

# “Peak Oil” – Are We There Yet?

Mirela Micu

Doctoral School of Economic Studies Academy, Bucharest  
e-mail: costianu\_mirela@yahoo.com

## Abstract

*The world, as we know it, is based on energy, primarily obtained from oil. Almost everything we have or use is using energy or was obtained using energy. But the specialists warn us: the oil reserves are going to end soon. “Peak oil” – also called “Hubbert’s peak” – is a problem of vital importance. What is “peak oil”? Have we already reached it or not yet? What do optimists say? What do pessimists say? How lack of supply is going to affect the price? I’ll try to talk about these matters and many others in my paper.*

**Key words:** *peak oil, price, resources*

## Introduction

Oil plays a central role in our society. We use it for a variety of purposes, including fueling our automobiles and producing our plastics and food. The amount of oil we consume increases every year while oil in the ground remains finite. This makes it inevitable that one day, world oil production will reach its peak. We can describe this moment as the highest production volume of oil in the history of mankind. After this, oil production will start its structural decline. Because industrial society is now extremely dependent on oil, hitting the peak will have tremendous impact; it has the potential to change society as we know it. Therefore, it is tremendously important to anticipate life in the post-peak era. In order to lay out a specific plan of action, be it in conservation or in an energy transition to alternative sources, it is necessary to have at least a rough idea of when the peak will be hit. Unfortunately, projections of the peaking date differ widely.

For the past few years the buzz about ‘peak oil’ has largely been confined to activist circles. The possibility of oil’s disappearance as a viable energy source was a cause for both dread - what horrible things might happen within a society deprived of its energy gluttonous toys? - and celebration - what desirable changes might occur? However, talk of the theory is increasingly finding its way into the mainstream. Although a peak and decline in oil production is a geological certainty, we should question whether it is actually occurring right now.

Beginning in 2003, a combination of strong demand growth (especially in China, India and the Middle East), rising prices, declining production in key regions and ominous warnings from market analysts has increased concerns about oil security. A milestone was the 2008 World Energy Outlook (WEO) from the International Energy Agency (IEA) which included a detailed examination of the accelerating decline in production from existing fields. In its reference scenario, the IEA estimated that 64 million barrels/day (mb/d) of new capacity would need to be put into production before 2030, equivalent to six times the current output of Saudi Arabia or 20

mb/d more than had been achieved over the preceding 23 years. While this scenario did not envisage a peak in the production of conventional oil before 2030, the IEA expressed serious concerns about whether the required investment would be forthcoming. The supply outlook has changed since the publication of the 2008 WEO, with the worsening economic recession leading to a major reduction in global oil demand, tumbling oil prices (from \$150/barrel in July 2008 to \$40/barrel in January 2009) and the cancellation or delay of many upstream projects. Given the long lead time on those projects, the likely result is constrained supply over the next five years and the risk of shortfalls and price spikes when demand recovers (IEA, 2009a). But while the short-term outlook has changed, the dispute about resource depletion and peak oil remains unresolved. Most governments exhibit little concern about physical depletion, several oil companies have been publicly dismissive and the majority of energy analysts remain skeptical. As a consequence, the general level of understanding of this topic remains fairly poor.

### **“Peak Oil” – who should we trust?**

In 1956, the geologist M. King Hubbert predicted that U.S. oil production would peak in the early 1970s. Almost everyone, inside and outside the oil industry, rejected Hubbert’s analysis. The controversy raged until 1970, when the U.S. production of crude oil started to fall. Hubbert was right.

Around 1995, several analysts began applying Hubbert’s method to world oil production and most of them estimated that the peak year for world oil would be between 2004 and 2008. If the predictions were correct, there would be enormous effects on the world economy.

At one of his courses at Stanford, Hubbert said that, though the crises in 1973 seemed hard, the real test would be in the early part of the twenty-first century, when the global oil would peak. This would be, he believed, the biggest challenge that our oil-based civilization had ever faced.

In 2005, oil production stopped growing, and the price of crude oil shot upward from \$45 per barrel to \$140 per barrel. According to some, we hit “peak oil”. With no additional supplies, a bidding war began in 2005 over the remaining oil in the ground. When geologic constraints stopped the growth of crude oil production, consumers around the world began outbidding one another for the remaining oil supply.

