

RWE npower



# RWE npower Factbook



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## II. Gas

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## UK: Large Combustion Plant Directive (LCPD)

### Background

From 2008, UK coal and oil-fired power stations will be governed by the Large Combustion Plant Directive. This sets new limits on the amounts of Sulphur Dioxide (SO<sub>x</sub>), Nitrous Oxides (NO<sub>x</sub>) and dust power stations can emit

### Step 1

- Power stations must choose whether to be part of LCPD or to request a limited life derogation (opt out)
- Power stations which opt out are allowed to run for 20,000 hours, or until 2015, whichever comes sooner

### Step 2

- Power stations which are part of LCPD must choose to be governed in one of two ways:
  - 1) Emission Limit Value (ELV)
    - Specific limits to the amounts of pollutants produced on a “milligramme per cubic metre of waste gas” (mg/Nm<sup>3</sup>) basis
  - 2) National Emission Reduction Plan (NERP)
    - A Company is given an overall allowance of emissions it may produce<sup>1</sup>

### Step 3

- In addition to the above, power plants must reduce Nitrous Oxide emissions from 500mg/Nm<sup>3</sup> to 200mg/Nm<sup>3</sup> by 1 January 2016.
- This will entail fitting Selective Catalytic Reduction (SCR) equipment.

<sup>1</sup> Due to the Environment Agency regulatory framework, stations which choose ELV will be allocated an annual limit of emissions (called a company B limit) and stations that choose NERP will be allocated site specific annual emission limit values

# UK: National Allocation Plan (NAP) I vs. II (1/2)



Allocation element	NAP I for 2005 – 2007	NAP II for 2008 – 2012
<b>Quantity</b>	245.4 million t CO <sub>2</sub> p.a. (= 736.3 million t CO <sub>2</sub> for the three-year trading period)	Overall cap is 246.2 million t CO <sub>2</sub> p.a. Total allocation to installations covered by NAP 1 is 236.6 million t CO <sub>2</sub> p.a.
<b>Allocation to electricity sector</b>	136.9 million t CO <sub>2</sub> p.a. (= 410.7 million t CO <sub>2</sub> for the three-year trading period)	Free allocation is 107.4 million t CO <sub>2</sub> p.a. including a contribution of 7.9 million t CO <sub>2</sub> p.a. to the new entrant reserve. Free allocation based on benchmarks for the electricity sector using fuel and technology specific emission factors: <ul style="list-style-type: none"> <li>■ Coal plant meeting LCPD<sup>1</sup> limits, CCGT and peaking plant based on category average load factors</li> <li>■ Coal plant opted out of LCPD emission limits based on 28.54% load factor</li> </ul>
<b>Allocation to other industries</b>	108.5 million t CO <sub>2</sub> p.a. (= 325.6 million t CO <sub>2</sub> for the three-year trading period)	The allocation to other sectors is 121.5 million t CO <sub>2</sub> p.a., including 9.6 million t CO <sub>2</sub> p.a. for new installations not previously covered  Use of relevant emissions; the average of the highest three years emissions during the baseline period 2000 – 2003

<sup>1</sup> Large Combustion Plant Directive

# UK: National Allocation Plan (NAP) I vs. II

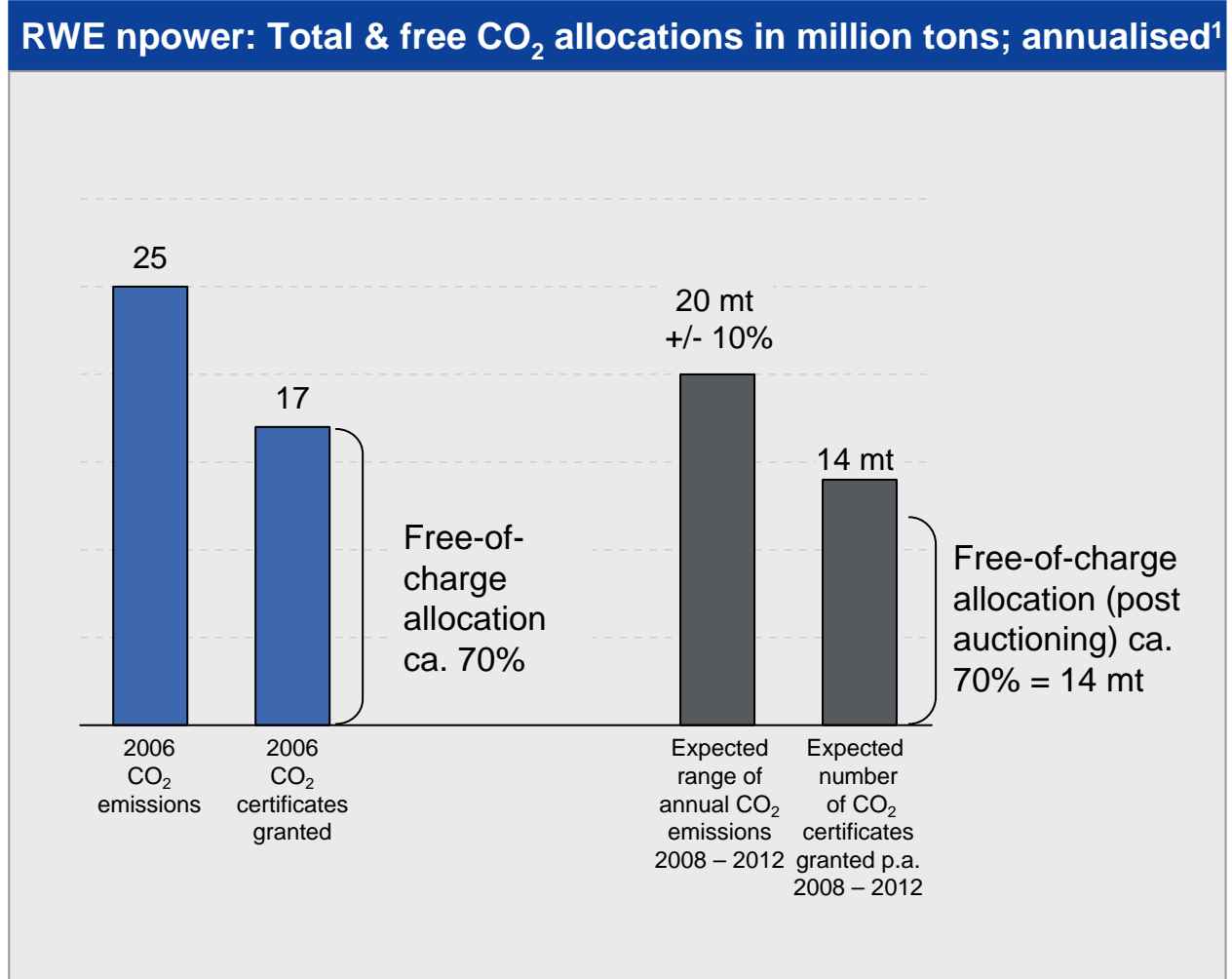
## (2/2)

Allocation element	NAP I for 2005 – 2007	NAP II for 2008 – 2012
<b>Auctioning</b>	Surplus allowances in the new entrant reserve will be sold rather than auctioned	7% of allowances (17.2 million t CO <sub>2</sub> p.a.) will be auctioned. Auctioned allowances will come from electricity supply sector
<b>New entrants</b>	6.3% of allowances retained in new entrant reserve, with 4.6 million t CO <sub>2</sub> p.a. (=13.9 for the three-year trading period) specifically ringfenced for new entrant Combined Heat and Power Generation (CHP) plant. Allocation to new entrants based on technology specific benchmarks, but with gas-specific emission factors in the electricity sector	The new entrant reserve will be 6.6% (total of 81.6 million t CO <sub>2</sub> equivalent to 16.3 million t CO <sub>2</sub> on average p.a.) of total allocation allowances at the following rates: <ul style="list-style-type: none"> <li>■ 100% to certified Good Quality CHP</li> <li>■ To new entrants from the electricity sector in line with incumbents, scaled back to be consistent with reduced allocation to this sector</li> <li>■ 95% to all other new entrants</li> </ul>
<b>Transfer rule (for replacement of old power plants)</b>	No transfer rule. Closed plant does not receive allowances in the year following closure	No transfer rule. Closed plant does not receive allowances in the year following closure
<b>Clean Development Mechanism<sup>1</sup>/ Joint Implementation<sup>2</sup></b>	No restrictions	Installations can use up to 8% of allocation; equivalent to 9.3% of free allocations accounting for auctioning deduction

<sup>1</sup> Emission reductions through investment by an industrialised country in a country without reduction commitments are credited to the emission account of the investor country

<sup>2</sup> Emission reductions through investment by one industrialised country in a second industrialised country are credited to the emission account of the investor country

