

What is 'peak oil'? When might it happen and what effect might it have on
transport usage and transport planning?

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Dedicated to JasFrasMas

1. Introduction

Current traffic growth forecasts are based on the assumption that oil prices in 2025 will be between \$20 and \$80 a barrel (see Eddington, TEMPRO). However, with current oil prices at approximately £135 a barrel, and predicted to rise to \$200 within the year, how likely is this traffic growth to occur? The key question is whether this is just a temporary blip such as the oil crises in 1973 and 1979, or part of a long term escalation in fuel prices, caused by an inevitable drop in world oil production. While it is clear that speculators, the low level of the dollar, social and political tensions in Nigeria, Venezuela and Iraq, have all contributed to the current record prices, there are a number of academics, oil industry experts, and even governments who believe that we are facing an imminent and irreversible shortage of oil supply.

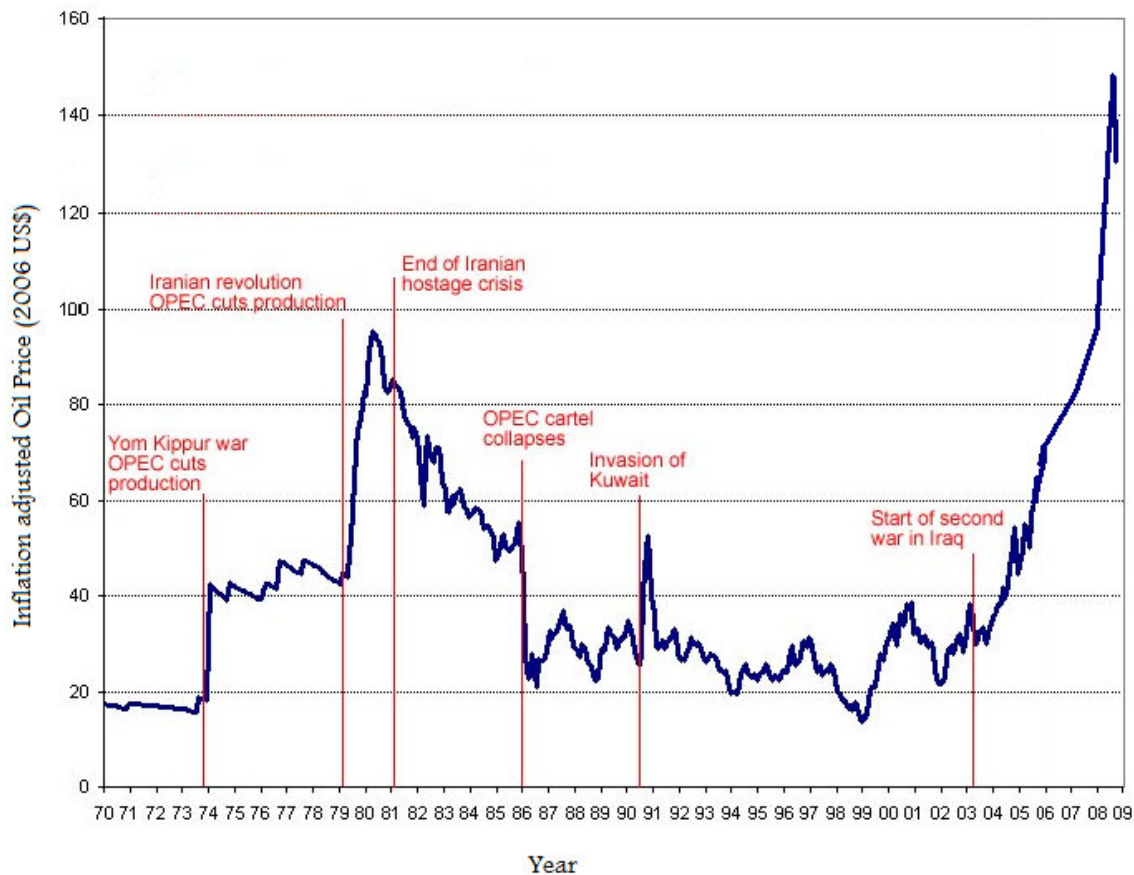


Figure 1: Inflation Adjusted Oil Prices 1970-2008 (Source: BP/Bloomberg)

In 2005, the United States Department of Energy published a report on the risks we face due to peak oil, commonly referred to as “The Hirsch report”. It warns of the potential consequences of approaching a peak in world oil production unprepared, and emphasizes the seriousness of the problem we are facing. The executive summary states:

“...the peaking of world oil production presents the US and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel prices and price volatility will increase dramatically, and without timely mitigation, the economic, social and political costs will be unprecedented. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact,

they must be initiated more than a decade in advance”

(Hirsch et al 2005)

As transportation is the most oil dependent sector of the economy, major rises in oil prices in the long term are likely to reverse current trends in traffic growth, forcing transport planners to reassess their roles, and adapt to a changing transport system. As Gilbert et al (2008, p6) note, “Tomorrow's transport professionals will have important roles to play in implementing transport revolutions, but the roles will differ from those of today...Much current work is guided by the models of economists and others that predict the demand for mobility. These models will become unreliable as oil depletion becomes a major influence”.

This paper seeks to further examine the background theory to 'peak oil', the potential of alternatives to oil, and possible impacts on current transport systems.

2. Peak oil theory

In 1956 a Shell geophysicist named Marion King Hubbert presented a paper to the American Petroleum Institute predicting that oil production in the United States would peak between 1965 and 1970 (Mitchel et al 2001). Peak production in the United States duly occurred in 1970, converting the US from a net exporter to a net importer of oil.

