



# The Coming Oil Supply Crunch

A Chatham House Report  
Paul Stevens



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## About the author

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# Executive summary

## The hypothesis and why it matters

This report argues that unless there is a collapse in oil demand within the next five to ten years, there will be a serious oil ‘supply crunch’ – not because of below-ground resource constraints but because of inadequate investment by international oil companies (IOCs) and national oil companies (NOCs). An oil supply crunch is where excess crude producing capacity falls to low levels and is followed by a crude ‘outage’ leading to a price spike. If this happens then the resulting price spike will carry serious policy implications with long-lasting effects on the global energy picture.

## The oil market context – comparing the 1970s with today

A comparison of the oil price shocks of the 1970s with the current oil market situation sets the hypothesis into context. The report considers similarities and differences between the 1970s and today. The similarities are:

- Both periods are characterized by high crude oil prices.
- There is a widespread view that the prices will go ever higher.
- Following the oil shocks of the 1970s, the majority of developing countries did not pass on higher prices to their consumers. Today a number of countries, including the major oil exporters and India and China, are not passing on the higher prices.
- Price rises were triggered by similar causes, with supply and demand playing a role.

- Security of supply suddenly becomes a major issue.
- A strong growth of ‘resource nationalism’ occurs in both periods.

There are, however, important differences:

- In the 1970s, the world experienced deep economic recessions. Today there has been no recession.
- Today oil is much less important in the macro-economy than in the 1970s.
- The speed of the price change was much greater and the increase proportionately larger in the 1970s than today.
- The nature of supply and demand is different in the two periods.
- Today, environmental concerns are a key driver of energy policy; this was not the case in the 1970s.
- There have been major changes in ideology affecting government policy. In particular, unlike in the 1970s, the ‘Washington Consensus’ discouraged government intervention. Industry investment has also been increasingly influenced by new ideas of ‘value-based management’ for the IOCs and ‘principal-agent’ analysis for the NOCs.

## The investment story

Most conventional forecasts expect a very large increase in the production of liquid fuels. However, these forecasts simply assume this will be forthcoming. The report focuses on the willingness and ability of the IOCs and NOCs to deliver on these expectations and concludes that the expectations are likely to be disappointed.

The willingness of the IOCs to invest is constrained by the adoption of ‘value-based management’ as a financial strategy. Thus they are returning investment funds to shareholders rather than investing in the industry. For the NOCs, willingness is driven by depletion policy. Increasingly this is motivated by a view that ‘oil in the ground is worth more than money in the bank’.

The IOCs’ ability to invest is constrained by their inability to access low-cost reserves, by manpower shortages and by

shortages in the service industries. Because of the spread of 'principal-agent' analysis which marks the NOCs as high-cost and inefficient, many are starved of funds. Many producer countries are also experiencing a resurgence of resource nationalism which excludes IOCs from helping to develop capacity. In some cases, the structure of the oil sector militates against its ability to develop the country's reserves. Finally, in many cases rising domestic oil consumption is eating into the ability to export.

Evidence is presented in this report to support arguments about inadequate investment. One is the failure of OPEC to meet plans for capacity expansion since 2005. Another is the poor performance of Non-OPEC. The literature on the change in investment patterns by the IOCs appears to support the *a priori* reasoning developed in the report that overall, investment in developing oil supply is inadequate and likely to remain so for the foreseeable future.

## The implications

The report develops a forecast of future oil demand and supply based upon a number of assumptions. While the forecast is controversial and extremely bullish, even allowing for some increase in capacity over the next few years, a supply crunch appears likely around 2013.

The implication is that it will quickly translate into a price spike although there is a question over how strategic stocks might be used to alleviate this. The problem in assessing what level the price spike might reach is to decide from what base it might occur. This requires a view of future oil prices, which the report develops. It concludes that a spike of over \$200 is possible.

To avoid a crunch, energy policy needs to reduce the demand growth of liquid fuels, to increase the supply of conventional liquids or to increase the supply of unconventional liquids. Various options are considered, including helping oil-exporters manage 'resource curse', improving the investment climate for sovereign wealth funds and bringing OPEC into the IEA's emergency sharing scheme. However, the report concludes that only extreme policy measures could achieve a speedy response – and these are usually politically unpopular.

Any major price spike would carry a macro-economic impact which would of itself provoke a policy reaction. The report argues that an oil price spike might break down opposition to a much greater interventionist approach by governments in their energy sectors. Thus it might do for energy policy what 9/11 did for US military and security policy. An intelligent and informed debate is needed about which energy policy interventions are desirable and which are not, and on what basis such judgments should be made.

# 1. Introduction

## The hypothesis and why it matters

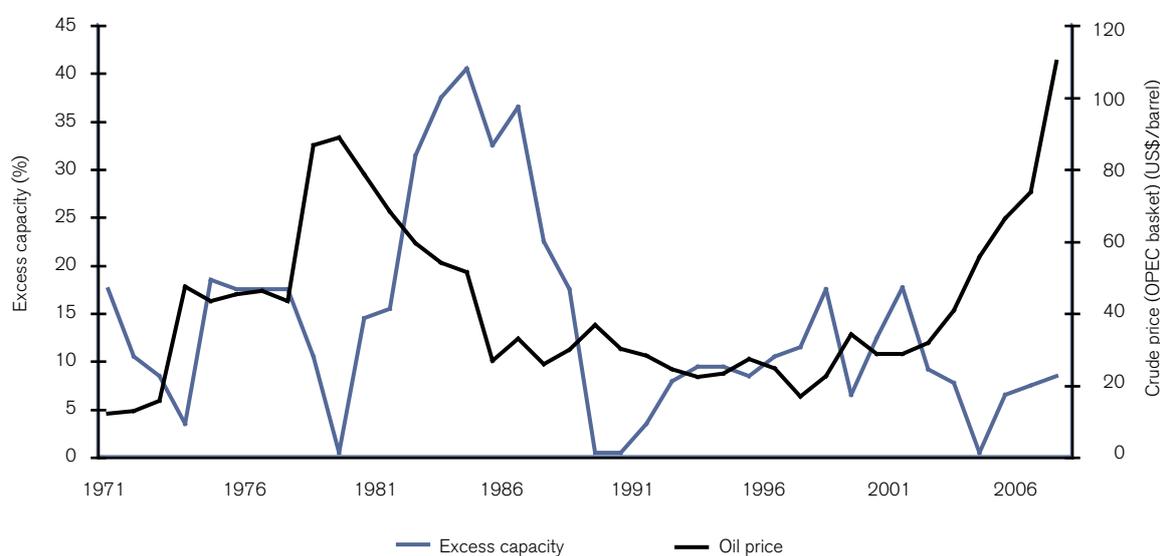
The main hypothesis of this report is simple. Unless there is a collapse in oil demand sometime within the next five to ten years, the world will experience a serious oil 'supply crunch'. This will be nothing to do with below-ground resource constraints or arguments to do with 'peak oil'. Rather, it will be the result of inadequate investment by international oil companies (IOCs) and national

oil companies (NOCs) which means that below-ground oil resources will not be converted into producing capacity.

What a 'supply crunch' means and why it matters can be explained by Figure 1. This shows the history of oil prices since 1971 together with estimates of the excess capacity within OPEC to produce crude oil.<sup>1</sup> Excess capacity refers to existing producing capacity which only requires the push of a button or the turn of a valve to produce a barrel above the ground. It does not include oil-in-place discovered but not yet developed into producing capacity. As can be seen from the figure, for much of the time OPEC has carried excess capacity.<sup>2</sup> However, whenever this excess has eroded (for whatever reasons) the price of oil has risen sharply.

Thus in this report an oil supply crunch is defined as a situation where excess capacity falls to low levels and there is some form of crude 'outage' which leads to physical shortage and triggers a price spike.<sup>3</sup> For example, in 1973–74 rising demand and lack of investment in

Figure 1: What a 'supply crunch' means and why it matters



Sources: Excess capacity – author's estimates; oil price – OPEC Secretariat.

1 This refers to what is now commonly called OPEC-10 plus Iraq which excludes recent additions to OPEC such as Angola and Ecuador.

2 This excess capacity is often triggered by higher prices, which depress demand and encourage new supply.

3 It does not require excess capacity to fall to zero. For example, if the only surplus capacity is for heavy crude oil and the refining sector faces a shortage of upgrading equipment, making it difficult to process heavy crude, the market would perceive this as amounting to the same thing as 'zero excess capacity'. Also a very large outage could wipe out existing excess capacity.

capacity led to an erosion of the excess capacity (see section 2a). The Arab oil embargo of October 1973 created the perception of an outage which led to the ‘first oil shock’. In 1979–80, the Iranian Revolution created an actual outage which caused excess capacity to disappear, and the outbreak of the Iran–Iraq war created the perception of an outage which led to the ‘second oil shock’. In 1990, the Iraqi invasion of Kuwait led to UN sanctions which wiped out the excess capacity, but Saudi Arabia had just sufficient excess capacity itself to prevent a major

oil price spike; thus there was no further outage to create a real shortage. In 2004, rising demand and constrained supply (see section 2a) again eroded the excess capacity, and a series of geo-political events<sup>4</sup> and weather accidents<sup>5</sup> created a perception of outage, forcing prices to rise.

If the report’s hypothesis is correct and excess capacity erodes and there is some form of outage, then the resulting price spike will carry serious policy implications which will have long-lasting effects on the global energy picture.<sup>6</sup>

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4 This began in November 2002 with the strike by Venezuelan oil workers. It was followed by the loss of Iraq after the invasion in March 2003 and the loss of some Nigerian output following civil disorder in the Niger Delta. According to the IEA’s *Oil Market Report* of July 2008, in the second quarter of 2008 some 1 million barrels per day (mb/d) of Nigerian output was closed in.

5 Hurricane Ivan in 2004 and Hurricanes Rita and Katrina in 2005 led to considerable loss of production in the Gulf of Mexico. They also damaged refinery upgrading capacity on the Louisiana coast, making heavy crude unattractive.

6 An interesting debate is whether current and future changes in energy markets represent a structural change or simply another phase in the cycle (Stevens, 2007).

## 2. The oil market context – comparing the 1970s with today

A comparison of the oil price shocks of the 1970s with the current oil market situation will not only set the hypothesis into context, but should also clear up a number of misconceptions which have crept into the analysis of the two periods. It is worth considering the

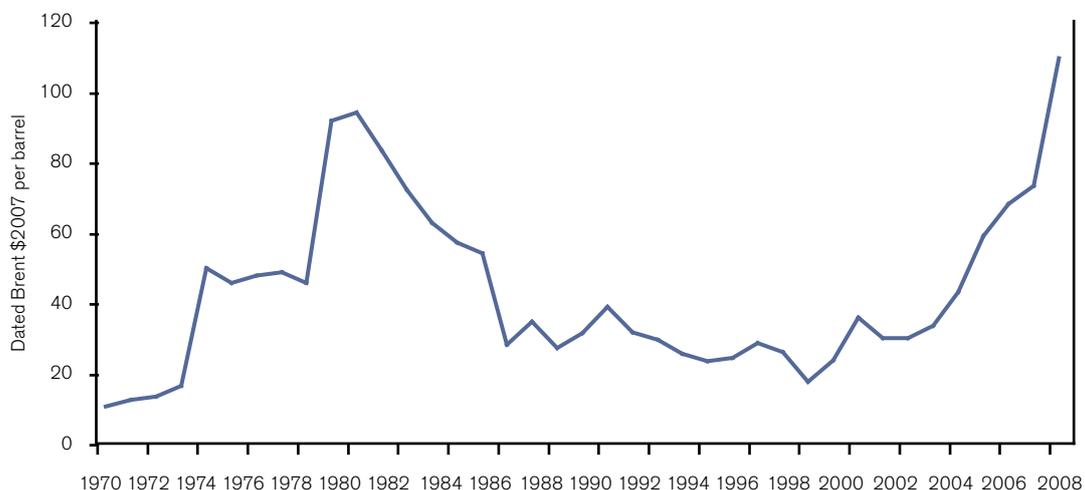
similarities and differences between the 1970s and today.

### (a) Similarities

(i) Prices reach high levels and are expected to go higher  
The first obvious similarity is that both periods were characterized by high crude oil prices. Figure 2 shows the price of crude oil in 2007 dollars;<sup>7</sup> the current price clearly exceeds the annual average of the second oil shock of 1979–80. Another similarity between the two periods which will be relevant for later analysis is a widespread view that the prices will go ever higher. In the early 1980s, forecasts were suggesting prices rising inexorably towards \$100 plus per barrel (Hartshorn, 1993). Today various pundits are talking of prices at levels ranging from \$150 to over \$200.<sup>8</sup>

Another similarity relating to price levels concerns the response of consumer governments. Following the oil

Figure 2: Crude oil prices, 1970–2008



Sources: 1970–2007 – BP, 2008; 2008 – OPEC Secretariat.

<sup>7</sup> The price for 2008 is actually in 2008 dollars and therefore to be strictly comparable with the rest of the graph would need to be slightly lower to account for inflation in 2008, but the effect would be minimal.

