Britain's Nuclear Power Program

Less than 16 months ago, Calder Hall, the first full-scale nuclear energy power station in the world, began to feed electric power into Britain's national grid. Now, four new and considerably more powerful stations are under construction, and sites are being explored for others. The great progress which has been made in plant design and technology, without any fundamental change in nuclear physics, is reflected in Table 1.

In March 1957, the Government revised the nuclear power program of February 1955 by virtually trebling the capacity planned for 1966, from 1500–2000 to 5000–6000 megawatts. But, thanks to the tremendous rate of advance of the last year and a half, 12 stations, the same number envisaged in 1955, will be capable of providing the new capacities.

Limitations on size receding. At first, it was thought that 19 stations would be required. Since the technical limitations on the size of nuclear power stations are rapidly receding, it is even possible that the figure of 12 with a total capacity of 6000 megawatts may not be the final number of stations operating in 1966. According to the latest information available, it is now feasible to build a single reactor capable of producing substantially more net electrical output—400 megawatts—than the first four complete stations listed in Table 1. This means that atomic power stations with a capacity of 800 megawatts can now be built and are likely to feature in the second group of stations to be constructed.

A number of factors have contributed to this development. The size of the reactor has increased, and with it the amount of uranium fuel. New welding techniques, based on the experience acquired in building Calder Hall, have made possible the increased size of the pressure vessel which houses the reactor. While in the case of Calder Hall 2-inch steel plates were the limit, it is now possible to weld 3-inch and possibly even 3½-inch plates. And the resulting increase in size of the pressure vessel has allowed core diameters to be raised from 35 feet at Calder Hall to 50 feet at Hunterston.

Table 1. Progress in plant design and technology.

Plant	Net electric output (Mw)	Heat output per reactor (Mw)	Uranium (ton)
Calder Hall	138	143.7	117
Berkeley	275	530	250
Bradwell	300	531	240
Hunterston	320	535	249
Hinkley Point	500	966	375

Table 2. Cost per unit of power generated.

Date	Nuclear (pence)	Conventional (pence)
1960	0.66	0.60
1970	0.47	0.66
1980	0.37	0.73

Cost of nuclear power will fall quickly. At the beginning, the new nuclear stations now under construction will generate electricity at a cost slightly higher than would be possible from the latest coal-fired power stations in Britain. But according to the calculations made by Sir Christopher Hinton, formerly in charge of industrial development at the United Kingdom Atomic Energy Authority, and now chairman of Britain's new Central Electricity Generating Board, the cost of electricity produced by nuclear and conventional power plants should be strictly competitive in 1962. By 1982 the cost of electricity produced by atomic power might well have fallen to half that of electricity from coal. The figures in Table 2 indicate the progress expected between 1960 and 1980. The improved efficiency of conventional generating plants will be offset by the increasing cost of mining coal.

In arriving at the calculations of the cost of nuclear electricity, allowance has been made for the fact that most of the nuclear stations from 1970 onward, like many of the conventional power stations today, have to operate on less than base-load. In fact, it is assumed that the rate of 80 percent of the 24 hours in each day during which the first nuclear stations would be operated would drop to 70 percent in 1970 and 65 percent in 1980. It is also worth stressing that all figures for electricity generated by nuclear energy have been worked out on present reactor and technological plans. Obviously, progress in fundamental research or technology may produce still more favorable results.

Research into new types of reactors. A great deal of research into new types of reactors is going on in the laboratories both of the U.K. Atomic Energy Authority and of the firms directly concerned with the construction of nuclear power plants. And intensive work is proceeding to realize the full potentialities of the gas-cooled graphite-moderated Calder Hall type of reactor which, it is visualized, will be used in stations to be built under the present program. One of the most important long-term objectives is the reduction of fuel costs by utilization of a higher proportion of the total uranium fed to the system. Recycling of the plutonium produced during the operation of the reactor might increase the burn-up rate by as much as a factor of five. In practical terms this would make 1 ton of uranium equivalent to 50,000 tons of coal, as against 10,000 tons in the case of the first Calder Hall reactor.

Perhaps the most striking feature of the rapid rate of progress in using atomic energy for peaceful purposes on a large scale in Britain is the fact that industry came in at an early stage to undertake commercial development of reactor systems designed by the U.K. Atomic Energy Authority. All power stations are being developed on a competitive basis by groups of British engineering and construction firms, supported by other companies specializing in the manufacture of the vast ranges of electronic and other measuring and ancillary equipment needed. All of them are able to call on the Atomic Energy Authority's basic knowledge, and they are thus able to accumulate a large amount of experience and to create great manufacturing capacities.

STEPHEN E. SCHATTMANN
London, England

Exchange of Agricultural Observers

The U.S. Department of Agriculture has announced that it will send six agricultural groups to the Soviet Union this summer and early fall, and that the U.S.S.R. will send a similar number to the United States. Three additional teams from each country are to be exchanged in 1959. The delegation exchange plan is in accordance with last January's agreement between the United States and the Soviet Union providing for a general program of exchanges in cultural, technical, and educational fields.

The teams going to the Soviet Union will be the first groups sponsored by the U.S. Department of Agriculture to have an opportunity to visit Russian farms, research stations, and institutions, and learn what agricultural developments have taken place in the U.S.S.R. The Russian visitors will have opportunity for similar observations in this country. Each of the U.S.–Russian delegations will be seeking specific scientific or technical knowledge. Accordingly, the membership of each American delegation has been selected from among U.S. Department of Agriculture and Land Grant institution specialists.

The U.S. delegations going to the Soviet Union in 1958, by subject interest and probable date of departure, are: agricultural economics, 25 June; agricultural crops, 5 July; soil and water use, 10 July; veterinary science, 15 July; mechanization of agriculture, 18 August; and cotton growing and plant physiology, 1 September. There are plans to