Concerns about global oil depletion are often characterized as concerns about ‘running out’. The image is one of a tank being slowly drained and eventually running dry, which implies that the main concern is precisely when this will occur. But there is very little risk of ‘running out’ of liquid fuels in the foreseeable future, even without considering the potential for bio-fuels or for replacing liquid fuels with electricity. To date, the world has used less than half of its endowment of conventional oil and the resource base of non-conventional fuels is very much larger. But the absolute size of the hydrocarbon resource is neither the only constraint on future oil supply, nor the most important. At least four other factors are relevant. First, the remaining resources are frequently more expensive to locate, extract, transport and/or refine than those which have been used to date, which implies that the era of cheap oil may have come to an end. Second, the exploitation of many of these resources will have severe environmental consequences, including landscape destruction, water abstraction and carbon emissions, which could constrain their use for liquid fuels. Third, compared to conventional oil, the exploitation of non-conventional resources generally requires more energy consumption at all stages of the processing chain, with the result that the net energy available for productive uses in society is likely to be reduced. Finally, the rate of production of the remaining resources could be relatively low as a result of their physical properties and/or location, together with the scale of investment that is required. And this last point is the key to the peak oil debate: it is not so much the size of the resource, but the rate of production of that resource and the reasons why that rate must eventually decline.

## Timing of peak oil

M. King Hubbert initially predicted in 1974 that peak oil would occur in 1995 "if current trends continue." [106] However, in the late 1970s and early 1980s, global oil consumption actually dropped (due to the shift to energy-efficient cars, [107] the shift to electricity and natural gas for heating, [108] and other factors), then rebounded to a lower level of growth in the mid 1980s. Thus oil production did not peak in 1995, and has climbed to more than double the rate initially projected. This underscores the fact that the only reliable way to identify the timing of peak oil will be in retrospect. However, predictions have been refined through the years as up-to-date information becomes more readily available, such as new reserve growth data. [109] Predictions of the timing of peak oil include the possibilities that it has recently occurred, that it will occur shortly, or that a plateau of oil production will sustain supply for up to 100 years. None of these predictions dispute the peaking of oil production, but disagree only on when it will occur.

According to Matthew Simmons, Chairman of Simmons & Company International and author of *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy*, "...peaking is one of these fuzzy events that you only know clearly when you see it through a rear view mirror, and by then an alternate resolution is generally too late." [110]

It is important to determine the period in which this peaking will occur, in order to implement appropriate mitigating measurements. Predicting the exact timing of the peak is a difficult task however, due to a lack of reliable data. There are large uncertainties regarding reserve data. In the 1980's OPEC stated an increase of approximately 300 billion barrels in their reserves within a few years. During this time no significant discoveries were made. It is still unclear what the true amount of reserves in OPEC countries are. The bigger problem is that there is no worldwide accepted method to account for oil reserves; various regions account their reserves in a different way. Oil companies, whether national or commercial, do not have a financial or political incentive to publish the correct amount of reserves.

Because of the uncertainty regarding the amount of worldwide reserves, oil production & peaking projections differ widely. We probably will never know the true amount of worldwide reserves.

Optimistic estimations of peak production forecast the global decline will begin by 2020 or later, and assume major investments in alternatives will occur before a crisis, without requiring major changes in the lifestyle of heavily oil-consuming nations. These models show the price of oil at first escalating and then retreating as other types of fuel and energy sources are used. [4] Pessimistic predictions of future oil production operate on the thesis that either the peak has already occurred, [5] [6] [7] [8] that oil production is on the cusp of the peak, or that it will occur shortly. [9] [10]

## The pessimists

Matthew Simmons said on October 26, 2006 that global oil production may have peaked in December 2005, though he cautioned that further monitoring of production is required to determine if a peak has actually occurred. [112] In 2007, Kenneth S. Deffeyes also argued that world oil production had peaked in December 2005. [5]

In October 2007, the Energy Watch Group, a German research group founded by MP Hans-Josef Fell, released a report claiming that oil production peaked in 2006 and would decline by several percent annually. The authors predicted negative economic effects and social unrest as a result. [6] [114]