# RWE npower: Expected Impact from UK NAP II



<sup>1</sup> Excludes CHP plant and new build plant

# UK & Germany: Renewables Support Frameworks



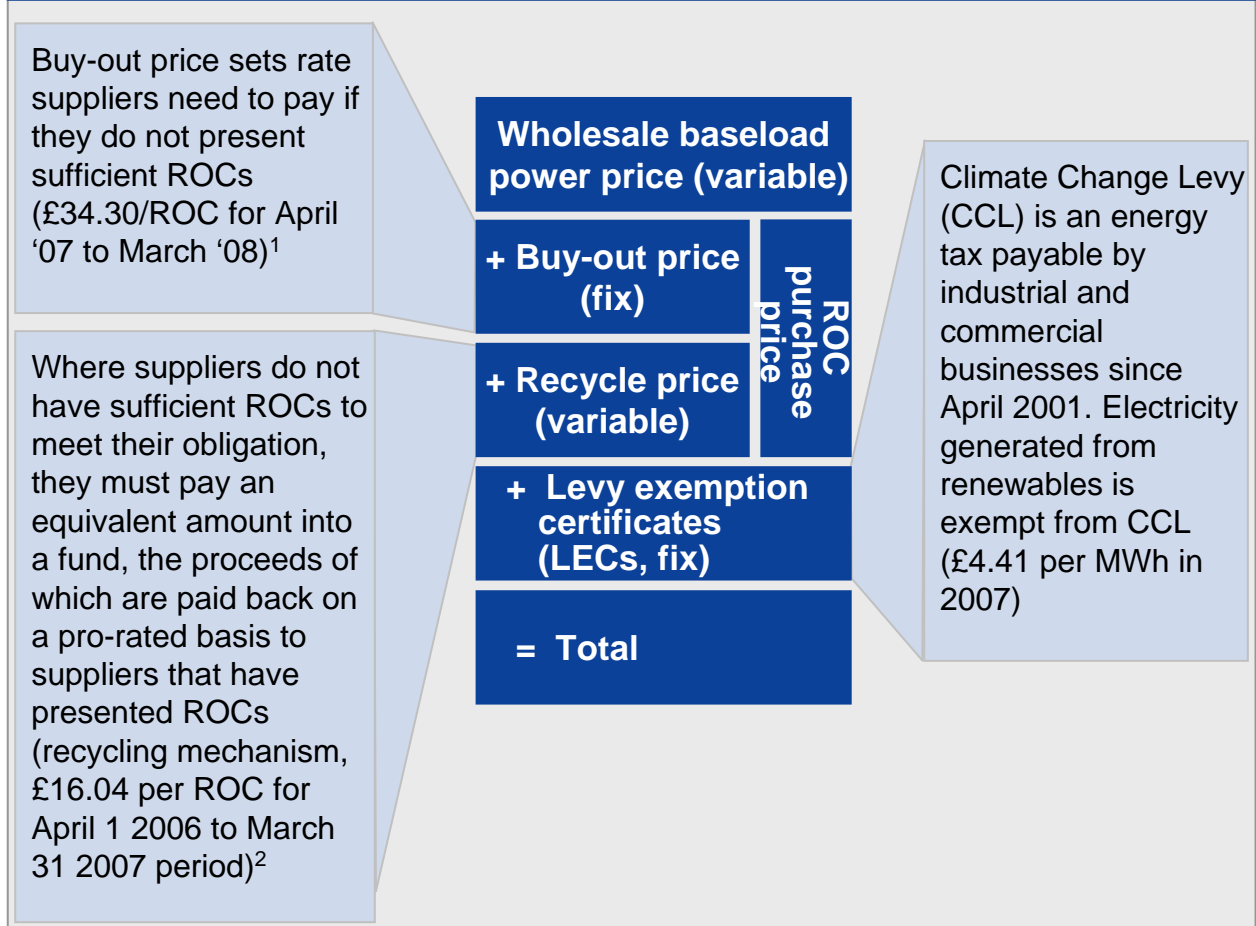
	Germany	UK
<b>Legal Framework</b>	<ul style="list-style-type: none"> <li>Erneuerbare-Energien-Gesetz (EEG, Renewable Energy Sources Act)</li> </ul>	<ul style="list-style-type: none"> <li>Renewables Obligation (RO)</li> </ul>
<b>Price Mechanism</b>	<ul style="list-style-type: none"> <li>Regressive, guaranteed feed-in-tariff (tariff fixed once installation is commissioned)</li> </ul>	<ul style="list-style-type: none"> <li>Certificate-based, indirect variable subsidy</li> </ul>
<b>Length of mechanism</b>	<ul style="list-style-type: none"> <li>Tariffs guaranteed up to 20 years for wind</li> </ul>	<ul style="list-style-type: none"> <li>Annual Compliance Periods (CPs), legislation from 2002 until 2026/27</li> </ul>
<b>Value of mechanism</b>	<ul style="list-style-type: none"> <li>Varying tariffs depending on technology, capacity &amp; location</li> <li>81.90 €/MWh for onshore, 91 €/MWh for offshore wind</li> </ul>	<ul style="list-style-type: none"> <li>Renewables Obligation Certificate (ROC) value for 2006/07 (CP5) of 49 £/MWh (70 €/MWh)</li> </ul>
<b>Other earnings captured</b>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>Power price</li> <li>Levy Exemption Certificates of £4.41/MWh in 2007</li> </ul>
<b>CO<sub>2</sub> Hedge Effectiveness</b>	<ul style="list-style-type: none"> <li>No – tariff not linked to power price</li> </ul>	<ul style="list-style-type: none"> <li>Yes – from power price earnings</li> </ul>
<b>Future legislation changes</b>	<ul style="list-style-type: none"> <li>Strong indications that new legislation in 2008/09 will increase tariff levels, particularly for offshore wind: increase tariff to 110-140 €/MWh</li> </ul>	<ul style="list-style-type: none"> <li>Energy White Paper reaffirms role of offshore and new-technologies, e.g. by introducing ROC banding (for offshore wind 1.5 instead of 1.0 ROCs/MWh)</li> </ul>

# UK: Renewable Energy Support Mechanisms

## Renewables Obligation Certificates

A ROC (Renewables Obligation Certificate) is the green certificate issued for eligible renewable source electricity generated within the UK. Generators are issued ROCs (which they can then sell on) for each MWh of eligible electricity generated. Most suppliers purchase ROCs from their generation assets or enter into long-term purchase agreements with independent generators

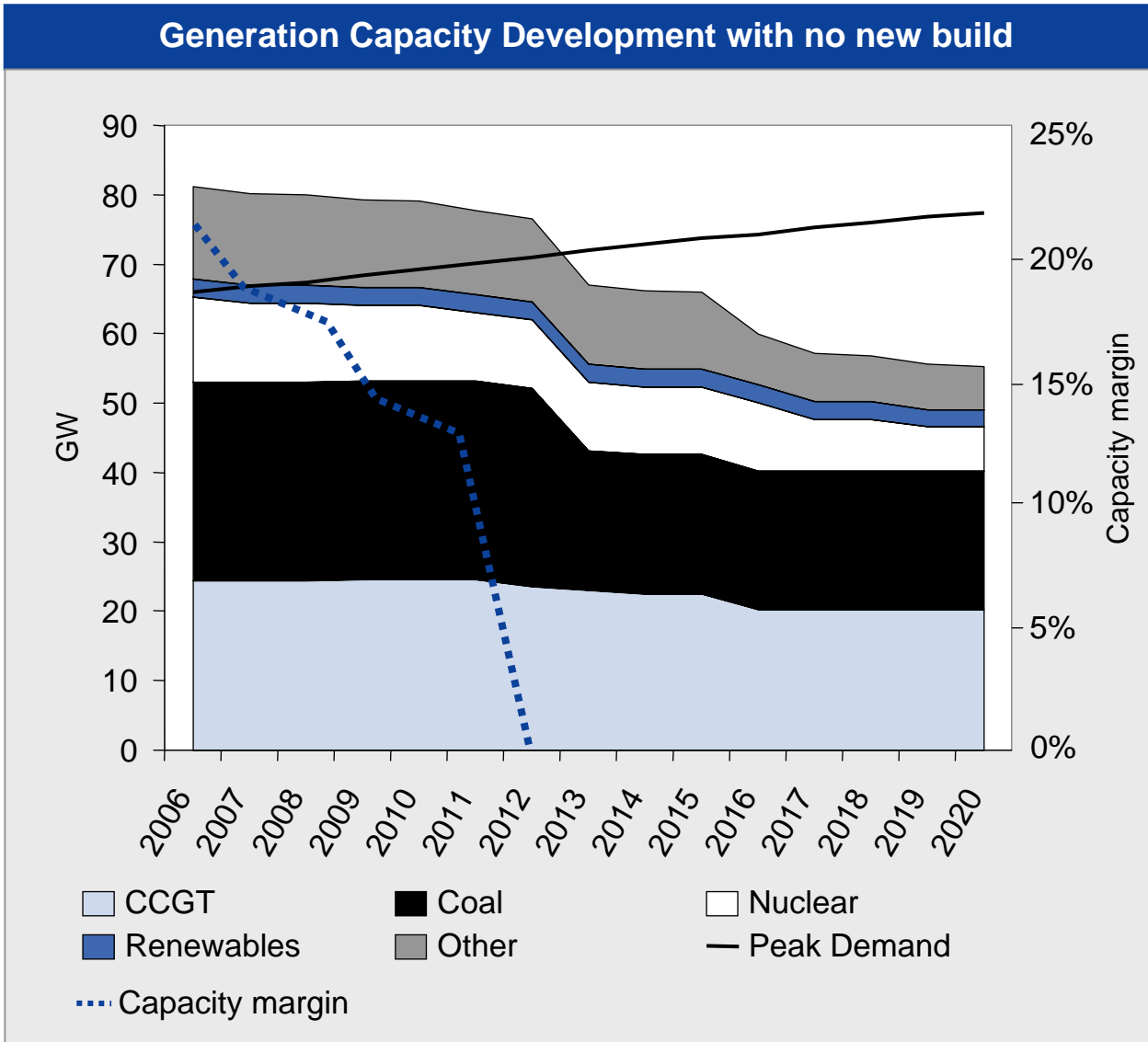
## Support Mechanism



<sup>1</sup> Buy-out price is updated each year by Ofgem to reflect changes in Retail Prices Index (RPI); for period April 1 2007 to March 31 2008 period was increased to £34.30 from £33.24 per ROC

