ARGENTINA


Don Bosco
M. M. Güemes
TONCO-AMBLAYO
Don Otto
La Despedida
Emmy
ALEMANIA
Los Higueritas
TINOGASTA
Bonanza
San Rubén
SAÑOGASTA
San Sebastián
Urcal
GUANDACOL
COSQUIN
BARREAL-JACHAL
FCA CORDOBA
LOS GIGANTES
El Trampolín
SAN ISIDRO
COMECHINGONES
Los Reyunos
S. PINTADA
FCA MALARGUE
BUENOS AIRES
Huemul
LA ESCONDIDA
MALARGUE
La Primera
RAHUECO
Palo Quemado
María Teresa
CHIHUIDOS
PRINCIPALES DISTRITOS Y
YACIMIENTOS URANÍFEROS
Carhué-Niyeu
CARHUE-NIYEU
Pichiñán
PASO DE INDIOS
Los Adobes
Sa. Cuadrada
TOBAS
AMARILLAS
SIERRA CUADRADA
Cad. Krüger
Cad. Soto
RIO CHICO
REFERENCIAS
Principales distritos nucleares
Yacimiento
Yacimiento en explotación
Planta de tratamiento
Sede Central
0 200 400 600 Km.

DEVELOPMENT OF NUCLEAR ENERGY IN THE REPUBLIC OF ARGENTINA

The Argentine Republic officially began its activities in nuclear energy in 1950, with the creation of the National Atomic Energy Commission (CNEA). Through the development of these activities, Argentina became the first Latin-American country to follow what is now a common tendency in the world, namely to use nuclear energy as a way of meeting increasing electricity demands: in 1968 construction was begun on the country's first power reactor.

The country's achievements up to 1972 can be summed up as follows:

Raw materials

A study of the territory of Argentina with a view to determining the abundance of minerals of nuclear interest was one of the first tasks undertaken by the CNEA. The first geological studies indicated 1 300 000 km² of continental territory with uranium-bearing possibilities; this area was divided into 400 000 km² of immediate interest and 900 000 km² of more remote interest.

Prospecting was concentrated on the areas of immediate interest and revealed resources adequate to provide for the needs of an independent nuclear programme based on domestic supplies. The results of this prospecting show that the country currently has the following resources:

Categories	Price (US $/lb) U_3O_8	8-10	10-15	15-30	Cumulative totals
Reserves (R) (including inferred deposits)		8 300	3 000	5 000	16 300
Cumulative sub-totals		8 300	11 300	16 300	
Reasonably assured resources (RAR)		3 600	6 100	9 800	35 800
Cumulative sub-totals		3 600	9 700	19 500	
Possible additional resources (PAR)		10 200	13 200	29 500	
Cumultative sub-totals		10 200	23 400	52 900	
SUB-TOTALS ACCORDING TO PRICE		22 100	22 300	44 300	
		44 400			88 700

In tons of U_3O_8, on 30 June 1972

Exploitation of these resources began in 1952, and was established on a more regular basis in 1967 to provide a supply of fuel for the first nuclear power station. For this purpose a number of mines producing 50 tons of yellow cake per year are being worked. This concentrate has already been used to produce the first loading of fuel elements for the station, and the second charge is now in process of fabrication.

Fuel elements

From the beginning it has been the policy of the CNEA to ensure domestic production of the fuel elements for future Argentinian reactors. Thus, as early as 1957 the first fuel elements for the RA-1 reactor were being produced. Since then all fuel elements for Argentina's research reactors have been produced in the CNEA laboratories, with the sole exception of the RA-4 elements: this reactor is a gift from the Government of the Federal Republic of Germany and includes the fuel elements.

Apart from the work mentioned above, Argentina has also developed PHWR fuel, and it is worth mentioning that fuel prototypes manufactured in Argentina have been very successfully irradiated in the MZFR reactor at Karlsruhe.

Reprocessing of irradiated fuel is being undertaken at the pilot plant level for the research reactors, and plutonium has been chemically separated since 1969.

Reactors

The policy described in the preceding section also applies to reactors. In February 1958, the first Argentine research reactor, the RA-1, became critical. This reactor, based on the American Argonaut design, was built in Argentina and subsequently modified to operate at 150 kW. Since then three more reactors, the RA-O, RA-2 and RA-3, have been constructed. The RA-3, intended essentially for the production of radioisotopes and, like the others, designed and constructed entirely in Argentina, is a tank-type reactor now operating at 7.5 MW. The last on the list of Argentine research reactors is the RA-4, which, as we have already pointed out, was a gift and is intended for training. The RA-5, a coupled fast-thermal reactor, is under construction.