Sadad Al Hussein, former head of Saudi Aramco's production and exploration, stated in an October 29, 2007 interview that oil production had likely already reached its peak in 2006. [7]

and that assumptions by the IEA and EIA of production increases by OPEC to over 45 MB/day are "quite unrealistic." [7] Data from the United States Energy Information Administration show that world production leveled out in 2004, and an October 2007 retrospective report by the Energy Watch Group concluded that this data showed the peak of conventional oil production in the third quarter of 2006. [6]

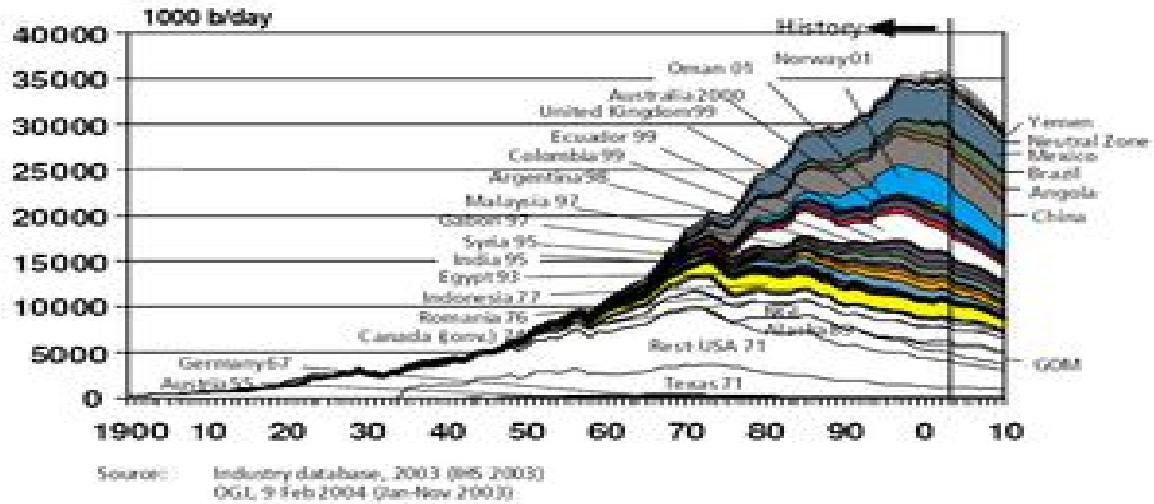


Fig. 1. 2004 U.S. government predictions for oil production other than in OPEC and the former Soviet Union

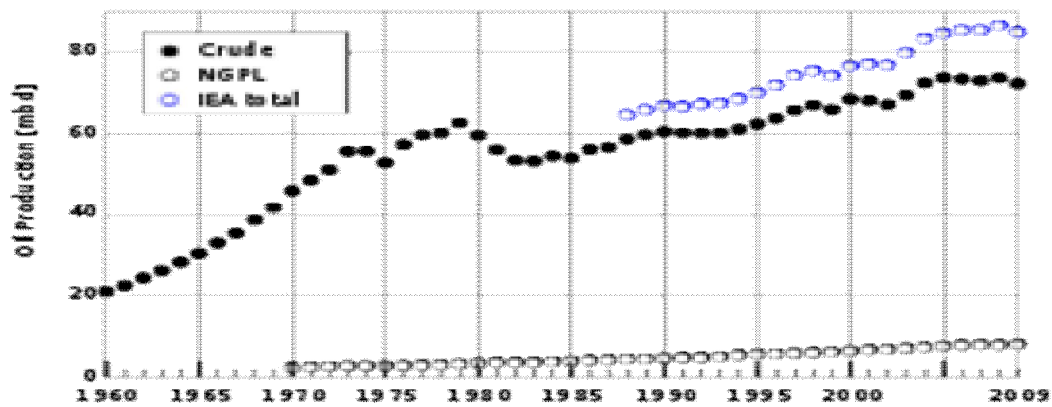


Fig. 2. World Crude Oil Production 1960-2008. Sources: DOE/EIA, IEA

ASPO predicted in their January 2008 newsletter that the peak in all oil (including non-conventional sources), would occur in 2010. This is earlier than the July 2007 newsletter prediction of 2011. [115] ASPO Ireland in its May 2008 newsletter, number 89, revised its depletion model and advanced the date of the peak of overall liquids from 2010 to 2007. [116]

