DEPARTMENT OF ENERGY & CLIMATE CHANGE

DECC Call for evidence - Summary of responses

Prospects for crude oil supply and demand

June 2011

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In August 2010 DECC's Chief Scientist sent a call for evidence on the prospects for future oil supply and demand over the next 1 to 40 years to industry and other experts to ensure our analysis is informed by all relevant factors and improve our understanding of the topic. Respondents were asked to provide information on the shifts in demand and supply that can be coped with and those that would present a challenge, future oil prices, the impact that coal and unconventional gas would have on the outlook for oil, and any policy recommendations.

We received replies from a range of stakeholders including advisory bodies, geologists, scientists, and peak oil stakeholder groups.

We are very grateful for the time and thought put into these responses by all concerned. This report summarises the responses to the call for evidence. Full versions of the responses can be found on the DECC website (www.decc.gov.uk).

Background

The concept of a peak in oil production began in the 1950s when M K Hubbert used the term to describe a point in time when the production of oil would reach a maximum, and then decline over time.

While this report uses 'peak oil' to refer to maximum global oil production, the term can also be used to describe the point of maximum production in a single field or region. Peak oil can include a variety of different types of oil. Some commentators consider just conventional crude oil production whilst others also include unconventional oil, such as oil shale, in their considerations of future oil production. The main areas of contention in the peak oil debate are the timing and level of a peak in production, the shape of the production profile and the drivers of oil production. The main disagreement surrounding the drivers concerns whether production is primarily resource-constrained (i.e. based on geology) or driven by economic factors such as demand, price volatility and government policy. Respondents also had a variety of views on the future of oil demand and prices; the impact of the Gulf of Mexico oil spill, coal and unconventional gas; and appropriate policy responses.

Summary of responses

Timing of peak

Most, though not all, respondents to the call for evidence argue that a supply 'crunch' (a medium-term constraint on oil production due to economic influences), is very likely before 2020. However, there is a wide variety of forecasts ranging from those that argue that a peak has occurred to those who don't anticipate a peak until after 2030. In addition, some analysts believe that oil demand will decline before resource constraints become an issue.

Peak Has Occurred

Those who argue that a peak in oil production has occurred, including scientists and peak oil stakeholder groups, focus on the production of conventional oil and believe that, while unconventional oil has an increasing role to play in total oil production, it will be unable to make up for the decline in conventional oil production. One scientist believed production and reserve estimates from OPEC to be over-optimistic, commenting that OPEC countries reserves are not subject to audit by independent analysts.

Peak Before 2020

Of the responses that anticipate that peak production will occur before 2020, some take into account both conventional and unconventional oil while others, generally scientists, consider only conventional. The focus of these analyses is primarily on conventional oil and geological constraints, although above-ground factors are also considered. One response claims that a peak in conventional oil production is a consequence of limits on resource availabilities, with a focus on the size of individual oil fields. Another put greater emphasis on the decline rates of currently producing fields.

Peak After 2020

These responses include unconventional oil in their considerations, and believe improvements in technology, such as enhanced oil recovery (EOR), will continue to increase production beyond 2030. They also tend to be at the upper end of the range for the amount of oil estimated to come from yet-to-find fields.

The International Energy Agency's (IEA) World Energy Outlook 2008 (WEO 08) projects that production from yet-to-find fields would reach 19 mb/d in 2030 from the discovery of 114 billion barrels of reserves worldwide and World Energy Outlook 2010 (WEO 10) predicts that about 20 mb/d of 2030 production will come from fields yet to be found, increasing further to 2035. Total oil production continues to expand through to 2035 in the Current Policies Scenario, reaching 107.4 mb/d by 2035 while the 450 Scenario sees production peaking before 2020 and then declining to 2035.

