BERR | Department for Business Enterprise & Regulatory Reform

Implications of higher renewables share for UK security of supply

EPRG Winter Research Seminar

13 December 2007

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Today's discussion

- Definition of energy security of supply
- Role of renewable electricity in 2020 targets
- Impact on electricity security of supply
- Impact on gas security of supply
- Conclusions and next steps

Energy security is ultimately about protecting our [economic] welfare

Bohi and Toman (1996) define energy *insecurity* as:

"the loss of economic welfare that may occur as a result of a change in the price or availability of energy"

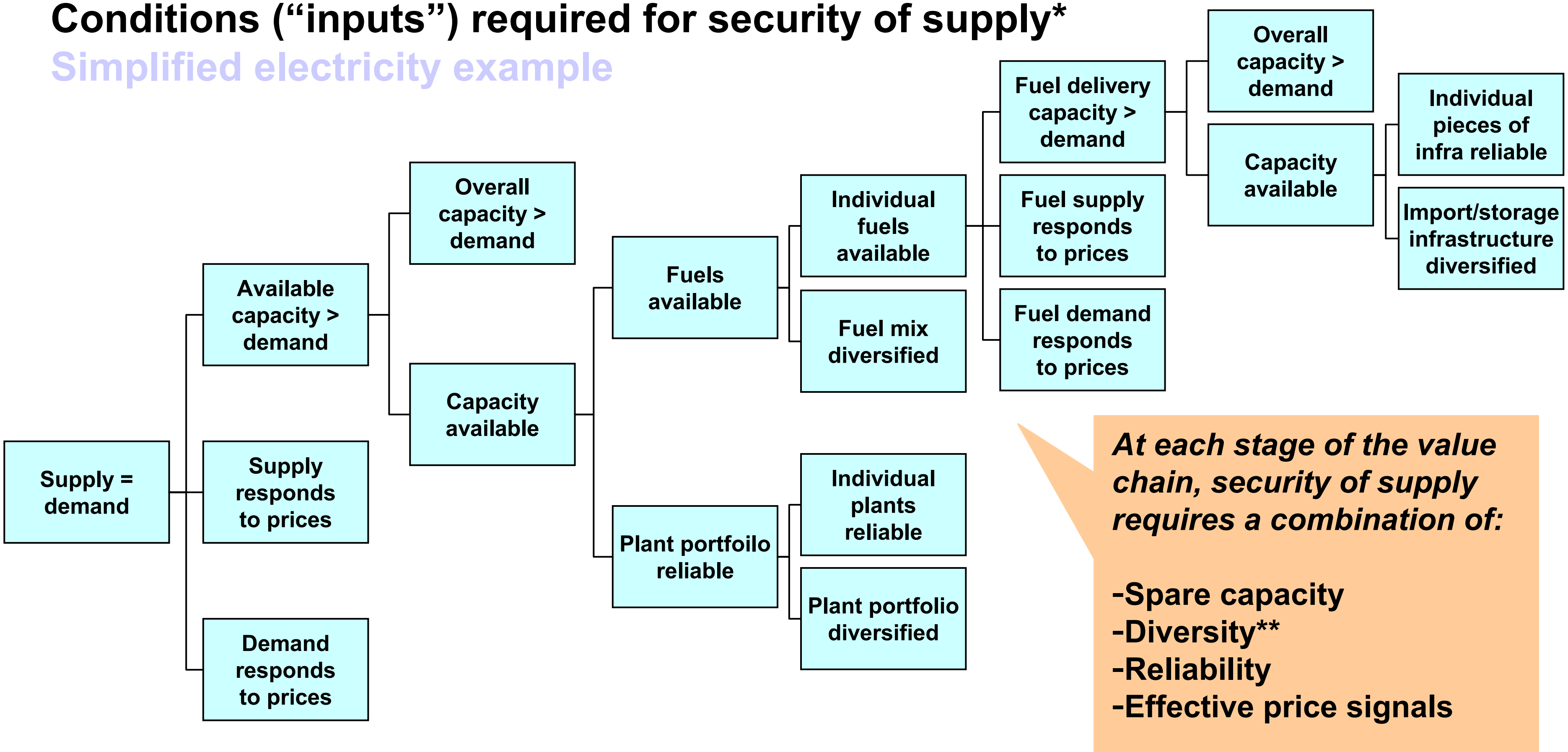
In practice this means outcomes ("outputs") with:

- **Only small risk of involuntary supply interruptions**
- **Prices that avoid significant demand destruction**
- **[Maintaining foreign-policy degrees of freedom]**