<sup>8</sup> On 28 April 2008, Chakib Khelil, the President of OPEC, was widely reported as saying that oil prices could soon reach \$200. In May 2008, Goldman Sachs' *Global Energy Report* suggested that prices of \$150–200 were 'increasingly likely' in the next '6 to 24 months' (MEES 51: 19, 12 May 2008). The *Middle East Economic Survey* (MEES) is cited throughout this report. For each citation, the volume and issue number are given together with the date. This avoids swamping the bibliography with multiple MEES references.

shocks of the 1970s, the vast majority of what were then classed as developing countries did not pass on the higher international price of crude to their consumers, preferring instead to subsidize product prices. The result was that their energy intensities failed to respond to the oil shocks in the same way that (eventually) the OECD countries' intensities did. Today too a number of countries, including the major oil exporters and India and China, are not passing on the higher prices but, for whatever reason, are again depending on subsidies.<sup>9</sup> This is certainly one of the reasons why current oil demand growth has not fallen in the face of such high international prices and indeed why much of the growth in oil demand in the last two years has come from these countries (IEA's *Oil Market Reports*, various issues).

#### (ii) Causes of price increases

In both periods, price rises were triggered by similar causes. A frequently repeated myth today (for instance Yergin, 2008) holds that the 1970s crisis was driven by supply constraints whereas the current crisis is due to strong demand growth. In reality, both supply and demand played a key role in each period.

To be sure, the first oil shock of 1973–74 did have a supply dimension. Since the late 1960s, the IOCs had slowed their investment in Middle East producing countries. This was the result of a speech entitled 'Participation: a better means to survive' given in spring 1969 at the American University of Beirut by the then Saudi oil minister, Ahmed Zaki Yamani (Stevens, 1976). Outlining his specific ideas on 'participation', a concept he had floated in general terms the year before, he effectively signalled to the IOCs that their future access to the reserves of the major producing countries was to be limited. In response, they began to increase production and at the same time slowed invest-

ment in capacity. There was little point investing in new capacity from which they would not be able to benefit. This led to a slowing of capacity growth, which had been feeding the OECD's 'economic miracle'.<sup>10</sup> Then in October 1973 the Arab states announced their oil embargo in response to the Yom Kippur War. This imposed an embargo against the export of oil to the United States and the Netherlands. However, the experience of 1967, when an oil embargo had been tried after the Six Day War, led them also to announce a gradual reduction in supply to consumers to prevent them from redirecting oil to their sanction targets.<sup>11</sup> While it is now clear that the 1973 embargo was ineffectual (Horwich and Weimer, 1988), at the time the threat of politics interfering with oil supplies and causing an outage felt very real and resonated powerfully among consumers.

However, strong demand growth driven by exceptional economic growth also played its part in the first oil shock. As Figure 3 illustrates, clearly the late 1960s and early 1970s exhibited very strong economic growth in the OECD countries.

At the same time, oil prices had been falling towards the end of the 1960s (Adelman, 1972). Together, economic growth and low prices created very strong oil demand growth, as can be seen from Figure 4.

Demand has also played an important role in the current oil price rise, as can be seen from Figure 5.<sup>12</sup>

However, supply constraints have played a role too. As already indicated, there have been a number of supply disruptions arising from geo-politics and weather problems, as well as a number of accidents. There have also been serious delays on projects, in part as the result of constraints within the oil service industry.<sup>13</sup> The overall result has been a disappointing performance by non-OPEC countries, as can be seen from Figure 6.<sup>14</sup>

9 Both China and India are trying to move their domestic prices closer to international prices but the major oil exporters are not.

10 This was the phenomenon of the 1960s when the OECD economies were growing at unprecedented rates.

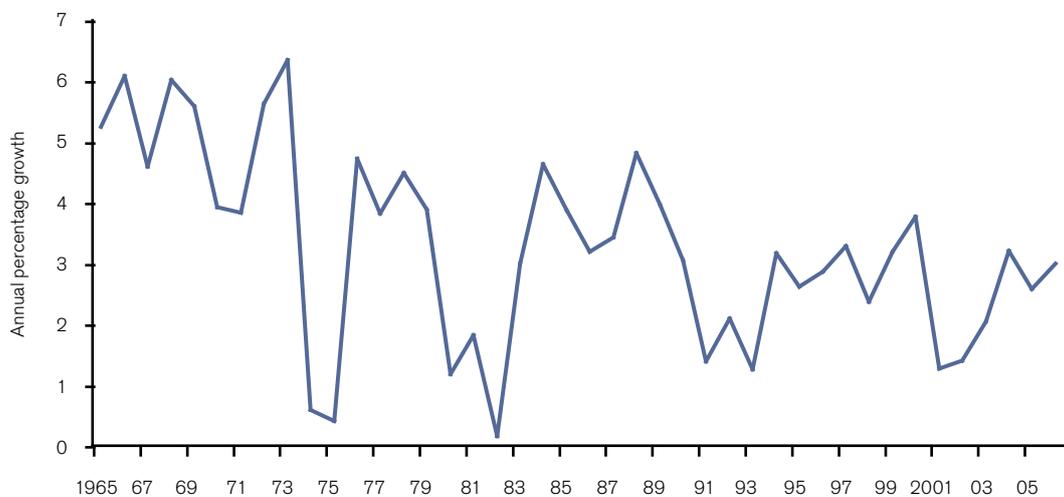
11 In June 1967, the international nature of the crude oil market meant that other OECD countries simply lifted oil on behalf of the US and supplied them indirectly, making the 1967 embargo totally ineffective.

12 It is perhaps worth pointing out that not all the demand growth was attributable to China as is popularly believed. Between 1996 and 2004, while China added 3.4 mb/d, the United States added 3 mb/d and India 1 mb/d (BP, 2008). However, there is no doubt that the sharp increase in Chinese oil demand in 2004, in part arising from problems in the power sector, did contribute significantly to the start of the price rise.

13 Until 2004, the service companies had a torrid time in terms of profitability. The mega-mergers of the oil companies in the late 1990s increased their monopsony buying power. This, coupled with the move to use e-commerce on a large scale (which greatly erodes margins), wiped out service company profitability. As a result they stopped investing in new capacity and shortages began to emerge in late 2003 (Stevens, 2008).

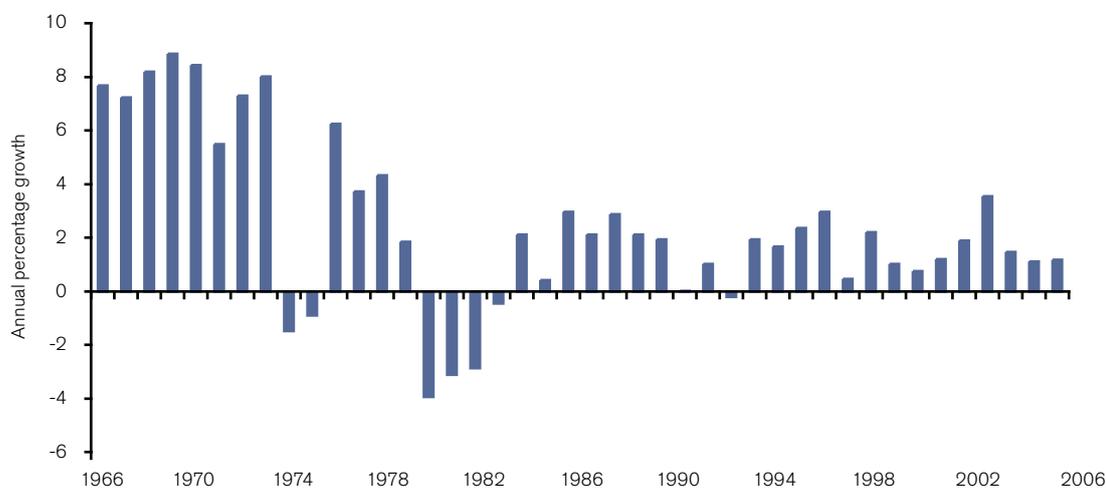
14 This poor performance cannot be blamed upon lack of access for the IOCs except possibly in the case of Mexico.

Figure 3: OECD GDP growth, 1965–2006



Source: World Bank Development Indicators, 2008.  
 Note: 2006 is the last year for which data are available.

Figure 4: Percentage growth in oil demand, 1966–2007

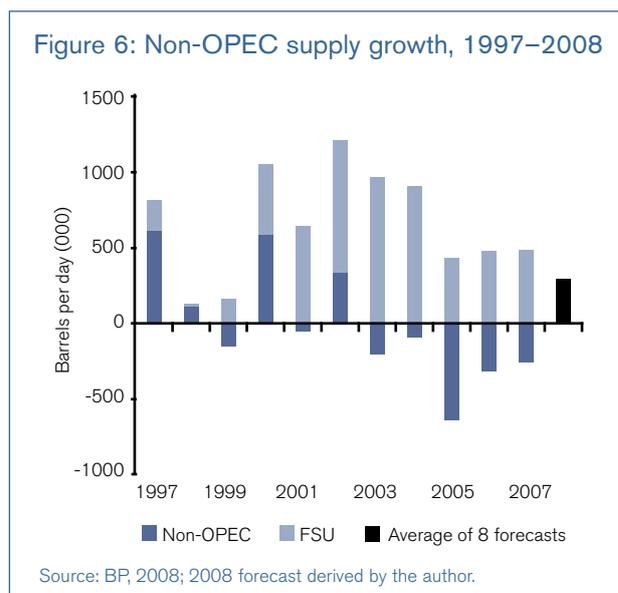
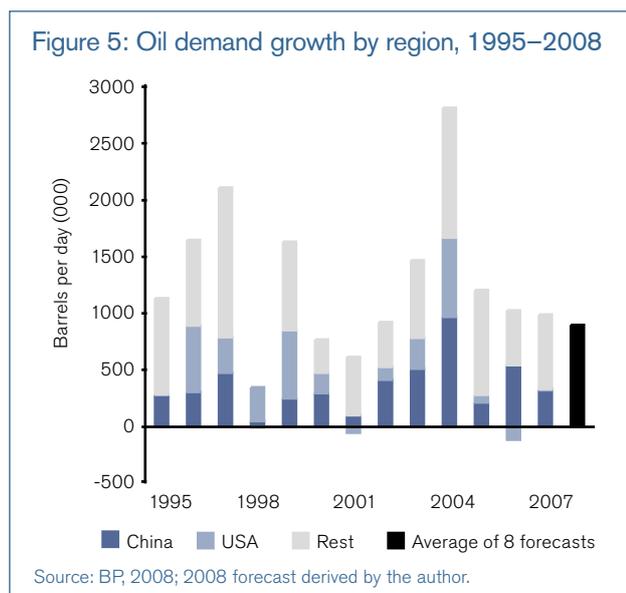


Source: BP, 2008.

Since 2002, without the former Soviet Union (FSU) – mainly Russia – non-OPEC growth would actually have been negative. However, the real problem on the supply side has been the inadequate levels of investment since 1998 (see section 3).

(iii) Security of supply as an issue

In the 1970s, security of supply suddenly became a major issue (Parra, 2004). This was initially triggered by the Arab oil embargo of 1973. However the nationalizations of the IOCs’ upstream operations which took place



after 1972 also added to the sense that politics was now entering the supply equation in a way that made the consumer countries extremely uneasy. Indeed the creation of the International Energy Agency (IEA) in November 1974 as the brainchild of Henry Kissinger, the then US Secretary of State, was in direct response to these fears.<sup>15</sup> Thus energy policy, as it began to emerge in the OECD countries in the 1970s,<sup>16</sup> was driven almost entirely by security of supply concerns. In recent years,<sup>17</sup> following the invasion of Iraq in 2003 and the many other upheavals and threats of upheaval in the Middle East and in other producers such as Venezuela and Nigeria, security of supply is back on the agenda. It has become a major driver of energy policy, along with concern over climate change which was not an issue in the 1970s (see section 2b).

(iv) 'Resource nationalism'

Both periods of high prices saw a strong growth of 'resource nationalism', in large part reflecting the cyclical nature of this phenomenon (Stevens, 2008). The recent

revival of interest has spawned a multitude of different definitions and interpretations. The International Energy Forum defined it as 'nations wanting to make the most of their endowment' (*Middle East Economic Survey (MEES)* 49: 39, 25 September 2006). Bill Farren Price of MEES described it as a situation where 'producer countries have moved to maximize revenue from present oil and gas production while altering the terms of investment for future output' (MEES 49: 37, 11 September 2006). Another version is that it is simply an expression of Ray Vernon's 'obsolescing bargain' (Vernon, 1971) whereby once oil has been discovered and the investment sunk in development, relative bargaining power switches in favour of the host government, which then tries to increase its fiscal take by unilaterally changing the terms of the original contract. Yet another view is that it is simply an expression of political antipathy to the United States (and by implication its oil companies) and/or economic globalization.

This report assumes resource nationalism to have two components: limiting the operations of private interna-

15 One of the first activities begun by the IEA was the creation of an emergency response system to manage outages (Horwich and Weimer, 1988).

16 Before the first oil shock of 1973–74 the OECD countries did not have an energy policy. At best, they had a series of sub-energy-sector policies with no coordination (Stevens, 2007).

