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OVERSIGHT OF ENERGY DEVELOPMENT
IN SOUTH AMERICA

TO THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-SIXTH CONGRESS
SECOND SESSION
Serial XX



JULY 1980

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LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, D.C., June 1980.

Hon. DON FUQUA,
Chairman, Committee on Science and Technology, U.S. House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: I am forwarding herewith my report on my recent Committee trip entitled "Oversight of Energy Development in South America." The report includes a summary of major findings and recommendations which I summarized in a letter to President Carter on April 23, 1980. Representative press coverage of my visit to Argentina is also included to emphasize the degree to which nuclear issues are at the heart of differences between the United States and Argentina. The background material for each visit appears at the beginning of the sections on Brazil and Argentina. A short section on energy development in Colombia is included although nuclear policy is not such a divisive element between that country and the U.S. because of the relative stage of Colombian nuclear capability.

I hope the Congress will find it useful to have this perspective on energy development and nuclear issues in South America. It is intended that the report complement the previous eight Committee oversight reports which I have submitted on Western Europe, the Eastern bloc countries, the Pacific Basin, China, the Caribbean, South Africa and the Middle East.

Sincerely,

JOHN W. WYDLER,
*Ranking Minority Member,
Committee on Science and Technology.*

(III)

CONTENTS

	Page
Transmittal letter to Chairman Fuqua.....	iii
Letter to President Carter.....	1
Major findings and recommendations.....	3
Argentinian press coverage.....	5
Brazil—Background.....	25
Argentina—Background.....	33
Colombia—Overview.....	51
Appendix:	
A. South American nuclear issues.....	53
B. Energy statements by the ex-President and ex-Minister of Mines (Brazil).....	82
C. The Brazilian nuclear program (international agreements).....	89
D. The Brazilian nuclear policy.....	131
E. Power development (1979-81), Argentina.....	150
F. Statement of Adm. Castro Madero.....	157
G. Listing of radioisotopes produced from RA-3 research reactor (Argentina).....	159
H. United States/Colombia draft nuclear agreement.....	161

THE PRESIDENT,
The White House,
Washington, D.C.

DEAR MR. PRESIDENT: I have just returned from a trip to South America during which I engaged in extensive discussions with Brazilian and Argentinian government officials as well as U.S. Ambassadors and diplomatic staff on the issue of nuclear energy development. The result of these discussions is that *I feel that South America is a microcosm of the failure and counterproductivity of the Administration's nuclear non-proliferation policy.* I am afraid that your policy of denial has not resulted in keeping critical nuclear technology from these nations, but rather simply in losing billions of dollars of business for the U.S. nuclear industry. It seems to me that even a policy deliberately aimed at dissipating our U.S. civilian nuclear capability could not have been more successful than this simplistic policy of denial.

I visited a nuclear fuel cladding fabrication facility near Buenos Aires and there discovered evidence of the ultimate in counterproductive results. The Argentinian plant was filled with machinery from the Soviet Union, stark indication that not only have we lost the ability to influence the nuclear-capable countries of South America, but *we have provided the Soviets an entry into that part of the world for their own technology and related policy influence.*

I have visited fourteen countries of the world to discuss nuclear policy since you first announced your non-proliferation policy in the Spring of 1977. In virtually every country I have found, as I stated in my Report to the Congress, "Oversight of European Nuclear Energy Development," back in June, 1978:

"This country's radical change in policy toward the development of nuclear energy and peaceful export of nuclear technology has raised grave doubts among our friends. We are losing credibility with these nations and losing business in the export of peaceful applications of nuclear energy as well.

"Our reneging on past nuclear commitments not only means that this country's technological capability will be wasted but also leaves open the market to nations who may not share our concerns about the peaceful uses of the atom.

"The fact that the United States is requiring foreign countries to renegotiate the terms of nuclear agreements *has literally put these countries in a mood of 'quiet rage'.* We are destroying our image as good neighbors and raising serious questions in international community about whether we honor the traditional American view of the 'sanctity of contracts'."

In April, 1978 I wrote you on my report from Soviet Russia to point out that the commitment to construction of a fast breeder demonstration plant was critical to the U.S. program. At that time, *I warned that we are on the verge of an "Atomic Sputnik" in terms of our nu-*

clear policy vis-a-vis the Soviets. Just last week the Soviets began operation of their second fast breeder power plant which generates 600 Megawatts of electricity and is a prototype facility. In light of the Soviet's demonstrated progress, I can only repeat these concerns of two years ago about our deliberate withdrawal in nuclear technology.

Unfortunately, these findings have been confirmed time and again in the past three years. I hope that in view of these unfortunate results you will consider a much more flexible approach to non-proliferation based on bilateral agreements that recognize differences between traditionally friendly nations and those who are our enemies or at least are seen as unreliable. I believe that you would have received much more support from nations such as Brazil and Argentina in your recent attempts to apply sanctions to the Soviet Union and Iran if this country had adopted a more realistic and sensible approach to South America.

I hope you will accept these comments in a constructive light, so that this country *can once again be called a "good neighbor" in South America and looked to as a reliable partner around the world.*

Sincerely yours,

JOHN W. WYDLER,
Member of Congress.

MAJOR FINDINGS AND RECOMMENDATIONS

TRIP REPORT—BRAZIL AND ARGENTINA

FINDINGS

What we have done in South America is to offend our "good neighbors" by our inflexible approach of "denial diplomacy." This policy has been counterproductive and, on all counts, it is time for a change.

The application of U.S. human rights policy, our policy on military sales and nuclear non-proliferation policy to Brazil and Argentina is the classic case of political conditions being applied to commercial transactions in an extremely counterproductive manner. The U.S. non-proliferation policy intended to deny technology to these countries has only encouraged their nuclear independence from the United States and succeeded in terminating the U.S. nuclear industry sales to the countries. As a result, the U.S. will have less and less influence on the nuclear policy of both Brazil and Argentina.

The implementation of U.S. non-proliferation policy has had a chilling effect on relations between the U.S. and Brazil. It is, in its negative effect, indeed the "Three Mile Island" of international cooperative programs in nuclear energy and has resulted in real risks of danger around the world that far outweigh the TMI accident itself in terms of its impact on health and safety of the citizens.

The bureaucratic and regulatory red tape that has become a way of life in the U.S. has resulted in significant negative international fallout. Government and business leaders in the South American countries throw up their hands at the complexity of doing business with the U.S., particularly in the nuclear areas where the issue of export licensing has become a major disincentive to dealing with the U.S. because we are no longer viewed as a reliable supplier of technology or nuclear materials for peaceful applications.

There are three major factors that have led to a widening breach between the U.S. and the nuclear-capable countries in South America. The combination of (1) our pullback in sales of military equipment and (2) seemingly inflexible application of human rights policy to many aspects of commercial traffic and finally, (3) our announced intent to deny nuclear materials and technology to these countries even by reneging on existing agreements unless they agree to our non-proliferation terms.

South American nuclear issues are a microcosm of the failures of the Carter Administration's non-proliferation policy. We have only succeeded in alienating two previously very friendly countries and we have failed to control their nuclear development in any way through out unfortunate "policy of denial".

These countries are pursuing the nuclear option without us as a result of our inflexible policy on non-proliferation and our refusal to deal with them in terms of bilateral agreements. They have obtained nuclear technology which we have denied them from free-world countries who are our cosignatories to the international non-proliferation treaty (NPT). As a result, these countries are much less dependent on us and our influence is weakened.

This deterioration of relations in South America is another dis-

sipation of U.S. economic strength and related world influence. Our international nuclear and military technology policies have affected other commercial activities, not simply the nuclear and defense industries, and resulted in losses of billions of dollars of business by the U.S. Our technology power and ability to shape world events has, in fact, "been held hostage to 'moralistic' jingoism". As a result of the bankruptcy of U.S. nuclear-policy, nobody is listening to us. Almost no U.S. diplomat or responsible industry spokesman believes that there have been any positive results from the policy of denial.

Energy officials of the South American governments appear genuinely puzzled at the U.S. actions of the past several years which seem designed to achieve overall loss of U.S. preeminence in nuclear technology.

The Argentians are relying on Russian equipment to fabricate zircalloy cladding for fuel rod elements to be used in civilian nuclear power plants. Thus, the denial policy of the U.S. has not only severely impacted the ability of U.S. industry to sell equipment to the Argentians, but now they are not only relying on friendly nations but the Soviet Union to provide the technology and materials that our policy was designed to prevent.

The only U.S. equipment in the cladding fabrication building was a lift truck and it is not inconceivable that the ultimate result of the Administration policy will even prevent sales of this type of equipment. The U.S. has delayed the issuance of an export license for a Combustion Engineering pressure vessel for a civilian power reactor to the Argentians and our policy appears to clearly imperil a bid by Teledyne to provide 300 tons of purified zirconium for cladding materials. The Teledyne bid is clearly the lowest but our inflexible non-proliferation rules will probably prevent such a contract award. Rockwell has also been asked to stop their work to support non-destructive evaluation (NDE) applications for structural crack detection, nuclear plant compounds, etc. because of the delay in notification from the State Department on the export license for this equipment.

RECOMMENDATIONS

It is time that this country adopted a much more flexible non-proliferation approach to recognize that we must treat each country on a case-by-case basis and approach nuclear development through tailored bilateral agreements.

The relationship between the U.S. and Argentina on nuclear matters has reached the eleventh hour. Unless the U.S. takes positive steps to modify this relationship based on mutual cooperation and a recognition that Argentina wants to remain our friend, we shall lose the trust of this nation and will have ultimately failed to affect its nuclear policy in the future.

It is clear that a serious flaw in the Administration's policy and the principles of the nuclear Non-Proliferation Act is the assumption that prior agreements can be ignored and we can simply force friendly nations to renegotiate such agreements. This country should rather retain its time-honored view that prior agreements must be honored and utilize this principle in seeking to implement a more realistic policy through mutual trust.

ARGENTINIAN PRESS COVERAGE

(The issue of U.S. relations with Brazil and Argentina must be considered in the context of the overall question of South American nuclear issues which is discussed in Appendix A.)

The CODEL Wydler visit to Argentina was covered in great detail by the press upon arrival of the CODEL, through the discussions with the Argentinian nuclear officials, and finally upon departure. The press interviewed Congressman Wydler at the airport upon arrival and departure and all major newspapers covered the visit and discussions. This in-depth press coverage is confirmatory evidence of the extent to which nuclear issues represent the major problem area between the United States and Argentina.

[LA OPINION Viernes 11 de abril de 1980]

INTENTARÁ SUPEBAR DIFERENCIAS

LLEGÓ UNA MISIÓN NUCLEAR DE EE.UU.

Una misión de la Cámara de Representantes de los Estados Unidos, especializada en asuntos nucleares, arribó en la vispera a nuestro país y su representante, John Wydker, anunció el propósito del Congreso estadounidense de "superar las diferencias existentes en materia de transferencia de tecnología nuclear".

Consultado sobre si consideraba que se pueden superar las diferencias con su nación, el visitante expresó que "estamos ansiosos de llegar a un acuerdo favorable para ambos".

Al preguntársele que opinión le mercián las declaraciones espinosas de Frederick Ordway según la cual grupos terroristas podrían eventualmente apoderarse de materiales nucleares sensitivos, Wydler subrayó que "no quiero responder a lo que él expresara. Vine en misión oficial representando al congreso, y lo que el Congreso piensa es seguir trabajando con la Argentina en materia nuclear, llegar a un acuerdo y salvar todas las diferencias posibles. Vengo—dijo—a entrevistarme con el vicealmirante Castro Madero para ver qué es lo que Argentina quiere de mi país y en qué forma podemos trabajar mejor juntos en esta materia para favorecer al mundo entero en este tema candente".

Respondiendo a la pregunta de si creía que Argentina estaba en condiciones de fabricar una bomba atómica, el enviado estadounidense no dudó en responder que sí. "No es difícil hacer una bomba atómica -afirmó-, el problema está en saber si la Argentina quiere o no fabricarla; eso es algo que sólo este país sabe y no lo sé yo".

Finalmente, John Wydler advirtió que estaba totalmente convencido de que "Argentina tiene el conocimiento y la tecnología para fabricar la bomba atómica. Lo que restaría saber es si quiere hacerla o si, por el contrario, tiene intenciones pacíficas y quieren luchar por la paz en el mundo".

Minutos antes de la llegada de Wydker a Ezeiza, los periodistas le consultaron a un funcionario de la embajada de los Estados Unidos de Norteamérica sobre qué repercusión habían tenido en aquel país del norte las otras declaraciones de Ordway sobre la no asistencia nuclear a la Argentina para evitar que ésta fabricara la bomba atómica. El funcionario le restó importancia a la misma y dijo que Ordway —que se encuentra en el país para dictar conferencias— no participa en las conversaciones en el área nuclear y no representa al gobierno del presidente James Carter.

[LA NACION—Viernes 11, abril 1980]

LLEGÓ UNA MISIÓN DEL CONGRESO DE EE.UU.

TIENE POR OBJETIVO SUPERAR DISCREPANCIAS EN MATERIA DE TRANSFERENCIA DE
TECNOLOGIA NUCLEAR. ENTREVISTAS

Llegó ayer una misión de la Cámara de Representantes de los Estados Unidos, que encabeza el presidente del Comité de Ciencia y Tecnología de ese cuerpo, John W. Wydler. El representante republicano por Nueva York señaló a su arribo a Buenos Aires que es propósito del Congreso de los Estados Unidos "superar las diferencias existentes en materia de transferencia de tecnología nuclear" con nuestro país.

La presencia de esta misión no había sido anticipada y sorprendió a los medios oficiales argentinos. A pedido de la embajada de los Estados Unidos, el representante Wydler será recibido hoy por el presidente de la Comisión Nacional de Energía Atómica, vicealmirante Carlos Castro Madero.

SALVAR DIFERENCIAS

(NA).—Un misión de la Cámara de Representantes de los Estados Unidos, especializada en asuntos nucleares, vino ayer a la Argentina y John W. Wydler, anuncio el propósito del Congreso norteamericano de "superar las diferencias existentes en materia de transferencia de tecnología nuclear".

"Yo vengo representando al Congreso de los Estados Unidos que piensa seguir trabajando con la Argentina muy estrechamente en materia nuclear, a través de un acuerdo en el que se salvea todas las diferencias posibles que se puedan presentar", dijo Wydler a los periodistas en Ezeira.

Además de Wydler, que es representante republicano por Nueva York, la misión esta integrada, entre otros miembros, por el doctor John Duggan, asesor de la Comisión de Ciencia y Tecnología de la Cámara de Representantes.

Wydler, que llegó procedente de Río de Janeiro, donde durante dos días mantuvo reuniones por cuestiones también vinculadas a la energía atómica, calificó de "rutina" la gira que realiza por Latinoamérica.

ACUERDO FAVORABLE

Consultado sobre las posibilidades de superar el diferendo en las relaciones de la Argentina y los Estados Unidos en materia nuclear, expuso que "nosotros estamos muy ansiosos por llegar a un acuerdo favorable a ambas partes".

Se comentaron a Wydler declaraciones de Frederick Orway, asesor político del Departamento de Energía del gobierno norteamericano, en el sentido de que grupos terroristas podrían eventualmente apoderarse de materiales nucleares sensitivos y dijo: "Yo no quiero responder por los expresado periodísticamente por ese señor".

Uno de los periodistas pregunto a Wydler si, a su juicio la Argentina estaba en condiciones de fabricar una bomba atómica.

"Pienso que si—repuso—no es difícil haber una bomba atómica. Es, algo que saben hacer los argentinos.

Una misión de la Cámara de Representantes de los Estados Unidos, especializada en asuntos nucleares, arribo ayer a la Argentina y su presidente, John W. Wydler, anuncio el propósito del congreso norteamericano de *superar las diferencias existentes en materia de transferencia de tecnología nuclear*".

Yo vengo representando al Congreso de los Estados Unidos que piensa seguir trabajando con la Argentina muy estrechamente en materia nuclear, a través de un acuerdo en el que se salven todas las diferencias posibles que se puedan presentar", dijo Wydler a los periodistas en Ezeira.

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GIRA DE RUTINA

Wydler, que arribó procedente de Río de Janeiro, donde durante los días mantuvo reuniones por cuestiones también vinculadas a la energía atómica, calificó de "rutina" la gira que realiza por Latinoamérica.

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Se comentó a Wydker declaraciones de Frederick Ordway, asesor político del Departamento de Energía del gobierno norteamericano, según el cual grupos terroristas podrían eventualmente apoderarse de materiales nucleares sensitivos y dijo: "Yo no quiero responder por lo expresado periodísticamente por ese señor".

Uno de los periodistas preguntó a Wydker si a su juicio la Argentina estaba en condiciones de fabricar una bomba atómica.

"Pienso que sí—repuso—no es difícil hacer una bomba atómica. Es algo que saben hacer los argentinos. Estoy convencido completamente que la Argentina tiene el conocimiento y la tecnología suficiente, pero entiendo que ello no ocurrirá, porque las intenciones son pacíficas y hay deseo de luchar por la paz en el mundo".

ORDWAY

La misión de la Cámara de Representantes fue recibida en Ezeiza por varios funcionarios y un vocero de la embajada aclaró que el ingeniero Frederick Ordway, asesor político del Departamento de Energía de los Estados Unidos, "se encuentra en la Argentina para dictar una serie de conferencias sobre energía por su condición de experto en capacidad nuclear".

El vocero dejó aclarado que Ordway "no participa en las negociaciones en materia nuclear de la Argentina y los Estados Unidos". (NA).

[CLARIN—Buenos Aires, Viernes 11 de abril de 1980]

ARRIBÓ OTRA MISIÓN NUCLEAR DE EE.UU.

Una misión de la Cámara de Representantes (disputados) de Estados Unidos, especializada en temas nucleares, arribó ayer a esta capital. Su presidente, John W. Wydler, anunció en el Aeropuerto Internacional de Ezeiza el propósito de los legisladores visitantes de "superar las diferencias existentes en materia de transferencia tecnológica nuclear".

El Congreso de Estados Unidos—acotó—piensa seguir trabajando con la Argentina muy estrechamente en materia nuclear, a través de un acuerdo en el que se salven todas las diferencias que se presenten".

La misión está integrada por el nombrado Wydler, republicano de Nueva York y, entre otros, por John Duggan, asesor de la comisión de Ciencia y Tecnología de la cámara mencionada.

"Nosotros estamos muy ansiosos—dijo también—por llegar a un acuerdo favorable a ambas partes". Rehusó comentar expresiones de otro asesor norteamericano, Frederick Ordway, para quien la tecnología nuclear argentina podría caer en manos de grupos terroristas.

COOPERACIÓN

"Existen grandes posibilidades de cooperación entre la Argentina y la República Federal Alemana en el campo de la utilización pacífica de la energía nuclear", afirmó en la víspera el vocero de la oposición parlamentaria de dicho país. Hizo esas declaraciones en Bonn.

Christian Lenzer, que recientemente visitó Buenos Aires, agregó que el gobierno de Helmut Schmidt debe dejar de lado cuanto pueda parecer discriminatorio para la Argentina en el terreno de la colaboración científica y técnica, así como para otras naciones "en desarrollo".

El portavoz del bloque demócrata cristiano felicitó a su gobierno—del cual es opositor—por decidirse, finalmente, a autorizar el envío a nuestro país de un reactor para uranio "natural".

Sobre las recientes conversaciones argentino-soviéticas en Moscú, Lenzer opinó que "no hay dudas de que Moscú está dispuesto a hacer grandes concesiones a la Argentina, incluso la de enviarle uranio enriquecido".

PENDING LICENSE APPLICATIONS FOR ARGENTINA

License application number: Applicant	Date of application	Date application received	Description of material	End use of material	Status as of June 4, 1980
XCOM0035: Carpenter Technology Corp.---	Aug. 18, 1978	Aug. 28, 1978	600 zircaloy-2 or zircaloy-4 tubes. Value: \$2,500,000.	For installation in the Atucha 2 heavy water reactor. Date of 1st shipment January 1982. (Contract awarded for this facility in fall 1979.)	To State Aug. 30, 1978. Pending receipt of sec. 109b assurance re safeguards peaceful use and no retransfer without prior U.S. consent. Approval would be facilitated by receipt of GOA assurance concerning sec. 128 criterion.
XCOM0103: Teledyne Wah Chang Albany---	Oct. 24, 1978	Nov. 3, 1978	2,513 kg of zircaloy-4 tube shells. Value: \$90,016.	For installation in the Atucha 1 reactor facility.	To State Nov. 7, 1978. Withdrawn by applicant.
XCOM0189: Teledyne Wah Chang Albany--	Feb. 28, 1979	Mar. 6, 1979	6,610 kg of zircaloy-4 tube shells. Value: \$242,388.70.	For installation in the Atucha 1 reactor facility.	To State Mar. 9, 1979. Withdrawn by applicant.
XCOM0293: Rockwell International Corp.---	Aug. 17, 1979	Aug. 17, 1979	1 ultrasonic inservice inspection system which locate flaws in otherwise inaccessible welded areas of reactor pressure vessels and piping. Value: \$1,500,000.	For installation in the Atucha 1 reactor facility.	To State Aug. 23, 1979. Favorable recommendation to NRC May 20, 1980.
XCOM0327: Combustion Engineering-----	Nov. 7, 1979	Nov. 8, 1979	Miscellaneous specially designed or prepared parts and components.	For installation in the Atucha 2 heavy water reactor. Date of 1st shipment January 1984.	To State Nov. 16, 1979. Status same as XCOM035.
XCOM0328: Combustion Engineering-----	Nov. 7, 1979	Nov. 8, 1979	Miscellaneous specially designed or prepared parts and components.	For installation in the Atucha 2 heavy water reactor. Date of 1st shipment May 1983.	To State Nov. 16, 1979. Status same as XCOM035.
XCOM0385: Teledyne Wah Chang Albany---	Mar. 21, 1980	Mar. 26, 1980	237,600 lb of zircaloy tubes. Value: \$4,835,000.	166,320 lb of Zircaloy tubes for installation in Atucha 1. 71,280 lb of zircaloy tubes for installation in Cordoba.	To State Mar. 31, 1980. Pending receipt of 109b assurances.
XSNM01496: Edlow International-----	Apr. 10, 197	Apr. 12, 1979	10.875 kg of U ²³⁵ contained in 12.03 kg of uranium (90.4-percent enrichment).	Fuel for the RA-3 reactor-----	To State Apr. 13, 1979. Pending receipt of GOA assurance concerning sec. 128 criterion.
XSNM01587: Edlow International for Comission Nacional de Energia Atomica.	Sept. 5, 1979	Sept. 7, 1979	10.17 kg of U ²³⁵ contained in 50.125 kg of uranium (19.9 percent enrichment).	Fuel for the RA-6 research reactor-----	To State Sept. 24, 1979. Status same as XSNM01496.

XSNM01588: Edlow International for Comi- Sept. 5, 1979 Sept. 7, 1979 6.384 kg of U²³⁵ contained in 31.446 kg Fuel for the RP-0 research reactor in To State Sept. 20, 1979. Status same as
sion Nacional de Energia Atomica. of uranium (19.9 percent enrichment). Peru. To Argentina for fabrication. XSNM01496 and also pending conclu-
sion of arrangements to permit export
and fabrication of fuel elements in
Argentina and subsequent transfer to
Peru.

XR-134: Combustion Engineering----- Nov. 7, 1979 Nov. 8, 1979 Reactor vessel for the Atucha II reactor -- To be installed in the Atucha II reactor -- To State Nov. 16, 1979. Pending receipt of
GOA assurance concerning sec. 128 cri-
terion and review of additional assur-
ances that may be required for major
new cooperation.

LICENSE ISSUED FOR ARGENTINA

XSNM01586: Edlow International----- Sept. 5, 1979 Sept. 7, 1979 0.73 kg U²³⁵ contained in 3.61 kg Fuel for RA-3 reactor and miniplates for
uranium, as U₃O₈, (19.9 percent) 0.36
kg U²³⁴ contained in 0.802 kg ORR reactor.
uranium, as metal, (45.4 percent) 3.15
kg depleted uranium as U₃O₈.
License issued by NRC staff Feb. 22, 1980,
but shipment temporarily delayed pend-
ing Commissioner review. Staff action
approved by Commission. Shipment
can take place 15 days after DOE pub-
lication of subsequent arrangement
May 20, 1980.

PENDING LICENSE APPLICATIONS FOR BRAZIL

XU08459: Edlow International Co., as agent Apr. 16, 1979 Apr. 19, 1979 40,704 kg of natural uranium contained For the Brazilian Government for storage
for Urangesellschaft GmbH. in 48,000 kg of U₃O₈ (0.711-percent and replacement of exported ores and
rare earths as required by the resource
laws of Brazil.

XSNM00909 (Amendment 2): Westinghouse July 16, 1979 Aug. 24, 1979 Additional 60 kg of U²³⁵ contained in Additional fuel for the Angra I reactor in
Electric. 1,726 kg of uranium (3.45-percent en- the form of 4 spare fuel elements to
be shipped if needed to replace dam-
aged or defective elements.
Reload fuel for the Angra I reactor -----

XSNM01629: Transnuclear, Inc.----- Nov. 30, 1979 Dec. 3, 1979 544,1335 kg of U²³⁵ contained in To State Dec. 10, 1979. Pending GOB as-
surances regarding application of agree-
ment for cooperation, authorized reci-
pient and with respect to sec. 128
criterion.
Commission approved staff licensing. Ap-
plicant told OK to ship May 22, 1980.

XMAT0104: Aldrich Chemical----- Apr. 29, 1980 May 5, 1980 1 kg deuterium contained in 5 kg deu- For research and development purposes
and NMR applications in analytical
chemistry.
For NMR applications in analytical
chemistry.
XMAT0101: Sigma Chemical----- Apr. 30, 1980 May 6, 1980 5 kg deuterium oxide ----- Commission approved staff licensing.
Applicant told OK to ship May 22, 1980.

[LA PRENSA, Sábado 12 de abril de 1980]

LA MISIÓN DE EE.UU. CON CASTRO MADERO

La delegación de legisladores norteamericanos que visita el país se reunió ayer con el presidente de la Comisión Nacional de Energía Atómica (CNEA), vicealmirante Carlos Castro Madero, para analizar aspectos vinculados con la cooperación nuclear.

La misión estadounidense está encabezada por el presidente del Comité de Ciencia y Tecnología de la cámara de representantes, John W. Wydler, e integrada entre otros por el asesor de ese mismo comité John V. Dugan.

Los nombrados concurren al local de la CNEA acompañados por el consejero Clifton G. Metzner, de la embajada estadounidense en esta capital. Del encuentro participaron también altos funcionarios de la CNEA.

Según informó ese organismo, en la oportunidad "se comentaron diversos aspectos relacionados con la cooperación entre ambos países en el campo de los usos pacíficos de la energía nuclear".

Agregóse también que se repasó la situación pasada revista a las dificultades que se presentan en actualidad en las relaciones en ese campo, y se intercambiaron puntos de vista respecto de la mejor forma de encontrarle solución.

EN EZEIZA

Al término de la reunión mencionada, el representante norteamericano efectuó una visita al Centro Atómico Ezeiza, cuyas autoridades le acompañaron en una recorrida por las instalaciones y lo agasajaron con un almuerzo.

LOS TEMAS

Desde 1962, la Argentina y los Estados Unidos mantienen un acuerdo de cooperación nuclear, por el cual aquel país suministra al nuestro diversos materiales, entre ellos uranio enriquecido para la producción de isótopos.

La sanción por el Congreso norteamericano en 1978 del Acta de No Proliferación Nuclear reclama mayores salvaguardias para autorizar la provisión de determinados materiales y tecnología nucleares.

The question of export licensing is one of the major aspects of the nuclear issues between the United States and both Brazil and Argentina. The status of a variety of export licenses, provided by the Department of State, for Brazil and Argentina is contained in the following report. The most revealing aspect of this status report is the fact that many licenses have been pending for months in the State Department so that it is clear that the Nuclear Regulatory Commission is not the sole source of delay in the process of license consideration in the Executive Branch. (See pages 8 and 9).

PREAMBLE

The policy statement of the Brazilian President and former Minister of Mines and Energy, which provided the basis for Brazil's energy planning and policies over the past several years, are included in Appendix B.

The primary energy consumption from 1967-1977 in Brazil, by resource, is shown in Figure 1. The forecast of primary energy consumption from 1978-1987 is shown in Figure 2 by resource category. Both sets of figures are for the intermediate case of 7% annual average increment in gross domestic product (GDP), a quantity which corresponds to our GNP.

