TRANSFER OF NUCLEAR TECHNOLOGY OBTAINED BY THE ARGENTINE REPUBLIC AS A CONSEQUENCE OF THE CONSTRUCTION OF ITS FIRST TWO NUCLEAR POWER STATIONS

OSCAR J. QUIHILLALT
HORACIO O. GRASSO
Direccion de Proyectos
Comision Nacional de Energia Atomica
Argentina

1. INTRODUCTION

In the majority of the cases to date, when a developing country has decided to install its first nuclear power station, it has chosen to sign "turn-key" contracts with large international firms or consortia for the supply of complete facilities in guaranteed commercial operation at an established date and at a known price.

This type of contract usually presents difficulties: the obligations of the supplier when the contracting agency wishes that this first nuclear power station become not only an efficient, economical and reliable electric power producing machine, but also an adequate instrument for transferring to local industry knowledge of nuclear technology advances and standards in the areas of safety, design, construction, quality control, erection and commissioning of nuclear systems and equipment.

This was the situation confronting the Comision Nacional de Energia Atomica when, in the years 1967 and 1972, it had to decide on the contracts for its two first nuclear power stations. It became necessary in both cases, to establish a mechanism which made the responsibilities and guarantees assumed by the main contractors compatible with maximum national participation in the design, construction, erection and commissioning of the projects.

2. ATUCHA NUCLEAR POWER STATION

This philosophy of integral utilization of Argentinian human and material resources began in 1965 with the feasibility study for the Atucha nuclear power station, carried out by technicians and professionals of the Comisión Nacional de Energía Atómica. At this time, because of the technological novelty of such a facility for the country, the engagement of an international consulting firm to perform the study could have been easily justified. In the case of a favorable result, this would have made it easier to obtain the final approval from the national authorities to proceed with the project. The Commission, however, preferred to face the challenge with its own specialists so as to be able to implement this idea of inte-

gral utilization of local capabilities from the beginning and, at the same time, to form a professional team that would be capable of evaluating and negotiating the offers which were to be received after the call for bids was issued.

In the case of the Atucha Nuclear Power Station, 17 offers were received on July 31, 1967 in answer to the invitation for bids. Since CNEA had stressed the importance it assigned to local participation, the response in this connection was in general adequate.

After a period of evaluation of the various offers, negotiations with Siemens A.G. reached a successful conclusion on May 31, 1968, and a contract was signed for the purchase of 340 MW power station, using natural uranium as a fuel and moderated and cooled by heavy water in a pressure vessel. In the contract, Siemens A.G. engaged itself to give preference to the human and material resources available in the Argentine Republic, and invest, within the general financing conditions of the contract, a minimum of 100 million DM in the country, an amount equivalent to about 36% of the total cost of the power station, which was 278 million DM , then equivalent to approximately 70 million U.S. Dollars. That price covered the construction, erection and delivery of the complete nuclear power station in guaranteed commercial operation, including interests during construction up to the reception date, and it was wholly financed over 20 years at a 6% annual interest on the outstanding balances. A period of grace equal to the time required for the construction was also granted.

As the delivery of the power station took place, on June 24, 1974, the final price of the equivalent supply, including the accepted additionals and the application of escalation formulae, turned out to be 360 million DM, at that time equivalent to approximately 145 million U.S. Dollars.

Of the above-mentioned minimum of 100 million DM for Argentinian supplies and services, 13 million were for electromechanical supplies.

As representative data for the latter amount, a list of 71 electromechanical parts and complete systems to be manufactured in principie in Argentina was included in the contract, for which Siemens would invest in the country the amount corresponding to the FOB price of the equivalent German supply, while CNEA would bear the differences between that price and the price exfactory of the similar national supply. In addition, for the items in that list, Siemens A.G. offered the same guaranties regarding delivery terms, quality, etc. as for the rest of the imported supplies.

In order to avoid significatively taxing the project total cost with the higher prices for these local components, CNEA had to generate a legal structure placing Argentinian suppliers in the best competitive position versus foreign suppliers. As a result, special legislation was obtained permitting them to quote those items in similar conditions to an export thus avoiding the comparison of the internal market price of the national item with the FOB price of the foreign component.

From the technical point of view, the above-mentioned list of 71 items was prepared selectively so as to achieve two important national development aims:

a) preparation of a nuclear component industry;

b) increase of the technological level of national industry through knowledge of new process, materials and quality controls.

It was thus preferred to permit importation of some items that were being currently manufactured in the country but, on the other hand, to benefit from the financing and technical advice from Siemens A.G. and from the overprice to be paid by CNEA, in order to locally manufacture electromechanical supplies which would bring a technological advance to local industry.

Argentinian manufacturers responded quite satisfactorily. The confidence they inspired in the main contractor permitted an increase in the original 71-item list, with the addition of 25 new locally manufactured supplies and systems.

In no case was there need for the replacement of a locally manufactured component by an import because of lack of quality or delivery problems.

Among the main supplies awarded to local firms are worth mentioning:

- Heavy water heat exchangers with very low permissible leakage.
- Ventilation systems for both nuclear and conventional areas.
- Mechanical clean up and chemical treatment system for cooling water (Primary circuit water-treatment systems).
- 200 t polar crane for the reactor vault.
- Main condenser tubing and envelope.
- Ordinary and stainless steel pumps and valves with very low permissible leakage.