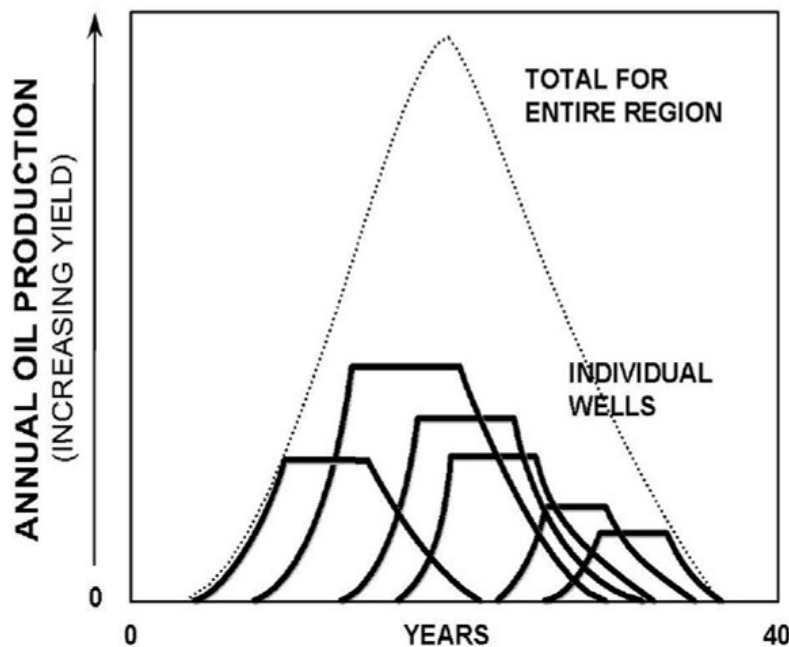


Figure 2: The bell curve of oil production

Hubbert predicted that oil production in a particular region would follow a bell curve, rising to a peak when half of a field had been extracted, subsequently falling into decline (see Figure 2). It is important to note that 'peak oil' does not refer to oil supplies ending abruptly, rather, reaching the top of the production curve, and therefore the end of cheap oil. As oil is a finite resource a global peak in production is inevitable at some point, the crucial and surprisingly difficult question to answer is *when* it will happen.

2.1 When will 'peak oil' occur?

The precise timing and speed of peak oil, which will probably be characterised by rapidly changing oil prices, is important for several reasons. The timing is important because as the Hirsch report noted, mitigation options should be in place at least a decade before the peak occurs. The speed of price increases will also play a key role, as a gradual rise in prices will allow time for market mechanisms to adapt and new technologies and fuels to emerge. However, a sudden and sustained rise in the price of oil is likely to have far reaching costs for both the economy and society. As Deffeyes (2005) notes, “The real question...is not whether change is going to come, but whether the shift will be peaceful and orderly or chaotic and violent because we waited too long to begin planning for it”.

The problem is that oil does not operate in an open and transparent market, largely due to the control of supply by the OPEC oil cartel, breaking the link between supply and price signals. Lack of reliable data concerning oil supplies, political and institutional self interest, and other complicating factors also make predicting the peak a notoriously difficult task. As Simmons notes, “Peaking of oil and gas will occur, if it has not already happened, and we will never know when the event has happened until we see it 'in our rear view mirrors'” (Web Ref 3). Optimists, such as the International Energy Agency (IEA) and the US government believe that the peak cannot occur before 2035, whereas, pessimists believe that the peak may occur much sooner, if it has not occurred already. Hirsch et al (2005) provide the following summary of dates that have been predicted for peak oil:

Timing	Source	
2006-2007	Bakhitari AMS	Iranian Oil Executive
2007-2009	Simmons MR	Investment banker
After 2007	Skrebowski C	Petroleum journal editor
Before 2009	Deffeyes KS	Oil company geologist (ret)
Before 2010	Goodstien D	Cal Tech
Around 2010	ASPO	
Around 2010	Campbell CJ	Oil company geologist (ret)
2010- 2020	Laherrere J	Oil company geologist (ret)
2016	EIA nominal case DOE analysis information	
After 2020	CERA Energy consultants	
2025 or later	Shell major oil company	
No visible peak	Lynch MC	Energy economist

Table 1: Peak oil predictions

2.2 The role of OPEC and Saudi Arabia

While there is continuing controversy over when a *global* peak in oil production will occur, world oil production outside of OPEC countries and the former Soviet Union (FSU) has already had a documented peak (see Figure 3), although this view contrasts to analyses by the International Energy Agency (IEA), which foresees a prologued plateau in non-OPEC production levels (OECD/ITF 2008a).