Supply Crunch

Several respondents, predominantly with backgrounds in business and economics, argue that a supply crunch will occur before 2015, with varying consequences for long-term oil production. All agree that this medium-term constraint on oil production is predominantly due to under-investment within the oil industry. The fast-increasing demand from China and India is also cited as exacerbating the problem. As a result, a price spike is anticipated, the consequences of which are uncertain. On the other hand, some respondents argue that high prices could incentivise a swift decrease in oil demand as new technologies such as electric vehicles and alternative energy sources become economically viable and are encouraged by governments concerned about the security of supply.

Oil production across this timescale is less uncertain than longer-term production forecasts due to the lead times between investment in a field and its production. Recent new projects are a reasonably reliable indication of production in 1-5 years' time. Nonetheless, uncertainty still remains, for example with regard to the technology available and its performance in more demanding environments.

Whenever a peak in production is predicted, the majority of respondents agree that unconventional oil production, such as that from the Canadian oil sands, will only be able to modify a peak, not prevent it. Another report cited production will be limited by water constraints as the extraction process is so water intensive.

Level and nature of peak

The likely shape of the production profile following a peak in oil production is also debated: whether production will follow a bell-shape, reach a plateau or decline slowly. The majority of the respondents, regardless of their background or conclusion about the timing and level of a peak, expect production to reach a plateau which could last for up to 20 years. Others anticipate that a peak would be followed by a slow, undulating decline while a minority, believe that production will fall off as quickly as it increased resulting in a symmetrical production profile.

A majority of respondents from a variety of backgrounds believe that total oil production will be less than 100 mb/d at its maximum.

Drivers

There are two main viewpoints when it comes to the drivers behind a peak in oil production: those that argue that geology will constrain production and those that believe above-ground factors, such as investment, prices and the demand for oil, will be the cause. Behind these main drivers are others.

Geology

Those responses which argue that geology will be the main constraint on production focus on ultimately recoverable reserves (URR), decline & depletion rates, and discovery rates. This view is generally put forward by geologists and petroleum engineers.

Ultimately Recoverable Reserves

The majority of proponents of this view argue that peak production of an individual field occurs when about one third of the ultimately recoverable reserves are depleted. Some, however, claim less specifically that a peak occurs when less than half of the reserves are depleted. After this point production plateaus or declines. Some analysts aggregate this production profile up to the global level in order to estimate when a peak in global production may occur, making assumptions about the depletion rate and of a constant decline rate.

Decline Rate

The decline rate is the annual rate at which oil production from a well, field or region declines. The overall decline rate includes fields that have yet to pass their peak production. The post-peak decline rate refers to the subset of fields that are in decline. Aggregate estimates of decline rates are usually weighted by production.

