Estimating Future Energy Prices: Geopolitics, Economics & Vulnerability

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Introduction

- Polaris and Defence Economics were commissioned by Dstl to assess the energy supply challenges to MOD:
  - How vulnerable is the MOD to interruptions in energy supply?
  - What is the likely long term price of oil and gas out to 2040?
  - How are short to medium terms ‘shocks’ likely to affect the price of oil and gas?
- The study was commissioned through SEA and was undertaken as part of a coherent Dstl programme to assess future MOD energy supply and demand
- Two-thirds of MOD energy cost is fuel, so the study focused on oil, but also tackled gas pricing and wider issues of energy vulnerability

Summary of Presentation

- This presentation comprises:
  - Setting the context and explaining how the study was approached
  - An examination of how the long term oil price was determined
  - A similar examination of long term gas price
  - An assessment of the volatility of oil market to short term shocks
  - A description of UK energy vulnerability and other factors influencing the MOD
  - Summary of conclusions

Future Conflict

"Out to 2040, there are few convincing reasons to suggest that the world will become more peaceful. Pressure on resources, climate change, population increases and the changing distribution of power are likely to result in increased instability and the likelihood of armed conflict" - *Global Strategic Trends, DCDC*

1. DCDC and the US Intelligence Community both suggest that conflict is more likely out to 2040
2. The world is moving rapidly to a multipolar distribution of economic and military power
3. International crises such as Libya in 2011 have well-documented effects on short-term oil availability and price
4. The nature of the oil market, however, militates against one country or bloc inhibiting supply in the medium to long term
5. Local conflicts over energy supplies would be costly (economically and diplomatically) to the countries involved which may reduce their likelihood
6. The OPEC oil price rise of the 1970s has not been repeated – suppliers and consumers are economically co-dependent

Geopolitical scenarios

Scenario analysis is widely used ”not to predict the future; but rather to show how different forces can manipulate the future in different directions” - *J. Staley (2002) ‘A History of the Future’*

As well as the baseline ‘business as usual’ scenario out to 2040, the study used scenarios to underpin the analysis, such as:

a. World of Blocs – the emergence of a Russia-China-India-Iran bloc
b. Global Action on Climate Change
c. Middle Eastern Politics – a persistent attempt to keep the oil price high
d. Middle Eastern Conflict – a major regional conflict

Summary: supplies are not threatened

Oil and gas are “fungible” products. If one country or bloc of countries threatens the UK with supply restrictions, it can be sourced elsewhere.

1. Market for oil is global, and gas is regional
2. UK sourced supply is running low, but this is not a problem (except to UK revenues)
3. Neither oil nor gas is running out over the time period
4. Resurgence in gas supply from developed nations
5. UK has good pipelines, port facilities and relationships with alternative suppliers

The supply of oil is not threatened

Source: IEA (2011)

Country	Current Global Production (mb/d)	Forecast Global Production (mb/d)	Change 2010-2035
	2009	2035	
Canada	3.4	5.7	2.3
Mexico	3.0	2.5	-0.4
US	7.8	8.3	0.5
Russia	10.5	9.7	-0.8
Kazakhstan	1.6	3.9	2.3
China	4.1	2.3	-1.8
India	0.9	0.6	-0.3
Brazil	2.1	5.2	3.1
Africa	2.6	1.8	-0.7
Middle East	1.7	1.0	-0.7
Europe	4.2	1.8	-2.3
OPEC	34.4	48.7	14.3
Total Non-OPEC	48.8	47.7	-1.1
TOTAL	125.1	139.2	14.4

Globally there is sufficient oil. Much of the growth is expected to come from OPEC.

