

THE CANDU EXPERIENCE IN ROMANIA

PRESENTED BY

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AT THE

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SUMMARY

The Candu Program in Romania is now well established.

The Cernavoda Nuclear Station presently under construction will consist of 5-CANDU 600 MWE Units and another similar size station is planned to be in operation in the next decade.

Progress on the multi-unit station at Cernavoda was stalled for 18 months in 1982/83 as the Canadian Export Development Corporation had suspended their loan disbursements while the Romanian National debt was being rescheduled.

Since resumption of the financing in August 1983 contracts worth almost 200M dollars have been placed with Canadian Companies for the supply of major equipment for the first two units.

The Canadian design is that which was used in the latest 600 MWE CANDU station at Wolsung, Korea.

The vast construction site is now well developed with the cooling water systems/channels and service buildings at an advanced stage of completion.

The perimeter walls of the first two reactor buildings are already complete and slip-forming for the 3rd Unit is imminent.

Many Romanian organizations are involved in the infrastructure which has been established to handle the design, manufacture, construction and operation of the Candu Stations.

The Romanian manufacturing industry has made extensive preparations for the supply of Candu equipment and components, and although a major portion of the first two units will come from Canada their intentions are to become largely self-supporting for the ensuing Candu program. Quality assurance programs have been prepared already for many of the facilities.

**“The CANDU Experience
in Romania”**

"THE CANDU EXPERIENCE IN ROMANIA"

How is CANDU in Romania?

THE CANDU PROGRAM IN ROMANIA IS NOW WELL ESTABLISHED, and to-day I would like to share our confidence with you by presenting a perspective of the past and the present, and to review what, I believe, are the challenges of to-morrow.

This presentation will include a review of:-

- ROMANIA - The Country
- PROJECT HISTORY - Up to 1983
- PROJECT - What is it?
 - Who is doing it?
 - Where are we today?

CHALLENGES OF
TOMORROW

BENEFITS

As we are all very aware, the task of introducing nuclear power into any society is challenging, to say the least.

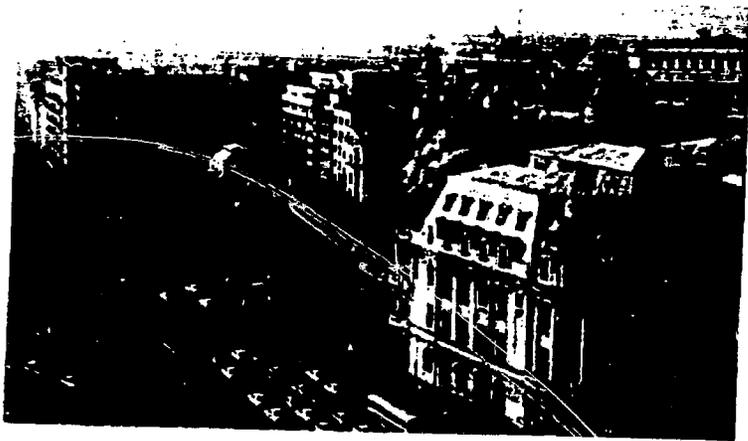
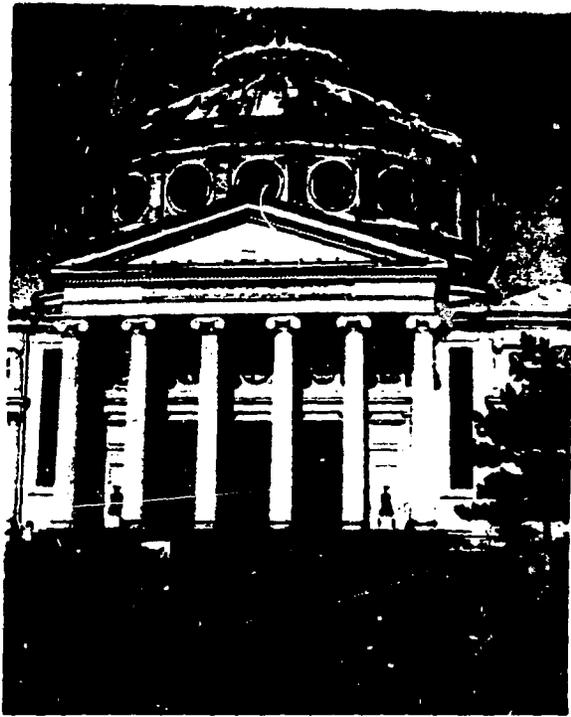
Facing international competition in selling your product requires outstanding skills and determination even though you are offering the best in the world.