At least one oil company, French super-major Total S.A., announced plans in 2008 to shift their focus to nuclear energy instead of oil and gas. A Total senior vice president explained that this is because they believe oil production will peak before 2020, and they would like to diversify their position in the energy markets. [119]

In October 2009, a report published by the Government-supported UK Energy Research Centre, following 'a review of over 500 studies, analysis of industry databases and comparison of global

supply forecasts', concluded that 'a peak in conventional oil production before 2030 appears likely and there is a significant risk of a peak before 2020'.<sup>[121]</sup> The authors believe this forecast to be valid 'despite the large uncertainties in the available data'.<sup>[122]</sup> The study was claimed to be the first to undertake an 'independent, thorough and systematic review of the evidence and arguments in the 'peak oil' debate'.<sup>[123]</sup> The authors noted that 'forecasts that delay a peak in conventional oil production until after 2030 are at best optimistic and at worst implausible' and warn of the risk that 'rising oil prices will encourage the rapid development of carbon-intensive alternatives that will make it difficult or impossible to prevent dangerous climate change'<sup>[123]</sup> and that 'early investment in low-carbon alternatives to conventional oil is of considerable importance' in avoiding this scenario.<sup>[124]</sup>

A 2010 report by Oxford University researchers in the journal *Energy Policy* predicted that production would peak before 2015.<sup>[10]</sup>

So, what about the experts and the oil companies who assure us that peak oil hasn't happened yet, won't happen anytime soon and isn't such a big problem.

## The optimists

Doom-laden forecasts that world oil supplies are poised to fall off the edge of a cliff are wide of the mark, according to leading oil industry experts who gave warning that human factors, not geology, will drive the oil market.

A landmark study of more than 800 oilfields by Cambridge Energy Research Associates (Cera) has concluded that rates of decline are only 4.5 per cent a year, almost half the rate previously believed, leading the consultancy to conclude that oil output will continue to rise over the next decade.

Peter Jackson, the report's author, said: "We will be able to grow supply to well over 100million barrels per day by 2017." Current world oil output is in the region of 85million barrels a day.

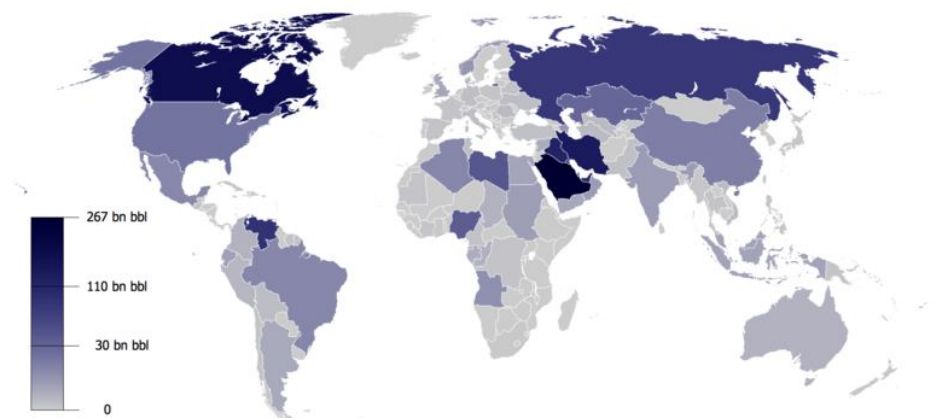
The optimistic view of the world's oil resource was also given support by BP's chief economist, Peter Davies, who dismissed theories of "Peak Oil" as "fallacious". Instead, he gave warning that world oil production would peak as demand weakened, because of political constraints, including taxation and government efforts to reduce greenhouse gas emissions. Speaking to the All Party Parliamentary Group on Peak Oil, Mr Davies said that peaks in world production had been wrongly predicted throughout history but he agreed that oil might peak within a generation "as a result of a peaking of demand rather than supply". He said it was inconceivable that oil consumption would be unaffected by government policies to reduce carbon emissions. "There is a distinct possibility that global oil consumption could peak as a result of such climate policies," Mr Davies said.