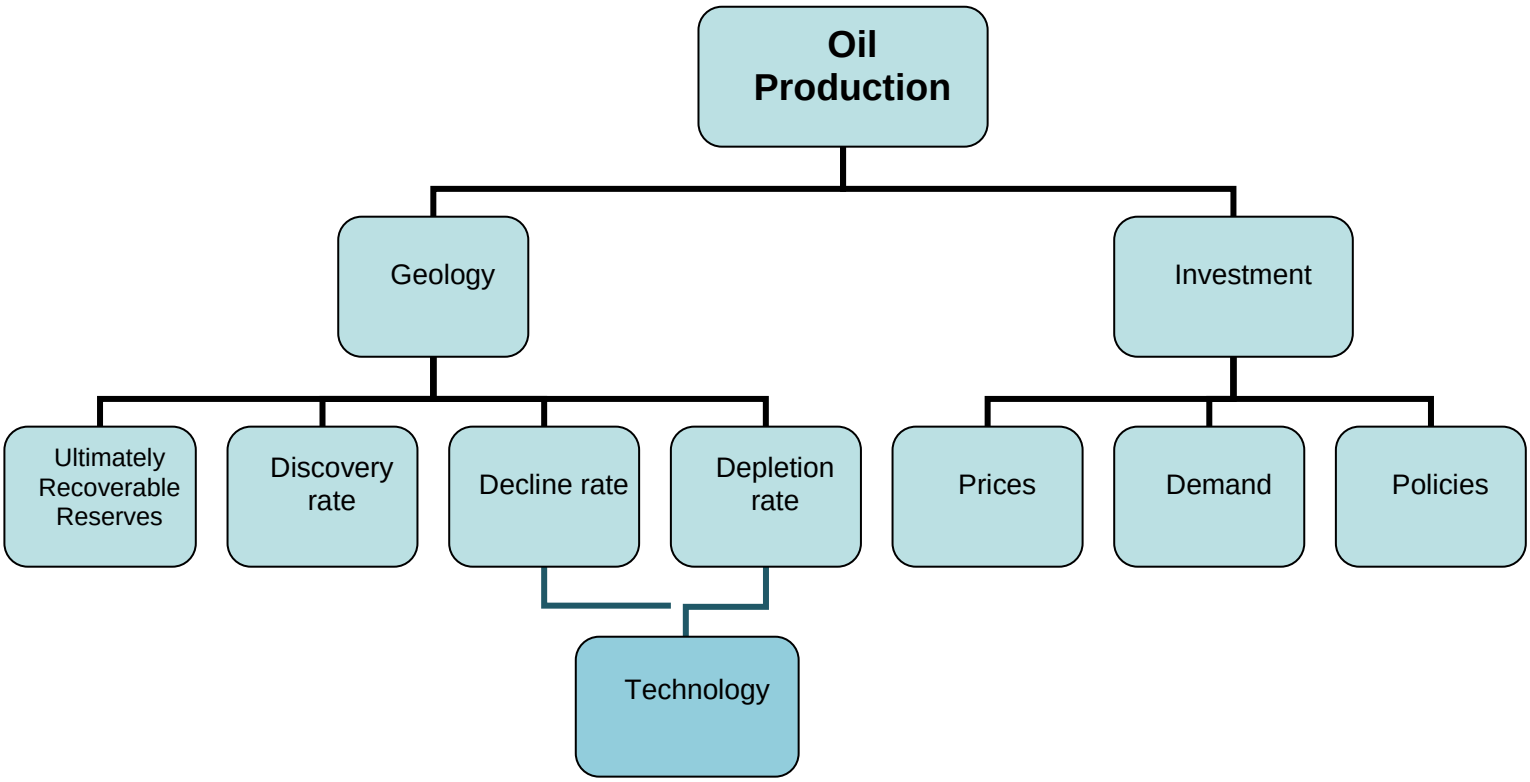
Depletion Rates

This is the annual rate at which the recoverable resources of a field or region are being produced. It is defined as the ratio of annual production to some estimate of recoverable resources.

Most respondents argue that new technology such as EOR would modify the depletion rate so as to extend the ‘tail’ of the production profile rather than delay the peak.

Discovery Rate

Some respondents believe that the decline in discovery rate is the driver of the peak in oil production as it sets a limit on the quantity of reserves available for exploitation.



Investment

Those who focus on the impact of above-ground factors on oil production emphasise the importance of investment. The main influences on investment in oil production are argued to be prices, demand and policies. These respondents generally have a business or economics background but some with scientific knowledge also argue that investment is a significant determinant of oil production although they tend not to go into as much detail.

Price volatility

Some respondents argue that under-investment is caused by volatile prices. Respondents believe that volatile prices create a high risk environment for oil companies and provide a disincentive for investing in the infrastructure necessary to exploit new oil reserves, especially in more difficult to access and more costly areas like deep-water oil. Volatile prices can also decrease demand as consumers react by increasing consumption of alternatives at more predictable prices, further decreasing the incentive to invest in new production.