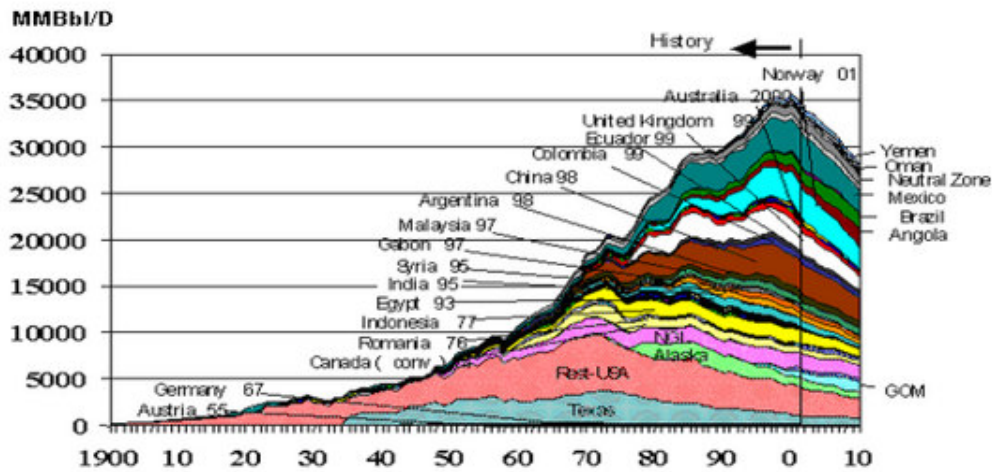


Figure 3: Non-OPEC, non-FSU Oil Production (source: ASPO 2008)

As a result the world is increasingly dependent of oil exports from the OPEC oil cartel, especially Saudi Arabia, which is thought to have the largest proven oil reserves, accounting for 19% of the world total.

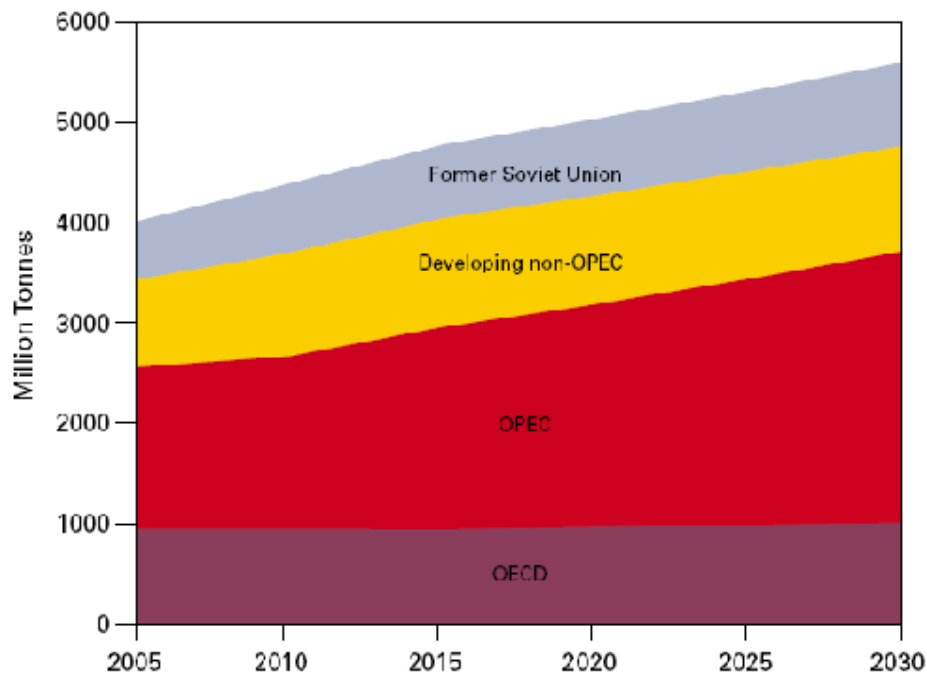


Figure 4: Global Oil Production 2005-2030 (source: IEA 2006)

As BERR's World Energy Outlook (2007) states, "OPEC is projected to contribute just over half the growth in global oil production between 2005 and 2015, and over two-thirds of the growth to 2030, boosting OPEC's share of world supply from 40% in 2006 to over 50% by 2030" (see Figure 4). Much of this production growth is expected to come from Saudi Arabia, as it is widely regarded as the only OPEC country with much spare production capacity. This places the rest of the world in the unenviable position of becoming increasingly dependent on the unstable Middle East for our oil supplies. However, some commentators, such as Matthew Simmons, an energy investment banker, believe that Saudi Arabia is at or near a production peak, stating "the entire world assumes

Saudi Arabia can carry everyone's energy needs on its back cheaply...If this turns out not to work, there is no Plan B” (Web Ref 1). Saudi Aramco, the national oil company, hotly dispute Simmons' findings, with HE Ali I. Al-Naimi, minister of petroleum and mineral resources stating, “This is not the end of the age of oil, as some pessimists have been saying. There is plenty of oil left to be found and produced, and petroleum will remain the dominant energy source for years to come. I assure you that Saudi Arabia's reserves are real and that we have the potential to produce at much higher rates in line with the growing demand for many years” (ibid). However, closer examination of Saudi Arabia's recent oil production shows that production rates have plateaued and are falling (see Figure 5).