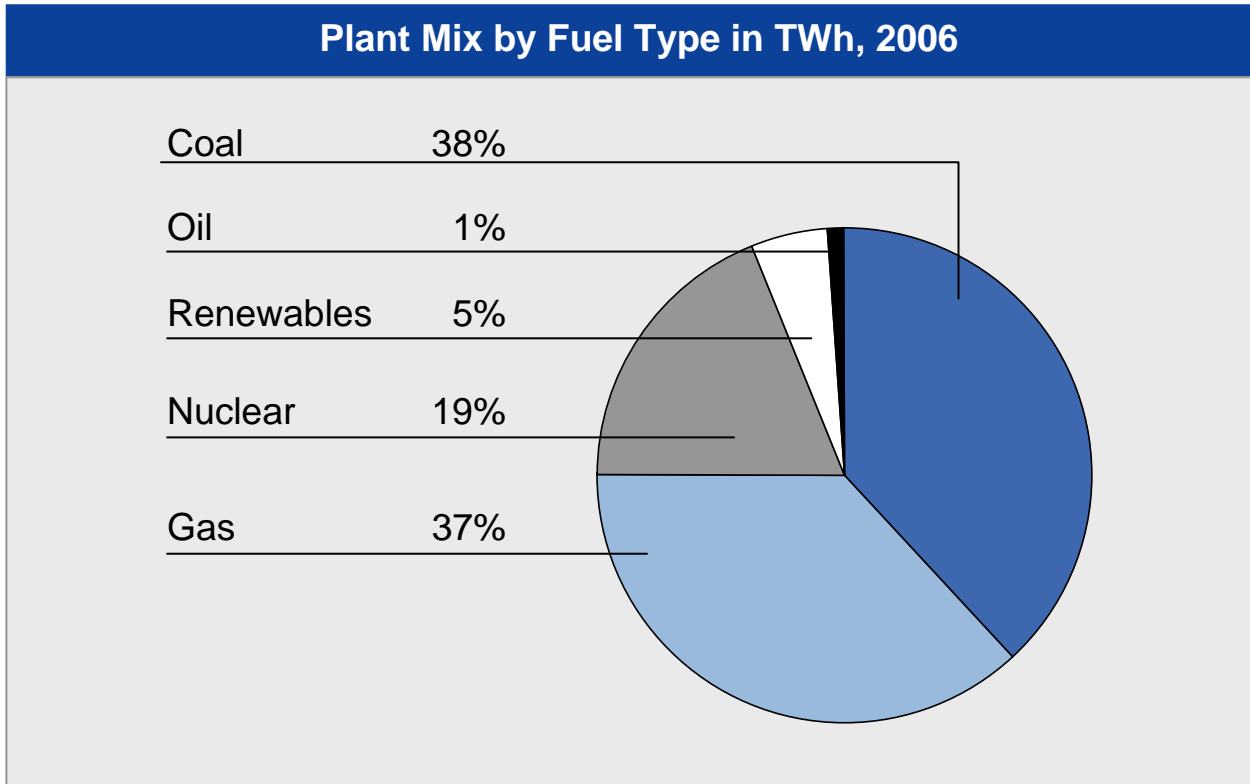
<sup>2</sup> Since the share of the buy-out fund is dependant on the number of suppliers who fail to achieve the target, this value depends upon the obligation target being greater than the available renewable obligation certificates (in 2005/06 the compliance ratio amounted to 76% of the total obligation target)

# UK: Electricity Supply and Demand



- Approximately 20 – 40 GW of new capacity (25 to 50% of total capacity) will be required by 2020 to maintain margins
- Market fundamentals support a sustained return of value to the generation sector

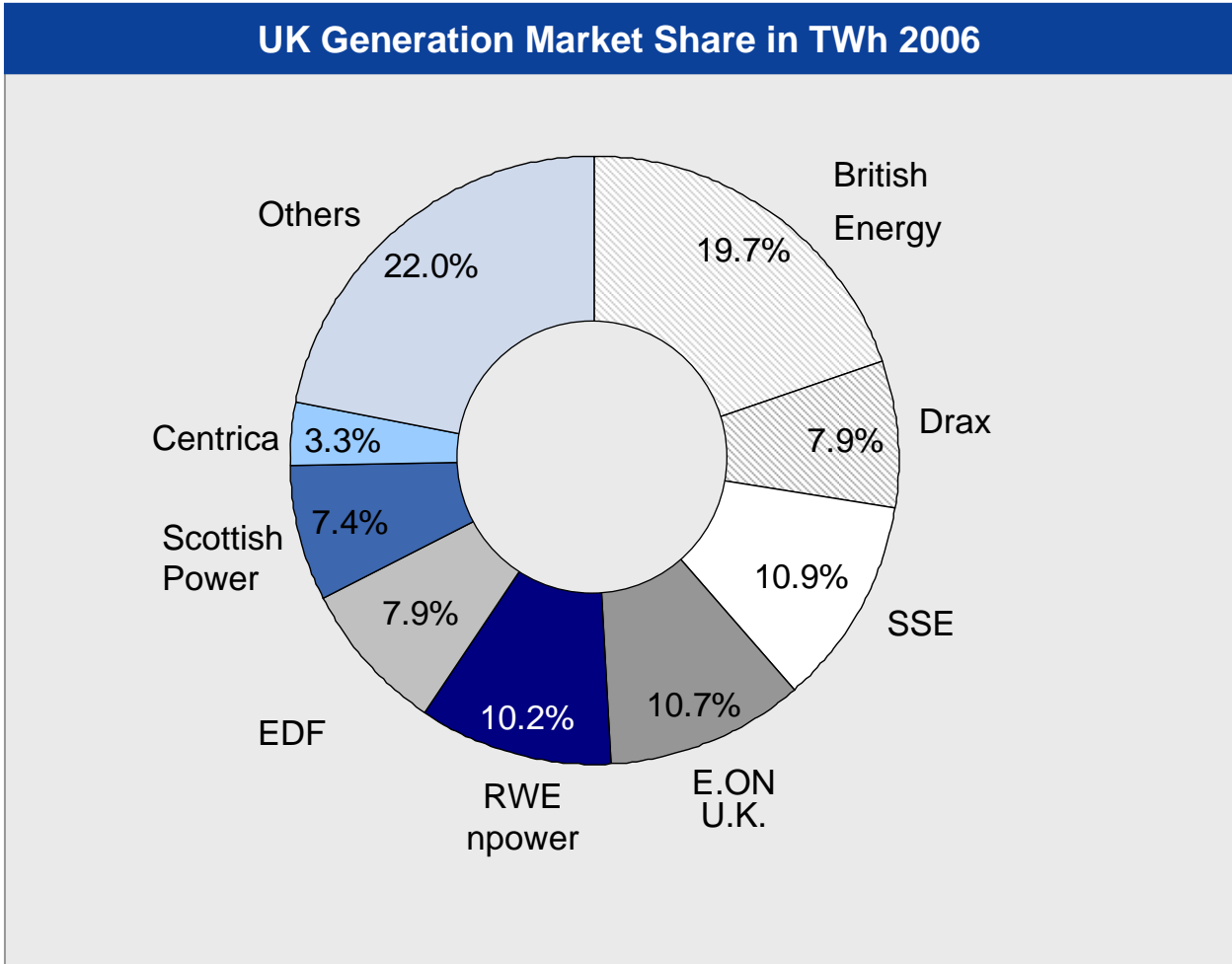
## UK: Generation Mix by Fuel Type



Source: DBERR (2006)

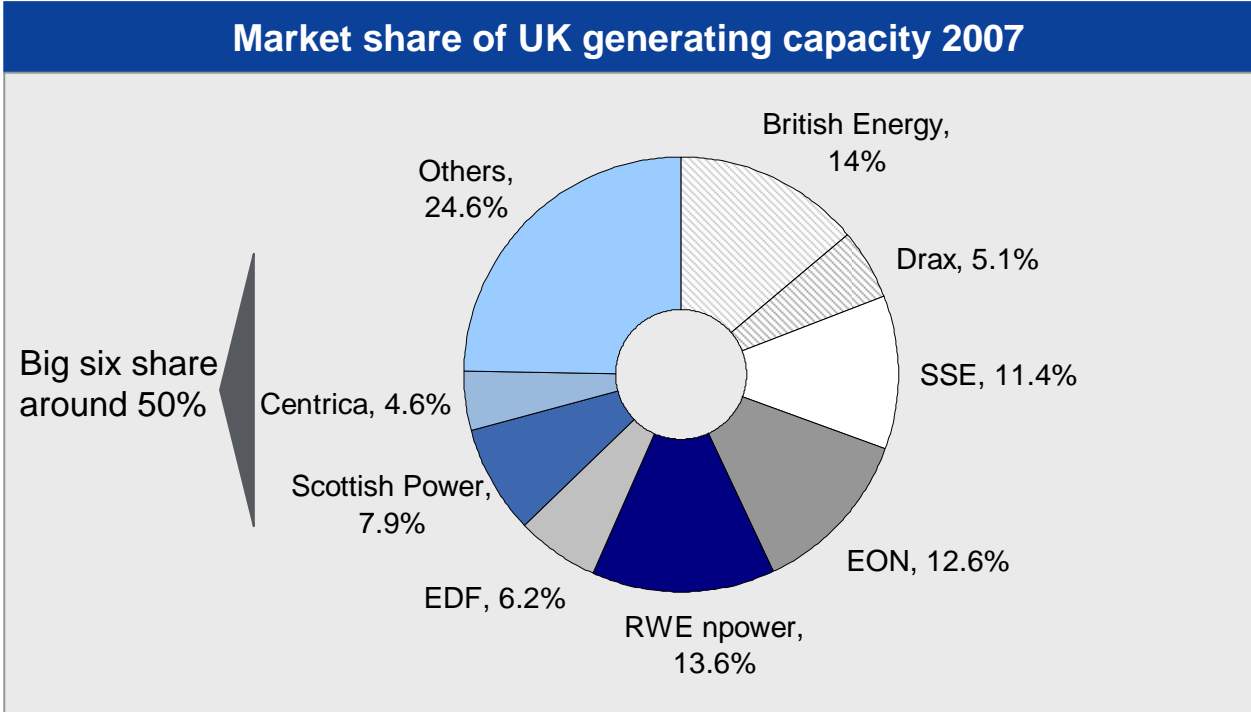
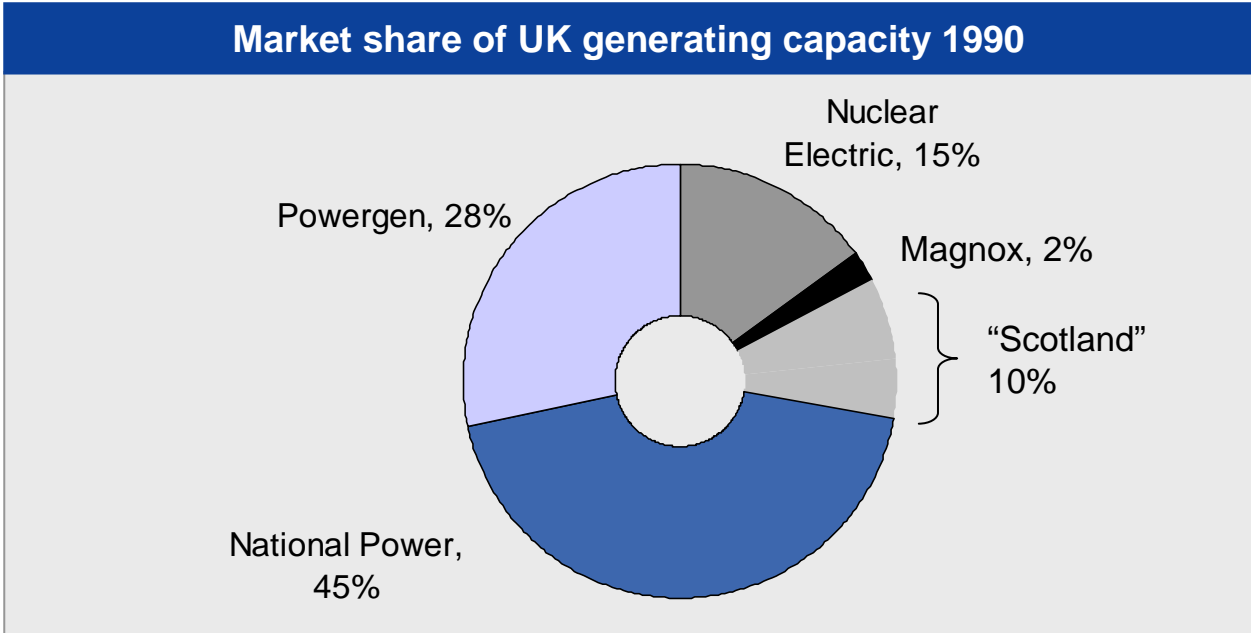
- Total generation ~ 400TWh
  - 25% generated from non-fossil sources
  - Conventional thermal plant generated roughly 75% of UK energy needs
  - Split between coal & gas is dependant upon relative fuel prices
  - Renewable output of 5% is currently well short of the UK government targets of 20%
- Gas was often the price-setting plant in 2006 but again very dependent upon relative fuel prices

