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Dear Professor MacKay

Evidence on the supply and demand for oil

Thank you for your letter of 27th July to Graeme Sweeney on the above topic. Graeme is not in the office this week so I am sending the reply.

We have taken the approach of providing in the attached paper a brief, summary response covering what we see as the main factors. There is much detail that underlies our response which is drawn mainly from Shell's Energy Scenarios to 2050.

We would be delighted to visit you and your colleagues to explain our views should you wish.

Yours sincerely

James Smith

James Smith
Chairman



Evidence on the supply and demand for oil – submitted to DECC, August 2010

This paper has been designed to provide a brief summary of views. The views are mainly drawn from Shell's Energy Scenarios to 2050. The Energy Scenarios consider alternative patterns of personal, business and government choice in energy use and are supported by a detailed econometric model that addresses individually all significant countries, all primary energy sources, conversion technologies and energy carriers. The model is used to examine the effects of policy and other choices made by society in response to the challenges of energy security and climate change.

Context of supply and demand for energy

Based on economic and population growth, global energy demand is likely to double over the first half of this century. This is even after very significant improvements in energy efficiency, with the energy intensity of the global economy declining by a factor of 2 or so by 2050.

Alternative sources of energy will experience major growth and meet about 30% of global energy demand by mid century. Wind and solar will grow by factors of about 40 and 70.

The existing nuclear fleet is likely to be replaced, with further building leading to some growth in nuclear compared with currently. On this basis, nuclear will be meeting around 6-8% of global energy demand by mid century, about the same proportion as now.

Fossil fuels will meet around 60% of energy needs by mid century. This compares with about 80% currently.

Although the recent economic recession has reduced the pressure on energy supplies in the short to medium term, these pressures are likely to resume in the years leading up to 2020. This will reflect technological and political impediments to accessing primary energy, the huge investment required in energy infrastructure and the need to develop and deploy new, low carbon technologies.

Much improved energy efficiency is necessary not just to tackle climate change but also in support of energy security. This is likely to require both improvements in technology and incentives that support changes in individual choices on energy use.

Charts 1 and 2 (attached) show trends in energy supply by type under the two main Energy Scenarios developed by Shell in 2008, "Blueprints" and "Scramble".

Supply of oil

Arithmetically, the volumes of oil contained in geological reservoirs globally are sufficient to meet demand for 50 years or more at current levels of consumption. Arithmetically, volumes of unconventional oil resources such as the Canadian oil sands and oil shales can provide another 20 to 40 years or so of supply.

It is generally accepted today that virtually all the 'easy oil' has been found. Reserves in the OECD are increasingly concentrated in technically more difficult settings such as under deep water offshore, the Arctic and in unconventional resources.

About 60% of reserves are concentrated in 5 countries – Saudi Arabia, Iran, Iraq, Kuwait and Abu Dhabi. While Saudi Arabia has reserves for 75 years of production at current rates, the United States has reserves for only 10 years and Europe for 8 years. These data do not however include the Canadian oil sands where the reserves at around 170 billion barrels are second only to those of Saudi Arabia. A summary of reserves by country is set out in Chart 3.

Normal decline rates for existing production average about 5% a year. The IEA has estimated that, between 2007 and 2030, about 64 million barrels per day of new production will need to be brought on stream to meet demand growth and offset declining production from existing fields. This new production is equivalent to about 6 times the current capacity of Saudi Arabia. See Chart 4.

The outcome of the investigation into the Deepwater Horizon incident in the Gulf of Mexico may mean that output from deep water wells will be somewhat lower than had been expected. Prior to this incident, the expectations of production from deep water wells globally was around 8 million barrels per day in 2020, according to Wood MacKenzie. Both Government and industry responses will be relevant to realisation of production from the deep offshore.

Today's sources of supply at the margin are producible for about \$60-\$90 per barrel in current money, while the highest cost resources are estimated as producible for up to \$110/bbl (Ref IEA WEO 2008). There could be some further real terms cost escalation in future because of resource bottlenecks caused mainly by the scale of economic growth in emerging economies. Such bottlenecks would be more likely and pronounced in Shell's "Scramble" scenario (see Chart 1).

Although resource rich countries may consider restraining production both to support prices and to preserve their resources for longer, they will also recognise that production constraints could undermine demand by stimulating additional energy efficiency measures and the development of alternatives to oil.

