TECHNOLOGY

Electric Power From Atom

The present status of harnessing the atom for peaceful uses is being discussed at the Third United Nations International Conference on the Peaceful Uses of Atomic Energy.

By WATSON DAVIS

➤ THE GENERATION of electric power from the atom has now reached an historical point where atomic reactors fed on uranium are competitive with the conventional power plants that use coal and oil as fuel.

This break-even point makes atomic power a real working force in the world on a practical basis, not just a scientific demonstration. Only a decade ago the first nuclear-powered station began to supply electricity to transmission lines. It was in Russia, followed closely by nuclear power on lines in the U.S.A. and Britain.

It has been only 22 years since there was demonstrated in Chicago the first controlled nuclear chain reaction which is basic to the utilization of the fission reaction of uranium. The discovery of the possibility of the conversion of mass into energy was only 26 years ago.

Atomic Race Slackens

The rush to build nuclear bombs has slackened. The atomic race, primarily between the United States and the Soviet Union, has now slowed to at least a temporary halt. Both sides of the Iron Curtain are so stocked with nuclear weapons that only madness would let them loose upon a world that would be in ruins if these weapons were used.

Bombs made from uranium, or plutonium manufactured from it, gave man almost undreamed power of destruction. But the newer fusion bomb, the hydrogen bomb utilizing light elements at the other end of the scale of chemical elements, was thousands of times more deadly. This type of weapon threatens the world if the present stalemate between the East and the West is violated.

Commercial atomic power for feeding the transmission lines of the world is obtainable only from the fission process of uranium products. The fusion process, the same reaction that occurs in the hydrogen bomb and in the sun itself, has not yet been harnessed. There has been intensive research for about a decade looking toward making the energy of the very plentiful light elements available for doing the peaceful work of the world.

The uneasy atomic peace sees the atom's munitions dumps overstocked. The materials with which to build atomic bombs are in surplus. The world can turn its attention to utilization of atomic materials for power purposes with greater speed and enthusiasm than it has in the past.

Atomic power plants now being designed compete in cost of power generation with conventional plants that generate electricity from coal and fuel oil. Atomic power plants, in the next few years, will come into economic and technical dominance.

We may even see in the next few years a competition between the coal and oil producers to lower their costs so as to continue to have a market in competition with the atomic fuel.

Three relatively large electrical power plants in the United States—Shippingport, Yankee and Dresden—have been in operation for a sufficient time to demonstrate their reliability and their economics. There have also come into service six other important stations, with eight more to go critical in the next four years.

Early this year detailed cost figures were revealed for the atomic power plant of the Jersey Central Power and Light Company at Oyster Creek, N. J., that will start up in 1967. This projected installation can be expected to produce electricity as cheaply as the most competitive alternative conventional power station that could be built. The cost of electricity production by the Oyster Creek plant would be somewhere in the neighborhood of four-tenths of a cent per kilowatt-hour.

The figures show that for coal to compete with uranium in New Jersey, its cost must be only about 10% more than what is paid in the coal districts of Pennsylvania, a very small difference. The falling prices of atomic power have put a ceiling on the cost of conventional power.

If the producers of coal and oil cannot find other markets, there could be price wars that might drive power prices downward and eventually push the carbon fuel out of use. That would be some years in the future.

Atomic Plants Safer

The atomic power plants already built have proved to be easier, simpler and safer to operate than any one dared to hope in the early days.

This has caused optimism. The builders of atomic plants believe that the way is clear for more plants on the basis of economic justification. They can be expected to push ahead in the United States financing their plants with private investment capital. The Government's role will be to supply research and sell or lease the fuel which must be controlled closely because tied to atomic bomb capability. The safety record of reactors is excellent, but since atomic energy is linked to bombs, there has been some public fear. For this reason, the liabilities for nuclear damage are assumed by the Federal Government, very much as was potential war damage in World War II.

By the end of this decade, U.S. atomic electricity production will be 5,000 million watts, or 3% of a total electric power production of 150,000 million watts. By 1980 the estimate is that the U.S. atomic electricity will rise to 38,000 million watts, 20% of 190,000 million watts of total U.S. electric power.

Great Britain, where development of

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atomic power began under the impetus of a coal shortage in 1950, has 12 stations with a total capacity of 1,500 to 2,000 million watts, not counting the stations at Calder Hall and its sister station, Chapel Cross, which were built, like Hanford in the U.S., primarily to produce plutonium, atomic bomb material.