17 Arguably, the worst-case scenario for oil supplies of a war in the Persian Gulf came and went in 1990–91 with only a minor short-term price blip. This did generate a great deal of complacency when security of supply was no longer an issue and the idea of just 'leaving it to the market' gained considerable ground in OECD government circles.

tional oil companies, and asserting greater national control over natural resource development. This phenomenon has had a long history and not just in the context of oil or minerals.<sup>18</sup> Furthermore it is not just a phenomenon associated with ‘dodgy’ governments in ‘dark continents’. Often Canada and Australia are cited in the literature as classic examples of countries where resource nationalism has ruled (Uslaner, 1989; Owen, 1988).

The drivers of resource nationalism are many and are a function of history as much as the current context. For a considerable number of countries in the 1970s it was driven by national independence and the end of colonialism (Mitchell, 2006). It can be driven by a concern that the IOCs are taking too large a share of the cake; by the perceptions that the resource will be needed for domestic uses;<sup>19</sup> or by a belief that the potential customers are somehow ‘unworthy’.<sup>20</sup> Yet another driver is the perception among ordinary people that they have seen little or no benefit from the extraction of ‘their’ oil and minerals, despite IOCs paying taxes to their governments. In such circumstances they either revolt (as in the Nigerian Delta) or elect populist governments (as in Venezuela and Bolivia). A variation on this ‘exclusion’ is the experience in Russia, where popular opinion is that the sell-off of oil resources in the early 1990s was an outrageous give-away and simply created a bunch of oil oligarchs tainted by corruption.

However, there is also an important ideological component to the phenomenon, strongly linked to the perceived role of the state in the operation of the national economy. The 1970s saw a severe outbreak of resource nationalism, in part as a response to growing dissatisfaction with the terms under which the IOCs operated and in part an expression of the euphoria of a post-imperial/colonial world. This also coincided with a growing view in what was then seen as the ‘Third World’,

in part promoted by UNCTAD, that the state should play a much greater role in the economy. For oil this meant the development of NOCs. Today there has been a revival of this view in Latin America and Russia although (as explained in section 2a) for different reasons. Furthermore this is now spreading to other producing areas, especially in the Middle East.

## (b) Differences

### (i) So far there has been no recession

As can be seen from Figure 3, after the first and second oil shocks, the world experienced deep economic recessions. After 1973, arguably this was triggered by the oil shock itself. However, after 1979 it was more likely the result of a switch in governments’ macro-economic policies away from a Keynesian solution for unemployment to a monetarist solution for inflation. In the current situation so far there has been no recession, although there is growing concern that the subprime mortgage crisis of the United State and the increasingly high oil price will trigger one sooner rather than later.<sup>21</sup>

One big difference is that oil is much less important in terms of the macro-economy than it was in the 1970s, as can be seen from Figure 7. Thus oil imports as a percentage of merchandise imports have fallen considerably for the high- and middle-income countries relative to the 1970s. (Significantly, the same is not true of the low-income countries, many of which are suffering terribly as a result of the current high oil prices.) Another difference is that since the 1970s the monetary authorities have become a lot smarter faced with the sort of macro-economic consequences that flow from very much higher oil prices.

The fact that, to date, there has been no recession goes a long way towards explaining why oil demand has continued to grow in the face of such high prices.<sup>22</sup>

18 For example, there were serious riots in Iran in 1890 over the tobacco monopoly granted to a British citizen by Mozaffar Al-Din Shah.

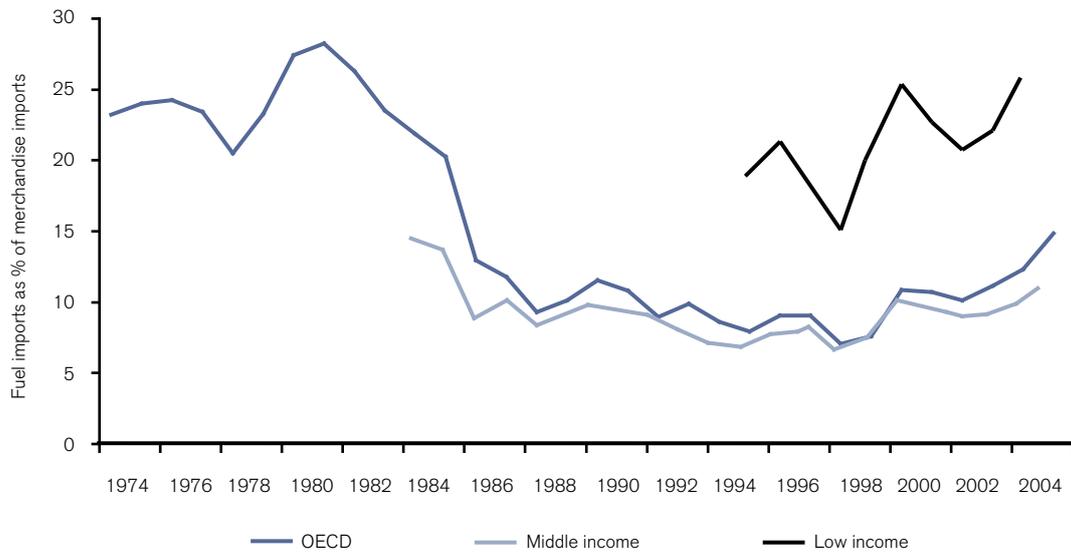
19 For example, this is becoming a major issue in relation to gas in Iran (ESMAP, 2007).

20 The case of gas exports from Bangladesh to India comes into this category, as does the export of Bolivian gas through Chile.

21 Most observers, including the IMF, are reducing their GDP growth forecasts for 2009 as fears grow that more subprime mortgage skeletons will emerge from the cupboards of some of the major financial institutions. There is also a debate over whether economic growth in Asia has decoupled itself from US economic growth in a way that was unthinkable 20 years ago.

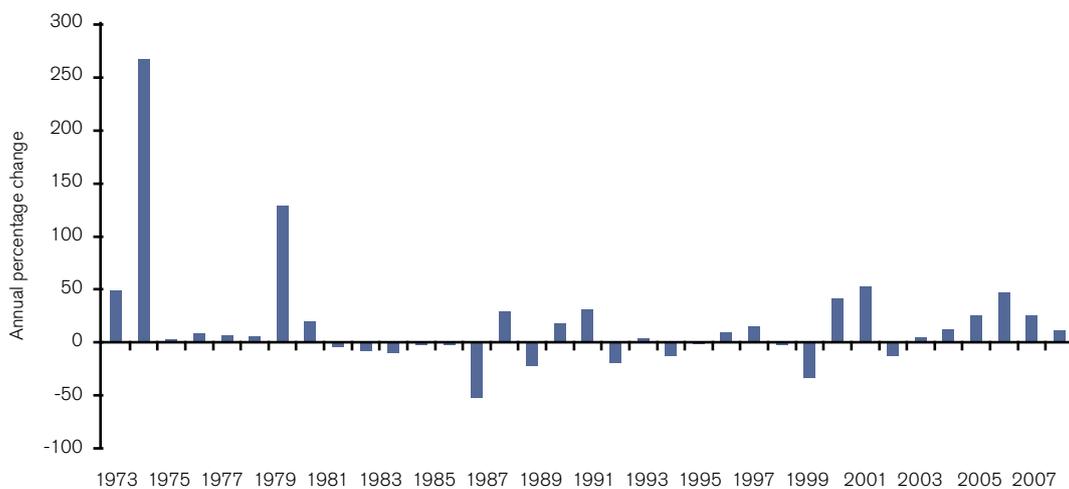
22 As indicated earlier, the fact that in many large consuming countries the higher price has not been passed on to consumers also explains a limited demand response.

Figure 7: The role of oil in merchandise imports, 1974–2005



Source: World Bank Development Indicators, 2008. Data availability are mixed and not available after 2005 for the low-income countries.

Figure 8: Oil price increases in percentage terms year on year



Source: BP, 2008.

Moreover, observers often ignore the time lag between price increases and demand response. Energy demand is a derived demand: consumers are not interested in the fuel *per se* but in energy as a source of light, heat and work. To get this, usable energy must be converted into useful energy by means of an energy-using appliance. The

consumption of energy therefore involves a three-stage decision: the decision to buy or not to buy the energy-using appliance; the choice of appliance in terms of fuel type and efficiency; and finally, the behavioural decision on capacity utilization. Once the first two choices are made, the appliance stock is fixed and it takes a considerable time

to change that stock. Only the capacity utilization decision is available to reduce consumption in the short term. While some reduction in capacity use in the form of conservation is welcome, real reduction requires deprivation, which is undesirable.<sup>23</sup> Thus currently, since there has been no recession, it is not surprising that oil demand has been slow to respond.

#### (ii) Price increases today are less dramatic than in the 1970s

Figure 8 illustrates beautifully the difference relating to the speed and magnitude of the price change.

Clearly the oil price rises in 1974 and 1979 were serious shocks. However, the price increases since 2003 have been far more gradual. The analogy has been drawn between dropping a frog into a pan of boiling water and dropping it into a pan of cold water which is then slowly brought to the boil. The significance is that the dramatic and sharp increases in oil price in the 1970s are more likely to bring about a change in consumer behaviour than the more gradual increase over the last few years, despite the fact that, in real terms, price levels now exceed those in the 1970s.<sup>24</sup>

There is also the fact that oil is normally priced in US dollars.<sup>25</sup> In recent years the dollar has devalued against most major currencies; for example, between 2001 and 2008 it devalued by around 40% against the euro. Thus the higher price of oil is not applicable to all consumers to the extent suggested by the rise in the dollar price.

#### (iii) The nature of oil demand and oil supply

In the 1970s, oil played an important role in the static sector as well as the transport sector. Indeed much of

the growth in oil demand seen towards the end of the 1960s and in the early 1970s stemmed from the increasing use of oil in power generation as a result of expectations that oil prices would continue to fall. However, in the OECD at least, the oil price shocks of the 1970s led to oil being replaced as a boiler fuel.<sup>26</sup> Now in the OECD oil is burnt largely in the transport sector, for which there are as yet relatively limited alternatives.<sup>27</sup> Thus in one sense much of the easy fuel-switching and conservation has been done in the OECD, which makes a response to higher prices today much slower than in the 1970s.

There is also an issue of affordability thresholds. When gasoline was \$1 per gallon in the US, a 30% increase did not eat much into the family budget. However, when that increase is added to a \$4 gallon it begins to affect consumer behaviour. This issue of non-linearity of own price demand elasticity is not well captured in much of the empirical literature (Dargay and Gately, 1995; Hughes et al., 2008).<sup>28</sup>

On the supply side in the 1970s there were huge alternative sources of oil to be tapped beyond the major OPEC oil exporters. In particular, the low oil prices of the 1950s and 1960s had seriously inhibited anything but the shallowest offshore operations, but now moving offshore made good economic sense. Thus Non-OPEC had a strong capacity to grow rapidly. In the ten years after 1974, Non-OPEC outside the Soviet Union added some 10mb/d and in the five years after 1980 some 5mb/d to global oil supplies (BP, 2008). Today, it is difficult to see where new potential on such a scale might lie.

23 For reasons already explained, the low-income countries are suffering serious deprivation, unable to afford oil to run even basic services.

24 The author has observed on many occasions that most energy consumers are unaware of the unit price of energy. Ask 50 people in an audience how many own a television or a fridge and most will put up their hands. If they are then asked how many know what it costs per hour to run those appliances, virtually all hands go down. Until recently and the growing publicity about gasoline prices, this was often the case with motorists outside the United States who simply go into the filling station and fill up or buy a fixed sum, unaware of the unit price. One of the most basic assumptions in economics is that the quantity demanded is a function of price and yet most energy consumers do not know what 'the price' actually is. This is a classic example of market failure through lack of information.

25 There have been various attempts to switch to other currencies but this has largely been driven by governments with a strong antipathy towards the US.

26 This was not the case in many emerging-market economies, whose consumers were protected from the higher oil prices by subsidy.

27 There are a number of options on the horizon in terms of hybrids, electric and hydrogen-powered cars but these, in the absence of very strong policy measures, will take time to infiltrate the 'car parc'.

28 This simply means the magnitude of the demand response is different when the price changes from a higher rather than a lower base.

(iv) Environmental concerns are now major drivers of energy policy

In the 1970s, environmental concerns were only in their infancy and certainly did little to drive energy policy in the consuming countries. Today, however, they arguably dominate the energy policy scene. It is true that security of supply remains on the agenda as it did in the 1970s, but the general view among many observers and analysts seems to be that climate change issues are dominant.<sup>29</sup>

(v) Major changes in 'ideology' affecting government policy and investment by IOCs and NOCs

The role of government intervention in an economy has a distinctly cyclical nature. The 25 or so years after the Second World War saw large state involvement in nations' economic systems. There was a widely held view that governments could and should intervene directly to address social and economic problems.<sup>30</sup> There was general acceptance of the existence of 'market failure' – the existence of imperfect competition arising from the presence of monopoly power and asymmetric information; the presence of ownership externalities; and finally the existence of public goods where consumption was non-rival and exclusion from access technically infeasible. Solutions to these problems of market failure lay in government intervention in the form of corrective taxes and subsidies, regulation, price controls, planning and ultimately government ownership. There was also the Keynesian legacy that the equilibrium level of employment would not necessarily coincide with full employment. The function of government was, through the management of aggregate demand, to force the two to coincide. Finally, Soviet planning was held up by many as the way for the future to mobilize the resources of an economy to promote growth. Collectively, these three drivers caused growing

government intervention in the economy to be regarded as the norm.