A complex set of drivers influence the ability of supply to meet demand

Conditions ("inputs") required for security of supply*

Simplified electricity example



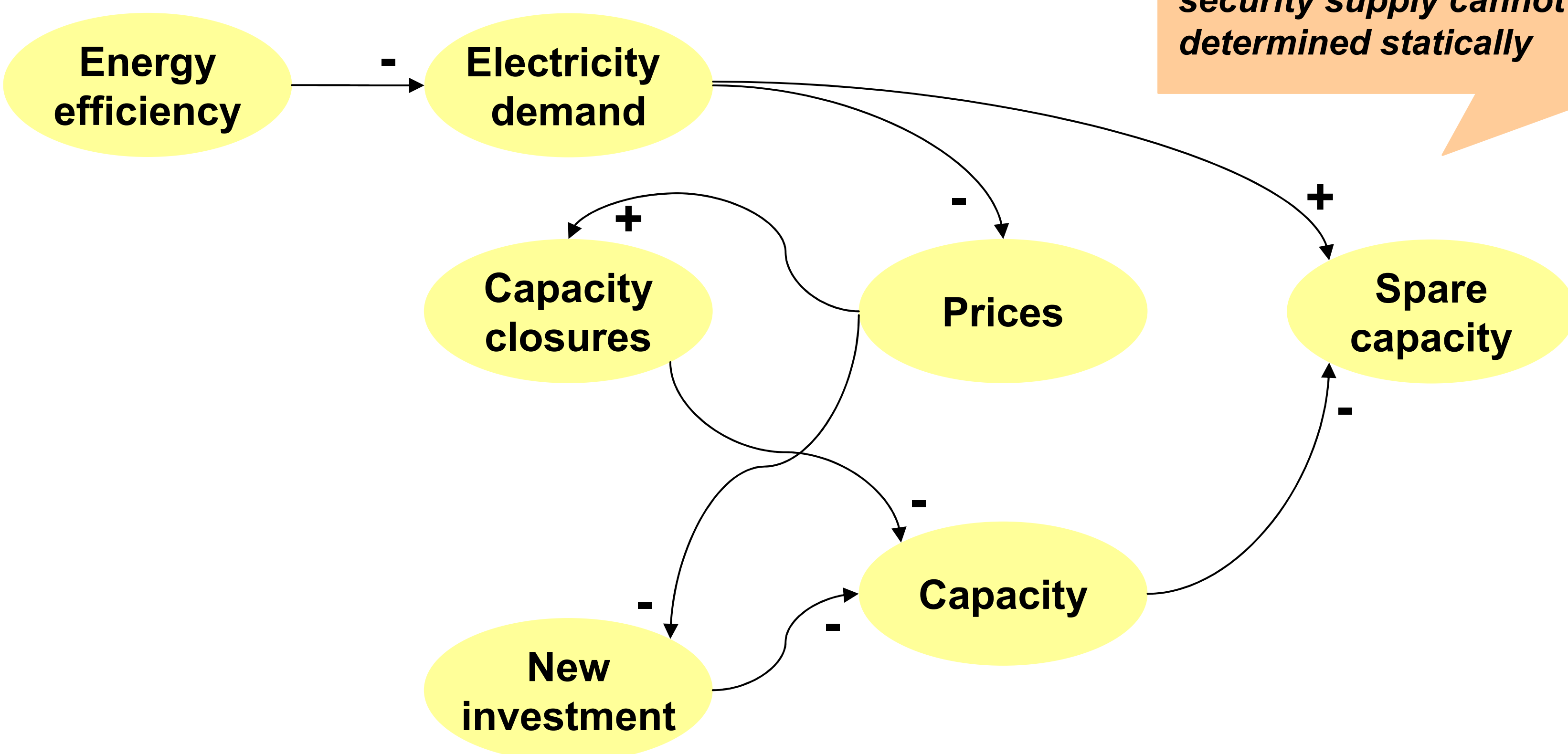
* This example is focused on the first "level" of security of supply, i.e. avoiding involuntary supply interruptions
** Lack of correlation between plant or fuel outages [*not*, for example, number of technologies or fuels deployed]

Static notions of security of supply can be misleading in the long term

Impact of energy efficiency on security of supply

Simplified* electricity example

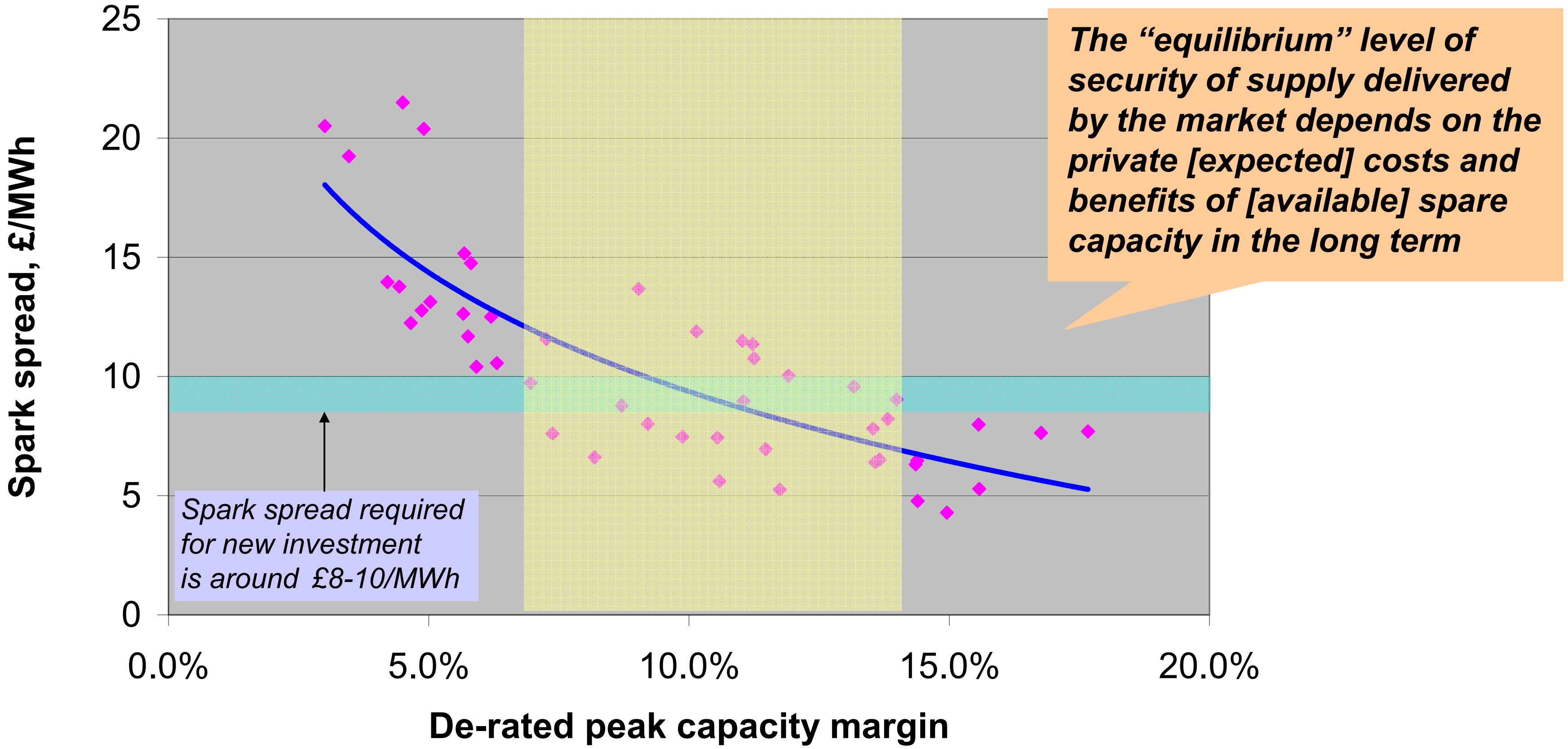
Ultimate "equilibrium" impact of energy efficiency on security supply cannot be determined statically