Drawing on the above information it needs to be considered whether it is likely that supply of oil will keep up readily with demand increases, even if the geological resources appear plentiful. It seems probable that supply can keep up with demand growth into the first half of the coming decade. However, beyond that the outlook is less certain. The technical complexity of production globally is likely to increase significantly, even in areas such as the Middle East where once prolific fields will require enhanced recovery methods of increasing technical intensity. All this will increase the demands for advanced technology, highly skilled labour and major investment. Delivering the scale of activity required will not be straightforward and, among other things, will benefit from relationships that enable ready flow of technology, people and capital to where the major production opportunities lie.

Consideration of supply needs also to include refining capacity. Although refining capacity was scarce 2 years ago it is now in surplus and likely to be for some years. Nonetheless, the major economic zones tend to import refined products. The United States imports about 2 million barrels per day of refined products, about 11% of its needs.

Demand for oil

Oil is used mainly for transport fuels and for petrochemicals. Some oil is used for heating, mainly domestic. The use of oil for power generation is decreasing to relatively small amounts.

Oil demand is shifting from the West to the East. Oil demand is largely about to peak in the US, Europe and Japan as populations numbers have stabilised and vehicle efficiency has improved. Demand is likely to decline in the coming years with further vehicle efficiency measures and increases in volumes of biofuels. Electrification of transport will begin to have an impact on reducing oil demand after 2020.

Large and growing populations and growing affluence in Asia are resulting in rapid increases in vehicle numbers and considerable growth in demand for transport fuels.

On balance it is expected that the growth in demand pressure in the East will significantly outpace reductions in the West.

The very large volumes of unconventional gas now available in the United States and perhaps available in other parts of the world, especially in China, can have a mitigating impact on oil demand in a number of ways. The main areas are in use of gas for heating and industrial purposes; the use of gas directly in transport as is now being seen to some degree in heavy transport in the United States; the possible use of abundant gas in electrification of transport in developing countries such as China and India; and the use of gas as a petrochemical feedstock in preference to oil based feedstocks. However these impacts on oil demand are unlikely to alter materially the picture emerging of constrained oil supply emerging in the years leading up to 2020.

Oil demand will be impacted by rising prices as production costs rise, non-OPEC supply becomes tighter, and subsidies for biofuels are phased out.

The combination of supply and demand pressures will result in a global oil production/consumption balance (excluding alternative fuels such as biofuels) growing gradually from now until the mid-2020s to reach an expected plateau of around 100 million barrels per day, compared with demand of about 86 million barrels per day currently.

Implications for prices

The above observations on supply and demand present a picture of increasing production costs, growing difficulty in increasing supply in the years leading up to 2020 and continuing demand growth.

In the longer term prices will tend to be set by the marginal cost of supply. As indicated above this is in the \$60-\$90 per barrel range in current money. However, the price can be subject to considerable volatility, as witnessed most recently when oil prices reached nearly \$150 per barrel in 2008 and fell to \$40 per barrel in early 2009.

It is worth separating consideration of oil prices between the periods of the next few years and that which may evolve in the years leading up to 2020 and beyond.

Over the next few years it looks as if there will be significant spare capacity. Prices have been fairly stable in the \$60 to \$80 per barrel range for most of 2010. Whether this position persists will depend mainly on OPEC production levels. A significant factor relevant to this will be the build up of production in Iraq. At the moment it is too early to say how quickly this will happen but if all the plans are fulfilled this could add significantly to spare capacity in the coming few years.

It should be realised that a period of low prices could well discourage investment. Given the length of the investment cycles in the oil industry, this may lead to future supply constraints and price spikes.

Over the longer term, up to and especially after 2020, the risk to price volatility seems more likely on the upside as supply will struggle to keep up with demand.

It is, of course, also possible to postulate significant supply disruptions driven by political or security events at any time.

Considerations relating to security of supply

The major zones of oil production are not in the major zones of oil consumption. The United States consumes about 19 million barrels per day and produces about 7 million per day, with a further 5 million barrels per day imported from near neighbours Mexico and Canada. Venezuela, Nigeria, Angola and Saudi Arabia are major suppliers to the United States. The United States also imports nearly 2 million barrels per day of refined products.

The import position for Europe is similar to that of the United States. Europe produces about 2 million barrels per day and consumes about 14 million barrels per day.