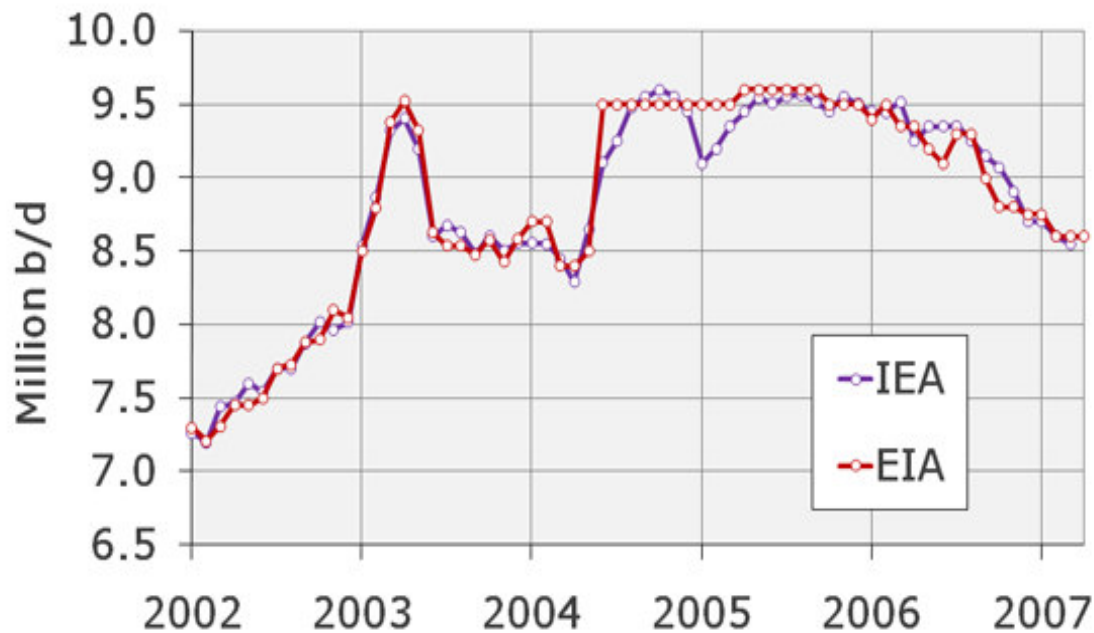


Figure 5: Saudi Oil Production

This fall in Saudi production may not necessarily be caused by lack of production capacity. Indeed, from the vantage point of 2004, the peak would have appeared to have occurred in 2003. However, in explaining the current drop in production, one commentator states, “The first possibility is that the Saudis could still pump 10 mb/d or more today if they wanted to, but they are cutting back production and exploring like mad because they put an extremely high value on have 2-3 mb/d of excess capacity. If so, the recent price behaviour suggests that the reason they would seek such capacity is not because they want to stabilize the price, but because it puts them in an incredibly powerful negotiating position. For example, the ability at any time to flood the market could be used at an opportune moment to undercut expensive alternatives such as oil sands that require an oil price over \$50. The second and more natural interpretation is even more disturbing: the mighty Ghawar oil field is already in decline, and the Saudis don't want anyone to know” (Web Ref 2).

2.3 Future demand and price

The International Energy Agency (IEA) reference scenario projects an increase in global oil demand of nearly 40% between 2005 and 2030, with an average annual growth rate of 1.3%, driven mainly by increasing demand from developing countries such as China and India. However, when compared to Aleklett's¹ 2006 prediction of future oil supply, with the peak placed in 2010, a large shortfall appears (see Figure 6).

¹ Kjell Aleklett is a Professor in Physics, and head of the Uppsala Hydrocarbon Depletion Study Group, at Uppsala University, Sweden. He is the acting President of the Association for the Study of Peak Oil and Gas (ASPO).

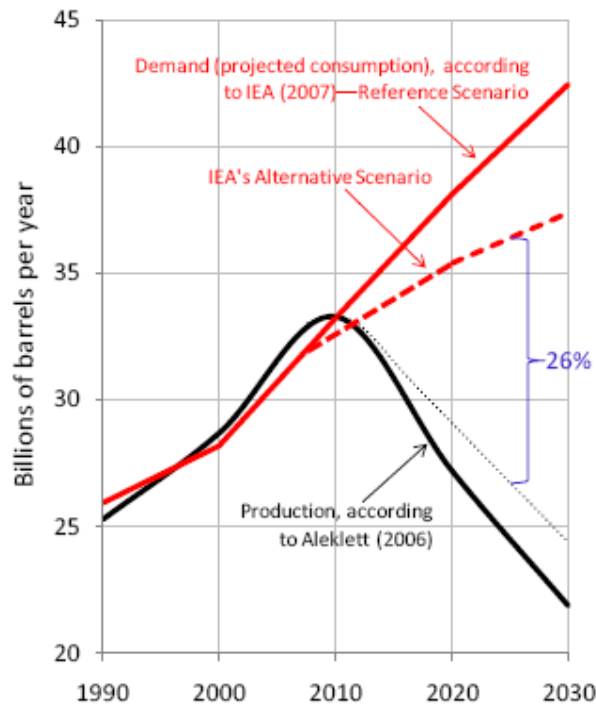


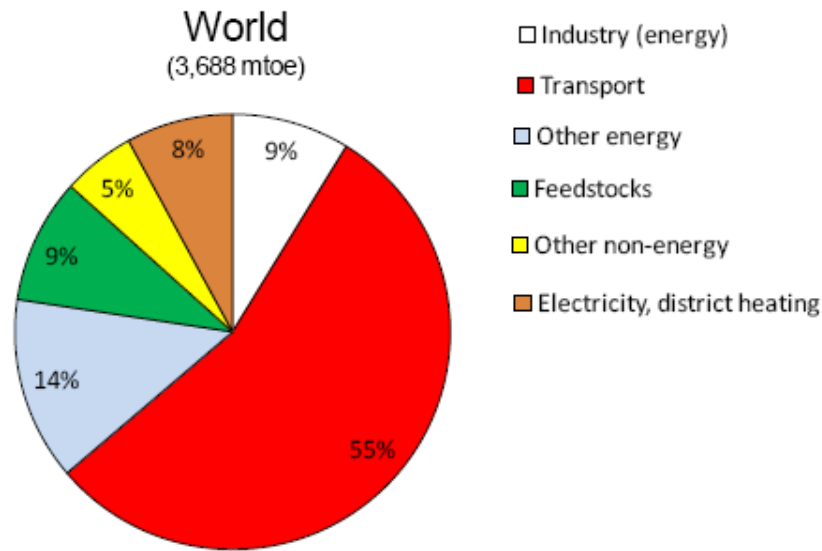
Figure 6: World oil supply and demand (Source: Gilbert et al 2007)

Even when compared to the IEA's Alternative Scenario, predicting a smaller increase in demand, and allowing for increased production in response to rising prices, the resulting gap between supply and demand in 2025 is estimated to be 26% (see Figure 6). This supply shortage is likely to result in a large increase in the price of oil. Research for the U.S National Commission on Energy Policy concluded in June 2005 that “a 4% global shortfall in supply results in a 177% increase in the price of oil” (NCEP 2005).