FIGURE 1

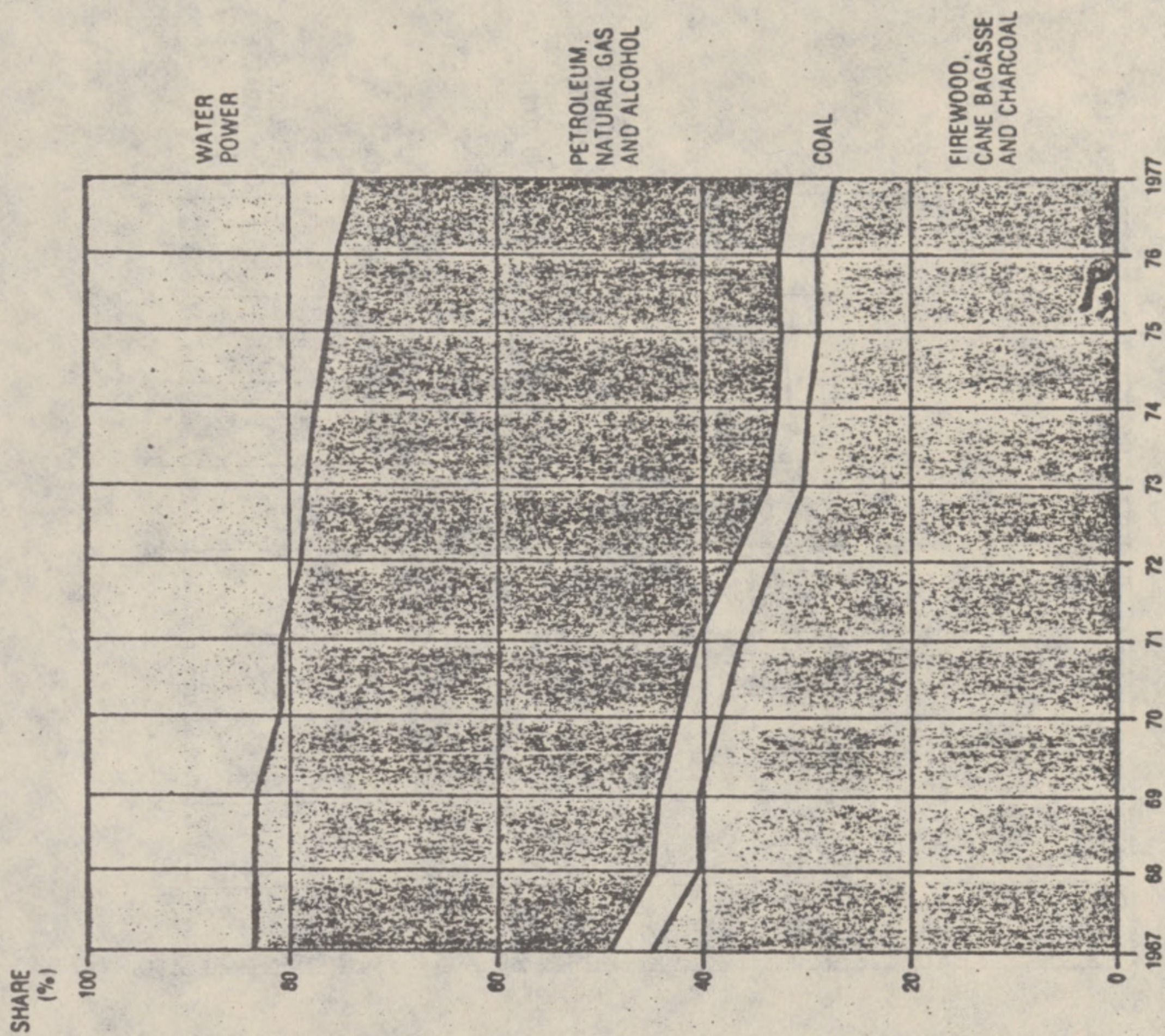
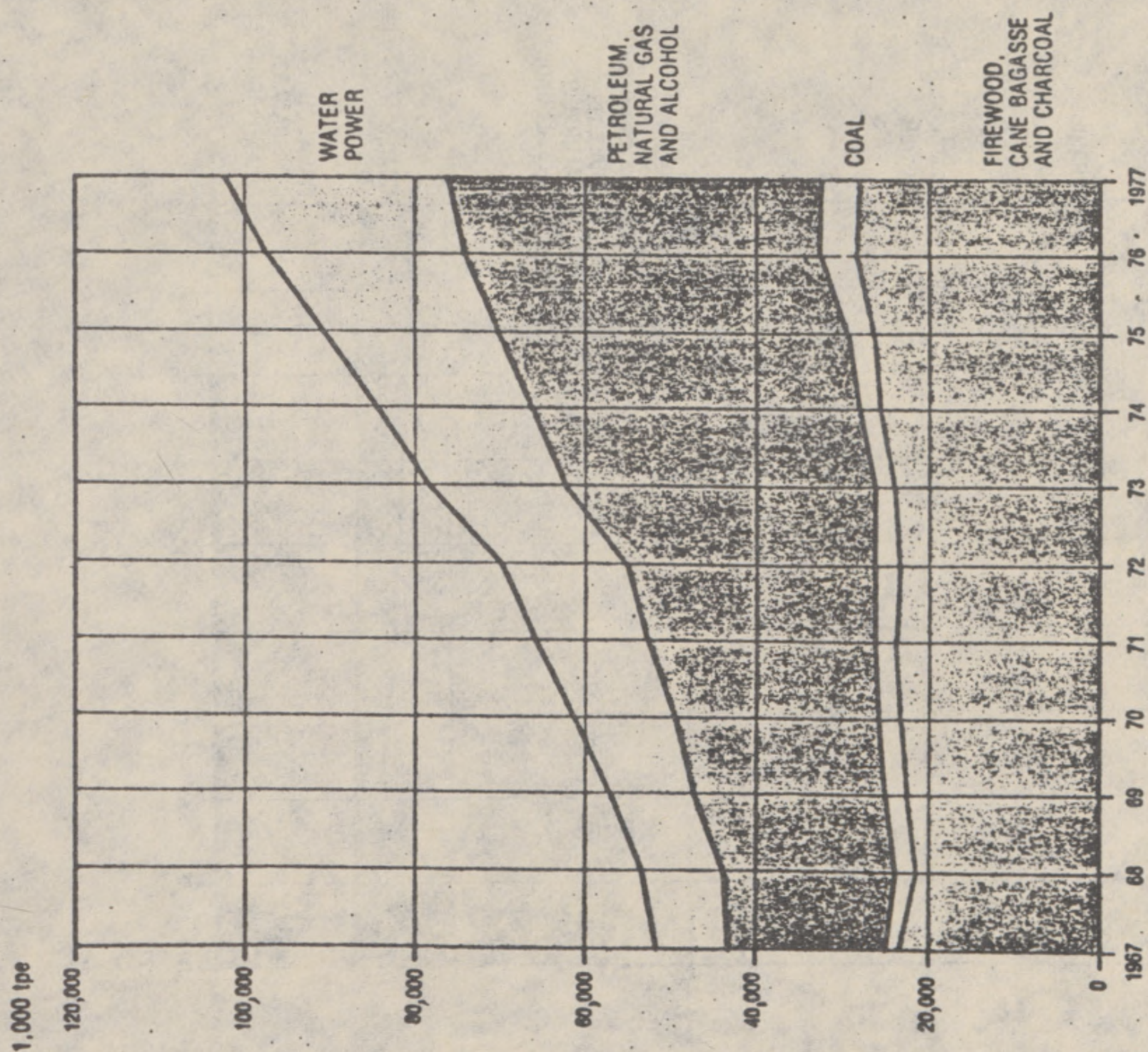
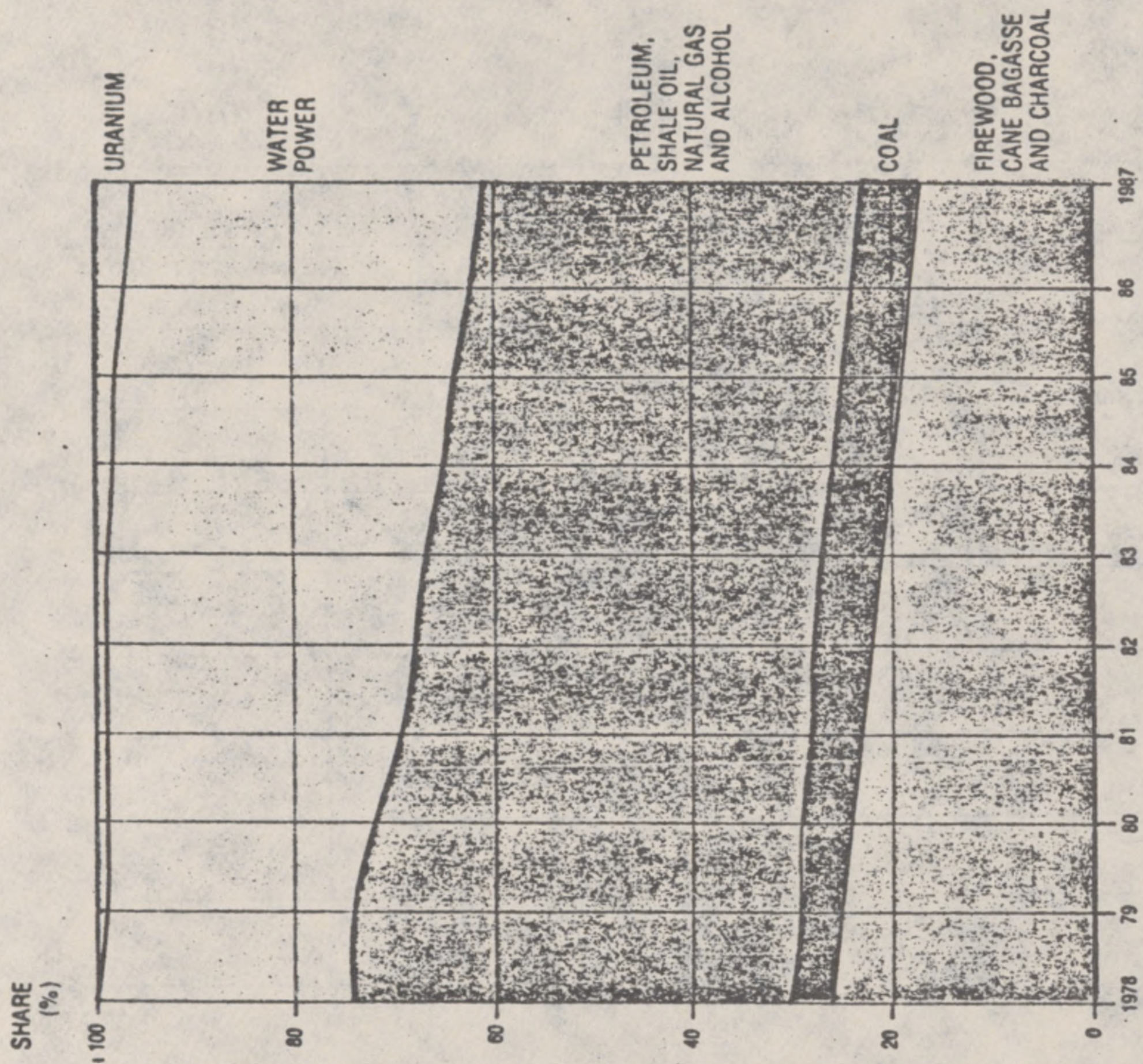
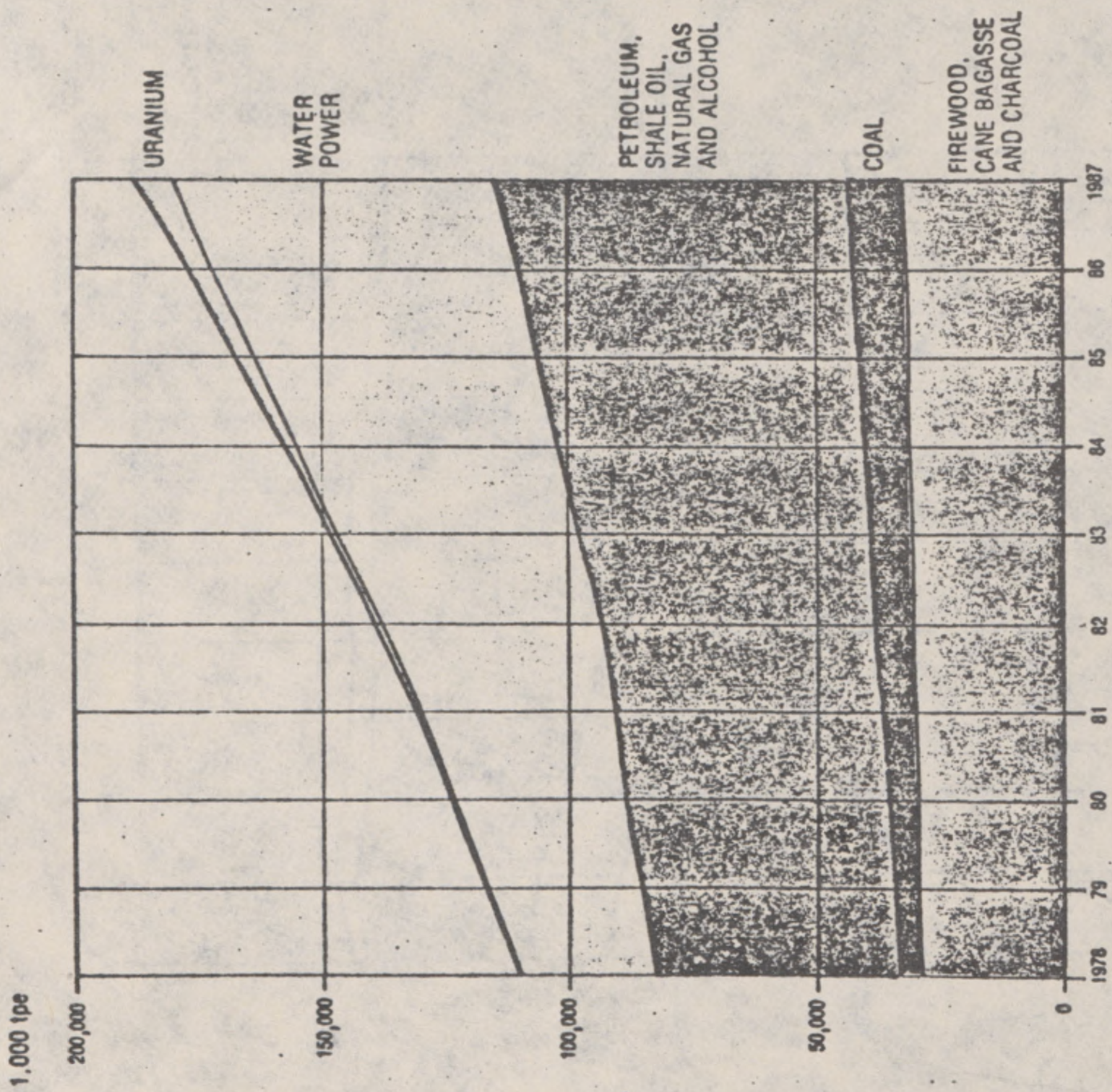


FIGURE 2



PRIMARY ENERGY CONSUMPTION IN TONS OF PETROLEUM EQUIVALENT

Years	Petroleum		Natural gas		Alcohol		Shale oil		Subtotal		Water power		Coal		Firewood		Bagasse		Charcoal		Uranium		Total	
	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent
1967	17,371	33.8	105	0.2	367	0.7			17,843	34.7	8,465	16.5	2,048	4.0	19,291	37.4	2,825	5.5	1,003	1.9			51,475	100
1968	20,279	37.9	93	.2	160	.3			20,532	38.4	8,860	16.6	2,317	4.3	18,048	33.8	2,564	4.8	1,094	2.1			53,415	100
1969	21,993	38.7	96	.2	27	0			22,116	38.9	9,481	16.7	2,342	4.0	18,999	33.4	2,762	4.9	1,191	2.1			56,891	100
1970	23,311	38.1	104	.2	155	.2			23,570	38.5	11,560	18.9	2,391	3.9	18,809	30.8	3,356	5.5	1,484	2.4			61,170	100
1971	26,186	39.9	140	.2	213	.3			26,539	40.4	12,549	19.1	2,431	3.8	18,862	28.8	3,559	5.4	1,655	2.5			65,595	100
1972	28,740	41.0	166	.2	328	.4			29,234	41.6	14,918	21.3	2,491	3.6	17,661	25.2	3,990	5.7	1,822	2.6			70,116	100
1973	34,240	43.9	178	.2	260	.3			34,678	44.4	17,055	21.9	2,493	3.2	17,429	22.4	4,459	5.7	1,897	2.4			78,011	100
1974	36,947	43.8	339	.4	160	.2			37,446	44.4	19,011	22.5	2,469	2.9	18,541	22.0	4,361	5.2	2,536	3.0			84,364	100
1975	39,300	43.5	369	.4	136	.1			39,805	44.0	21,412	23.7	2,850	3.2	19,328	21.4	4,032	4.5	2,897	3.2			90,324	100
1976	42,894	43.3	367	.4	144	.1			43,405	43.8	23,626	23.8	3,435	3.5	21,294	21.5	4,166	4.2	3,154	3.2			99,080	100
1977	43,063	41.7	505	.5	537	.5			44,105	42.7	26,953	26.1	4,106	4.0	20,885	20.2	4,714	4.6	2,489	2.4			103,252	100
1978	46,452	42.4	614	.6	1,461	1.3			48,527	44.3	28,088	25.6	4,830	4.4	20,676	18.8	5,058	4.6	2,554	2.3			109,733	100
1979	49,297	42.5	659	.6	1,967	1.6			51,923	44.7	30,934	26.5	4,793	4.1	20,469	17.5	5,602	4.8	2,655	2.3	137	0.1	116,513	100
1980	50,269	40.6	677	.6	2,479	2.0			53,425	43.2	34,066	27.5	5,736	4.6	20,265	16.4	6,168	5.0	2,939	2.4	1,114	.9	123,713	100
1981	51,180	39.0	736	.6	2,521	1.9			54,437	41.5	39,886	30.3	6,172	4.7	20,062	15.3	6,600	5.0	3,086	2.3	1,114	.8	131,357	100
1982	51,823	37.2	976	.7	2,598	1.9			55,397	39.8	45,059	32.3	7,878	5.6	19,861	14.2	7,013	5.0	3,152	2.3	1,114	.8	139,474	100
1983	54,481	36.8	1,109	.8	3,001	2.0			58,591	39.6	49,410	33.3	8,496	5.7	19,663	13.3	7,534	5.1	3,284	2.2	1,114	.8	148,092	100
1984	56,069	35.6	1,142	.7	3,357	2.1	1,154	0.7	61,722	39.1	53,252	33.9	8,886	5.7	19,466	12.4	8,023	5.1	3,481	2.2	2,412	1.6	157,242	100
1985	58,478	35.0	1,172	.7	3,541	2.1	1,154	.7	64,345	38.5	57,816	34.6	10,004	6.0	19,272	11.6	8,405	5.0	3,600	2.2	3,517	2.1	166,959	100
1986	61,288	34.6	1,218	.7	3,735	2.1	1,732	1.0	67,973	38.4	61,626	34.7	10,647	6.0	19,079	10.8	8,805	5.0	3,600	2.0	5,545	3.1	177,275	100
1987	64,477	34.2	1,268	.7	3,941	2.1	2,310	1.2	71,996	38.2	65,516	34.8	11,244	6.0	18,888	10.0	9,224	4.9	3,600	1.9	7,761	4.2	188,229	100

The Brazilian energy policy as outlined by Cesar Cals, the present Minister of Mines & Energy for the Federal Republic of Brazil, appears in the following section. The prospects for domestic petroleum and energy conservation, and the extent of Brazil's energy reserves are discussed. The details of the planning for electricity generation and use of alcohol in the transportation sector are also considered. Finally, the RD&D programs are outlined and the projection of alternative energy contributions by 1985 are enumerated.

THE BRAZILIAN ENERGY POLICY

I. INTRODUCTION

It was on October 17, 1973 that the large producers of petroleum decided to suspend their shipments of petroleum, and at that time the energy problems passed to the front ranks of concern of the international community, and there it remains until today.

Since then many studies have dealt with the energy problem from the economic viewpoint, placing emphasis on the impact caused by the recent increases in the price of petroleum on the behavior of different national economies, in the creation of incentives for developing alternative forms of energy, and in the formation of international financial agreements. There also exist many reports which attack the energy problem from a technological point of view, analyzing the costs and the benefits of a variety of new technologies which are, or are being, developed to produce, refine, convey, distribute and conserve energy.

However, it will be the political processes operating inside the nations and between these which will determine in large part the point up to which the economic efficiency and the technological possibilities will control the future evolution of the world energy panorama, and also measure other factors such as national security and prestige, which must be taken into consideration.

The time required is necessarily elastic. When making economic analysis, adequate rates of discount are used to reduce all opportunities to their actual values. In terms of technology, that which is ready for commercial demonstration is distinct from the possibilities of development and from the efforts to establish the practicability of new methods. A demonstration can demand three to five years, but the development will perhaps require more than ten.

During the three decades since World War II, the economies of the nations have become more and more interdependent. This economic interdependence was both the cause and the effect of the rapid recovery from the devastation of war and of a long period of desirable economic growth. But, in counterpart, it created an insecurity, since the nations no longer controlled the destination of their own economies. Petroleum played a very important role both in promoting the economic growth and in creating an economic insecurity.

The crisis of 1973/74 represented up until today the most traumatic challenge to economic interdependence of the post-war period. The principal feasible result of this crisis was the explicit vulnerability of the countries substantially dependent upon foreign petroleum, both regarding the continuity of supply of this fuel, as well as the arbitrariness of the prices unilaterally established. The interdependence upon petroleum led the majority of the countries into a profound economic insecurity.

Last March 25th OPEP, besides approving an increase in the prices of petroleum, also took three very significant decisions:

1. It determined that the prices established by OPEP be considered as minimum prices, and authorized the addition of surtaxes as the sovereign right of each member country;
2. It established a control over the supply of petroleum, so as to avoid a greater supply than demand;
3. It forecast quarterly readjustments of the price fixed by OPEP.

As the initial result of these measures, the free petroleum market which held only 1% of the world sales reached 10% in its sales, and the price of a barrel of petroleum reached the figure of US\$ 44.00 last July.

II. THE BRAZILIAN ENERGY SITUATION

Currently, around 45% of the primary energy used in Brazil is derived from petroleum, with foreign dependence of around 85%—23% of solid fuels, 30% of hydraulic use, 0.6% of natural gas and 1.4% of alcohol.

Of our consumption of primary energy of approximately 800 million BEP, our outside dependence is around 40%, with the sectors most affected being transportation and industry.

A permanent emphasis upon efficient and judicious use of energy constitutes the key element of our national energy policy. Today, we must accept the fact that it will be difficult, if not impossible, to eliminate our dependence upon foreign petroleum for some time to come.

At the moment, the search for independence in energy occupies an important place on our agenda.

Three master lines have already been defined :

1. An increase in the supply of domestic petroleum which should be attained through expansion of a program of prospection and development of production by petrobras;

2. Implantation of a program of conservation of energy at all levels;

3. Diversification of internal energy sources, incentivating whenever possible, the use of regional resources such as hydraulic energy, nuclear energy, national coal, pyrobituminous shale, biomass, rays from the sun, etc., avoiding carrying energy as much as possible, which should become more and more expensive.

III. INCREASE IN SUPPLY OF DOMESTIC PETROLEUM

As a result of the expansion efforts of the prospection program, on December 31, 1978 our proven petroleum reserves were calculated at 1,150 billion barrels, against 0,778 billion barrels at the end of 1973. Considering the production of 0,307 billion barrels during the period of 1974/78, the effective increase of our reserves was 0,679 billion barrels. To achieve this, 2,208,825 meters were drilled during the years 1974-1978, and in 1978 alone 527,257 meters were drilled, against 238,130 meters drilled in 1973. For the year 1979 a goal of 731,130 m has been proposed, and up to this time this is being accomplished as scheduled, and for 1980 an objective of 1,000,000 meters is being stipulated.

Adoption of the so-called "risk contracts" represented one of the measures which the Government used for the purpose of increasing the supply of domestic petroleum. For this purpose, nine other exploratory contracts were signed during 1978 with the risk-sharing clause, relating to areas at the mouth of the Amazon River and in the Santos Basin. When added to previous contracts, the total number of such contracts already signed reaches 17, involving 15 companies of international reputation, and containing commitments of investments of US \$212 millions for exploration.

As an added effort, in the third call for international bids in which 32 companies have already been qualified and petrobras has received 15 proposals, regions upon land were opened as well as areas on the continental shelf, near exploratory areas of petrobras.

As a consequence of these efforts, it is expected that from a daily average production of 174,000 barrels of petroleum in 1979, we will reach an average daily production of 500,000 barrels in 1985, as detailed below :

[In thousand barrels per day]

	1979	1980	1981	1982	1983	1984	1985
Fields in operation.....	174	195	200	199	260	249	231
Fields to enter into operation.....		6	14	24	76	121	127
New discoveries.....							142
Total.....	174	201	214	223	336	370	500

IV. CONSERVATION OF ENERGY

The increase in the price of petroluem since October 1973 created at the same time an economic necessity for the industries, as an imperative of national character, because of the impact caused on the commercial balance: the ration-

alization and economy of petroleum derivatives. If, before this, the basic criteria for optimizing a design or industrial equipment was basically its initial investment and production, today the efficiency of energy comes to be the most important consideration.

With the elevation of the petroleum prices, alternatives in processes, new maintenance and instrumental projects, modifications in equipment, and even an analysis of complex installations for purposes of evaluating the energy generated, lost or recoverable at each stage, come to be economically feasible.

Even in 1974, with the increase in the price of petroleum and other products which indirectly rose in price, the costs with importing raw petroleum and derivatives were US\$ 2,812.4 millions, that is, the equivalent of 22.4% of the total Brazilian imports (US\$ 12,530.5 millions), or in other words, equal to 35.3% of the total of our exports of US\$ 7,962 millions.

The real increase in the volume of petroleum imports in 1974, when compared to 1973, was 7.2%, while the increase in costs with these imports was 284.3%.

Such results made it obvious that measures should be taken very urgently to minimize the negative impact of the increase in the price of petroleum upon the Brazilian economy.

As a consequence of initial efforts, in 1978 expenses with imports of raw petroleum and derivatives were US\$ 4,219.6 millions, that is the equivalent of 30.9% of the total Brazilian imports of US\$ 13,639 millions, or equal to 33.4% of the total of our exports of US\$ 12,650 millions.

The effective increase in volume of petroleum imports in the period 1974/78 was 35.6% while the increase in costs for these imports was 52.9%.

Even if the Brazilian energy situation is potentially controllable, it will be attained only at the cost of the efforts and the sacrifices of every Brazilian.

As an initial step for the energetic independence and consequent economic independence, a program of conservation was inaugurated and is in a stage of implantation.

Two means exist for us to face the subject of conservation. One of them is to consume less; the other is to use our energy resources with the greatest efficiency.

Ideally, it would be possible to convince each individual and every industry to contribute voluntarily in a national conservation effort. At the other extremity, economies could be obtained, without doubt, by declaring certain uses of energy as illegal.

One of the factors which can encourage greater action toward conservation of energy is the cost for not conserving energy.

Up to this time the Government has supported a situation in which the prices are adjusted for a large part of fuel consumed at prices very much different from world prices. To attempt to attain simultaneously a conservation of energy and a lowering of prices is inconsistent and a violation of market laws and human nature.

In the area of transports, which is responsible at this time for more than 45 percent of the consumption of petroleum derivatives, permanent measures of rationalization of every means of transport are being adopted in order to insure satisfactory standards of optimization of use of fuels.

Among these measures, those directed toward minimizing waste and unproductive uses by vehicles are being given preference.

Whenever possible, and because of the nature of the loads and the distances to be travelled, integration of transport methods is being attempted so that a maximum yield is established for which the system is capable of providing.

Some of the principal measures adopted in the transport sector are the following:

- limiting the operating hours of gasoline stations from 6 a.m. to 9 p.m. from Monday to Friday; to supply gasoline only for taxis on Saturdays from 6 a.m. to 7 p.m.; and those stations in tourist regions distant from large urban centers open on Sundays from noon until 9 p.m.;

- establishing special taxes on the price of gasoline to guarantee resources for special programs to reduce the volume of imported petroleum.

- discouraging individual transportation of passengers, searching for alternative means of public transportation;

- revising and rescheduling inter-city lines in the metropolitan areas;

- recommending the restriction of delivery and collection of merchandise in urban traffic corridors;

- intensifying speed controls;

- recommending conversion of official federal and state agency fleets from gasoline to alcohol.

In the industrial sector, which is currently responsible for over 30 percent of the consumption of petroleum derivatives, measures are being adopted which will permit a more efficient use of energy from the petroleum derivatives, as well as of other raw materials from petroleum for certain uses such as industrial heating, etc.

Some of the principal measures taken in the industrial area were the following :

a reduction of 10% in the quotas of fuel oil of all consumers and 5% in quotas of fuel oil ;

scheduling, over a period of time, a complete elimination of all quotas of fuel oil for those consumers who can substitute this for other sources of energy (such as has occurred in the cement industry which, up until 1984, will totally substitute the consumption of fuel oil by coal) ;

encouraging the substitution and adaptation of machinery and equipment to use alternative fuels which are not derived from petroleum.

V. BRAZILIAN ENERGY RESERVES

Considering that the rate of annual average growth in consumption of primary energy was 6% in the period 1979/2000, we should have during this period approximately 36 billion BEP ; in December 1978 the Brazilian depletable energy reserves totalled 63.56 billion BEP of which 58.37 billion BEP (91.8%) referred to mineral coal, 2.54 billion BEP (40%) to uranium, 1.50 billion BEP (2.4%) to pyrobituminous shale and 1.15 billion BEP (1.8%) to petroleum.

Such data indicates to us that in order to obtain a goal of harmonic development of our country, we should establish an energy policy which places into action the potentiality of all resources available, including those which up to this time have not been explored. We must necessarily adopt a technological pluralism in the subject of energy which will permit us to answer adequately every specific problem.

VI. DIVERSIFICATION OF NATIONAL SOURCES OF ENERGY

These considerations lead us to initiate a logical effort to define a new model of energy which will lead us eventually to a significant invulnerability in energy.

In relation to hydraulic energy, theoretically our potential could possibly supply our electricity requirements until the beginning of the next century. In the year 2005 we will be consuming 925 TWh/year. corresponding to installation of around 210,000 MW.

The estimated Brazilian hydraulic potential is 209,631 MW when referring to installed capacity, or 104,815 MW when related to actual energy with a load factor of 50%.

It should be mentioned that in terms of average hydrology, our hydroelectric production should be an average 134,000 MW.

In December 1978, the situation by regions of the Brazilian hydroelectric potential and thermal capacity installed in MW was as follows :

North/Central-West Region

In operation—63 (H) and 470 (T) ;

In construction—2,640 (H) ;

In expansion—1,370 (H) ;

Available inventory—21,097 (H) ;

Estimated availability—70,774 (H) ;

Total, 95,994 (H).

Northeast Region

In operation—2,153 (H) and 411 (T) ;

In construction—5,136 (H) ;

In expansion—1,000 (H) ;

Available inventory—5,665 (H) ;

Estimated availability—490 (H) ;

Total, 14,444 (H).

Southeast/Central—West Region

In operation—17,309 (H) and 1,769 (T) ;

In construction—5,124 (H) ;

In expansion—1,340 (H) ;

Available inventory—18,477 (H) ;

Estimated availability—13,397 (H) ;

Total, 55,647 (H).

Southern Region

In operation—2,050 (H) and 1,004 (T) ;
 In construction—9,908 (H) ;
 In expansion—1,503 (H) ;
 Available inventory—16,495 (H) ;
 Estimated availability—13,640 (H) ;
 Total, 43,596 (H).

All Brazil

In operation—21,575 (H) and 3,654 (T) ;
 In construction—22,808 (H) ;
 In expansion—5,213 (H) ;
 Available inventory—61,734 (H) ;
 Estimated availability—98,301 (H) ;
 Total, 209,631 (H).

As can be observed, we need to dominate the technology of transmission over long distances and to interconnect the North/Central-East and Northeast, the Southeast/Central-West and Southern, and in the future, North/Central-West and Southeast/Central West, since a large part of the unused hydric resources are located in the Northern and Central-East Regions, that is, large distances from the consuming centers.