Summarizing, national participation amounted to approximately 40% of the total cost of the project, while in the area of electromechanical supplies it was 12% of the total.

Even more important than the percentage of local participation achieved in the country's first nuclear power station, is the fact that local industry was successfully able to meet the requirements imposed by strict and severe quality control standards, within the established delivery times.

The Atucha Nuclear Power Station was the first significant Argentinian public work for which an analysis of the technology involved was made in order to achieve maximum national participation and to spread the work among the various potentially adequate firms.

3. NUCLEAR POWER STATION AT EMBALSE - CORDOBA

The experience obtained through the participation of Argentinian industry in the Atucha Nuclear Power Station was valued by CNEA. When the cali for bids for the Nuclear Power Station at Embalse - Cordoba was being prepared, a chapter was included in the bid specifications detailing the national participation to be included in the offer - more than 50% of the total amount.

Regarding electromechanical supplies it was stipulated that the bidders should prepare a "Positive List" for these systems, equipment and components which they would have designed and constructed by local firms or purchased in Argentina. Such items were to be quoted in Argentinian currency at normal internal market prices and were to be included

as a part of the proposal without reservations as to the guaranties they would be prepared to offer for the complete power station. The bid specifications indicated the amount of internal financing that would be available during the whole process to cover the resulting expenses.

In addition, the specifications included an "Indicative List" of 112 items that could serve as a basis for the bidders in preparing their "Positive Lists" by adapting it to the particular characteristics of the systems and components in their proposal. This "Indicative List" was not a taxative one, but the bidder was asked to investigate by himself every possibility of increasing it and, whenever he would be unable to include in his "Positive List" a supply of foreseeable Argentinian fabrication, he should give a detailed explanation of the technical reasons involved.

Finally, in addition to the "Positive List" of Argentinian electromechanical supplies, the bidders were asked to submit a "Probable List" of the systems and components for which they were uncertain of the capability of local suppliers to comply with the technical guaranties or delivery terms offered by the bidder for the complete nuclear power station. Items in the "Probable List" were to be quoted in the foreign currency section of the proposal. A mechanism similar to that explained for the Atucha Nuclear Power Station was established for the case of a later decision to have any such items manufactured by local industry. As a result of the call for bids, on May 2, 1972 six proposals were received, four of them for enriched and two for natural uranium fueled nuclear power stations.

From these, on March 14, 1973 the proposal submitted by the consortium of Atomic Energy of Canada Limited and Italimpianti Societa Impianti p.a. for a 600 MW CANDU type unit was selected, and the corresponding contract signed on December 20, 1973.

Substantial increases in local participation were achieved in the Nuclear Power Station at Embalse - Cordoba, compared with the Atucha Nuclear Power Station in the following items:

- Electromechanical supplies, which from 12% of the total rose to 33% for Embalse, including for the first time the manufacture of instrumentation and control equipment for nuclear systems.
- Engineering, which from a minimum participation in Atucha now represents 33%, including basic and mainly detail engineering for a series of systems expressly listed in the contract.
- All civil works and the erection of the nuclear and conventional systems will be carried out by Argentinian firms.
- Commissioning of the above systems will be carried out by Argentinian personnel under supervision of the contractors.

4. CONCLUSIONS AND FUTURE ACTION

The levels of local participation achieved for the Nuclear Power Station at Embalse are practically the maximum compatible with the present state and equipment of Argentinian

industry and with the characteristics of a "turn-key" contract with a single main supplier. In order to achieve a significant increase of Argentinian supplies and services for future nuclear power stations, action is required in the following directions:

a) A long-term nuclear power program should be established, defining the types, power capacities and commissioning dates for the future nuclear power stations. On the basis of these data it will be possible to foster the development of a national nuclear industry, since knowledge of the prospective market will allow the industries involved to adequately plan the necessary investments for the manufacture of equipment for nuclear power stations.

b) The "turn-key" contract method should be abandoned and full project coordination responsibility should be assumed by CNEA, by purchasing the basic engineering and the main nuclear components from the designer of the chosen reactor type, while the turboset should be separately purchased from the most convenient source. This will allow us to equate the project with the real capabilities of Argentinian industry and engineering, construction and erection firms.

c) Firm and continued support from the central authority must be secured, particularly as regards the economic and financial aspects, since the fuifillment of actions a) and b) has a direct influence on the project costs and financing, due to the following:

   1) Production costs in developong countries for these first supplies and services for an advanced technology and a specific market can be twice as high as the costs of the equivalent items supplied by highly developed countries with well established industries. This may be partly compensated by the fact that the fees and contingency costs usually charged by "turn-key" suppliers no longer apply.

   2) All national supplies and services must be wholly supported over the entire period of construction, with little financing available for imported components, much less than that obtainable when purchasing through a "turn-key" contract.

   3) The country's availability of foreign currency will constitute another critical factor. Its abundance or scarcity will determine the convenience or otherwise of paying higher prices for national supplies in order to reduce foreign exchange expenditure.