The supply of oil is not threatened

Region	Source of UK Oil Consumption in 2010 (bpd)	% of UK Oil Consumption from Region	Regions share of world production	
			2010	2035
EU 27	13,330	0.8%		
Other Europe (Non-EU 27)**	807,881	50.5%	14.5%	14.1%
North America	5,449	0.3%	13.4%	14.5%
Other America	25,396	1.6%		
Middle East and North Africa**	104,629	6.5%	41.6%	50.5%
Sub-Saharan Africa	45,048	2.8%		
Asia and Oceania	7,206	0.5%	10.0%	5.4%
UK	590,061	36.9%	1.7%	Zero?
Total UK Consumption	1,600,000	100.0%		

Source: EIA (2011)

**Note: Production regions may differ slightly from consumption regions

The supply of gas is not threatened

Country	Current global Production (bcm)	Forecast global Production (bcm)	Change 2009-2035
	2009	2035	
Canada	164	172	8
Mexico	48	60	12
US	583	696	113
Russia	572	858	286
Azerbaijan	16	56	40
China	85	290	205
India	46	120	74
Europe	294	204	-90
Africa	412	442	30
Middle East	196	773	577
Latin America	152	269	117
Subtotal	**2568**	**3940**	**1372**
RoW	483	810	327
Total	**3051**	**4750**	**1699**

Implication: Globally there is sufficient gas. Much of the growth is coming from Eurasia, the Middle East, China and India.

Source: IEA (2011)

The supply of gas is not threatened

Country	Source of UK Gas in 2010 (GWh)	% of UK Gas Consumption from Country
Belgium	13,568	1.2%
Netherlands	87,120	8.0%
Norway	276,807	25.4%
UK	510,493	46.8%
Liquefied Natural Gas, *of which*	203,789	18.7%
Qatar	*159,984*	*14.6%*
Trinidad & Tobago	*16,464*	*1.5%*
Yemen	*1,794*	*0.2%*
Total UK Consumption	1,091,777	100.0%

Source: DECC

The supply of gas is not threatened

There have been significant investment in both LNG port and pipelines which provide a security of supply.

Type	Name	Location
North Sea terminals	Shearwater-Elgin Line (SEAL)	North Sea – Bacton, Norfolk
	Scottish Area Gas Evacuation	North Sea - St Fergus, Scotland
	Central Area Transmission System	North Sea –Teeside
	Far North Liquids and Gas System (FLAGS)	North Sea - St Fergus, Scotland
International Pipelines	Belgium interconnector	Zeebrugge – Bacton
	Frigg pipeline	Norwegian gas fields – St Fergus, Scotland
	UK-Eire interconnector	Moffat, Scotland – Dublin

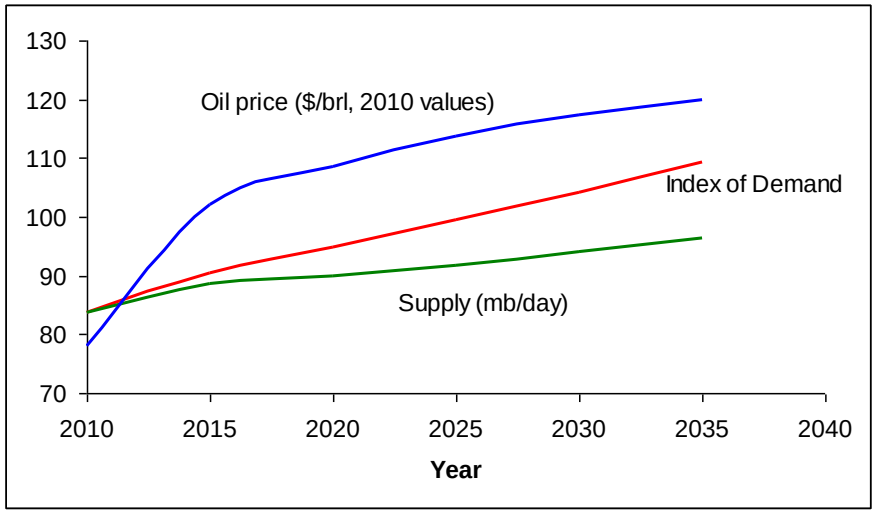
There are four LNG import facilities:

- South Hook LNG terminal at Milford Haven
- Dragon LNG at Milford Haven
- Teesport LNG (capacity 600MMcf/d)
- National Grid's LNG terminal on the Isle of Grain

However, diminishing Norwegian reserves will mean that UK gas will need to come from alternative countries and Russia could become more important as a source in the future

Long term price of oil (and gas) will increase significantly

Demand overtakes supply and this will cause an increase in prices. Significant increasing demand comes from the transport sector in China and India.
Long-term price will rise by 66% by 2040 (against 2010 price).