Cera analyzed the output of 811 oilfields, which produce 19 billion barrels a year, out of total world output of 32 billion. These included many of the giants, including Saudi Arabia's Ghawar, the largest known oilfield, which has been at the centre of the debate between peak oil analysts and their detractors. Cera reckons that oil output, including unconventional oil, such as tar sands, could allow oil to peak at much higher levels of as much as 112 million barrels per day, with average rates of more than 100million bpd. The Cera analysis targeted oilfields producing more than 10,000 barrels a day of conventional oil and concluded that overall output was declining at a rate of 4.5 per cent a year and that field decline rates were not increasing. This is much lower than the 7 to 8percent average rate that is generally assumed in the industry. Typically, Peak Oil theorists believe that the output of oil reserves can be plotted on a graph as a bell curve, rising to a peak and then falling rapidly.

His analysis is disputed by many geologists today, who argue that technology has changed the equation, allowing oil companies to produce more oil from reservoirs than was previously possible.

## Oil reserves

To pump oil, it first needs to be discovered. The peak of world oilfield discoveries occurred in 1965[42] at around 55 billion barrels(Gb)/year.[43] According to the Association for the Study of Peak Oil and Gas (ASPO), the rate of discovery has been falling steadily since. Less than 10 Gb/yr of oil were discovered each year between 2002-2007.[44] According to a 2010 Reuters article, the annual rate of discovery of new fields has remained remarkably constant at 15-20 Gb/yr.[45]



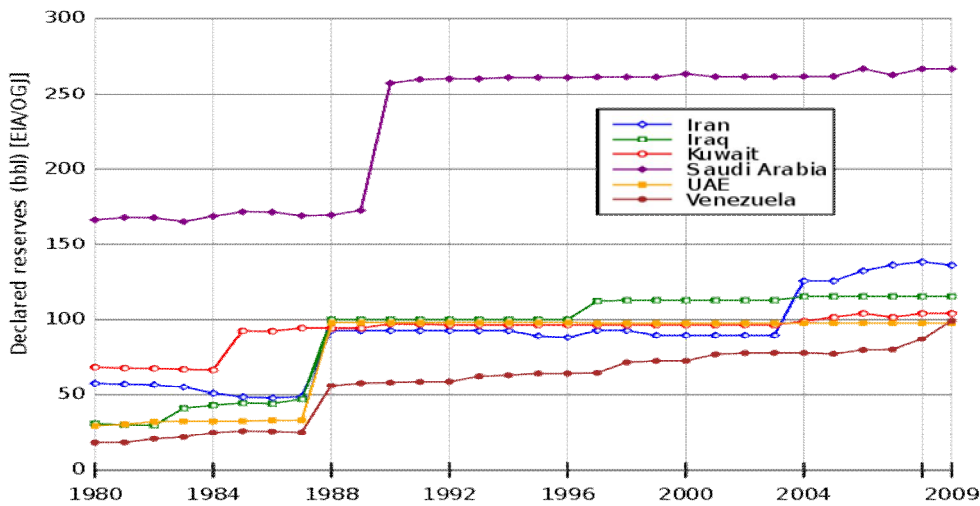
**Fig. 3.** Oil – proved reserves. Source: CIA – The World Factbook, June 15, 2009

One difficulty in forecasting the date of peak oil is the opacity surrounding the oil reserves classified as 'proven'. Many worrying signs concerning the depletion of proven reserves have emerged in recent years.[51][52] This was best exemplified by the 2004 scandal surrounding the 'evaporation' of 20% of Shell's reserves.[53]

For the most part, proven reserves are stated by the oil companies, the producer states and the consumer states. All three have reasons to overstate their proven reserves: oil companies may look to increase their potential worth; producer countries gain a stronger international stature; and governments of consumer countries may seek a means to foster sentiments of security and stability within their economies and among consumers.