As regards power reactors, the country's first nuclear power station, which will generate 320 MW of electricity, is in an advanced stage of construction and will go into commercial operation in September 1973. The second nuclear power station, designed for a capacity of 600 MW, is up for tenders and a decision is expected very soon. In the first power station the participation of domestic industry will make up about 40% of the total and in the second station domestic industry is expected to contribute at least 50%.

Production and utilization of radioisotopes

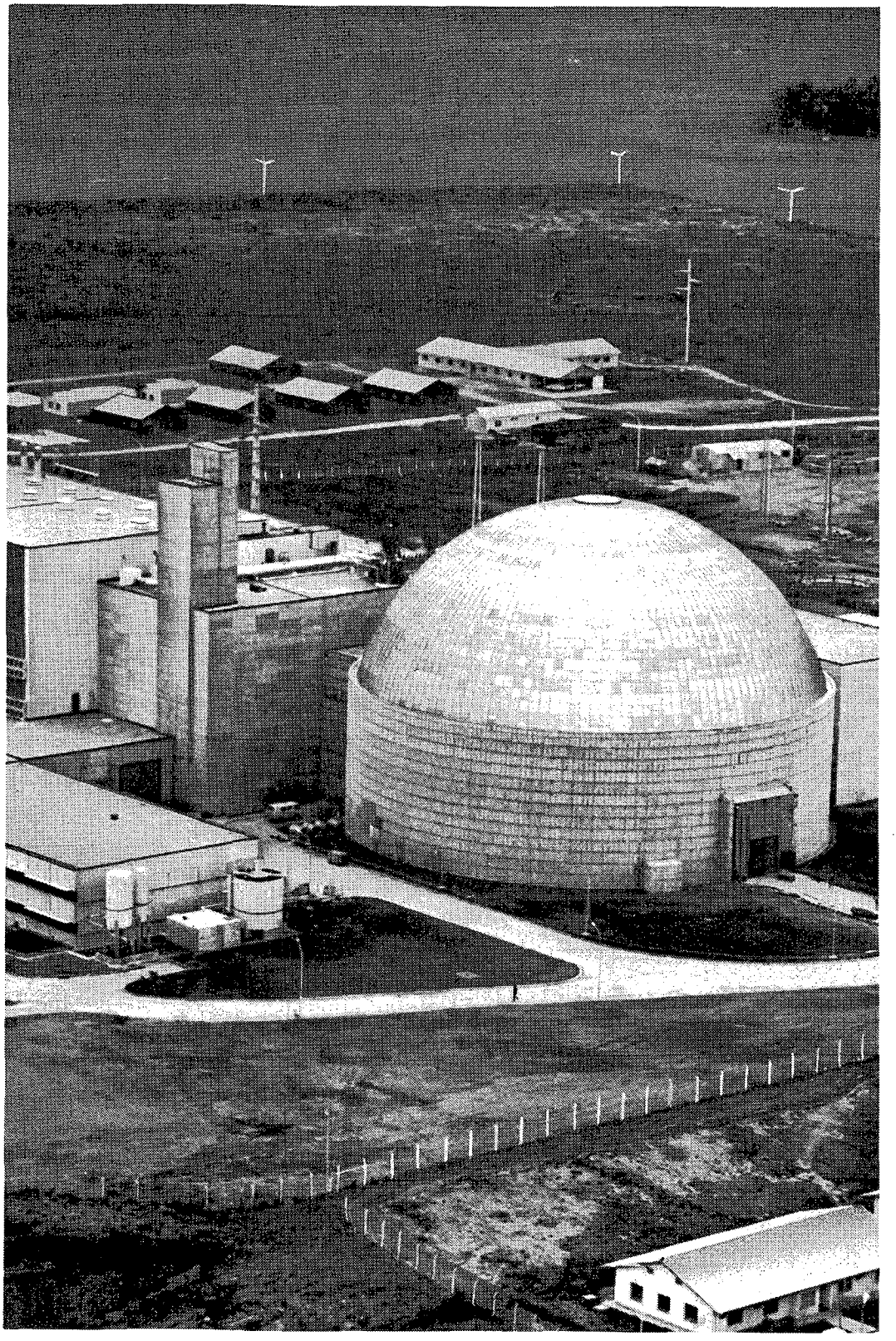
At present 80% of the radioisotopes required for the domestic market (150 Ci in 1972) are being produced in Argentina. These isotopes are intended for medical, industrial and agricultural applications, the medical uses remaining so far the most thoroughly established in Argentina. There are by now more than 470 centres using radioisotopes.

