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Nuclear Profile: Back from the Dead?

After triple-digit growth rates during the 1970s and 1980s, the nuclear industry virtually died after a series of massive accidents. But with high oil and gas prices and concerns about global warming, nuclear power is making a comeback.



Picture Gallery (click on the image to start)

With concerns over global warming nuclear power seems to make a comeback. Find out about the pros and cons (Photo: Reuters)

Worldwide Importance

The power unleashed by nuclear fission has no equal on Earth, but the world's 439 nuclear reactors only produce around 6 percent of the world's energy and between 12 and 15 percent of its electricity. This small number has less to do with limited resources, technological problems, or geopolitical constraints, than the low cost of fuel alternatives like gas and widespread fears over the safety of nuclear power plants.

The anti-nuclear movement became a strong political force in Europe after the catastrophic meltdown of a Soviet nuclear reactor in Chernobyl, Ukraine in 1986. A less-devastating incident at the Three Mile Nuclear Power Station in Pennsylvania, USA in 1979 led to a similar situation in North America. The impact of these accidents on public opinion was significant, and growth in the industry came to a virtual halt.

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Many poor countries, on the other hand, simply have no access to nuclear power, because of the high costs of building a nuclear power plant, the complicated technology involved, or political restraints on nuclear material that can be used both for a power plant and nuclear weapons.

Some rich European countries like Switzerland or the Netherlands use no or very little nuclear power because of its unpopularity and the

availability of cheap renewable energy. Others, like Germany or the UK, rely partially on nuclear power, but have not built new plants for decades. Nuclear still produces only a small fraction of electricity in countries where coal is still king, like China and India.

The global nuclear leader is France, with nuclear producing nearly 80 percent of the country's electricity. France also exports huge amounts of nuclear power to European neighbors, and its energy conglomerate, Areva, builds most nuclear power plants worldwide.

Future Trends

After years of stagnation, many countries have announced plans to build new nuclear power plants. More than 30 reactors are under construction, among them a Finnish plant, the first nuclear reactor to be built in Europe for 15 years. The U.S. Nuclear Regulatory Commission foresees a dozen new applications for nuclear power plants. For over 30 years, U.S. utilities had not applied for new nuclear reactors. Demand is also growing in Asia. Facing energy shortages, China and India are building several reactors, and intend to increase their nuclear capacity several times over in the next 15 years.



Infographic (click the image to enlarge)

See the costs of climate change with and without early action

The International Energy Agency (IEA) estimates that nuclear power generation will grow by at least 13 percent by 2030, and perhaps as much as 40 percent if politicians decide on a price for carbon dioxide emissions. Areva estimates that 130 new plants will be built globally by 2030.

Despite the surge, the share of nuclear power in many countries is likely to decline initially. Most power plants in rich countries, built back in the 1960s and 1970s, are nearing the end of their projected lifespan, and will go offline in a couple of years. And while many new plants are being planned, building them often takes decades.

The main reason for renewed interest in nuclear fission is the high prices for rival power sources like coal and natural gas. Prices for nuclear fuel have increased as well, but their share in total operating costs is relatively small. According to the IEA, nuclear power is currently cheaper than gas and almost as cheap as coal.

Global Resources and Producers

Nuclear fuel depends on the reactor design, but there are two fuel sources: uranium and plutonium. Conventional reactors run on uranium,

but less than one percent of all uranium found on Earth can be used directly for fission. Most uranium has to be enriched in a complicated process to qualify as a fuel source.

So-called breeder reactors have the ability to turn conventional, non-fissionable uranium into an enriched form of plutonium that can be used as a nuclear fuel. While this implies drastically less resource consumption, breeder plants account for less than one percent of worldwide nuclear capacity, because they are more difficult to control and pose significantly higher environmental risks. Breeder reactors are also critical, because plutonium is the most effective fuel source for nuclear weapons.

While a huge share of the world's remaining oil and gas reserves is located in non-democratic countries, uranium is available from many different sources, including politically stable places, such as Canada and Australia, which hold 15 and 27 percent of the world's reserves, respectively. Other major producers include Kazakhstan, Russia, Namibia, and Niger.

At current uranium consumption levels, the world's known resources of uranium, some 4.7 million tons, are enough to last for about 70 years, according to the Australian Uranium Association (AUA). The AUA estimates that a doubling of uranium prices from present levels could create about a ten-fold increase in measured resources. Unlike gas and oil, nuclear fuel can also be used several times, if reprocessed in special facilities.

Since the end of the cold war, both the U.S. and Russia have agreed to decommission thousands of nuclear warheads. The highly enriched warhead uranium can be blended down to produce large amounts of reactor fuel. The AUA estimates that warhead uranium currently accounts for more than ten percent of reactor requirements worldwide.

Environmental Drawbacks

Nuclear power has an ambiguous environmental record. The World Health Organization estimates that more than 4,000 people died in the aftermath of the Chernobyl disaster, which contaminated parts of Belarus, Ukraine, and Russia. Although utilities in Europe and North America claimed that such a catastrophe could never happen in modern plants, Chernobyl still marked a turning point and the decline of nuclear power.

Another problem with nuclear power is the disposal of radioactive waste. Due to the extremely long half-life of uranium, spent fuel rods stay contaminated for millions of years. There are plans to dispose of such waste in disused salt mines or special rooms deep within stable bedrock, but protests from the public have prevented the construction of any such depository worldwide.

Amidst growing fears of global warming, however, nuclear power has regained some environmental credentials. Unlike power plants that run on coal or gas, nuclear reactors emit almost none of the greenhouse

gases responsible for global warming. While environmentalists point at the energy needed for uranium mining and enrichment, proponents of nuclear energy argue that a low carbon-future is simply impossible without nuclear power.

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