When the customer plans to buy, not only the finished product to produce electrical power, but also seeks the ability and the autonomy to design, build and operate your product, the task is indeed formidable and awesome.

This was the task faced by the Candu representatives in the late sixties when the first discussions with Romania took place.

Let us look at the people, their country and current environment.





ROMANIA is a Balkan Country whose people take great pride in its early historical ties with the Roman Empire in the first and second centuries when it was known as Dacia.

Since that time they have encountered invasion by the Goths, Huns, Slavs and Bulgars. They have had their land attacked by the Turks and became pawns in the conflict with Russia. During World War I they were ravaged by the German-Austrian-Bulgarian armies. They survived World War II, reformed their territories into the country we now know and recognize as Romania.

It seems that this was an ample training ground for the Romanians to engage the advancing hordes of Candu salesmen in the late sixties and early seventies.

The Socialist Republic of Romania has a population of over 22 million. Their current economic strategy is to recover from the difficulties experienced over the last few years by:

- (1) applying an austerity program at home to reduce domestic demand and imports.

- (2) and by increasing exports

Last year saw encouraging results in lowering their foreign debt. With a positive trade balance of \$2.4B, the outstanding debt was reduced by close to \$1B.

With the emphasis on industrial growth and the drive to reduce the use of oil for electricity generation from the current 50% to 5% over a period of 6 years, nuclear power is expected to contribute over 20% of the expected 110 billion Kwh/year demand in the early 1990's, a demand which is now around 75. The Romanian government expects the Candu - 600MWe units to play the major role in meeting this challenge of making the dramatic shift to nuclear power

with the Cernavoda Project and a second multi unit station near Sibiu in Transylvania, which is in the final stages of specific site selection.

Let us briefly review the highlights of the PROJECT HISTORY. The early discussions with AECL were extended as a result of a major flood and earthquake in Romania.

ROMENERGO concluded agreements with AECL in December 1978 for:

- (1) The transfer and rights, for use in Romania, of the AECL Candu 600 MWe nuclear steam supply processes
- (2) Engineering services for the design of a Candu 600 MWe Unit at Cernavoda
- (3) Procurement services for the Canadian supply of equipment and materials for the first unit.

Concurrent with these agreements, the Romanians had negotiated a loan to a value of one billion U.S. dollars with the Canadian Government's Export Development Corporation. \$680M of this loan is available for goods and services to be supplied from Canada.

As 15% of each contract price must be paid directly from Romania this means that, at to-days exchange rate, over \$1 billion Canadian dollars is available to the Romanians for contracts placed with Canadian suppliers for the Cernavoda Project.

The extent to which these funds are used will depend largely on three key factors:

- (1) the speed with which the Romanian industry can develop the skills and expertise to manufacture Candu components by themselves,
- (2) the future economic decision making of the Romanian authorities and last, but not the least,
- (3) the marketing skills of Canadian suppliers.

The AECL Agreements became effective in May 1979 and the project got underway with the issue of engineering documentation, tenders, and start of site construction.

As the transfer of manufacturing technology from Canadian suppliers was a key factor to the Romanians, when it was realized that the Canadian suppliers would not provide their manufacturing technology without the benefit of contracts for at least two (2) reactors, further negotiations were initiated to expand the basis on which the program would continue. These resulted in an agreement in 1981 with AECL which provided for procurement services to include concurrent Canadian supply commitments for two units.

This makes the last known international export order for a nuclear power plant in the world.

By late February 1982 most of the first major contracts had been negotiated and were ready for implementation. However, just prior to this, the banking world had been facing demands for financial restructuring from many countries that were having difficulties in servicing their debts. Romania was not immune to these problems and in early March 1982, EDC decided to suspend disbursement of the Cernavoda loan until further improvements and assurances of economic performance could be achieved.