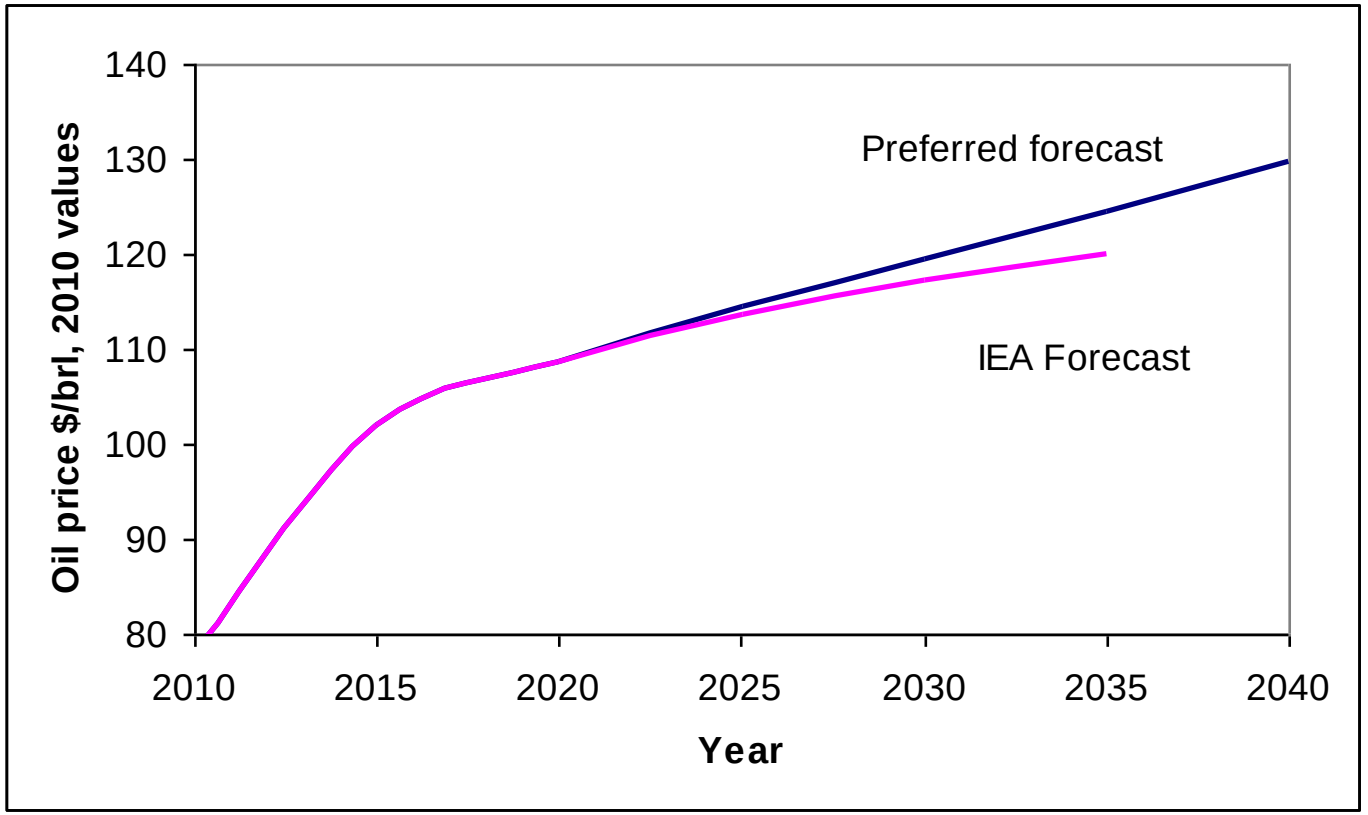
Source: IEA 2011

Country	Change in demand 2010-2040 M barrels/day
China	+6 = +67%
India	+4.1 = +124%
Rest of world	+2.6 = +3%

There is nothing UK (or MoD) can do to affect price.