# UK: Generation Market Share by Volume



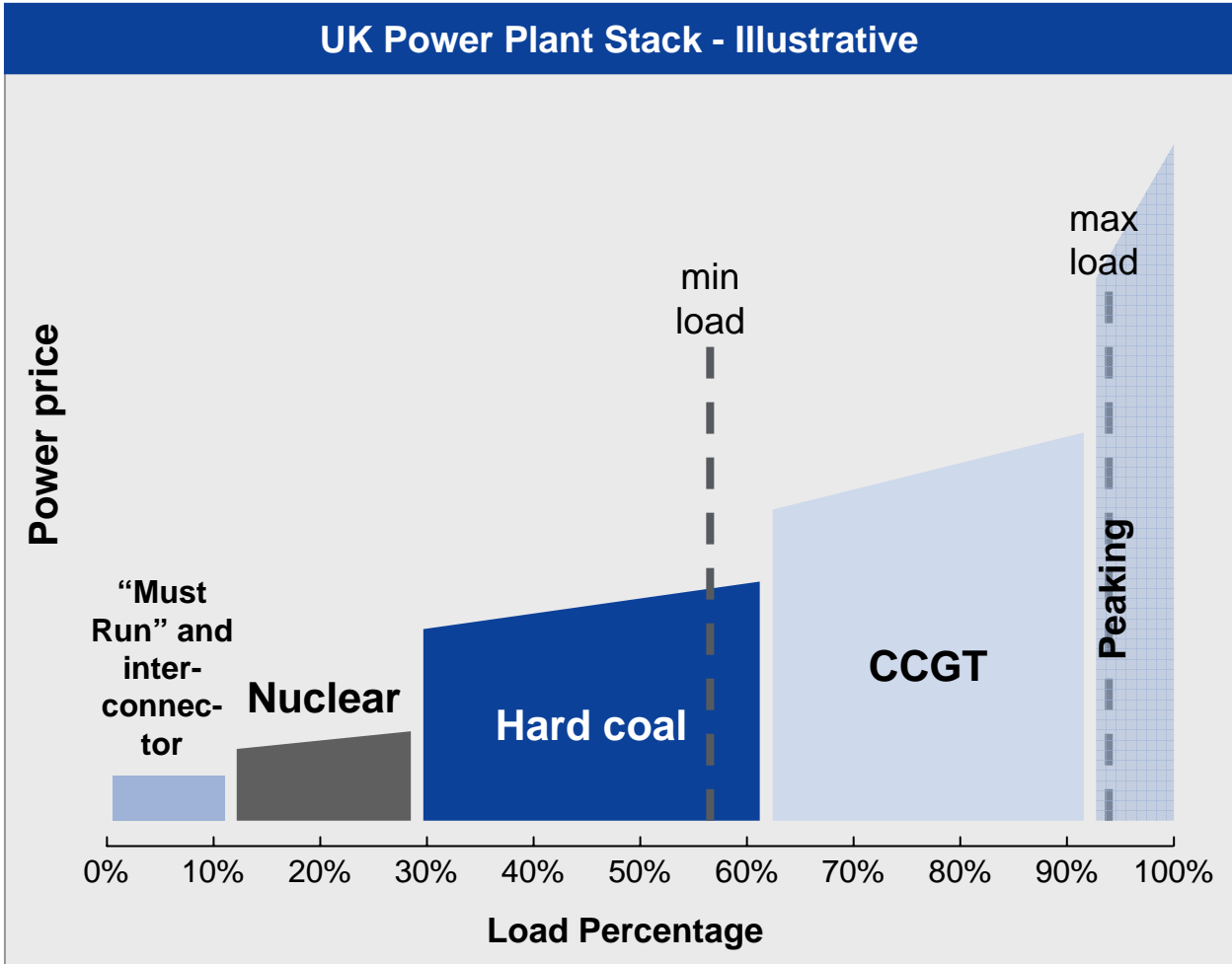
Source: Elexon 2007; excludes wind, hydro, CHP, own station use and Northern Ireland