Demand

Some respondents believe that demand drives supply as producers will only want to exploit their oil reserves, and therefore invest in their fields, if they are confident that they will be able to sell the oil. The long lead times typical in bringing a new oil field on stream increase the risk and act as a disincentive to investment. The 2008-9 recession can be argued to have aggravated the problem of under-investment by reducing the demand for oil, although only temporarily as demand is expected to rebound quickly with the recovery and continue to increase in the long term. Investment is also expected to increase with economic recovery, although the speed of this is uncertain. The IEA estimates that total upstream capital spending

on oil and gas will increase 9% in 2010 to $470 billion compared to a 15% fall in 2009. A further, direct effect of the recession on future oil production is that it reduced the amount of capital available for investment, causing delays in new supply coming on stream. While this is a common narrative in many responses, none of the respondents provided specific figures on the extent of oil production delayed due to the recession.

Policies

Policies can encourage or discourage investment through a variety of different avenues. They can help create a conducive environment through the stabilisation of oil prices or improving relations between producers and consumers. This is discussed in the policy recommendation section below.

Demand

Given concerns that future oil production will be unable to meet forecast demand, projected world demand is an integral element of the debate.

Respondents from a variety of backgrounds believe that emerging economies will have the greatest impact on oil demand over the short- and long-term. One response anticipates that China, as a planned economy, will develop its transport sector in such a structured way that electric vehicles will become the predominant mode of transport, bypassing the combustion engine era that developed countries experienced, and hence lower the oil intensity of China's growth. By contrast, OECD oil demand growth is expected to be small, if not negative in the long-term.

Population growth is cited by a range of respondents as a major driver behind oil demand in developing countries. Some respondents, mostly with an economics/business background also believed that the demand for oil could be limited by prices, in that once prices reach a certain level, the economy will go into recession and demand will decrease. The specific price level that would cause this was not discussed.

Respondents who provided demand forecasts, mostly research and advisory groups had varying assumptions regarding policy changes in the OECD aimed at lowering oil consumption and the impact of electric vehicles on transport demand.

The impact of the Gulf of Mexico Oil Spill

A variety of respondents believe that the impact of the 2010 Gulf of Mexico oil spill from the Macondo well on current and future oil production could be significant, although the details remain uncertain.

Reductions in production are argued to be mostly due to the six month moratorium imposed following the spill and the tighter regulations likely to be imposed in the aftermath. Some respondents believe that tighter regulations could exacerbate delays as equipment is modified

or changed. Respondents also believe that insurance costs and costs related to safety could increase with potential for these to impact on production of recent discoveries, and squeeze out smaller firms operating in deep water.

One scientist argues that the impact of Gulf of Mexico spill will not be significant as oil companies will continue to explore and produce in deep water, whilst another believes that deepwater production will continue to play an important role once the public accepts that the industry has the technology to deal safely in this area. The IEA similarly sees deepwater production continuing to play a key role in all three of its policy scenarios in the latest WEO.

The impact of Coal and Unconventional gas

Some attention is devoted to the role that unconventional gas could play in offsetting the decline in oil production since the boom in North American shale gas production. However, one advisory group highlights the impact on oil demand may be limited for several reasons. Gas tends to be a more regional market as it is costly to transport and is therefore dependent on local networks, fuel supply changeovers take time and investment, and the demand for unconventional gas will be driven by economic growth, particularly in electricity generation and industry.

An economist argues that unconventional sources of energy such as shale gas will become increasingly important in our energy future, raising the possibility that global oil reserves may not be completely exploited.

Nonetheless, a scientist argues that, over time, there is considerable opportunity for substitution for oil by natural gas and coal in heating, electricity generation and in making plastics. Respondents also believe that the share of shale gas production could increase. A few respondents consider the role of coal in the future energy mix and focus on the uncertainty surrounding reserves data and on the difficulty this poses for estimating future production in isolation from the impact on oil demand and supply. One respondent believes that global reserves of coal are hugely over-estimated due to infrequent revisions and the possibility of bias from the governments that produce the data. Therefore, it is difficult to analyse when there may be a peak in coal production.