Cernavoda Project

5 x 600 MWe CANDU Station

1968 - 75	Preliminary Discussions - AECL - Romania
1976	Joint Study - CANDU in Romania
Dec. 1978	ROMENERGO - AECL Agreements Signed - 1st Unit
April 1979	Disbursement Procedures Agreement in Place (Export Development Corporation - Loan)
May 1979	AECL Agreements Effective
Dec. 1981	2nd Unit Agreement - Effective
March 1982	Suspension of EDC Loan
Aug. 1983	Resumption of EDC Loan
Dec. 1983 } - Feb. 1984 }	Major Orders Negotiations Complete <ul style="list-style-type: none">- Steam Generators- Heat Exchangers- Pumps- Fuelling Machines- Calandria

While the procurement work was essentially stalled by this suspension, construction work continued with engineering support from AECL and the contract for the supply of pressure tubes was kept alive by direct payments from Romania. During this period Romanian industry and engineering continued developing their skills and expertise in Candu technology. Meaningful progress could not be made until the visit of the Canadian Government team to Romania in June 1983. This team, consisting of representatives with both financial and technical interests, investigated the Romanian situation in depth. They concluded that financial conditions were suitable for resumption of the loan disbursements and that the Romanians were well equipped and fully committed to pursue the implementation of the Candu program in Romania.

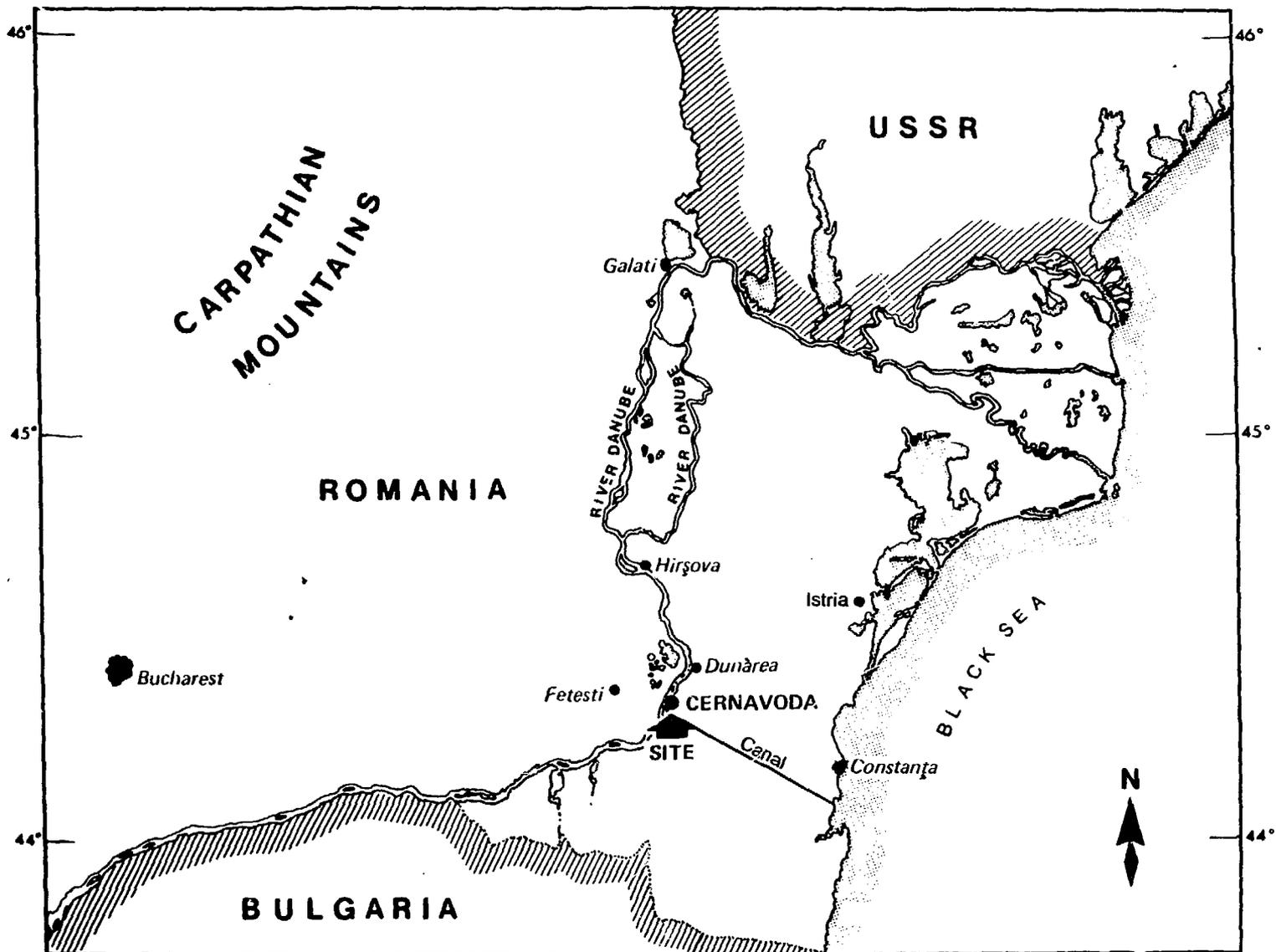
The loan suspension ended in August 1983.