For this, the energy generated in Itaipu will already be carried at extra-high voltages and direct current (DC), and this is the first concrete step toward dominating the technique of conveying large units of electricity from the Amazon Region to the consuming cities in the South and Southeast.

The "Electrical Energy Services Plan to 1995" was prepared using the following general lines :

1. To service an average growth of electricity in the following averages :

	<i>Percent per year</i>
1979 to 1985-----	12.7
1985 to 1990-----	8.2
1990 to 1995-----	7.4

2. To proceed to maximum utilization of hydroelectric resources so as to supply markets with the minimum transmission of energy ;

3. To eliminate by 1985 the consumption of petroleum by-products in the large and medium-sized thermal-electrical plants ;

4. To implement the 9 units planned in the Brazilian Nuclear Program ;

5. To install thermo-electric units using coal in the Southern Region of Brazil and, depending upon the results of research, in the Northern Region ;

6. To use other resources of energy in small size plants (rays from the sun, aeolian, sea-power, wood, lignite and alcohol) ;

7. To assure compliance with chronograms for interconnecting the different systems.

In these efforts, we will proceed from an installed hydro-electric capacity of 21,575 MW in 1978 to 47,682 MW in 1985, and 69,107 MW in 1990 ; our installed thermal capacity will be augmented from 3,654 MW in 1978 to 5,560 MW (of which 626 MW nuclear) in 1985, and 8,370 MW (3,116 MW being nuclear) in 1990.

In the area of nuclear energy, as a consequence of the Brazil-Germany Nuclear Agreement, we will be dominating the process of nuclear fission, using the technology of enriched uranium reactors.

Along with generating electricity, the nuclear program offers us the opportunity of promoting the industrial modernization of the most diverse sectors of operations, including the quality of university education itself, through means of appropriating new and complex end techniques. For this it is necessary that we have compatible dimensions with the involvement of Brazilian industry and with the installation of key procedures, such as the enrichment and reprocessing of fuel.

The absorption of nuclear technology, principally in the fuel cycle, represents the most important object of the Brazilian-Teutonic Nuclear Agreement, for which reason pronuclear should be the element defining the rhythm for the nuclear program implantation.

Transfer of technology will be conducted at the level of each industrial undertaking through :

1. participation of Brazilian technicians in the work now in progress in the German Federal Republic ;

2. arrival of German technicians in Brazil ;
3. complete transfer of all specifications, codes, drawings, computation programs and manuals relating to every design ;
4. availability of licenses and patents in all the technological areas involved.

In order to support nuclebras and its subsidiaries in the fixation of this sophisticated and complex technology, the Institute of Radioactive Research has been reorganized and transformed into the Center of Development of Nuclear Technology, with its principal objectives as :

1. domination of the technology of reactors and nuclear fuels ;
2. support to industrial units and mineral research ;
3. training of technical and scientific personnel for the program ;
4. development of technology of reactors and of the fuel cycle.

The level of our reserves of natural uranium of 193,800 tons in 1978 obliges us to enter into the technology of enrichment of uranium.

Our reserves of natural uranium are valued at around US\$ 19.38 billions ; these same reserves when enriched are worth around US\$ 44.99 billions, since 193,800 tons of uranium of 0.7% offers after enrichment 159,193 tons of uranium of 0.2% (exhausted uranium) and 34,607 tons of uranium of 3% (enriched uranium).

Together with the Brazilian-German Nuclear Agreement, the National Commission for Nuclear Energy and other institutions are continually following-up the international development of advanced technologies, such as that of regenerating reactors and technology of nuclear fusion.

Domestic coal will play an important role in the energetic model through maximum utilization in industrial heating, coal gasification substituting naphtha gases, or in generating electricity (gas turbines), as well as in the production of liquid fuels.

As a part of these efforts, a program has already been approved which plans the use of domestic mineral coal at a level of 170,000 BEP/day in 1985.

This program is based principally on the following technologies of processing and use :

direct burning—maximum conversion of existing boilers of all capacities for direct burning of coal ;

oil-coal mixture—use of an oil/coil mixture in boilers and furnaces where direct burning of coal is demonstrated as being unadvisable ;

atmospheric small-size coal gasificators for applications in driers, furnaces, thermal treatment, in the ceramic industry, fertilizers, steel-making, and substitution of diesel oil for generating electricity ;

large installations of coal gasification for production of gas of average heating power for general industrial and domestic uses ;

employment of combined cycles of gas turbine and steam turbines or boiler, to generate electricity and/or industrial heating ;

addition of coal shavings in blast furnaces ;

transformation of fuel oil gasification in producing synthetic gas and reducer gas, from coal gasification ;

use of coal in furnaces of petroleum refineries ;

production of methanol, ammonia and other petroleum derivatives from synthetic gas obtained from coal.

By sectors, the use planned for the period of 1980/1985 is as follows :

[In thousand BEP per day]

Sector	1980	1981	1982	1983	1984	1985
Gasification.....					11	47
Cemente.....	2	7	14	22	28	34
Steelmaking.....				5	10	15
Generating electricity.....			5	5	13	13
Petrochemicals.....		2	3	6	16	16
Refinery.....				2	4	6
Other industrial sectors.....	2	7	14	18	24	29
Total.....	4	16	36	58	106	170

To reach this planned level of replacement, we will have to pass from a production of 4 million tons of usable coal in 1978 to an output of 25 million tons of coal in 1985.

For the planted forest, production and processing are planned in large scale of vegetable biomasses to generate energy and/or energetic products (ethanol, methanol, vegetable oils, vegetable carbon, firewood, etc.), in order to assure: maintenance and expansion of economic operations competing for energy raw materials and for their basic materials;

joint utilization of factors of production, potentially or currently available, to offer a multiple expansion of economic operations.

Basically, two concepts exist for using the planted forest as a source of energy:

1. utilization of wastes left in the forests, or those generated by industries using wood as raw material;
2. the planted forest to generate energy, either by direct or indirect conversion.

The overall use of the planted forest is deserving special attention in order to obtain vegetable carbon, coke of vegetable origin, alcohol (ethanol and methanol), etc.

The general criteria which will conduct and guide this utilization is as follows:

1. preservation of the natural forest cover, and preparation of a solid infra-structure of production and distribution of wood for energetic purposes;
2. development and spread of modern technologies of transformation of wood into efficient and versatile energetic raw materials.

It is intended to implant projects of this nature principally in regions distant from the carbonaceous reserves—or where transport of mineral coal is not deemed economically or technically advisable—and in this manner substitute the imported energetic raw materials, such as is the case with coke used for making steel.

The utilization of energetic raw materials, arising from planted forests, planned for the period 1980/1985 is as follows:

	1980	1981	1982	1983	1984	1985
1,000 BEP per day.....	12	22	40	55	84	120

In the field of pyrobituminous shale, which normally used in other countries to extract petroleum, we intend to enlarge the program of commercial exploration of shale, as exemplified by our Industrial Plant of São Mateus which should be producing the equivalent of 25,000 barrels of petroleum per day in 1984, and in 1986, when it reaches full capacity, the equivalent of 50,000 barrels of petroleum daily.

The utilization of biomass as energy, with the consequent production of fuel alcohol, vegetable oils and the development of alcohol-chemistry, although not the ultimate solution for our problems, can be the solution for locations distant from the large systems of energy; it can solve a significant portion of the problem, and can be a transitory solution.

In 1974 the consumption of petroleum by-products was around 303 million barrels, distributed as follows:

- Gasoline—14.3 billion liters (29.6%);
- Diesel oil—10.7 billion liters (22.2%);
- Fuel oil—13.9 billion liters (28.8%);
- Other by-products—9.3 billion liters (19.4%).

As a result of the fuel rationalization policy, principally for gasoline, the consumption of petroleum derivatives in 1978 was approximately 392 million barrels, distributed in the following form:

- Gasoline—15.2 billion liters (24.5%), representing an increase of about 6.3% when compared to 1974;
- Diesel oil—16.0 billion liters (25.8%), representing an increase over 1974 of about 49.5%;
- Fuel oil—18.6 billion liters (30.0%), representing an increase of around 33.8% in comparison with 1974;
- Other by-products—12.2 billion liters (19.7%), representing an increase in relation to 1974 of about 31.2%.

Currently, the average structure of petroleum refining is:

- Gasoline—24.9%;
- Diesel oil—27.1%;
- Fuel oil—29.4%;
- Other by-products—18.6%.

The percentage consumption of petroleum by-products in 1978 was:

For non-energetic purposes—8.4% ;

Automobile gasoline—24.5%, with 59% in highway transports and 41% in urban traffic ;

Fuel oil—30.0%, with 6% on waterways, 6% in generating electricity and 88% in industry ;

Diesel oil—25.8%, with 41% in highway transports, 34% in urban traffic, 13% in industries, and 12% for other uses ;

Other purposes of energy—11.3%.

The first concrete step for energy utilization of renewable resources of biomass was the National Alcohol Program. Initiated in 1975, when the proportion of anhydric alcohol mixed with gasoline was, on average, 1.14% (162 million liters of alcohol), in 1978 such proportion had reached 11.08% (1,506 billion liters of alcohol), representing an increase of around 830% when compared with 1975.

As the first phase of the program, an overall mixture of 20 parts of ethanol to 80 parts of gasoline is planned, which has already been reached in the producing regions.

In the second phase, already begun, the commercial supply is planned for hydrated ethylic alcohol at attractive prices, to be used as an automotive fuel substituting gasoline. For this purpose, a program has been already defined and approved by the Federal Government which forecasts the production of ethylic alcohol, ethanol, at a level of 10.7 billion liters in 1985.

For this objective, financial, human and technological resources were allocated at levels which guarantee the complete success of the program. For this volume of 10.7 billion liters of ethanol, it is planned to use sugarcane as priority raw material, since the technique of obtaining alcohol from this basic raw material has already been demonstrated.

The total volume of alcohol should focus upon three sectors : alcohol-chemistry, mixture of gasoline, and exclusive consumption as automobile fuel.

The portion referring to alcohol-chemistry is easily determined by forecasts of consumption by operational industrial projects, being implanted and/or planned, with the following as yearly consumption :

	1980	1981	1982	1983	1984	1985
Alcohol: $\times 10^9$ liters.....	0.3	0.6	0.8	1.0	1.2	1.5

For that section relating to mixing with gasoline, the mixture level can vary up to a maximum of 20 percent. This variation should be followed in order to adjust to annual differences in production of alcohol and total volume of gasoline consumed, so as to accompany the requirements of alcohol for use as automotive fuel and to explore the possible benefits from exportation, both as raw material and as by-products (sugar, alcohol, etc.) offered by the international market.

It should be mentioned that the difference in average national percentage of alcohol mixture with gasoline should be obtained through regionalization of a standard mixture of 20 percent.

In such manner, the volume of alcohol to be allocated for mixture with gasoline has the following upper limits :

	1980	1981	1982	1983	1984	1985
Alcohol: $\times 10^9$ liters.....	3.1	3.2	3.2	3.2	3.2	3.2

Knowing the requirements of these two sectors of alcohol consumption, we can determine the volumes of hydrated ethylic alcohol to be available for use as alternative automotive fuel. These are as follows :

	1980	1981	1982	1983	1984	1985
Alcohol: $\times 10^9$ liters.....	0.4	0.90	1.5	2.5	4.1	6.0

According to present data, the average national consumption of gasoline is around 2,000 liters/vehicle/year. Considering that the engine using alcohol presents a consumption of approximately 20 percent more than its gasoline equivalent, the average national consumption should be at a level of 2,400 liters of alcohol/vehicle/year.

However, this average was reached considering vehicles of low utilization and thereby compensates the high consumption of certain fleets. Evidently, once priorities are adopted for certain fleets (government agencies, state-private companies, public companies, taxi owners, private companies, etc.), the average consumption should be more, at least during the first years. In this manner, it is believed that a realistic average consumption of alcohol would be between 2,400 and 3,600 liters/vehicle/year.

From the volume of alcohol allocated for exclusive use as a replacement for gasoline, the volume available for mixing with gasoline, of the average consumption of alcohol expected resulting from the protocol signed between the Federal Government and the National Association of Manufacturers of Automotive Vehicles (of 250,000 vehicles in 1980, 300,000 vehicles in 1981, and 350,000 vehicles in 1982), from expectations of conversion of vehicles from gasoline to alcohol (80,000 vehicles in 1980, 90,000 vehicles in 1981, 100,000 vehicles annually during 1982/1985), and the rate of scrapping of 1 percent yearly, we can establish the following number of vehicles expected to operate in the period 1980/1985:

	1980	1981	1982	1983	1984	1985
Vehicles (thousands).....	370	717	1, 160	1, 598	2, 032	2, 461

According to response from the users who are driving vehicles using alcohol, whether manufactured or converted, other programs can be created to produce ethanol, not necessarily from sugarcane; this because, although a certain flexibility exist as to the volume of alcohol available in comparison with the number of vehicles expected to enter into such operation, it becomes necessary not only to form strategic stockpiles, but also to diversify the basic raw material and the type of soil, in order to minimize the transport of alcohol and to create alternatives for absorbing possible overages and/or shortages of alcohol from overproduction or poor harvests, or even from variations in international prices of the different basic raw materials.

The implantation of mini hydrated alcohol plants should be encouraged for use in isolated regions or by owners of fleets of vehicles who wish to become self-producers.

The idea today is to offer energetic alternatives for all by-products of petroleum; not only for gasoline but also for diesel oil, fuel oil, GLP, lubricants, kerosene, etc.

For this purpose we are researching the production of ethanol from sources other than sugarcane and manioc; the production of methanol; the production of vegetable oils; and the uses of wood for energy; the uses of energetic feed from residue; alcohol-chemistry, etc.

It has been demonstrated that, at the lowest levels of energetic consumption, relatively small increments reflect improvements in a geometric proportion in the quality of human life. This fact becomes particularly relevant in the rural areas where the renouncement of technological plurism for solving energetic requirements has led, in many cases, to a precariousness and deterioration of the atmosphere. The development and implantation of technologies for using energy from regional alternative sources, such as direct rays from the sun, aeolian energy, energy from the tides, energetic use of small waterfalls, energetic use of biomass—through biodigestion of the residue and of the use of planted forests, etc., avoiding transporting energy as much as possible, which should become more and more expensive—can contribute significantly to the solution of these problems.

With such a purpose, the Federal Government has allocated financial, human and infra-structure resources which will permit us to reach a technological level which will allow energetic utilization of these regional alternative sources.

The direct rays from the sun and its energy, because of solar radiation conditions existing, can be explored practically all over Brazil, and can be used, over a short period, for the following applications:

- Ambiental air heating and conditioning;
- Heating water;
- Refrigerating perishable products;
- Drying agricultural and other products;
- Producing industrial heat of low thermal level;
- Generating electricity.

Aeolian energy, which could best be explored in the Northeast, Southeast and Southern Region should have limited applications, under restricted and specified conditions, in

- Using directly mechanical energy;
- Generating electricity.
- Producing hydrogen and ammonia.

The energy from the tides, because of special topo-geographical conditions, can be economically explored on the North Shores of our seacoast in the areas from Maranhão to Amapá, can furnish electricity for coastal towns, as well as supply larger systems by injecting energy generated into the distribution network.

In this direction, the government is conducting program to determine locations on the North Coast where topo-geographical conditions are suitable for using the energy from the tides. Through contracts signed with specialized firms, a parallel program has been developed for selecting areas, in those locations potentially favorable, on our seacoast which would serve for constructing plants using sea-power, taking into consideration the technical-economic aspects.

In this field of utilization a study of the technical-economic feasibility is in an advanced stage and the preliminary design is being prepared for a sea-power plant to be constructed on the Bacanga River in Maranhão. The energy potential of the area permits the construction of a plant with installed capacity of 15 MW.

The energetic utilization of small waterfalls to generate electricity can attend principally those locations along rivers, where development has been limited because of the high cost of transporting energy. In this item, the Federal Government has authorized the construction of hydroelectric plants by self-producers who would generate electricity for their own use and could, when such is the case, sell the excess to the local utility company; the only obligation would be to use all the hydroelectric potential and not to waste energy.

The use of urban, agricultural and rural wastes, from sewage slime and aquatic plants to produce biogas, to recycle materials, produce activated and adapted carbon, light aggregates and fertilizers, besides contributing toward an ecological control, will be of great importance to energetic regionalization.

Along with these projects, programs of research, development and demonstration (R D & D) in this area will be conducted using the following guide-lines:

- A survey of the potential and a map of each one of the so-called alternative sources of energy;

- Complete analysis of the energetic requirements of each area, including a complete survey of the sociological characteristics and general indications of all limiting conditions which any device or system should answer in order to be feasible. This survey should include all forms of energy;

- Rational energetic utilization of vegetable biomass, so as to reach a balancing point in the curves of food products, energetic benefits and ambient protection;

- Adaptation of conventional machinery and equipment to use alternative fuels (alcohol, vegetable oils, biogas, etc.);

- Development of machinery and equipment to use alternative fuels (alcohol, vegetable oils, domestic coal, biogas, etc.);

- Efforts toward standardization, normalization, production and control of the quality of components and systems to use alternative forms of energy (for instance, sun collectors, aeolian systems, biodigestors, etc.);

- Programs in the inventory area of energy, attempting to develop technology and national techniques in order to make feasible the use of intermittent sources of energy, electric cars and other programs for conserving energy. These programs should focus with priority upon development of special batteries and on the utilization of reversible plants.

Although it is difficult to offer reliable figures because of the inherent nature, for quantifying the energetic participation of the alternative sources of energy for the period 1980/1985, the following goals of level of participation have been established, expressed in barrels equivalent to petroleum per day (BEP/day) :

Source	1980	1981	1982	1983	1984	1985
Direct solar rays and aeolian.....						1,000
Biogas.....				1,000	2,000	4,000
Others.....				2,000	3,000	10,000
Total.....				3,000	5,000	15,000

In this manner, with programs of substitution of petroleum by-products already defined and in operation by the Federal Government, the projection of Brazilian consumption of petroleum and substitutes for the period of 1980/1985 is composed as follows :

[In thousand BEP per day]

Source	1980	1981	1982	1983	1984	1985
Alcohol.....	55	68	79	96	122	155
Coal.....	4	16	36	58	106	170
Vegetable carbon and by-products.....	12	22	40	55	84	120
Shale.....					25	25
Alternative sources.....				3	5	15
Domestic petroleum ¹	195	200	199	260	249	231
Domestic petroleum ²	6	14	24	76	121	127
Domestic petroleum ³						142
Subtotal.....	272	320	378	548	712	985
Imported petroleum.....	892	900	905	804	716	518
Total.....	1,164	1,220	1,283	1,352	1,428	1,503

¹ Estimate of average production from fields in operation.

² Estimate of average production from fields to enter into operation.

³ Estimate of average production from new fields discovered.

VII. CONCLUSION

The universal consciousness that energy is a resource involving the survival of humanity should oblige each country to individually exert its maximum efforts to conserve it. There is no sense in wasting a finite asset, whose depletion is already visible on the horizon.

If in bygone times it was firewood, at this time the resources are fossil. We should prepare ourselves for the transitory phase in which we are living since, with the depletion of our reserves, soon we will have to supply ourselves energetically by using fissionable and fertile materials; in the near future, from nuclear fission; and later, from nuclear fusion, and finally, with the sun's energy as a definite solution of the world's energy problem.

Brazil lives with its current reality and moves forward with large steps into the future. For this, President Joao Baptista Figueiredo has created a National Commission and has placed energy as a top priority of his government. All other sectorial programs are guided toward searching for energetic independence upon imported petroleum.

What we pursue is energetic independence with technological autonomy. In order to attain this, the Government is proceeding with broad debates about the Brazilian energetic model in the various capitals of the States in order to obtain the support of the Nation.

Several important Brazilian nuclear agreements on (1) cooperation with the Federal Republic of Germany, (2) safeguards agreement with FRG and IAEA, (3) the treaty of Tlatelco, and (4) the non-proliferation treaty are all included in Appendix (C).

The basis of the need for the nuclear option in the context of Brazil's overall energy problem is outlined in Appendix D.

BRAZIL—BACKGROUND

The background material for the Brazil visit consisted of the following news articles on topical energy stories and issues in Brazil and in the context of United States/Brazil relations. The discussions in Brazil consisted chiefly of meeting with U.S. Ambassador Sayre and Dr. Cavalho, the father of nuclear energy in Brazil. There is no question that Brazil is a nuclear-capable country, and although not as far advanced in nuclear development as Argentina, it is clear they are serious about their nuclear commitment, particularly for civilian power development. The issue of nuclear export licensing by the United States and the uncertainty it has created for Brazil was paramount in all of the discussions. The Brazil/United States relations are further aggravated by the fact that the Foreign Secretary is clearly not interested in building a stronger nuclear cooperative program with the United States.

The sources of the topical energy stories are the trade publications *Energy Daily* and *Nucleonics Week*.

Brazil's Offshore Output Rises.—Production from Brazil's offshore oil fields reached 1.8 million barrels during July, a 42 percent jump from July 1978, according to Petrobras, the state-owned oil company. Petrobras reported expenditures of \$360 million on offshore operations during the first half of 1979; the company's overall investment totalled \$769 million—a 62.4 percent hike over the first half of 1978. Total Brazilian oil output (including liquefied natural gas) reached 5.3 million barrels during July, 4.7 percent higher than the previous July.

[From the *Energy Daily*]

Brazil Adds To Oil Reserves.—Brazilian oil reserves have increased by 8.9 percent since last December, to an estimated level of 1.14 billion barrels, according to Petrobras, the Brazilian government's oil and gas company. The rise in offshore reserves have been even more rapid, Petrobras said recently—a 24.3 percent hike since December, to a level of 637 million barrels. Some 85 percent of Brazil's offshore reserves are located in the Campos Basin, off the coast of Rio de Janeiro, where active Petrobras exploration has brought a 29 percent rise in reserves since December (to 540 million barrels) and a 338 percent increase December 1976. Petrobras' overall drilling activity in total meters drilled jumped 30 percent during the first seven months of 1979, compared to the same period last year.

[From *Nucleonics Week*]

ANTINUCLEAR FORCES IN BRAZIL GATHERING MOMENTUM; SAFETY NOT THE ISSUE

Forces opposed to Brazil's nuclear power program are rapidly gathering momentum, causing one leading critic to wonder whether the government could be jarred to the point of collapse. However, experienced observers of the Brazilian scene caution that toppling the government is hardly likely, given the nature of government in Brazil—a military dictatorship.

In recent weeks, increasing calls for lectures by nuclear critics Rogerio Cerqueira Leite and Jose Goldenberg are carrying the opposition message to many levels of Brazilian society. Goldenberg believes this will gradually build public doubts about the national nuclear program to the point where "they will vote for the opposition" party in the Brazilian Congress.

Thus, he is beginning to think that the antinuclear people could—in theory, at least—bring down the government which took office only last March 15. The government has 220 seats in the House, Goldenberg said, and the opposition

party has 190. In the Senate the opposition had a majority but the government appointed enough new senators to give itself a majority. "That is not going to last," Goldenberg said.

The main arguments against the Brazilian nuclear power program are that it is too expensive and that it is not needed. A sub-argument is that Brazil's buying control of the nuclear fuel cycle from West Germany is an illusion, and that Brazil will never be able to develop enough expertise to avoid long-term dependence on Germany.

Arguments about nuclear safety, or even about the technology per se, never seem to arise. Nucleonics Week interviews with Cerqueira Leite and Goldenberg in Sao Paulo indicate that they are gathering confidence in their outspoken criticisms of the nuclear power program. During a talk with Goldenberg he had a telephone call from Manaus in the Amazon region inviting him to lecture there on his views on the nuclear program. This, he said, is happening with increasing frequency. Cerqueira Leite reported the same experience; that diverse groups of people are inviting him to expound his arguments against nuclear power in Brazil.

And the government is listening, or appearing to, as part of the avowed policy of the new government to take more heed of public opinion than past governments have. Minister of Mines & Energy Cesar Cals de Oliveira Filho said he has started a series of conferences in which he is "willing to debate with anybody in any sector of society the merits of the program." He will also appear on TV to discuss the energy plan and says that everywhere he goes he is getting the support of the people who listen.

These talks may lead to "adjustments" in the energy program, Cals told Nucleonics Week, to be made by August. The adjustments will be modifications to the energy model that may place more emphasis on production of methanol than hitherto.

Cals is presenting his views to Congress (he is also a senator) and "any member of Congress who wants to argue can have breakfast with me on Wednesdays," he said. Cals suggested to the government that it keep the present congressional investigation of the nuclear program going. Cals wants the debate to be in the open. "We don't want any secrets," he said, adding that anybody can examine the nuclear safety standards and other documents.

The last point is greeted with skepticism by Cerqueira Leite and Goldenberg, who allege that key papers and figures are being covered up by the government. And another nuclear critic said he believes that Cals privately wants to get rid of the nuclear program or at least reduce it "because it is a tremendous pain in the neck" and is only a symbol of Brazilian independence from the U.S.

Goldenberg, president of the Brazilian Association of Scientists, said most of his colleagues believe it makes some sense for Brazil to gain access to nuclear technology and to have a few reactors. "But how to do it is where conflicts with the government start," he added.

He describes the comprehensive agreement with West Germany's Kraftwerk Union and other German companies as a "new colonialist deal"—new, to distinguish it from the "old" colonialist deal with Westinghouse for the turnkey supply of Brazil's first nuclear power unit, Angra-1, now under construction at Angra dos Reis, some 60 miles south of Rio de Janeiro.

Goldenberg and other critics allege that technology transfer is not taking place—and transfer is the whole point of the huge Brazil-Germany nuclear agreement. "It is a great deal for the Germans," he said. He claimed that the agreement stipulates the Brazilian manufacture of nuclear equipment will be maximized but a clause says that if KWU can produce equipment for a price 15% or more lower than the Brazilians can, the order will go to the Germans. "If you knew Brazil, that clause really kills national industry," he said. "Everything costs more in Brazil."

Goldenberg questions the need for the large factory now being completed south of Rio to build heavy components for nuclear steam supply systems, including pressure vessels, steam generators and pressurizers. It will be operated by Nuclep, a subsidiary of Brazilian state enterprise Nuclebras. "All the equipment is German. They are going to do something that the German companies can do very well. Since the [nuclear power] market is becoming tight there is a real question of what is going to happen to this factory. We are probably going to have a very large amount of idle capacity," he said. Goldenberg added that there is already a perfectly capable Brazilian industry that could build the equipment and this is presently going through a crisis of lack of orders.

Another "sticky problem" seen by Goldenberg as the Achilles heel of the Brazilian program is uranium enrichment. The jet nozzle method offered by the Germans and which Brazil plans to put into commercial production will not be shown to be feasible (or otherwise) until 1982 or '85, Goldenberg said. Dependence on Germany will not disappear, he said, "because we don't know whether it will work. I am absolutely flabbergasted at the confidence that the government expressed in this without any fundamental technical knowledge." Physicist Goldenberg has visited the German nozzle enrichment labs and discussed the technology with E. W. Becker, its developer.

Critic Cerqueira Leite believes that nuclear is unnecessary since the 200,000 Mw of hydroelectric capacity potential that he sees in Brazil (based on government figures) will take the country through 2020. Alternative energy sources will be developed by then to take the country well into the 21st century. Cost of the nuclear program has, Cerqueira Leite says, risen from the original estimate of \$10-billion to \$25-billion or more, much more than a hydroelectric program would cost.

Both Goldenberg and Cerqueira Leite emphatically reject the notion put forward by Mines & Energy Minister Cals that Brazil could export nuclear plants as well as enriched uranium after the turn of the century. Cerqueira Leite said the 200,000 tonnes of U308 claimed by the government to be available for production is only a guess made from flying airplanes about the areas. "It is very unlikely that they have any certainty at all," he said. The idea of "exporting technology is quite stupid. They really don't know what it means. Brazil does not have the basis of nuclear technology, the metallurgy and chemistry," he said.—*Roger Smith*

[From Nucleonics Week]

NUCLEBRAS WILL RUN BRAZILIAN PROGRAM AFTER ANGRA-2

Brazil is pushing ahead vigorously with its nuclear power program, undeterred by slowdowns elsewhere in the world or by the Three Mile Island accident. This month the government centered its future program responsibility in Nuclebras, a state-owned company, which will be responsible for plant engineering, project preparation, civil construction and equipment erection.

The job will begin with Angra-3, Angra-1 and -2 being largely under the control of Furnas, the utility on whose system the units are being built some 60 miles south of Rio de Janeiro. Angra-1 is a Westinghouse PWR now nearing completion on a rather cramped site at Itaorna Bay. Angra-2 is a Kraftwerk Union PWR being built alongside unit 1. Angra-3, another KWU unit, was until late this month to have been built next to unit 2 but now could be relocated outside the bay.

During the second half of this year the Brazilian government will select the site for the next pair of units and the utility that will operate them. These units will be from KWU and contracts will be written for them. Beyond that, four more units will be ordered, with increasing Brazilian participation.

Brazil fully intends to go ahead with its ambitious program of nine nuclear units, a nozzle enrichment plant, a factory to manufacture heavy nuclear components, and a reprocessing plant. The whole thing was supposed to cost \$10-billion and be completed by 1990. Now, costs are alleged to have risen to \$20-30-billion (although the government denies it) and the schedule has obviously slipped, possibly by 5-10 years.

But the determination of the new Brazilian government which took office March 15 to continue with the program of its predecessor—to gain from West Germany the full range of nuclear technology, including control of the entire fuel cycle—is quite apparent from wide-ranging Nucleonics Week interviews in Brazil.

The centering of future program responsibility in Nuclebras appeared to cause some confusion. Some sources saw the development as changing nothing; others saw it as a new direction. Furnas, the state utility on whose system the Angra units are being built, appeared to believe that it would be a big hand in design and construction of Angra-3—largely in order to avoid the sort of problems encountered by Metropolitan Edison operating personnel at Three Mile Island. Nuclebras, on the other hand, is sure that although Furnas (and other utilities on whose systems future units will be built) will be involved to some extent in design and construction, its main role will be to take the plants over and operate them.

The decision rests with the Brazilian Minister of Mines & Energy, Cesar Cals de Oliveira Filho. He told Nucleonics Week: "Since we are going to be installing

a series of nuclear power plants it is going to be necessary that they operate with a high load factor, so they should be distributed among more than one utility company." To avoid each company wasting time and resources in trying to absorb nuclear technology, he said, "Nuclebras will be in charge of engineering, project preparation, construction and erection."