Large radiation sources

Argentina has a facility for large radiation sources with a capacity of 1 million Ci. The facility is used for sterilization techniques which have already become well established here, and for processes designed to improve the properties of wood and composition materials and to preserve foodstuffs.

Research and development

The basic and applied research essential to the development of nuclear energy has been given the most careful attention. Argentina now has well equipped laboratories and, most important of all, personnel thoroughly trained in disciplines such as physics, chemistry, biology, metallurgy, materials and so on.



Argentine's nuclear power station 1

Radiological protection

The radiological protection services needed to ensure the security of personnel working with radiations and the safety of the population as a whole have not been neglected. Radiological and industrial safety, environmental radiochemistry, radiosanitary medicine, the engineering required for all forms of protection including nuclear safety, the treatment of radioactive wastes and the instrumentation required for radiological protection – all these things have been developed to a level commensurate with the present activities of the CNEA.

These, in brief summary, are the results that have been obtained in Argentina so far.

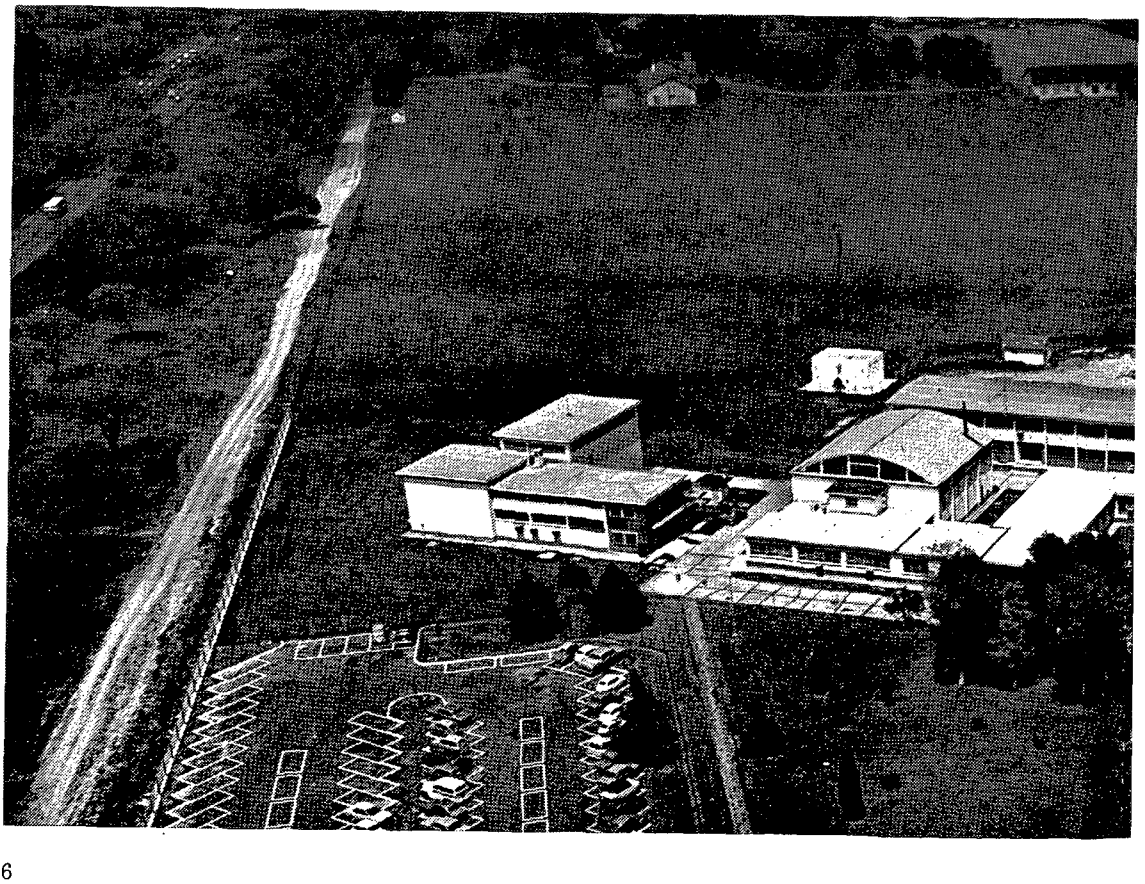
FUTURE PROSPECTS

Future prospects for the development of nuclear energy in Argentina are promising indeed, as can be seen from the following outline.