By the end of the decade the atom will produce about 13% of Britain's energy production, which in kilowatts will just equal the U.S. production. The rest of the world by 1970 will just about equal the U.S. and United Kingdom combined.

Although the first atomic power plant to supply electricity to transmission lines actually got into operation in 1954 in Russia, a year before the first U.S. large-scale reactor, not too much is known about the development of the atomic program of Russia. Three large Soviet power plants are known to exist.

Rivaling the U.S. merchant ship demonstration, the N.S. Savannah, Russia has had in operation since 1957, the icebreaker, Lenin.

The extensive nuclear submarine program of the United States began with the Nautilus in 1955 and was followed by many other atomically powered Polaris missile-carrying undersea ships. This probably has been duplicated in part, on a smaller scale, by the Soviets. However, these are atomic marine applications for war, not peace.

Energy Hunger Satisfied

The world is hungry for energy. Its growing appetite for electric power will be satisfied by the conversion of the atom's mass in coming decades.

We are no longer dependent upon the availability of coal, oil and gas, the carbon fuels. Civilization can be powered by uranium and thorium, the elements of which the world is estimated to have proved resources of 592,400 tons of uranium and a million tons of thorium. Both can be made into elements that fission in bombs or reactors. One pound of uranium used as nuclear fuel produces about a couple of million times the energy of burning one pound of coal.

Uranium is the prime atomic element for power. The natural 235 isotope (or variety) constitutes seven-tenths of one percent of natural uranium and can be concentrated (enriched) as fuel for atomic reactors. It was the stuff of the first atomic bomb. From the largest part of natural uranium that is not fissionable, U-238, there can be made the non-natural element, plutonium, which is fissionable or "fissile." This is done by bombarding it in a reactor. From the element thorium, also by atomic bombardment, uranium-233 can be made, and this is a reactor fuel.

Fissile fuels can take over the job of providing power when the fossil fuels become scarcer or more uneconomic. The world's energy resources are estimated to amount to 3,500,000 million tons of coal equivalent, enough to last 800 years at the present consumption.

Because the demand for energy is increasing year by year, the carbon fuels will be used up faster and will not last that long if the atomic fuels do not begin to take over.

A time may come when the burning of coal will be outlawed because the chemicals contained in it are more valuable than the fuel content.

Experts have been generally pessimistic about the extent of the resources of the world. Every time an estimate has been made in the past 40 years concerning the remaining oil reserves, there has been a finding of new reserves that is sufficient for another 20- or 30-year consumption. The amount of nuclear fuel in the form of uranium and thorium raw materials is probably also underestimated.

Future Power Possibilities

In estimating the future possibilities of supplying power to the world, no account has been taken yet by careful experts to include the utilization of the light elements, deuterium (heavy hydrogen) and lithium, which are sources of the material for the hydrogen or thermonuclear bombs. Intensive research effort has been underway for more than a decade to harness the fusion, thermonuclear reaction, for peaceful purposes. Likelihood of success cannot yet be firmly assayed.

Eventually there will probably be power from the light elements just as the sun uses them to stoke its tremendous energy.

Although nuclear power will be dominant in the future and is rapidly coming into its own, its application to the world's work is not simple and uncomplicated.

Dr. Sigvard Eklund, Director General of the International Atomic Energy Agency, Vienna, in a report issued just before the Geneva Conference on Atomic Energy has observed that atomic power has special characteristics, among them is its exceptional adaptability to meet certain special power needs because of the small quantities of fuel needed for the operation of nuclear power plants, which alleviates fuel transport problems and costs.

Other considerations are the absence of air-polluting wastes, the use that atomic power has for military applications and the international complications that result from this, the unique situation represented by the fact that only three countries at present are in a position or willing to sell enriched uranium, used as reactor fuel; the very strict safety regulations which are still attached to atomic plants; the still prevalent uncertainty as to the cost of chemical reprocessing of burnt atomic fuel, and the resale price for the plutonium produced in reactors.

The Third United Nations International Conference on the Peaceful Uses of Atomic Energy, assembled in Geneva, is covering a wide range of research and development.

Several hundred scientists from 37 nations and five international agencies are presenting 761 papers before several thousand experts. The economics of nuclear power looms large in the program of the ten-day meeting.

Questions

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ELECTRONICS—What source of heat is used by a new pocket-size radio transmitter? p. 150.

GEOPHYSICS—What temperatures are believed to prevail at the bottom of steam wells? p. 154.

TECHNOLOGY—What is the estimated U.S. commercial atomic power production by the end of this decade? p. 147.

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