For what was then called the 'Third World', justification for state intervention received additional support. There was a 'structuralist' view of the economy that challenged the assumption that participation in the international market economy would lead to mutual gain. Rather, the 'normal' operation of market forces would aggravate differences between countries and not encourage the convergence assumed by more mainstream economics. Hence state action was essential if this was to be avoided. In a less extreme vein, many economists advocated the need for a 'big push' to promote development – a concerted effort to focus resources to 'break out' of the vicious circle of poverty: low income leading to low savings, low investment, low output leading back to low income. The underdevelopment of the private sector in these countries meant that only the state could marshal sufficient resources for such a 'breakout'.

The implication of this was that following the first oil shock of 1973–74, it was regarded as the norm that governments should intervene to mitigate the impact and prevent a repetition. And they did intervene heavily in the energy sector in a variety of ways to reduce demand and increase supplies.<sup>31</sup> It was this policy response that reinforced the natural market tendency to reduce demand and increase supply, which led eventually in 1986 to the price adjusting to a new reality.

The intellectual underpinnings of these previously unchallenged views of state intervention came under scrutiny and attack during the 1970s from three recently developed areas of economic analysis – the economic theory of politics examining the behaviour of politicians; theories of public choice examining the behaviour of bureaucrats; and 'principal-agent' analysis examining the interaction between politicians and bureaucrats. All

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29 In fact the policies to abate climate change and those to address security of supply concerns are often the same and energy policy analysts see the two issues as complementary.

30 This was not the case in the United States, where an innate dislike of government overcame any ideological arguments for government intervention.

31 A classic example was the decision by France to reduce its oil dependence by going nuclear. In 1972, nuclear power accounted for less than 2% of French primary energy consumption. By 1996 it had reached 37% (BP, 2008). Even in the US, subsidies for ethanol production received widespread support, as did the creation of the Strategic Petroleum Reserve.

these schools asserted that government intervention would lead to a misallocation of resources if government intervened in the economy – so-called ‘government failure’.

These intellectual attacks on government intervention were reinforced in the 1970s because macro-economic management which had previously delivered economic growth and full employment now failed to produce in a world of economic downturn coupled with extensive factor price instability. Supply-side and monetarist economic analysis attacked Keynesian macro-economic intervention. The internationalization of macro-economic stabilization after the collapse of the Bretton Woods system of monetary/exchange rate management also reduced the scope for independent government intervention. In the Third World, the obvious failure of many economies to deliver led to the conclusion that the lack of expected convergence was the result of government intervention. There was also concern that state intervention in developing countries led to ‘crony capitalism’ which further undermined the economy’s performance.

During the 1980s, these views coalesced into what became (disparagingly) called the ‘Washington Consensus’. Because of the Third World debt crisis of the 1980s, the prime missionaries of this position – the International Monetary Fund (IMF) and the World Bank – found themselves in a uniquely powerful situation to impose such views. When the Soviet Union collapsed, the story appeared complete. The result was privatization, deregulation and general liberalization. State-owned enterprises became viewed as dinosaurs requiring a helping hand into extinction. Reducing state intervention was seen as an undisputed requirement. Thus as the oil price began its inexorable rise after 2002, there was an innate opposition within many governments to intervene in the way they had done following

the oil price shocks of the 1970s. As will be seen in section 4, this was crucial since conservation, fuel-switching and increasing energy supplies are all areas riddled with market failure which requires government to intervene. Left to the market they will not happen, or at best happen very slowly. In addition, many of the necessary interventions are politically unpopular.<sup>32</sup> Thus in the current situation there has not yet been any significant government intervention to reduce demand or increase supply.<sup>33</sup> A key question to be addressed below is what it will take to force governments into action in terms of energy markets.

There have also been a number of major changes in the ideological and intellectual thinking which guides investment decisions in the oil industry. First, many in the IOCs have become wary of getting their fingers burnt by the cyclical nature of the industry. The danger in investing a lot at the height of what might be a cycle is that it could lead to over-capacity and falling margins. Thus investors need to be convinced that some form of structural change is occurring in the industry, rather than just a phase in the cycle. This is reinforced by the economist’s notion of the ‘fallacy of composition’. This is where the outcome of a decision is different if one individual makes it rather than a large number of people. A good current example relates to the decision on whether to invest more in refinery upgrading capacity. The margins on upgraded refineries have been much better than on simpler configurations in recent years, reflecting a shortage of upgrading kit. The temptation is therefore to invest in more such kit. However, if everyone invests, then the refineries develop surpluses and return to the bad old days of poor or even negative margins. On the other hand, there are first-mover advantages to be had. Thus there is invariably a stand-off as potential investors eye each other to see who will move first.<sup>34</sup>

32 One only has to look at the widespread protests in Europe at higher prices for transport fuels.

33 What ‘interventions’ there have been can only be described as ‘gesture politics’ aimed at giving the impression that ‘something is being done!’. The Jeddah Conference in June 2008 between the oil consumers and exporters provides an excellent example (MEES 51: 26, 30 June 2008). One possible exception to this is the decision by President Bush on 14 July to lift the presidential ban on leasing acreage in the US Outer Continental Shelf for oil and gas exploration, although this has led to a major row within Congress.

34 A classic example of this occurred in the mid-1990s when it was realized that the VLCC tanker fleet was rapidly ageing but tanker owners were reluctant to invest, given the memory of the huge excess capacity which emerged in 1974 and wiped out tanker profitability for over ten years.

Two other key changes in investment thinking which were not relevant in the 1970s relate to the discovery by IOCs of 'value-based management' as a financial strategy and the discovery by elements in producer

governments of 'principal-agent' analysis and the existence of 'resource curse'.<sup>35</sup> This raises the issue of the investment story which is central to the hypothesis of this report.

<sup>35</sup> These essentially technical terms will be explained below.

# 3. The investment story

## (a) Expectations

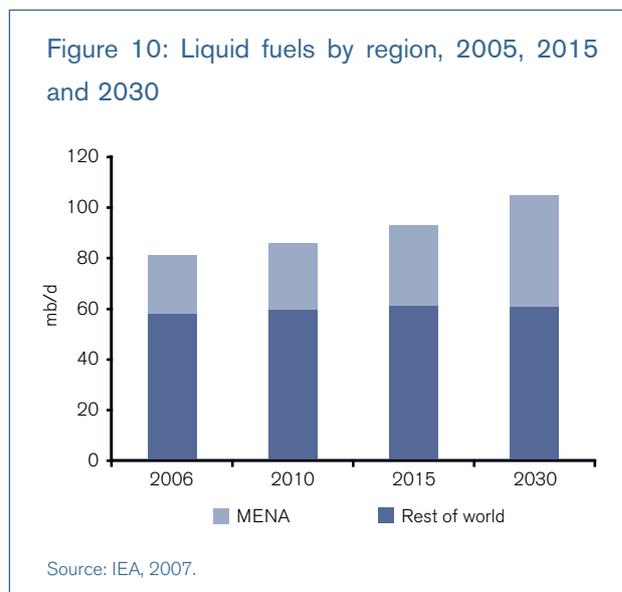
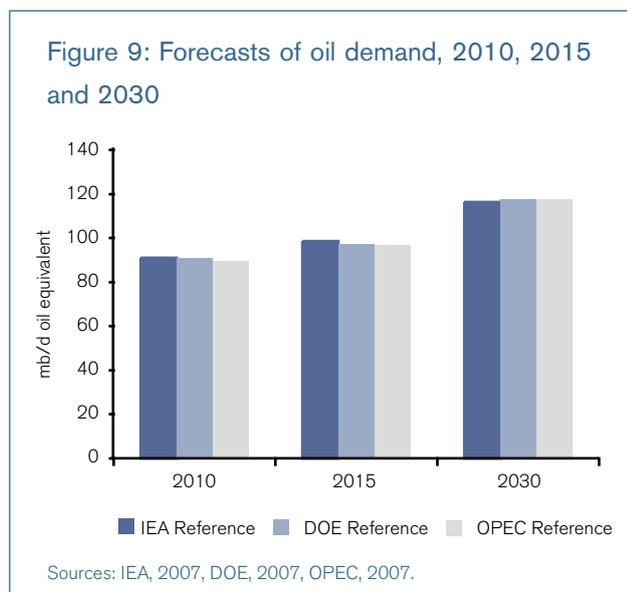
Figure 9 illustrates the current conventional thinking about what is expected of the oil producers. It shows the reference case scenarios<sup>36</sup> for three forecasts, from the International Energy Agency (IEA), the US Department of Energy (DOE) and the OPEC Secretariat.<sup>37</sup> To give a starting point, the 2007 production global oil production was 81.5 mb/d (BP, 2008).

Using the IEA forecasts, other aspects of this view of the future can be determined.<sup>38</sup> The vast majority of this

expected increase in liquid consumption will be in the form of 'conventional oil', with biofuels, unconventional liquids and oil from coal and gas accounting for relatively little of the supply by 2030. The IEA projects in its reference case that by 2030 these unconventional liquids will account for only 9% of the total (IEA, 2007).

Figure 10 illustrates that the majority of this growth in demand for liquid fuels is expected to be supplied from the Middle East and North Africa (MENA). Herein lies the problem at the heart of this report.

The numbers in Figure 10 are not forecasts. They are simply arithmetic. Thus the forecasters, at great length and in considerable detail, consider future energy demand. They then, with similar rigour, examine Non-OPEC supply options. Subtracting this supply number from the demand number gives a residual which OPEC and especially the MENA region is expected to supply. There is virtually no discussion of the willingness or ability of the producers to invest in order to be able to produce at this level. The willingness and ability of oil producers, whether IOCs or NOCs, to deliver on these numbers must be in question. It is this which creates the argument of an impending 'supply crunch'.



36 The 'reference case' for all three forecasts can be thought of as a 'business as usual' future.

37 It must be a matter of concern that the three forecasts are so very close together. Such clustering gives little confidence in their likely outcome.

38 Using either of the other two sources would produce relatively similar results.

## (b) Willingness

### (i) IOCs

A new element which has emerged in the IOCs<sup>39</sup> since the early 1990s is the development of a financial strategy derived from ‘value-based management’, whereby the performance of a company is measured by the return to the shareholders. The concept was developed at a theoretical level in business schools and universities in the 1970s and 1980s in the context of work on the corporate cost of capital (Brealey and Myers, 1988). It started to be widely used by the IOCs in the late 1980s and early 1990s. The underlying idea is that if the company cannot perform better (in terms of shareholder value) than competing firms, then the company should return money to the shareholder who can employ it more productively. The return to the shareholder is the dividend paid on the share plus any capital appreciation on the share price. The greater the value to the shareholder, the better is the performance of the company.

Following the oil shocks of the 1970s, the IOCs found themselves with very large surpluses of funds. While much of this was wasted on diversification into other energy sources, minerals and a variety of economic activities ranging from supermarkets to hotel chains,<sup>40</sup> much was also put into exploration and development. This led in the 1980s to the rise of Non-OPEC supplies.<sup>41</sup> Recently, however, driven by ‘value-based management’ strategies, the IOCs have been returning money to their shareholders rather than investing. In 2005, the six largest IOCs invested \$54 billion but returned to their shareholders \$71 billion.<sup>42</sup> This process of returning funds has been reinforced for the following reason:

Towards the end of the 1990s, oil companies’ failure to deliver satisfactory investment returns triggered massive pressure for restructuring, strategic change

and improved financial performance ... [this led to] ... heavy focus on production growth, cost-cutting, operational efficiency and short term profitability. (Mohn and Misund, 2008, p. 2)

In reality, returning funds to the shareholders is an entirely understandable and rational reaction by the IOCs, which are finding it increasingly difficult to match their required rates of return – a situation aggravated because they are unable to access most of the world’s low-cost oil on reasonable terms. As far as future supply growth is concerned, this aggravates an already difficult situation because of the collapse in exploration budgets in the IOCs after the oil price collapse of 1998. Thus ‘the share of exploration spending in total E&P investment has been cut back substantially since 1990’ (Mohn and Misund, 2008, p. 2).<sup>43</sup>

### (ii) NOCs

As for the willingness of the NOCs to invest in capacity, this is driven by the **states’ depletion policies**. Figure 11 illustrates the nature of the depletion choices facing any government which suspects it has hydrocarbon resources.

