Uranium Availability

Opponents of nuclear power have produced a new line of attack – namely that there is not enough uranium to support global nuclear generation of electricity. Some opponents claim that there is enough uranium to keep the present 441 nuclear power stations in the world going for only three years. The following note has been prepared by SONE's committee for SONE members to use in letters, articles and debates to disprove any notion of a uranium shortage.

Facts

Naturally-occurring uranium is a metal roughly as common as tin, tungsten or molybdenum. Ore bodies – i.e. concentrations from which the metal is economically recoverable – range from 1,000 parts per million to 20,000ppm (2%). Neither granite (4ppm) nor the oceans (0.003ppm) yet qualify as economically attractive options.

It follows that uranium resources depend on the intensity of the exploration effort and movements in the costs of extraction and the price uranium can command. They will rise to meet demand. After all, man has been exploring for uranium for only a short time compared with gold and silver.

Figures from the OECD's Nuclear Energy Agency and the UN's International Atomic Energy Agency showed that in 2001 the sources of known economically recoverable uranium were:

Australia	863,000 tonnes representing 28% of the global total
Kazakhstan	472,000 tonnes representing 15% of the global total
Canada	437,000 tonnes representing 14% of the global total
South Africa	298,000 tonnes representing 10% of the global total
Namibia	235,000 tonnes representing 8% of the global total
Brazil	197,000 tonnes representing 6% of the global total
Russian Fed	131,000 tonnes representing 4% of the global total
USA	104,000 tonnes representing 3% of the global total
Uzbekistan	103,000 tonnes representing 3% of the global total
Total	**3,107,000**

The current rate of use is about 70,000 tonnes of uranium per year, according to the World Nuclear Association. Allowing for some reprocessing, this means that currently known resources are enough to last for about 45 years, even when used in conventional reactors (i.e. with no breeding). This is a higher level of assured resources than is normal for most minerals.

Further exploration and higher prices will, even on the basis of present geological knowledge, yield further resources. Highly probable deposits are already put at 12m tonnes.

A doubling in the price of uranium could be expected to result in a ten-fold increase in resources. It would increase the price of nuclear generated electricity only marginally because fuel price is not critical to nuclear electricity's costs. What is more, the cost of finding uranium is less than one per cent of the cost of finding oil.

There is therefore enough uranium to maintain or expand substantially the world-wide level of nuclear generation using the current design of nuclear power stations (i.e non-breeding).

Uranium Use

Present global nuclear capacity (350 gigawatts electric (350 GWe) from 441 power stations) requires some 70,000 tonnes of uranium a year. Demand is increasing but so has been the efficiency with which uranium is used. Over the 18 years to 1993 nuclear generated electricity rose well over five-fold but the uranium employed increased by only just over three-fold. Most of the improvements in efficiency with current types of reactor have now occurred but there are still some to come.

Burn-up of fuel is certainly improving and the reprocessing of spent fuel is a form of recycling that may well become common practice if uranium prices rise. Reprocessing at Sellafield or La Hague in France recovers 96-97% of the uranium, plus plutonium. The uranium so recovered joins new uranium in fuel fabrication. The plutonium recovered can be used to a limited degree in mixed oxide fuel (MOX) that can be burned in PWR reactors such as Sizewell B. Existing reactors can accept only a third of new fuel as MOX, but it nonetheless means that a former sword (plutonium) can steadily be turned into a ploughshare (electricity). We have in the UK some 80 tonnes of plutonium with an energy content broadly equivalent to a year's consumption of electricity in the UK.

Currently, the number of reactors is increasing at the rate of about 10 per year. This represents an increase of only 2% a year in uranium demand.

The energy intensity of uranium is 20,000 times that of coal. So, Sizewell B nuclear power station requires only about 30 tonnes of fuel per year from 200 tonnes of raw uranium. This means that even when poorer grade ores have to be used the CO_2 consequences of a doubling of the energy use in extraction and processing would have little impact on CO_2 emissions for the whole of the nuclear fuel cycle. Taking account of that cycle, a nuclear reactor would then still produce only about one per cent of the CO_2 as the same size of coal-fired power station.

Widespread use of the fast breeder reactor could increase the productive use of uranium 60-fold or more – i.e. each tonne of ore would yield sixty times more energy than in today's conventional reactors. Stations of this kind have been developed and demonstrated but have not yet been deployed commercially because of low uranium prices. They are nonetheless available as an energy-efficient system when required. There is also the long-term possibility of reactors fuelled by a derivative of thorium, an element more abundant than uranium.

SUMMARY

There is no shortage of nuclear fuel, nor is one foreseen. The efficiency with which nuclear fuel is burned has steadily increased and new types of reactor could dramatically raise that efficiency.

Uranium resources are likely to exceed those of oil and gas, underlining nuclear's contribution to the UK's energy security. Reactors require such small quantities of fuel that supplies for many years ahead can be stored without difficulty.

For more information visit us at:

www.sone.org.uk

Supporters of Nuclear Energy, c/o BNES,
7 Great George Street, London SW1P 2ZS

SONE is registered as a private limited company No. 3576562