

OIL PEAK

A CHALLENGE FOR THE RENEWABLES

By Emil Bedi and Gunnar B Olesen



The world's energy consumption has never been as huge as it is now. The use of commercial energy now exceeds 200 million barrels of oil equivalent (BOE) each day. But it seems that the world is going to face serious problems with peaking and decline of oil production and in some regions also

gas production. The peak of oil discoveries was reached in the 1960s. This peak has to be followed by a peak in production, since we can only produce what has already been found. Peak production has been reached in many countries, for example in the US in 1970. Recent 'members' joining the club of 50+

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countries with declining production rates are the UK (1999), Australia (2000), Oman (2000) and Norway (2001).

OIL PEAK

The production pattern during the life of any oil region can be divided into three phases: continual or increased production, flat (or peak) production and decline of production. The production peak of each field is an inevitable fact. Today almost all large oil fields have already passed their maximum production and are in decline. Many geologists who study world oil reserves against production believe that the world oil supply will soon reach the turning point towards an irreversible decline. According to Dr Campbell, who spent decades working as an international exploration geologist for major oil companies, world oil discovery peaked in the 1960s and has declined steadily ever since. The world is facing the situation when we produce four barrels for every one we discover. Clearly, this is an unsustainable situation since long-term discovery and production must be in balance to some degree. There is an imminent threat of oil peak ahead of us. But a peak does not mean the world will run out of oil. Peaking does mean growth is over and steady decline is ahead.

PAST PEAKS

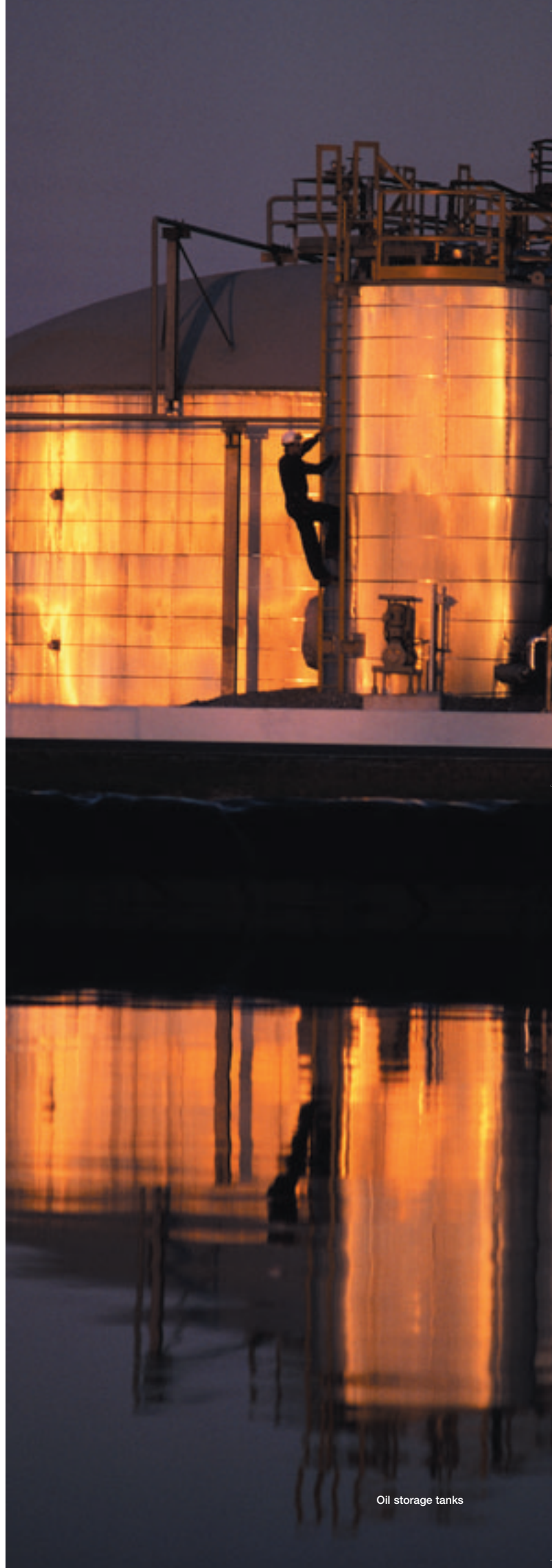
The geologist King Hubbert (former employee of Shell) predicted in 1956 that the peak of US oil production would be reached around the year 1970. This prediction was widely ignored at that time, but later turned out to be correct. US oil supply peaked in 1970.