The first choice concerns protection of the national hydrocarbon wealth. Two issues are involved here. The first is ensuring that the resources are produced to maximize the recovery factor. This is normally described in upstream oil agreements as ‘pursuing good oilfield practice.’ The concept is essentially a technical matter to do with natural decline rates and recovery factors. The second issue is ‘optimizing’ the resources and is concerned with the hydrocarbon depletion policy of the country. Any depletion policy involves choices made by the government as the owner of the sub-soil hydrocarbons.<sup>44</sup>

The first choice (1 in Figure 11) – is whether to produce the oil now or later. If production is postponed, this choice earns a rate of return which will be positive if the future

39 The IEA estimates that of world oil reserves, 28% are controlled by the IOCs and 72% by the NOCs, while for production the figures are 50% for both (IEA, 2007).

40 Gulf Oil – one of the ‘seven sisters’ now no longer in existence – actually bought a circus.

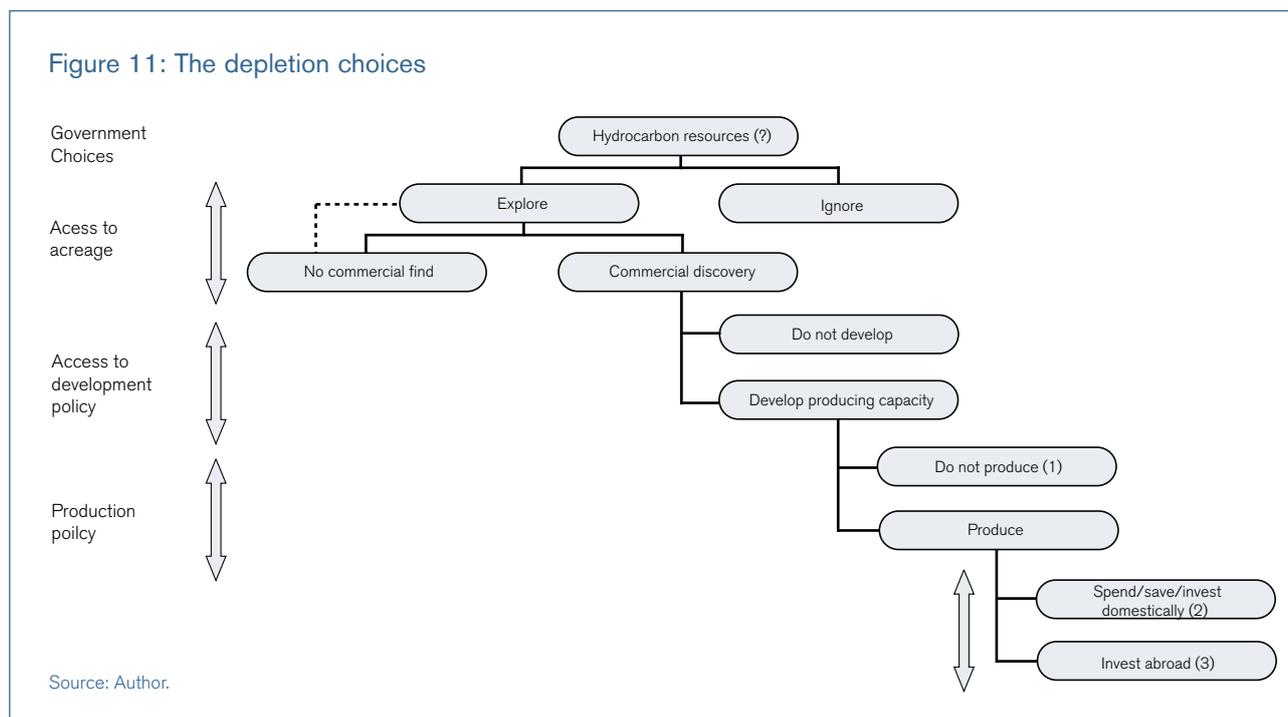
41 Non-OPEC excluding the FSU increased production from 18.2 mb/d in 1972 to 28.5 mb/d in 1986 (BP, 2008). This was an important part of the market story leading to the 1986 price collapse since the growth was at the expense of OPEC production and explains the growth of surplus capacity seen in Figure 1.

42 Source is based upon private information. When the size of this return to shareholders was pointed out to one IOC by the author, the response was ... ‘What do you want us to do, buy circuses?’

43 Thus the nine largest non-Russian integrated IOCs in 1997 spent \$14 billion on exploration. This fell steadily, reaching \$7.5 billion in 2004 (Stevens, 2008).

44 In the US sub-soil minerals are the property of the landowner although often this is the Federal or State Government.

Figure 11: The depletion choices



rent from the barrel is higher than today's, either because oil prices have risen or because production costs have fallen, or both. If the oil is produced today, then the choices are either to invest the revenue domestically (2 in Figure 11) or to invest it abroad (3 in Figure 11) through some form of oil fund.<sup>45</sup> Investing domestically will earn a rate of return, although how much will be a function of the government's ability to use the revenue productively and wisely and avoid attacks of 'resource curse'. Investing abroad also earns a rate of return, although how much will be a function of how well the fund and its portfolio are managed and whether the assets are secured from political interference from other governments which may control their investment context.

Optimizing the depletion policy is choosing a course of action by the government which maximizes the return given the three options.<sup>46</sup> Currently there appears to be a growing view among major producing countries that option 1 (i.e. leaving it in the ground) is the most attractive. This is causing many producer governments to revisit their capacity plans.

For example, in Algeria, where the Hydrocarbon Law of 2006 appeared to be aimed at constraining the IOCs, the oil minister announced in July of that year that the country no longer wanted additional revenue. Algeria's debt had been repaid and there was a fear that more revenues would simply induce an attack of 'resource curse' (MEES 49: 28, 10 July 2006). The only exception to the 'leave it in the ground' approach among large oil exporters appears to be Saudi Arabia, and even here the oil minister indicated in public on a number of occasions during April 2007 that there were no plans to go beyond 12.5 mb/d.<sup>47</sup>

## (c) Ability

### (i) IOCs

Leaving aside willingness, the IOCs' abilities to increase production face several constraints. As already indicated, a key problem is their **inability to access low-cost reserves**. Over 50% of global proven oil reserves are in four

<sup>45</sup> Of course, these three options are not mutually exclusive.

<sup>46</sup> The role of the NOC in determining the depletion policy will vary between countries. At the very least the government will need to consult the NOC on what is technically feasible to produce both now and in the future.

<sup>47</sup> Following the Jeddah Conference in June 2008 there were some indications that this may not be the case – see section 3e(i).

countries – Iran, Iraq, Kuwait and Saudi Arabia (BP, 2008). All four are effectively off-limits to the IOCs: Saudi Arabia because there is a deliberate decision to exclude them; Iraq because of the poor security situation and the lack of a coherent oil law;<sup>48</sup> Iran and Kuwait because although the official policy is to welcome IOCs, the process has fallen foul of domestic politics.<sup>49</sup> At the same time, growing resource nationalism and a revival of the ‘obsolescing bargain’ within many oil-producing countries is further limiting their access to acreage (see section 3b).

A further constraint is a **shortage of managerial capability** in the IOCs. One of the consequences of ‘value-based management’ has become an obsession with maximizing share prices. A key tool in this pursuit is trying to cut costs and reduce working capital. One result has been the shedding of manpower on a massive scale. It has been estimated that since 1981 the 25 largest IOCs have got rid of almost one million workers (Stevens, 2008). Thus even if the IOCs decided to invest funds rather than returning them to the shareholders, they would struggle to mount the management teams internally to run the projects. Today the real corporate constraint for IOCs is manpower rather than capital. This is likely to get worse in the near future. It has been estimated that within the next ten years half the current workforce of the international oil industry will retire (MEES 51: 28, 14 July 2008).

Finally, as indicated earlier, the whole industry has been suffering from serious shortages of capacity in the service companies which actually do much of the work. This, linked to the general increase in factor prices across the board for inputs such as steel, means new projects have become horribly expensive, and many have been put on hold in the hope that future conditions will be more favourable. A recent IHS/CERA Upstream Capital Cost Index has suggested that upstream costs for developing new oilfields have more than doubled in the last four years

(Yergin, 2008). Some elements of cost have increased even further. A deep-water drill ship costing \$125,000 per day in 2004 today costs more than \$600,000 per day – even assuming there is one available (Yergin, 2008).

#### (ii) NOCs

A number of factors limit the NOCs’ ability to increase capacity and produce more oil. The first relates to a new set of ideas related to ‘**principal-agent analysis**’, which began to emerge in the 1980s as a way of thinking about how state-owned enterprises such as NOCs would behave. This analysis examines the behaviour of the ‘agent’, which in this context is the management of the NOC, and the ‘principal’, which is the controlling ministry.<sup>50</sup> The ‘agent’ is assumed to be involved in ‘rent-seeking’ behaviour. This is absorbing the resources of the NOC for the benefit of the employees. Thus agents will seek better working conditions, trips abroad, more layers in the hierarchy to allow for greater opportunities for promotion etc. Often rent-seeking, which is perfectly normal and legitimate behaviour, converts into corruption, which is not legitimate. Rent-seeking is especially important in the public sector where the solution of simply paying employees more is constrained by public-sector pay scales.

The central question is why the principal allows the agent to get away with rent-seeking behaviour. The simple answer is that there exists information asymmetry between the principal and the agent. Thus only agents can know the full and true costs of whatever they are producing. The actual analysis is complex and sophisticated;<sup>51</sup> what is described here is a very simplified version. The real issue is one of people’s perception of the analysis rather than the analysis itself. This author’s personal observations are that the finance ministries of many of the oil-producing countries are full of bright young PhDs who have returned from a number of years in Western univer-

48 Although several IOCs are negotiating technical service agreements (TSAs) with the Southern Iraqi Oil Company to provide technical assistance (MEES 51: 27, 7 July 2008), this is a long way from actually getting any serious access to reserves. The IOCs have only agreed to such deals in the hope of securing future preferential treatment when (and if) the institutional set-up of the Iraqi oil sector is sorted out. This is almost exactly the same process which led them to sign similar agreements in Kuwait after the liberation in 1991. In that case, they are still waiting for Project Kuwait to approximate to a reality.

49 In Iran the growing pressure of sanctions is not helping and on 10 July 2008 Total announced that it was pulling out of its Iranian operations because it viewed the country as ‘too politically risky’ (<http://news.bbc.co.uk/1/hi/business/7498902.stm>).

50 In many oil-producing countries the oil ministry has been ‘captured’ by the NOC and it is therefore the finance ministry that effectively becomes the controlling influence.

51 There is a large literature on ‘principal-agent analysis’; for example, see Stiglitz, 1987.

sities where they have learnt all about ‘principal-agent analysis’ and as a result hold a strong belief that their NOC is high-cost and inefficient. In their view, if it is given more resources it will simply waste them and at best produce high-cost results. Thus many NOCs are being starved of financial resources which seriously inhibit their ability to develop their producing capacity.<sup>52</sup>

Another limiting factor is the **rise of resource nationalism** already discussed. Many of the NOCs are far from effective and require the sorts of skills provided by the IOCs. Yet the presence of resource nationalism linked into a general outbreak of the obsolescing bargain means the NOCs are unable to take advantage of what the IOCs can offer. However, this argument needs to be treated with care and raises the issue of what the IOCs actually contribute. Much of the ‘work’ needed in the oil industry is in fact not done by the IOCs. Thus activities such as seismic, drilling, field developments and construction are done by service companies. These can be (and are) hired by the NOCs. However, potentially the IOCs still have a role.<sup>53</sup> What they remain good at is managing large projects which require coordination of the service companies. At the same time, they can manage the risks of the projects which can be very large indeed. Some NOCs can also fulfil this role but many cannot. If, therefore, the IOCs are excluded because of resource nationalism, this will inhibit the ability of many producers to expand their producing capacity or indeed maintain it at its current level.

A third constraint on many oil producers’ ability to expand production is created by **the structure of the oil sector**, which refers generally to the governance of the sector (Myers et al., 2006). This should be such that it is conducive to investments and to efficient oil and gas production. However, closer examination of the structure of the petroleum sector in many cases points to deficiencies (ESMAP, 2007).

The key is the objectives applied to the sector and how those will be achieved through the interaction of multiple players (government entities, NOCs and subsidiaries, IOCs, other private investors, etc.). Whether public or private, petroleum-producing firms are likely to maximize their revenues from petroleum production and sales; but this target may conflict with the goals of the government, which may prefer to increase its own fiscal revenues for non-oil purposes, or even allocate part of the oil rent in subsidizing energy prices for domestic consumption, or in encouraging labour demand from the petroleum sector.

The greater the number of players and the more fragmented the responsibilities, the less likely are cohesion and strategic clarity to be driving the sector’s supply. This is especially relevant where the state and its institutions dominate the operations. If the private sector was the key operator, then the discipline of the market would be likely to improve clarity and coherence by focusing the players on finding a balance between revenue maximization for the firms and for the government. The danger is that an absence of clarity and coherence leads to policy paralysis, and an inability to mitigate the risks of state capture by the NOC or the risks of under-investment in the development of production and petroleum resources by the NOC (as rents are allocated outside the NOC, for example to energy consumers through subsidized prices).

Clarity of responsibilities related to regulation and operation of the sector is essential but often absent. Regulation of the upstream operation can range from technical inspection to overseeing financial transactions and monitoring licensing rounds to prevent corruption or anti-competitive practices. It is generally agreed that the optimal solution is to allow operators to operate and regulators to objectively determine compliance (Myers et al., 2006), but this is not always the case.