3. Transport and oil

In total, approximately 95% of transport activity is fuelled by oil products, with transport comprising over half of oil's end use², rising to 69% in the US (see Figure 7). The transport sector itself uses a range of fuels including petrol, diesel, kerosene (jet fuel), and bunker fuel (heavy fuel oil) as shown in Figure 8. When combined with the fact that there are few viable alternatives to oil as a cheap and abundant fuel source, it is clear that, “The transport sector is the most exposed part of the economy to oil prices” (OECD/ITF 2008a). However, “The transport sector's demand for oil is less price sensitive than any other part of the economy. This is partly because demand for transport services is relatively insensitive to price and partly because substitutes for oil in road transport are currently far from cost-effective. Evidence from the USA suggests that as incomes rise, transport sector oil demand becomes even less price sensitive. This implies that oil consumption is set to become increasingly concentrated in the transport sector” (ibid).

² Before end uses, approximately 7% of oil is used during the extraction and refining process. (Gibert et al 2007)



mtoe = millions of tonnes of oil equivalent
 Sources: International Energy Agency (2006a, 2006b)

Figure 7: Worldwide, end use of oil (source: Gilbert et al 2007)

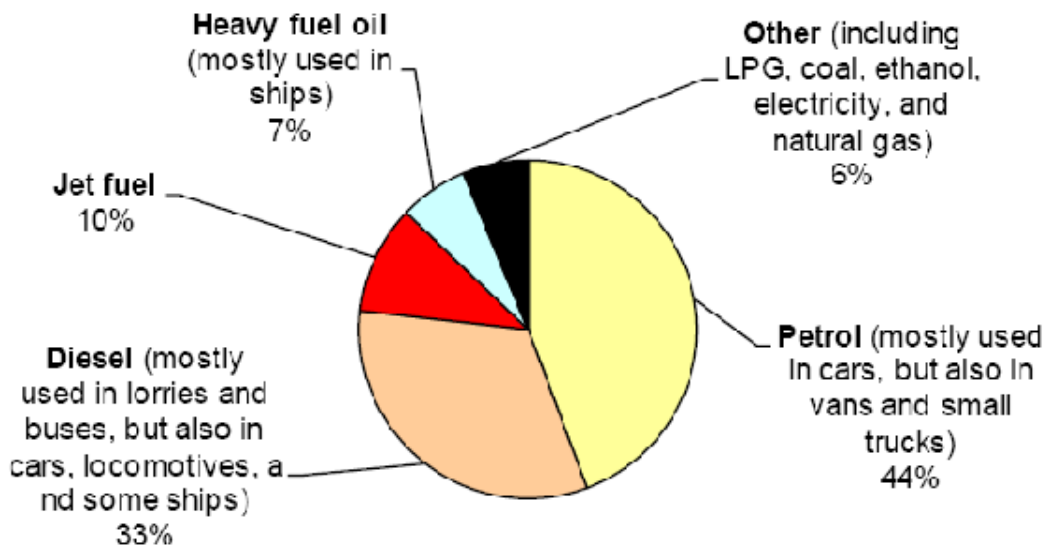


Figure 8: Worldwide, transport fuel use (Source: Gilbert et al 2007)

3.1 Impacts by transport sector

The aviation industry is likely to be the hardest hit by oil price rises, as a relatively large percentage of costs are associated with kerosene. While there have been high profile investments made in biofuel and hydrogen research and development for aviation (see Lott 2006), neither solution appears to be technically or morally viable in the short to medium term. Many airlines have

introduced fuel surcharges to cope with the current high oil prices. Steve Lott, a spokesman for the International Air Transport Association (IATA), stated, "The economic slowdown in the US, the oil price and the weakness of the dollar are all conspiring to hit the aviation market. Americans are going to be thinking hard about whether they can afford to travel... The outlook is grim" (Times 2008). More than a dozen airlines worldwide have already gone out of business this year, primarily due to the record oil prices.

Higher fuel prices will also encourage consumers to drive less, potentially reducing the current levels of traffic growth. Evidence suggests that traffic levels are falling due to increasing oil prices in the UK, with sales of SUVs down by a fifth (ACT-Travelwise 2008). A report by Canada's CIBC bank estimated that \$200 a barrel oil would result in a 15% drop in miles driven in the US (ibid). In the long term, increasing prices may be partially offset by a switch to more fuel efficient vehicles and reductions in other parts of the economy in the short term. However, it is essential that a larger range of oil prices are included in central forecasts for traffic growth, and used in transport appraisal.