North Sea oil peaked between 1999 and 2001. Oil production in the former Soviet Union peaked in 1988 and recent growth is considered as the capturing of oil left behind. Iran's great oil fields peaked in the 1970s. Most of them now produce 15 to 30 percent of peak rates. Oil production has peaked in more than 50 oil producing countries, including the US and Great Britain. China, which is just second behind the US in oil consumption, was a net exporter of oil until 10 years ago and now imports almost one third of its own oil needs.

And natural gas is peaking as well. North American natural gas peaked in 2001. Gas supply also peaked in Indonesia, Netherlands, the UK and probably in Russia, at least in the European parts of Russia.

The oil production peak was reached in the US in 1970. Growing oil production in Alaska in the following years could only compensate for the decline of the old fields for a short while. High oil prices stimulated enormous activity in the early 1980s in order to bring new wells into production. This resulted in a slight increase in the production of the 'Lower 48' states. Nevertheless within a few years production started to decline again at even higher rates than before. The long-term decline trend was approaching the values one would have expected from the experience of the 1970s.

Alaska reached its peak more than 10 years ago. Average oil production per well has also declined – in Texas



Oil storage tanks

to about six barrels per day. This production rate can be compared with the generation of renewable energy: an average oil well in Texas produces about the same amount of energy as might be provided in the form of thermal energy by solar collectors of a square of 45m each side (1800m²).

Oil production in the UK peaked in 1999. The production of all the big fields has been declining for many years, but for the first time in 2000 bringing new fields into production could not offset this decline. Since then, total production has also been decreasing. A fact recognised by Michael Meacher, former UK environment minister (1997-2003), who expressed his worries about an upcoming oil peak in an article that appeared in the Financial Times (5 January, 2004): "Four months ago, Britain's oil imports overtook its exports, underlining a decline in North Sea oil production that was already well under way. North Sea oil output peaked at about 2.9m barrels per day (bpd) in 1999, and has been predicted to fall to only 1.6m bpd by 2007.

Today the world enjoys a daily production of 75m bpd. But to meet projected demand in 2015, we would need to open new oilfields that can give an additional 60m bpd. This is frankly impossible. It would require the equivalent of more than 10 new regions, each the size of the North Sea. The production of non-conventional crude oil has already been initiated at enormous cost in Venezuela's Orinoco belt and Canada's Athabasca tar sands and ultra-deep waters."

What happened with the North Sea oil? Evidently giant and medium sized fields declined fast and have not been compensated for by the new discoveries. Almost all new finds were small. The important thing is that that only few believed the UK could peak. So the question is if the North Sea lesson will be a global case study.

Ghawar is the world's largest oil field, and was discovered in Saudi Arabia in 1949. This oil field accounts for the production of 55 to 60 percent of all Saudi oil. Shaybah, Saudi Arabia's last giant oil field was discovered in 1967. The fear is that these elder oil fields may have already peaked and their production loss will never be compensated for by new discoveries.

The world has assumed that Middle East oil is possibly inexhaustible, but major declines in previously great oilfields have already occurred. The great Iranian oil fields are typical examples. Recently Oman's surprising production declines were also unexpected. Peaking has always been a surprise. Few thought that North American natural gas peak production was possible, but it came. Middle East oil peak will be the biggest surprise. When Saudi Arabia's oil output peaks, the world has also peaked.

OIL DISCOVERIES

The crucial question is: Are the new supplies large enough to replace declines in existing production? Probably not. The world used four times as much oil as was newly found in 2003. The rate of discoveries of worldwide oil reserves is steadily declining. In 2000, there were 16 large discoveries of oil, eight in 2001, two in 2002, and none last year. Furthermore, 95 percent of new oil discoveries are small fields.

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The year 2003 seems to be the first year since the beginning of the modern oil industry to have recorded no large oil discoveries at all. According to a recently published review by consultants IHS Energy: "One of the most significant concerns was that 2003 didn't produce large, unpredicted finds." Chris Skrebowski, editor of Petroleum Review, described the year's exploration results as "little short of horrifying", noting that "we would probably have to go back to the early 1920s to find a year when fewer large oil discoveries were made".

Total oil discoveries from new fields have replaced only 40 percent of production since the mid-1990s. And all this cost a huge amount of investment. Since 2001, the 10 largest oil companies together spent more on exploration than the current value of the discoveries they made. And natural gas discoveries follow the same pattern. In 2002 gas discoveries failed to replace annual production for the second year running.