* Note that in reality, outcomes may depend as much on market participants' *expectations* as actual outcomes

The market-delivered security level is determined by costs and benefits

Electricity profit margins as a function of market tightness*



* De-rated peak capacity margin compares peak demand against average expected available capacity at peak
Source: Redpoint; BERR analysis

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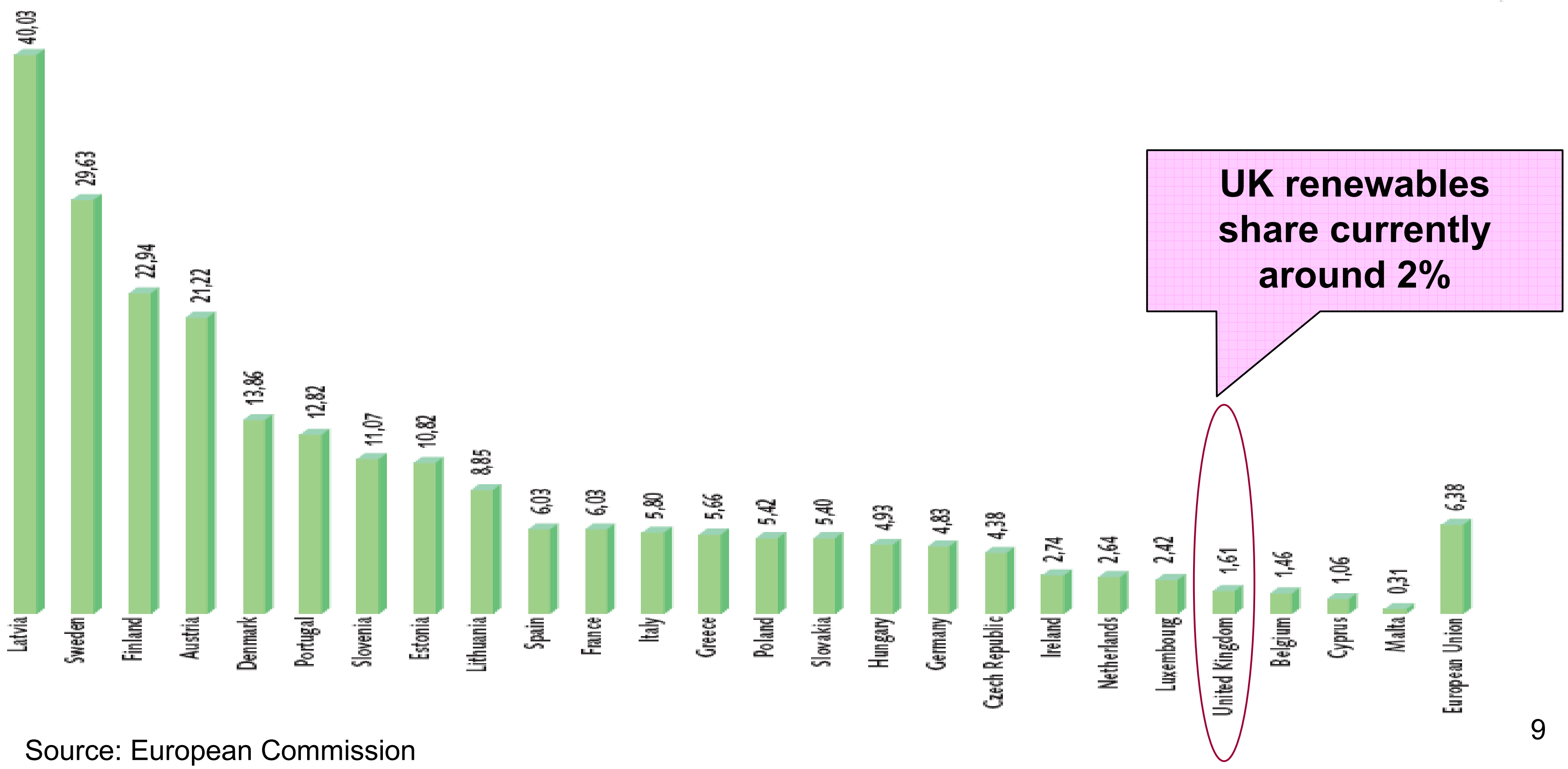
Delivering 20% renewable energy by 2020 will be a challenge across EU

