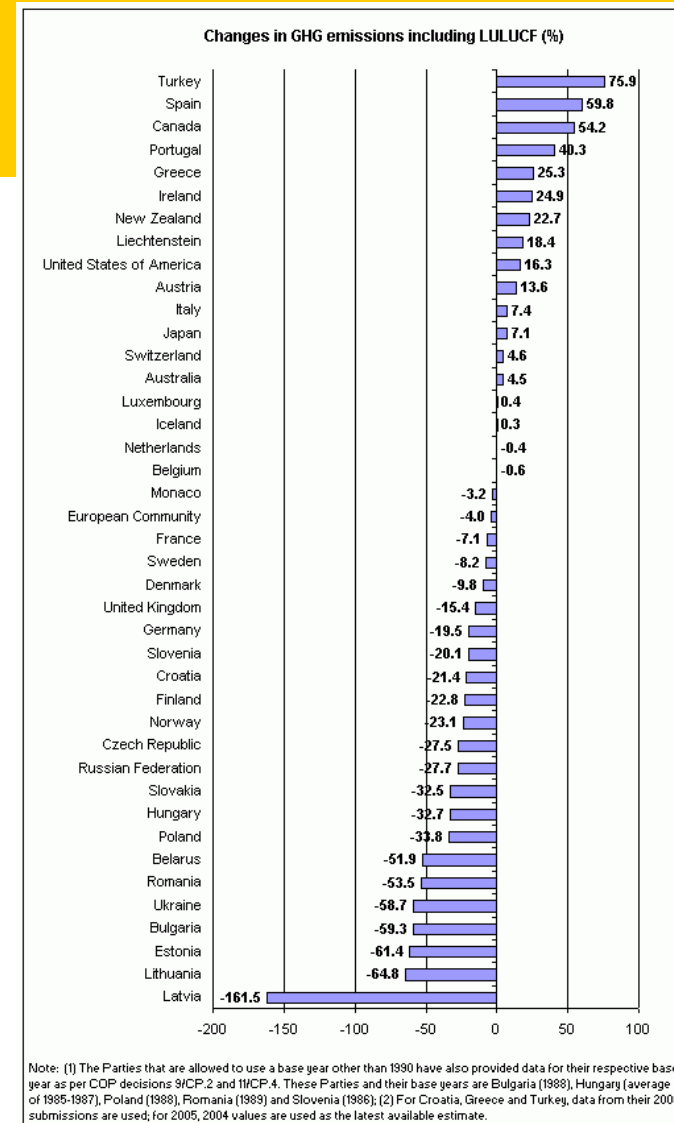
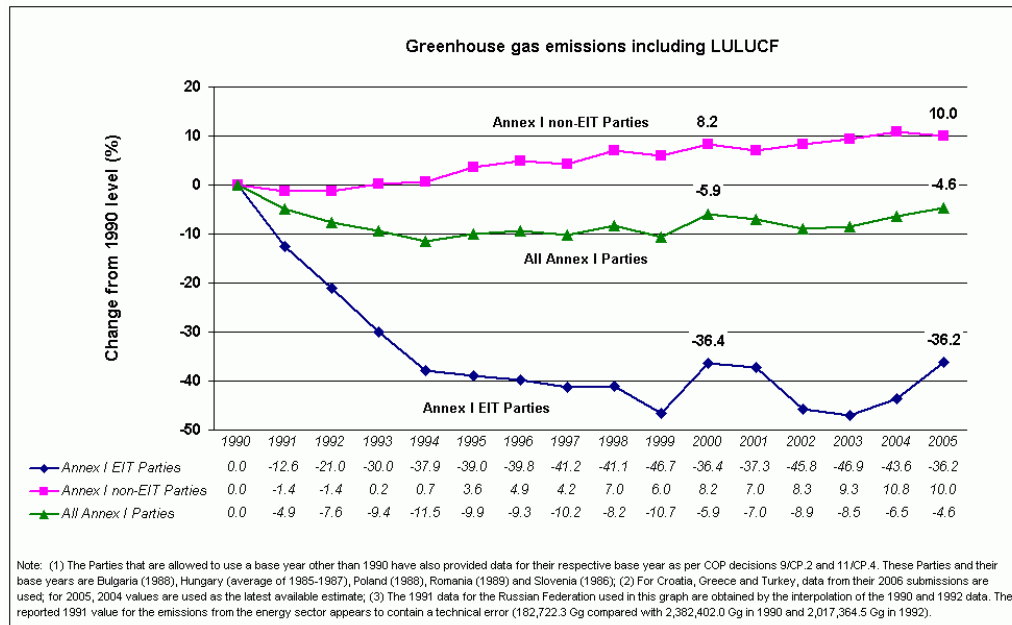


