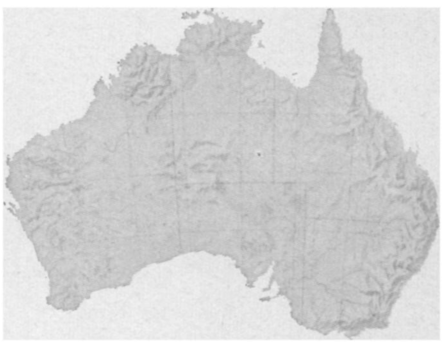

letter from Sydney

Picking reactor concepts

Heavy water reactors suit the needs of a score of nations

Out of the welter of possible types of nuclear power reactors, logical choice depends on which particular advantages and disadvantages are most important.

In Australia, on the verge of nuclear power development, the important factor is the kind of fuel used: natural uranium, which need not be processed in gaseous diffusion plants which the country doesn't have, or enriched fuel obtained from abroad.

That factor, say two scientists of the Australian Atomic Energy Commission, operates in favor of heavy water moderated reactors. Returning from a Geneva symposium on the heavy water machines, D. R. Ebeling, head of the AAEC's design and development section, and W. J. Wright, head of the fuel element section, report that many of the 30 other nations with similar economic, technical and political conditions at the symposium support the heavy water concept—a comforting discovery, since Australia plumped for this type of reactor two years ago.

At the base of this choice is heavy water's ability to slow down neutrons and absorb few of them. In the nuclear chain reaction, splitting uranium atoms give off, with heat, high energy neutrons. If these neutrons can be slowed down, they will cause other uranium atoms to split.

Some neutron-slowing materials, or moderators, absorb so many neutrons completely that not enough are left to continue the chain reaction with natural uranium. To use these moderators—ordinary water is a prominent one—the uranium has to be enriched: the proportion of U-235 atoms, which are the only kind that normally fission, has to be increased. Heavy water, on the other hand, can use un-enriched uranium.

Besides the advantage of using natural uranium, thus making the country independent of foreign supplies, the heavy water reactors make fuller use of the uranium available, an important factor in countries like Australia where the known resources are limited.

Ebeling and Wright suggest the following line of development of the Australian nuclear power industry:

- Start with natural fuel and heavy water reactors.
- When installed capacity reaches 2,000 to 3,000 megawatts electric, begin separating the plutonium, which is produced in nuclear reactors and can also be used as fission material, from the irradiated fuel.
- Continue installation of second-stage heavy water reactors using plutonium-enriched fuel, gaining a reduction in power costs and more utilization of fuel.
- If fast reactors (which don't slow up the neutrons, are more efficient but are more difficult to build) develop as promised, plutonium from the heavy water reactors can be used in them. If they don't, it can continue to be recycled in the second-stage type of heavy water generators.

The Australian approach is based on the success of Canadian development of heavy water reactors. Britain, France, and the U.S., have different policies.

The Canadian program is firmly committed to a policy of natural uranium feed and the installation of at least 2,000 MW of natural-fuel HWR's has been authorized for the next few years. The major factors influencing this policy are the extensive uranium reserves, the early lead built up by Canada in heavy water technology and the high natural power growth rate in the country. The Canadians clearly regard heavy water moderated systems as superior to any other in terms of economics, fuel utilization and versatility, and it is now this latter point which is receiving emphasis.

The U.K. and France, with heavy commitments to gas cooled graphite reactors, generally regard HWR's as a backstop. This type also allows natural uranium to be used, but has some limits on size. A major change in technology such as the change from gas to water cooling is also inconvenient.

The U.S., with its ample supply of enriched uranium, has concentrated almost exclusively on light water reactors, which are more compact and avoid the expense of a supply of heavy water.

William A. Scholes