NUCLEAR PHYSICS

Atomic Power Production

Large scale atomic plants will not be operating for 20 years or more. Many problems must be solved first. At present, bomb has first place.

By WATSON DAVIS

➤ PRACTICAL POWER from the atom, competing with present energy sources, promises to require more time, research and money than the achievement of the atomic bomb itself.

The best guess being made these days is that power on any large scale from fission of uranium and thorium is at least 20 years and possibly 30 or even 40 years in the future.

The first operating nuclear energy plant for power will probably be designed for use in a naval ship that could make long voyages without refueling. And it may take to sea five to 10 years from now before it is publicly announced.

Admittedly less sanguine than they were two years ago, scientists and engineers are nevertheless convinced that useful nuclear power reactors can and will be built, just as the atomic bomb was made a reality.

Heat is being obtained from the conversion of atomic mass into energy, but it is not useful as power. The temperature of the Columbia river is raised several degrees by the heat given off from the Hanford, Wash., atomic furnaces in which plutonium for bombs is manufactured. All the other nuclear reactors, less than a dozen of which are in existence, produce heat which is wasted in cooling them.

Brookhaven Pile

About the end of next year some power will be obtained from the research atomic pile under construction at Brookhaven, Long Island. But this reactor is not built for power and it may produce only about half enough power to operate the pumps and blowers necessary to run it.

There is really no atomic power program being undertaken vigorously today.

About a year ago the Daniels power pile at Oak Ridge was abandoned after several hundred thousands of dollars had been spent on it and a dozen industrial companies and government agencies had worked together on it. General Electric has a program aimed at eventual power production, but little is known about when that power reactor will get started.

Diversion of men, skill and money to atomic power production is being postponed now for two primary reasons:

1. Actual bomb production is being given priority in the non-research activities of the Atomic Energy Commission.

2. Non-military expenditures are being concentrated on new giant cyclotrons and other long-range attacks upon the frontiers of physical knowledge out of which may come new and important developments.

An array of difficulties beset atomic power production.

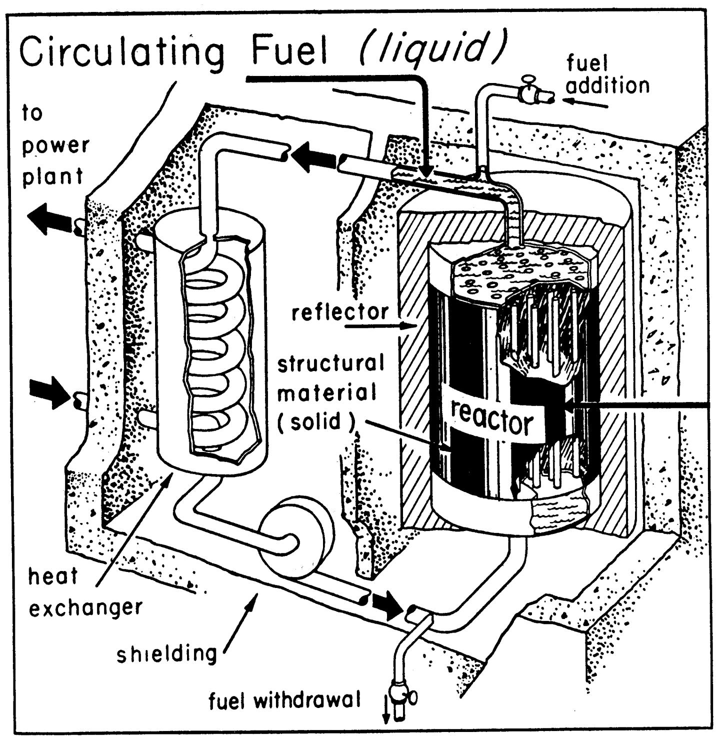
The heat handled is much higher than in conventional coal-fired power plants, probably in the range of 1,800 to 2,700 degrees Fahrenheit. This means that unusual materials must be used in constructing the nuclear pile. For not only must they withstand high temperatures, but they must not absorb unduly the neutrons that produce the chain reaction of exploding atoms of uranium and plutonium. This rules out conventional steel. There is some possibility that titanium metal would do the trick and could be produced cheaply enough. But as a pure metal it hardly exists at all today. Or a new ceramic (clay) material may be the answer.

The deadly and intense radiation from nuclear fission must be protected against at all steps in atomic power production. This means thick shielding of concrete or other radiation-absorbing materials. The liquid picking up the heat in the atomic furnace will be almost as dangerous as the pile itself and the whole system must be leak-proof, which is much to ask because of the damaging effects of radiation upon machinery. Control rods in the pile (controlling the fission reaction) must be operated with great reliability inside the shielding and at the high temperatures. Replacements and repairs of the furnace will be dangerous because of the radiation contamination. Atomic power plants will be like battleships subjected to atomic bomb attack that become so "hot" they must be sunk at sea as a safety measure.