52 It is interesting to note that Bernard Mommer, currently Hydrocarbon Vice-Minister in Venezuela in the government of Hugo Chávez, has been writing about ‘principal-agent’ problems with NOCs for some time (Mommer, 2000). Arguably this influenced the thinking behind Chávez’s initial election promise in 1998 to force Petroleo de Venezuela SA (PDVSA) to divest itself of all its overseas downstream assets. Operating abroad is a classic means to deepen the information asymmetry between ‘principal’ and ‘agent’. The experience of Saudi Arabia is also interesting in that within the Finance Ministry there is strong support for the view that Saudi Aramco is becoming high-cost and inefficient (personal information). This explains the ministry’s support for the attempted opening-up of the Saudi upstream operation to the IOCs in 1998 (Robins, 2004). However, by order of successive kings, Saudi Aramco has been protected from the impact of such views and does not face capital constraints in the way other NOCs have done.

53 The future role of the IOCs is the source of much discussion and debate (Stevens, 2008).

Conflicts of interest between government and operator hamper the sector. Links between the regulator and the ministry can be controversial. Of special note is the frequent conflict of interest that emerges when the oil minister is on the board of the NOC. The two hats worn are those of sovereign owner (on behalf of the citizens) and those of company shareholder seeking profit and value creation.

Governments have an interest in clarifying the sector's objectives and priorities in a number of ways: broad supply capacity expansion target; role of private sector; long-term fiscal contribution of sector; domestic energy pricing principles; or share of production allocated to domestic energy markets. Producing countries exhibit different policy objectives, all focusing on national interest and often trying to reduce the risks of revenue decline to the government. In terms of the upstream operation, in many countries the objectives were driven predominantly by the need to arrest and reverse declining crude export volumes. In others, the driver was anticipated problems with production as the geology of the existing fields became more complex.

To assess the oil sector's performance, transparency of data between the government and the operator in terms of operational but above all financial information is key but is frequently absent. This disguises fundamental problems with the sector. A consensus has emerged that what is required is internal financial transparency between the oil ministry, the ministry of finance and the NOC. There is a need for clear delegation of responsibilities within the sector; for the development of capable regulatory institutions; and finally for the means to enforce regulations within the sector, leading to greater accountability. However, in many of the producers achieving these conditions is extremely difficult and it is clear that the sector structure inhibits the ability of the sector to deliver on its geology.

A final issue relating to the ability to deliver on geology concerns **domestic oil consumption**. The world oil markets are interested in the oil exports from the producing countries rather than their actual production levels. Therefore domestic consumption is an important factor.

Most of the major oil exporters within OPEC continue to subsidize their domestic oil product prices. The result is that domestic oil consumption has been growing strongly and there is little sign of the rising international prices slowing this trend. Thus between 1999 and 2007 Middle East domestic oil consumption grew on average 3.9% per year. This compares with the OECD growth rate of 0.4% and the non-OECD non-Middle East growth rate of 3.1%. Saudi Arabia's domestic consumption in this period averaged 4.6% annual growth. Thus for many of the major oil producers, rising domestic consumption is seriously inhibiting their ability to increase their exports of oil into international markets (Mitchell and Stevens, 2008).

#### (d) The evidence of inadequate investment

So far, the argument that the oil producers, with the exception of Saudi Arabia, will fail to deliver on their geology as a result of inadequate investment is assertion based upon a *priori* reasoning. There is, however, evidence to support this assertion. Table 1 shows the IEA's various estimates of sustainable capacity in OPEC-10.<sup>54</sup> The starting point is the November 2005 *Oil Market Report* which catalogued the IEA's detailed estimates of OPEC-10 capacity plans for 2005–06 based upon discussions with the relevant government. These are effectively OPEC governments' official estimates of capacity expansion plans. They implied an increase in OPEC-10 crude capacity of 2.57 mb/d by the end of 2006.

Table 1: IEA estimates of OPEC-10's crude capacity (mb/d)

	OPEC-10	Saudi Arabia
November 2005 projected to end 2006	31.86	10.95
January 2007 estimate of actual capacity	30.11	10.08
January 2008 estimate of actual capacity	30.13	9.06
June 2008 estimate of actual capacity	30.10	10.65

Source: IEA monthly *Oil Market Reports*.

<sup>54</sup> The IEA defines sustainable capacity as capacity which can be reached within 30 days and sustained for up to 90 days.

Clearly, OPEC is failing to meet its own targets on capacity expansion for crude oil.<sup>55</sup> This view is supported by any reading of the trade press. Thus OPEC's recent claim in its latest *World Oil Outlook* (2008) that OPEC will invest \$160 billion between now and 2012 to expand producing capacity by 5mb/d from 2007 looks extremely ambitious. Even Saudi Arabia, whose record on capacity expansion plans has been superb, is facing questions over its ability to deliver. The Khursaniyah expansion, which was due on-stream at the end of 2007, is now expected in mid-2009. Furthermore there have been 'widespread reports of delays on start-up targets for the majority of its upstream program' (MEES 51: 25, 23 June 2008, p. 1).<sup>56</sup>

Table 2: Forecasts and actual outcomes of Non-OPEC oil production, 2004–08 (mb/d)

	Forecast at start of year	Outcome
2004	1.10	0.82
2005	1.00	-0.21
2006	1.20	0.16
2007	1.60	0.23
2008	1.10	0*

Sources: Forecast: see text. Outcome 2004–07: BP, 2008.

\*Outcome as of June 2008: IEA monthly *Oil Market Report*, July 2008.

This disappointing performance also applies to Non-OPEC, reflecting poor IOC investment levels. Table 2 shows the estimates of eight forecasters of expected growth in Non-OPEC supply at the start of each year. These forecasts come from a number of publicly available sources such as the IEA, the US DOE and OPEC, together with those from a number of analysts, some publicly available and some available only on subscription. The actual outcome clearly shows a failure to deliver on expectations as projects have been delayed. Part of the reason for this poor performance is that the natural decline rates in the OECD fields have taken analysts by surprise. Furthermore

in many of the deep-water fields where much of the new Non-OPEC capacity is coming on-stream, maintaining production is difficult because operations such as in-fill drilling are much more complicated and far more expensive than in traditional oilfields.

There is also a growing literature on the change in investment patterns by the IOCs since the oil price collapse of 1998. One study concludes:

Tight market conditions have resulted in high oil prices over the last few years. However, exploration and production among international oil and gas companies has remained stagnant ... Our analysis suggests that increasing pressure for improved financial performance... [has]... tilted the balance of management attention from long-term reserves and production growth to short term earnings. In other words, we suspect that the management of oil and gas companies temporarily became more myopic. (Osmundsen et al., 2007, p. 473)

Thus the evidence appears to support the *a priori* reasoning developed in this report that overall, investment in developing oil supply is inadequate and likely to remain so for the foreseeable future.

## (e) The implications

### (i) The numbers

The argument of the report so far is that in the near future, the industry will find its spare capacity to produce crude oil eroding close to zero and therefore any subsequent outage would trigger a price spike. However, it is necessary to add some numbers to this assertion, if only to establish some sort of timescale. To that end, some estimates of future demand and future supply capacity are needed. This is clearly a very controversial area and what follows is a classic 'back-of-the-envelope' calculation designed only to

55 It is also failing to meet its target for natural gas liquids (NGL) production. The November 2005 *Oil Market Report* gave an expansion in OPEC NGL capacity of 0.6 mb/d by the end of 2006, which would have made end-2006 NGL capacity 5.4 mb/d. By the first quarter of 2007 production was only 4.8 mb/d and even by the second quarter of 2008 it had only managed 5.0 mb/d.

56 To be fair, at the Jeddah Conference in June 2008, Saudi Aramco vehemently denied such claims (MEES 51: 26, 30 June 2008).

Table 3: Assumptions for demand and supply capacity (mb/d)

	2007	2008	Assumptions post-2008
<i>Demand</i>			
Normal OECD	49.1	48.6	+0.5% average 2005–08 = -0.4%
Normal Non-OECD	36.9	38.1	+3.6% average 2005–08 = +3.6%
Normal total	86.0	86.7	
Low OECD	49.1	48.6	0% average 2005–08 = -0.4%
Low Non-OECD	36.9	38.1	+1% average 2005–08 = -0.4%
Low total	86.0	86.7	
<i>Capacity</i>			
Saudi Arabia	8.5	9.0	Reaches 12.5 in 2009 then flat
Iraq	2.1	2.1	Flat
Rest OPEC-10	20.1	20.1	Flat
FSU	12.8	13.1	Flat
Non-OPEC	37.2	36.9	-1.29% = average 2005–08
OPEC NGLs	4.8	5.1	+5% = average 2005–08
Total capacity	85.5	86.3	

Source: Data for 2007–08 – IEA monthly *Oil Market Report*, July 2008. Assumptions – see text.

give orders of magnitude rather than precise figures. The basic historical data are taken from the IEA and can be viewed as being as good as any others available.<sup>57</sup>

Demand is given as a range which shows an annual growth rate of between 1.6% and 1.7% after 2008 for the ‘normal’ projection and 0.4–0.5% for the ‘low’ projection. This compares with an actual annual average from 2005 to 2008 of 1.2% (on a steadily declining trend of 1.6% in 2005 to 0.68% in 2008). It is clear that higher prices are causing demand to slow, with an expected lag given that it takes time to change the nature of the fuel-burning appliances away from oil or to use less oil. For example, much of the fall in oil demand experienced in the four years after 1979 was a lagged response to the first oil shock of 1973–74 (Stevens, 2000). The only exception, as already discussed, is in areas where product prices continue to attract subsidies, such as in

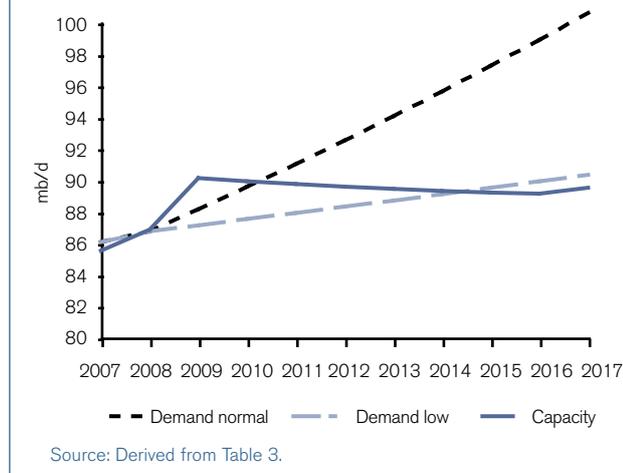
the major oil-producing countries and in China and India. The assumed range of demand is given by the dotted lines in Figure 12. In the sort of time period being considered in this report – five to ten years – only an economic recession could slow oil demand growth and it would take a major recession to actually reduce demand.<sup>58</sup> These demand assumptions are not too far out of line with others. For example, the latest OPEC *World Oil Outlook* (2008) medium-term oil market reference case suggests oil demand will grow from 84.7 mb/d to 92.3 mb/d in 2012 and 96.1 mbd in 2015 (MEES 51: 28, 12 July 2008). The ‘normal’ case underlying Figure 12 gives demand in 2006 as 84.8 mb/d and in 2012 as 92.5 mb/d, rising to 97.2 mb/d in 2015.<sup>59</sup> The demand projection also assumes there will be no major policy changes in the OECD aimed at lowering oil consumption other than those either in place or in the process of being put in place.

57 Although this is true of the historical data, the IEA’s forecast data are far more controversial. In particular, its short-term forecasts in the *Oil Market Reports* have been shown to be very unrealistic. For example, in January 2007 it projected non-OPEC supply for 2007 at 52.3 mb/d. In reality the outcome was only 50.5 mb/d. Many more examples could be cited.

58 It is worth remembering that in the Asian financial crisis of 1998, global oil demand still grew by some 340,000 b/d (BP, 2008).

59 Figure 12 also shows a surplus of supply capacity before 2010. However, given that most of this is located in one producer, Saudi Arabia, it should present no problem to control and avoid the threat of any major fall in price.

Figure 12: Estimates of future demand and supply capacity



The supply capacity assumptions are more controversial.<sup>60</sup> It is assumed that Saudi Arabia reaches its capacity target of 12.5 mb/d in 2009 but capacity thereafter remains flat. In 2007, Ali Naimi, the oil minister of Saudi Arabia, publicly stated on a number of occasions that there was no reason for the Kingdom to go above 12.5 mb/d capacity. However, at the Jeddah Conference in June 2008 he said that it could consider going to 15 mb/d subject to ‘conditions on demand’ (MEES 51: 26, 30 June 2008). As for Iraq, the rest of OPEC-10 and the FSU, their crude production capacity levels are also assumed to be flat after 2008, reflecting the consequences of the arguments developed in section 3. This can obviously be challenged.<sup>61</sup> There are bits of new capacity coming on-stream in Angola, Nigeria and Qatar. Iraq recently has also managed to produce more and may manage to increase capacity further if security conditions improve and the technical service agreements become operational. But, at the same time, Indonesia is on a decline and plans to leave OPEC, and there are signs that Iran and Venezuela are struggling to maintain current capacity levels. The FSU could easily produce more but all the signs suggest that Moscow is less than keen to get ever more oil revenues and risk an attack of ‘Dutch disease’,

which would wipe out the gains in the non-hydrocarbon economy resulting from the rouble devaluation in 1998.