Prices of oil and gas are closely linked

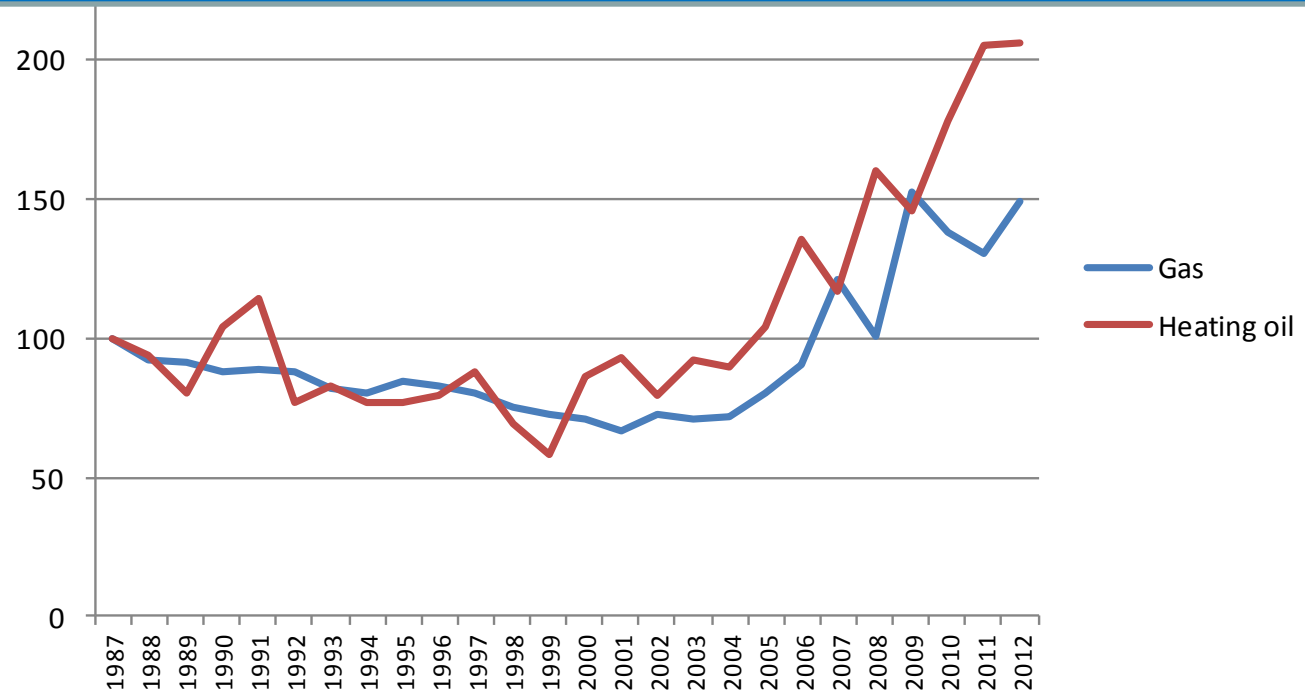
Long term price of oil will increase significantly