# UK: Generation Plant Market Share

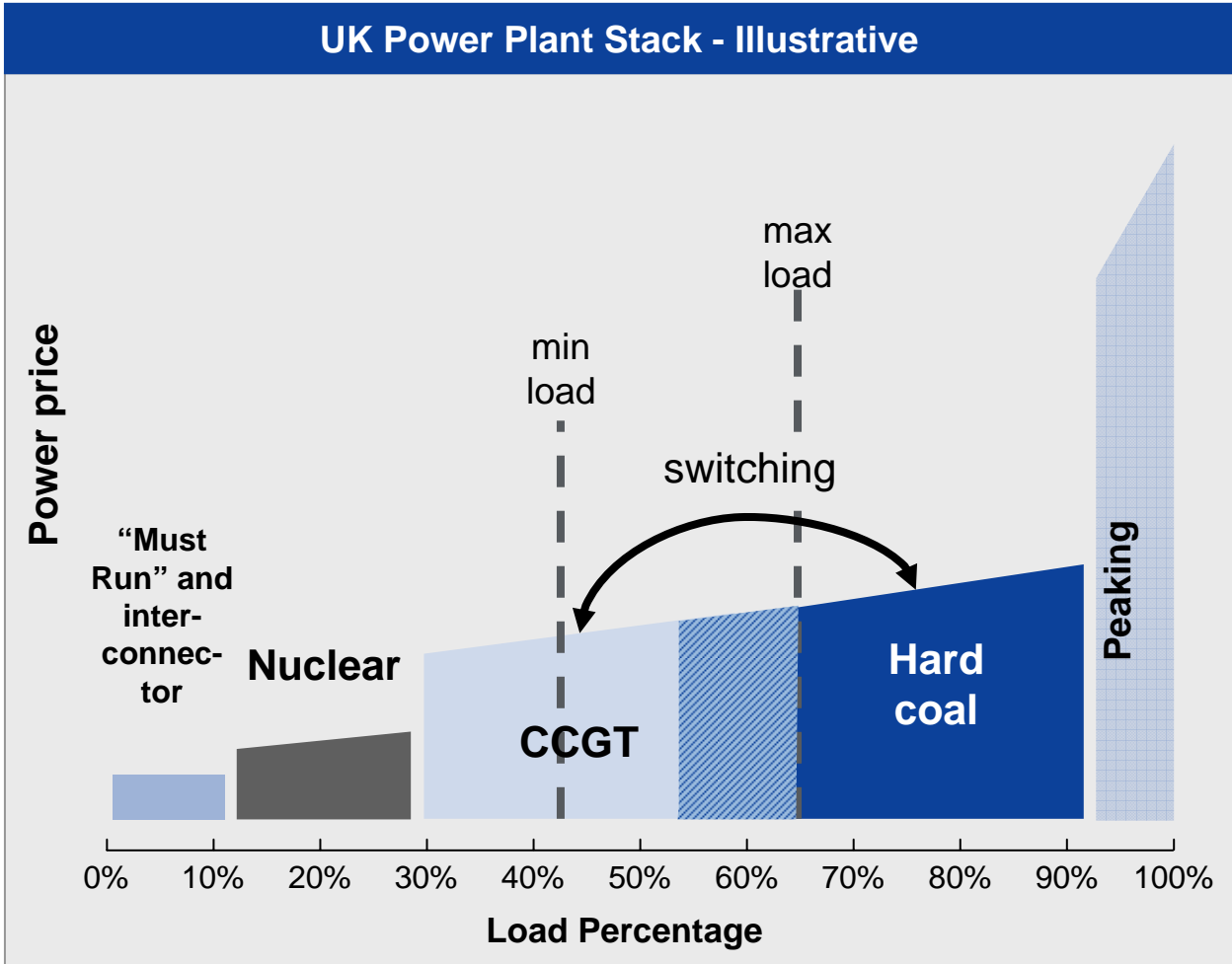


Source: DBERRIOfgem

# UK: Illustrative Merit Order - Winter

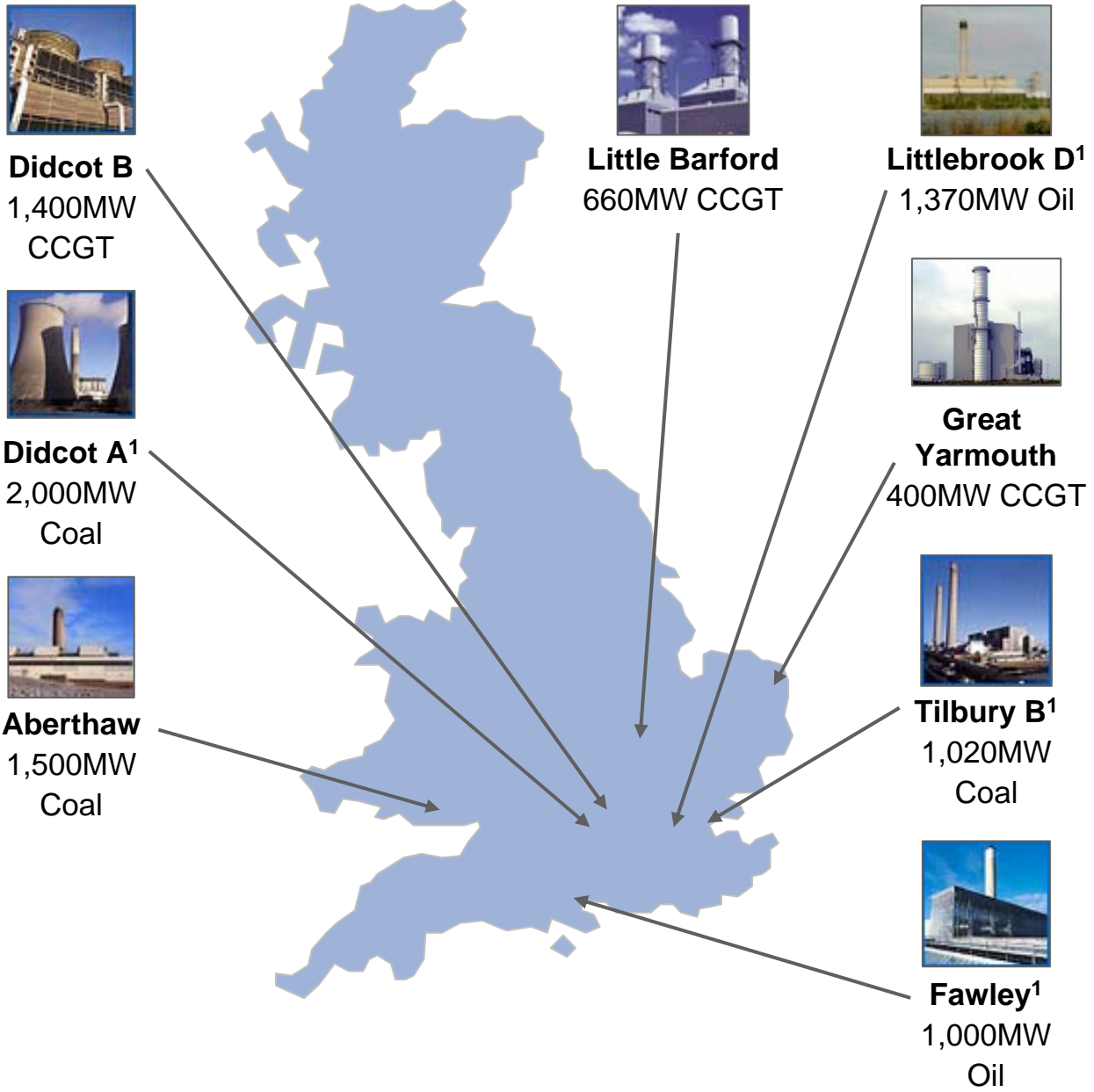


- High winter gas prices mean CCGTs have a higher marginal cost than coal in winter
- But high levels of demand means gas plant is generally price-setting

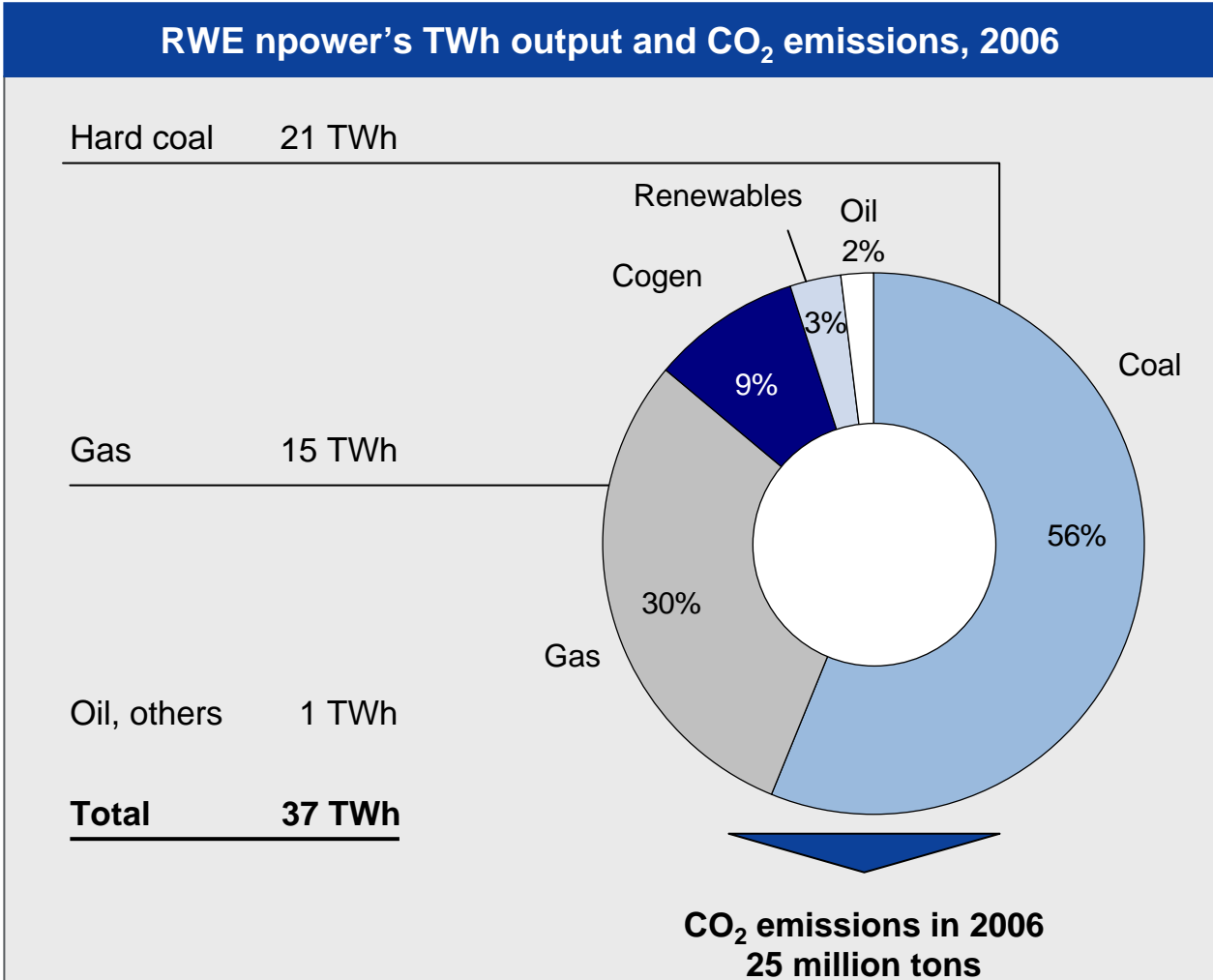


- UK gas prices much lower in summer than in winter
  - Historically 30% differential between summer and winter prices
- CCGTs may be lower marginal cost than coal in summer, therefore may switch in the merit order
- However lower levels of demand mean that gas remains price-setting

# RWE npower: Main Plant Portfolio



<sup>1</sup> Opted-out under Large Combustion Plant Directive



## RWE npower: Installed Capacity (1/4)

Type	Name	Technology	Fuel 1	Fuel 2	Commissioned	Capacity MW	Total
<b>Coal</b>	Aberthaw	B	coal		1971	1,500	
	Tilbury	B	coal	oil	1968	1,020	
	Didcot	A	coal	gas	1972	2,000	
							<b>4,520</b>
<b>OCGT</b>	Aberthaw		GT	gas	oil	1971	51
	Cowes		GT	gas	oil	1982	140
	Didcot		GT	gas	oil	1972	100
	Fawley		GT	gas	oil	1969	34
	Littlebrook		GT	gas	oil	1982	105
	Tilbury		GT	gas	oil	1968	68
	Little Barford		GT	gas	oil	2006	17
<b>Oil</b>	Fawley			oil		1969	1,000
	Littlebrook	D		oil		1982	1,370
							<b>2,370</b>
<b>CCGT</b>	Didcot	B	CCGT	gas		1998	1,400
	Great Yarmouth		CCGT	gas		2001	400
	Little Barford		CCGT	gas		1995	660
							<b>2,460</b>

## RWE npower: Installed Capacity (2/4)

Type	Name	Technology	Fuel 1	Fuel 2	Commissioned	Capacity MW	Total
<b>Hydro</b>	Braevallich	hydro			2005	2.0	
	Cwm Dyli	hydro			2002	9.9	
	Dolgarrog High	hydro			2002	17.0	
	Dolgarrog Low	hydro			1926/2002	15.0	
	Garrogie	hydro			2005	2.4	
	Inverbain	hydro			2006	1.0	
	Kielder	hydro			2006	6.0	
	Auchteryre	hydro			2000	0.6	
	Blantyre	hydro			1995	0.6	
	Garry Gulach	hydro			2002	0.8	
	Glen Tarbert	hydro			2000	0.9	
	Stanley Mills	hydro			1921/2003	0.8	
	Cwm Croeser	hydro			1996	0.5	
	Cynwyd	hydro			1997	0.1	
	Dulyn	hydro			1998	0.5	