SIGNS OF IMMINENT PEAK PRODUCTION

There are several facts supporting the claims that the world is facing an imminent threat of the oil peak:

- The oil industry is spending huge amounts of money and using all available technologies to find new oil in unfavorable areas (like the Arctic region and deep sea areas). This could be seen as the industry's admission of the fact that less oil is being found at other more accessible places.
- More oil producing countries are reaching their peak of production in spite of very favourable economic conditions like high oil prices.

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- The oil industry spent billions of dollars just to keep production flat. A survey covering 145 companies (1996-2000) shows that US\$410 billion was spent for net production decline. The big five oil companies spent US\$150 billion during 1999-2002 for four percent growth (600,000 bpd).
- Combined production peak of all countries outside OPEC occurred around the year 2000.
- Non-OPEC, non-FSU supply has been flat for seven years.
- 120 giant fields (mostly old) make up 47 percent of total world oil supply (14 old oil fields make up 20 percent).
- BP downscaled its production goals three times within the year 2001.

Several large oil companies are changing their reporting patterns and publish only their total output with combined financial results for oil and gas. This policy obscures the change in the production portfolio – a declining oil business and a growing share of the gas production.

High-ranking managers of Exxon (largest private oil and gas company) made several speeches in which they said that the whole industry is facing new and fundamental problems. Exxon has also published a graph, which shows the historical records of oil discovery that were first published by Colin Campbell and Jean Laherrère. It shows the fact that peak discovery took place in the 1960s. Exxon admits the fact that discoveries declined in the last two decades despite increased oil prices.

FUTURE DEMAND

Even at today's oil price of nearly US\$35 per barrel we can see few large-scale efforts for energy conservation or moves towards renewable energy sources. In fact, many countries (China being the best example) are experiencing record oil demand. Today two billion people still use no oil and another three billion use very little oil. So the question is: How solid is our energy future? Where will China and the others get their oil? China, second largest world oil consumer, currently imports 32 percent of its oil and is expected to double that amount by 2010. A report by the International Energy Agency predicts that by 2030, the oil imports of China could equal imports of the US today.

There is no doubt that huge increases for oil imports will take part in China, India, and other developing nations and that the 21st century will need far more oil and gas if the world economic development is to continue to be based on fossil fuels like oil and gas. Population is growing and current oil and gas use is still limited to the 'chosen few.'

NEW FRONTIERS

Fighting decline curves is the greatest challenge for new technology, new regions and non-conventional oil. Today it seems that if offshore and non-conventional oil and gas cannot grow fast, the futures of these fossil fuels are grim. Oil recovery from ageing fields utilising new technology is becoming more and more important. New measures are often

mentioned as a viable source of increased future oil recovery and as a reason to blame forecasters for being too pessimistic regarding future oil production. It is true that these measures are widely used and have the potential to increase the oil production rate. But the results of new technologies seem to lead only to faster declines. An example is the Yates field – one of the largest US fields, which was found in 1926 in Texas and has been exploited since 1929. In 1993 the new technology of hot steam and chemicals injection was introduced to increase production. This measure was successful for less than five years. The decline afterwards was very steep, exceeding 25 percent per year compared with 8.4 percent up to then. Today the production rate is even below the level it would have been without these measures.

Another example with multi billion-dollar technology of gas injection to boost old fields is Oman's Yibal oil field. The new technology was introduced in 1990 – after 30 years of water injection and pressure maintenance. In 1997 Yibal reached the peak. In 2001 production declined by 65 percent. The collapse was a total surprise for many experts.

NON-CONVENTIONAL OIL

Quite often we hear claims that the depletion of conventional oil supply will be offset by production from non-conventional sources, like oil from tar sands (heavy oil). Scientists acknowledge abundant non-conventional oil. But the production is costly and environmentally unfriendly. Oil sands are now, and will be, important for some countries like Canada. But they will hardly be a source of oil such as the world's oil wells are today.

NATURAL GAS

Natural gas faces similar uncertainty as oil. For years, most natural gas was flared as a waste product to oil production. Now many experts believe that natural gas will be the energy of the future – or at least of the 21st century. But gas is a fossil fuel and, like oil, it will peak. Conventional natural gas in the US peaked in the mid-1990s, and is now down to 20 to 30 percent. This decline reflects US oil decline more than 30 years ago. More important for the world economy is that 60 percent of current world gas base (US, Russia, Canada, UK) is in decline. It is also interesting to see worldwide gas discoveries peaking only a few years later than oil did, though worldwide interest in natural gas business increased over the last two decades.