The sustained growth in the demand for electric power during the last four years, at an average rate of 13% per annum, together with the declared policy of adopting new fuels in order to allow more profitable utilization of the country's conventional resources, makes it certain that nuclear development will continue apace. Even assuming a slower rate of growth, one can predict with a fair degree of certainty that Argentina will need an installed electric potential of the order of 100 000 MW by the year 2000 in order to supply its grid.

The total power installed at present is 7000 MW. Even if known hydro-electric resources are fully utilized, and even if conventional thermal power generation also grows, at least 30% of the power to be installed will have to be provided by nuclear energy. And, since the

The Constituyentes Atomic Centre



nuclear stations will be used for base-load operation, this fraction will become approximately 70% in terms of power generated.

The power programme

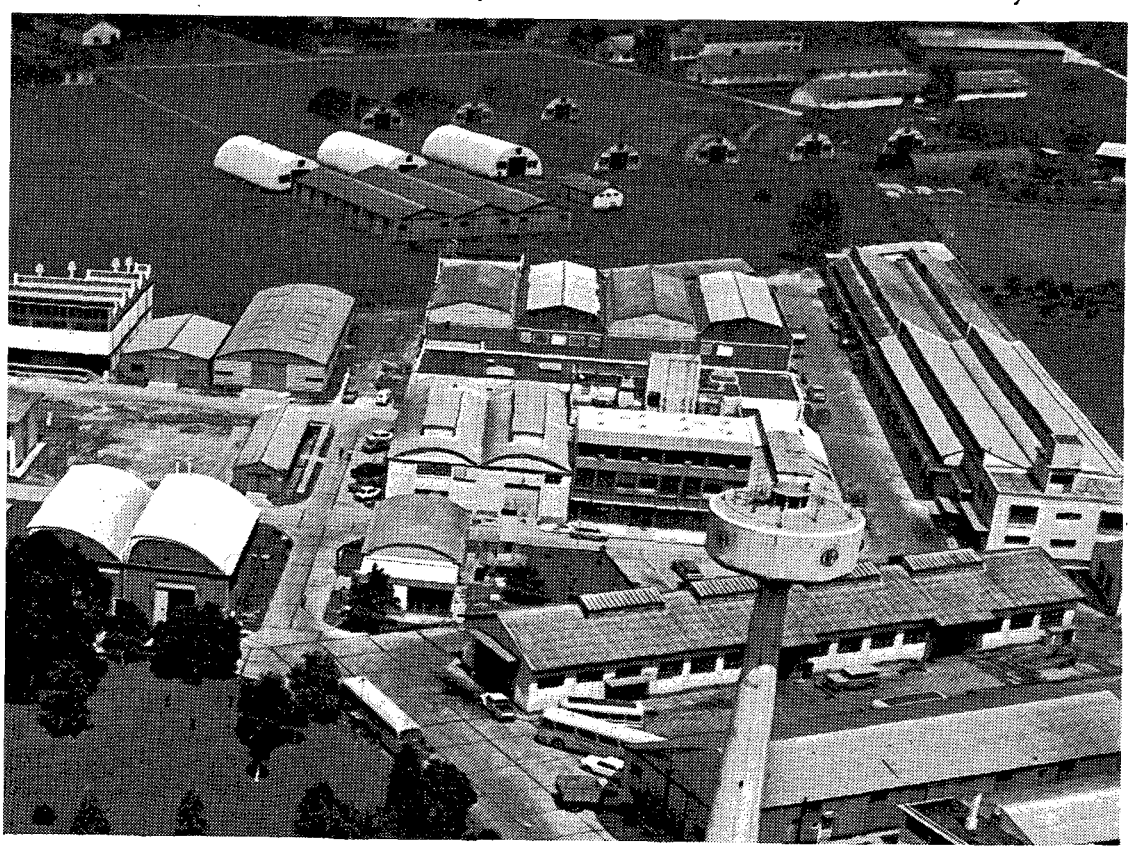
To satisfy this demand the Argentine Nuclear Plan envisages the following nuclear power stations:

Power Station I	320 MW	1973
Power Station II	600 MW	1978
Power Station III	600 MW	1979/80
Power Station IV	1200 (2 × 600) MW	1981/2

From there on it will be necessary to install at least one 1000 MW station per year in order to have about 13 000 MW installed by 1992.