## RWE npower: Installed Capacity (3/4)



Type	Name	Technology	Fuel 1	Fuel 2	Commissioned	Capacity MW	Total
<b>Wind</b>	Bears Down	wind			2001	9.6	
	Bein Ghlas	wind			1999	8.4	
	Bryn Titli	wind			1994	9.9	
	Carno	wind			1996	33.6	
	Causeymire	wind			2004	48.3	
	Kirkby Moor	wind			1993	4.8	
	Lambrigg	wind			2000	6.5	
	Llyn Alaw	wind			1997	20.4	
	Mynydd Gorddu	wind			1996	10.2	
	Novar	wind			1997	17.0	
	Taff Ely	wind			1993	9.0	
	Tow Law	wind			2001	2.3	
	Trysglwyn	wind			1996	5.6	
	Windy Standard	wind			1996	21.6	
	North Hoyle	Offshore wind			2003	60.0	
	Farr	wind			2005	92.0	
	Ffynnon	wind			2006	32.0	
	Burgar Hill	wind			2007	5.0	
	Hameldon Hill	wind			2007	4.5	
							<b>401</b>

## RWE npower: Installed Capacity (4/4)



Type	Name	Technology	Fuel 1	Fuel 2	Commissioned	Capacity MW	Total
<b>Cogeneration</b>	Aylesford	Gas			1994	98.0	
	BASF	Gas			1997	75.0	
	Bridgewater Paper High	Gas			2000	58.0	
	Philips Petroleum Low	Gas			1999	58.0	
	Dow Corning	Gas			1998	22.0	
	Esso Fawley	Gas			1999	135.0	
	Fort James	Gas			1995	9.0	
	Huntsman Tioxide	Gas			2003	20.0	
	Lancaster University	Gas			1994	1.6	
	Millenium Inorganic	Gas			1995	15.0	
	Rhodia Oldbury	Gas			1993	3.7	
	SCA Hygiene	Gas			1999	7.0	
	Whitegate	Gas			1998	6.2	
							<b>509</b>
<b>Total Installed Generation in the UK (MW)</b>							<b>10,832</b>
<b>Co-firing</b>	Didcot	Biomass				10	
	Tilbury	Biomass				10	
	Aberthaw	Biomass				15	
							<b>35</b>

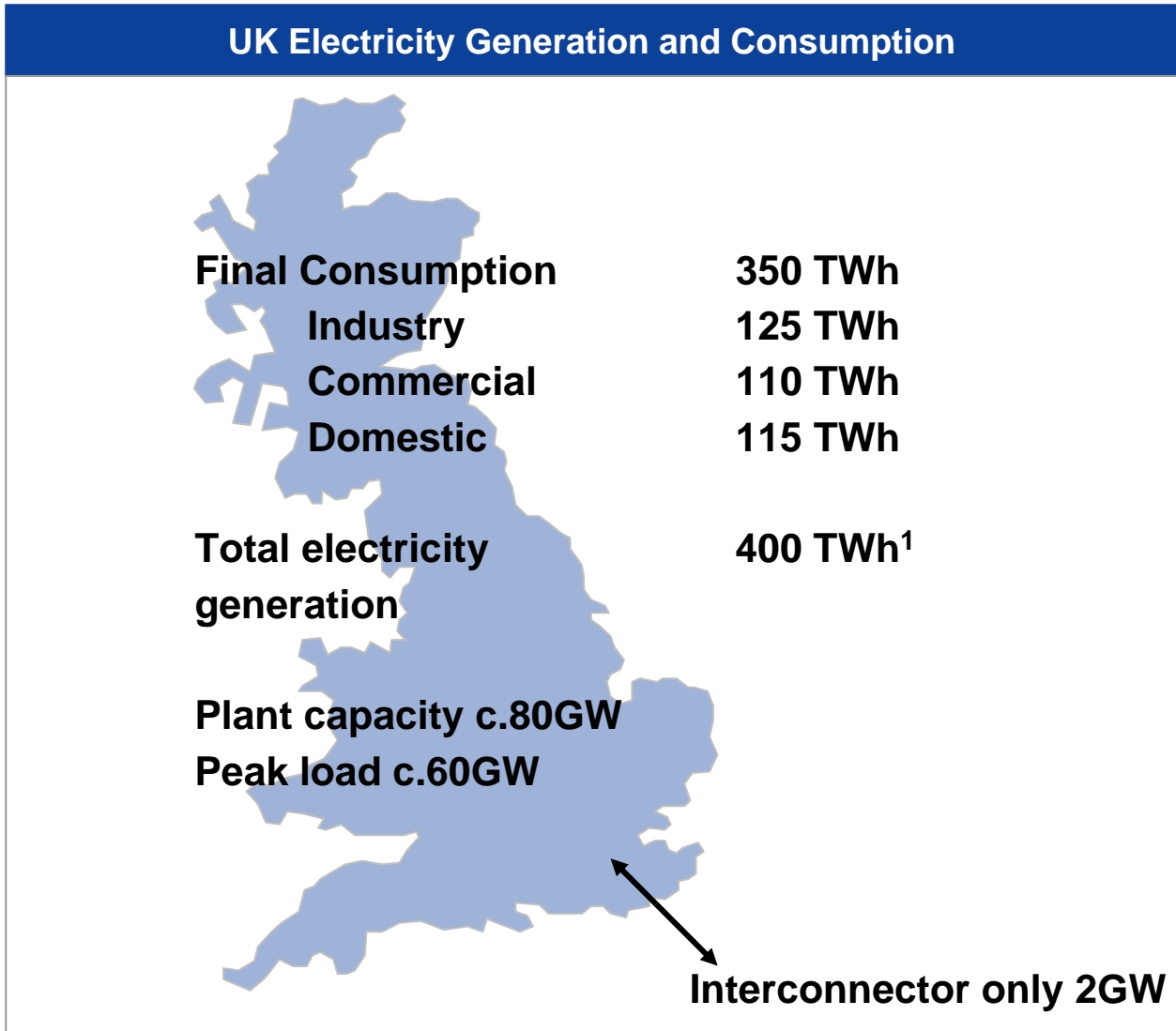
Note: Co-firing is not included in the total capacity as it is included in existing station capacity

# RWE npower: Sourcing of Physical Fuel Requirement



Fuel	Sourcing of fuels	Comments
<b>Gas</b>	<ul style="list-style-type: none"> <li>■ UK NBP wholesale market</li> <li>■ Long-term depletion contracts</li> </ul>	<ul style="list-style-type: none"> <li>■ UK market historically supplied by UK Continental Shelf, however depleting supplies are being replaced by imported sources (e.g. pipeline, LNG)</li> <li>■ NBP has become one of the most liquid gas markets, reducing the need for long-term contracts</li> <li>■ Consequently the UK market is predominantly focused on prompt trading in a 2-3 year timeframe</li> </ul>
<b>Coal</b>	<ul style="list-style-type: none"> <li>■ Global coal market purchases</li> <li>■ Medium to long-term contracts with indigenous suppliers</li> </ul>	<ul style="list-style-type: none"> <li>■ UK coal production has fallen due to lack of Government support and cheaper imports</li> <li>■ Therefore purchases are predominantly made from the global market</li> </ul>
<b>Oil</b>	<ul style="list-style-type: none"> <li>■ Global oil market purchases</li> </ul>	<ul style="list-style-type: none"> <li>■ Small proportion of RWE npower station fuel burn is oil-based</li> <li>■ Spot market purchases, together with ability to store oil, shape purchasing behaviour</li> </ul>