Road freight transport is likely to be less affected by oil price increases than private car use as fuel accounts for only a small part of the total cost of producing most goods. Staff overheads, vehicles and tax are larger items of expenditure than fuel for most transport companies. The primary difficulty for freight transport companies is the delay in passing on fuel costs to clients in periods when prices rise rapidly (OECD/ITF 2008a). Nonetheless, continuing high oil prices may see companies decentralising distribution systems, with a possible move to smaller, widely dispersed warehousing to cut down on transport costs.

4. Alternatives to oil for transport

In order for the market to respond to rising oil prices, alternative energy sources and liquid fuels must become cost competitive, and most also be available in the volumes needed to provide cheap and abundant fuel to the rest of the world. However, on closer inspection it appears that there are significant barriers to the introduction of most alternatives.

4.1 Biofuels

Biofuels, generally in the form of biodiesel or ethanol have been seen as a way to reduce greenhouse gas emissions and improve energy security, with the Renewable Transport Fuel Obligation (RTFO) in the UK setting a target of 5% of road transport fuel to be produced from biofuels by 2010, bringing the UK into line with the EU Biofuels Directive. However, there are concerns over the climate impacts of many types of biofuel, and the impact increasing production may have on world food prices. Second generation biofuels in the form of cellulosic biofuels, and biofuels from algae may reduce these problems, but they are both many years from commercial production.

4.2 Hydrogen

Hydrogen is an energy carrier rather than an energy source, and can be produced from various sources including coal, nuclear power, natural gas and renewables. In the US, the National Research Council (NRC) found that in order for hydrogen fuel cells to compete with existing petroleum-based internal combustion engines, fuel cells must improve by a factor of 10-20 in cost, a factor of 5 in lifetime and a factor of two in efficiency. It did not believe that these improvements could be achieved through incremental technological development alone, requiring new concepts and breakthroughs to be made (NRC 2004). As Hirsch et al (2005) state, "In other words, today's technologies do not appear practically viable".

4.3 Electrification

Several commentators (see Gilbert et al 2007) have suggested a switch to grid connected electric vehicles as a way to mitigate the impacts of peak oil. Although this option would be vastly more efficient than using hydrogen or batteries, it would require enormous investment in additional infrastructure. Switching road vehicles to electric has the potential to flatten electricity demand curves, if the vehicles were to be recharged at night. However, until the UK substantially de-carbonises its electricity supply, this is likely to result in an increase in CO₂ emissions due to the prevalence of coal power (see section 6).

4.4 Natural Gas

Natural Gas is more expensive to transport than oil, and while it may offer a short term solution, a peak in global gas production is likely to closely follow a peak in global oil production making investments in natural gas refuelling stations and infrastructure appear short-sighted (ASPO 2008).

4.5 Improved supply and demand side efficiency

Improved oil recovery (IOR) increases the amount of oil recoverable from a single oil field. Various techniques are used including pumping water or carbon dioxide into an oil field to increase the pressure, and changing drilling angles. IOR adds extra expense to the extraction of oil, and is expected to have only a small effect overall oil supplies. Demand side measures such as improved vehicle efficiency could have potentially large impacts on oil use and carbon emissions, even when 'rebound' effects are taken into account.³

4.6 Non-Conventional Oil

At around \$40 a barrel it becomes profitable to produce oil from a range of unconventional sources, such as very heavy crude and tar sands. The Orinoco Belt in Venezuela is estimated to contain 230 to 300 billion barrels (bb) of very heavy crude, and Canada holds a similar amount of very heavy oil in its tar sand deposits. The USA, Russia and the Middle East also have large tar sand deposits and oil shales around the world are thought to have potentially recoverable reserves of around 3000 bb, ten times the amount of conventional oil found in Saudi Arabia.

Coal can also be converted to oil, as was done in wartime Germany and by SASOL in South Africa since 1955. There are large coal deposits in a wide range of countries around the world, with the USA holding the largest reserves. In 2007 several bills were presented to the US Congress for subsidies to finance coal to liquid fuel plants (OECD/ITF 2008a).

However, the environmental consequences of widespread use of non-conventional oils pose a serious challenge. They produce more than twice the CO₂ emissions of conventional oil (Green 2007), and would greatly increase the difficulty in global efforts to reduce greenhouse gas emissions. Carbon capture and storage may be used to reduce CO₂ emissions to similar levels as conventional oil, but this is still a relatively unproven technology and would raise the price of unconventional oil still further. Commercial production of oil sands also requires large amounts of water, and environmental damage through mining, with approximately two tonnes of oil sands needed to produce a single barrel of oil (GAO 2007). The executive director of the Sierra Club of Canada calls tar sands "...the world's dirtiest source of oil" (Hirsch et al 2005).

5. Peak Oil and Climate Change interaction

As the DTI Energy White Paper states, "Climate change is not simply an environmental problem,

³ The rebound effect notes the increase in miles driven when a consumer purchases a more fuel efficient car. It is estimated to erode 20-30% of the fuel savings made by efficiency measures.

but a threat to international peace, security and development” (DTI 2007). In the long term, it is likely to have much longer lasting and undesirable impacts on our future society than peak oil, and any attempts to tackle oil dependence and peak oil should be set within a framework of greenhouse gas emissions reduction targets. Peak oil solutions such as use of unconventional oils, relaxed drilling regulations, and massively scaled biofuels as recommended in the Hirsch report cannot be justified when climate change is taken into account.

There is also an argument that suggests current climate change policies may hasten the onset of peak oil, as oil producing nations and companies become less willing invest in oil production capacity in the face of deep fossil fuel cuts in the future.