As for Non-OPEC supply<sup>62</sup> outside the FSU, this is assumed to decline at  $-1.29\%$  per year, which is the average decline rate from the period 2005–08. Again this can be debated. OPEC’s *World Oil Outlook 2008* projects Non-OPEC, including Russia but excluding non-conventional and natural gas liquids (NGLs), to increase by 3.1 mb/d from 2006 to 2012 but thereafter to increase only by 0.3 mb/d to 2015 and then to continuously decline. Clearly some Non-OPEC countries or regions, such as Brazil, Canada and the Caspian, will increase supply, but at the same time the mature OECD fields are experiencing steep declines. For example, in Norway the decline has increased steadily from  $-2.5\%$  in 2002 to  $-8\%$  in 2007; in the UK it has fluctuated but has averaged  $-6.9\%$  since 1999; and in Mexico it has increased from  $-1.7\%$  in 2005 to  $-5.6\%$  in 2007 (BP, 2008). The supply of OPEC condensates and NGLs is projected to grow at 5% per year, reflecting the average growth rate during 2005–08. The resulting overall forecast for supply capacity is the solid line in Figure 12.

Obviously this supply capacity forecast is an extreme version of the argument about supply constraints. However, even allowing for some increase in capacity over the next few years, a crunch appears likely before 2014. The message is clear. As the oil market approaches the end of this decade, spare crude producing capacity moves closer to zero. Any supply outage would therefore create a supply crunch. There can be endless speculation about what might trigger such an outage. Sadly, the Middle East currently offers a number of candidates including a potential Israeli attack on Iran, a deterioration of the situation in Iraq or a terrorist attack on oil facilities in Saudi Arabia, among many other possibilities. Even outside the region other threats loom, ranging from a cut-off in Venezuela to civil war in Nigeria to hurricanes and other potential accidents.

60 Given the methodology underlying the other forecasts, as explained in the Introduction, supply has to match demand.

61 OPEC’s latest *World Oil Outlook* (2008) is extremely optimistic about OPEC capacity and assumes it increases by 1.4 mb/d by 2012 from 30.9 mb/d in 2006 and by a further 3.2 mb/d by 2015.

62 It is assumed that Non-OPEC are producing to capacity, thus their supply is the same as their supply capacity. Non-OPEC in the IEA data also includes non-conventional oil and biofuels. Given that the supply of these fuels is expected to rise, this implies the decline in conventional Non-OPEC supply is greater than the overall percentage forecast implies.

(ii) The price implications

The implication of the supply crunch projected in Figure 12 is that it will quickly translate into a price spike. This requires qualification. The IEA carries at least 90 days' crude oil supplies in the form of stocks as part of its emergency response system. If well managed these could possibly alleviate or even offset the effects of the outage depending on its magnitude and likely longevity. However, the IEA's past record of using stocks to smooth markets has not been encouraging. On the last occasion, in February 1991 in the context of the first Gulf War and liberation of Kuwait, it significantly added to the consequent price volatility. Moreover, the system has never been tested in the face of a serious global shortage and it can be argued that in that event it would be 'everyone for themselves' and the system would rapidly break down.

The problem in assessing what level the price spike might reach is to decide from what base it might occur. This requires a view of future oil prices. There is much misunderstanding of what has been driving oil prices ever higher since the start of 2007. Supposed culprits include excessive Chinese demand, refinery shortages and speculators, to name but a few. In reality it is more complex than this.

There are two markets for crude oil: the wet barrel market where producers sell and refiners buy physical oil,<sup>63</sup> and the paper barrel market where promises are made to exchange oil in the future. In the 1980s, the paper market began with unregulated forward markets. However, now most attention is given to formalized regulated futures markets such as NYMEX trading West Texas Intermediate (WTI) in New York and the Intercontinental Exchange

(ICE) trading a Brent blend in London. The links between wet and paper barrel markets are complex, the most obvious being the fact that the WTI contract, if not covered by another paper transaction, ultimately involves exchanging a wet barrel of WTI at Cushing in Oklahoma. However, it is possible to characterize the linkage in the following way. The paper market provides the signals which set the price in the wet barrel market. It does not set the price *per se* but indicates a starting point for discussion of the numbers in the contract. Perceptions in the paper market about the state of the wet barrel market in terms of surplus or shortage inform behaviour which creates the paper barrel price. Perceptions of shortage, current or impending, will push the price up, and perceptions of surplus will push the price down.

Since 2002, there have been a number of occasions when the paper market has misread the signals in the wet barrel market, leading to a disconnection when the price in the paper market fails to reflect the reality in the wet barrel market. This is partly because the 'money managers'<sup>64</sup> of the paper market do not understand the oil industry.<sup>65</sup> For example, an argument heard by this author when asking the money managers why they are pushing up oil prices is that 'there is a shortage'. When asked why they think there is a shortage they reply 'because the price is rising!'<sup>66</sup> Furthermore there is little reason for them to understand the oil industry at any deep level since all they need to do, quoting Keynes's famous remark on currency traders in the 1930s, is 'to anticipate what the average opinion of the average opinion is likely to be'.

Each time the disconnection between paper and wet barrel markets has been realized there has been a sharp

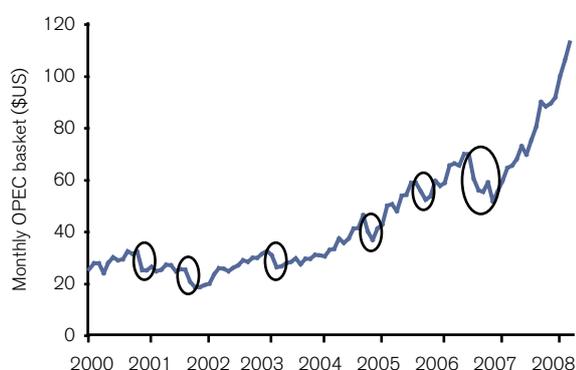
63 Some analysts call this 'the fundamentals'. However, this assumes that it is only the wet barrel market which matters when patently this is not the case.

64 This term is used in preference to 'speculators'. The reason is that speculators move in and out of the market on a short-term basis and thrive on price volatility. They push the price up and they push the price down. By contrast, much of the money going into paper barrel markets recently has been investments by the 'money managers'. This investment has in part been triggered because there are limited alternative investments for the money managers to make. Government bonds are unattractive and equity markets are in free fall. Oil and other commodities have become an asset class (Yergin, 2008). This author would argue this is not speculation as such but obviously there is a semantic argument to be had over the issue.

65 This argument needs to be handled carefully. Many of the financial institutions do have extremely good oil analysts who understand the industry very well indeed. However, it is questionable how much notice the money managers take of their analysts. Perhaps it can be argued that in recent years the understanding of the money managers has improved.

66 Often the money managers judge surplus or shortage by reference to the IEA stock data. However, low stocks may mean other things. Thus the industry may have moved to 'just-in-time' inventory management to reduce working capital, which involves holding fewer physical stocks. Or panic buying may have reduced the primary stocks held by the industry, pushing them into secondary and tertiary stocks. Only primary stocks are measured, giving the impression of 'lower' stocks when only the property rights have altered. Finally, if the future market is in backwardation – where the future price falls below the prompt price – there is absolutely no incentive to hold physical stocks instead of a piece of paper promising to deliver at a price below the current prompt price.

Figure 13: Oil price adjustments

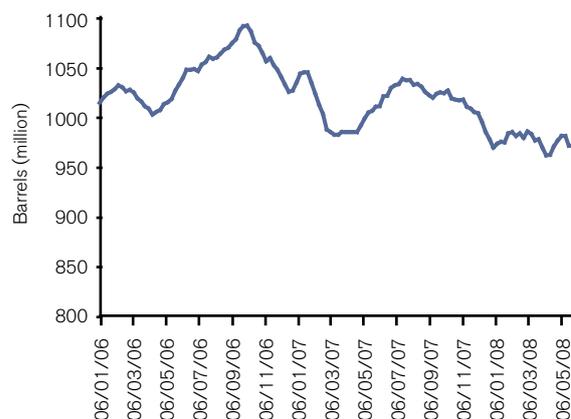


Source: OPEC Secretariat.

price adjustment, illustrated in Figure 13. On almost each occasion the price fell quickly by around \$10 per barrel from a peak of around \$30–40. At the end of 2006 prices quickly fell \$20 from a peak of \$70.

Since the start of 2007, there has again been a growing disconnect between paper and wet barrel markets. The money managers have been pouring into the paper market because of a perception of current and immediately impending shortages of oil in the wet barrel market. This behaviour, of course, creates a self-feeding cycle, which is reinforced by the apparent (but illogical) connection between dollar devaluation and rising oil prices. However, in reality, at present, the wet barrel market is comfortably supplied (despite the odd data blips from US stocks which are notoriously unreliable). As Figure 14

Figure 14: US oil industry stocks



Source: US Department of Energy.

Note: The data exclude the Strategic Petroleum Reserves. These have increased steadily from 688 million barrels on 5 January 2007 to 705 million barrels by 13 June 2008.

shows, US inventories are close to levels in recent years. Indeed the signs are that if nothing changes, inventories will rise in the second half of 2008, indicating an over-supply.

As in the past, when the paper markets realize this disconnect, there could in the near future be a sharp downward adjustment in price to reconnect paper and wet barrel markets. How sharp the adjustment will be depends upon the peak at the time and OPEC's reaction. Given the \$20 adjustment at the end of 2006 from a peak of \$70, a \$40 adjustment would be a possibility. Thus the base from which any supply crunch will lead to a price spike must be extremely uncertain. However, given recent price experience, a spike in excess of \$200 per barrel is not infeasible.

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## 4. Policy solutions and implications

### (a) Policy solutions to avoid the supply crunch

To avoid a crunch, energy policy needs to reduce the demand growth of liquid fuels, to increase the supply of conventional liquids or to increase the supply of unconventional liquids. Ideally it should be some combination of all three.<sup>67</sup> However, when discussing policy it is important to remember the long lead times between applying any policy instrument and any significant supply or demand responses. Only extreme policy measures could achieve a speedy response<sup>68</sup> and these are usually politically unpopular. It would therefore require some form of crisis to allow such policy measures to be introduced – an issue developed below.

To reduce liquid fuel demand requires either greater efficiency or fuel-switching. In reality, both would probably take too long to be effective in the time frame suggested by this study.<sup>69</sup> Only a major recession in the short term could reduce demand growth and even then the probability is that this would merely delay the supply crunch.

Increasing supplies of conventional liquids requires persuading IOCs and NOCs to invest more in expanding crude producing capacity, and producing it. IOCs can be encouraged to increase investment by improved fiscal terms and perhaps by governments helping to open up acreage. In the US this would involve removing current restrictions on drilling offshore and in the Alaskan National Wildlife Refuge.<sup>70</sup> In other areas it might involve increasing the size and frequency of licensing rounds for exploration acreage. It might also require the US and the EU to try to pressure some countries to open up their upstream operations, although this would be controversial in terms of interference in sovereignty. What would be important is for the host governments of the IOCs to avoid trying to achieve increased supply by intrusive regulation involving the IOCs. This would almost certainly inhibit IOC investment plans and simply create unnecessary distortions in the market.

For NOCs, perhaps there is the option of applying political pressure on the producers, as happened at the Jeddah Conference in June 2008. The result was that Saudi Arabia, at least, announced it would increase production (MEES 51: 26, 30 June 2008). However, examination of its pricing proposals for August 2008 suggests it has not moved from its basic position.<sup>71</sup> How realistic it is to expect sovereign governments to bow to such external pressure is a moot point. Another option could be to remove sanctions against some oil-producing countries, notably Iran, which could then help unleash that country's undoubted production potential.

Perhaps a more realistic and constructive policy option is to encourage a change in depletion policy to produce sooner rather than later. Here several possibilities suggest themselves. The first is to use the collective wisdom to

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67 Of course, this assumes governments see a price spike or trough as a 'bad thing'. It can be argued that extreme price volatility produces structural changes which serve other purposes. A price spike can help address security of supply and climate change issues. A price trough can discourage the entry of new sources of energy and reinforce OPEC discipline.

68 An obvious example in Europe would be to reduce the speed limits on the road, as the US did in response to the first oil price shock.

69 This is naturally not intended to imply that governments should not bother to try to encourage more efficient use of fuels. Even if the 'supply crunch' argument is rejected, climate change and security of supply concerns make such policies essential.

70 This would probably be unpopular. However, it is worth remembering the experience of the Trans-Alaskan Pipeline (TAPS) which was delayed from 1969 to 1977 by popular opposition. It took the aftermath of the first oil shock and the consequent higher prices and general sense of 'energy crisis' to sweep away this opposition (Yergin, 1991).