- Fuel is mainly sourced via the liquid markets

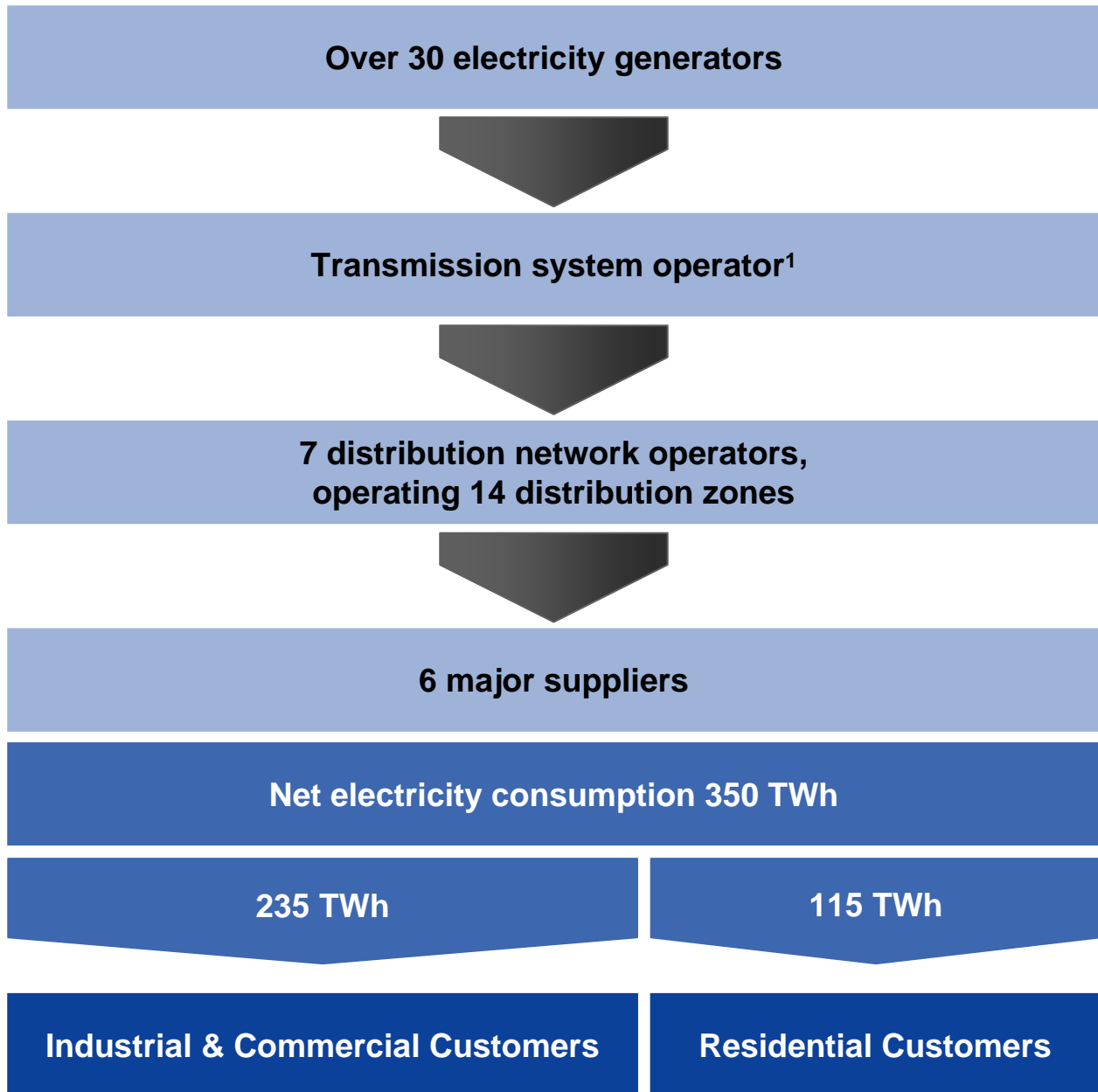


Source: DBERR (2006)

<sup>1</sup> Total electricity generation includes grid losses and energy industry usage

- 26 million domestic households
- 2.5 million non-domestic customers

# UK: Structure of the Electricity Market 2006

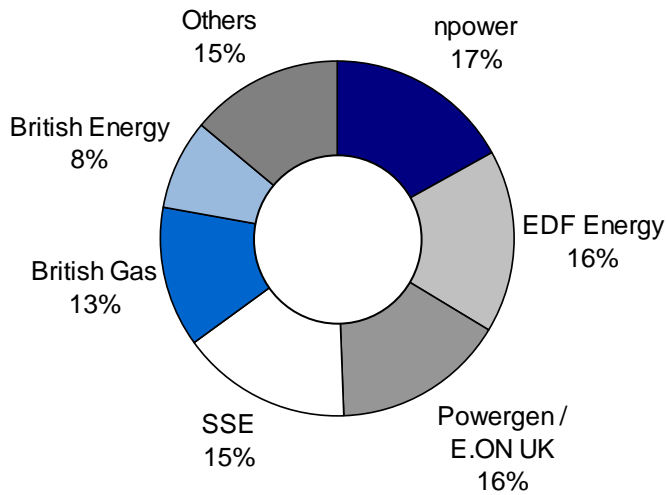


<sup>1</sup> One Transmission system operator (National Grid); three system owners (SSE, Scottish Power and National Grid)

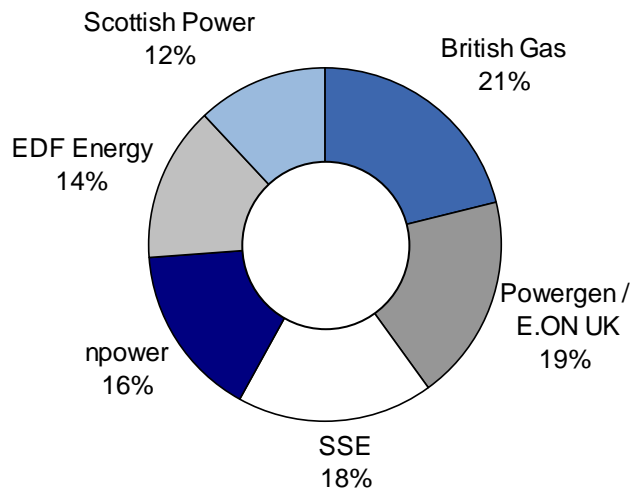
Note: Excludes Northern Ireland

Source: DBERR 2007

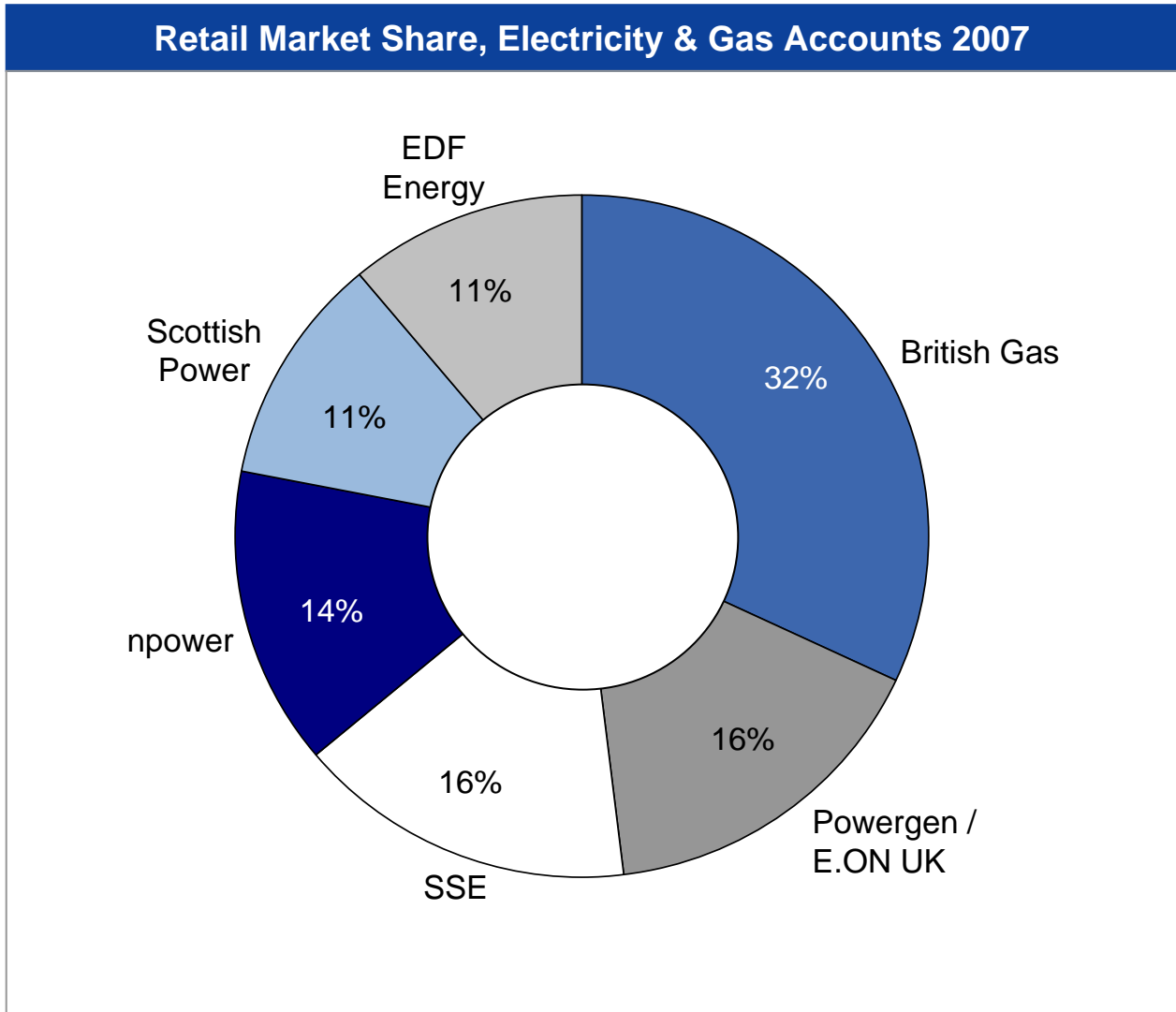
## Electricity Retail Market Share TWh Jan 2007