Utilities will monitor construction in order to be ready for their main job, operation of the units, Cals said. The Comision Nacional Energia Nuclear (CNEN) will be restricted to licensing, safety evaluation, and operator training, he added.

The recently clarified nuclear plan has these objectives: 1. transfer technology from the Germans; 2. assure the building of nuclear plants; 3. make feasible the fabrication of nuclear components and nuclear fuel; 4. consolidate national capability in design, construction and operation of nuclear plants; and 5. centralize services for design and procurement of equipment.

The Nuclebras subsidiary responsible for design, civil works and erection of nuclear units is Nuclen, which also oversees the transfer of West German nuclear know-how to Brazil. Germans and Brazilians work side-by-side at Nuclen. At present there are 49 German engineers, representing about 28 percent of the technical work force. By 1982 the number of Germans will increase slightly to 52 but the number of Brazilian engineers will rise to about 600, said a Nuclen source.

Reprocessing appears to have been postponed for the time being. Nuclebras is starting to plan it, and a site for the plant will be chosen by the end of this year. But, said one observer, spent fuel from Angra-1 will probably be stored on site until startup of Angra-2 "and then they will look for a place for storing the fuel somewhere offsite or onsite, maybe for years."

CNEN is looking for sites to dispose of low level wastes and newspapers recently carried a story about a site allegedly picked just outside Rio in a poor area. "I don't think this is a firm choice," said the Nuclen source. Another source said the same suburban Rio site could be chosen for the reprocessing plant.

There is much controversy about nuclear program costs. One government official was quoted in the newspapers as saying that Angra-2 will cost \$3,000 per kw but sources at Furnas, Nuclebras and Eletrobras—the big state utility holding company—disagree. The figures usually given are \$1,600 per kw for Angra-1 (1979 dollars) and \$1,800 for Angra-2 and -3. These costs include interest during construction but exclude the first fuel loads. "Future units' costs should fall," said a Furnas executive. "On the other hand there is the policy of manufacturing more and more components locally and this could increase costs."

For comparison, Furnas reckons hydroelectric plants to cost \$1,000 per kw plus transmission—likely to be expensive since most of the remaining hydro potential is in the Amazon basin in the north of the country and most of the load centers are in the south. Adding transmission costs to nuclear brings the Angra-2 and -3 figures to \$1,850 per kw and the comparable hydro plants to \$1,100–1,150 per kw, the Furnas source said.

So why build nuclear plants? This source and other government officials say that the 150,000 Mw or so of firm hydro potential will be used up by 2020 and nuclear must be available by then, with Brazil in full control of the technology. And having a national system consisting of 8–10% nuclear and the rest mainly hydro in 10–15 years would be a good balance, the Furnas source said. Having relatively cheap hydro and relatively expensive nuclear in that mix would add up to a generation system with balanced and acceptable costs, an Eletrobras official said.

The Eletrobras source sees a need for 10,000–12,000 Mw per year by 2000, in addition to the hydro capacity in operation then. About half of this could be taken up by nuclear, he said, meaning that Brazil could have a need for 5–6 nuclear units of 1,000 Mw each year immediately after the turn of the century. This fits exactly with Mines & Energy Minister Cals' vision of a Brazilian nuclear industry in full flight by then, having absorbed German technology and in control of the entire fuel cycle.—*Roger Smith*

[From Nucleonics Week]

BRAZIL INTENDS TO EXPORT NUCLEAR TECHNOLOGY, SAYS ENERGY MINISTER CALS

Brazil could become an exporter of not only enriched uranium but reactor pressure vessels, steam generators and perhaps even complete nuclear steam

supply systems. This is the view of Brazilian Minister of Mines & Energy Cals de Oliveira Filho, given to Nucleonics Week in an interview in Brasilia.

It is all too obvious, Cals said, that the countries with political power these days are those with energy to sell—the oil-exporting countries. Looking to the 21st century, Brazil is determined to be a country with power and world influence.

The way to do this, Cals said, is to export energy. "We want more than just autonomy; self-sufficiency in energy. We want to be exporters of energy," he said. In recent months, Brazil has been finding evidence of ever-greater resources of uranium. These now stand at nearly 200,000 tonnes of U_3O_8 and Cals believes that with West German nozzle enrichment technology which Brazil is importing it can market enriched uranium toward the end of this century.

It is due to start building PWR pressure vessels, steam generators, pressurizers, and other heavy nuclear equipment next September at a plant being built by the Germans south of Rio de Janeiro. The expertise Brazil is gaining in construction of nuclear power units at the Angra dos Reis complex between Rio and Sao Paulo will, Cals said, enable the country to market complete nuclear services and equipment.

Cals believes that nuclear power will actually play a relatively small role in the country's energy future. Brazil has some 200,000 Mw of hydro-electric potential which is expected to last until 2000 or 2010. Nuclear will add an ever-increasing layer on top of this but, Cals believes, the main purpose of nuclear power will be to enable Brazil to develop a greater technological sophistication than it now has and which will enable it to become an economically stable and important country in the 21st century.

By that time the importance of nuclear as an energy source will start to fade, being replaced possibly by fusion or solar power, Cals said. "The nuclear fusion program is the real goal," he added. Other energy sources now being pursued in Brazil are some 25 billion tons of coal not yet touched, oil undeveloped as yet, alcohol (produced from sugar cane), tidal power potential, and solar. In fact, Cals said, "few countries in the world have the diversity of options available as here."—*Roger Smith*

[From Nucleonics Week]

TECHNICAL PROBLEMS IN CONSTRUCTING BRAZIL'S ANGRA-1 AND-2 ARE LARGELY SOLVED

Brazilian sources say, although startup dates for Angra-1, -2 and -3 have slipped considerably from their original schedules. However, one knowledgeable source in Rio de Janeiro claimed that Angra-1 is likely to be delayed further by problems with plant final design.

Angra-1 is a Westinghouse PWR being built as a turn-key job for the Furnas utility at Itaorna Bay some 60 miles south of Rio de Janeiro. The whole 3-unit plant is named the Almirante Alvaro Alberto Nuclear Power Station. Angra-1 was due to start up in March 1977 but now the Westinghouse date for fuel loading is Feb. 15, 1980, and for plant acceptance Sept. 15, 1980. A Westinghouse source maintains that "we just don't see any problem" at Angra-1.

The Rio source believes Angra-1 startup could be delayed until mid-1981 because of difficulties with the balance of plant and that the late 1980 date could only be achieved if everything goes according to plan. The source said that there are many plant systems that are 90% complete but adding the final 10% is proving very difficult. This is largely caused by equipment and technical specifications not matching on site, he alleged. Said the Westinghouse official: "We totally disagree."

The turbine building foundation problem has been cleared up, the source said. This had earlier caused trouble with turbine rotor alignment, due to settlement of the turbine building.

Angra-2 is a Kraftwerk Union PWR being built close alongside Angra-1 but, said the source, there is almost no communication or cooperation between the Americans and the Germans. A Brazilian government official noted that there is a fence separating unit 1 from the other two. Angra-2 had been plagued by foundation problems because although the nuclear island of Angra-1 is on bedrock, Angra-2 is not and many piles are having to be driven down to bedrock. After encountering many more boulders than expected during pile-driving, the piling job is now well in hand and should be completed by mid-1980, said a government source.

Now, however, a new problem has arisen, to do with seismic loading of the piles. One source said that Angra-1 was licensed by the Comision Nacional de

Energia Nuclear (CNEN) along the lines of U.S. NRC regulatory requirements. Angra-2 and -3 foundation designs were licensed in accordance with West German licensing requirements, the source said. Then the Brazilian government decided to re-examine the licensing requirements for the seismic design of the Angra-2 and -3 piles. A Furnas executive said that KWU believes CNEN is being too conservative but Furnas rather agrees with CNEN.

This could mean a two-year delay for the two German units, the Rio source alleged, because of the need to put concrete collars around piles under safety-grade buildings. The Furnas source said the three units' schedule has slipped about two years but thought that delay from reviewing piling design will be minimal. Commercial operation of Angra-1 is due by September 1980 "if we have good success with loading the reactor. September-December is the target." Angra-2 is due to start up by the end of 1985 and unit 3 by the end of '86 or the beginning of '87.

The Three Mile Island accident will probably have an effect on the Angra units similar to that which is expected at U.S. nuclear plants. Furnas and CNEN engineers have been visiting the U.S., seeing NRC and Westinghouse staffers and attending industry meetings. Whatever changes are decided upon by CNEN will be carried out by Furnas, another utility executive said.

"We think there will be more emphasis on training," he said, adding that this, plus additional instrumentation that may be required by CNEN, will not delay Angra-1 very much. Angra-2 and -3 are still in early-enough stages to accommodate changes without delay, he said. Furnas believes NRC will urge more senior reactor operators for nuclear plants in the U.S. Furnas has 25 already and they are being sent to the U.S. for further training.

Furnas will have a reactor operations simulator for the KWU units but not for the Westinghouse Angra-1, and is ready for a call from Cnen for another simulator to be built for Angra-1.

[From Nucleonics Week]

BRAZIL POT BOILS AS GERMAN HOLD ON NUCLEAR TECHNOLOGY IS REVEALED

A report that the Germans control the transfer of technology and decision-making in the Brazil-West Germany fuel-cycle nuclear accord has threatened to become a Brazilian political issue.

The Sao Paulo police vainly tried to prevent the newspaper Gazeta Mercantil from distributing the report of the supposedly secret terms for the formation of Nuclen-Nuclebras Engenharia S.A., technological and engineering joint venture created by the Brazilian government's nuclear power agency Nuclebras and West Germany's Kraftwerk Union. Brazilian authorities said terms of the agreement were secret and involved national security, but the police arrived too late to stop the newspaper trucks.

Gazeta Mercantil reported that the Germans hold effective control of Nuclen through key technological and commercial directors, although KWU holds only 25% of the stock and Nuclebras has 75% (NW, 31 May, 5). The joint venture was formed to carry out the transfer of fuel-cycle technology to the Brazilians as well as the construction of a controversial fuel reprocessing plant, a uranium enrichment plant and eight nuclear power plants. An important Nuclen function is to order equipment from KWU and Brazilian manufacturers.

The newspaper Jornal do Brasil expressed a Brazilian reaction by commenting that since KWU holds control of Nuclen nothing indicates that the transfer of technology may be carried out. The Brazilian technicians are learning to make a finished product without knowing the reasons for doing things, it said. The promise of a transfer of fuel-cycle technology was one of the chief reasons for Brazil to make its deal with the Germans.

Aurelio Chaves, Brazilian Vice-President and chairman of the National Energy Commission, declared that the accord should be thrown into Congress for debate. President Figueiredo, cabinet ministers and military chiefs decided that the accord should be discussed by a private meeting of the congressional committee that has been investigating Brazil's nuclear program.

Revelation of the supposedly secret terms came after visiting German Economics Minister Otto Lambsdorff showed signs of impatience over the delays in getting the reactor construction program under way. Lambsdorff was quoted by the Brazilian press as hinting that Germany might withhold transfer of technology until at least some reactors were completed and operating. He reportedly

said that the transfer of technology and operation of the plants were indivisible and that transfer of technology without any nuclear plants operating did not make economic sense.

Work on Angra-2, the first unit to be started under the German accord, has been suspended while foundation piles are strengthened. The reinforcement was ordered by CNEN (Comision Nacional Energia Nuclear). Meanwhile, Furnas Centrais Eletricas, the state power company which is building the first two units and which will operate them, ordered Nuclen to renegotiate orders for equipment placed with Brazilian manufacturers and postpone deliveries for 16 months. At the same time, engineers are looking for another site for Angra-3, the second unit to be built under the accord. Originally it was to be built near Angra-2, but many underground boulders prevented driving foundation piles. Work originally was scheduled to start on Angra-3 in 1977. Brazilian Foreign Minister Antonio Saraiva Guerreiro repeated assurances that Brazil would complete the accord with West Germany, although with delays. The accord was signed in 1975, and runs to 1990.

Licinio Seabra, president of Furnas Centrais Eletricas, estimates that delays and the need to reinforce the foundation piles will increase the cost of Angra-2 by \$55-million. Total investment in the 1,300-Mw plant is budgeted at \$2.3-billion, with completion in 1983.

Furnas reported that cold hydrostatic tests were completed successfully in the primary circuit of Angra-1 which is being built by Westinghouse. Fueling is scheduled for February or March, with commercial operation to start in 1981 some 3½ years behind schedule.—*Henry Johnston, Rio de Janeiro*

Brazil and Iraq signed a nuclear cooperation agreement that among other things calls for Brazil to supply Iraq with low-enriched uranium as well as equipment and technology for reactor construction. The accord excludes the transfer for the knowhow that Brazil is acquiring from West Germany for uranium enrichment and fuel reprocessing technology and equipment. The agreement also calls for Iraq to adhere to the safeguard provisions of the Brazil-West Germany-IAEA agreement.

Brazil and Iraq declared their adherence to the principle of nuclear weapons nonproliferation, although Brazil is not a signatory of the Nonproliferation Treaty while Iraq is. Both countries proclaimed their right to develop and apply nuclear energy for peaceful purposes. They agreed to inform IAEA of their negotiations for the purpose of applying safeguards.

The agreement is for 10 years, with a provision for extension beyond that. It also could be terminated on six months' notice.

Among the areas for cooperation are: uranium exploration, supply of both unenriched and low-enriched uranium, supply of finished fuel elements, reactor safeguards, supply of equipment and engineering services for reactor construction, exchange visits to research centers and development of scientific experiments.

Brazil has named the chief of staff of its armed forces to be ambassador to Iraq.

About 3,000 Brazilians protested suspected government plans to build a nuclear plant at Vila de Santa Cruz in the state of Espirito Santo. The demonstration, organized by labor and student groups, was sparked by geologic tests made by the state nuclear power agency. Nuclebras, which says only that no site for a projected plant has been chosen.

In a related matter, the government's Superior Energy Council has decided to postpone resuming work on the Angra-2 nuclear unit until plans are in place for strengthening foundation piles, possibly by mid-1980. It was discovered that the piles are not sufficiently resistant to seismic disturbances (NW, 21 June, 12)

ARGENTINA—BACKGROUND

Argentina and the United States had just completed discussions with respect to nuclear safeguards and the following article from the *Washington Post* indicates the result, i.e., the United States was unsuccessful in halting the sale of a West German reactor to the Argentinians. The additional details on the Argentina/Federal Republic of Germany are included in the following trade press stories. The Argentinians made the commitment as early as 1970 or 1971 to pursue the natural uranium/heavy water cycle. They based that decision on the potential uncertainty of availability of enrichment services. The Argentinian officials discussed their problems with the Atomic Energy of Canada in constructing their second plant but indicated that such problems were under control. Although the Germans have pushed for upgraded safeguards in their reactor deal with Argentina, the Argentinians still feel that the Germans are a much more reliable supplier of technology than the United States. They make their business decisions on that basis.

A particularly interesting article on nuclear issues in Argentina appears in Appendix A. "Nuclear Energy in Argentina," by Jorge Antonio Aja Espil, the Argentinian ambassador to the U.S.

As a result of Mr. Wydler's letter to the President, Mr. Espil visited Mr. Wydler in April. As a result of discussions about the Russian equipment at the Argentinian fuel fabrication facility mentioned in the letter to President Carter, the ambassador wrote the following letter to Mr. Wydler:

EMBASSY OF THE ARGENTINE REPUBLIC,
Washington, D.C., May 9, 1980.

HON. JOHN W. WYDLER,
*Member of Congress,
House of Representatives, Washington, D.C.*

DEAR MR. WYDLER: I thank you for having sent to me a copy of your April 22 letter to President Carter with regard to different aspects on the issue of nuclear energy developments in South America.

I am pleased to see that you consider the notion that the United States should make its nonproliferation policy more flexible toward Argentina. That notion does not imply that we are unaware of existing differences but it emphasizes our two countries' long term shared interests.

In one specific paragraph you refer to the evidence of Soviet machinery in Argentina. As I mentioned it to you in our conversation of April 22, I would like to point out that the sensitive technology for our peaceful nuclear program has been provided mainly by West Germany and Canada.

I hope that in the near future you will once again travel to our country. The officials at the National Commission on Nuclear Energy, and Admiral Castro Madero specially, have made eloquent reports on your last visit.

Sincerely yours,

JORGE A. AJA ESPIL, *Ambassador.*

The following excerpts from trade publications provided background on Argentinian issues.

[From the Energy Daily]

ARGENTINA SNUBS CANADA, OPTS TO BUY GERMAN REACTOR

(By Jeff Carruthers, Canadian Editor)

Canada has lost a crucial \$2 billion (Can.) nuclear sale to Argentina because of continued Canadian government vacillation on nuclear safeguards policy.

In an announcement made in Buenos Aires on Monday, the Argentine Nuclear Energy Commission (CNEA) said it rejected a bid from Atomic Energy of Canada Ltd. (AECL) to supply a nuclear reactor and a heavy water production plant as the first step in a four-reactor, 15-year nuclear development program.

Instead, Argentina has selected West Germany's Kraftwerk Union (KWU), subsidiary of the giant Siemens electrical corporation, to supply the South American nation's second commercial-size nuclear power plant.

KWU and Siemens teamed up to build a 320-megawatt pressurized heavy water reactor that went on-line in 1974 at Atucha near Buenos Aires, with technology based on the 60-MWe MZFR pilot reactor operating at Germany's Karlsruhe nuclear research center. KWU plans to scale up its design to roughly 600 MWe, the same size as AECL's standard Candu heavy water reactor. Another European company, Swiss-based Sulzer Brothers Ltd., will supply the heavy water production plant to Argentina. Heavy water is used as moderator and coolant in both the West German and Canadian reactor designs. The fuel for HWRs is natural uranium, which Argentina has in abundance: an estimated 17,800 tonnes of reserves plus some 24,000 tonnes of reasonably assured resources, according to the Nuclear Energy Agency.

Despite the choice of KWU for its first reactor, Argentina turned to Canada to supply its second HWR, the 600 MWe Cordoba plant now under construction in western Argentina. The Cordoba project, which includes an Italian engineering firm, has run into financing problems and is about two years behind schedule, with operation projected in 1981. In the current bidding, AECL had offered to supply both the reactor and the heavy water plant for roughly \$1 billion (Can.)—about \$500 million less than the combined KWU-Sulzer bid. In spite of the obvious economic edge and the fact that Canada is the only country with operating commercial-sized HWRs, Argentina opted for the European package.

AECL officials, who were stunned and livid when they learned of the final decision late Monday, blamed Canada's External Affairs Minister Flora MacDonald for ruining an otherwise sure deal. They cited a recent United Nations speech criticizing Argentina's human rights policy, and related comments by MacDonald suggesting that Canada's nuclear safeguards policy could get together, as the two most critical factors in this commercial setback.

AECL is deeply concerned that the loss of the Argentine deal will cripple Canada's domestic nuclear industry, which was depending on the sale to carry it through a lull. On the other hand, West Germany, whose nuclear industry went public early last month to proclaim impending collapse (it hasn't had an order since 1975), gains an important proving ground for its HWR system and threatens stiff competition on the international HWR market. Future AECL sales in Japan and South Korea, perhaps even in Romania, may be jeopardized by the Argentine decision.

Canada almost surely would have built the rest of Argentina's reactors after Cordoba had it not been for a dramatic turnabout in nuclear safeguards policy in the wake of the Indian nuclear explosion in 1974, accomplished via a Canadian-supplied reactor. Canada has been insisting that Argentina submit to full-scope safeguards if it refuses to sign and ratify the Nuclear Non-Proliferation Treaty. West Germany is expected to require only compliance with the London nuclear suppliers' group guidelines, which fall short of international safeguards on the country's entire nuclear program. Argentina has a bilateral safeguards accord with the International Atomic Energy Agency in Vienna.

KWU also is building nuclear reactors—of the more common pressurized light water variety—plus pilot enrichment and reprocessing plants for Argentina's neighbor and rival Brazil. Neither of the two South American nations has agreed to sign the NPT.

[From the Energy Daily]

KWU AND ARGENTINA PREPARE NUCLEAR DEAL

Germany's Kraftwerk Union (KWU) and the Argentine Nuclear Energy Commission (CNEA) will establish a joint engineering firm to build the South American nation's third heavy water reactor at Atucha north of Buenos Aires. As in a similar deal with Brazil, the German participation is expected to be 25 percent and the Argentinian share 75 percent. Also part of the deal, estimated by KWU to be worth a total of \$1.5 billion (U.S.), is supply of a 250 tonne-per-year heavy water production plant by Sulzer of Winterthur, Switzerland. No mention is made in the accord about transfer of heavy water production technology.

Negotiations are being initiated to determine which firms will supply which components and for which share of the total sum. According to a KWU spokesman, his company will certainly supply the turbines and generators and the nuclear fuel elements of natural uranium. The contract for the reactor pressure vessel could go to one of several European firms; Germany's specialist is Gutehoffnungshuette of Oberhausen. The Argentinians are eager to sign contracts and begin engineering work soon.

The agreement calls for KWU to build four reactors of 700 MWe size up to the turn of the century. Although the first is to be of KWU's previously proved pressure vessel, heavy water cooled and moderated design (Atucha 1, of this design, has been operating for five years with good availability), the agreement provides that the following three may be of the more common pressure-tube variety. This is a design offered by Canada's industry (the Candu reactor) but never built by KWU or any other manufacturer besides the Canadians.

[From the Energy Daily]

Argentina's Hydro Loan—The World Bank recently approved its largest loan ever to a Latin American nation—a \$210 million loan to Argentina for construction of the Yacyreta hydroelectric project. Argentina and Paraguay plan to install 20 generating units with a capacity of 135 megawatts apiece between 1986 and 1990 on the Parana River separating the two countries. The total cost of the project is estimated at \$3.8 billion.

[From the Nucleonics Week]

ARGENTINE PLANNING TO ORDER THIRD NUCLEAR UNIT IN JUNE; AECL OR KWU

Argentina plans to decide in June from whom to order its third nuclear power unit—Atomic Energy of Canada Ltd. or Kraftwerk Union of West Germany. The Comision Nacional de Energia Atomica (Cnea) is currently in the midst of discussions with vendors on technical and management details of bids. Last week and the week before the discussions were with AECL. KWU begins its discussions next week.

A senior Cnea official in Buenos Aires told Nucleonics Week that commercial bids, which the commission has had in hand since April 23, have not been opened but will be reviewed during a 15-day period in June so that Cnea can report its choice of vendor to the President of Argentina in the same month. Cnea had promised to report by June 1 but "it may be necessary to get a delay," said the Cnea source. Another source expects a decision by mid-June.

The already complex bidding arrangements are further complicated by the recent finding of steam generator damage at the AECL Pickering Canada nuclear plant on the Ontario Hydro system (see story, p. 9). This led to examination of the four steam generators at the Cordoba (also called Embalse) nuclear plant designed by AECL for Argentina some 400 miles from Buenos Aires. Damage was found there, and this week teams from AECL and Babcock & Wilcox Canada (maker of the Candu steam generators) were at the site assessing the damage and what is involved in repairing it. The Cnea official said that in a month or two a decision will be taken on repairs and Cnea is now studying the possibility of repairing the steam generators within the reactor containment.

An AECL official said it may be possible to cut the steam drums off the steam generators and lift out the tube bundles for repair, leaving the bulk of the components, including the steam drums, inside the containment. AECL firmly believes that the trouble at Pickering and Cordoba is a B&W Canada liability, not AECL's. The pinching of steam generator tubes—"dinging" is the word used by AECL to distinguish it from "denting" experienced with LWR steam generators—was apparently caused by heat treatment during manufacture. How much the repair job at Cordoba will be is unknown at the moment.

How long the job will take and what delay it will cause to the schedule is also unknown, the AECL executive said, although he estimated it would only be "a very few months." Cordoba is presently scheduled to start up by the end of 1981 or the beginning of '82 "if everything goes okay," said the Cnea man. Another AECL official said the vendor is working toward a criticality date of mid-August 1981, but this was before the steam generator problem.

Argentina announced at the end of last year that after the third unit is ordered there will be three more units purchased, making six in all. Atucha-1 is already operating (it is a Siemens heavy water reactor; Siemens is now the main owner of KWU); the second unit is the Cordoba Candu, now under construction; the third unit will be Atucha-2, whose construction is due to begin in the first quarter of 1981 and startup is planned by 1987; the fourth is due to start up by 1991; the fifth by 1995 and the sixth by 1997. The last three units need not necessarily be ordered from the winner of the Atucha-2 nuclear steam supply system competition, the Cnea official said.

In the bidding for Atucha-2, AECL is going for the NSSS, with either Canatom and General Electric Co. (of Britain) or Nira-AMN (of Italy) providing the balance of plant. KWU is seeking either contracts for the NSSS and balance of plant or, as an alternative offer, for supply of the turbine-generator to mate with a Candu reactor. AECL says it will agree to this arrangement but refuses to provide KWU any data until Cnea has decided what type of reactor to buy, the Cnea official said.

KWU had made four separate offers for Atucha-2 and three later nuclear plants. Offers range from supply and installation of the four reactors and turbine-generators to supply and installation of turbine-generators alone.

Argentina is building a 3 tonne/yr pilot heavy water production plant near Atucha-1 and associated with the Atucha-2 bidding is Cneas call for bids on a 250-tonne/yr heavy water production plant as part of Argentina's intent to gain control over the nuclear fuel cycle. AECL is bidding for the plant in association with either Lummus or Canatom. Canada is talking of an alternative 400-tonne/yr plant in order to guarantee 250 tonne/yr output. Other bids are from Sulzer of Switzerland and Uhde of Germany, the last being only loosely linked with the KWU bidding for the nuclear power plant job.

AECL takes the position that Argentina should buy both Canadian reactor and heavy water production technology because 1. AECL and Canada in general have had much experience of both, especially in scaling up small production plants to large ones; and 2, Canada is committed to heavy water reactor technology whereas Germany is committed to LWR technology.

KWU replies that all components that would be used in Atucha-2, including the pressure vessel, pumps and steam generators, are the same as used in the vendor's LWR's. KWU also says that in spite of possible scale-up problems in construction of a heavy-water production plant, Sulzer and Uhde have demonstrated that their designs are capable of fulfilling heavy water requirements. KWU has the manpower and engineering capability to carry out the Atucha-2 contract, said a KWU official, particularly since the rundown of the Iranian nuclear program.

The Cnea executive, asked about the merits of these vendor arguments, hedged but implied that Canada's experience and commitment would not necessarily win the contest. Another problem which could favor KWU is safeguards. Canada has demanded full-scope safeguards but Germany has not yet said what it wants. Argentina refuses steadfastly to sign the NPT, although it has started the procedure to ratify the Treaty of Tlatelolco, which ensures nonproliferation in Latin America. It has placed much of its nuclear installations under IAEA inspection. Argentina must accept full-scope safeguards first, before it can enter into negotiation for a Canadian contract.

Argentina appears to have postponed consideration of reprocessing for the time being. The Cnea official said that spent fuel storage capacity at Atucha-1, which would have become filled by 1981, is now being expanded to give another 10-12 years' storage. "The question of reprocessing remains open," he said, adding that when the expanded Atucha-1 capacity is filled Argentina could build dry storage, which could presumably take care of spent fuel from Cordoba and Atucha-2.

ROGER SMITH.

[From the Nucleonics Week]

The Argentine reactor order has cast a cold spell on Canadian-West German relations. A Canadian foreign ministry delegation headed by political director Klaus Goldschlag during a two-day visit to Bonn last week voiced criticism about Argentina getting a West German reactor station without full-scope safeguards. Bonn will tie the reactor permit only to international inspections of the reactor station.

While a spokesman for the West German foreign ministry plays down the controversy, emphasizing that the talks were held "in a good atmosphere," Canada seems to consider the Argentine safeguards a major issue. Foreign minister Flora MacDonald has brought up the subject twice already with her West German counterpart Hans-Dietrich Genscher, when meeting with him in September at the United Nations in New York (before the Argentine decision) and in a subsequent letter to him. The matter was also brought up by U.S. special ambassador Gerald Smith during a late October meeting in Bonn.

A West German foreign ministry spokesman concedes that, in repeated consultations in the months preceding the Argentine decision, Ottawa and Bonn had agreed to insist on full-scope safeguards for what was at that time expected to be an Argentine package order comprising both a reactor and a heavy water plant. Bonn claims, however, to have always made it clear to both Canada and Argentina that a sole reactor was something else. Argentina, apparently getting the message, split the package, giving the heavy water plant order to Switzerland and the reactor order to West Germany. What upsets Canada now is that both supplier countries insist on international controls merely for their respective projects, so that Argentina—by paying \$500-million more than the price of a Candu reactor—can close its fuel cycle after all without being subjected to full-scope safeguards.

Bonn defends its policy by two arguments, firstly that it cannot make an exception with Argentina when full-scope safeguards are not a prerequisite for reactor exports to other countries, and secondly that, according to assurances given by IAEA, all nuclear facilities in Argentina are covered by international controls.

[From the Nucleonics Week]

Argentina is 10 years ahead of Brazil in nuclear energy development, says Brazilian nuclear physicist Jose Leite Lopes, considered one of the top nuclear scientists in his native country. He was expelled from Brazil in 1969 by the military government, returned there several months ago, but left again this week to resume university teaching in France, "since in my country there are not proper conditions to develop my activities." He said Argentina "knew how to concentrate the efforts of its scientists and technicians."

[From the Nucleonics Week]

Argentina's Cordoba plant will be delayed about 18 months in completion because of contract disputes with the Canadians and other suppliers over the installation of parts, said Carlos Castro Madero, president of Argentina's CNEA (Comision Nacional de Energia Atomica).

Steam generator damage was found in the four generators at the Cordoba plant several months ago, and Atomic Energy of Canada Ltd. and Babcock & Wilcox Canada (maker of the Candu steam generators) inspected the damage to assess possible repair techniques. At the time, an AECL executive estimated the damage would delay the construction schedule only "a very few months,"

Castro Madero said. The Cordoba plant had been scheduled to start up by the end of 1981 or the beginning of 1982.

Castro Madero also said that local suppliers for the Atucha-1 and Cordoba nuclear power plants quoted supply prices that were sometimes 10 times the prices quoted by foreign firms, and he warned that Argentina's plan to promote its own nuclear industry includes incentives for production by national firms, but also will establish limits that will preclude such large price differences between local and foreign suppliers. Argentina's national nuclear energy plan, which calls for the construction of the country's sixth nuclear reactor by 1997, also stipulates that by the time the sixth reactor is built, Argentine firms should be contributing 80 percent of the work.