71 This has been that high prices are due not to physical shortages but to behaviour in the paper markets. The Saudis' argument has been that while they have offered more crude no one wants it. However, clearly if they refuse to lower prices, this is hardly surprising.

educate producer governments in ways to avoid ‘resource curse’, thereby making domestic spending of oil revenues more effective. This could involve creating independent<sup>72</sup> task forces to visit producing countries to help improve understanding of resource curse and how to avoid it and to build macro-economic management capacity. Another possibility could be for the recipient countries to make investments through sovereign wealth funds seem more attractive. This would require them to be far more receptive and reassuring about how secure such investments could be and how they could act as a hedge against what is likely to be a very significant price risk. They might attempt to develop something similar to the Energy Charter Treaty<sup>73</sup> to try to provide independent guarantees for sovereign wealth funds away from the whims of individual governments.

A further possible policy option would be to offer the OPEC countries a carrot to increase capacity and create some surplus capacity. This would involve bringing the OPEC producers into the IEA’s emergency sharing system. Thus their spare capacity could be viewed as part of the IEA’s inventories but they would be given first option to use this spare capacity in the event of a crisis. The other IEA stocks held by existing members would be kept back until OPEC’s spare capacity was exhausted. The price for this ‘membership’ would be a commitment by OPEC to maintain a degree of spare capacity. Such a system could also prove to be a sound business move. It is well known within Saudi Aramco that the Kingdom’s policy of maintaining spare capacity has proved to be extremely profitable because when that capacity is brought into play, it is inevitably at very much higher prices than before the crisis.

Encouraging new sources of liquid fuels is another option although this itself is controversial. Biofuels are already provoking a public backlash because of their alleged role in pushing up food prices and the doubtful claims regarding carbon emissions. Tar sands, oil shale and

coal-to-liquids all have environmental implications, not least in terms of their carbon emissions. Gas-to-liquids or compressed natural gas in the transport sector are much less controversial from an environmental perspective, but again the economics of such projects are debatable and they are also likely to suffer from long lead times.

However, as already emphasized, the big problem with any policy solution to avoid the possibility of a supply crunch is the time lag between applying the policy instruments and producing a result. In reality, the only possibility of avoiding such a crunch appears to be if a major recession reduces demand – and even then such an outcome may only postpone the problem.

## (b) Policy implications of a supply crunch

Any major price spike would carry a macro-economic impact which would itself provoke a policy reaction. However, it is possible to construct an argument about the policy implications deriving from a major sense of crisis engendered by a further sharp increase in oil prices. As already outlined, a major consequence of the oil shocks of the 1970s was significant government policy intervention in the energy sector. However, this was in a world which accepted such intervention as the norm. The influence of the ‘Washington Consensus’ in the 1980s and 1990s made such intervention increasingly undesirable. Arguably this goes some way towards explaining why the policy response to date in the OECD to the higher oil prices since 2001 appears to have been muted.<sup>74</sup>

However, as the twentieth century ended, this dominant ideology of non-intervention began to falter. A number of factors contributed. The Asian financial collapse of 1997–98 and the economic collapse of Russia in the summer of 1998 had a profound impact on thinking within the World Bank. Here were economies that had complied with all the measures required by the

72 ‘Independence’ implies not using the current international financial institutions such as the World Bank and the IMF which, rightly or wrongly, have a poor reputation in many emerging-market economies following their pursuit of the ‘Washington Consensus’ in the 1990s.

73 This is not to imply that the Energy Charter Treaty has been especially successful.

74 A good example of this is provided by the UK’s 2007 White Paper on Energy, which exhibits an obvious tension between the realization that the government must intervene in energy if the issues are to be addressed and the rhetoric of ‘leaving it to the market’.

‘Washington Consensus,’ yet they simply collapsed. At the same time, the ‘trickle down’ mechanism, whereby everyone benefited, appeared not to be working.<sup>75</sup> This disillusion with market forces was also linked into a growing anti-globalization movement, driven in large part by the sense of many in the emerging-market economies that they had seen little benefit from the process (Abdelal and Segal, 2007). In energy, many were beginning to question that such a strategic sector could simply be ‘left to the market.’ This view was reinforced by growing problems with power supplies, most spectacularly in California in 2002–03; growing concerns over climate change and the need to control greenhouse gas emissions; and rising oil and gas prices. State intervention in energy again started to become respectable for governments, although not yet with the same fervour as in the 1950s and 1960s.

It is quite feasible to argue that a supply crunch leading to an oil price spike would be sufficient to break down some of the last vestiges of opposition to a much greater interventionist approach by governments in their energy sectors.<sup>76</sup> If this coincided with a growing awareness and concern about climate change, it could strongly encourage intervention. Of course, this is not necessarily guaranteed to produce positive results. Certainly much

government intervention in the 1970s was ill advised and unhelpful. However, it seems clear that given the market failures associated with energy markets, governments must intervene to a much greater extent than they have so far been willing to do in this century.<sup>77</sup> For reasons already discussed, in recent years state intervention in other parts of the economy, especially in developing countries, has been in decline. Policy intervention in energy triggered by a supply crunch could well buck this trend and conceivably could even become the Trojan horse which gives greater government intervention a way back into the general economic policy mix. Of course the Trojan horse led to the fall of Troy, and it could be that greater government intervention might return us to the ‘bad old days’ when much of the intervention was ill informed, unhelpful and positively damaging. However, it may be that more government intervention, if done thoughtfully and intelligently, could actually help to improve the situation and manage the extensive market failures which characterize energy markets today. What is needed is intelligent and informed debates about which energy policy interventions are desirable and which are not, and on what basis such judgments should be made.

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75 For those with a sense of history, it will come as no surprise that exactly the same failure in the 1960s led to the gradual undermining of conventional development economics and the rise of the ‘Basic Needs’ development strategy (Hirschman, 1977).

76 A good example, relevant to this argument, is the fact that the tragic events of 9/11 enabled the US Administration subsequently to undertake policy actions in the military and security sphere that previously would have been unthinkable.

77 Many are increasingly referring to climate change as the greatest market failure in history.

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# Postscript

May 2009

Since completion of this report at the end of July 2008, three significant changes have occurred in the context of the international oil market. While the main text remains unaltered, this postscript identifies these changes and considers their influence on the analysis in the report.

First, oil prices have fallen dramatically. When the report was being finalized, the oil price hit record levels, averaging \$133.9 per barrel for WTI during June and \$133.8 during July 2008. On 3 July WTI reached an all-time high at \$147 per barrel. The report had actually predicted a sharp fall as the paper markets realized they had been misreading the state of the wet barrel market. It suggested that from that record level 'a \$40 adjustment would be a possibility' (page 31). This was indeed what happened, and WTI averaged around \$116.6 in August and \$104 in September. Subsequently, as the financial crisis unfolded in the wake of Lehman Brothers' failure and the paper markets focused on an impending recession/depression with falling oil demand, prices fell even further. During February 2009, prices averaged \$39.1 per barrel. OPEC's defence of the price, described below, met with some success and during April WTI averaged \$49.65.

The second change was the global economy's plunge into recession. The IMF's World Economic Outlook for April 2008 had predicted that world real GDP would grow by 3.8% in 2009. The October report had reduced this to 3.0% and by April 2009 the prediction was -1.3%.

The third change was that, in its 2008 World Energy Outlook (WEO), published in November, the IEA made the first serious attempt to address concerns with previous WEOs, which had simply assumed that supply would be available to meet the projected demand. The 2008 WEO looked in detail at the implications of natural decline rates on existing fields and concluded that

there remains the real risk of a supply crunch in the medium term as the gap between the capacity that is due to come on stream from current projects and that needed to keep pace with demand widens sharply after 2010, squeezing spare capacity and driving up oil prices – possibly to new record highs (pages 91-2).<sup>1</sup>

For the oil market, these three major changes produced several reactions of relevance to the analysis in my original report.

Oil demand fell dramatically. In July 2008, a consensus of eight forecasters (derived from private sources) put oil demand growth in 2008 at 900,000 b/d and in 2009 at 900,000 b/d. By April 2009 the same consensus showed a decline of 400,000 b/d in demand in 2008 and a decline of 1.5 million b/d for 2009. The result of this falling demand was that OPEC was forced into a succession of cuts to try to defend oil prices. By March 2009, the official ceiling was 24.8 million b/d, compared with 28.8 million b/d in September 2008. Estimates suggest that actual production was running at 26 million b/d, some 3.2 million b/d below actual production in September. The inevitable result was a large increase in spare capacity within OPEC, which is expected to increase even further into 2010. Estimates have suggested that this could be 5–6 million b/d by the end of 2009.<sup>2</sup> A further result was a collapse in oil revenues, which left a number of OPEC members in difficult financial straits. For example, one source (PFC Energy) calculated in November that the breakeven price of oil (WTI) to balance external accounts was \$97 for Venezuela, \$71 for Nigeria, \$58 for Iran and \$62 for Saudi Arabia.<sup>3</sup>

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1 The WEO 2008 actually cited *The Coming Oil Supply Crunch* as an example of analysis which suggested that investment in capacity after 2010 would not necessarily meet the required levels to avoid a serious shortage.

2 A significant proportion of this increase in capacity arises because several Saudi projects are due on-stream in 2009.

3 <http://www.pfcenergy.com/viewNew.aspx?id=38>.

In terms of the analysis contained in *The Coming Oil Supply Crunch*, there are two issues related to future demand and supply. First, the decline in oil demand and the consequent rise in spare capacity would, other things being equal, push out the date at which the threat of a crude supply outage would trigger a price spike. However, when the global economy recovers, past experience suggests that the income elasticity of demand for oil will be higher than shown in earlier trends. Thus oil demand would rapidly recover. This is in part because economic recession slows down the process of increasing the efficiency of oil-burning appliances, for two reasons. First, lower income and fears of unemployment mean consumers hang on to their oil-using appliances for longer. Second, lower incomes tend to raise the implicit discount rate of consumers. This inhibits their decision to pay more for an efficient appliance in the expectation that future savings on their fuel bill will more than offset the higher costs associated with buying a more efficient oil-burning appliance.

Second, of key importance is how the new oil market environment will affect the future development of crude producing capacity. The picture is confused. On the one hand, the recession, the extreme price volatility and the credit crunch are all likely to inhibit greater investment in crude oil supply even more than suggested by the original report. Certainly there is a great deal of casual observation from the trade press that upstream projects are being cancelled, delayed or postponed. Also, the growth in spare capacity in the OPEC members must raise serious questions over whether investing to maintain (let alone increase) capacity makes any sense unless a sharp increase in demand is expected soon. This is reinforced by the budgetary pressures created by the collapse in the oil revenues. Governments have more urgent things to spend their money on than adding to existing surplus capacity.

On the other hand, however, this reduction in activity to develop new capacity is leading to a fall in the cost of projects, which could encourage greater investment in capacity. This process of lowering project costs had already

begun, albeit with a lag, as the service companies faced with improved profitability after 2003 began to invest in new capacity. At the same time it has been suggested by PFC Energy that a number of OPEC countries including Venezuela, Ecuador and Algeria might ease access to IOCs, also encouraging more investment.<sup>4</sup> This is reinforced by the apparent decision by some of the larger IOCs to try to invest through the cycle in the belief that prices will be much higher in the not too distant future. For example, based on its annual report and quarterly statements, ExxonMobil in first quarter 2009 increased upstream capital expenditure to \$4,366 billion, from \$4,095 billion in first quarter 2008.

In general, a key issue on the supply side is how the events since September may have affected the depletion policies in the OPEC countries in the context of deciding between the options outlined in Figure 11 above: (1) not producing more today; (2) producing more today and deploying the revenue domestically; and (3) producing more today and investing abroad. The report concluded that

Currently there appears to be a growing view among major producing countries that option 1 (i.e. leaving it in the ground) is the most attractive. This is causing many producer governments to revisit their capacity plans (page 23).

However, the financial crisis has rather changed circumstances. The collapse of equity markets and the financial markets generally has meant that the sovereign wealth funds (SWFs) responsible for investing abroad on behalf of the oil producers have been very seriously hit. The Gulf Cooperation Council's SWFs suffered a capital loss on their external assets portfolios, excluding those held by the region's ruling families, of \$350 million between December 2007 and December 2008.<sup>5</sup> Since then things have probably deteriorated further given that the state of the financial sector has deteriorated further. For example, between November 2008 and April 2009 the value of the Dow Jones Industrial Average fell by 14%.

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<sup>4</sup> <http://www.pfcenergy.com/viewNew.aspx?id=45>.

<sup>5</sup> B. Setser and R. Ziemba, 'GCC Sovereign Wealth Funds: Reversal of Fortune', Working Paper, Council on Foreign Relations, Centre for Geoeconomic Studies, 2009. In December 2007 the Funds totalled \$1,282 million. By December 2008 the total had fallen to \$1,200 million despite new capital inflows of \$273 million.

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Taken overall, the developments since publication of the report in August 2008 have done little to change its original conclusions. Estimates in Figure 12 above of when the supply crunch might occur were only ever intended to be

rough calculations. The events since August, while reversing demand growth, have also further inhibited investment in maintaining capacity. Thus the suggested timing of five to ten years for a supply crunch remains valid.

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