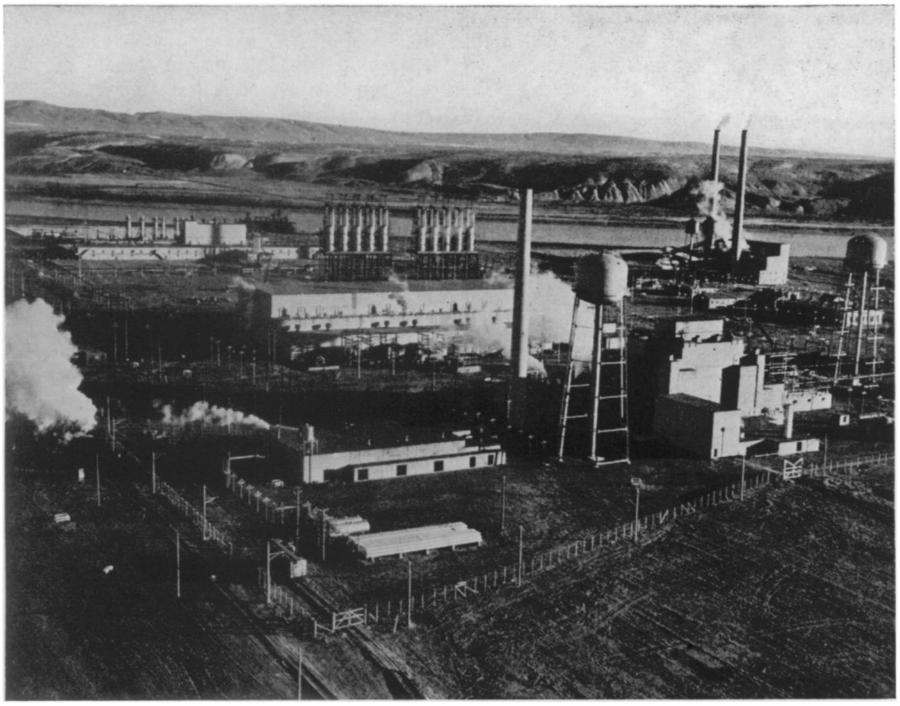
Debris of Fission

The debris of atomic fission, comparable to the ashes of a fire, will tend to quench the nuclear reaction by absorbing neutrons. The changed fuel must be removed periodically and reconcentrated, which means a difficult chemical treatment. Meanwhile the atomic furnace is shut down.

The supply of fuel for the atomic furnace is always a critical matter. There is only a relatively small amount of uranium



POSSIBLE ATOMIC POWER PROCESS—This is a heterogeneous reactor with circulating liquid fuel and structural, solid material as a moderator. Fuel could be ordinary or enriched uranium. The diagram is from The Science and Engineering of Nuclear Power (Addison-Wesley Press).



PLUTONIUM PLANT—This element which may play an important role in atomic power as well as atomic bombs is manufactured at the Hanford, Wash., plant of the Atomic Energy Commission. The plant has changed in the three years since this picture was taken, but the AEC has not released any more recent pictures which would reveal changes.

(and thorium from which one kind of fissionable uranium can be manufactured) in the world. Despite the fact that a piece of uranium metal that can be held in one hand would yield the heat equivalent of 2,500 tons of coal, the extraction of the uranium or its conversion into fissionable material is a long and tedious technical task.

Once the technical problems are overcome, what is the competitive cost position of atomic power compared with generating power from conventional fuels? No one can estimate this too closely now.

There is another danger in atomic power plants beyond the technical ones. In the operation of any pile there will be a concentration of uranium from which atomic bombs might be made. In addition, the pile reaction may be just the same as the process at Hanford where plutonium is made from non-fissionable uranium. So every atomic power plant becomes potentially an atomic bomb material factory, from which there could be bootlegged the materials for illicit atomic bombs. Thus atomic power plants must be controlled if there is to be international or other control of atomic energy.

Some experts feel that time is being lost by lack of a direct construction program for atomic power plants, while others believe that money and time will be saved by collecting additional experimental data and perfection of theory.

Secrecy shields some of the facts needed for judgment as to whether America is doing all that can be done to bring about the new era of atomic power.

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ASTRONOMY

Many Man-Made Skies

➤ MANY more people today can observe man-made skies than ever before.

Ten months to a year ago, planetaria existed in only a half dozen communities. Now over 30 different organizations are operating instruments that within a half hour or so show stars visible in the heavens not only that particular night, but throughout the entire year. Most of the projecting devices and domes in use today are portable so they can be carried to out-of-the-way localities for display.

By far the most effective device yet produced for picturing the motions of the heavens is the Zeiss planetarium, designed by engineers of the firm of Carl Zeiss in Jena, Germany, at the suggestion of the astronomer Max Wolf. Several such instruments, which cost around $150,000, are in operation in the United States.

The first was installed at the Adler Planetarium of Chicago, almost two decades ago. More than 3,000,000 visitors attended during its first three years. The Fels Planetarium of the Franklin Institute of Philadelphia opened in 1934. Almost 200,000 visit it each year.

Other Zeiss instruments are operated at the Griffith Planetarium in Los Angeles, the Hayden Planetarium in New York City, and the Buhl Planetarium in Pittsburgh. Stockholm's Zeiss planetarium has been acquired by the University of North Carolina, in Chapel Hill, but will not begin operation for some time.

The clock can be turned back a thousand years or more with a Zeiss planetarium. It is designed to exhibit, with close fidelity, the appearance of the sky at any place on the earth and any time of day or night for many thousands of years. Projectors of sun, moon and planets may be operated independently. The Zeiss works are no longer in existence, and it is unlikely that any more of these instruments will be available.

At the Museum of Natural History in Springfield, Mass., is the Korkosz plane-