I would like now to briefly describe the project as it is today.

- What is it?
- Who is doing it?
- and Where are we today?

The station is now planned to consist of five individual 600 MWe Candu Nuclear Power Plants. The nuclear steam plant design is that used by AECL at Wolsung, Korea modified to meet site conditions and to accommodate the specific equipment being purchased by ROMENERGO for Cernavoda.

The Cernavoda site is located in Eastern Romania near the bank of the Danube as it turns northwards in its meandering route to the Delta on the Black Sea. A canal, which has been



CERNAVODA-1 GENERAL SITE LOCATION

constructed to afford a more direct navigation link between the Danube and the Black Sea, was officially opened by President Ceaucescu last week, is the source of cooling water for the station.

The Candu 600 MWe design, construction and the excellence of its performance in operation has been well presented by others and is not part of my presentation today.

I will therefore focus on who is doing what for the Candu station in Romania.

There are many organizations contributing to the overall project - 3 countries - 11 major groups participating as in Table I.

It will be no surprise to you that, faced with this array of eager and energetic participants with diversified motivations, there is a need for good communication, co-ordination and co-operation.

With this in mind, regular meetings are being held between the participants to ensure that there is - a common understanding of the work - progress reporting, and - prompt resolution of problems (scheduling, technical and contractual).

The site is well developed with most of the temporary construction facilities either in place or nearing completion.

The site layout included in this presentation does not show the fifth unit but it will be located in the area to the west of Unit #4.

You will note that each unit is independent, no vacuum building as used in the Ontario Hydro multi-unit stations, and each unit has separate control rooms.

Cernavoda Project Organizations

Romania	CSEN	- State Committee for Nuclear Energy
	ROMENERGO	- Import of External Services Equipment/Materials
		- Client to AECL/GE/Ansaldo-NIRA
	INC	- Station Owner/Operator
		- Construction Management (TCICN, GSNM, IMSAT)
	IRNE	- Station Designer Engineer - NSP - Unit 2, et al
	ISCAN	- Romanian Nuclear Regulatory Body
	MICM	- Large Mechanical Equipment and Materials
	MIMUEE	- Smaller Mechanical Equipment, Electronics and Electrical
Canada	AECL	- Engineer - Unit-1
		- Procurement Agent - Canadian Supply
		- QA and Technical Assistance
	Canadian CANDU Suppliers	- Nuclear Steam Plant Equipment Materials, Services
USA	General Electric	- Turbine Generator - 2 Units
Italy	Ansaldo-NIRA	- Conventional Plant Design and Selected BOP Equipment

TABLE 1

The cooling water supply system is well advanced with the pumphouse for the first unit close to completion and the others in various stages of construction. The outfall structures are already in place from the second unit to the boundary of the site.