The current position for India and China is not the same as for the United States and Europe. Currently they import about 2.5 million barrels per day and 5 million barrels per day respectively. However, they will continue to experience rapid increase in demand for many years.

It is worth recognising that while countries rightly consider security of supply, major resource holders also consider security of demand for what is often their prime economic asset.

The implications of these observations on security of supply are dealt with in the next section.

Considerations for Governments

As indicated in the opening paragraphs of this paper, oil is going to be a major and essential source of energy well into the middle part of this century and beyond. And oil resources are not located in the areas of major consumption. So energy security is not achievable through energy independence. At least for oil, the importance of interdependence needs recognised. Against this background, Governments may wish to consider the following:

Energy efficiency: Effort should continue on significant improvements to vehicle efficiency (including through weight reduction), improved availability and attractiveness of public transport and encouraging consumers to adopt more energy efficient driving styles and make alternative choices on mobility. As an example, if the United States car fleet was as efficient as the European car fleet this would reduce demand in the United States by 3 million barrels per day.

Alternative energy for transport: Work should continue on the development of advanced biofuels and electric mobility (including hydrogen fuel-cell vehicles). However, it will be well over 10 years before these technologies can make a material difference. Therefore attention needs to continue to be given to improvement in the efficiency of existing internal combustion engine technologies.

Continued support for the global oil market: There is a longstanding and well established market and transport infrastructure for oil globally. A market-based approach is a vital underpinning of security of supply by providing investment signals and offering a well diversified supply chain.

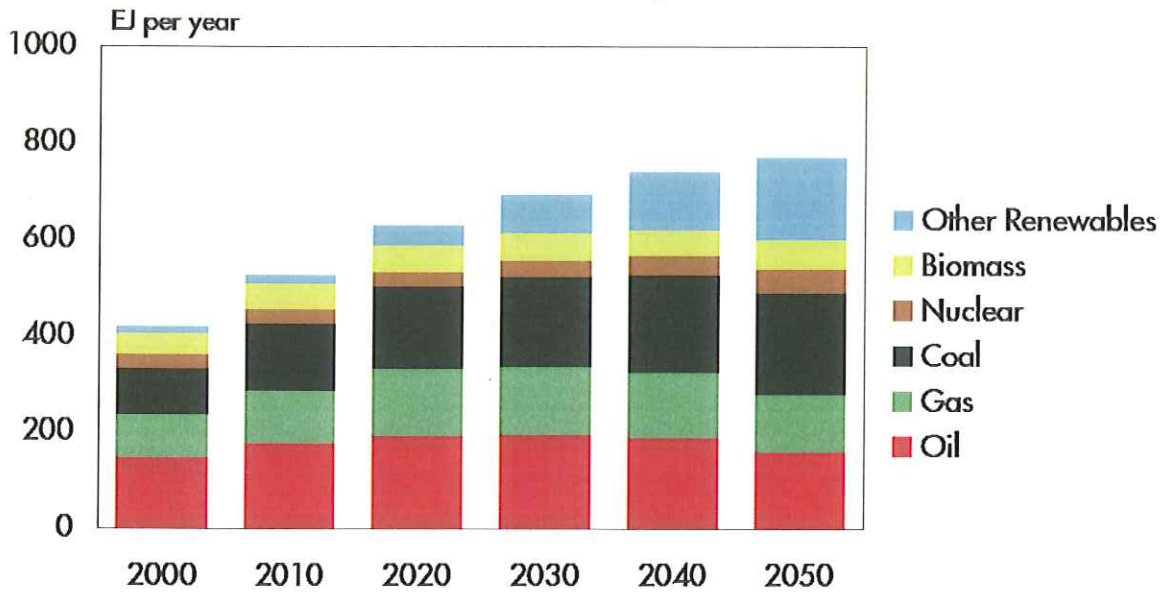
Indigenous resources: Governments should ensure maximum development of indigenous resources to support security of supply and to maximise economic benefits from employment, industrial capability and balance of payments.

Strategic Stocks: Some level of strategic stocks is appropriate and already practised around the world. Governments need to ensure that the existence of such stocks does not create any disincentive to investment in new production.

International relations: The interdependence among producer and consumer countries and the importance of maintaining good relations among them should be a key feature of international diplomacy. The preservation of open seaways should also be a high priority for foreign and defence policy.