Price Implications[1]

Some respondents considered the implications of their anticipated oil production on prices. There was some consensus among those with an economics/business background that prices are likely to increase, particularly in the medium-term, but the level to which they will rise varied or was unstated. Estimates ranged from a possible price spike of over $200 per barrel resulting from a supply crunch to long term price estimates of $60-$90 (set by the marginal cost of production). Prices over $100 per barrel were generally accepted as likely over the medium-term. One report argued that long term prices have an inbuilt ceiling, except for short term spikes, at which point economies find oil unaffordable and enter recession, reducing demand. This is argued to be due to the low elasticity of demand for oil in the short-term, i.e. that the demand for oil is relatively unresponsive to the price.

One advisory group argues that prices will fall to about $40 per barrel after 2016, after their estimated peak in oil production, again set by the marginal cost of production, because demand for oil will have declined significantly as hybrid and electric vehicles are used widely.

[1] Prices referred to in this document are nominal.

Policy Recommendations

The majority of responses that include policy suggestions consider reducing oil demand a priority and suggest that this is achieved through improved efficiency, particularly vehicle efficiency. The potential impact of such measures on total demand is argued to be significant as the transport sector accounts for such a large amount of global demand, accounting for 53% of oil demand in 2009. Many emphasise the importance of public transport and the need to invest in it to make it a more accessible and practical alternative to private cars.

Similarly, hybrid and electric vehicles are considered in varying detail as the future of the transport sector. Opinions on the speed of uptake in more efficient vehicles vary widely. Nonetheless, a consensus emerges on the role for government in developing the necessary infrastructure to make them practical and also in providing incentives for their production and uptake such as subsidies and/or tax breaks.

> However, we are reminded that an increase in the number of electric vehicles will increase the demand for electricity, highlighting the need to change the electricity mix away from fossil fuel sources. Therefore renewable energy sources and other alternatives such as biofuels are suggested by a large number of reports.

Subsidies for oil products prevalent in many producing nations are referred to by some respondents. Since the oil production problem is global, it is argued that we must work to persuade these countries to phase out such subsidies, which dampen demand responses to price increases.

On the supply side, some respondents, especially those that cite investment as a driver of oil production, emphasise the need to stimulate further investment through the creation of a conducive economic environment and strong international relations. For an investment-friendly environment, stable oil prices are argued to be key for reducing investment risk for companies, which implies a role for governments, possibly through taxation. With respect to international relations, an advisory group recommends that these links are used to stimulate a change in depletion policy, so that oil is produced sooner rather than later. Another response argues that governments should be careful that strategic stock levels are not too high as this could provide a disincentive for investment.

Potential difficulties arising from these policy suggestions are highlighted by some responses. These include issues surrounding the level of investment required, for example in transport sector infrastructure, and the long lead times of new investment resulting in greater oil production or reduced oil demand from efficiency measures. Furthermore, conflict with environmental policies could arise, for example, from greater exploitation of deep-water or Arctic oil. There is a consensus that implementing mitigation policies now will be much less costly than reacting at the last minute.

Key messages

There are many views on the future supply of oil which highlights the uncertainty which surrounds the issue of peak oil production. Some of the key messages from the responses are outlined below:

- The majority of respondents believe that total oil production will peak before 2030 and many argue that there will be significant supply-side constraints before 2020.
- The majority of responses anticipate that production will plateau and then decline gradually.
- The main drivers of oil production on the geology side are argued to be the decline, depletion and discovery rates, the volume of ultimately recoverable reserves and technology.
- The most significant above-ground factor is investment, which is influenced by oil prices, demand and related policies.
- The general consensus is that demand will continue to increase until 2030, mostly driven by growth from emerging economies. An alternative report anticipates that the widespread introduction of electric vehicles will cause demand to fall from 2016.
- The majority of respondents believe that prices are likely to increase to over $100 per barrel over the medium-term but many argue that the long-term price will be set by the marginal cost of production at $60-90 per barrel.
- Key policy recommendations include demand reduction (e.g. through encouraging electric vehicles and reducing fossil fuel subsidies) and increasing investment (e.g. through investment-friendly policies and encouraging price stability).

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