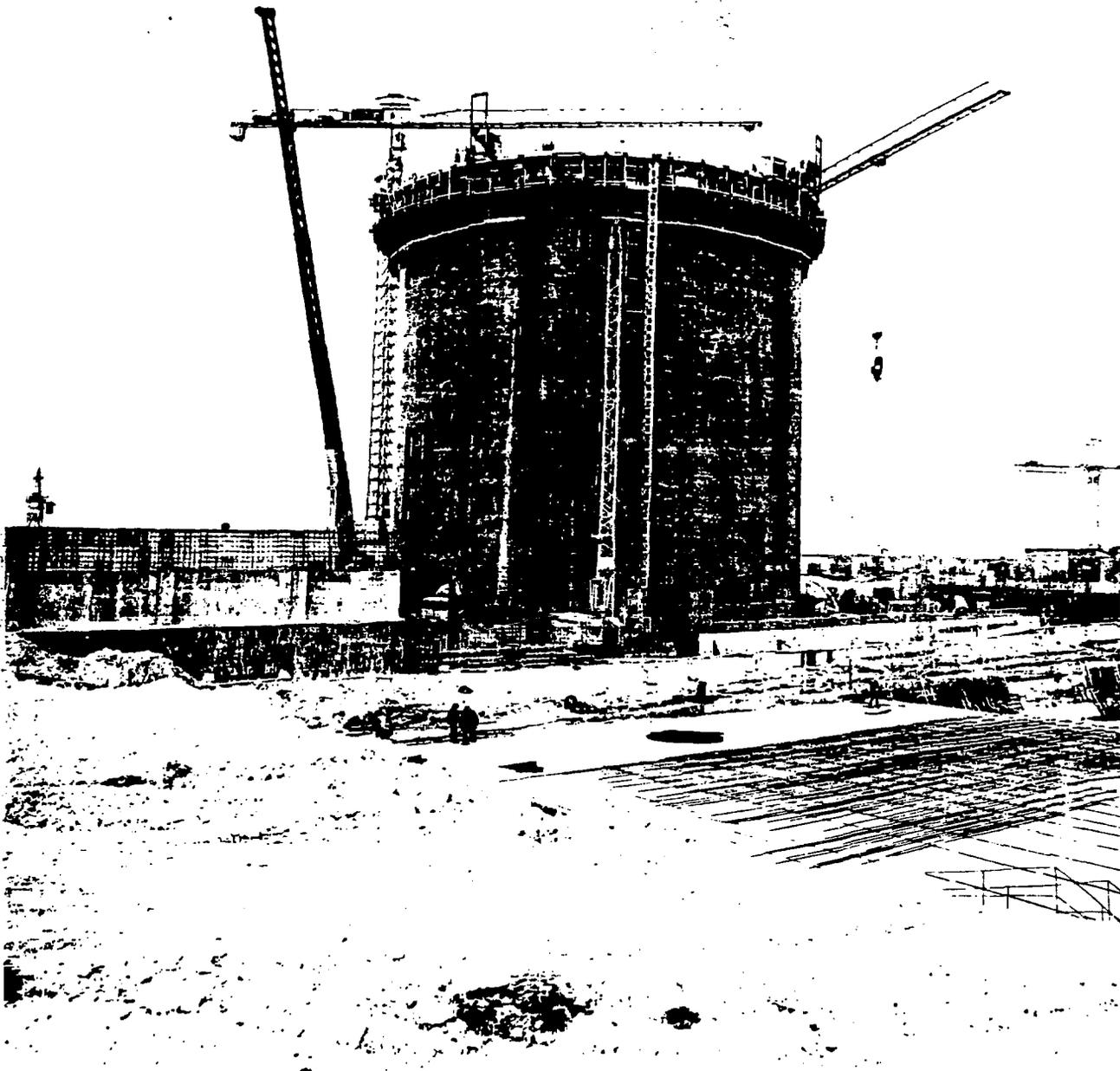
The administration and utilities buildings are complete and finishing work is now in process.

The slipform of reactor building for the first unit was completed in April 1983 and for the second unit in November 1983. The base slab for the 3rd unit was completed earlier this year and excavation has started for Unit 4.