[From the Nucleonics Week]

GERMANS DELAY ARGENTINE REACTOR DEAL IN PUSH FOR UPGRADED SAFEGUARDS

(By Geri Smith, Buenos Aires)

West Germany has apparently reversed its position and is seeking a full-scope safeguards agreement with Argentina before permitting Kraftwerk Union to export components for the Atucha-2 unit. German foreign officer Guenther van Well met with top Argentine authorities in Buenos Aires last week to discuss the delay in approving an export license for the reactor, which the German firm was selected to supply after intense competition with Atomic Energy of Canada Ltd.

When the contract was awarded last October, it was generally understood by observers—and apparently also by the Argentine government—that Germany would require a safeguards agreement covering only the Atucha-2 plant, using IAEA standards. But the long delay in granting an export license suggests that once the Germans won the contract, they decided to try for more stringent safeguards, covering the whole Argentine nuclear program.

Pressure to require full safeguards has come not only from the U.S., but also from Canada. AECL lost the Atucha-2 contract to KWU partly because the Canadian government publicly insisted on full safeguards. German officials said that Canada is upset because before the contract was awarded, Canada and Germany had agreed to insist on full-scope safeguards for what at that time was expected to be a package order for both a reactor and a heavy water plant (NW, 29 Nov '79, 5). But Bonn officials claimed they made it clear to both Canada and Argentina that the same requirements would not be made if Argentina ordered only a reactor from Germany. Argentina split the package, ordering the heavy water plant from Switzerland and the reactor from Germany, expecting to close the deals without full-scope safeguards.

Diplomatic and industry sources in Buenos Aires doubt that the apparent push for greater safeguards was prompted merely by U.S. displeasure with the Swiss decision to sell Argentina the heavy water plant without full safeguards. (The contract was signed last Friday in Argentina.) "The West Germans have been debating the issue—and meeting for negotiations with Argentine officials in Bonn—since the contract was awarded," said one source. "This posture is not new—it's been coming for some time now." Van Well's trip to Buenos Aires was described by observers as a "feeling-out exercise" designed to gauge just how far the Argentines will go on the safeguards issue. "The Argentines are in no hurry to sign up for full safeguards," said one source. "Their sovereignty is very important to them, and this could end in a standoff, with postponement of the reactor order."

Argentine Foreign Minister Carlos Washington Pastor met with van Well last Wednesday. Before the meeting Pastor told journalists, "Some time ago, Germany formally promised us it would sell Argentina materials for the nuclear reactor. Argentina has maintained its offer and its conditions, and the only thing we're waiting for is a serious response that they will modify their attitude and return to the initial position and comply with it."

[From the Nucleonics Week]

ARGENTINA AND CANADA AGREE ON CONTRACT REVISION FOR CORDOBA

(By Geri Smith, Buenos Aires)

For the second time in four years, the Argentine government has agreed to come up with more money than called for in the contract it signed with Atomic Energy of Canada Ltd. in 1973 to build the country's second nuclear plant, the 600-Mw Cordoba unit. In an agreement reached late last month in Buenos Aires, Argentina agreed to pay an additional \$30-million to compensate for the greater than anticipated costs of building the much delayed plant, according to AECL officials in Argentina.

This most recent compensation boosts the total purchase price to \$559.1-million—40 percent more than the original purchase price of \$400-million. The first contract adjustment, granted in 1976, called for Argentina to pay \$129.1-million extra to compensate for the 150 percent inflation that had driven up the cost of local subcontracting services and supplies. AECL and Argentina have disagreed for more than a year over whether the 1976 agreement had been properly carried out. In 1976, Canada agreed to accept a \$130-million loss—caused by increased costs of heavy water, uranium and Canadian engineering and fabrication work—and Argentina was to pay \$129.1 million for the extra costs of doing work in Argentina. (This includes local AECL management of the project, local subcontractors and supplies, and any other costs incurred in Argentina.)

Canada's complaint, which local AECL officials say was satisfied by the Feb. 22 agreement, was a breakdown in the complicated payment mechanism set up in 1976 through which Argentina would channel the money to the appropriate subcontractors and local concerns. "There was a growing disparity between the actual costs and what was being paid out," said an AECL source. "The new agreement means we (Argentina and AECL) will correct the mechanisms for payment to make sure that the principle of paying for the real costs is carried out."

The Cordoba plant was originally scheduled to go on line in early 1980, but contract disputes and the discovery last year of damage in the Babcock & Wilcox Canada steam generators have delayed plant startup until July 1982, according to Carlos Castro Madero of the Comision Nacional de Energia Atomica (CNEA). Cost overruns and construction delays on the Cordoba project were a big factor contributing to Canada's failure to win last October's bidding for Argentina's third nuclear power plant, Atucha-2. West Germany's Kraftwerk Union won the Atucha-2 contract largely because of CNEA satisfaction with KWU's performance in construction of Atucha-1, Argentina's first nuclear power plant which went on line in 1974.

Although Argentine officials have expressed frustration and some annoyance over the delays and cost increases at Cordoba, care is being taken to maintain harmonious relations with Canada, one of Argentina's few suppliers of nuclear technology. Argentina's ambassador to Canada, Esteban Takacs, made a trip home to Buenos Aires during the negotiations to confer with the Argentine Foreign Ministry and with Castro Madero of CNEA to "discuss with national authorities the distinct aspects of Argentine-Canadian relations in the area of nuclear cooperation." Knowledgeable nuclear energy sources in Buenos Aires said Takacs conferred with leaders of Canada's Liberal Party before the recent elections, and affirmed that Takacs brought back input on Argentine-Canadian nuclear cooperation from the new Liberal leaders. "The agreement," a source said, "reflects not only the negotiations (carried out for this contract), but also a strong Argentine initiative to maintain good relations with Canada."

Argentina, which has been criticized by the U.S. and other London Club suppliers for its failure to sign the Nuclear Nonproliferation Treaty, is apparently cultivating the best possible relations with its nuclear technology suppliers to ensure that its sources for such technology do not dry up. The Atucha-2 contract is still under negotiation in Bonn and safeguards are the main issue under discussion. Argentina has refused to be bound by full safeguards, and is apparently willing to let Germany take its time negotiating the terms of the agreement, despite possible delays in the country's 15-year nuclear development program.

[A more detailed discussion of Argentinian power development including trends in reserves of oil and gas, as well as gas production prospects and estimates of coal reserves are included in Appendix F. The general Argentinian nuclear plan is outlined in the following materials supplied by the Argentinian Embassy.]

THE ARGENTINE NUCLEAR PLAN AND ITS FUTURE

With the signing of Decree 302 by the Executive branch of government on January 29th last, a fundamental step was taken for establishing a long term nuclear policy for the Argentine Republic. Although it may be true that background history shows that the country's future in this matter is not only the expression of wishes, but a concrete reality, it is only by the signing of this document that a programme for nuclear-electric power has been given tangible form, so overcoming the practice indulged in up to now, of deciding the construction of nuclear power plants, one by one.

This decision provides the adequate framework for the national industry to properly plan for its investments and managerial decisions with a view to becoming immersed in this plan which aims, fundamentally, to achieve national self-sufficiency in a subject vital from the geopolitical point of view.

From a perusal of the Decree (see appendix) the plan of action on nuclear matters stands out clearly practically to the end of the century. But it is worth pausing over the objectives which motivate this plan, which, in their main generalities point to the "increase of scientific, technical and industrial effort in nuclear matters for peaceful ends, by taking advantage of the human and natural resources of the country in this field, so as to contribute to the consolidation of national development".

This, in turn, can be broken down into the following detailed objectives:

1. Development of a continuous programme of research and nuclear achievements for peaceful purposes.
2. Improvement of the position of relative development reached in nuclear matters.
3. To obtain an increase of scientific and technical personnel specialising in the nuclear field, to assure their permanent training and occupation and promote their permanence in the country.
4. Contribution to the national development of science and techniques, through achievements obtained in the nuclear field.
5. Increase of the production of nuclear-electric power, so contributing to the development of the interior of the country and to the saving of hydrocarbons.

To achieve these objectives a series of policies have been put forward, detailed as follows:

1. Give high priority qualification to the development, production, use and control of nuclear power as being of national interest.
2. Encourage increasing application of nuclear technology.
3. Draw up research and development plans in the nuclear field covering short, medium and long terms, assuring continuity in execution and tending to achieve the most suitable reactors for the country in the next generation of nuclear reactors.
4. Further the design and construction of nuclear power houses, with an increasing share for local industry, to cope with the future demand for electric power.
5. Development of a technical-scientific structure, with its own creative capability, which would generate the necessary knowledge to attain a high level in national contribution to nuclear matters.
6. Encourage a growing share of national industry and engineering in nuclear equipment.
7. Make known the medium and long term plans for research and nuclear works, assuring their continuity and the supply of the necessary scientific and technical personnel.
8. Favour national training in design, projects, management, construction, putting into operation, and operation of the installation required by the nuclear plan.
9. Include in the National Power Plan a share of the nuclear-electric power.
10. Opt for the natural uranium technology for the nuclear power plants, taking into account the possible use of other nuclear fuels, in accordance with national interest.

Starting from this framework, the National Atomic Power Board carries out a work plan, which is continually up-dated and which includes six plans: Installation of Nuclear Power Houses; Supplies to Nuclear Power Houses; Radioisotopes and Radiations; Radiological Protection and Safety; Research and Development; and Management, Training and Support.

It is worth while then, to comment briefly on each one of them.

PLAN FOR THE INSTALLATION OF NUCLEAR POWER PLANTS

The objective calls for the "installation and operation of Nuclear Power Plants, with an increasing share of national science, engineering, technology and industry."

Fundamentally, the work plan includes operating the Atucha Nuclear Power Station, which since it has been put into operation has given a highly satisfactory performance (during 1978 it was one of the most efficient nuclear power stations in the world calculated on the percentage of effectual power generated in relation to the maximum power possible). In particular, there is under construction a second basin house to increase the storage capacity of burnt out fuels and to continue substituting national products for imported inputs for this plant.

Furthermore, this plan includes continuing the assembly of the conventional electro-mechanical and nuclear components of the Nuclear Power House at Embalse, the training of personnel detailed for its operation and the encouragement and implementation of the active participation of national firms and the supply of components and in the assembly of systems in the same power house.

As regards the Atucha II Nuclear Power House, in 1979 bids will be invited from such companies as may supply technology in reactors using natural uranium and heavy water, and contracts will be awarded with a view to opening the service in 1987. Also, work is continuing actively to comply with the commitment entered into with the Republic of Peru, for the installation of a Nuclear Research Centre in that country which will be located in the Huarangal area.

SUPPLY PLANS FOR NUCLEAR STATIONS

With the object of "providing nuclear supplies to the nuclear stations, with the maximum share of national science, engineering, technology and industry, and tending to achieve complete self-sufficiency in nuclear matters", the plan for its implementation is probably the most far reaching, owing to the amount of sectors which are involved.

It includes, for example, all the work in connection with the exploration and search for nuclear minerals, especially aerial prospecting over an area of 100,000 km² in Patagonia (provinces of Chubut and Santa Cruz), geological and geophysical surveys in Chubut, detailed exploration of new deposits in Salta and Jujuy, prospecting in areas of interest in the Cordoba Hills, investigation of the uranium bearing potential in the Conlara Valley (San Luis), enquiry into the beds at Sierra Pintada (San Rafael, province of Mendoza) and prospecting in the area of Los Chihuidos (Neuquen).

As for the production of uranium concentrate, the work is so disposed so as to get the best production in the mining-manufacturing complexes at Tonco (Salta), Pichiñá (Chubut) and Malargüe (Mendoza), as also to intensify the work at the Sierra Pintada field, this being the most important as far as known reserves are concerned, and where there will be a large productive complex. In the Cordoba Manufacturing Complex, located in the provincial capital, they are doing their best with the processes for obtaining uranium dioxide for synthesis, of nuclear purity.

On the other hand, the manufacture of combustible nuclear elements of the Atucha type includes within this plan, various undertakings at a pilot plant level, in order to acquire in the country the manufacturing technology, which will make it possible to operate an industrial factory whose construction is well advanced at the Ezeiza Atomic Station. Adjoining it there is a Special Alloys Factory under construction, which, with the technology being developed also at pilot plant level at the CNEA, will be able to produce the zircalloy sheaths used for containing the uranium tablets within the combustible elements. This plan also includes the pilot plant for zirconium sponge which functions at the Bariloche Atomic Centre, the expansion of which is under study to obtain a production of 10 tons per year.

The vast requirements of the nuclear industry, in their turn, demand a highly efficient infrastructure for the study of the behavior of combustible elements, both before and after their insertion into the reactors. In this case the plan includes the installation of a Laboratory for Testing Fuels and Irradiated Materials, a High Pressure Thermohydraulic Circuit for the Examination and Testing of Combustible Elements, and another Low Pressure one to test and verify them before entering the reactor.

This plan also covers the production of heavy water for which a pilot plant has been constructed and is being installed near the Atucha Nuclear Station, and the operation of a laboratory to undertake experiments with hydro-sulfuric acids.

RADIOISOTOPES AND RADIATIONS PLAN

The object of this plan is to "produce radioisotopes and radiation sources required on the market and to promote their application".

In general lines, this means the manufacture of radioisotopes and radioactive compounds so as to cover more than 90 percent of the national demand (a small proportion is imported for technical-economical reasons) and increase the export; to continue operating the Semi-industrial Radiation Plant at the Ezeiza Atomic Station, extending its uses in the radiosterilisation services required by the national market; to encourage the installation of plants of that type by private enterprise; to operate cells and other installations for the handling and splitting of radioisotopes and radioactive materials; to produce sealed, high activity sources in order to provide reference services in dosimetry and meteorology of ionising radiations for the Latin American area; and in general, develop new applications for the radioisotopes and sources of irradiation in medicine, industry, science, farming, feeding, etc.

PLAN FOR RADIOLOGICAL PROTECTION AND NUCLEAR SAFETY

This plan is directed to "assure the protection of the country's population and the environment from any possible harmful effects of nuclear origin".

This implies carrying out standard procedures on control, vigilance, inspection and authorisation of all activities involving the use of radioactive material of nuclear origin and of the ionising radiations, with the exception of X rays; to carry out preoperational studies and evaluation (for the Nuclear Station at Embalse); the nuclear reactor to be installed at the Bariloche Atomic Centre; the Nuclear Research Centre in Perú; the Atucha II Nuclear Station, etc., and operate the treatment plants for radioactive waste.

RESEARCH AND DEVELOPMENT PLAN

The objective is directed at strengthening a technical-scientific infrastructure with its own talent for achievement which generates the necessary knowledge to attain self-sufficiency in nuclear matters.

To this end, many activities are under way in basic and applied research, and technological developments in the fields of biology, physics, chemistry, engineering, etc., adequately selected to sustain the plans mentioned above and the future requirements of the country in this line.

One of the most ambitious projects in this plan, now under execution, is the construction, installation, start-up operation of an electrostatic accelerator for 20 MVe, which will operate in the extension of the Constituyentes Atomic Station, as recently agreed with INTI (National Institute of Industrial Technology).

There are also developments in the manufacture of low enrichment combustion elements for irradiation and investigation reactors and for manufacturing combustible element for type CANDU power reactors. Other jobs refer to the installation of a research laboratory on nuclear fusion; the installation and operation of prototypes of solar tanks for industrial use; research into the possibility of obtaining electric power from the sun for general consumption, and carry on work on the conclusion of a medium power reactor suitable to the requirements and future evolution of the Board.

MANAGEMENT, TRAINING AND SUPPORT PLAN

This plan has for objectives the "direction of the activities of the National Atomic Power Board (CNEA), the training of personnel and the provision of the necessary infrastructure".

As regards organisation and planning, work is under way for the implementation of a system of accounting based on the principles in common usage in industrial and commercial companies; on the outlining of nuclear plans which will succeed the present ones; to procure a legal framework adequate to the future working of the institution and the nuclear industry within the country and, especially, to achieve the constitution of an Argentine State Nuclear Company which will be responsible for the construction and operation of the Nuclear stations.

The work on training (one of the most deep rooted activities of the CNEA) includes the implementation of a plan for obtaining the necessary human resources to fill the Nuclear Plan and to continue with the many training courses (at the Balseiro Institute; at the Atucha Nuclear Station Training Centre and at other Board dependencies and institutions within the country and abroad).

In the matter of infrastructure backing it is hoped to make some headway on the Computer Centre and its distant operational terminals; to improve the system of communications between dependencies of CNEA and to increase the physical infrastructure of the Atomic Stations.

This plan is also responsible for the implementation of agreements on international cooperation, both at bilateral level with other nations in Latin America and in the whole world, as also at multilateral level with international organisations like the OIEA (International Organisation for Atomic Power), CIEN (Interamerican Committee for Atomic Power), etc.

CONCLUSIONS

As can be seen, the Nuclear Plan set in motion by Decree No. 302/79 which covers the construction, starting up and operation of four nuclear stations for an output of 600 MW, using natural uranium moderated by heavy water, and which will be put into operation in 1987, 1991, 1994/5 and 1997, together with their complementary installations, has the Atomic Board fully engaged and will press this organisation to increase its efforts in these fields. Based on the foundations of the silent and consistent work of the group of people in CNEA during nearly three decades (many of whom, regrettably, are no longer with us, but have left their valuable legacy), it is possible to assure that the targets—within the measure of the country's possibilities—will be achieved, as is desired by the entire community.

[The Argentina national plan for electrical energy development calls for major increases in both hydroelectric and nuclear power plants, roughly 5-fold and 7-fold increases in capacity, respectively, and a gradual phase-down of thermal power plants which are chiefly oil-fired. The details of the electrical energy plan follow:]

NATIONAL PLAN FOR ENERGY EQUIPMENT 1979-95

AT THE COMPLETION OF THE PLAN, ARGENTINA WILL HAVE AN INSTALLED CAPACITY OF 29820 MW. MORE THAN THREE-FOLD THE 1978 LEVEL.

The State Secretariat of Energy, through the Undersecretariat of Hydroelectric and Thermal Energy, has prepared the National Plan for Electric Energy Generation and Transmission Systems for the period 1979-2000. This work is, in fact, the second stage of a task initiated in 1976, the first part of which, covering planning for the 1977-85 period, was completed in April 1977. That stage tended to achieve fundamentally the financial-technical reordering of a number of works and supplies which had been contracted—some with uncertain objectives—during the period 1973-75, and was characterized by the fact that the task carried out was mainly centered on adjusting the projects to the demand, ordering their financial impact and reconsidering their original schedules.

The second stage now approached comprises the review and updating of the first stage and the extension of the electric sector development plan until the year 2000.

This work comprised, in the first place, an analysis of the available energy resources to be found in the country, in order to define basic guidelines as a framework for the Plan. Afterwards, the current situation of the service was studied, comprising the fundamental values and characteristics involved.

The next step consisted in studying the demand for electric power forecasted up to the year 2000, and on that basis and with the use of modern programming methods, the power generation and transmission equipment for the period under

study were selected. Lastly, the work was completed with an economic-financial analysis in which the level of investments was determined, together with a consolidated forecast of the results of the exploitation in the whole country and a statement of Sources and Applications of Funds showing the manner in which the works programmed could be financed.

ENERGY FRAMEWORK FOR THE PLAN

Argentina has a considerably balanced panorama in the total demand and supply of energy and a reasonable availability of resources, both renewable and non-renewable. The geographical location of these resources is, however, not the most favourable one, as production centers are far away from the main consumption centers, which increases exploitation costs considerably, due to the high impact of transportation on overall costs.

The country's total energy consumption was 37.8 million eot (equivalent oil tons) in 1978, with a per capita value of 1433 eok (equivalent oil kilograms), close to the world average.

The quantification of the country's total energy resources and their exploitation at December 1978 was as follows :

ENERGY TOTAL

	Resources		Consumption	
	10 ⁶ eot	Percent	10 ⁶ eot	Percent
Hydraulic.....	1,429	55.6	2.2	5.8
Oil.....	341	13.2	23.7	62.7
Natural gas.....	383	14.9	8.4	22.2
Coal.....	80	3.1	1.0	2.6
Uranium.....	281	10.9	.7	1.9
Vegetal fuels.....	60	2.3	1.8	4.8
Total.....	2,574	100.0	37.8	100.0

This table shows the importance hydroelectricity has as reserve, and how little it has been used up to now.

As for resources in detail, the studies afford the following conclusions:

The identified hydroelectric potential amounts to 136,000 GWh and would suffice to cover the requirements of electric power demand in the country practically up to the year 2000, even should no other type of power plants be installed. In turn, the potential detected but not yet identified in detail amounts to 200,000 GWh with which the period mentioned above would be exceeded.

The available liquid hydrocarbons are insufficient should the current rate of consumption be maintained and no new reserves incorporated. Active work is being carried out to that end.

The availability of gas, on the basis of recently discovered fields, is considerable.

The availability of coal is enough to maintain a moderate consumption level unless important sums are invested in its development.

Uranium reserves are encouraging but their exploitation requires large investments and special technology to achieve a situation of self-supply.

Non-conventional resources do not currently represent an important offer at the industrial level.

These conclusions are translated into the following guidelines applied to the development of the Plan :

To restrict the installation of thermal energy plants to those strictly indispensable.

To intensify the share of hydroelectric energy.

To develop a program of nuclear power plants allowing the country to maintain an active technological development and be prepared to cover an important development as of the last years of the century.

For the third point in particular and in accordance with the instructions of the Executive Branch, the Secretariat of Energy and the National Atomic Energy Commission agreed upon a plan comprising the installation of four nuclear power plants during the next 18 years, which has already been approved by the Executive and forms part of the Electric Plan.

ELECTRIC POWER DEMAND

The study of electric power demand was undertaken following basically, two guidelines: on the one hand, the evolution of historical consumption trends and, on the other, the behaviour of demand in connection with the development of the economy. For the first case, three projections were obtained: mean, maximum and minimum. For the second, two projections corresponding to two probable values of GNP growth rate in the period 1977–2000. Said projections were then compared and checked to adopt the definite projection.

Antecedents: The historic evolution of electric power consumption from 1962 to 1977—period for which reliable statistics are available—shows there were permanent oscillations with annual increases varying between 3.9 percent and 12.2 percent and averaging 8 percent.

As of 1974 a reduction in consumption can be noted—the longer lasting one since 1962—which only started being overcome around the middle of 1978.

Growth rates for the period 1962–77 in the items Public Service and Self-generated electric power are as follows:

ANNUAL GROWTH RATE

[In percent]

	1962–75	1974–77	1962–77
Public service.....	8.9	6.3	8.3
Self-generation.....	3.9	–2.2	3.0
Total.....	7.7	5.1	7.3

From the sectorial standpoint, industrial consumption—which represented 32% of the total in 1962—was 46% in 1977, while the shares of the domestic and commercial sectors decreased, thus evidencing the industrialization trend followed by the country.

In general, the historical analysis of demand's behaviour shows a market with a higher growth rate than in developed countries (U.S.A. 5.4%; Germany 6.4%; France 6.5%) but in the range of what may be considered reasonable values compared to developing countries with rates similar to Argentina's: Colombia 8.3%; Venezuela 8.3% (figures for the 1968–1976 period).

Projection: To make the projection according to the historical trend, regional projections for energy consumption were first calculated, thus obtaining the forecast for the whole country. In each case and for each region, industrial consumptions exceeding the scale of the region or including non traditional processes or new technologies in which electric power represented an important input were incorporated in a punctual manner.

In turn, the projections made on the basis of economic growth were calculated relating total future consumption (Public Service + Self-generation) of electric power to the foreseeable development of economy represented by the growth of the Gross Domestic Product. Two probable rates for the annual growth of the GNP were adopted—5.5 per cent and 4.5%—with which two respective projections for total demand of electric power were obtained.

The analysis of the results obtained from both procedures, both at the total and sectorial level, showed the convenience of adopting the projection considered better suited to carry out the Plan, which takes into account variable growth rates for the period 1977–2000, representing an average of 8.3% for Public Services.

The criterion adopted for the demand of self-generated energy was that in the future it would have a decreasing trend, owing to the greater and improved supply of Public Services. Consequently, the share of self-generation which was 28% in 1965 and 16% in 1977 was assumed in the order of 5% of the total consumption by the year 2000.

The total values adopted (Public Service + Self-Generation) are compatible with an average annual GNP growth rate of 5.3%.

The following table shows some of the values obtained for the projection of Public Services generated energy consumption which was adopted for each of the regions and the country's total, together with historical values for the pertinent comparison.

CONSUMPTION OF ENERGY GENERATED BY PUBLIC SERVICES

[Gigawatt-hour]—GWh—

Region	1962	1968	1975	1977	1981	1985	1990	1995	2000
G.B.A.	4,101	6,292	9,868	10,397	13,148	17,061	23,986	33,242	45,080
Littoral	992	1,530	3,066	3,522	5,485	7,739	12,253	19,350	30,150
Comahue	105	179	522	656	1,104	2,370	3,794	5,719	8,611
S.B.A.	372	673	1,269	1,492	2,100	3,181	5,374	8,817	13,945
Center	547	860	1,447	1,600	2,145	2,943	4,436	6,592	9,587
Cuyo	467	781	1,988	2,171	2,763	4,771	7,552	11,393	16,921
N.E.	121	213	520	635	993	1,553	2,758	4,829	8,271
N.W.	220	344	925	1,088	1,610	2,554	4,592	8,067	13,742
Patagonia	311	369	969	1,550	3,527	3,837	4,424	5,297	6,597
Country's total	7,236	11,241	20,574	23,111	32,875	46,009	69,169	103,306	152,904

The data show the trend towards decentralization of consumption which has been taking place and results in a greater share of provincial regions in overall consumption together with a decrease in the percentage of consumption of the Greater Buenos Aires area. The following table shows some of these values.

REGIONAL PARTICIPATION IN CONSUMPTION OF ENERGY GENERATED BY PUBLIC SERVICES

[In percent]

Region	1962	1968	1975	1977	1981	1985	1990	1995	2000
G.B.A.	56.7	55.9	48.0	45.0	40.0	37.1	34.7	32.2	29.5
Littoral	13.7	13.6	14.9	15.2	16.7	16.8	17.7	18.7	19.7
Comahue	1.5	1.6	2.5	2.8	3.3	5.2	5.5	5.5	5.6
S.B.A.	5.0	6.0	6.2	6.5	6.4	6.9	7.8	8.5	9.1
Center	7.6	7.0	7.0	6.9	6.5	6.4	6.4	6.4	6.3
Cuyo	6.5	6.9	9.7	9.4	8.4	10.4	10.9	11.0	11.1
N.E.	1.7	1.9	2.5	2.7	3.0	3.4	4.0	4.7	5.4
N.W.	3.0	3.1	4.5	4.7	4.9	5.6	6.6	7.8	9.0
Patagonia	4.3	3.3	4.7	6.7	10.8	8.2	6.4	5.2	4.3
Country's total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The breakdown of the adopted projection into consumption sectors shows, furthermore, the changes which will take place in due time in the structure of consumption, with the consequent increase of industrial consumption together with the proportional reduction of household consumption.

SECTORIAL STRUCTURE OF CONSUMPTION, PUBLIC SERVICE

Year	Domestic		Commercial		Industrial		Other		Total	
	GWh ¹	Per-cent	GWh	Per-cent	GWh	Per-cent	GWh	Per-cent	GWh	Per-cent
Recorded:										
1962	2,540	37.8	938	13.0	2,553	32.2	1,207	17.0	7,236	100
1968	4,164	37.0	1,499	13.4	3,833	34.1	1,745	15.5	11,241	100
1975	6,614	32.1	2,224	10.8	9,074	44.1	2,663	13.0	20,575	100
1977	7,178	37.1	2,406	10.4	10,632	46.0	2,895	12.5	23,111	100
Projected:										
1981	9,159	27.8	3,043	9.3	16,952	51.6	3,721	11.3	32,875	100
1985	12,153	26.4	3,964	8.6	24,918	54.2	4,964	10.8	46,009	100
1990	17,431	25.2	5,562	8.0	38,976	56.4	7,189	10.4	69,169	100

¹ Gigawatt-hour.

The plan tends to the integration of regional electric power markets by means of a 500 kV transmission network linking them with generation centers. At present only the regions of Greater Buenos Aires, Littoral, Southern Buenos Aires and Comahue are linked. It is estimated by 1980 the central region—comprising

the provinces of Cordoba and San Luis—will be annexed. As of 1983 and on the basis of high voltage lines which will start being built in the near future, the Northeastern, Northwestern and Cuyo markets will be included.

Graph No. 1 shows the program of equipping selected to cover the projection of power and energy of the National Interconnected System (NIS) for the period 1979–1995, and the participation of the different methods of generation. As may be appreciated, the structure of the offer of electric energy changes substantially from a participation of 30% for hydroelectric power in 1979 to 68% in 1995, with a decrease of conventional thermal energy from 64% in 1979 to 22% in 1995.

The sequence of the works reflected in the program is the result of the technical and economical analyses of the Argentine electric power market, although bi-national works are included in it. For those projects, designed to start operating to cover the demand from both countries, the dates shown may be changed, in accordance with the agreements entered into, without that substantially affecting the results of this plan.

All the generation equipment to be added, plus the existing plant and less the foreseen withdrawals, results in the situation shown in the following table:

[In megawatts]

	Existing in 1978	Additions foreseen	Withdrawals	Total in 1995
Hydraulic powerplants.....	2,910	16,930	-----	19,840
Nuclear powerplants.....	370	2,580	-----	2,950
Thermal powerplants.....	6,060	2,510	1,540	7,030
Total.....	9,340	22,020	1,540	29,820

The figure for thermal power plants corresponds to those which are presently under construction, as the program does not foresee any new important works of this type for the interconnected system.

After supplying the 1979–1995 period, 51% of the country's identified hydraulic potential will have been employed, and a production capacity of approximately 66000 GWh per year will remain, in works which may be developed.

The generation equipping plan ran parallel to the development of a high voltage transmission system, the two stages of which are shown in graphs No. 2 and 3. They comprise the running of about 15000 km of 500 kV lines, apart from the corresponding transformation, subtransmission and distribution works.

With the equipping programed, the electric integration of 99% of the country's market will be achieved by 1955. Nevertheless, a small percentage will remain which due to economic and technical reasons will have to continue being supplied by means of diesel equipment and gas turbines, for which 330 MW will be installed during the period 1979–1995.