Source: IEA, Defence Economics

Long term price of gas will increase significantly

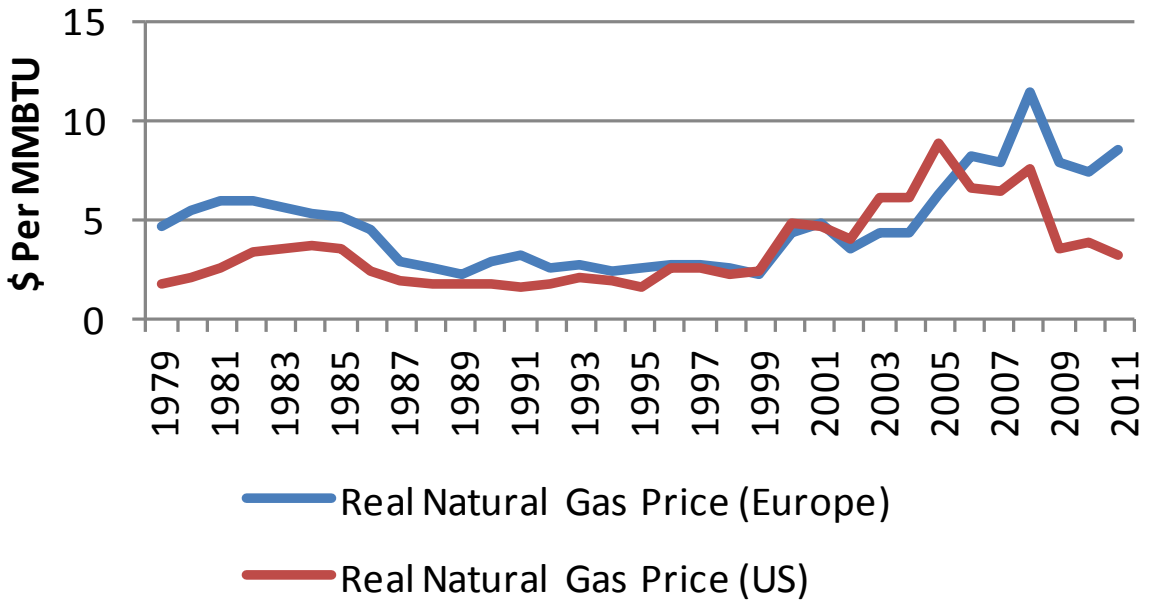
Close correlation in the UK between movements in oil and gas. Increased demand for gas will increase prices of gas . We forecast a 2040 price of $12 per British Thermal Unit – a real term increase of 70%



Source: ONS

Long term price of gas will increase significantly

European and UK gas prices are aligned to oil. US has recently broken this link with the discovery of significant shale gas reserves. Most analysts argue that this is a short term break and prices will again correlate.



Efforts to limit emissions would result in even higher prices

End user oil price (includes duties/taxes) could rise to $160/bl in order to mitigate the effects of global warming through raising price to suppress demand.

1. To mitigate the effects of global warming the price of oil will raise to $140/bl instead of $120/bl in 2035

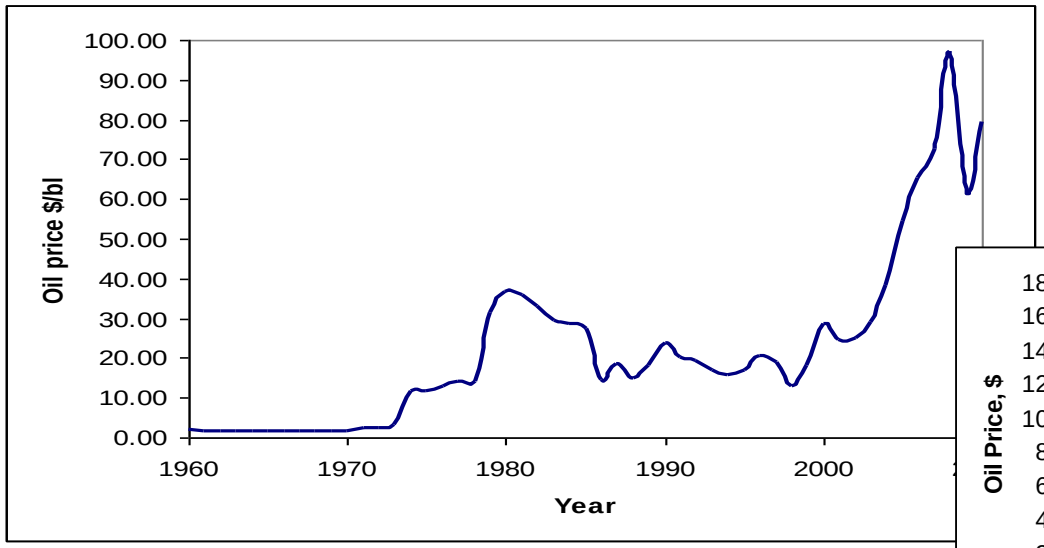
   - this assumes massive, concerted, coordinated, world-wide investment