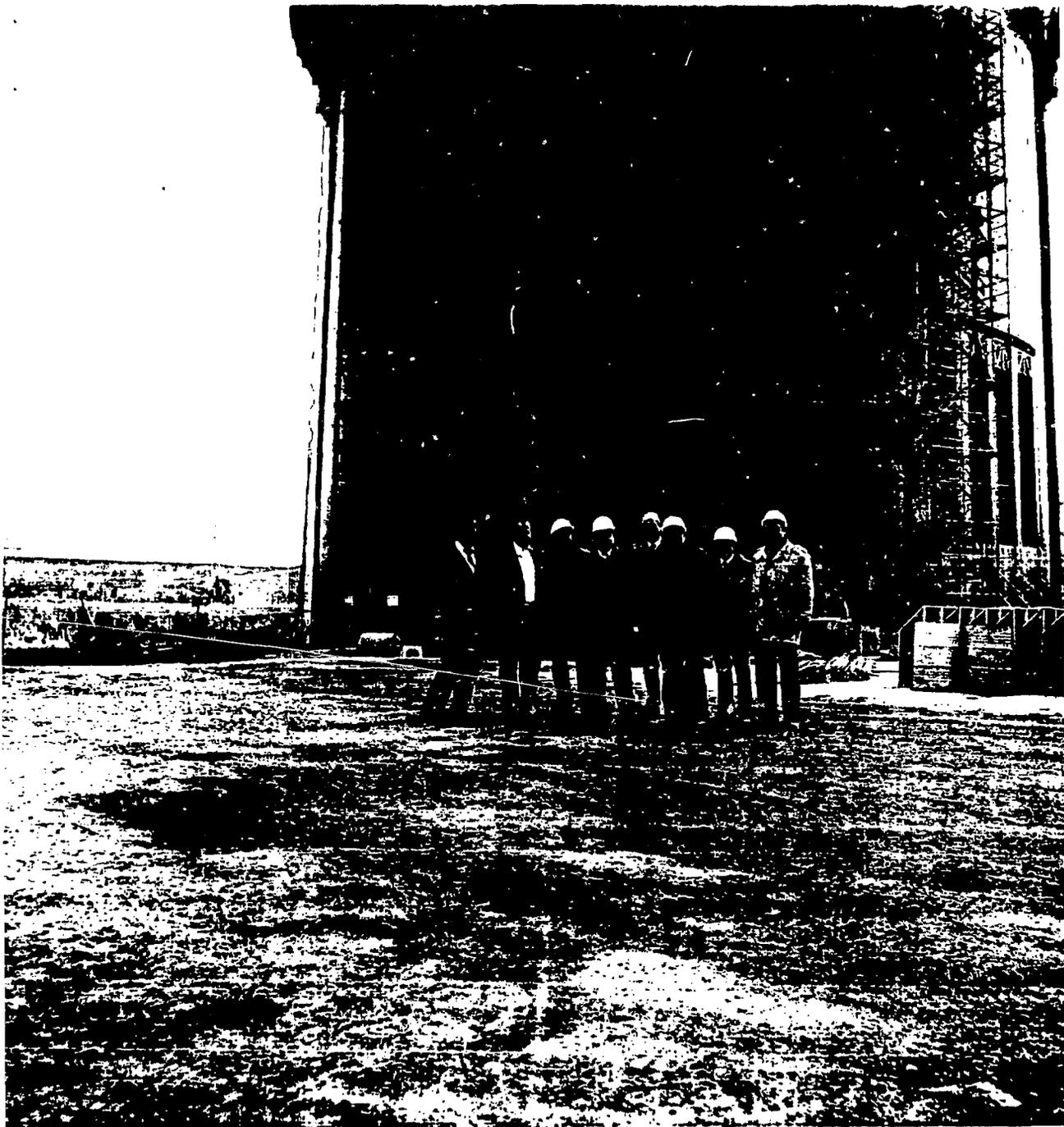
The photographs on pages 9, 10, 11 and 12 were all taken last year.



Minister Mihulecea, President of the State Committee
for Nuclear Energy, inspecting the slipforming of Unit #1
Reactor Building.



COMPLETED REACTOR BUILDING #1



A JOB WELL DONE - MINISTER MIHULECEA AND CONSTRUCTION CREW



CERNAVODA PROJECT

#1 Slipforming operation during
night shift - Apr./83

Canadian suppliers have made many visits to ROMENERGO in Bucharest and have felt thwarted and frustrated through long periods of repeated and exhaustive negotiations regarding schedule, scope, price and counter-trade.

However, to-day,

For many of the major suppliers these days are over,

- With close to 200 million \$ now committed in contracts for the supply of equipment from Canada,
- the Canadian procurement program is now in full swing with many of these initial (or teething?) problems now resolved.

As you saw in the earlier slide, major contracts, have been placed in Canada for the -

Steam Generators
Calandrias
Fuelling Machines
Pumps
Heat Exchangers

and work is now active in the Canadian shops on these and other orders.

A vital part of the project is the ongoing training program of Romanian staff. We have had several training groups in Canada for construction, quality assurance and commissioning, and these people are now very prominent in the work now going on in Romania.

This program is ongoing with a group presently at the Ontario Hydro Bruce Nuclear Station and further groups are expected this Fall.