ECONOMIC-FINANCIAL DEVELOPMENT

The Plan comprises an economic-financial analysis to verify the feasibility of the execution of the work under the program within the framework of rational rates. The analysis was carried out at the national level and comprises national, provincial and municipal companies and agencies supplying the Public Service, as well as binational agencies in charge of executing and operating the electric system.

The currency used for the calculation is U.S. dollars at the constant value of December, 1978. The projection was made until 1990 because in view of the present circumstances of the world financial markets, it was not considered really indispensable and realistic to study in detail financial schemes for periods longer than the former.

The study includes the following points:

Annual Schedule of Actual Investments: It includes all the generation equipment selected, as well as those for transmission, subtransmission and distribution. The period 1979–1995 includes the initial investment in works to be commissioned after the year 1995.

	1979-85	1986-95	Total
Generation.....	5,600	16,300	21,900
Transmission.....	1,500	2,900	4,400
Subtransmission and distribution.....	3,600	10,400	14,000
Other.....	800	3,300	4,100
Total.....	11,500	32,900	44,400

Statement of operating profits: A consolidated statement of operating profits was developed for the whole country which shows how all operating expenses and capital charges may be covered with a mean level of reasonable rates.

Expenses include all those allocatable to operation, consisting in fuel, personnel, purchases of energy and power, taxes on the sale of energy, etc. Capital charges comprise the addition of depreciation fund and a profitability of 8% on the value of operational facilities. As the values of those assets are outdated due to the depreciation of the dollar in the last few years, a revaluation was included in 1981 and 1982, which shall entail a larger internal generation of funds, more in accordance with the strong requirements of the sector.

The statement for some typical years is summarized below:

[In millions of U.S. dollars]

	1979	1982	1985	1990
Sales de Energy (gigawatt-hour).....	27,740	35,890	46,010	69,170
Total operating cost:				
Fuel.....	430	510	546	458
Personnel salaries and wages.....	476	547	651	900
Other expenses and taxes.....	694	1,282	1,805	2,942
Capital Charges.....	203	302	385	763
Total.....	1,803	2,641	3,387	5,063

Statement of source and application of funds: This statement shows the possible financing of the works, the investments in which were detailed above.

The main sources of financing for the Argentine electric sector are the following: funds generated by the companies, specific funds of the sector and loans. Among the main applications we may mention: the investment program, the service of the debt and the increase in working capital.

The loans which were included are those already contracted and the ones it will be necessary to obtain. For future loans, the financing of each work has been studied in detail and the parts in them to be financed with local funds, supplier credits, international agencies loans and commercial bank loans have been determined, in accordance with the current practices for this type of transaction.

The reimbursement and interests on said loans represent each year an acceptable amount. The financial scheme stated, developed with the assumed economic and rates framework, leads to values which can be handled by the electric sector.

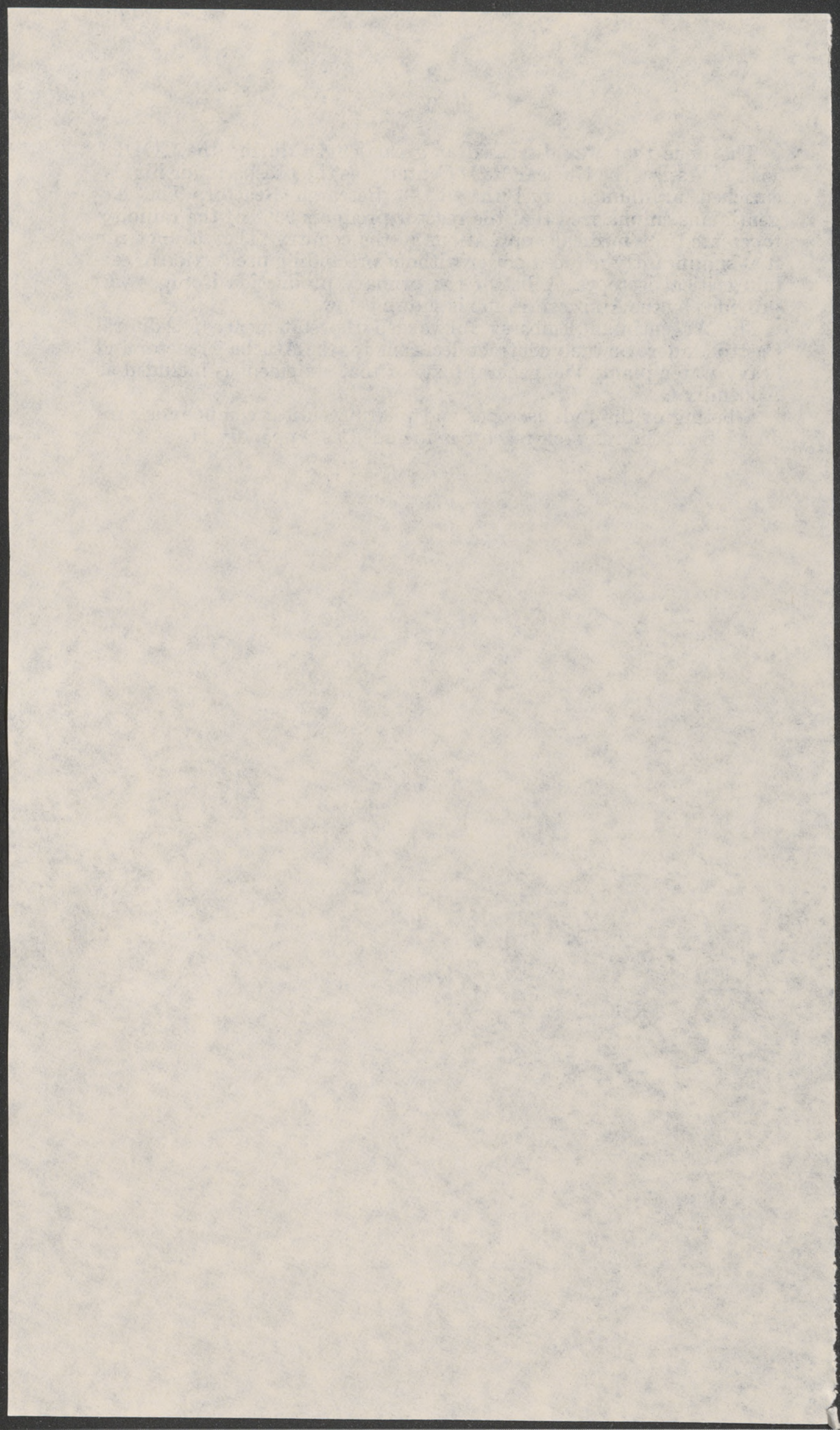
[In millions of U.S. dollars]

	1979-82	1983-85	1986-90
Sources:			
Internally generated funds.....	3,800	4,900	12,300
Specific funds.....	2,700	2,600	5,200
Loans.....	5,100	2,500	3,600
Other.....	500	100	
Total sources.....	12,100	10,100	21,100
Applications:			
Investment program.....	7,400	5,700	13,900
Debt service.....	3,500	4,000	6,300
Increase in working capital.....	1,000	400	900
Contributions to the National Treasury.....	200		
Total applications.....	12,100	10,100	21,000

The issue that was discussed at great length during the CODEL visit to Assiza, the Nuclear R&D Center, was the prospects for highly-enriched uranium to fuel the RA-3 Research Reactor. The Argentinians emphasized that the reactor produces 93% of the radioisotopes used for medical applications in the country. They cannot run it at significantly reduced power without precluding production of certain critical isotopes. A list of the primary production isotopes was provided by the Assiza staff, and is shown below.

The Argentinian Embassy forwarded the statement of Admiral Castro Madero on their contract decisions for the Atucha 2 reactor and heavy water plant. The general text of that statement is included as Appendix G.

A listing of the radioisotopes and pharmaceutical compounds produced from the research reactor is included as Appendix H.



COLOMBIA—OVERVIEW

In Colombia, there were no discussions with energy officials. The discussions were held with embassy personnel assigned to the Economic Section. At the time of the visit, the United States and the Colombian Government were on the verge of reaching a nuclear agreement which would bind Colombia under the conditions of the Nuclear Non-Proliferation Act. This agreement was apparently reached without nearly the controversy which accompanied similar negotiations in Brazil and Argentina because of the very limited nuclear capability extant in Colombia. An energy overview of the Colombian oil import situation and their prospects for coal production and uranium resource assessment is included in Appendix A.

The draft nuclear agreement provided by the U.S. Embassy for United States/Colombian cooperation appears in Appendix H.

APPENDIX A

SOUTH AMERICAN NUCLEAR ISSUES

Foreword

The land trembled around a remote New Mexico testing range when the awesome power of the atom was first unleashed in July of 1945. But the entire world rocked when one month later the United States destroyed Japan's sixth largest city, Hiroshima, in a single deadly blast. The reverberations from it can be seen today in issues surrounding the subject of nuclear weapons proliferation. Since these issues seem to be growing more serious and controversial by the year, we may ask why some nations object to U.S. efforts to halt proliferation by tightly restricting the transfer of advanced nuclear technology. Answers can be drawn from essays presenting the candid views of two of our hemispheric neighbors, Argentina and Mexico, and the Organization of American States.

Pedro Sanjuan, guest editor of this issue of the *AEI Foreign Policy and Defense Review*, is AEI resident fellow and codirector (with Otto Reich of the Council of the Americas) of a new AEI project, the Center for a Definition of Hemispheric Priorities. He points out in his introduction that U.S. policy governing the export of nuclear materials and technology originated in the 1950s. At that time the United States pledged to let

other nations share in the peaceful dividends of our atomic discoveries by providing them the means of generating plentiful and affordable energy. Our policy is now seen to be quite different, however, and it has become a source of growing resentment abroad.

The distinguished contributors to this issue argue that the hemisphere's expanding energy demands are at the heart of Latin America's dispute with our stance on nuclear exports. Prospects for rapid economic development are threatened everywhere by the specter of global energy shortages. Yet, we have not renounced our goal of continued economic expansion, and the U.S. economy already consumes the greatest share of the world's energy. Lacking assured energy supplies, many of the countries of Latin America fear they will find themselves in ever fiercer competition with their northern neighbor for scarce fossil fuels. Thus, for the sake of sustaining their economic progress, they now ask the United States to adhere to its traditional policy of supporting peaceful uses of nuclear energy.

The essays give comparatively little attention to this nation's deep concern about the spread of nuclear arms. One reason is that certain other nations view the

The AEI Public Policy Project on National Defense

The American Enterprise Institute established the Public Policy Project on National Defense in June 1976 to examine the many controversial issues involved in the defense of the United States. The project commissions research into concepts of strategy, manpower and force structure, the economics and administration of defense, and other major aspects of defense policy. It also sponsors television debates and round table discussions, as well as informal seminars and conferences, on current defense issues. The *AEI Foreign Policy and Defense Review* is one result of this project.

The project is chaired by Melvin R. Laird, a former congressman, secretary of defense, and domestic counsellor to the President, and now a senior counsellor for *Reader's Digest*.

An advisory council composed of distinguished proponents of many different viewpoints participates in project programs, which are designed to encourage the competition of ideas on defense policy. Dr. Robert J. Pranger is AEI's director of Foreign and Defense Policy Studies.

The AEI Public Policy Project on the Future Conduct of American Foreign Policy

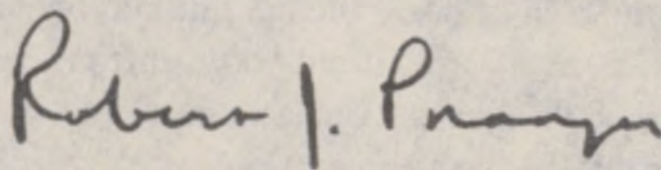
The American Enterprise Institute established the Public Policy Project on the Future Conduct of American Foreign Policy in June 1978 to examine the full range of issues involved in the conduct of U.S. foreign policy. The project commissions research regarding American policy towards specific countries and regions of the world, on the formulation and execution of foreign policy, on the relationship between economics and politics in international affairs, and on other major aspects of American foreign policy. It also sponsors television debates, round table discussions, informal seminars, and conferences on current foreign policy issues.

An advisory council composed of distinguished proponents of many different viewpoints participates in project programs, which are designed to encourage the competition of ideas on foreign policy.

Donald C. Hellmann, professor of Asian and international studies at the University of Washington and a member of the AEI Council of Academic Advisers, serves as consultant to the project.

problem from a somewhat different perspective from ours. Having watched the relentless growth of our nuclear arsenal in what is sometimes called vertical proliferation, they ask why we selectively focus on the possibility of new nuclear powers, when existing weapons stocks pose a greater danger to global security. And there is a warning that because the United States no longer enjoys a monopoly over nuclear technology, countries wishing to proceed with their nuclear development may do so without U.S. assistance and without our stringent controls.

In pursuit of its vital interests, the United States must often promulgate policies that do not coincide with the interests of other states, even of its friends in some cases. The risks of nuclear proliferation threaten the interests not only of the United States but of all nations. But there also can be risks in failing to understand how the consequences of U.S. policy are felt within this hemisphere. These are dealt with best by recognizing and weighing the concerns of our neighbors. To this end we welcome their views to the competition of ideas.



ROBERT J. PRANGER
December 1979

Contents

NUCLEAR ENERGY IN ARGENTINA,
Jorge Antonio Aja Espil 5

TRANSFER OF TECHNOLOGY AND THE FUEL CYCLE,
Dalmau Costa 9

CONTINENTAL INTERDEPENDENCE, ENERGY, AND
INTEGRATION IN THE AMERICAS,
Alejandro Orfila 15

RESHAPING U.S. REGIONAL POLICY,
Francis X. Gannon 21

Introduction

Pedro A. Sanjuan

THIS issue of the *AEI Foreign Policy and Defense Review* is devoted to the Latin American view of U.S. policy on the export of nuclear materials, technology, and information. It tries to bring into focus the official attitudes of the governments of Argentina and Mexico, as well as to offer a hemispheric view of the situation as seen by the secretary general of the Organization of American States (OAS). It also appears as the United States prepares its reply to the International Fuel Cycle Evaluation (INFCE) report that is critical of this country's policy regarding the transfer of advanced nuclear technology. The essays may help to clarify the concerns of the global community.

A comprehensive analysis of the nuclear market in Latin America is made in a study recently prepared by Octave Du Temple, executive director of the American Nuclear Society and by Edward Hennelly, the society's president.¹ Their assessment mirrors the conclusions reached in meetings of nuclear experts held throughout Latin America and also in the United States over the last few years. Those conclusions have been frequently restated by Marcelo Alonso, director of the Inter-American

Pedro A. Sanjuan, a resident fellow at AEI, codirects (with Otto Reich of the Council of Americas) the activities of AEI's Center for the Definition of Hemispheric Priorities. Formerly he served in the Departments of State and Defense and on the White House staff. The center's activities are based on the premise that joint action between the United States and the countries of Latin America can, within the divergence of cultures and traditions in the hemisphere, contribute to the resolution of common problems. The project is being conducted through AEI's Foreign and Defense Studies Program.

¹ Octave Du Temple and Edward Hennelly, "Latin America: Emerging Nuclear Market," *Nuclear News*, vol. 22 no. 11 (September 1979), pp. 59-64.

Nuclear Energy Commission and by other members of that organization. In essence, these experts identify three issues. First, they conclude that the Latin American energy requirements of the 1980s and 1990s, and beyond the year 2000, will considerably exceed the resource capabilities of this hemisphere in hydroelectric and coal-generated power. Second, they predict that those energy needs will also surpass the hemisphere's capacity to withstand the economic drain occasioned by rising petroleum prices. Third, they conclude that Argentina, Brazil, Chile, and Peru—and eventually the other countries of Central and South America—have no choice but to develop alternative sources of energy, especially nuclear power, if they are to safeguard their well-being.

The essays presented in this issue of the *Review* by Dalmau Costa, director general of Mexico's National Institute of Research, and by Jorge Antonio Aja Espil, ambassador of Argentina to the United States, discuss the role of nuclear power in the energy planning of their nations. These first two contributions echo a shared concern: that the United States has adopted regulations restricting the export of nuclear technology at a time when our neighbors look to us for the hardware and the expertise needed to meet their growing energy demands. These regulations emanate from a law, the Nuclear Nonproliferation Act of 1978, which reverses our traditional and, until recently, well-publicized claim that advanced industrial technology would be the gift of the United States to other nations seeking the benefits of rapid and sustained economic development. Recent U.S. policy has sought also to discourage efforts by the European and the Canadian nuclear industries to introduce into Latin America different elements of advanced or conventional nuclear technology. The U.S. measures have prevented, so far as is possible, the development of any indirect energy-related potential sources of nuclear explosives.

With the exception of Cuba and Guyana, every Latin American country is party to the Treaty for the Prohibition of Nuclear Weapons in Latin America, the 1968 Treaty of Tlatelolco, a Latin American initiative named after the foreign ministry of one of the earliest champions of arms control in the twentieth century, Mexico. The Treaty of Tlatelolco establishes a zone free of nuclear weapons in Latin America. An appropriate regional agency,

the Organization for the Prohibition of Nuclear Weapons in Latin America (OPANAL) already exists. Its function is to develop, as far as foreseeable future conditions might require, the controls needed to maintain the Latin American zone of this hemisphere free of nuclear weapons. That the rest of the hemisphere virtually bristles with such weapons is seen by our neighbors as the prerogative of *droit de seigneur* of the world's highly industrialized societies, those which, in this instance, can afford the privilege of being capable of extinguishing civilized life on our planet.

The present policy has left no doubt that the United States opposes nuclear weapons proliferation. Paradoxically, the approach has also helped to weaken our ability to influence developments in nuclear energy trade, an ability essential to making that policy effective. In the area of services for the enrichment of uranium, contracts with the United States are being cancelled for fear that the United States will default on future licensing of such exports. Our Nuclear Regulatory Commission has compiled statistics showing that our former monopoly in supplying enriched uranium is now gone. President Carter, in reporting to the Congress on March 22, 1979, on the Nuclear Nonproliferation Act of 1978, noted that other countries, including the principal nuclear energy producers of Latin America, consider our present policy impractical.² The President acknowledged that doubts exist everywhere outside the United States about our reliability as a nuclear fuel supplier.

There are also signs that the Nuclear Nonproliferation Act and the policy it represents have produced unwanted side effects in our relations with Latin America. Although Mexico is one of four countries in Latin America with abundant fossil fuel reserves (the others are Venezuela, Ecuador, and Bolivia), it nevertheless is looking to the nuclear option in its more advanced forms as a desirable alternative source of energy. In 1978, after bargaining with unaccustomed toughness with the United States, Mexico turned down a modified natural gas agreement, whereupon it signed a \$5 billion, ten-year energy agreement with Canada as

² Jimmy Carter, "Report on the Activities of the Government Departments and Agencies to Prevent Nuclear Proliferation—Message from the President—PM 43," *Congressional Record*, vol. 125, no. 36 (March 22, 1979), p. S3162.

U.S. NUCLEAR EXPORT POLICY

part of a swap of Mexican oil for Canadian nuclear technology. It also signed different forms of energy agreements with France, Spain, and Cuba.

The coolness of U.S.-Argentine relations, described euphemistically in diplomatic circles as "correct," seems to go beyond the human rights issue, on which there has been considerable accommodation and progress, or beyond such issues as the recent challenge by the U.S. Department of Defense of Argentina's 400-mile territorial sea claims. It is becoming clear that our present difficulty with Argentina is linked to our nuclear export restrictions, which are a matter of profound significance for a country with an advanced nuclear industry of its own. The Argentine answer has been to affirm its sovereignty in the most palpable way. This has been done by means of improved Argentine-Soviet relations—a trend recently expressed through renewed cultural ties and the unprecedented visit to Argentina by a Soviet military mission, which was decorated by Argentina's top military in an affair described by Tass, the Soviet news agency, as "a transcendental event." Similarly, U.S.-Brazilian relations have been impeded by the Nuclear Nonproliferation Act, with the effect of bringing Brazil and Argentina closer together in the area of nuclear technology exchanges.

The United States should not be surprised or offended if traditional terms of friendship give way to pragmatism in the face of impending energy shortages. The underlying question posed by the first two essays, however, is whether we fully comprehend how our own policy might be hastening that process in this hemisphere.

In the third essay, Alejandro Orfila, secretary

general of the OAS, surveys the energy outlook for Brazil, Jamaica, and Colombia. He does so show why nuclear power will soon become critically important to other states that now depend largely or entirely on fossil fuels and hydroelectric power. He writes of a "new bargain" among American countries which could pave the way for a hemispheric cooperation on economic development joined with the peaceful uses of nuclear energy. In regarding the energy challenge as a potentially binding force, he offers the case of industrial development in Western Europe in the early 1950s as a contemporary model for the integration of the American family of nations. The fourth and final article by Francis X. Gannon, advisor to the OAS secretary general, presents his views on bilateral and multilateral energy policies for the Americas. These policies, if joined by a U.S. commitment to regional energy development, could lead to a reconciliation between U.S. nonproliferation goals and Latin America's energy and security needs.

Here in the United States, popular debate has focused primarily on ways of squaring U.S. objectives in halting the spread of nuclear weapons with the commercial interests of our own nuclear industry. This issue of the *Review* attempts to widen the debate to include views from an area of the world that sees the same policy as confounding its economic future. Our own national interests are deeply and historically intertwined with Latin America, and that is perhaps reason enough to pay heed. In reading these articles, however, one also wonders how long our neighbors will continue to look northward to express their concerns before seeking solutions to their problems elsewhere.

Nuclear Energy in Argentina

Jorge Antonio Aja Espil

CONSIDERING the critical energy situation in the world today, the resources of Argentina place it in a very fortunate position compared with that of some other countries. Argentina is endowed with such diversified energy resources as crude oil, natural gas, coal, and uranium. It also has completed or initiated major hydroelectric projects. These include the 1,200 megawatt El Chocon plant in the south, the 1,800 megawatt Salto Grande facility being built jointly with Uruguay, and the 2,700 megawatt Yacyreta plant being built jointly with Paraguay and with the technical and financial participation of the World Bank and Inter-American Development Bank. Argentina's coal reserves, however, are small, and the oil and gas reserves are mostly located in areas that, like the hydroelectric projects, are fairly remote from the main centers of consumption.

In 1976, crude oil and natural gas accounted for 86 percent of the total primary consumption of energy, including noncommercial energy. High oil prices have led to a great increase in our projected demand for nuclear energy.

Given this basic background, the following discussion is organized around four main themes: the evolution of Argentina's nuclear development; the evolution of U.S. policy and its impact on this development; the specific problem of technological discrimination; and the challenges of dealing with U.S. policy. There is a brief concluding summary.

Jorge Antonio Aja Espil is Ambassador of Argentina to the United States. His article is based on views expressed in "A Conversation with Ambassador Aja Espil" held at the American Enterprise Institute on April 30, 1979.

Argentina's Nuclear Development

Let us first go back nearly three decades and analyze Argentina's nuclear development. In 1950, when a group of twelve technicians and scientists started a study for the development of a national nuclear plan, only the most optimistic of them could have visualized the results apparent today. At a time when matters concerning the fusion and fission of the atom were still a taboo subject in many countries, the initial group of the National Atomic Energy Commission in Argentina nevertheless clearly defined an objective. That objective was to create a nuclear plant that would secure domestic self-sufficiency.

The first step was a nuclear geological program to detect the presence of uranium and examine the possibility of its exploitation. Once this program confirmed the presence of large deposits in sufficient quantities to guarantee national independence in the supply of raw materials, efforts were concentrated on developing educational institutions for the training of scientific and technical personnel. Great advances have subsequently been made toward solving this difficult problem. Today, the National Atomic Energy Commission has more than 1,200 technicians and scientists whose expertise is coveted by similar organizations elsewhere.

When these primary needs were covered, two research reactors, using enriched uranium, were built on the outskirts of Buenos Aires, the capital. The work in these institutions brought about great advances in the study of material exposed to atomic radiation and resulted in the construction of a third reactor. This reactor, operating at the Ezeiza nuclear power plant, produces all types of irradiated

U.S. NUCLEAR EXPORT POLICY

materials including radioisotopes for industrial and medical use.

At this point in the growth process, however, the scientific and technological level of industrial development in Argentina limited its nuclear planning. The subsequent purchase of a West German reactor capable of producing 319 megawatts was a substantial qualitative leap forward for national nuclear development. This power reactor was the first of its kind in Latin America. In March 1974, the Atucha nuclear power plant reactor, which is located 100 kilometers from Buenos Aires, became active. Its output of 360 megawatts supplies electric power to an enormous area, which includes the suburbs of Buenos Aires. Atucha in fact supplies 4.5 percent of Argentina's electrical energy today.

Another 600 megawatt nuclear plant is now under construction in Rio Tercero, Cordoba, and is expected to start operating by the end of 1980. It is a heavy water reactor of Canadian design, known as "CanDu," a name derived from Canadian deuterium uranium. Argentina chose a system that uses natural uranium instead of enriched uranium because of its own large uranium reserves. There are about 27,000 tons of assured uranium reserves, with a production cost (not allowing for inflation) of between \$5 and \$10 per pound, and an estimated potential of 270,000 tons of additional resources. In contrast, approximately 90 percent of the world's present and planned nuclear generating capacity requires slightly enriched uranium for fuel. Canada, however, is a major exception: because its reactors use natural uranium, they require a moderating material, heavy water (lye water with deuterium, a heavy isotope of hydrogen). In other words, heavy water permits the use of natural or unenriched uranium as fuel.

The government of Argentina, with assistance from the University of Santa Fe, Argentina, is now building a heavy water pilot plant utilizing indigenous or domestic sensitive technology. The plant is expected to start operating in 1980 with an anticipated production of only about two or three tons a year. At some point, Argentina will be able to design its own sensitive plants on a larger scale. Perhaps they will be less efficient, more costly, and take longer to build. But once we achieve the necessary know-how, we will be in a position to develop an autonomous power program using natural uranium and heavy water.

In any event, the Argentine government, early in 1979, asked for international bids and received two identical offers to build a 250 ton heavy water plant, one from a Swiss firm and the other from a German firm.¹

Evolution of U.S. Policy

Some decisions of the Carter administration have a direct bearing on Argentina's nuclear energy planning and on relations with the United States. In order to explain the international problems caused by the policies adopted by the U.S. government, it is first necessary to describe a few aspects of global technical capabilities in the production of nuclear energy. As commercial nuclear capabilities spread, a new problem arose: that those commercial capabilities, particularly the sensitive facilities, could be used for military purposes. The problem for the world community became one of reconciling the spread of commercial nuclear capabilities with the possibility of their military misuse.

In December 1953, President Eisenhower delivered an address, "Atomic Power for Peace," to the General Assembly of the United Nations. In that speech he proposed a program called Atoms for Peace and the establishment of an international agency to promote peaceful usage of nuclear energy. Reaction to President Eisenhower's proposal was overwhelmingly favorable, and in 1957 the International Atomic Energy Agency (IAEA) was established. Safeguard regulations established by the agency require each country to file regular detailed reports with it on their civilian nuclear activities. Each country must also allow international inspection.

¹ By Decree No. 2441 of September 28, 1979, the Nuclear Energy Commission of Argentina has been authorized to: 1) Accept the offer presented by Sulzer Brothers Limited of Winterthur, Switzerland, and to carry out negotiations for the signing of the respective contract for the construction of a heavy water plant of 250 tons per year; and 2) Accept the offer submitted by KRAFTWERK UNION AKTIENGESSELLSCHAFT of Erlangen, Federal Republic of Germany, to participate in the development of the Argentine nuclear plan and to carry out negotiations for the signing of the respective contracts for the establishment of an Engineering Enterprise, as a joint-stock company, and for the joint construction of Atucha II Nuclear Power Plant, equipped with a pressure container reactor included in a four-plant program, with the condition that the three remaining reactors may be equipped, in principle, with a steam pressure supply tube system.

tions of their nuclear facilities. The purpose of such visits is to ensure that there is no transfer of nuclear material from civilian to military use.

Argentina accepted the establishment of safeguard provisions for the Atucha nuclear power plant on October 3, 1972, and for the Rio Tersero nuclear power plant on December 6, 1974. The policy of accepting international safeguards will be maintained in the future because Argentina agrees with the existing consensus on the legitimacy of international controls.

Since 1975, the United States has had doubts whether the safeguard policy, which has worked perfectly well for two decades, will remain satisfactory in the foreseeable future. These doubts are the reason the United States has adopted discriminatory policies toward some countries and, in the same way, has coerced other nations to follow the American policy on nonproliferation.

The seven major nuclear suppliers that began discussions on these matters in London in 1975 are the United States, the Soviet Union, France, Great Britain, Japan, West Germany, and Canada. The series of secret meetings of the so-called London Suppliers Club came in the wake of international concern spurred by India's atomic explosion of a year earlier. In January 1978, the London Suppliers Club—which by then also included Poland, East Germany, Czechoslovakia, Belgium, Netherlands, Italy, Sweden, and Switzerland—made public their set of ground rules for selling atomic supplies. The rules covered the transfer of all nuclear technology, including reactors, enrichment and reprocessing plants, enriched uranium, and other sensitive nuclear materials. (Reprocessing is the process of extracting plutonium from the spent fuel of a standard nuclear reactor: plutonium can be shaped into an explosive but also into an economic fuel element for the new fast breeder reactors.)

Over the same period, the United States made internal decisions that, in various ways, affected countries developing their own nuclear technology. The United States adopted a policy of denials which has encouraged supplier countries to exercise self-restraint in the transfer of sensitive facilities and technologies. But what has happened to that policy of denials? A program consisting of denials not only could create severe political resentments, but also could be the cause of dangerous discrimination among similar countries.

AND DEFENSE REVIEW

The U.S. position on the transfer of nuclear technology does in fact represent a continuing source of irritation between the United States and all recipients of such technology. Many developing countries believe that the U.S. position is arbitrary and gives the impression that the country does not want to share its technology.

It would be appropriate here when considering denial and restraint to recall what President Carter said with regard to the Soviet-American strategic arms pact in his August 1979 speech to the American Newspaper Publishers Association. He warned that it was a delusion to believe that rejection of the Strategic Arms Limitation Talks (SALT II) treaty would lead the Russians to exercise restraint. The effect, he said, might be just the opposite because the most intransigent and hostile elements in the Soviet Union could be encouraged and strengthened.²

One can see different attitudes in U.S. nuclear export policy. Let us look at some examples illustrating the so-called Atherton idea of flexibility in cooperative U.S. agreements on nuclear development. India detonated an atomic device in May 1974, but the American government apparently believed up to that point that India had no usable nuclear bombs. Even though India had diverted materials from civilian programs to explode a plutonium device, the United States did not subsequently cut off any economic aid to the country. Furthermore, as noted below, India is currently receiving slightly enriched uranium to fuel the atomic power station near Bombay.