6. The UK perspective

In the UK, North Sea oil and gas peaked in 1999, and had fallen by 36% by 2006 (BERR 2007). Therefore, forecast demand in the UK is unlikely to be met by indigenous production. Currently, the UK produces about the same quantity of oil as it consumes, however roughly 60% of this production is exported, with large amounts of oil being refined in the UK coming from Norway (46%), Russia (8%) and the Middle East (2%) (ibid).

The majority of UK oil demand is derived from the demand for road or air travel, with the remainder for energy or industrial use and non-energy use for lubricants and petro-chemical feedstocks, as shown in figure 9 (BERR 2007). In terms of rising oil prices for the transport sector in the long term, the UK is relatively well placed to absorb rising fuel prices for road transport, with the price for gasoline after tax equating to over \$300 a barrel (OECD/ITF 2008a). However, fuel duty reductions would be made at the expense of potential carbon emissions savings.

In terms of electricity generation, oil currently accounts for only 1% of UK capacity (see figure 10) and is expected to maintain at or below its current level for the foreseeable future (BERR 2007). However, natural gas, which will reach its peak soon after oil, accounts for 37% of our electricity supplies, and is forecast to increase its share of production to roughly 50% by 2020.

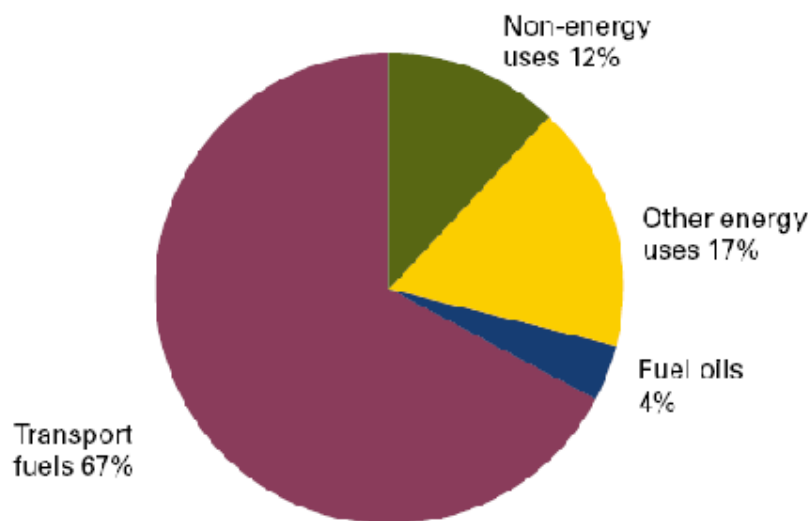


Figure 9: UK oil demand 2006 (source: BERR 2007)

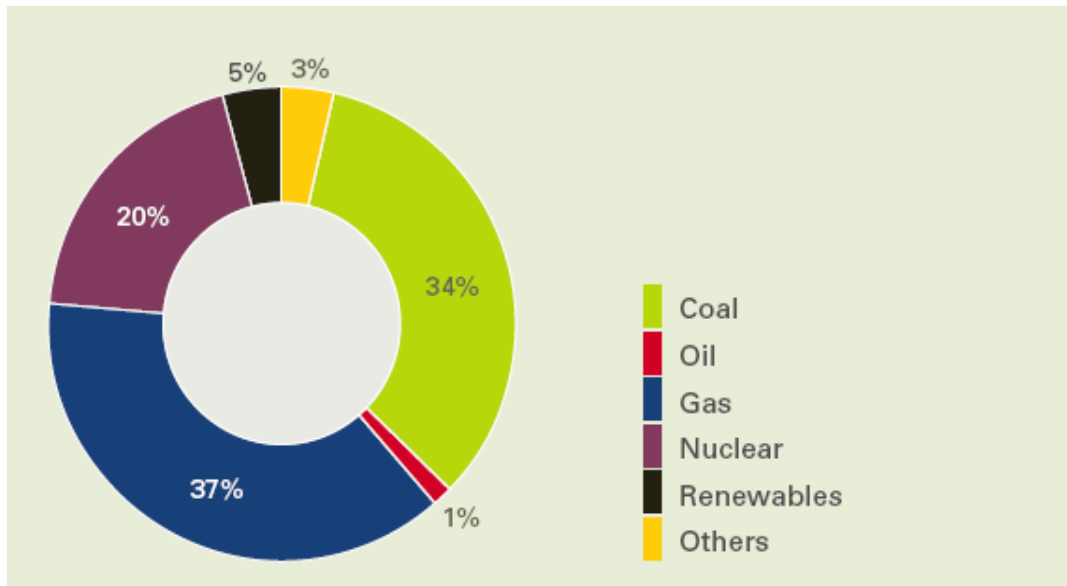


Figure 10: UK electricity generation mix 2005 (source: BERR 2007)

6.1 Government position

In the course of researching for this paper, the Department for Transport were contacted regarding their official standpoint on the 'peak oil' issue, who referred all enquiries regarding the topic to the Department for Business Enterprise and Regulatory Reform (BERR). The view of BERR is based on the findings of the International Energy Agency, with the Energy Market's Outlook (BERR 2007) stating, "We conclude that global resources are sufficiently abundant to meet demand for the foreseeable future". However, there appears to be a some indecision, with the report going on to state, "There are wide ranging views on when and why a peak in global oil production will occur...(and)...There are significant uncertainties surrounding the extent to which global supply will continue to be able to meet global demand".