## Electricity Residential Market Share TWh Jan 2007

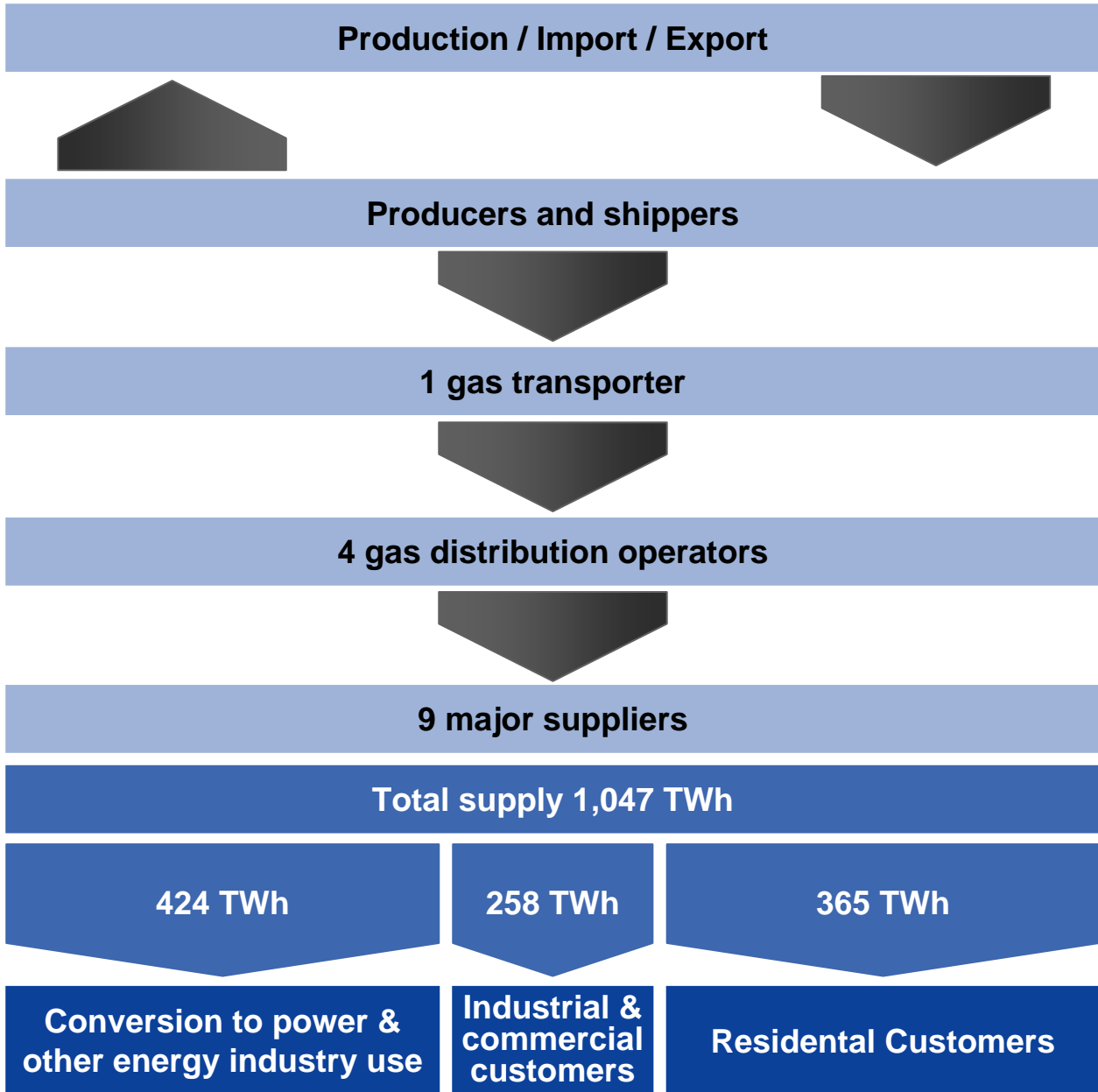


Source: Cornwall Energy Associates 2007



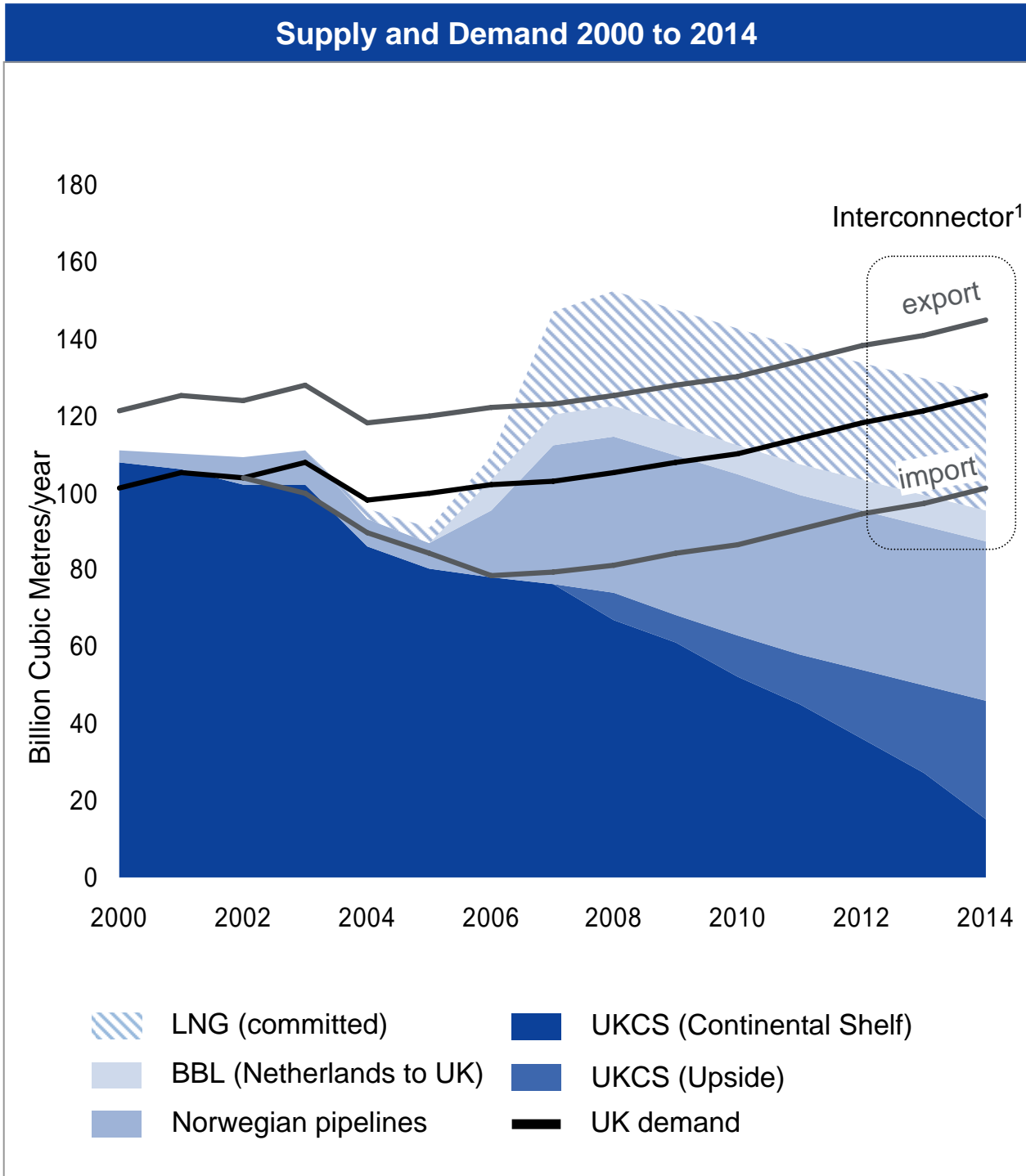
Source: Cornwall Energy Associates 2007

# UK: Structure of the Gas Market 2006



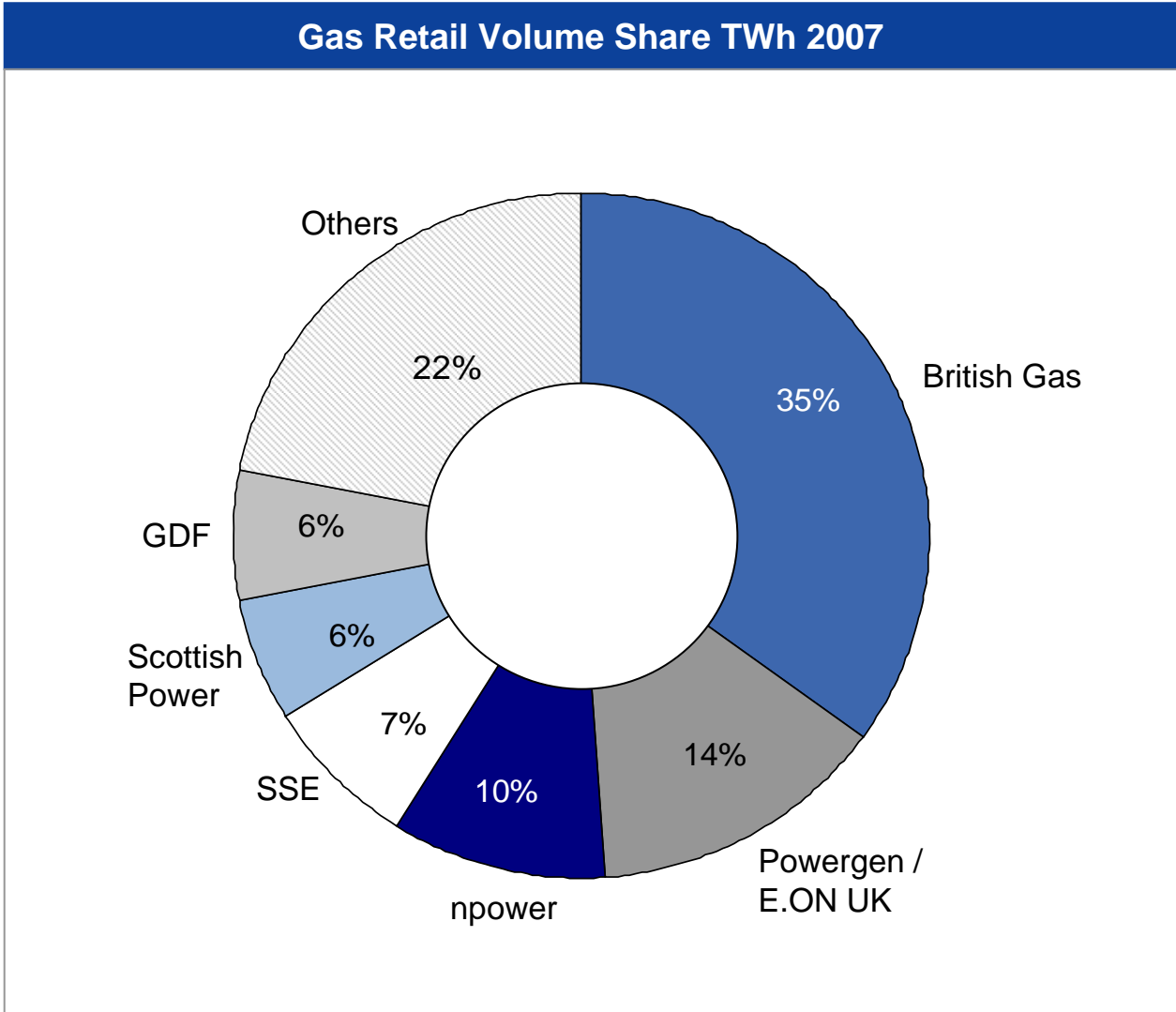
Source: DBERR 2007

# UK: Gas Supply and Demand



Source: National Grid Transco 10 year Statement, 2006  
<sup>1</sup> Represents the interconnector import / export capacity

# UK: Retail Gas Market Share



Source: Cornwall Energy Associates 2007