Source: IEA Global Energy Outlook 2007

To date: CO2 has had an impact in UK

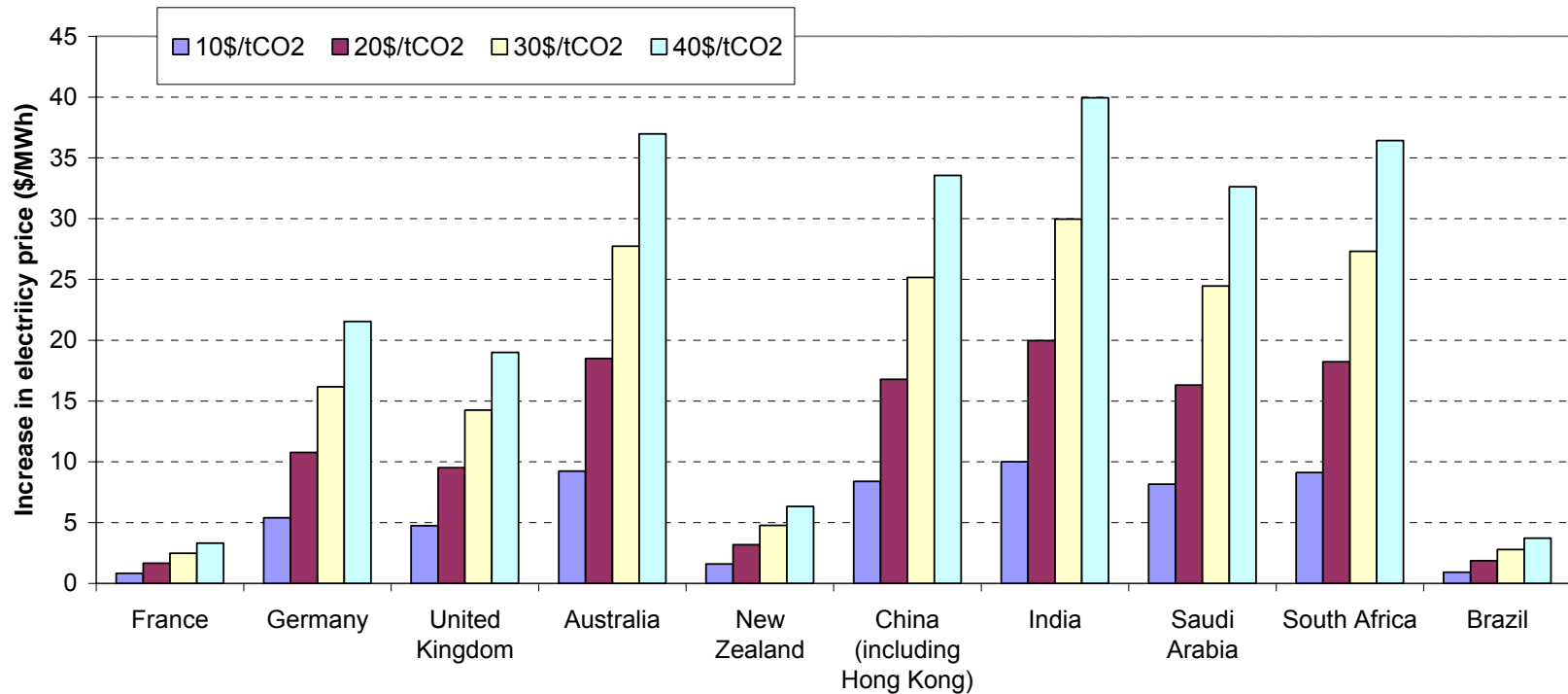


CO2 emissions



Source: http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