The Energy Watch Group (EWG) 2007 report shows total world Proved (P95) plus Probable (P50) reserves to be between 854 billion and 1,255 billion barrels (30 to 40 years of supply if demand growth were to stop immediately). Major discrepancies arise from accuracy issues with OPEC's self-reported numbers. Besides the possibility that these nations have overstated their reserves for political reasons (during periods of no substantial discoveries), over 70 nations also follow a practice of not reducing their reserves to account for yearly production. Analysts have suggested that OPEC member nations have economic incentives to exaggerate their reserves, as the OPEC quota system allows greater output for countries with greater reserves.[48]

On the other hand, investigative journalist Greg Palast argues that oil companies have an interest in making oil look more rare than it is, to justify higher prices.[56] This view is refuted by ecological journalist Richard Heinberg.[57] Other analysts argue that oil producing countries understate the extent of their reserves to drive up the price.[58]



**Fig. 4.** OPEC declared reserves between 1980 and 2008 - Data from EIA (US Energy Information Administration), International Energy Statistics, Crude Oil Proved Reserves for OPEC (based on Oil & Gas Journal)

In November 2009, a senior official at the IEA alleged that the United States had encouraged the international agency to manipulate depletion rates and future reserve data to maintain lower oil prices.[59] In 2005, the IEA predicted that 2030 production rates would reach 120 million barrels per day, but this number was gradually reduced to 105 million barrels per day. The IEA official alleged industry insiders agree that even 90 to 95 million barrels per day might be impossible to achieve. Although many outsiders had questioned the IEA numbers in the past, this was the first time an insider had raised the same concerns.[59] A 2008 analysis of IEA predictions questioned several underlying assumptions and claimed that a 2030 production level of 75 million barrels per day (comprising 55 million barrels of crude oil and 20 million barrels of both non-conventional oil and natural gas liquids) was more realistic than the IEA numbers.[8]

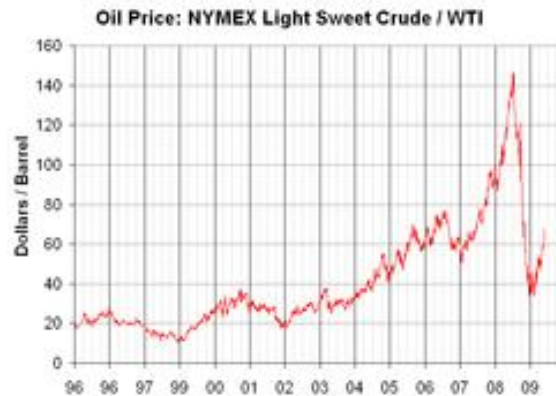
World wide oil discoveries have been less than annual production since 1980.[6] According to several sources, worldwide production is past or near its maximum.[5][6][7][9] World population has grown faster than oil production. Because of this, oil production per capita peaked in 1979 (preceded by a plateau during the period of 1973-1979).[28]

The increasing investment in harder-to-reach oil is a sign of oil companies' belief in the end of easy oil.[40] Additionally, while it is widely believed that increased oil prices spur an increase in production, an increasing number of oil industry insiders are now coming to believe that even with higher prices, oil production is unlikely to increase significantly beyond its current level. Among the reasons cited are both geological factors as well as "above ground" factors that are likely to see oil production plateau near its current level.[80]

Recent work points to the difficulty of increasing production even with vastly increased investment in exploration and production, at least in mature petroleum regions. A 2008 Journal of Energy Security analysis of the energy return on drilling effort in the United States points to an extremely limited potential to increase production of both gas and (especially) oil. By looking at the historical response of production to variation in drilling effort, this analysis showed very little increase of production attributable to increased drilling. This was due to a tight quantitative relationship of diminishing returns with increasing drilling effort: as drilling effort increased, the energy obtained per active drill rig was reduced according to a severely diminishing power law. This fact means that even an enormous increase of drilling effort is

unlikely to lead to significantly increased oil and gas production in a mature petroleum region like the United States.[81]

## Oil prices



**Fig. 5.** New York Mercantile Exchange prices for West Texas Intermediate 1996 - 2009

Why are oil prices rising usually? Explanations generally fall into two major categories. Financial market speculators are said to have driven oil prices well above the “equilibrium” price. Major oil companies are said to be hoarding cash and buying back their stock instead of putting the money into oil exploration. OPEC and national oil companies promise only tiny increases in production, which drives up the price. Alternative energy sources are not being sufficiently supported by governments. But even if we repaired something in the economy, it wouldn’t make much of a difference – there just isn’t enough oil to pump. So, the second possible driver of the price increase – quite simply lack of supply. Geologists just can’t find enough new sources of oil to meet the demand. It was pointed out that two barrels of oil are being burned for every new barrel that it is discovered. And the geological limits on the world oil supply are propelling the price of oil higher.