Renewable energy in primary energy consumption in 2005

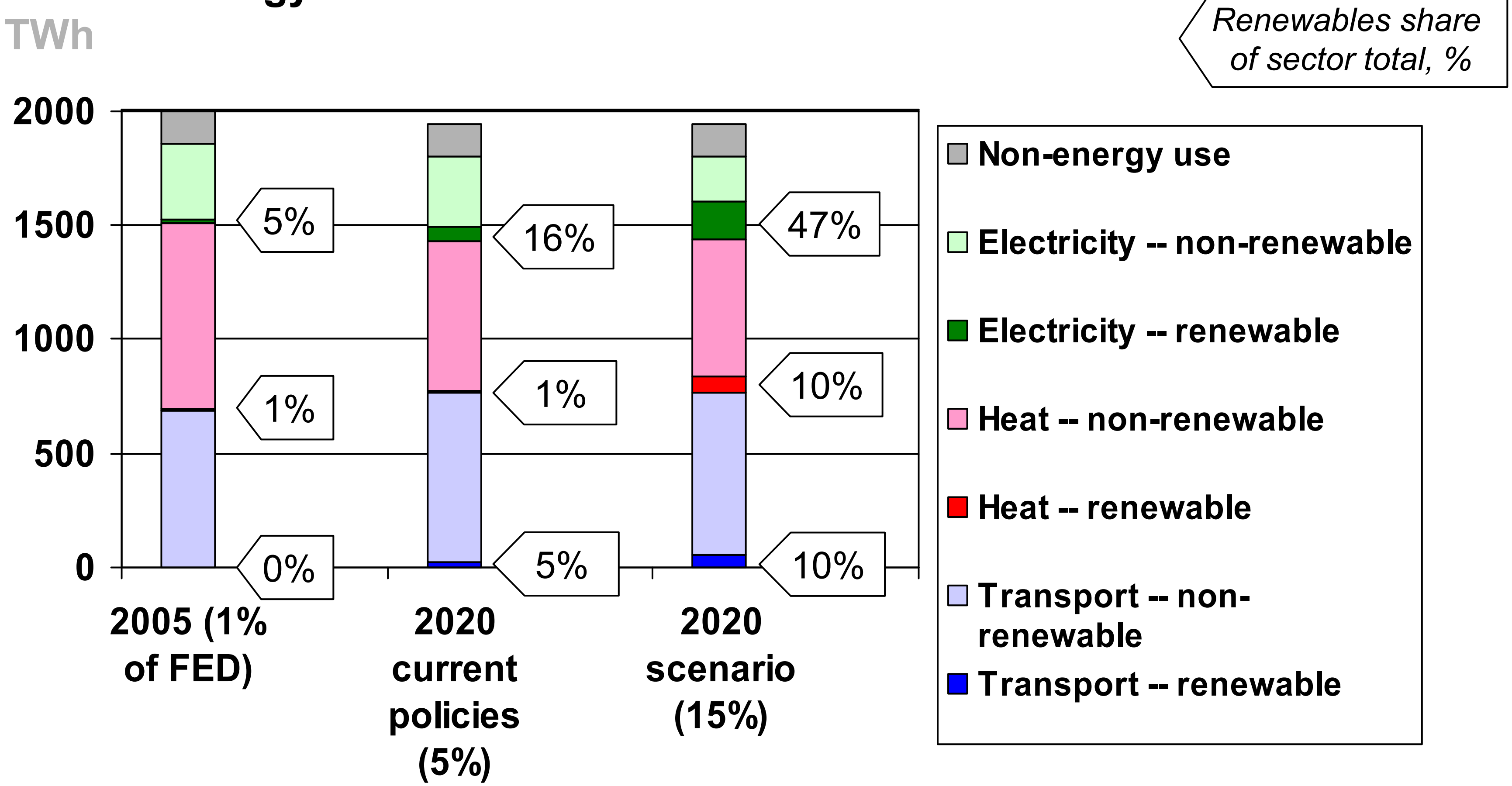
Percent



Source: European Commission

Electricity will be a key contributor to meeting 2020 renewable targets

UK final energy demand in 2005 and 2020

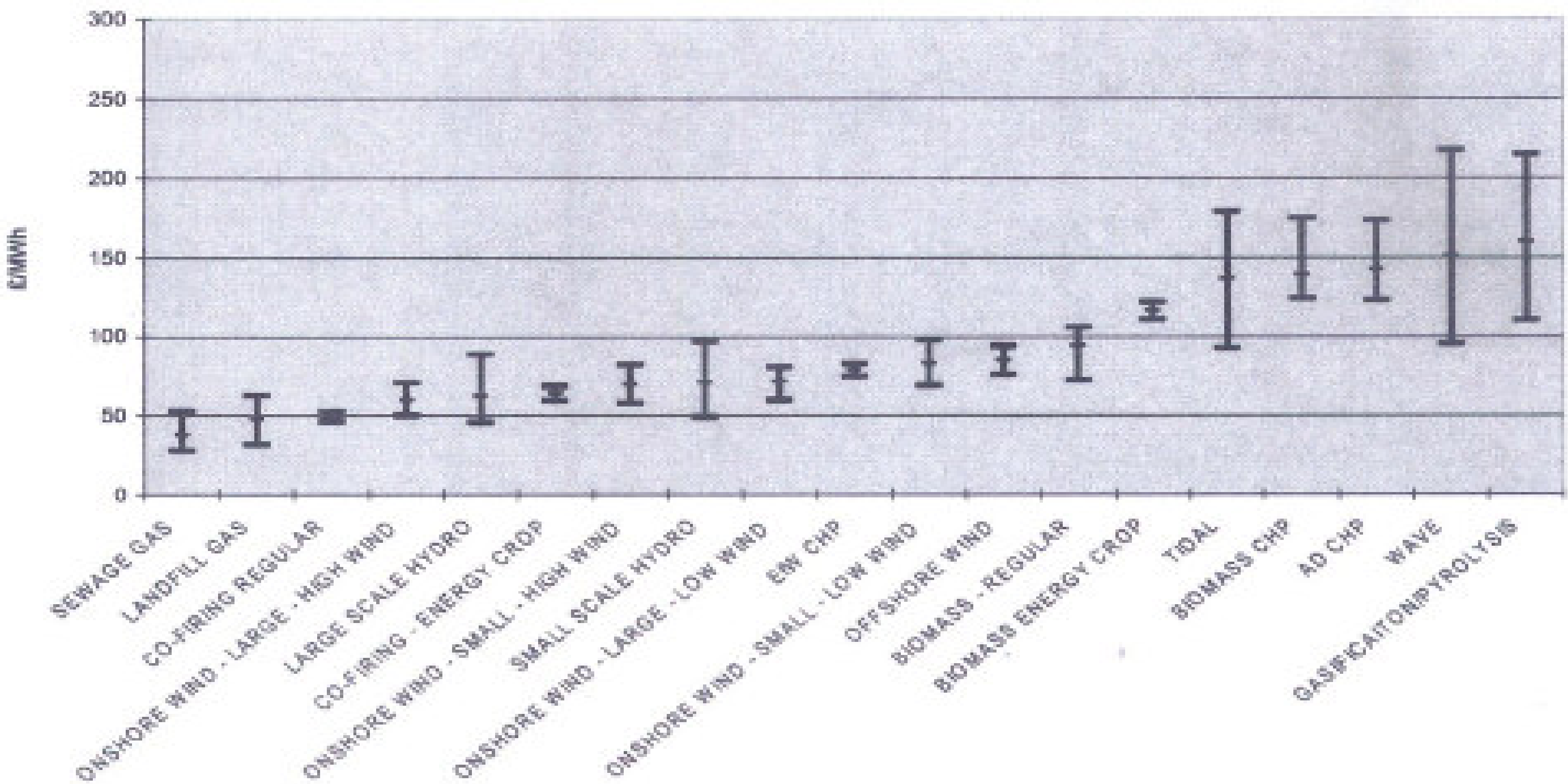


Source: DUKES; BERR analysis