So for the Cernavoda Project, what are the challenges of today and tomorrow? (Or what have we learned and expect to face in the future)

- The integration of all project activities involving all participants in a way which will ensure that all interfaces are properly detailed and co-ordinated in terms of technical and schedule requirements.
- The development of Romanian industry to satisfy, without compromise, the demands of technical, quality, schedule, and political requirements.
- The adequate communication of information and patient understanding of the other parties' needs and capabilities so that prompt decisions may be made.
- We will face issues that will require careful handling and resolution of contractual conflicts without loss of momentum to the work.

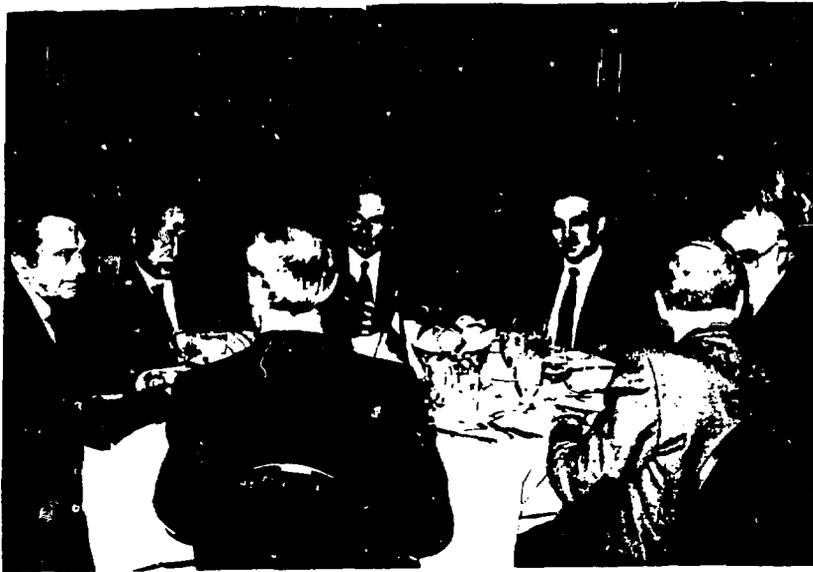
This is a major undertaking and there will be challenges for everyone. As the AECL President Mr. J. Donnelly said recently.

"BUSINESS IS HARD AND TOUGH AND DIFFICULT AND WE BETTER GET ON WITH IT IN THE BEST WAY POSSIBLE".



VISIT OF MINISTER A. NECULA ON MAY 9/84
TO PICKERING, C.G.E. PETERBOROUGH, AND
SHERIDAN PARK.





Dinner honouring visit to Canada of
Minister S. Andrea, Feb.8/84





DINNER & RECEPTION ON AUGUST 11, 1983 FOR
VISITING MINISTER MIHULECEA (SEATED ON THE LEFT)
AND DELEGATION WITH DR. PON AND MR. J. SIMARD,
CANADIAN AMBASSADOR - BUCHAREST, SEATED ON THE
RIGHT.

However, we have seen ample evidence of the eagerness with which the Romanians are tackling the challenge. As an example of this interest, over the last nine months we have had visits to Canada by several Ministers of State.

Minister Stefan Andrei - Minister of Foreign Affairs

Minister Alexandru Rosu - Secretary of State, Minister of Foreign Trade & International Economic Co-operation

Minister Alexandru Necula- Minister of Machine Tools, (MIMUEE) Electrotechnic & Electronics

Minister Cornel Mihulecea- President, State Committee for Nuclear Energy, IRNE

and for many in this room you are well aware of the continuing interest and involvement of the Romanian Ambassador in Ottawa, Mr. Rodean.

We do have a worthy and eager partner in the Candu program and with continued determination and co-operation, Cernavoda will also achieve the high standards of performance set by previous Candu Stations.

Yes the Candu program in Romania is now well established.

The Cernavoda Project is:

- Meeting the expectations of Romania for nuclear power.
- Helping to sustain an active Candu program and bridge the time till new projects are committed.
- Bringing significant work to Canadian industry.
- A further example of international co-operation in the peaceful use of nuclear energy.

Who knows it may even have something to do with the Olympics!

Ladies & Gentlemen, in this short time I hope I have shared with you something of the CANDU experience in Romania.