

Is Oil Running Out?

Pablo Benavides

At a time when renewable energies are all the rage, there is a simple answer to the question regarding the end of the oil era: like so many other natural resources, oil is also expected to become scarce, and ultimately runs the risk of disappearing. That calm, wise man Sheik Yamani, creator and manager of OPEC for many years, once said and likes to repeat, showing his great sense of humour, that “the Stone Age came to an end not for a lack of stones and the oil age will end, but not for a lack of oil”. This exaggerated and provocative statement defies the opinions of “oil-supply pessimists” like Colin Campbell, who have been predicting the disappearance of oil resources for many a year, and have constructed a group that goes by the name ASPO (Association for the Study of Peak Oil) to defend their theses and warn against the risks. However, in all truth – there is no room for dogmatism on this issue – neither the Sheik’s *boutade* nor the pessimists’ predictions match the reality of a very complex situation that depends on multiple factors.

The calculation and exploitation of oil reserves have traditionally been depicted by the famous King Hubbert curve, a graph whose horizontal axis plots the period of exploitation in decades, and whose vertical axis indicates exploited reserves. The highest point of the bell-shaped curve comes at the so-called exploitation peak, which triggers a drop in available reserves until their eventual depletion due to a lack of replacement discoveries. For decades analysts have been modifying the profile of the bell, increasing the height of the peak to reflect increased consumption, and its width to show the progressive expansion of the period during which available resources are expected to last. In short, the Hubbert curve gets taller, wider and, what is most encouraging, it moves rightwards on the horizontal axis, indicating that the resource will last longer. The threat of oil depletion has, therefore, been falling practically since the beginning of its industrial exploitation, when Mr Al Hammil drilled an extraordinary well in Spindletop (Texas) on January 10, 1901.

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To respond to the challenge, we must start with a series of precise questions so as to not to dwell in the realm of speculation, but instead adopt the decisions needed to ensure orderly management of oil resources: How much and what kind of oil are we talking about? What is current oil consumption, and what levels are expected? What technological means do we have at present, and what will be available in the future, to exploit these reserves? At what prices, and for how long?

Oil reserves

There is absolutely no consensus as to how the concept of hydrocarbon reserves is interpreted. Institutions, companies or governments use different versions at will, depending on multiple criteria. The most widespread method was agreed in February 2000, and differentiates between proven reserves, i.e. with exploitation probabilities over 90 per cent; probable reserves, where the probability ranges around 50 per cent; and possible reserves, which stand at around 5 per cent. However, reserve assessments are subject to interference from geopolitical factors or business preferences. In truth, all evaluations are biased by one or another interest. For instance, the assessment of hydrocarbons in the Caucasus, which have secured great significance, is still surrounded by uncertainty. It is hard to believe reports that over the course of a few years, and depending on the source consulted, have doubled the size of assessed reserves in this area. These estimates can affect extremely important geopolitical decisions, among others those concerning advisable oil pipelines, their layout and their capacity. Equally, companies in the sector have often been forced to correct their reserve evaluation, sometimes reducing them, as in the recent cases of Shell and Repsol-YPF, and at other times increasing them, as was the case of Petrobras after discovering new off-shore reserves in the great Tupi oilfield.


In late 2006, proven global oil reserves could be estimated at, at least, 1.2 trillion barrels, of which 742,000 million are in the Middle East, far more than the African Continent with 117,000 million, and South and Central America with 100,000. Moving downward, we find Russia, North America, the rest of the former Soviet Union, Asia and Europe, which has merely 17,000 million. These figures, like any others, can be questioned, but in any case they refer to exploitable conventional crude oils in current technological conditions and at affordable extraction prices. At the same time, global production amounted to 81.7 million barrels a day, with 25.6 million extracted in the Middle East area; 13.7 million in North America; 9.8 in Russia; 10 in Africa; 7.9 in Asia-Pacific; 6.9 in South and Central America; 5.2 in Europe; and, finally, 2.6 in former USSR countries. The exploitation and reserve ratio, thus, swings enormously from under 10 in the case of the

scarce and over-exploited European reserves, to almost 80 for the Middle East, which is – and will continue to be – the main world provider.