In terms of 2007 inflation adjusted dollars, the price of oil peaked on June 30, 2008 at over \$143 a barrel. Before this period, the maximum inflation adjusted price was the equivalent of \$95–100, in 1980.[171] Crude oil prices in the last several years have steadily risen from about \$25 a barrel in August 2003 to over \$130 a barrel in May 2008, with the most significant increases happening within the 2008 year. These prices are well above those that caused the 1973 and 1979 energy crises. This has contributed to fears of an economic recession similar to that of the early 1980s.[11] One important indicator that supported the possibility that the price of oil had begun to have an effect on economies was that in the United States, gasoline consumption dropped by .5% in the first two months of 2008,[172] compared to a drop of .4% total in 2007.[173]

In 1980, when crude first hit an inflation-adjusted high of \$100, the pace of drilling by producing countries and major oil companies became fast and furious, leading to rising output and a price collapse in 1986.

## Conclusions

Despite much popular attention, the growing debate on ‘peak oil’ has had relatively little influence on energy and climate policy. Most governments exhibit little concern about oil depletion, several oil companies have been publicly dismissive and the majority of energy



analysts remain skeptical. But beginning in 2003, a combination of strong demand growth, rising prices, declining production in key regions and ominous warnings from market analysts has increased concerns about oil security. While the global economic recession has brought oil prices down from their record high of July 2008, the International Energy Agency (IEA) is warning of a near-term ‘supply crunch’ owing to the cancellation and delay of many upstream investment projects. There is a growing consensus that the age of cheap oil is coming to an end. Without sufficient investment in demand reduction and substitute sources of energy, a decline in the production of conventional oil could have a major impact on the global economy. In addition, the transition away from conventional oil will have important economic, environmental and security implications which need to be anticipated if the appropriate investments are to be made.

The supply of energy as we have known it is in the process of transition. Today’s “easy” conventional oil that the world relies upon as a primary energy source is being depleted, and, regardless of the exact timing of peak oil production – be it this year or fifty years from now – the world faces the challenge of adapting to a new model of energy supply. Although the peak oil literature tends to concentrate heavily on the scenarios of peaking world oil production, the true underlying issue is a fear that the transition from conventional oil to substitutes will be expensive and chaotic, leaving insufficient time for supply substitution and adaptation.

This adaptation process (which involves using more renewable resources and conservation and developing new technology and processes to better access hydrocarbon deposits and more efficiently extract and refine non-conventional sources) has already begun. But the road to the future energy balance – one with dwindling amounts of conventional oil – is far from mapped out.

It is possible that the world’s vast endowments of hydrocarbon resources will be heavily relied upon to answer this growing call for substitutes for the conventional oil supply. However, there is also potential for an energy future largely diversified away from hydrocarbon use. Most likely, future energy sources will be a combination of the two. Perhaps the peak oil literature would better serve society by being more solution-orientated, focusing on discovering the best way to transition to a world with less conventional oil rather than locking horns about discrepancies in terminology.

One thing is for sure: we need alternatives.

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## “Varful petrolului” – I-am atins deja?

### Rezumat

*Lumea, asa cum o stim noi, se bazeaza pe energie, obtinuta in principal din petrol. Aproape tot ce detinem sau folosim contine energie sau a fost obtinut folosind energie. Dar specialistii trag un smenal de alarma: rezervele de petrol se vor termina in curand. “Varful petrolului” – sau “varful lui Hubbert”, cum mai este denumit – e o problema de o importanta vitala. Ce este “varful petrolului”? I-am atins deja sau nu inca? Ce spun optimistii? Ce spun pesimistii? Cum va afecta lipsa de oferta pretul petrolului? Aceste probleme sunt cuprinse pe scurt in lucrarea mea.*