DEVELOPMENT OF NUCLEAR INDUSTRY

Domestic industry will have an increasing share in the construction of these reactors. It is hoped that by 1982 at least 75% of each station will be of domestic origin and that by 1992 nuclear stations can be constructed in their entirety in Argentina; but this will depend on the development of the heavy industry needed to make large components and turbines. It will obviously require great efforts on the part of Argentine industry, but the efforts would be well justified by the resultant savings of foreign exchange – very large savings when one considers the capital investment which such a programme involves. CNEA will give the greatest possible support to domestic industry, so that in the long run it can supply the greater part of Argentina's nuclear equipment and lay the foundations for an efficient nuclear industry.



RAW MATERIALS

Prospecting for uranium will have to be intensified so as to increase reserves by at least 3000 tons per year. At present the annual rate of increase is only 1000 tons per year. By 1982 we hope to have located 30 000 tons of reserves and by 1992 at least 70 000 tons, our aim being to guarantee the fuel supplies needed for the full lifetime of each power station installed. Prospecting should keep about 12 to 15 years ahead of the installations for which the uranium is required.

For the production of concentrates, we are contemplating an industrial-scale plant in the immediate future. This plant will begin operation with a capacity of 400 tons per year in 1977, rising to 800 tons per year before 1980. By 1992 its output will have to be trebled.

FUEL ELEMENTS

The fuel elements needed for the nuclear power stations are to be produced in Argentina, and work on the first fabrication plant will begin next year. A feasible course, we believe, is to build a plant which will produce the fuel element tubes in the first instance from imported raw material (Zircaloy ingots). If power plants with natural uranium reactors are installed, every stage in the fabrication of their fuel elements can even now be carried out in Argentina. If enriched uranium reactors are included in the power plant park, we do not discount the possibility of setting up an enrichment plant. This decision will have to be reviewed in the light of the evolution of new processes and the installation of multinational plants in the rest of the world.

REPROCESSING

Reprocessing of irradiated fuel on an industrial scale is not contemplated in this decade. However, this stage of the fuel cycle will be carefully analysed so that we can decide on the economic practicability of such an endeavour before 1990. The analysis will have to take account of other factors, such as the timetable for commercial introduction of fast reactors and the evolution of the world plutonium market. A point to be emphasized is that when the time comes Argentina will have accumulated enough plutonium to incorporate breeder reactor plants in its Nuclear Plan.

MODERATORS

Should the decision now pending on the second Argentine nuclear power station also fall in favour of a natural-uranium heavy-water reactor, and should this decision be maintained for at least three further plants, it would clearly be in the interests of the country's nuclear industry to produce heavy water domestically as well. In that case we would consider the immediate installation of a plant with a capacity of 400 tons per year, to be increased to 600 tons per year before 1980.

Radioisotopes and radiations

Work involving radioisotopes and radiations seems likely – judging by the results already obtained – to continue and indeed to increase in scope. Efforts will be aimed at consolidating the medical applications, which are already well established, and at promoting more intensively the industrial and agricultural applications. In this sphere the CNEA will limit its own activities to the primary production of radioisotopes and radiation sources, allowing and

encouraging private undertakings to share in the work of fractionation and distribution to the degree required by the domestic market. This also applies to industrial irradiation plants: CNEA will give all the support and technical advice required to those who are willing to take charge of such installations.

Auxiliary activities

The research and development work needed to ensure continuity in the Argentine Nuclear Plan will continue to be the inescapable responsibility of CNEA, which proposes to maintain its objective of developing domestic technologies as well as introducing in Argentina, as early as possible, those technologies developed abroad which are of abvious interest to the national economy. Radiological protection work will naturally have to be intensified to keep abreast of the plan outlined here if adequate protection of the population is to be ensured. From what has been said we may conclude that in the next 20 years Argentina, following the example of the advanced countries, will complete the transformation already begun and thereby reap from nuclear energy all the social and economic benefits it has to offer.

The Bariloche Atomic Centre