The problem stressed by defenders of the rapid depletion theory is the lack of oilfield discoveries capable of replacing those that are gradually being depleted. It is unquestionably true that the age of easy, cheap oil is over, and that the era of discoveries of important oilfields like Ahwaz, Marun, Urengoy, North Field or Astrakan is now long gone, and that in certain cases, such as the US, the exploitation/reserve ratio has embarked on an irreversibly declining trend over the past twenty years. Even discoveries like those of the South Pars oilfields in Iran, or Kashagan in Kazakhstan, which are evidently of great importance, present geopolitical or technical problems of such magnitude that they have caused notorious failures for some Western companies that risked too much.

In order to satisfy expected demand in 2015, on the basis of contemporary consumption parameters, another 60 million barrels a day will have to be added to current production. This figure is unattainable, since it would involve discovering and developing a dozen new oilfields, each as large as North Field.

Yet the decline of conventional crude oil need not imply the approaching end of oil. Growing global demand forces us to turn to other non-conventional types of oil. What were previously considered non-exploitable crude oils have become a necessary and possible objective. This is the case of the Athabaska tar sands in the Canadian province of Alberta, where reserves would exceed, in terms of extractable oil, the current Saudi Arabian reserves, although exploitation involves gigantic earth-moving procedures, requiring a major water and energy supply while incurring considerable environmental risk. Another example is the heavy and extra heavy crude oil from the Orinoco Belt in Venezuela, which could be extracted – either by orimulsion or other methods – and marketed, were the government to allow the huge investments needed to face this technological challenge. The same can be said of off-shore exploitations in deep and extra-deep water. The technical difficulties surrounding off-shore exploitations – such as in the Gulf of Mexico, the North Sea, Nigeria, Equatorial Guinea or Angola –, are not comparable to those of sites located in extra-deep water. In fact, the Tupi oilfield opposite the city of Santos – which Brazil has quickly counted as short-term exploitable reserves – refers to an enormous site of some 8,000 million barrels on one layer, with an average 500 metre thickness spreading out over an area measuring 800 kilometres long and 200 wide. The whole field is located under a salt sheet measuring 2,000 metres and located



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6,000 metres deep, of which 2,000 are sea water. The exploitation costs for such an extraordinary site would not be under 50,000 million dollars.

For years, Norway, which exploits hydrocarbon reserves in the North Sea, has been proclaiming the vast possibilities of more northern waters, such as the Barents Sea, alongside those of polar oil, including the potential reserves of Greenland. At present, it seems very difficult to assess the potential of all these reserves, but that has not stopped major Nordic powers from setting their eyes on the Arctic as an area holding more than just important hydrocarbon reserves, and for some, like Russia, to have positioned their flag on the sea bed to mark a territory whose limits and economic exploitation could give rise to serious international friction. The Great Game of the beginning of the century in the Caucasus may be repeated in the future in other areas. The main difficulty lies in transporting crude oil in seas that are frozen during most of the year – unless a strange paradox of the thawing produced by climate change opens up new routes. Other potential exploitations in Alaska or North-Eastern Siberia face unresolved problems linked to preservation of the environment (like the Nature Reserve in Alaska), or the delicate stability of the Periarctic permafrost.

This quick summary of the oil supply situation is expressed in terms of reserves potential. If we were to include all the aforementioned possibilities, reserves would multiply by no less than 250 per cent, resulting in a figure above three billion barrels of oil equivalent.

Demand, technology and prices

Oil depletion, after estimating available reserves, will depend essentially on three factors: the evolution of global demand, technological advances and market prices. All calculations from any source considered come to the same result: the energy demand for the coming decades will grow at an approximate rate of 2 per cent a year. The International Energy Agency in its World Energy Outlook 2007 fixes it at 1.8 per cent, which would lead to a global increase of 55 per cent by the 2030 time horizon. Emerging countries, especially China and India, will play a pivotal role in this foreseeable increase in demand, while the Agency also pays special attention to developing countries. The BRIC group (Brazil, Russia, India and China) will account for 80 per cent of the increase, as Chinese imports will multiply by four and India's will triple. Meanwhile, in industrial countries consumption will tend towards stabilisation and will be curbed by energy efficiency. For instance, improvements in the models of the vehicle fleet and the use of biofuels, and perhaps of fuel cells in the United States, will be responsible for current consumption of conventional oil (9.2 million barrels/day) increasing to a foreseeable 10.6 million, although this would actually involve a reduction of conventional oil to 8.5 million barrels. Biofuels would represent almost one million, and


savings regarding consumption would represent the other remaining million barrels.

