

Statements on Oil

by the Energy Committee at
the Royal Swedish Academy of Sciences.

Introduction

The Royal Swedish Academy of Sciences is an independent non-governmental organization, with expertise in most of the sciences as well as economical, social and humanistic fields. The Academy has recently established a committee to consider today's important energy issues that need our full, unbiased attention. The Energy Committee has a national as well as a global perspective and will summarize scientific knowledge on the supply and use of energy as well as the predicted impacts on society over the coming 50 years. Sustainability and environmental considerations are essential for any future energy system. Readily available, inexpensive and environment-friendly energy provides the foundation for economic growth and prosperity.

The Energy Committee has selected a number of subjects to be studied in some depth. One of these deals with oil and related carbon-based fuels. Therefore, the Committee, organized, together with the Committee of Energy and Environment of the Royal Academy of Engineering Sciences, a seminar with the title "Running out of oil – scientific perspectives on fossil fuels" held at the Academy on 26 May 2005. Prior to the Seminar, the Energy Committee conducted a hearing with the seminar participants. More information about this seminar can be found on the Academy's web page www.kva.se. The Committee also arranged a hearing with speakers in an Uppsala seminar on "Global oil reserves" on 23 May 2005 together with the Graduate School of Instrumentation and Measurements (AIM). Members of the Committee participated in the Uppsala seminar. Some essential points brought up at the hearings and seminars are highlighted below. It should be pointed out that the perspective given here is not purely scientific, since there are important social, political and technical factors that need consideration.

General remarks

It is very likely that the world is now entering a challenging period for energy supply, due to the limited resources and production problems now facing conventional (easily accessible) oil. Nearly 40 % of the world's energy is provided by oil, and over 50% of the latter is used in the transport sector. An increasing demand for oil from emerging economies, such as China and India, is likely to further accentuate the need for new solutions. In addition, it is important that the poorer countries have access to oil at reasonable prices to meet their development goals. This places an additional burden on responsible, matured economies. Compared to many developing countries, the same percentage increase in the crude oil price will be less problematic for Sweden and other European countries because of our tax system (the crude oil's share, c. 25%, in the gasoline price is quite small, compared to the taxes). The poor countries will suffer most from an increased price.

China and India and several nations in South-East Asia and Latin America are now experiencing rapid economic development. Continued high oil prices will jeopardize their chances of economic growth. Many countries, for example in Africa, may not even be able to develop economically in the absence of cheap oil. With China and India emerging as engines of the global economy, the sharp increase in the oil prices which we are witnessing today could lead to a serious international economic recession, similar to those that followed the oil price increases in 1973-74 and 1981. The European economies may be severely affected.

There is at present an extreme dependence on supply from the Middle East holding more than 60 % of the global oil reserves. A key country is Saudi Arabia, which is supposed to hold about 20% of the global reserves of conventional oil and much of the world's spare capacity.



Some analysts maintain that there are inherent technical problems in the Saudi oil fields, but this is not an uncontested viewpoint. It is uncertain how much the oil production in the Middle East can be increased in the next few years and to what extent it would be in the interest of these countries to greatly increase production. It is clear that, even in these countries, conventional oil is a limited resource that they are almost totally dependent on. It is, however, also clear that the countries of the Middle East are undergoing massive internal and regional changes which may have negative consequences for the global oil supply system. Mitigation measures must be initiated in the next few years in order to secure a continued adequate supply of liquid fuels, especially for the transport sector. Over the longer term, completely new solutions are required. Therefore, increased R&D (Research and Development) in the energy sector is urgently needed.

Key points

1. Shortage of oil

The global demand for oil is presently growing by nearly 2 % per year and the current consumption is 84 million barrels per day (1 barrel=159 liters) or 30 billion barrels per year. Finding additional supplies to increase the production rate is becoming problematical, since most major oil fields are well matured. Already 54 of the 65 most important oil-producing countries have declining production and the rate of discoveries of new reserves is less than a third of the present rate of consumption.

2. Reserves of conventional oil

In the last 10-15 years, two-thirds of the increases in reserves of conventional oil have been based on increased estimates of recovery from existing fields and only one-third on discovery of new fields. In this way, a balance has been achieved between growth in reserves and production. This can't continue. 50% of the present oil production comes from giant fields and very few such fields have been found in recent years. Oil geologists have a wide range of opinions on how much conventional oil there is yet to be discovered, but new reservoirs are expected to be mainly found in the deeper water, outer margins of the continental shelves, and in the physically hostile and sensitive environments of the Arctic, where the production costs will be much higher and lead times much longer than they are today. A conservative estimate of discovered oil reserves and undiscovered recoverable oil resources is about 1200 billion barrels, according to the US Geological Survey; this includes 300 billion barrels in the world's, as yet unexplored, sedimentary basins.

3. Middle East's key role

Only in the Middle East and possibly the countries of the former Soviet Union is there a potential to significantly increase production rates to compensate for decreasing rates in other countries. Saudi Arabia is a key country in this context, providing 9.5 million barrels per day (11% of the current global production rate). Their proven reserves are 130 billion barrels and their reserve base is said to include an additional 130 billion barrels. Iraq also has considerable untapped oil reserves.