Support for IOCs: Supply is likely to be greater if international oil companies are successful in forging partnerships with national oil companies and governments in major resourcing holding countries. International oil companies (IOCs) can bring technologies for dealing with more difficult resources. In addition they can bring technical resources and investment capital to complement those of national oil companies. So governments in consumer countries can help bring additional production to the global market through support for IOCs commercial activity in MRHs. There are concomitant benefits of material streams of invisible earnings to the IOCs' "home" countries.

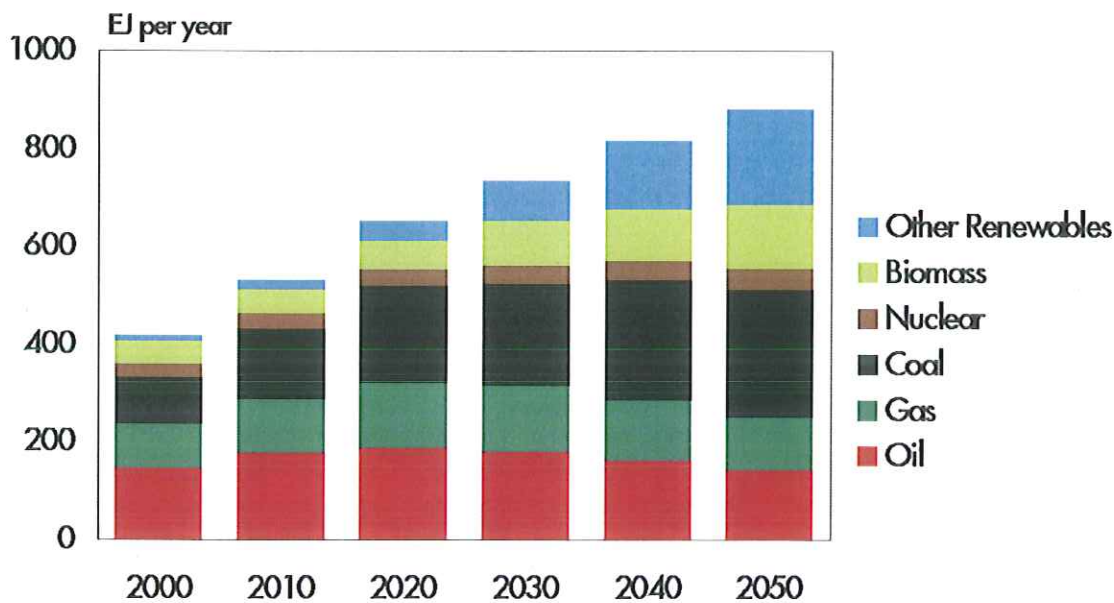
Primary energy by source 2000-2050: Shell "Blueprints" scenario



In the Blueprints scenario there is more and earlier agreement among diverse stakeholders recognising shared interests, with increasing common action. Action proceeds in parallel on energy availability, energy efficiency and decarbonisation of energy supply. A carbon market gets going globally by 2015. There is eventually a considerable amount of electrification both in buildings and vehicles. Greenhouse gas concentrations are much lower than in Scramble. However environmental stresses remain. It should not be thought that Blueprints represents a tidy or simple process. Blueprints comprises a wide variety of parallel actions that gain scale and are eventually knitted together nationally and internationally. Blueprints is not top-down.

Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries OECD/IEA 2006

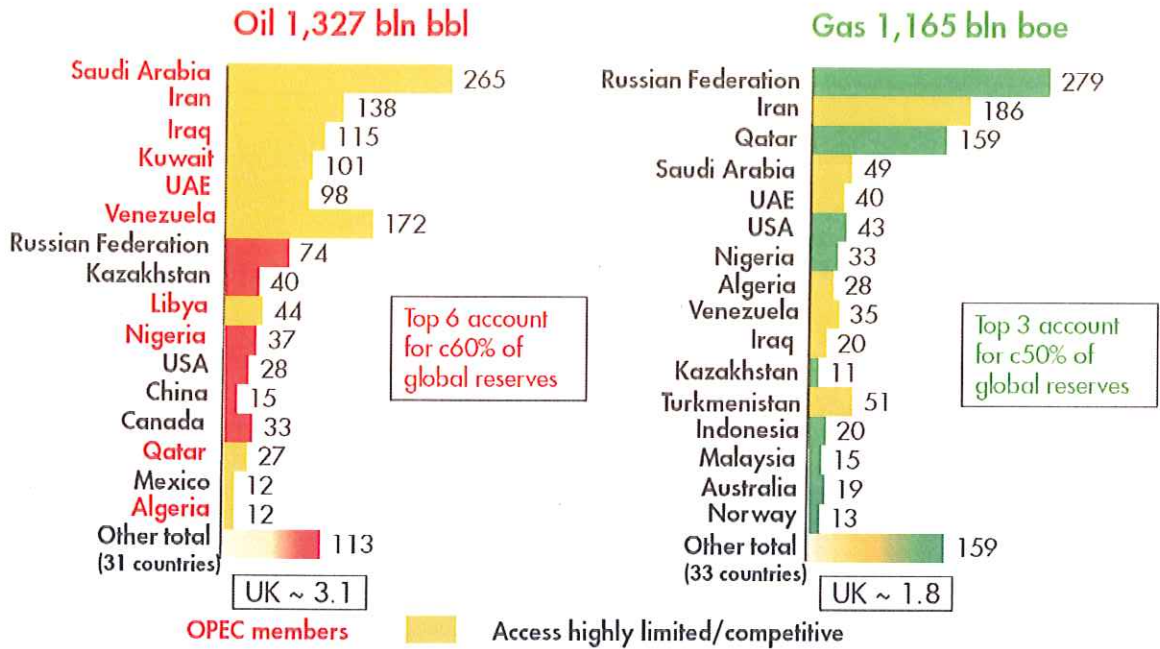
Primary energy by source 2000-2050: Shell "Scramble" scenario



The Scramble scenario is driven by national concerns over energy security. There is insufficient international agreement for action, though plenty rhetoric. Individual nations act in a stepwise way on energy security, energy efficiency and later in response to climate change. While there is some improvement in energy efficiency, not enough is achieved. There is emphasis on coal and biofuels but not with an accent on sustainability. By 2020 or so there are economic tensions and volatility because of limitations on energy availability. Greenhouse gas concentrations in the atmosphere increase to high levels and significant climate stresses are inevitable. New policies are implemented in hurried and reactive mode and recently implemented infrastructure is rendered redundant.

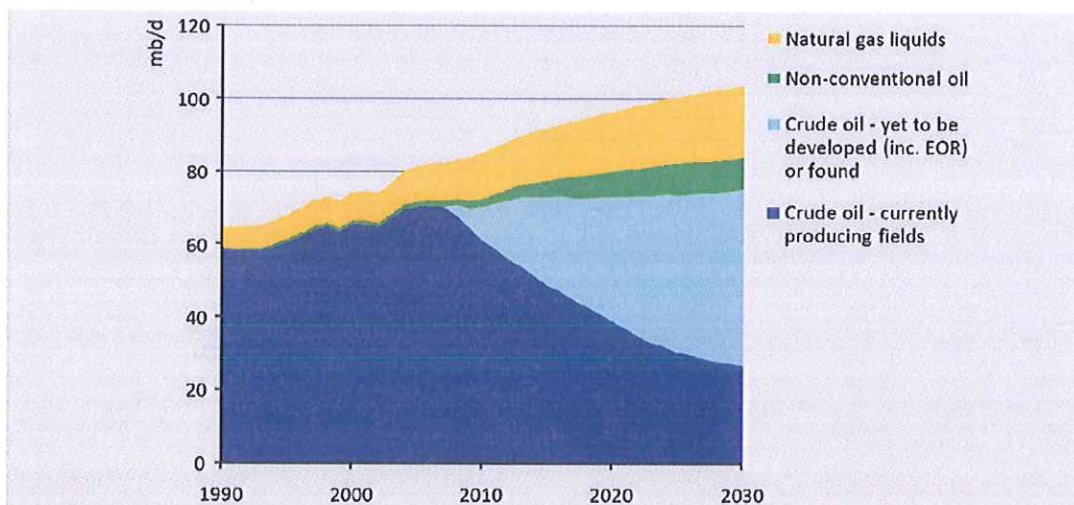
Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries OECD/IEA 2006

Distribution of proved reserves* (2009)



*BP Statistical Review 2010 (does not use the SEC definition of "proved"), McKinsey

IEA Perspective on oil supply



64 mb/d of gross capacity needs to be installed between 2007 & 2030 – six times the current capacity of Saudi Arabia – to meet demand growth & offset decline

Source: IEA WEO2008