An analysis of the global consumption curve shows a sharp slope between 1950 and 2000, according to which the growth of energy consumption doubled that of the global population. However, after the year 2000 consumption of over 10,000 million tons of oil equivalent (toe), and rising, could reach levels that will become more stable between 2025 and 2050, at around 12,000 million toe. If this occurs, the consumption of energy per capita could also stabilise at a figure somewhat below 2 toe.

This result takes into account factors like the foreseeable increase of vehicles per population, which is vital to oil consumption. At present, compared to the 620 vehicles per 1,000 inhabitants in the US, 487 in Japan and South Korea or 444 in Western Europe, China only has 12. By 2025, the US will be standing at the same rate, perhaps somewhat above the present figures, but the vehicle fleet will increase spectacularly in countries like China, reaching up to 74 vehicles per 1,000 inhabitants, with similar increases in Russia, the former USSR and Latin America, which will double their fleet to 312 and 269 vehicles per 1,000 inhabitants.

In any case, demand derived from transport needs will continue to constitute the main body of oil consumption, which will continue to grow regardless of substantial improvements introduced both in land vehicles and aviation, where the consumption of fuel per engine or passenger has decreased drastically since 1960 but has tended to stabilise as of 2005.

As regards technologies, very briefly, it is important to highlight the improvements introduced in all stages of oil production. With reference to exploration, thanks to enhanced and more precise information regarding geological basins and fields; as regards perforation, thanks to greater accuracy and the reduction of failures; in development, thanks to off-shore fields that are essential to maintaining the production of conventional crude oils at appropriate levels; and in the production stage, thanks especially to crude oil recuperation. An increase of the exploited oilfield recuperation factor would result in a very significant increase of available resources. In the technological sector, according to the recent HyWays Report financed by the European Union Research Programme, the consumption of crude oil in the land transport sector will drop by 40 per cent from now to 2050 through the use of hydrocarbons. According to the Report, in 2030 it will reach the profitability threshold, with a fleet of 16 million vehicles and total accumulated investments of 60,000 million euros in infrastructures.



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Last but not least, the price factor. In November 1998, the barrel of Brent was quoted at slightly under 10 dollars; on February 27th 2008, that same barrel exceeded the magical figure of 100 dollars, a sum that not even the most pessimistic analysts dared to predict at such early a time. After that, nothing prevents speculating with Brent at 125-150 dollars, as predicted by some financial institutions, or, in the event of a dramatic action such as a US attack on Iran and the resulting interruption of traffic along the Strait of Hormuz, at 200 dollars, as Yamani himself admitted during a recent speech in Madrid.

Whichever the future price range, the fact is that everyone will benefit from a price level that allows for the development of alternative solutions. A hasty analysis of the relationship between both factors shows that production costs range between five and seven dollars for Saudi and Qatar crude oils, between 15 and 20 dollars for deep-water exploitation and for heavy crude oils, around 25 dollars on continental platforms, and upwards of 45 dollars in Canadian bituminous sands. Obviously, the famous Hubbert curve also expands, making available reserves increase from one billion barrels at 15 dollars to 4.5 billion barrels at 75-80 dollars. These reserves would progressively include non-conventional crude oils, deep-water exploitation, Arctic oil, super-deep oil, recuperation, extra-heavy crude oil and bituminous sands and slates.

Is oil running out?

Let's pick up the issue this article began addressing. The end of oil is not near nor foreseeable, despite the predictions of pessimists like Campbell who, even after considering all the factors outlined in this paper, position the peak of the curve around 2015, with maximum production of 30,000 million barrels a year followed by a drop that would see production end up at around 15,000 million a year in 2050. Other predictions – like those voiced by Latherer based on International Energy Agency models, which incorporate investments established by the Agency for the coming thirty years of 22 billion dollars – calculate that on the basis of consumption of over 90 million barrels a day (some say 116 million), available resources will most probably reach three billion barrels (the least realistic say four), while the descending production curve will reach 2100. Thus, the famous peak will depend on two very different visions and, according to one or the other, could reach 2012-2015 or around 2030-2040.

None of this exempts humanity from abiding to the golden rule that seems to be ignored quite obstinately: the Earth's natural resources are not infinite. They are not only for the use of our era, but should also guarantee the wellbeing of future generations. Financial skills and reason will have to do the rest.