4. Unconventional oil resources

In addition to conventional oil, there are very large hydrocarbon resources, so-called unconventional oil, including gas (c. 1000 billion barrels of oil equivalent, much of which could be converted to liquid fuels), heavy oil and tar sands (c. 800 billion barrels) and oil shales (c. 2 700 billion barrels); coal, from which liquid fuels can be produced and methane hydrates provide a vast additional potential. During a transition period, gas often available adjacent to the oil fields, will help to bridge future deficits of conventional oil. With the exception of gas, all unconventional oil is expensive to produce (c. \$ 20-40/barrel) and exploitation involves significant environmental problems. At \$ 40 oil, which is now commonly accepted as the long term equilibrium price, the cost of developing unconventional oil is less problematic. (see pt. 7 below). At present, 1 million barrels of oil per day comes from Canadian tar sand and 0.6 million barrels from Venezuelan heavy oil. The Canadian government estimates that by 2025 the daily production rate will have increased to 3 million barrels per day. Thus, the problem

with these unconventional oils is not so much price, but lead times and non-price related aspects, such as the effects on the environment and availability of water and natural gas for the production process.

5. Immediate action on supplies

Forceful measures to improve the search for and recovery of conventional oil as well as improving the production rate of unconventional oil are required to avoid price spikes, leading to instability of the world economy in the next few decades. Improved recovery of oil in existing fields can be expected. The estimated reserves of conventional oil are, however, located primarily in unexplored sedimentary basins, in environments difficult to access. A substantial part has yet to be found! Sizeable contributions from unconventional oil need time (some decades) to become really effective. It is necessary to have public funding for long term petroleum-related research, since this must not be an exclusive task for the oil companies.

6. Liquid fuels and a new transport system

Oil supply is a severe liquid fuels problem and less of a general energy supply problem; 57 % of the world's oil is consumed in the transport sector. Unless government's ration oil, there will never be a shortage of oil; just increasing prices. Major programmes need, therefore, to be implemented to develop alternatives to oil in the transport sector. Until these measures have been introduced, (which may take one to two decades) demand for oil for the needs of a globally expanding transport sector will continue to rise; other users of oil will suffer, including those concerned with power generation.

7. Economic considerations

At present the high oil prices are due to the limitations of worldwide production, refining and transportation capacities. Furthermore, the price is influenced by the threat of terrorist attacks on the world's oil supply, transport system and infrastructure. In the long run, the price of crude oil will be determined by the price of substitutes. Some estimates indicate that oil may be produced from tar sand at a price of 20-25 USD a barrel, compared to the present cost of about USD 5 for Saudi Arabian oil. Liquid fuels from coal could be produced for many decades; cost estimates vary greatly and generally exceed USD 30. Factors that are hard to estimate are environmental requirements, taxation levels and profit margins. However, we can anticipate continued high oil prices, as long as the pressure from the expanding Asian economics is maintained.

8. Environmental concerns

Unconventional oil will significantly extend the length of the hydrocarbon era, assuming that the negative impacts on the environment can be avoided. Constraints similar to those imposed on other fossil fuels (for example emission controls and CO₂ sequestration) will be necessary and provide major challenges for industry. The impact on the environment, in general, and on the atmosphere and climate in particular, produced by combustion of fossil fuels, is not considered here. However, it is worth noting that such considerations provide further support for the conclusions presented below.

9. Increased R&D and international efforts

To avoid acute economical, social and environmental problems worldwide, we need a global approach, with the widest possible international cooperation. Activities in this direction have started and they should be strongly encouraged and intensified; the technically advanced countries have a particular responsibility. Considerably increased resources for R & D on alternative non-fossil energy sources, as well as on efficient and sustainable use of energy, particularly electricity, are necessary. In order to develop a sustainable energy system beyond the fossil fuel era, we need a full system analysis of the energy sector based on realistic time scales. The Energy Committee intends, in the next couple of years, to study other sources of energy and evaluate their relative merits and impact on environment and climate.

Members of the Energy Committe at the Royal Swedish Academy of Science:

Sven Kullander, Professor em., Uppsala University
Gia Destouni, Professor, Stockholms University
Harry Frank, Professor, Mälardalens University
Karl Fredga, Professor em., Uppsala University
Bertil Fredholm, Professor, Karolinska Institutet
David Gee, Professor em., Uppsala University
Karl Grandin, Ph.D., Center for History of Science
Peter Jagers, Professor, Chalmers Institute of Technology
Bengt Kasemo, Professor, Chalmers Institute of Technology
Rickard Lundin, Professor, Swedish Institute of Space Physics
Karl-Göran Mäler, Professor em., The Beijer International Institute of Ecological Economics
Kerstin Niblaeus, Director General, Council of the European Union
Bengt Nordén, Professor, Chalmers Institute of Technology

Contact persons:

Malin Lindgren, Information Officer, +46 8 673 95 22, +46 709 88 60 04, malin@kva.se
Eva Krutmeijer, Executive Director, +46 8 673 95 95, + 46 709 84 66 38, evak@kva.se