The U.S. Congress later passed the Nuclear Non-proliferation Act of 1978. This act required that, by 1980, all recipients of American nuclear fuel were to open their installations to full-scope international inspection. Prime Minister Desai objected to this requirement. He did so not only on the grounds that it offended India's sovereignty but also because the major powers had not yet agreed to reduce their own nuclear arsenals and to stop testing nuclear devices. On March 23, 1979, the U.S. Nuclear Regulatory Commission nevertheless voted to approve the export of 18.5 tons of slightly enriched uranium to fuel the Bombay power plant. Two members of the commission said that the export proposal failed to meet the standards for

² Transcript of President Carter's address to the Newspaper Publishers Association, *New York Times*, April 26, 1979.

U.S. NUCLEAR EXPORT POLICY

approvals set forth in the Atomic Energy Act.³ The Nuclear Regulatory Commission had in fact come close to cancelling fuel shipments to India on two earlier occasions, but the White House kept pressing for more deliveries. The Carter administration also argued that this particular shipment was not only consistent with the law but also essential to the continuation of the United States-India dialogue on nuclear cooperation and safeguards.

In stark contrast, the other side of the Atherton idea of flexibility can be seen in the recent Pakistan case. The United States collected information showing that Pakistan had been buying pieces of equipment for a uranium-enrichment plant. The administration is said to have sought to avert a cutoff of aid to Pakistan by asking that the facility in question be placed under full-scope international inspection safeguards. When the Pakistanis refused this request, the United States ignored the Indian precedent and privately informed the Pakistani government that it was moving to terminate economic and military aid.⁴ The attempt to keep the action quiet appears to reflect the feeling of some American officials that current policy is likely to be counterproductive. Pakistan finally proposed that South Asia become a zone free of nuclear arms, inviting a choice between possession of nuclear weapons by both India and Pakistan, or a nonnuclear status for each country.

Technological Discrimination

Argentina's own nonproliferation policy illustrates another concern about the U.S. position. Argentina is a peaceful country. By historical inclination and by constitutional precept, it favors negotiated solutions for international conflicts. The main concern of the nation is to provide for integrated and harmonious economic and social development in cooperation with those other nations to which Argentina lends its solidarity and from which it expects the same treatment.

With one exception, Argentina has signed all the international agreements directly or indirectly connected with the question of the proliferation of

nuclear weapons. The exception is the 1968 Treaty on the Nonproliferation of Nuclear Weapons (NPW) because of its discriminatory character. The NPW serves to legitimize a distribution of power that is unacceptable because it seeks to perpetuate the nuclear technology of each nation at the date of signature. Although this stratification tightly restricts the countries without nuclear weapons, it erects no barrier to the vertical proliferation of nuclear arms in those countries that possess them.

The true mission of nonproliferation is to ban the spread of nuclear weapons, not to stop the dissemination of nuclear technology for the benefit of mankind. Given adequate controls, access to the technology for the peaceful uses of nuclear energy by any country (whether or not it possesses nuclear weapons) should not be subjected to discriminatory restrictions.

Dealing with U.S. Policy

Argentina and Brazil have the most advanced and sophisticated civil nuclear energy programs in Latin America. Both countries have been opposing international measures that would limit research and development for the peaceful use of atomic energy.

In November 1977, Secretary of State Cyrus Vance visited Argentina and Brazil and exchanged views on important issues in the nuclear field. In Buenos Aires, there was a wide-ranging discussion of three themes: first, the evolution of international cooperation on the solution of existing problems about the transfer of nuclear technology; second, the advance of the peaceful uses of nuclear energy; and, third, the shared interest in measures to prevent all forms of proliferation of nuclear weapons.

In their joint communiqué of November 21, 1977, the American and the Argentine governments expressed their interest in increasing existing cooperation and in enlarging the scope of their previous agreement of June 25, 1969, to include relevant technology and ways of meeting Argentina's needs for heavy water. The communiqué also dealt with the provision of fuel to be used in the research reactors that Argentina had proposed to export to Peru, thus recognizing Argentina's potential as a significant nuclear supplier on the same basis as other suppliers.

At the end of his visit to Buenos Aires, Secretary Vance went to Brasilia to discuss the execution of

³ Thomas O'Toole, "Nuclear Regulatory Commission Alters Stand on Atomic Fuel to India; Votes 3-2 to Export Enriched Uranium," *New York Times*, March 24, 1979.

⁴ Richard Burt, "U.S. Aid to Pakistan Cut after Evidence of Atom Arms Plan," *New York Times*, April 7, 1979.

the Brazilian nuclear program. Brazil has purchased several nuclear reactors and plants from West Germany to enrich and reprocess nuclear fuels in an arrangement worth billions of dollars. At that time, the press speculated on the possibility that if the Brazilian government continued its plans to build a nuclear reprocessing plant, it ran the risk of triggering a nuclear arms race with Argentina. According to one press account, the message Vance brought from Buenos Aires was that if Brazil would renounce reprocessing Argentina would do the same.⁵

The negotiations on nuclear matters between the United States and Argentina are still on the table. As has been noted, in 1978 the U.S. Congress approved the Nuclear Nonproliferation Act; Section 305 states that the government of the United States

⁵ See Karen DeYoung, "Brazil Adamant on Nuclear Policy," *Washington Post*, December 7, 1977. In the article a senior Brazilian Foreign Ministry official was reported to remark that Vance "probably said the same thing to Argentina."

reserves the right to export, or not to export, either sensitive nuclear materials or any special nuclear material produced through the use of such material or sensitive technology. In making that reservation, the United States is in effect proposing an amendment to the agreement for cooperation between it and Argentina concerning civil uses of atomic energy—an amendment which actually includes more stringent transfer conditions. Today Argentina is in fact working with West Germany and Switzerland to acquire technology for a complete nuclear fuel cycle agreement.

Conclusion

As the Brazilian and Argentinian cases have demonstrated, the countries that wish to produce their own nuclear fuels have other objectives beyond the weapons potential. They do not wish to depend on other nations or on still imaginary agencies for their energy supplies, and they see energy independence as a vital symbol of modernization.

Transfer of Technology and the Fuel Cycle

Dalmau Costa

MEXICO's recent findings of substantial reserves of oil and natural gas have not diminished the importance of developing alternative sources of energy for that nation. On the contrary: the ready availability of vast quantities of hydrocarbons adds a sense of urgency to the need for expanding supplementary energy programs, from both conventional and nonconventional sources, in order to

meet the requirements that will be generated in the immediate future and, obviously, in the long run. There are three main reasons to support this sense of urgency.

Three Reasons for Urgency

First, on the one hand, the demand for electricity has been increasingly pressing in Mexico in view of the country's spectacular population growth: from 20 million people in 1940 to 56 million in 1970; then on to the 70 million or more estimated for 1980; with the forecast for the year 2000 at over

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U.S. NUCLEAR EXPORT POLICY

100 million, depending on the results of current efforts to slow down the trend. In spite of the population explosion, however, the political stability that has characterized Mexico for more than fifty years—a rare case among developing countries—has created the necessary conditions for a rapid pace of economic growth (an annual average, with few exceptions, of over 6 percent for more than three decades) and an intense process of industrialization since the mid-1940s. Industrialization and the population explosion have thus prompted in turn the process of urbanization. The outcome will depend, to a considerable degree, on Mexico's ability to meet the corresponding energy needs.

Second, on the other hand, if one is to assume that oil and gas will serve not only to overcome Mexico's current economic crisis—the internal reasons of which seem circumstantial, the external being more profound—but also to open new perspectives and trigger the country's capacity to develop further and faster, it is obvious that the industrial and municipal requirements for electricity will become even more pressing in the immediate future. A reliance placed solely on hydrocarbons in order to meet an increasing energy demand would not only be unrealistic in the long run, but foolish as well. This is because Mexico's oil and gas resources, no matter how vast, should not be depleted by utilizing them exclusively as fuel. Hydrocarbons, the reserves of which are limited and nonrenewable, will be too precious in the coming decades as raw materials for domestic industrial expansion.

Third and finally, although present conditions have forced Mexico to tap its oil and gas resources at well above the level that is required to meet its own domestic consumption, it is expected that once the crisis is overcome and financial stability is ensured, the country will follow a more rational policy in the use of such resources. The urgency of developing, as of today, other sources of energy is once again demonstrated.

Since Mexico's reserves of uranium are perhaps substantial,¹ it is only logical to contemplate nuclear energy as the most advisable of all alternative solutions to supplement hydroelectric and thermo-

electric power.² The development of a meaningful nucleoelectric program has, however, been dependent on external relationships and, to a certain extent, will remain so in the future. The remainder of this essay is therefore organized around three themes: dependence on external relationships; technological dependence and the fuel cycle; and the transfer of technology.

Dependence on External Relationships

As in most countries—and particularly in the developing countries—the feasibility of nuclear activities in Mexico has been limited by a triple combination of external factors: political dependence; financial dependence; and technological dependence.

Political Dependence. As far as political dependence is concerned, nuclear development in states as yet without nuclear weapons has encountered strict restrictions stemming from the general concern to prevent the so-called horizontal spread of such weapons. Mexico, like many other countries that are now initiating their nuclear activities, has spontaneously accepted such limitations. It has in fact been an outstanding promoter of nonproliferation measures—but only insofar as they actually serve to prevent the manufacture or acquisition of nuclear weapons.

In voluntarily renouncing any military use of nuclear energy,³ Mexico has by no means denied itself pursuit of the nuclear option for peaceful purposes. When the 1968 Treaty on the Non-proliferation of Nuclear Weapons (NPT) was concluded, nonproliferation was understood as the *nonacquisition and nonmanufacture of such weap-*

² Mexico is in fact exploring all alternatives: coal is available, but the implications of its wider use are considerable because of the investment required and the need for the prevention of ecological damage. Geothermal energy is beginning to be utilized, but its availability is limited to certain areas. Solar technology is at the experimental level only, and serious doubts exist as to the actual possibility of deriving quantities of energy on an industrial scale from this source.

³ Expressing its pacifist vocation, Mexico is the only country in Latin America that has formally adhered to all international instruments in the context of disarmament and was the first in the world to submit all its nuclear activities—present and future—to International Atomic Energy Agency (IAEA) safeguards.

¹ According to official estimates, proven reserves of uranium (U_3O_8) in 1978 amounted to approximately 9,000 metric tons *in situ*, but potential reserves could vary from 200 to 600 thousand tons.

ons or any nuclear explosive device. More recently, however, the nuclear powers have widened the concept in such a manner that nonproliferation, if their interpretation is to be accepted, would mean *nonacquisition of the capability*—the mere capacity—to even develop any element that could eventually lend itself to the manufacture of weapons. Such a distortion apparently is shared by all nuclear supplying countries (the so-called Club of London or London Suppliers Club).⁴ If it were translated into specific measures, it would lead to a situation whereby the most industrialized countries, besides holding a monopoly on the manufacture of nuclear weapons, would also consolidate a commercial monopoly on the supply of nuclear elements for peaceful uses.

International relations generally, and international cooperation specifically, cannot be based on generalized distrust and the curtailment of essential facilities for the development of nonindustrialized countries.⁵ Like other countries which are simply initiating nuclear activities, Mexico has had to overcome considerable and varied difficulties, notably with respect to the supply of fuel required for the operation of its first nucleoelectric project. The initial load of enriched uranium for its twin-reactor plant in Laguna Verde, Veracruz, could not in fact be obtained from Canada in 1976. This was a result of the set of measures of direct control over the material imposed by the Canadian authorities, and which was presented as a prerequisite to supplying the load. In 1977, an agreement for the provision of enrichment services was entered into with the United States under the auspices of the International Atomic Energy Agency (IAEA); in 1978, however, upon the promulgation of the U.S. Non-

proliferation Act, the delivery of that material was held up, and it was not until February 1979 that the corresponding export license was finally issued. The argument supporting such a delay in delivery was that Mexico should accept a series of stringent measures taken by the U.S. authorities on the basis of the new legislation. These measures included the direct inspection of the Laguna Verde plant. Retroactive enforcement of a law can in itself be subject, to say the least, to several interpretations. In addition, the withholding of nuclear fuel which was to be delivered on the basis of precise terms formally agreed upon by both countries is a rather unorthodox way of handling business.

The imposition of unilateral measures of supervision and control, which go beyond the well-established safeguards system of the IAEA, is an unnecessary pressure on recipient countries. The pressure becomes particularly irritating in the case of Mexico, a country that has clearly and beyond any shadow of doubt renounced all military uses of nuclear energy. Military uses of nuclear energy are in fact formally and legally forbidden in Mexico at the internal level as well as by virtue of regional undertakings and a world commitment.⁶

It is nevertheless evident that if the nuclear supplying countries are to adhere to the "Guidelines for the Export of Nuclear Material, Equipment, or Technology" transmitted in January 1978 to the director general of the IAEA, countries in a position similar to that of Mexico will have to go their own way to ensure access to nuclear elements to develop their national programs. It would indeed be paradoxical if a group of countries, proclaiming their intention to strengthen international controls to assure the nonproliferation of nuclear weapons,

⁴ See the "Guidelines for the Export of Nuclear Material, Equipment, or Technology" subscribed to in 1978 by the United States, the Soviet Union, and fourteen other countries, and reproduced in *Nuclear Power and Nuclear Weapons Proliferation*, Report of the Atlantic Council's Nuclear Fuels Policy Working Group, The Atlantic Council Policy Papers, vol. 2, Appendix D (Boulder, Colo.: Westview Press, 1978).

⁵ An interesting analysis of the consequences of distrust among states in relation to nuclear energy can be found in Bertrand Goldschmidt and Myron B. Kratzer, *Peaceful Nuclear Relations: A Study of the Creation and Erosion of Confidence* (New York and London: The Rockefeller Foundation and The Royal Institute of International Affairs for The International Consultative Group on Nuclear Energy, 1978).

⁶ Article 27, paragraph VII of the Mexican constitution expressly forbids all military uses of nuclear energy. The Treaty for the Prohibition of Nuclear Weapons in Latin America (the Treaty of Tlatelolco)—to which Mexico is not only a party but which was negotiated mostly on the basis of Mexican efforts—and the NPT itself are two expressions at the international level of Mexico's definite decision to utilize nuclear energy exclusively for peaceful and civil purposes. The full implications of Mexico's adherence—and that of other Latin American countries—to military denuclearization can be found in A. Gonzáles de León, *La renuncia al uso de la fuerza, la proscripción de las armas nucleares por zonas y el Tratado de Tlatelolco* (Mexico: Publicaciones del OPANAL, Serie Estudios y Monografías, no. 2, 1976).

U.S. NUCLEAR EXPORT POLICY

were to end up promoting that same proliferation.⁷ If India, for example, had had easier access to the benefits of all peaceful uses of nuclear energy, that country would doubtless not have turned to the indigenous development and manufacture of an explosive device. Similarly, Brazil's course of action might have been different if nuclear supplying countries had been more reasonable with respect to the development of that country's nuclear program.

In any event, it remains obvious that if a country has the will to "go nuclear" in the military sense, there is no way in which the states possessing nuclear weapons can prevent it, even if they were to become—as they sometimes seem to desire—the "nuclear policemen" of the world. As has been suggested, mutual trust is a precondition for mutual cooperation, and mutual cooperation for the benefit of all is, in turn, a precondition for a lasting peace. Measures of greater and greater stringency, however, seem to be in the offing in the nuclear field. Developing countries have a right to interpret this development as an attempt to maintain not only the nuclear *military* monopoly, but also a nuclear *commercial* monopoly.

One additional source of concern is the fact that the most advanced countries in the nuclear field, in spite of their pronouncements to the contrary, have not given international organizations—the IAEA in particular—sufficient support. That support is necessary if such organizations, acting as true representatives of the world community, are not only to operate as the legitimate channels for nuclear cooperation but also to undertake the main responsibility for the nonproliferation of nuclear weapons. In maintaining the capacity to foster the development of nuclear energy for peaceful purposes at the lowest level, the nuclear supplying countries, and notably the states possessing nuclear weapons, have forced recipient countries to deal directly with them, thus relying on particular circumstances and capricious considerations.

Financial Dependence. From the viewpoint of financial dependence, there have been dramatic restrictions on the availability of funds for the development of nuclear activities. This has been the case

not only bilaterally but also through multilateral mechanisms such as the World Bank and regional institutions. Whenever financial resources for nuclear development have been available to developing countries, they have been attached to the purchase of equipment, materials, and technology from the providing powers. The commercial competition established among providers has, furthermore, caused confusion and contradictions in the recipient countries. Finally, it should be noted that rivalry among the giant transnational corporations that dominate the market, and the competitive race that it generates, has cost the developing countries dearly. They find themselves in constant doubt as to whether they have opted for a certain alternative on its own merits or because of the financial attractiveness of the accompanying proposals.

For Mexico, as for many other countries, the availability of financial resources to initiate nuclear activities while retaining a capacity for free choice has been a very remote possibility until recently. Fortunately, the external financial dependence of this country will to a certain degree diminish because of the substantial oil revenues that are expected to accrue from exports. This expectation is particularly attractive from the nuclear point of view, since, as already noted, the expansion of the oil industry is logically bound to foster the development of alternative sources of energy. Should this perspective prove to be sound, in the relatively near future Mexico will, at least financially—which means a lot—be free to choose among the different options for its nuclear advancement.

Technological Dependence. The same conclusion, unfortunately, cannot be drawn with respect to Mexico's external technological dependence. In this area, it will take a long time for the country to free itself from the limitations which now exist. Here, too, highly industrialized nations have invoked motives of nonproliferation to prevent the transfer of nuclear technology in more respects than would seem necessary. Access to the most advanced technology has been almost impossible in the past and, in the light of the attitudes reflected in the guidelines of the "Club of London," more flexibility cannot be expected in the future. The limitations imposed on technology, once again, reflect not only political considerations but also commercial interests.

⁷ This possibility is explored at length by David J. Rose and Richard K. Lester in "Nuclear Energy, Nuclear Weapons, and International Stability," *Scientific American*, February 1978.

As is the case in many other fields, it is almost impossible for a country like Mexico to obtain access to the appropriate knowledge that would enable it to undertake all stages of nuclear development by itself. This is because of the commercial interests which have led to a true monopoly of that technical knowledge being concentrated in the hands of a few countries and a few corporations.⁸ Quite apart from the fact that this situation preserves the privileged position enjoyed by those countries and those corporations, additional reasons are invoked in the specific case of certain stages of the nuclear fuel cycle to restrict the spread of the corresponding technologies. The enrichment of uranium, the reprocessing of spent fuel, and the manufacture of heavy water—to say nothing of plutonium technology—are in effect considered critical processes since they represent the means to acquire the capability to develop components for the manufacture of nuclear weapons.

Technological Dependence and the Fuel Cycle

To take a concrete example, Mexico, like many other countries, is technologically dependent on external sources in almost all stages of the fuel cycle. It is true that with respect to the prospecting for, and exploration of, radioactive minerals, Mexico can continue to develop programs based on the technology which it already controls. The same programs would, however, be considerably facilitated if the country were to have access to the latest developments in the most advanced countries. As far as the mining aspect of the extraction of these minerals is concerned, systems that would eventually increase efficiency are perhaps all that Mexico could obtain from abroad.

Dependence on technologies which Mexico does not possess is much clearer in the subsequent stages of the fuel cycle: the processing⁹ of radioactive

minerals and the refining and conversion¹⁰ of ores. If it were to opt for the development of nucleoelectric projects based on the use of natural uranium in a heavy water reactor (HWR)—and many recommend this option in view of the availability of natural uranium in the country—Mexico would nevertheless depend on foreign technology with respect to the manufacture or purchase of heavy water.¹¹

If, on the other hand, Mexico persists in developing its nucleoelectric program on the basis of enriched uranium in a light water reactor (LWR)—its first project in Laguna Verde includes two boiling-water reactors (BWRs)—it will obviously depend on resources from abroad for enrichment.¹²

As far as the manufacture of fuel elements (including uranium dioxide [UO₂], zirconium, and zircaloy tubes) is concerned, Mexico is dependent on foreign sources both for the technical alternative based on natural uranium and for the one employing enriched uranium. In case of the former, its dependence for the time being is on a single source, Canada; for the latter, although the external sources are more varied,¹³ dependence on those sources persists.

Nuclear fuels are, of course, consumed in reactors. The design, construction, and operation of these, as has been noted, also depend on an imported technology supplied from a variety of sources. In this instance, however, there is less dependence on a

¹⁰ As far as refining and conversion is concerned, Mexico can also manage a good part of the required technology, but it would need to have access to supplementary elements which are available in Canada, France, the United Kingdom, the Soviet Union, and the United States.

¹¹ As long as the development of other systems is not completed, technology for the manufacture of heavy water can only be obtained from Canada, though perhaps in a not too distant future it may become available in Argentina, India, and the Soviet Union.

¹² The enrichment service can at present only be obtained in France, the Soviet Union, and the United States. In the near future, however, it will become available through multinational corporations such as EURODIF and URENCO and, eventually, through COREDIF (in which Mexico may well have a share).

¹³ In the case of boiling-water reactors (BWRs) like the ones being installed in Laguna Verde, the appropriate services are now only available in West Germany, Sweden, or the United States. If pressurized-water reactors (PWRs) were being used, services from West Germany, France, the Soviet Union, or the United States would be indispensable (perhaps supplemented, a little later, by those from Italy or Spain).

⁸ A most relevant study in this context is Aant Elzinga's *New Forms of Technological Dependence—The Case of Nuclear Power*, paper presented at the workshop on "Technological Dependence—A Major Hindrance for Autonomous Development," Bonn, West Germany, November 2–5, 1978.

⁹ Mexico can manage an adequate technology for the initial processing of uranium. Additional assistance from France, Italy, Japan, Spain, the United Kingdom, or the United States, would, however, be highly beneficial.

U.S. NUCLEAR EXPORT POLICY

single source.¹⁴ In addition, it is foreseeable that countries like Mexico may gain more autonomy in the short run if they choose to develop their own techniques in this area. After all, the design, construction, and operation of reactors are the monopoly of no one. The same conclusion can be drawn with respect to the handling and storage (temporary and permanent) of spent fuel, as well as the manufacture of components for the nucleoelectric industry.

The situation is, however, quite different with regard to the reprocessing of spent fuel and the disposal of radioactive wastes. In the former instance, the subordination of countries like Mexico to external sources for reprocessing is even more pronounced than in the case of enrichment. In the case of waste disposal, it must be noted that even the most advanced countries are confronting unsolved technical problems.

Transfer of Technology

The lack of an adequate technology for the development of resources other than oil and gas is the fundamental problem facing Mexico in the energy field. Even with vast reserves of hydrocarbons it is not advisable to base an integral scheme of development for the medium and long term on a source which is limited and nonrenewable. Energy is not generally usable without the transformation of energy resources. As the development of each type of energy poses different scientific and technological problems, possession alone does not suffice. There must be full utilization at all stages.

The world community has long understood this concept, and the need to facilitate access to the necessary technologies has been repeatedly asserted in most international forums. The United Nations Conference on Trade and Development (UNCTAD), for example, adopted its "Guidelines to Less-Developed Countries and Developed Countries" in February 1976.¹⁵ These stated that the developed

nations should be more active in guiding the policies of transnational corporations and encouraging the public sector enterprises to assist developing nations in obtaining access to the most advanced technologies. In Resolution 98 (IV) of May 1976, UNCTAD itself insisted on such a policy, and the secretary general of the United Nations endorsed the same view in a "Report on the Establishment of a Network for the Exchange of Technological Information."¹⁶

The United Nations Economic Commission for Latin America (ECLA) followed the same approach in 1977 and in fact went further in proposing a revision of the Paris Convention for the Protection of Intellectual Property in order to facilitate the access by developing countries to patents vital for their development needs.¹⁷ It is important to point out that the definition by UNCTAD of the concept of technology transfer refers to "transfer of production, management, and marketing technologies," and thus avoids limiting the transactions involved to the sale of goods, as has been mostly the case until recently.¹⁸

There is, therefore, a growing international awareness of the need to facilitate the access by developing countries to modern technology in all fields. If this is the case in general terms, then the importance and urgency of such access in the nuclear field is particularly relevant in view of the increasing demand of energy both in those countries and in the world as a whole.

Precisely such a realization underlies the philosophy behind the New International Economic Order, which in turn permeates the Charter of Economic Rights and Duties of States as well as the Program

¹⁶ Document E/5839, June 1976.

¹⁷ Document E/ECLA/1030/PEV.1 77-5-1064, 1977.

¹⁸ Also relevant in this connection are the June 1976 declaration of the Organization for Economic Cooperation and Development (OECD) on international investment and multilateral enterprises, and the conclusions of the August 1977 conference on International Economic Cooperation: The North-South Dialogue. The participants in the latter meeting agreed that the Paris Convention for the Protection of Intellectual Property should be revised within the framework of the World Intellectual Property Organization (WIPO) to take fully into account the interests of developing countries. This would be done in order to strengthen the ability of those countries to select, adapt, develop, and apply technology—including its institutional aspects and training—as well as to promote their export of technology.

¹⁴ In effect, reprocessing services can only be presently obtained in West Germany, France, the United Kingdom, and the United States, though perhaps in the future they will become available through EURODIF or EURENCO.

¹⁵ See H. Frewer and W. Altvater, "Technology Transfer by Industry for the Construction of Nuclear Power Plants," *Annals of Nuclear Energy* [London], vol. 4 (1977). See also Chong K. Lew and Donald L. Conchman, "Transfer of Nuclear Power Technology: A Practical Approach."

of Action for the establishment of such an order—both measures having been adopted by an overwhelming majority of states in 1974.

Conclusion

The prevention of the proliferation of nuclear weapons and all means of mass destruction has been—and continues to be—one of the most laudable efforts of the world community. No one can deny that, since 1945, the very existence of such instruments of extermination has posed perhaps the most serious threat to the survival of mankind. Proliferation, therefore, must be stopped not only by preventing an increase in the number of countries possessing nuclear weapons, but also by avoiding a senseless growth in that kind of arsenal where it already exists.

Furthermore, the world community must strive not only for the reduction of existing nuclear arsenals, but also for their suppression. The only voices raised in disagreement are those of believers in the pursuit of a power policy that would not stop even before a holocaust, those of mistaken believers in the prestige of unlimited military power, or those of the merchants of war.

An endeavor to prevent the proliferation of nuclear weapons—one in which we all share—is, how-

ever, quite different from the use of that policy to prevent the flow of technology for the benefit of all. The efforts of states possessing nuclear weapons should be addressed to the elimination of the threat posed by nuclear weapons, not to the prevention of the spread of the proven benefits of nuclear energy in its peaceful uses. The nuclear powers themselves took the initiative to establish international machinery to this end: the best they can do now is to ensure its effectiveness by lending it not only their moral support, but also by providing it with the material means to fulfill the task for which it was created.

The IAEA offers the appropriate means to channel a serious effort in that direction on a worldwide basis. In this hemisphere, there already exists an additional assurance for the safety of development of nuclear energy: the Agency for the Prohibition of Nuclear Weapons in Latin America (OPANAL). The use of both agencies to their fullest capacity would be in keeping with the international approach that inspired the states possessing nuclear weapons, from the "Atoms for Peace" proposal of 1953 to the NPT of 1968. Somehow, this approach has to be revived and made effective in both its expressions: the provision of safeguards *and* the transfer of technology.

Continental Interdependence, Energy, and Integration in the Americas

Alejandro Orfila

WHEN the countries of the Americas began their long journey together as equal partners in this region, they were setting out onto uncharted ground. But nearly ninety years of experience under the

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world's oldest regional international system indicates that the members of the Organization of American States (OAS) can find solutions to the dilemmas that divide them and at times disturb them deeply. The regional principles and the regional system are sound. As evidenced by the actions taken over Nicaragua by the Seventeenth

U.S. NUCLEAR EXPORT POLICY

Meeting of Consultation of Foreign Ministers of the OAS in June 1979 the alliance plays an essential, if continuously changing, role in securing the well-being of the American family of nations.

If the basic regional principles and system are sound, changing times and conditions nevertheless require that they be updated and modernized. Generally, this process of updating takes place on a recurrent and almost unnoticed basis. We have forged a system of working together in this region whereby issues and problems are quietly and adequately approached or resolved—challenges which in other regions would lead to severe international disharmony. This is the central point to be kept in mind: the basic strength and flexibility which is built into our regional system and institutions.

We have learned, though, that from time to time the American region must find ways not merely to make regular and gradual changes and adaptations in the regional relationship, but also to overhaul and then to realize certain of its key objectives and its contributions. If this does not happen, the relationship deteriorates, the OAS member countries become dissatisfied with their regional common cause, and conflict, rather than cooperation, tends to mark the regional system.

During the twentieth century the American nations confronted two critical situations where the regional relationship was eventually revised and strengthened following a concerted regional effort to deal with severe problems which were deeply troubling to both Latin America and the United States. These situations were, first, Latin America's rejection of the patterns of U.S. intervention in the earlier part of the century and, second, its postwar concern that the United States was generally ignoring the trading, financial, and development needs of its immediate neighbors as it assumed worldwide responsibilities after 1945.

In both these instances Latin American concerns, when linked to eventual U.S. recognition that its own security, well-being, and global interests were deeply bound to those of the Western Hemisphere, led to basic transformations in the regional system. In the first case, the principles of nonintervention and the juridical equality of all regional nations, large or small, were integrated into the OAS Charter, which was adopted in 1948. In the second instance, the Alliance for Progress was agreed upon

in the 1960s to propel the regional relationship forward.

In effect, in both critical periods a "regional gain" was struck. Essentially, this bargain consisted of a mutual recognition and acceptance by both Latin America and the United States that unless they could place their own regional house in order first, their regional system would not serve, as it should and must, as a basic foundation for world peace, order, and prosperity. In other words, by forging a common regional policy to respond to common regional concerns, the OAS members were not isolating themselves from the dilemmas confronting the world community of nations. On the contrary, they were making it possible for their regional system to more effectively support the cause of world peace and justice.

It is my conviction that the American nations—at least since the waning of the Alliance for Progress—have been searching for a new realignment in their relationship to promote more effective cooperation for development in the region. Events of the past decade have made this objective both essential and realizable.

Latin American Energy and Interdependence: An Overview

At present, perhaps for the first time in their history, Latin America and the United States are confronting each other as equals. The growing economic strength of Latin America, its newly discovered vast energy resources, and its successful international diplomacy have largely brought about this turn of events.

