surveying the market

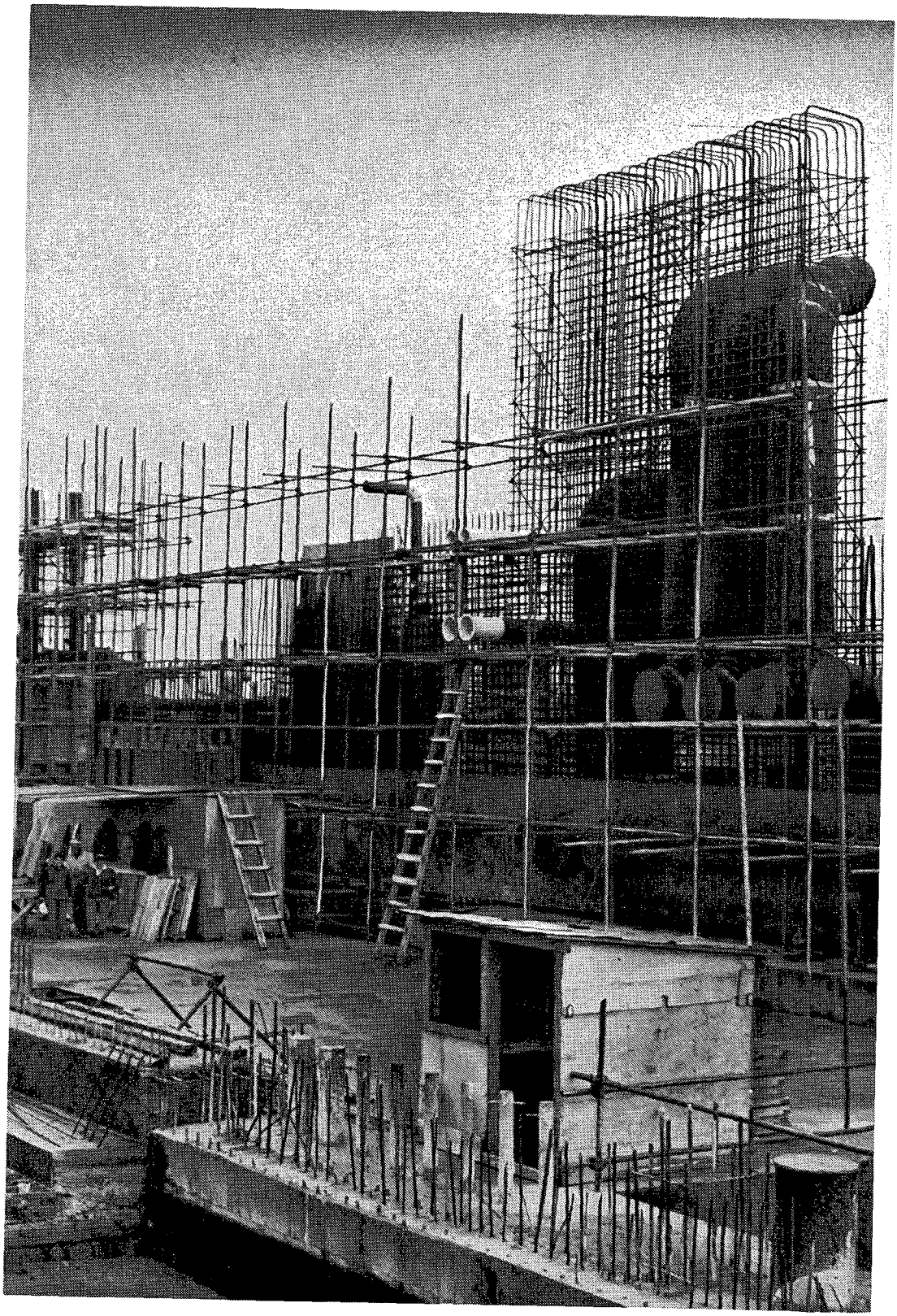
Nuclear power has expanded much faster in industrial than in developing countries. Of the 50 000 MW(e) of nuclear-powered generating capacity which it is estimated will be in operation throughout the world in 1972, only 1000 MW(e) is to be found in developing States. The share of such countries in the capacity which is expected to be commissioned during the next seven years, up to 1980, is unlikely to exceed 30 000 MW(e), as against more than 300 000 MW(e) in industrialized nations. The following article surveys some of the reasons for this disparity, and describes the aims and methods of a survey of the market for nuclear power in developing countries which is about to be carried out.

The past...

The lag which has occurred was not altogether unexpected. To begin with, many developing countries had only started developing domestic resources of fossil fuels and harnessing their hydro-electric potential at the time when nuclear power plants became available. Further, the trouble-free operation of large, commercial nuclear power stations of differing designs has been confirmed fully only in the course of the last decade. The policy of letting countries who could best afford them bear the costs of 'growing pains' and engineering improvements therefore was not as disadvantageous for developing countries as has sometimes been depicted. In addition, the special sensitivity to plant size of the unit cost of electricity generated in nuclear installations affected the competitive position of nuclear stations in developing countries, both directly through the limitations on the maximum size of such installations imposed by the relatively small capacities of the supply systems into which they would be connected; and indirectly because of the concentration of nuclear equipment makers on the largest possible units acceptable within the supply systems of their own countries. Finally, the developing countries had to cope with the complex preparatory measures in the fields of education, training and legislation which the introduction of this entirely new technology required, and with the problems of financing the substantial initial outlays of domestic and foreign capital which the introduction of nuclear power involves.