php

Impact on electricity prices from CO2



Source: EIA and IPA calcs



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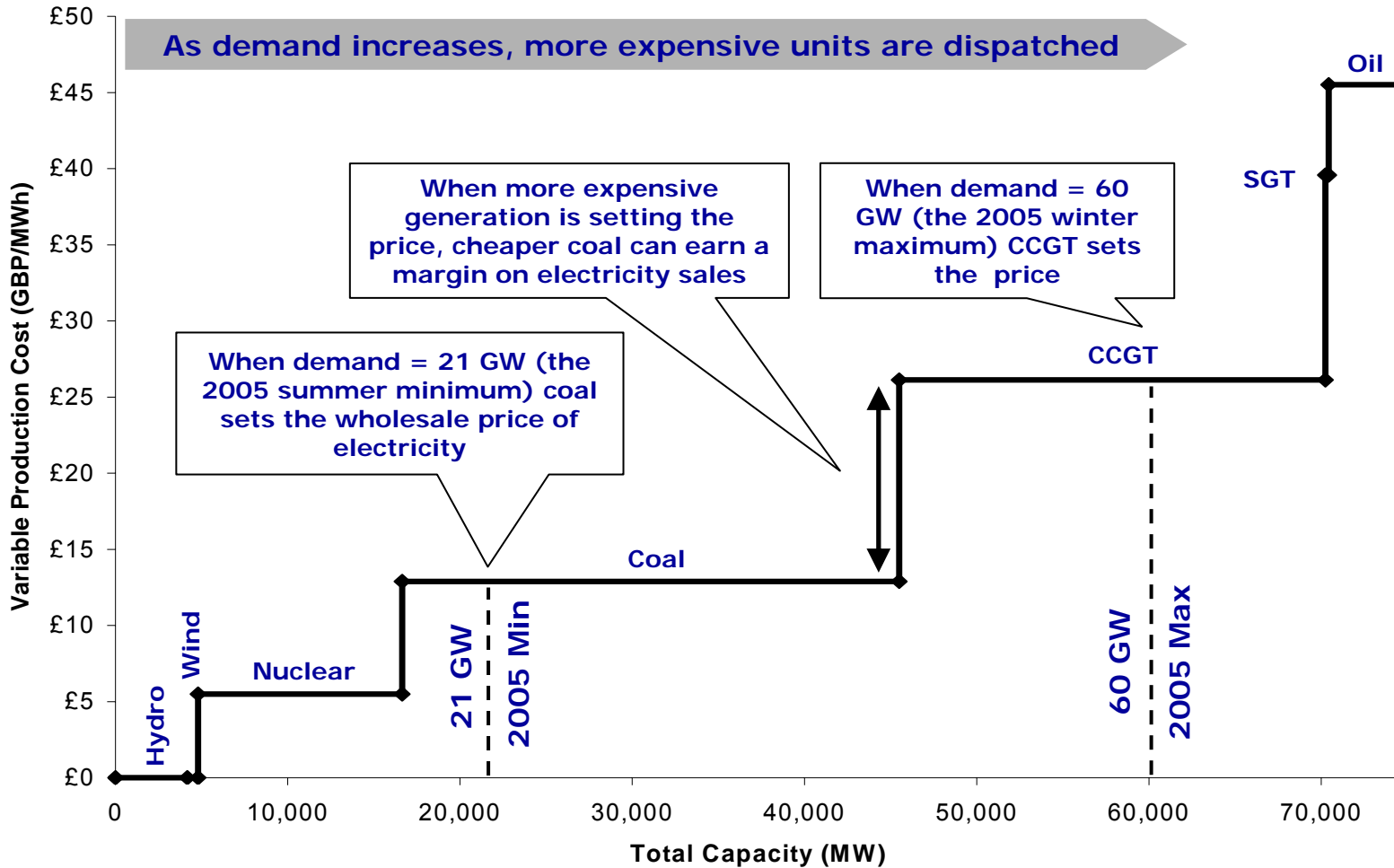