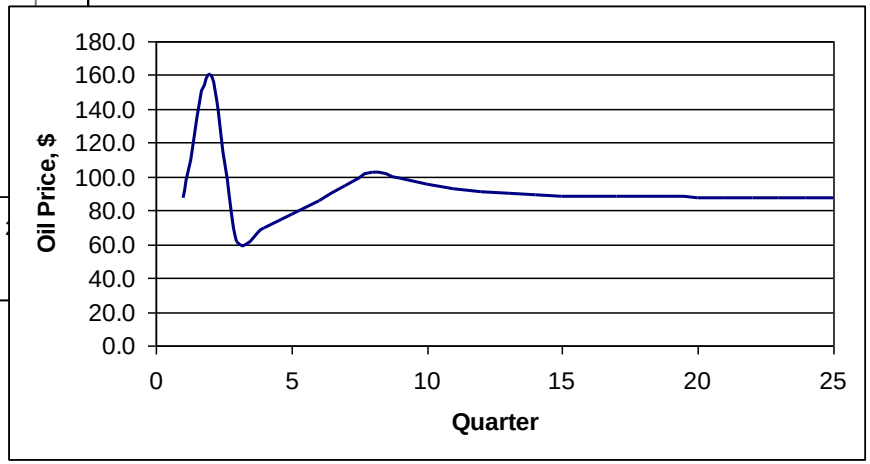
2. Otherwise price has to rise even higher to suppress demand. The study calculates this new price could be as high as $160/bl in 2035

Massive subsidies ($15T) would be required on an international scale from developed to developing countries. Lack of global institutions mean that the world is likely to face climate change rather than preventing its impact.

Volatility in prices should be expected at all times

Prices affected by short term changes in actual or expected supply.





Short sharp shock & 'bounce-back' model

This study has carried out scenario analysis and modelled the effect on short term prices. Prices correct themselves against a long-term trend of increasing price.

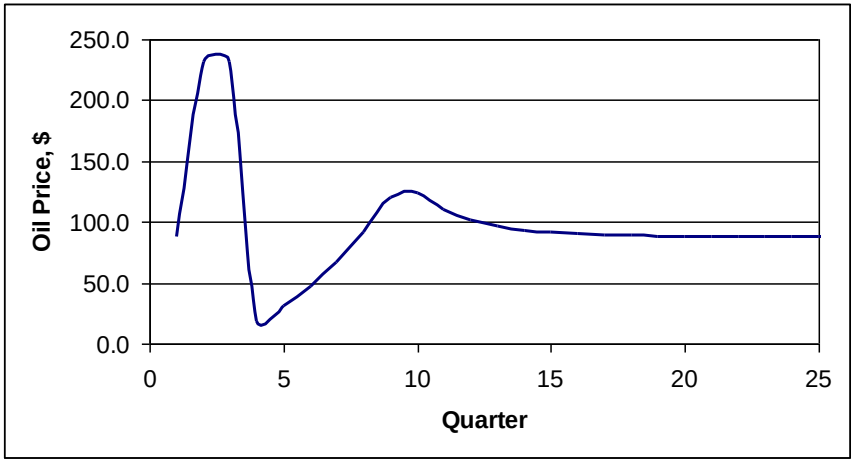
Volatility in is the result of three main factors

- The holding of inventories and the existence of forward markets give end users the ability to defer purchases when the price is high, or buy when the price is low
- Speculators try to sell at the top of the market and buy at the bottom
- Short run response of GDP lowers overall demand at high prices (a ‘real’ effect), or increases demand at low prices