Increasing renewable electricity requires tapping into new sources

Levelised costs of renewable electricity technologies in 2020

£/MWh



Source: Ernst & Young

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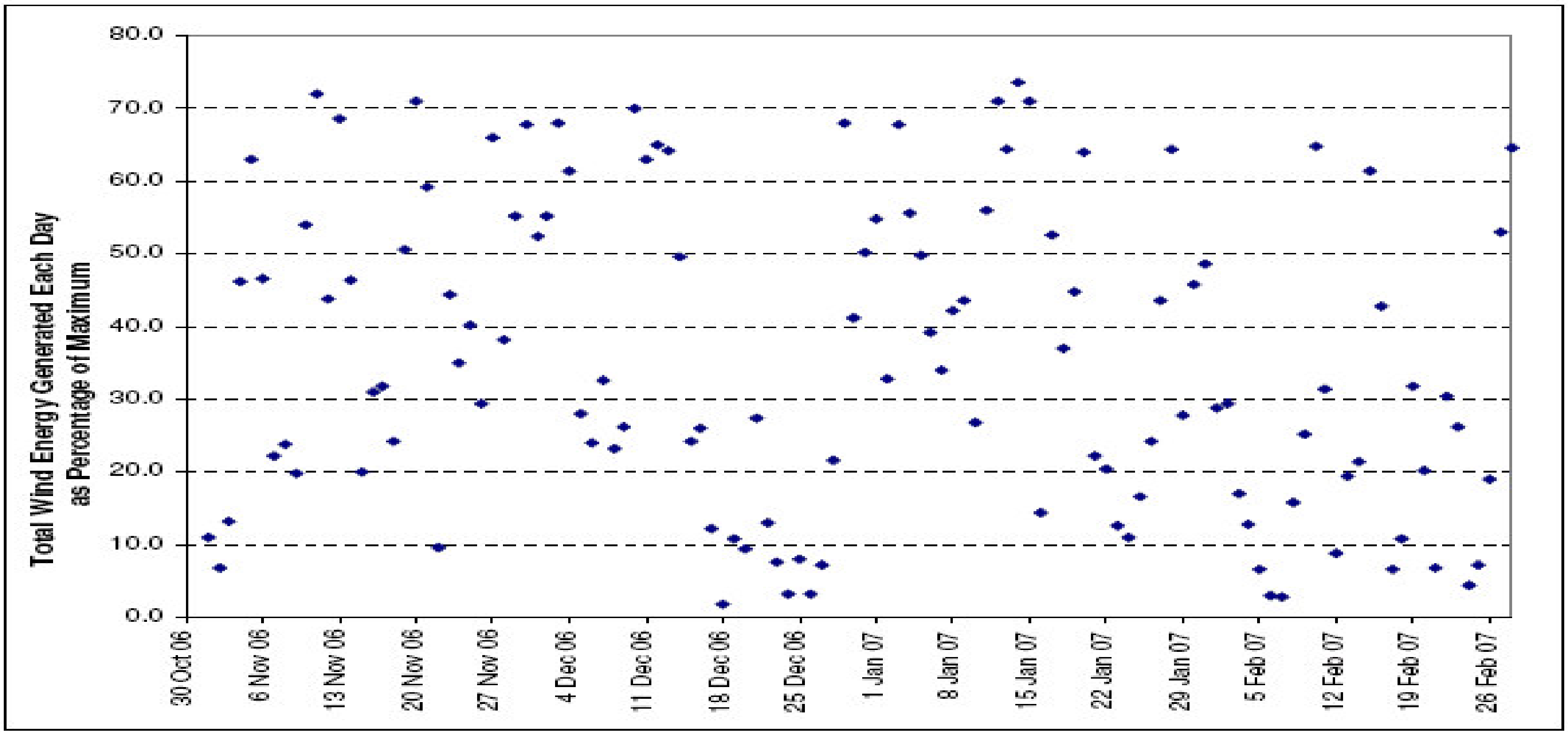
The intermittency of renewable power raises challenges for the system