The problem appears to be that if the government explicitly recognises the issue of peak oil production, it could damage consumer confidence and have a damaging effect on the markets. In the words of Joe Romm, former US assistant energy secretary, "if the US government even brought up the possibility that global oil production might peak in, say, 2020, not only would that have an enormous and very negative impact on the markets, but it would essentially force the United States abruptly to change its energy policy" (Roberts 2004). However, in the UK an Early Day Motion (no. 1453) calling for a reassessment of peak oil was signed by 69 MPs. At a recent conference Ruth Kelly, the Secretary of State for Transport, formally recognised the issue and called for a revolution in the way we live and do business, stating, "The era of cheap oil is over... we need to start finding alternatives now as well as ways to ensure we use the oil we have more efficiently" (Web Ref 4).

7. Conclusions and way forward?

Whether you believe the pessimists or optimists, a peak in global oil production within the next 20-30 years is a significant risk that we should be addressing. While there are alternatives to oil as transport fuel, few appear to offer a viable substitution for cheap and abundant oil, especially when

viewed through the prism of climate change. Our oil dependent lifestyles cannot continue indefinitely, and in the opinion of the author, the sooner we move away from oil dependency the better. The government should follow the lead of Sweden, who have committed to large cuts in oil use (COI 2006), and grass roots movements in the UK such as the Transition Towns network, in taking on the challenge that peak oil presents.

Oil prices are unlikely to return to the low levels of the 1990's and future planning decisions, government policy, and economic models should take this into account. The timing of peak oil lies within the time frame of 30-60 year economic appraisal and the DfT's 'Towards a Sustainable Transport System', and greater recognition should be paid to peak oil mitigation measures. Forecasts for oil prices need to be urgently revised to take account of increasingly unstable, and higher, oil prices in the future, and incorporated into transport appraisal methods such as NATA to achieve a more robust assessment of benefits.

Transport planners will have a vital role to play in adapting our current transport systems to the demands of more expensive oil supplies. Rising oil prices are likely to hit the aviation sector the hardest, and also slow, and possibly reverse current trends in traffic growth. The roles of transport professionals in the future are likely to be vastly different to those of today. Historically, much of transport planning has concerned itself with managing traffic growth and increasing capacity. However, if this predicted growth does not occur these roles will no longer be as necessary. Instead transport professionals will be needed to answer the question of how to provide mobility and access to services and markets in a world with increasingly scarce, expensive transport fuel. Energy efficiency is likely to play a crucial role and different patterns of mobility may emerge, with some commentators suggesting that large investments in grid-connected electrically powered transport infrastructure are needed. Although climate change remains the most pressing reason for transport planners to encourage a shift to more sustainable forms of transport, the inevitability of peak oil adds extra weight and urgency.

8. References

- ACT-TravelWise (2008) *Press Watch: Canada's CIBC Bank studies at the effect of \$200 oil on transportation in America.* www.acttravelwise.org/news/1130
- ASPO (2008) Association for the Study of Peak Oil and Gas. www.peakoil.net
- BERR Department for Business, Enterprise & Regulatory Reform (2007) *Energy Markets Outlook 2007*, TSO: London
- BP (2007) *Statistical Review of World Energy*, BP: London
- COI (2006) *Making Sweden an oil free society.* Commission of Oil Independence: Stockholm
- Deffeyes, K. (2005) *Beyond Oil: The view from Hubberts peak*, Farrar, Hill and Wang: New York
- DTI (2007) *Energy White Paper: Meeting the energy challenge*, Department of Trade and Industry: London
- GAO United States Government Accountability Office (2007) *Crude Oil: Uncertainty about Future Oil Supply Makes It Important to Develop a Strategy for Addressing a Peak and Decline in Oil Production*, GAO: Washington
- Gilbert, R., Perl, A. (2008) *Transport Revolutions: Moving people and freight without oil*, Earthscan: London
- Green, D. (2007) *Future Prices and Availability of Transport Fuels*, JTRC Discussion Paper 2007-15, ITF/OECD: Paris
- Hirsch, R., Bezdek, R., Wendline, R. (2005) *Peaking of World Oil Production: Impacts, Mitigation, & Risk Management*, DOE: Washington
- IEA (2006) *World Energy Outlook 2006*, International Energy Agency: Paris
- Lott, S (2006) Virgins Branson Tackles Emissions, *Aviation Daily*, September 28th
- Mitchel, J., Morita, K., Selley, N., Stern, J. (2001) *The New Economy of Oil: Impacts on Business, Geopolitics and Society*, Earthscan: London
- NCEP (2005) *Oil shockwave: Oil crisis executive simulation.* US National Commission on Energy Policy: Washington DC
- NRC National Research Council (2004) *The Hydrogen Economy: Opportunities, Costs, Barriers and R&D Needs.* National Academies Press: In Hirsch et al (2005)
- OECD/ITF Joint Transport Research Centre (2008a) *Discussion Paper No. 2008-5 Oil Dependence: Is transport running out of affordable fuel?*, OECD/ITF: Paris
- Roberts, P. (2004) *The End of Oil*, Clays: London
- Times (2008) May 31st 2008
http://business.timesonline.co.uk/tol/business/industry_sectors/transport/article4036174.ece

Web ref 1. Accessed 13th July 2008

<http://www.saudi-us-relations.org/newsletter2004/saudi-relations-interest-08-25.html>

Web Ref 2. Accessed 13th July 2008

<http://www.theoil Drum.com/node/2325>

Web Ref 3. Accessed 14th July 2008

www.simmonsco-intl.com

Web Ref 4. Accessed 20th August 2008

<http://www.lowcyp.org.uk/news/964/bulletin/>