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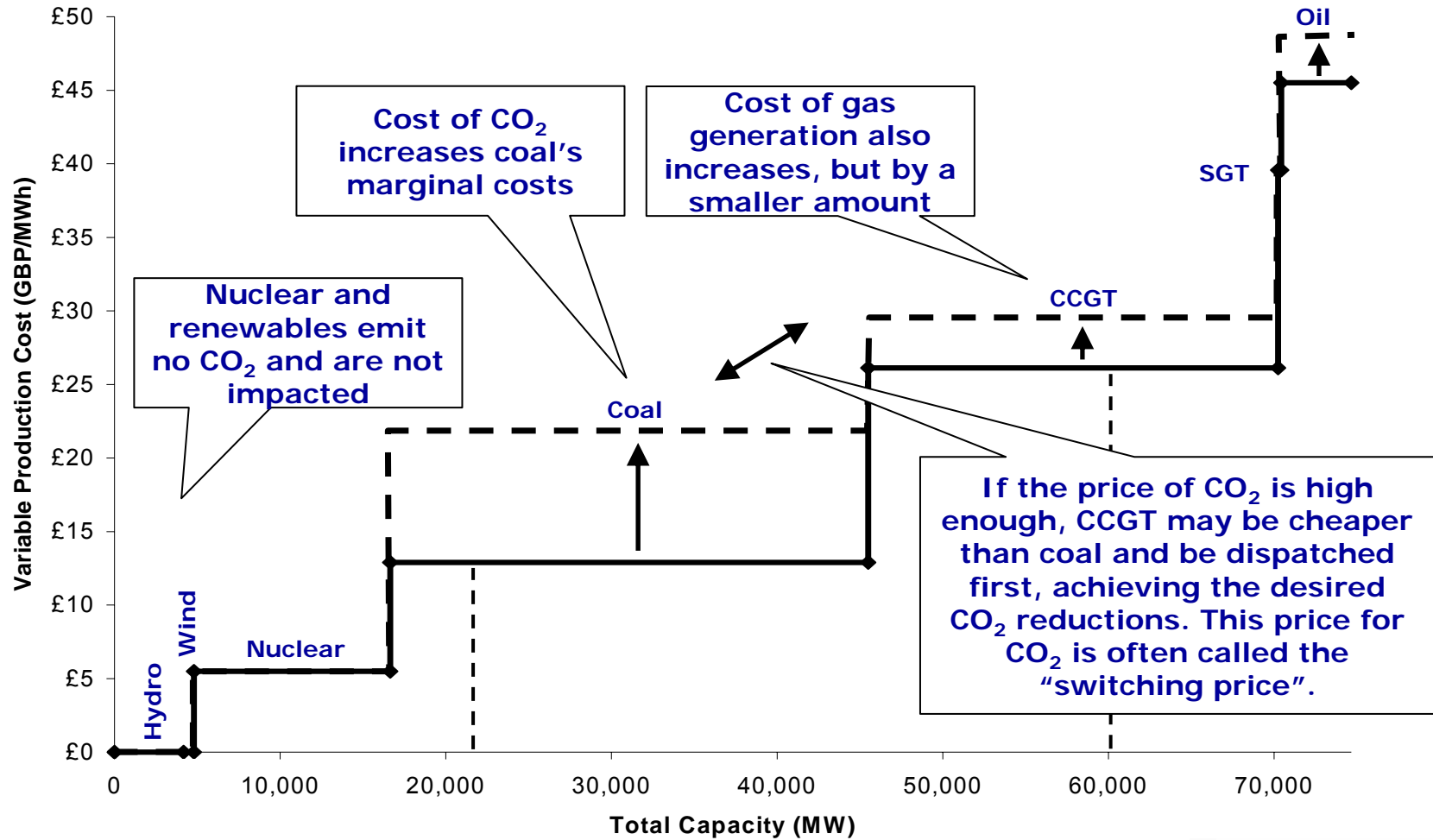
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