Daily UK wind output relative to maximum capacity winter 2006/7

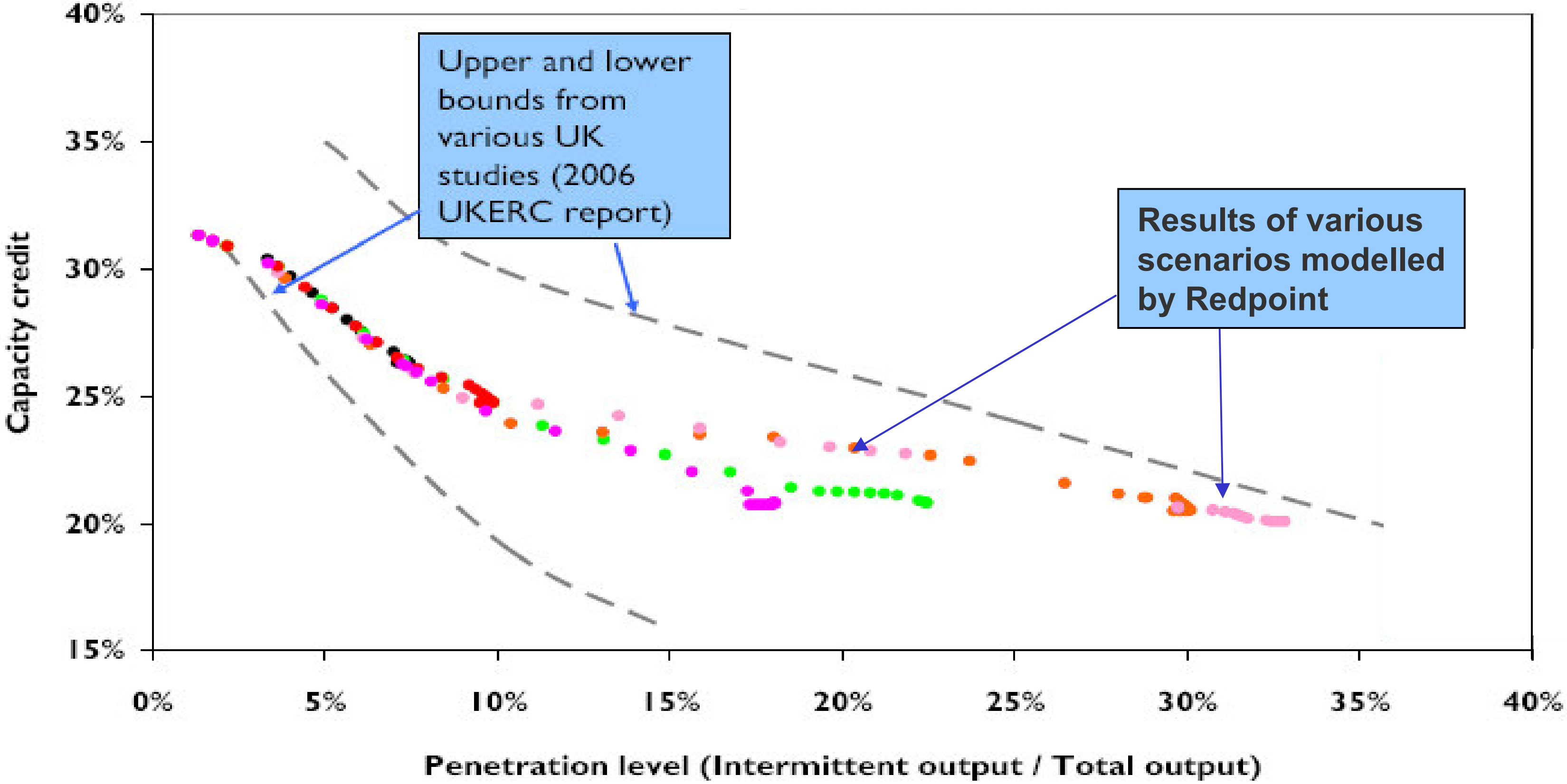
Percent



Source: National Grid 2007/8 Preliminary Winter Consultation Report

As penetration of intermittent power increases, capacity credit decreases

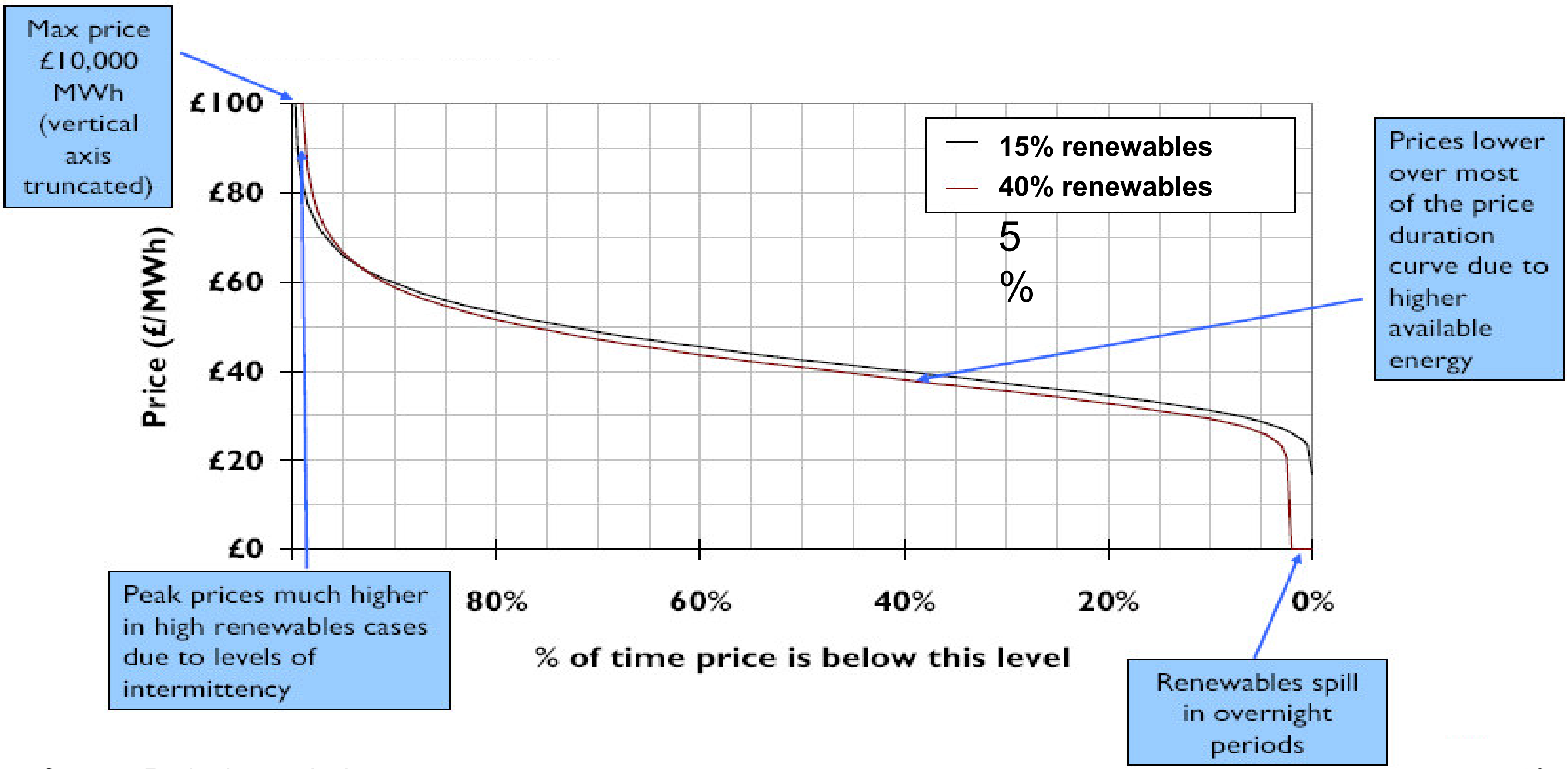
Different estimates of capacity credit* for intermittent power sources



* Capacity credit = % of installed capacity that makes the same contribution to LOLP as incumbent generation
Source: UK ERC “The Costs and Impacts of Intermittency”; Redpoint modelling

Lower prices and load-factors could discourage “baseload” investment

Price duration curve with 15% and 40% renewable electricity



Source: Redpoint modelling

First-order, renewables could be good or bad for security of supply

Driver of security of supply	**First-order impact of higher renewable share**	**Comments**
Spare capacity	Negative	Lower wholesale prices (and load-factors) may reduce incentive to maintain spare capacity
Diversity* of plants	Positive	Large number of small units unlikely to all be out at the same time
Diversity* of fuels	Negative	Even with geographic diversity, wind conditions and output across UK correlated
Diversity* of technologies	Positive	Lower dependence on any one technology provides insurance against "type failure"
Reliability of plants	Neutral/positive	Modern wind plant likely to be technically quite reliable, just like other types of plant
Reliability of fuel supply	ST – Negative LT – Positive	Many fuel sources intermittent; but long-term insurance against fossil fuel scarcity

* Diversity defined as lack of correlation between fuel or plant outages such that system-wide large outages are unlikely