CRISIS OR A NEW START

It seems that the world has to have more, and preferably cheap, energy to continue economic growth. Global economy has enjoyed stable and low oil prices for almost all of the past two decades, but oil peak and increases in demand could bring an ultimate end to this.

The world has already experienced the shock of shortage of cheap oil. During the oil crisis in 1973, the price of oil rose from US\$3 during autumn to almost US\$12 by Christmas Eve.



Is the sun setting on oil supplies?

It was described as the “the worst crisis to the free world since World War II” by Henry Kissinger. All that happened was a five percent imbalance between demand (great) and supply (low). Evidently if supply is ever even one percent less than demand, a crisis is triggered and if it lasts longer the effect on the economy will be immediate and drastic. Oil peak could once again be the ultimate trigger for a world economic crisis.

Experts predict that oil production will peak when half of the oil reserves are used. This prediction is quantitatively unquestionable. But the question of when the peak will occur depends on uncertain numbers. The so-called proven oil reserves as reported by various countries and companies are often just guesses and probably not honest guesses. Statistics show that oil reserves have almost continuously increased for more than 40 years, though each year about two percent of known reserves are removed by production. Oil companies frequently publish information and scientific studies on the future availability of oil. Unfortunately the oil industry has a natural financial interest in overstating the supply. The oil business wants consumers and shareholders to stay loyal to oil even at declining production rates and rising prices. Convincing the consumer that any current problems are only temporary will keep them dependent on oil even in worsening times.

ECONOMICAL VERSUS GEOLOGICAL POINT OF VIEW

Today's discussion of future oil and gas supply is dominated by two opposing positions. Economists base their knowledge

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mainly on information coming from the oil companies. They usually argue that market mechanisms will guarantee future discoveries and production rates. Many of them also believe that in the long-term supply shortages can be avoided. According to the economic theory, price increases will happen only for short times and market forces and new technology will create a new equilibrium between supply and demand.

In contrast, geologists base their knowledge more on the physical and mainly geological view. They argue that the

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historical peak in discoveries has to be followed by the peak of production. Several of these analysts have many years of experience in oil exploration with large oil companies.

“Geologists look for oil, engineers produce oil, and economists sell oil. Beware of economists who tell you how much there is,” said geologist Colin J. Campbell.

OIL SHORTAGE AFTER 2007?

According to a recent analysis of existing and planned major oil-recovery projects published in *Petroleum Review* (January 2004) global oil supplies could have a problem with meeting growing demand after 2007. While it is expected that several new productions will enter the market over the next three years, the volumes expected from these projects thereafter are likely to fall well below requirements. All known projects with estimated reserves of over 500 million barrels of oil and the claimed potential to produce over 100,000 barrels per day were analysed. These projects account for about 80 percent of the world’s oil supplies. The report found that just three such projects are expected to come on stream in 2007 and three more in 2008. The volumes of new production beyond 2007 will likely fall short of the combined need to replace lost capacity from depleting older fields and satisfy continued growth in world demand.

In 2003, oil demand reached 80 million barrels per day. Natural gas demand exceeded 45 million barrels of oil equivalent per day. Together they account for 60 percent of a US\$3 trillion energy business or US\$1.8 trillion per year. If supply is available, the International Energy Agency estimates that demand for oil will reach 120 million barrels a day by 2030, up from 80 million barrels now.

If we are looking far into the future we can say that the world needs energy for between nine and 10 billion people, maybe more. If economic development, and the developing world catch up, the world would need more than three times today’s energy using current technology. Fortunately there is great scope for increased energy efficiency, in end-use as well as in energy conservation. If today’s best available, energy-efficiency technology were used, the demand could be cut sixfold compared with today’s technology. The energy demand would then be 50 percent of today’s demand. Do we have sources to cover this demand? Yes we do. Renewable energy. There is 165,000TW of sunlight hitting the earth every day. There is technology utilising this source in place, as well as solar, wind, clean biomass, etc. What is needed is the political leadership and willingness to redirect the money allocated for fossil fuels towards renewables. We know that we have to do this. What we are waiting for? ■

Emil Bedi and Gunnar Boye Olesen are coordinators of the International Network for Sustainable Energy (INFORSE) that has launched visions for a world fuelled with renewable energy by 2050. For more information visit www.inforse.org.



Are our fossil fuels disappearing?