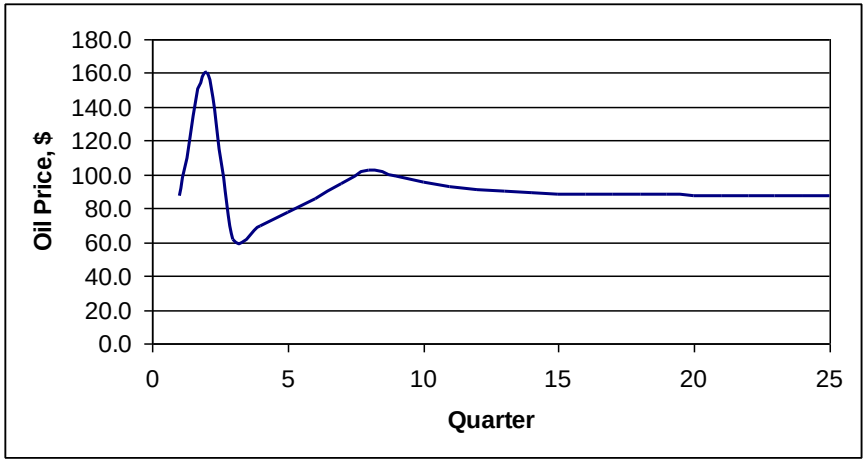
Volatility in prices at all times

Econometric modelling shows that supply restrictions cause a short term spike which then over-corrects

Blockage of Straits of Hormuz – baseline 6 months



Blockage of Straits of Hormuz – short sharp shock



A supplying country wanting to restrict supply and gain a price hike would be worse off longer term – the over-correction means a price drop afterwards and then its market share would suffer longer term

Geopolitical Scenarios

Of the scenarios, action on climate change would have a long term price effect and a Middle Eastern conflict would have a short term price effect

Geopolitical Scenario	Probability, and effect on market structure	Effect on prices	Effect on availability
'World of Blocs'	Highly unlikely. Impossible to target individual countries because of global trading in oil. Concerted action on global supply would be self-defeating in medium term and damage whole world economy	Not material	Not material
'Global action on climate change'	Very possible. May increase real end user price of oil (and therefore energy in general)	Yes – based on the level of carbon tax. Potential increase of 30% in real terms	None
'Middle Eastern politics'	Possible, but no significant effect.	Very minimal	None
'Middle Eastern Conflict'	Possible. Short sharp conflict has no effect on MOD, given hedging programme. Longer conflict could increase prices by 20-30% in one or two year period.	Yes - medium term. May increase MOD costs by around 20% in one year	Yes but only in very short-term, manifested in increased prices

UK has good energy security

Energy security should not be confused with energy independence. The actions of the global market for oil and regional markets for gas militates against supply disruption.