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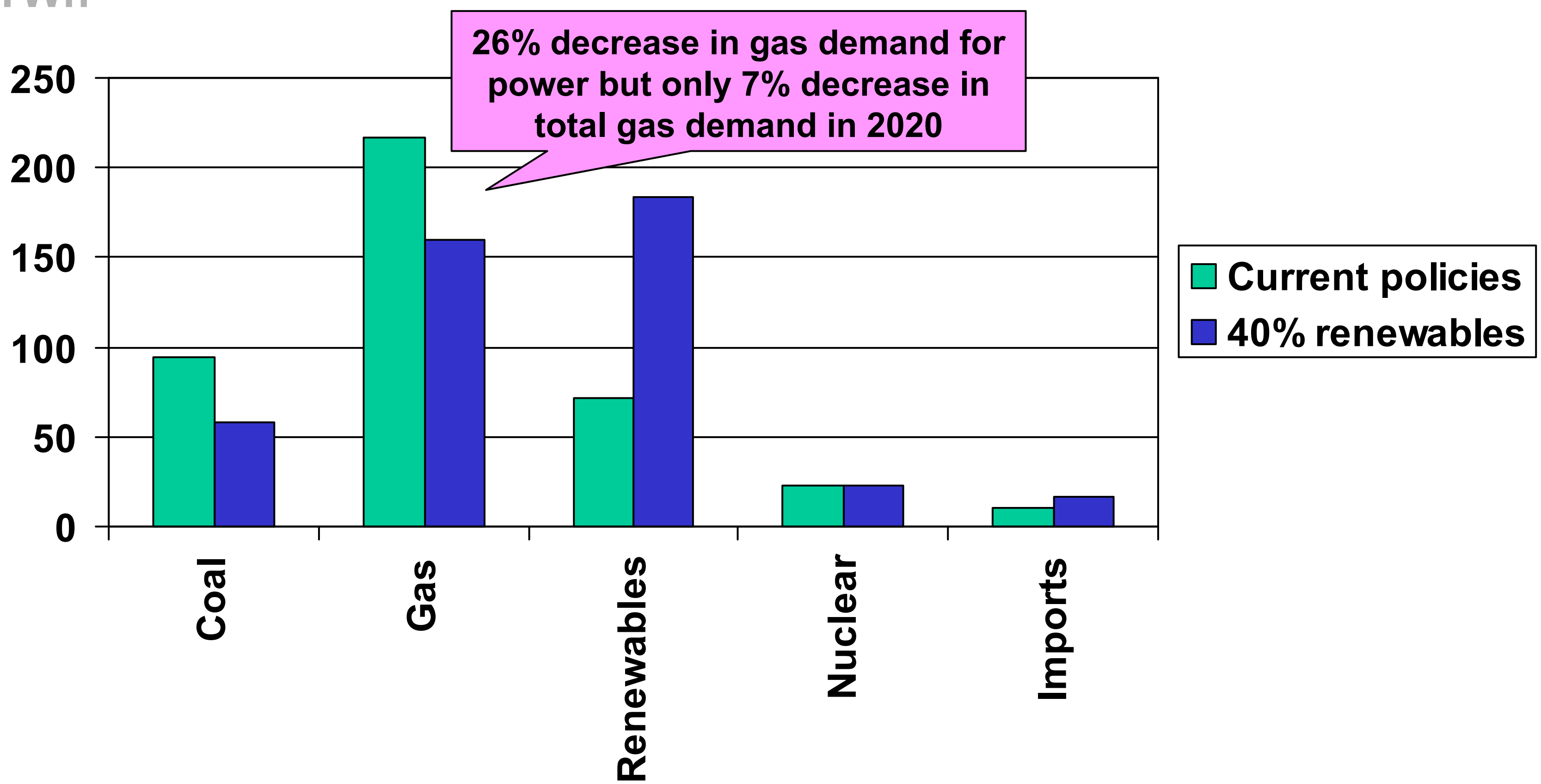
The impact on gas demand by 2020 would appear to be relatively minor

Generation mix under two possible scenarios by 2020

TWh



Source: Redpoint; BERR analysis

Higher renewables share is unlikely to impact gas security materially

Driver of security of supply	**First-order *gas* impact of higher renewable share**	**Comments**
Spare capacity	Neutral/positive	Market likely to respond to any lower demand by building less capacity; but volatile demand (and prices) may encourage storage investment
Diversity* of gas supplies	Neutral/negative	At the margin, lower gas demand may discourage investment in new import capacity
Reliability of gas supplies	Neutral/positive	At the margin, gas may be delivered from "more reliable" sources; but only a minor effect
Demand flexibility	Neutral/negative	May reduce power sector's ability to provide demand-side flexibility in the gas market

* Diversity defined as lack of correlation between outages from different sources or via different infrastructure

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Higher share of renewable electricity will mainly impact costs, not security

- Higher renewable penetration likely to lead to lower wholesale prices but higher wholesale price volatility
- Market likely to respond by building/maintaining more mid-merit, flexible capacity [gas or coal]
- Impact mainly felt in costs* [and retail prices] of delivering energy and security, less so in security levels
- Moreover, impact of higher renewables scenarios on gas security of supply likely to be relatively small

- *However, these are preliminary conclusions: more analysis on this complex issue is probably warranted*

* Additional costs of renewables themselves, system balancing and back-up capacity (with low load factors) required

The UK Government now needs to define a strategy for the 2020 targets

Key dates going forward

- Early 2008: legislate for Renewables Obligation reform in Energy Bill; remove barriers through Planning Bill
- Early 2008: Commission draft directive including burden share and other proposals
- Early 2008: UK Government call for evidence on heat [including renewable heat]
- During 2008: Consultation on measures to meet UK's share of EU renewables targets
- Spring 2009: Full UK Renewable Energy Strategy published