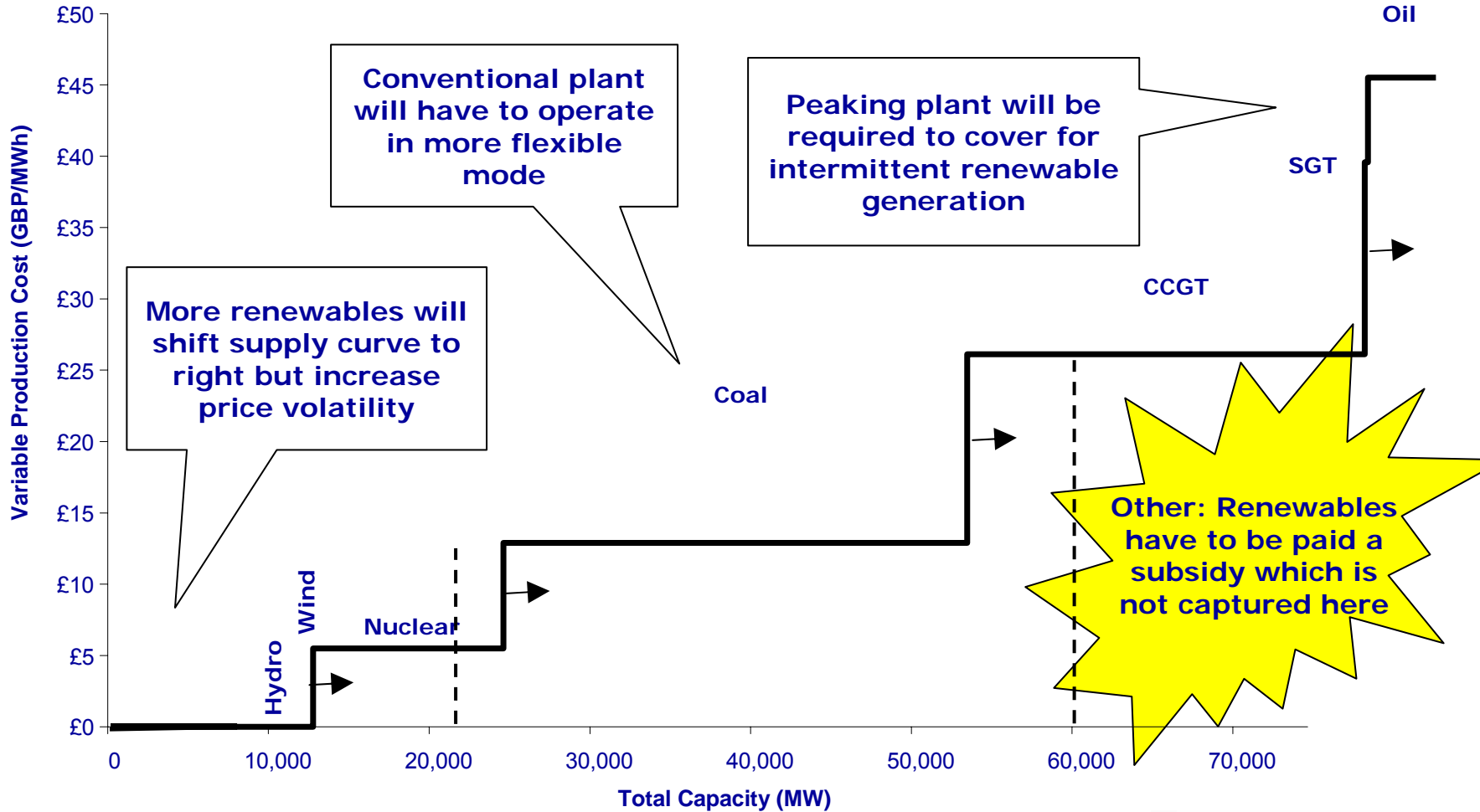
UK Electricity Supply Curve



UK Supply Curve with CO₂ Price



UK Supply Curve with more Renewables



UK Supply Curve with more Energy Efficiency