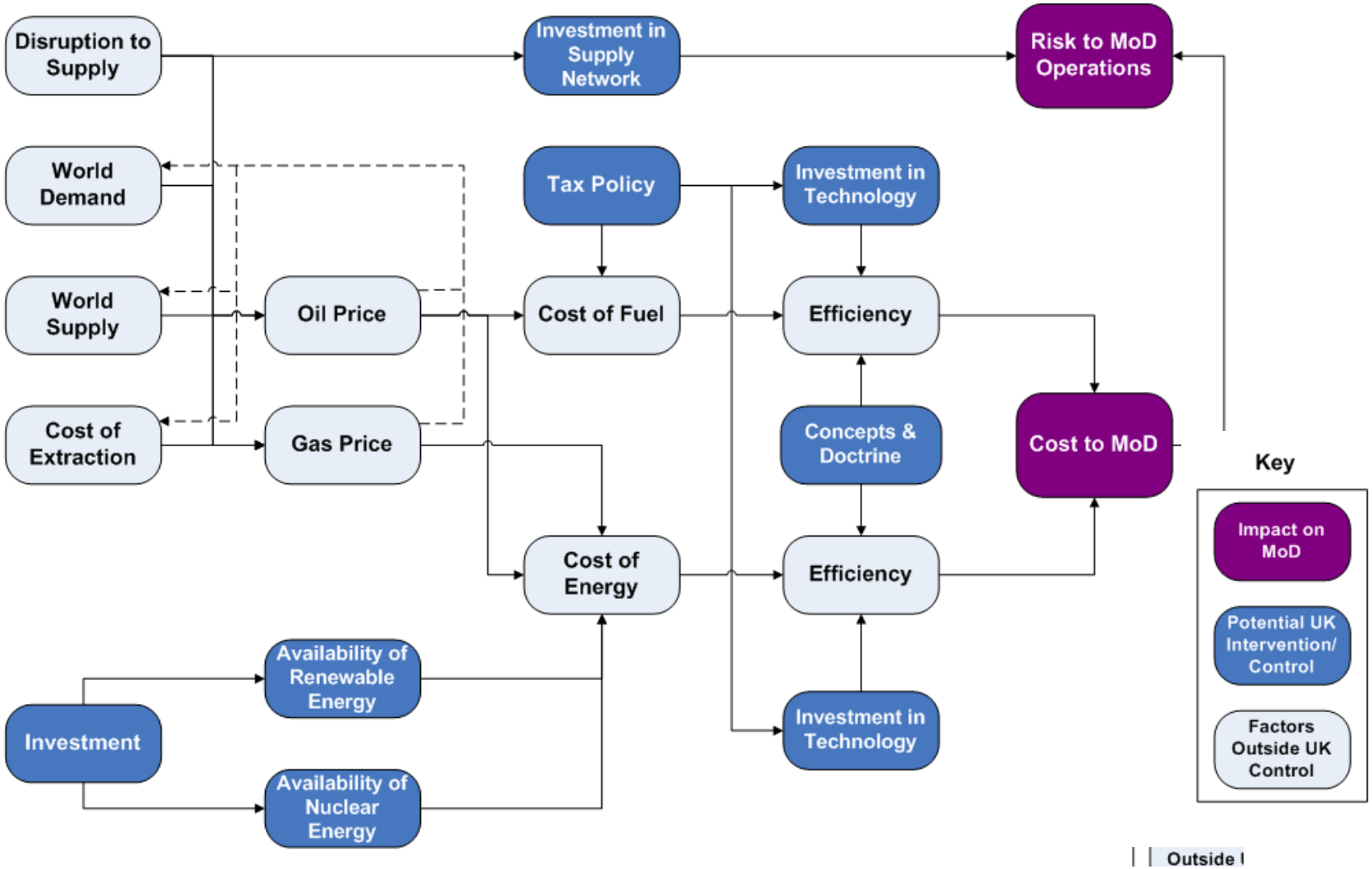
1. The global oil market works through co-dependence between suppliers and consumers
2. The UK has one of the most diversified gas supplies in Western Europe
3. There are more risks to energy distribution than physical security of supply, and short-term disruptions to supply must be managed
4. As long as planned power plants are built to schedule there should not be a gap in energy supply
5. As the UK moves to meet its legally binding carbon emissions target of 2050, the country will be significantly less reliant on energy imports
6. Energy security can be supported through a resilient global energy market and influencing other countries

Doctrine could have a greater impact than technology before 2040-50

The long lifetimes of current and planned platforms means it will be challenging to improve significantly fuel efficiency by 2040. Further, hydrocarbons provide high energy density and ensure operational effectiveness.

1. MOD fuel use is dominated by air and maritime use and the major UK platforms will be conventionally fuelled out to 2040 and beyond
2. The high energy density provided by hydrocarbons, and its resilience and safety, deliver high operational effectiveness
3. The civil market is likely to see earlier adoption of hybrid technology than the MOD
4. The MOD will remain reliant upon the commercial market for its energy supply in the UK
5. Significant cost savings are more likely to come through changes to doctrine and training than equipment, although technologies such as UAVs could also reduce operating costs

MOD can only influence demand



Summary

The cost of fuel and energy is paramount, rather than supply. Changes to ways of operating, buying policies and – within realistic limits - technological innovation can reduce cost, but must be weighed against the need to delivery operational effectiveness.

1. Supply of oil (and gas) is not threatened
2. Long term price of oil (and gas) will increase significantly
3. Successful international efforts to limit emissions would result in even higher prices
4. Volatility in prices should be expected at all times, caused by real or expectations of supply shocks. Prices always expected to fall back
5. UK has good energy security
6. MOD can only influence demand, and not supply
7. Commercial market will drive investment in technologies and/or fuels

Thank you

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