... and the future

The reasons for the past and present lags are thus sufficiently explained. The next question is about the future: what will be the participation of developing countries in a form of energy which is generally expected to account for more than half of the world production of electricity by the turn of the century? The preceding summary of the retarding factors gives some



guidance toward an answer. Domestic resources of fossil fuel and the most attractive hydro sites in the developing countries are being exploited progressively, and their interconnected supply systems are growing in size and thus becoming capable of accepting increasingly larger units. The first of these trends eliminates progressively competitors with low foreign exchange costs. The second improves the competitive status of nuclear plants versus conventional thermal stations. The merits of a power source characterized by fuel costs which are both low at present and more predictable and controllable in the future than those of their fossil competitors have the same inherent appeal to developing as to industrial nations. The penetration of nuclear power into the electricity supply systems of the former may rightly, therefore, be expected to accelerate.

But the process of expansion will necessarily be uneven, and will differ from country to country and even within a given country, from region to region, in ways which only a very careful analysis of each specific case can be expected to predict. Yet a global picture of this future development might prove of benefit to all parties:

* For the developing countries it might provide the opportunity for a systematic analysis of the rôle of nuclear power in meeting their energy needs, assessed using a uniform approach based on the latest data on the performance and cost parameters of alternative plants. In a more indirect way it might achieve for them lower costs and better financing terms, thanks to a clearer picture of the volume of future outputs which equipment manufacturers may be called upon to provide, and of the total assistance which may be required from financing institutions.
* For the industrial States it might enable a better assessment of future markets for the sale of nuclear power plants in different size ranges, and for the various components of the nuclear fuel cycle.

These considerations, and the wishes expressed by the General Conference and the Board of Governors of the IAEA, have led the Agency to supplement its continuous efforts to assist developing countries in the peaceful use of nuclear energy by initiating a market survey of nuclear power in developing countries, on a systematic basis. In order to define the objectives, the scope and the means of this enterprise a working group of 22 experts from 11 Member States was convened in Vienna in October 1971, and its recommendations, after review and approval by the Director General, served as a basis for immediate action.

Objective and scope

The objective of the survey is to define with the maximum possible accuracy the probable timing and size of nuclear units which might be commissioned in developing countries in the period 1980 - 1990, and to make a general report on this subject available to Member States and to the sponsors of the survey by the second half of 1973.

The scope of the survey has to be restricted at this stage, with regard both to the time period covered and to the number of countries. With respect to the time horizon, it was felt that ten years starting from 1980 represented a maximum for dependable forecasting and that, even with this restriction, the reliability of the estimates will be greater for the first half of the decade than for the second. With respect to potential participants, this restriction implied a

... and the twin 400 MW(e) installation at Kozloduy, in Bulgaria, in skeletal form. The first unit of this installation is scheduled to go critical in 1974. Photo: Sofia-Press

provisional selection of countries on the basis of the degree of advancement of their national plans for the introduction of nuclear power. It can hardly be overemphasized that this selection represents only a temporary order of priority, dictated by considerations of efficiency and manpower limitations for a short-term assessment.

Even with these restrictions on the scope of the survey, it represented a serious strain on the budgetary and manpower resources of the Agency, which therefore approached some of its Member States and some international financing organizations for possible contributions of manpower and money ear-marked for this particular job. Meanwhile, the Agency was finding out which of its developing Member States with potential plans for the introduction of nuclear power over the next ten years would be interested in taking part in the survey.

To date, the appeal to Member States for money and manpower has brought assurances of support from the World Bank, the Inter-American Bank, Canada, France, the Federal Republic of Germany, the United Kingdom and the United States. It is possible that others may be added to this provisional list later.

The favourable response received from both sides in the early months of 1972 permitted a rapid crystallization of a plan of action. As a result, 13 developing countries out of the 23 initially approached are expected to be surveyed during 1972. They are: Argentina, Brazil, Chile, Egypt, Greece, Korea, Mexico, Pakistan, the Philippines, Singapore, Thailand, Turkey and Yugoslavia. The surveys will be carried out through field missions dispatched after careful preparatory work and composed of Agency staff members and of such outside experts as the specific problems of each country may require. The missions will do their work in close contact with the competent national authorities in endeavouring to assess alternative patterns for expansion of interconnected supply systems, on the basis of an economic analysis using a uniform approach and methodology in order to compare competing alternatives.

The concentration of efforts over the relatively short span of time required by this programme, the wide range of topics it is expected to cover and the complex issues of electric utility planning which it involves made the recruitment of a full-time Project Manager very desirable. Mr. O.B. Falls, Jr., Former President and Chief Executive Officer of Commonwealth Associates Inc., a large US consulting engineering firm specialized in assisting domestic and foreign utilities in the fields of engineering and planning, was appointed to this post.

On the basis of the findings of the missions a comprehensive report will be prepared during the first half of 1973, with a view to giving Member States and other sponsors of the survey as complete a picture as possible not later than the General Conference of the Agency to be held in the autumn of 1973.

Although this 'picture' will result from intensive effort, it is inevitable that it will be tentative and provisional, since its scope will be limited to the prospects of nuclear power in a restricted number of countries over a relatively short period of time. It is therefore possible that it will need to be up-dated and expanded in the future. The work done now should be considered to be not so much a separate and self-contained exercise, more as a particularly important part of the general programme of the IAEA in assisting developing countries in the introduction of nuclear power plants to their electricity supply systems.