Interest by the United States in hemispheric energy matters, however, has for several years primarily emphasized concern for limiting the proliferation of nuclear weapons, a concern equally shared by Latin American nations. Yet a policy of non-proliferation is no substitute for formulating a common regional policy for energy production and development, a policy currently conspicuous by its absence.

The U.S. Energy Situation. Perhaps the United States is at present unable to reflect seriously on the need for such a common regional policy, since it confronts a different energy situation than do Latin America. The United States has vast proven

and accessible reserves of coal, a comprehensive transportation network, and the technical capacity to use this fuel either in utility boilers or through gasification and liquefaction, even though both of the last-named techniques are at present costly forms of using coal. The synfuel industry could expand rapidly in that nation. The United States also possesses the technology, the capital resources, and the trained manpower to achieve a rapid and safe increase in the use of nuclear energy for its domestic economy, should existing constraints on this fuel source be reduced.

While the postwar period of cheap energy as a foundation for economic growth has ended, the United States has demonstrated that it could absorb both the post-1973 sixfold increase in energy prices and also the importation of half of its oil supplies, without undermining national economic growth, at least in the short run. There apparently also exist extensive opportunities for improving the U.S. energy conservation potential.

The Latin American Prospects. The energy outlook for Latin America, on the other hand, differs considerably. Its opportunities for energy conservation seem more limited since its commercial energy is consumed more for industrial production than for wasteful or unnecessary purposes. The region's coal resources, moreover, have traditionally been considered quite small; frequently, they are also inaccessible and would require enormous transportation investments for their effective use. Nuclear power capabilities to fuel national development exist only in several large countries, while current large-scale nuclear plants are hardly adaptable to most of the smaller Latin American and Caribbean countries.

Large amounts of oil may remain undiscovered in Latin America, but only a few nations in the region—Bolivia, Colombia, Ecuador, Mexico, Trinidad and Tobago, and Venezuela—possess sufficient oil supplies to make them generally self-sufficient in energy, although several other countries may be moving in this direction. Almost *half* of the hemisphere's countries must import *all* of their oil supplies, making the region the most oil-dependent area in the world.

Hydroelectric power is playing an increasing role in the region—the new Itaipu dam between Paraguay and Brazil is the largest in the world—but

there are signs that this energy source, despite its apparent potential, is actually quite limited.

However one examines this picture, it portrays a fairly negative outlook for Latin America's energy situation in the immediate future. Yet the region's high economic growth rate and rapid industrialization have led to a greater rate of energy consumption than in any other world region during most of the past twenty years.

Latin America therefore will require immense new energy sources to meet its development needs. Not even the most optimistic of experts suggests that alternative energy sources would provide other than a small fraction of these fuel sources by the year 2000, with many observers believing that energy sources such as solar power will become more readily available in the already industrialized nations prior to their widespread use in developing countries.

National Disparities: Some Case Studies

The energy conditions in, and potential for, the various Latin American and Caribbean nations vary from country to country. It is these differences which have induced the separate countries to adopt diverse energy policies for conservation and production. What does an overview of the energy outlook for several individual nations indicate?

Brazil. The largest nation in the Western Hemisphere, Brazil is heavily dependent on oil and imports more than 80 percent of its needs. With its enormous development programs and rapid growth rates over the last two decades, Brazil has had no choice but to accelerate the formation of national energy policies. In brief, these have consisted of promoting energy conservation, stepping up its hydroelectric and nuclear power programs, and turning heavily towards use of sugar-based gasohol as a substitute for gasoline.

What have been the results of this strategy? In April 1979, in *Américas*, the former minister of Mines and Energy of Brazil, Shigeaki Ueki, spelled out some of the policy choices and their consequences.¹ In the face of its almost overwhelming energy needs and the world oil crisis of the past six years, Brazil, according to Dr. Ueki, adopted the

¹ Shigeaki Ueki, "Brasil and the Crisis of Petroleum," *Américas*, April 1979, p. 3.

U.S. NUCLEAR EXPORT POLICY

following principal elements of a national energy policy:

[It] sought to devise a selective pricing formula based on the established need for each petroleum product. Thus the price of gasoline, which is used mostly for individual transportation and is consumed by people in the upper middle income brackets, was raised through a tax increase. The additional revenue is being used to improve mass transportation systems, in particular those that utilize other sources of energy such as hydroelectric power.

Under this policy gasoline consumption in Brazil in 1978 was practically the same as it had been in 1973, despite the fact that the nation's fleet of gasoline-powered vehicles had grown by nearly 50 percent in the five-year period. These figures are the best answer to the theoreticians who claim that there is no elasticity of price and demand in the case of gasoline. . . .

Brazil's second primary source of energy is hydroelectric power, for which there is a potential of 150,000 megawatts (mw), equivalent to between 5 and 6 million barrels of oil a day. During the crisis the construction of new hydroelectric plants, which already had priority, was given even greater emphasis.

Today the country's installed capacity is 25,000 mw, and with the incentives offered to those industries that make intensive use of electric energy Brazil will be relying more each year on that source. Since the crisis, its utilization has increased by an average of 13 percent a year, and at present daily consumption is equivalent to 600,000 barrels of oil.

Construction is currently under way to provide an additional installed capacity of 40,000 mw for meeting future needs. . . .

Also, as part of the same policy, we have developed a nuclear program that seeks, in its first phase, to complement the hydroelectric system. In order to enhance the system's reliability, it is essential to have a certain thermal generating capacity. Moreover, in the southeastern region of the country we will be building the last of the hydroelectric plants.

This program is not overly ambitious; it is perfectly compatible with the stage of technical and industrial development that we are currently in. True, there is a fervid debate going on about nuclear energy, but we are using the arms of realism to contend with it. . . .

The search for coal has been greatly stepped up, and our national reserve has been increased sevenfold, from 3 to 20 billion tons, and exploration continues. The first mechanized coal mines have begun production. We are endeavoring to substitute coal for oil wherever possible; it is not an easy task, but we have already achieved some promising results. . . .

Bearing in mind the vast area of Brazil and the country's strong agroindustrial base in sugar cane, we have undertaken a program to produce alcohol for use in place of petroleum products in the chemical industry and in internal combustion engines.²

Subsequently, the new government of President João Figueiredo set the following goals:

- substantially increase domestic oil production (known reserves allow domestic production to be estimated at 500,000 barrels a day by 1985)
- expand Petrobras's prospecting and research activities; and widen the areas to be explored under venture contract with foreign companies
- expand the National Alcohol Program so as to reach an output of 10.7 billion liters by 1985, or the equivalent of 170,000 barrels of oil a day
- encourage the use of coal as a substitute for naphtha in the production of gas and for fuel oil in high consumption industries
- promote the use of alcohol as a partial substitute for gasoline and naphtha and the combination of the two last-named with fuel oil in a 1:5 blend nationwide
- check fuel consumption through rationing or rationalized use
- create a National Energy Commission to perform as an interministerial agency directly under the president, and thereby to strengthen national fuel policies.

Jamaica. In a variety of ways, Jamaica is fairly representative of the smaller non-oil exporting nations of Latin America and the Caribbean. This is principally because it must import the bulk of its commercial energy in the form of oil and petroleum products. Like most developing nations in the post-war period, Jamaica embarked on a path toward industrialization based on the ready availability of cheap energy. Given the new international energy

² Ibid., p. 5.

system created over the past few years, Jamaica, like many smaller nations lacking oil, has been pressed, according to studies made by the OAS, to divert much of its foreign exchange earnings to cover the cost of oil imports, a process which restrains the forces of development.³

Compared with a 1975 increase in the world average of per capita commercial energy consumption of 9.3 percent, Jamaica averaged an 8.4 percent increase, a figure which, however, was considerably higher than the 1.8 percent estimate for the developing world as a whole. This Caribbean OAS member state is generally ranked on the basis of per capita income and related statistics as among the world's middle level or transitional societies.

Estimates have been made that under a variety of projections the country's energy demand by 1982 could vary from a low of 20.4 million barrels of fuel oil equivalent to a high of 22.6 million barrels. With the oil price increases of 1979—and perhaps beyond—it is impossible to forecast the costs for meeting these energy demands, but under any foreseeable conditions they are bound to be on a rising curve. Under the best of circumstances, moreover, according to a UN report, "the foreign exchange needed to import projected petroleum demand would amount to about 30 percent of Jamaica's earnings in 1982."⁴

In the light of its projected development needs, national energy demand, and increasing energy costs, Jamaica, like other non-oil producing nations in Latin America is seeking to diversify the sources of its energy base. In the case of Jamaica, it has been suggested that retrofitting be applied to its oil plants to allow them to use coal which, in turn, could be brought to the island by empty returning bauxite vessels. Proposals have been advanced for restructuring the nation's transportation system to conserve energy, and consideration is being given

to forming long-term petroleum exploration policies. The central difficulty is that in the short run smaller countries appear to have limited flexibility to change their demand patterns. As a result, they must rely on imported energy to meet ever-rising demands. This will particularly prove true for countries which—like Jamaica with its aluminum and bauxite industry—require enormous amounts of energy for production purposes.

Colombia. In a genuine sense Colombia represents those traditional societies which at one time seemed to have abundant oil supplies, but which suddenly found themselves scrambling to find new sources of energy as those supplies declined. The Colombian situation is reflected in the changing patterns of its oil production: in 1970 this reached a high point of 81.1 million barrels a year but by 1977 this had decreased to 47.8 million barrels. National demand for oil, however, increased from 49 million barrels to 60 million barrels over the same period. This meant that, in 1978, Colombia, which formerly exported oil, had to start importing 60,000 barrels a day to cover its refining deficit and to maintain adequate levels for security. It is possible that these imports could reach 30 million barrels of oil in 1980 and almost 150 million by the year 2000.⁵

Against this unpromising backdrop, Colombia, according to the plans of its Ministry of Mines and Energy, is involved in an exploration plan which would require drilling 730 new wells over the next ten years. There are indications that the country has recoverable oil reserves of some 7 billion barrels, and the exploration plan seeks to discover 2 billion barrels for use by the year 2000. Of all the Latin American countries, moreover, Colombia is the one with the greatest proven reserves of recoverable coal, as it possesses some 60 percent of the region's currently known reserves. During the past decade annual coal production has averaged 3.4 million tons, but improvements in transportation and better technologies could increase these levels considerably: efforts are thus underway to produce 5 million tons a year by 1990. The government is also, however, examining proposals for reducing its dependency on hydrocarbon fuels. Hy-

³ See for example the *Permanent Executive Committee Report to the CIES* (Inter-American Economic and Social Council), fourteenth regular annual meeting of CIES, August 27-31, 1979, Guatemala, OEA/Ser. H./X37, p. 4; also see Leonardo da Silva, "Latin American Energy and Oil: Present Situation and Prospects," Economic and Social Development Department, Inter-American Development Bank, June 1978 (unpublished report).

⁴ Ahmad Zia Mian, *Jamaica—Preliminary Energy Forecast*, Technical Report, Part 2, prepared for Energy Division, Ministry of Mining and Natural Resources, Kingston, Jamaica, February 1978, p. 2.

⁵ Colombia's rate of consumption increase of crude oil is about 5 percent per year; unless substantial new discoveries are made to arrest the decline in production, heavy imports of oil are expected.

U.S. NUCLEAR EXPORT POLICY

hydroelectric power remains relatively underutilized, given the large potential which seems to exist for its use in this Andean Pact nation.

Colombia's energy conditions have not created a pressing need to build nuclear energy plants, but the world energy crisis is rapidly transforming this situation and alternatives to hydrocarbon use are being examined. It is increasingly felt that the country will not remain much longer on the fringe of the world nuclear industry. Its energy requirements are pressing it to study the possibility of moving fully into the nuclear field sometime during the 1980s. The Colombian government has already taken steps to identify the country's uranium reserves and to prepare the necessary human resources for nuclear development. It is important to note that Colombia is pressing in this nuclear direction, even though it has long used forms of solar energy, especially for drying an agricultural product like coffee, the backbone of the nation's economy.

The Outlook

If these are the kinds of energy conditions which confront specific Latin American nations, what are some of the broad energy issues that are particularly relevant to the Latin American region as a whole? Through a variety of its activities the OAS has considered this larger question. In general, the informed view of energy experts is expressed in the following conclusions.

First, in relation to resource availability and technological capabilities:

- Latin America possesses large unexplored areas in which substantial energy resources might still be found, including fossil fuels and hydroelectric potential.
- Latin America possesses large known but still untapped reserves, for the exploitation of which technical and economic feasibility studies are needed in order to be considered as viable supply alternatives.
- Capital and technological capabilities represent the most critical elements for energy development; foreign capital and technology cannot and ought not to be considered as the only source to satisfy such requirements.⁶

⁶ Chester Cooper, *Latin American Energy Analysis Seminar: Preliminary Final Report*, Institute of Energy Analysis Report to the OAS on the Oak Ridge Conference of December 3-16, 1978 (Oak Ridge, Tenn.: Oak Ridge Associated Universities, 1979).

Second, in relation to economic and social concepts and strategies:

- Essential differences in economic and social structures, such as agricultural and industrial capital stock and productivity, etc., as well as population growth rates, income distribution, etc., recommend the use of different parameters and approaches to energy development planning, as those currently used in industrialized, developed countries might not be relevant and/or realistic when applied in totally different contexts.
- Energy policies in developing countries should address both the modernized and the traditional economic sectors, in order not to impose even greater hardships on large segments of the population already under economic and social stresses.⁷

These were the points agreed upon in a 1978 regional energy analysis seminar sponsored by the OAS Department of Scientific Affairs. They indicate the outlines of the kinds of issues on which the United States, Latin America, and the Caribbean could focus their common attention, were they to make a political commitment to establish new efforts leading to a common strategy for hemispheric energy development.

Both Latin America and the United States increasingly sense that the fortunes of one will, in the future, hinge on the fortunes of the other. That is why it is essential that they work together to promote their mutual security and political, technical, economic, and cultural well-being. The American continent must become fully interdependent not only as an ideal, but in practice.

It is important to recognize that regional cooperation and integration do not spring full-blown into being overnight. In postwar Europe, for instance, it was the overriding ideal of an eventual European community which inspired men of vision to move toward the future, but it was their practical determination to take one step at a time—to create the Iron and Steel Community, for instance—which eventually led to the Treaty of Rome and subsequent success for the integration movement.

Currently, the American region is in more or less the same situation as that which existed in Europe in 1950. Even the levels of development between the Europe of then and the Latin America of now

⁷ Ibid., pp. 4-5.

FRANCIS X. GANNON

are roughly comparable. The American region, too, has a high vision of continental integration before it.

What we now require are both practical policies, starting as in Europe with energy cooperation, and practical statesmen to allow the American countries to strike a "new bargain" leading to cooperation for development and continental integration. This cooperation must become an open and a two-way street with Latin America and the United States

equally giving to, and receiving from, each other. A failure to achieve new forms of energy and other cooperation will prove counterproductive to the peace, security, and well-being of the entire hemisphere. If, however, we act to confront and to resolve the challenges at hand, the American family of nations may well be able to look back in years to come with the same kind of mutual satisfaction as do members of the European community today.

Reshaping U.S. Regional Policy

Francis X. Gannon

LATIN America's future centers around its burgeoning demand for energy. Historically, there has been a lock-step relationship in every industrial society between a growth in the use of energy and in employment.¹ While this relationship has been marginally decoupled in the United States in recent years, there is little reason to suspect that Latin America, as it moves through its present transition to an advanced economic stage, will escape living with this correlation. This is especially so since the Latin American population of 600 million by the year 2000 will be almost double that of 1975.

Latin America's Energy Challenge

One major factor, of course, looms largest in Latin America's energy outlook: it sees the United States consuming 35 percent of the world's annual energy

output, with little prospect that this will radically change in the short term. Faced with a future energy demand perhaps triple that of the present, Latin America generally senses that it can meet this demand through reliance on two resources: oil and natural gas, and uranium. As a practical outcome to this feeling, the larger nations of the hemisphere are already moving rapidly to greater and greater use of nuclear energy, for which the technology is already available and well-tested. The extent of the commitments involved is reflected in discussions within the Inter-American Nuclear Energy Commission. There, Latin American representatives have firmly rejected proposals to turn the commission into a broader regional energy body rather than one concerned only with nuclear energy. Their argument is that Latin America mistakenly slowed down its nuclear programs twenty years ago when cheap oil became abundant, and that this was a mistake it can no longer afford.

The development of nuclear power in Latin America is now well under way and should increase substantially by the year 2000. It brings in its wake a great number of political, economic, and technological issues. Every society using this form of energy must face up to them. It creates a host of unforeseen problems and challenges not only for

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¹ Ahmad Zia Mian, *Jamaica—Preliminary Energy Forecast*, Technical Report, Part 2, Prepared for Energy Division, Ministry of Mining and National Resources, Kingston, Jamaica, February 1978, p. 2.

U.S. NUCLEAR EXPORT POLICY

government and industry but also for the legal profession, which is called upon to help society strike a proper balance between the need for reliable energy sources and the demands of public safety. At times it is quite difficult for traditional legal and political systems to adapt themselves to the problems flowing from use of a technologically sophisticated form of energy such as nuclear power. Yet the adaptation is taking place to the benefit of nations and peoples everywhere, including those in Latin America.

The Nuclear Future and the Breeder Reactor

There are many public voices, even in the heavily industrialized nations, who say that mankind should strive to keep open its "nuclear option." Statements such as these trivialize a serious matter. The truth is that nuclear energy is not an "option" but a growing reality in every part of the globe, especially in Latin America. There is no way now that mankind can put the nuclear genie back into the bottle. No doubt its safety can and should be improved. The dangers of nuclear proliferation, too, should be dealt with effectively: but nuclear power is simply a *sine qua non* for mankind's future, notably so in the Western Hemisphere.

The industrial future for nuclear power, of course, has from its inception been inextricably linked to the use of the breeder reactor. This, by transforming uranium into fertile isotopes, gives fifty or more times as much energy from every pound of uranium extracted by conventional plants. The straight linkage between nuclear use and the breeder was pointed out in 1952 by President Truman's Materials Policy Commission. The report of that commission argued, in effect, that without the breeder, and given the proven reserves of uranium, there would be no nuclear power.² In June 1976 the Federal Energy Resources Council of the U.S. government reconfirmed this widely accepted scientific judgment when it estimated known and possible U.S. uranium resources (a total of 1.84 million tons) as being sufficient to fuel three hundred 1,000 megawatt reactors over their entire life-

² The commission concluded in its report that the breeder reactor "... is the presumable recourse for atomic energy, since the known supply of natural uranium is not enough to sustain foreseeable energy needs." See *Resources for Freedom: Report of the President's Materials Resources Commission* (Washington, D.C.: Government Printing Office, 1952), vol. 1, p. 37.

time of about thirty years.³ Other estimates by the Ford Foundation, the Mitre Corporation, a Department of Energy have, of course, given what higher estimates of uranium availability.⁴ The power industry, however, cannot plan on the basis of uncertain estimates and therefore generally accepts the "no-breeder, no-nuclear" arguments.

Most industrial nations of Europe, other than Sweden, Spain, and Portugal, lack sufficient uranium resources to meet their energy needs and thus rely on U.S. supplies. Middle-sized powers such as those in Latin America, sensing the vulnerability of their own economies to a disruption in oil imports, and objecting to continued technological dependence on the United States, are pressing to get control over the entire nuclear cycle. In a 1978 joint study published by the Center for Strategic and International Studies and Georgetown University, Charles K. Ebinger suggested on the basis of in-depth interviews that Brazil, for instance, entered into its nuclear deal with West Germany as a way to overcome the "long legacy of U.S. attempts to control the international nuclear market in Europe and the Third World."⁵ National uranium enrichment and reprocessing facilities are generally viewed in the Western Hemisphere as a means to achieve relative energy independence. The larger countries, faced with overwhelming and unprecedented energy demands between now and the year 2000, are turning away from the United States to seek help elsewhere in developing an indigenous nuclear technology of a full-cycle nature. In the short run, nonproliferation policies originating in the highly in-

³ See the General Accounting Office reports, *The Clinch River Breeder Reactor—Should the Congress Continue to Fund It?* and *Comments on the Administration's White Paper: "The Clinch River Breeder Reactor—An End to the Impasse"* (Washington, D.C.: Government Printing Office, 1979). The Comptroller General advised Congress that, in contrast to the thesis advanced by the Carter administration, most knowledgeable sources agree only with the Energy Department's data on proven uranium reserves. Most current scientific opinion is that the Energy Department is overestimating total uranium resources, thereby providing insecure ground for the administration's decision to postpone building the breeder reactor.

⁴ Ford Foundation/Mitre Corporation, *Report of the Nuclear Energy Policy Group: Nuclear Power Issues and Choices* (Cambridge, Mass.: Ballinger Publications, 1977).

⁵ Charles K. Ebinger, *International Politics of Nuclear Energy*, the Washington Papers, vol. 6, no. 57 (Beverly Hills and London: Sage Publications, 1978), p. 54.

dustrialized nations might have some success in restraining the use of nuclear materials by developing countries. In the longer haul, however, those policies seem to be pricing the United States not only out of the international breeder reactor market but also out of the light water reactor (LWR) market, where it was previously the dominant and, technologically, the safest supplier.

Future efforts at joint energy development in the Western Hemisphere then, cannot therefore be seen merely as reflecting the need to discover and bring to market more oil, or the supposition that Latin America's portending energy crunch will be met by reliance on alternative energy sources in any near future. On the contrary, effective regional energy policies must realistically recognize that the United States—the world's largest consumer of energy—will probably be burning up all the oil, gas, and coal it produces. While the United States now possesses half of the world's proven uranium resources, it will invariably be seen by its hemispheric neighbors as squandering these scarce uranium reserves unless it reprocesses plutonium and is fully committed to using the existing breeder technology. As President Truman's commission argued nearly three decades ago, use of the breeder is inevitable. Any other course leads to massive energy wastage, rather than to energy conservation, and any U.S. (or other) policies grounded in the squandering of regional energy sources could hardly prove an acceptable basis for promoting harmonious economic or energy relationships in the Western Hemisphere or elsewhere.

The Challenge for U.S. Policy

If, in general terms, this is the existing frame of reference within which the United States confronts the suddenly transformed energy outlook for Latin America, what elements should be included in efforts to forge a new U.S. energy policy towards the region?

In view of the U.S. reluctance, however solidly grounded, to turn aside from the globalist mold which currently encases its inter-American economic perspective, the first step should perhaps be to recognize the considerable difficulties involved in attempting to redirect U.S. policies towards a more regional focus in the economic and development fields, including the energy area. The growing vulnerability of the United States, both from the economic and from the security viewpoints, appears,

however, to be gradually pressing U.S. foreign policy makers to focus more favorably on the nation's neighbors. In his farewell statement as the first secretary of energy, James R. Schlesinger dramatically pointed to this vulnerability when he spoke before the National Press Club:

Soviet control of the oil in the Middle East would mean the end of the world as we have known it since 1945 and of the association of free nations. . . . Even if we put aside such opportunities for external mischief, the flow of oil from the OPEC nations can still not be considered wholly reliable. The worldwide system for the production and distribution of petroleum is already stretched taut. There is little, if any, relief in prospect. Any major interruption—stemming from political decision, political instability, terrorist acts, or major technical problems—would entail severe disruptions.⁶

The Need for Cooperation. The circumstances that Mr. Schlesinger examined from a negative aspect, namely the threats to U.S. security and well-being, should, of course, also be looked at from the positive side. This finds expression in the need for the United States to cooperate with its immediate neighbors so that, through the development of the entire American region, the Western Hemisphere can in comparative terms remain a regional island of international peace. This argument was stressed by Sydney Weintraub at the Sixth Annual National Security Affairs Conference held, in July 1979, at the National Defense University. According to Mr. Weintraub, the United States—in its own self-interest and that of its neighbors—should not hesitate to work out special arrangements on movements of trade, development, and energy into Mexico and into the Caribbean since "other things being equal, nearby instability is apt to affect the United States more than distant instability. Nearby economic growth is likely to affect U.S. trade more than growth in distant countries. Income disparities in nearby countries affect the United States more than do similar disparities in distant countries."⁷ Efforts

⁶ As quoted in Larry Kramer, "Schlesinger: U.S. Forces Must Protect Mid-East Oil," *Washington Post*, August 17, 1979.

⁷ Sydney Weintraub, "The Importance of Nearness: U.S. Policy towards Mexico and the Caribbean," in *Continuity and Change in the 1980s and Beyond*, conference proceedings (Washington, D.C.: National Defense University, forthcoming).

U.S. NUCLEAR EXPORT POLICY

to regionalize U.S. policy would not necessarily cut loose that policy from its basic global moorings. On the contrary, it would function as a foundation which would help strengthen the region's contributions to serving globalism, rather than impeding its realization, as is all too frequently the current situation.

A Better Balance. A second step would be to encourage a more adequate balance between concerns about nonproliferation and a broader U.S. interest in regional energy development. The proliferation of nuclear weapons constitutes a serious threat to regional and global security, a fact recognized by both the United States and Latin America and addressed through such measures as the 1968 Treaty on the Nonproliferation of Nuclear Weapons (NPT) and the 1968 Treaty for the Prohibition of Nuclear Weapons in Latin America, the Treaty of Tlatelolco. This treaty created the first nuclear free zone in a populated area of the world and is currently binding on twenty-two Latin American nations. It prohibits the manufacture, testing, use, storage, development, or possession of nuclear weapons. Several larger nations have either not adhered to the NPT or have not bound themselves to the Treaty of Tlatelolco. In addition to these treaties, however, countries operating under the London Suppliers Club guidelines, adopted in 1975, place certain requirements on the transfer of nuclear technology, materials, and equipment. These restrictions are placed so that this process would not lead to the manufacture of nuclear explosive devices. The U.S.-proposed International Nuclear Fuel Cycle Evaluation (INFCE), whose findings are to be presented in February 1980, has also operated, in effect, as a restraint on nuclear proliferation.

These strong constraints on proliferation, or expressions of interest in moving toward nuclear nonproliferation, have as yet to be matched by equal U.S. interest in, or commitments to, regional energy development. Periodically, U.S. proposals are advanced for forming a Western Hemisphere energy strategy, or a similar policy. So far, however, these have led only to minor energy assessment projects by the Department of Energy and the Agency for International Development, with two or three Latin American nations participating on a bilateral basis. Proposals are periodically advanced within the OAS Inter-American Economic and Social Council and

the Inter-American Education, Science and Culture Council, as well as within the Inter-American Clear Energy Commission, to promote regional multilateral approaches to energy development. The halting and almost casual U.S. response to such proposals, however, helps to keep them at the level of ideas rather than action.

Until the United States commits itself to exploring, and acting upon, the question of regional energy development with the same determination and capacity it demonstrates in its policies for achieving nuclear nonproliferation, it will remain difficult for Latin America and the Caribbean to cooperate effectively on regional energy questions with their largest neighbor. This difficulty arises chiefly because Latin America generally lacks the trained and highly qualified human resources required for increasing its energy potential.

A Policy Framework

Were such a U.S. commitment to regional energy development forthcoming, the door might then be open to working out improved multilateral and bilateral U.S. energy policies for the Americas. What might such policies be? Without entering into specifics, it may be assumed that they would deal in multifaceted ways with problems such as the following:

- The possibility of broadening U.S. nonproliferation efforts so that they center not only on the question of transferring nuclear weapons systems but on the more difficult problem of U.S. cooperation with countries in the region on serious attempts to promote their self-security. In a recent statement in the *Washington Post*, Congressman Clement J. Zablocki, chairman of the House International Relations Committee, argued that "there is, in fact, an inescapable connection between a country's sense of security and the determination of that country's attempting to acquire nuclear arms," a viewpoint shared by many.⁸ If it fails to address the larger issue of reducing the possibilities of nuclear proliferation by encouraging greater regional security, U.S. policy toward the Americas at the very least only relates to part of the dilemmas confronting the larger nations in the inter-American

⁸ In "Talking Pakistan Out of the Bomb," *Washington Post*, August 28, 1979.

system. National security, in their view, is no longer primarily a geopolitical challenge, but rather the more difficult matter of expanding the horizons of peace through an acceleration of their potential for development. The production of greater amounts of energy, inevitably through greater reliance on nuclear power, is thus central to their development objectives. Unless the wider dimensions of regional development and security are given stronger consideration under U.S. policy, it is conceivable that, sooner or later, the problems posed by nuclear non-proliferation could be exaggerated and intensified, rather than reduced.

- The need to address the question posed by Dr. Jorge Castañeda in Washington, D.C., at the Mexico-Today Symposium in October 1978, before he assumed his subsequent position as Mexican Foreign Minister, that: "the Inter-American System is not the natural nor the appropriate legal-political frame to further the regional needs of Latin American countries."⁹ This is a broad multilateral question concerning the future directions of regional policy and should be addressed primarily within multilateral frames of reference.

- The adoption of common regional measures for enabling the OAS member countries to meet their energy needs during times of crisis and emergency. While the U.S. economy is large and strong enough to cope, however haphazardly, with abrupt changes in the world's energy supply, this is not always the case for many of its neighbors. As Costa Rica's proposal for a common oil import policy for the Central American countries indicates, these neighbors are seeking to devise different arrangements for minimizing the disruptive impact of reduced oil supplies. At their eighth General Assembly, the OAS foreign ministers adopted a Peruvian resolution that OAS states should concert their forces when economic dislocation results from international financial pressures on a specific country, another indication of regional concern regarding the energy crisis.

- The challenges facing smaller nations, such as those in the Caribbean and Central America, which are searching for formulas to reduce their almost exclusive dependence on oil through development of alternative energy sources. What soft-technology advocates in the United States and elsewhere often

⁹ "Mexico and the World," address to the Mexico-Today Symposium, Washington, D.C., October 30, 1978.

overlook is that it may be easier to introduce alternative fuels in the more advanced nations than in the poorer ones. This may prove to be especially true in the Caribbean where, despite almost universal literacy, educational systems with a classical focus are producing a major export: highly trained and entrepreneurially minded individuals who go abroad rather than face limited work opportunities at home. The continuing loss of talented human resources thus constrains the efforts of many smaller countries as they seek to move ahead into alternative energy fields.

- The outlook for cooperating with Venezuela on a mutually advantageous basis so that advanced U.S. technology could assist the Venezuelans to develop their huge oil reserves of heavy crude in the Orinoco Belt, reserves that are conservatively estimated at 700,000 million barrels of heavy oil. From Venezuela's viewpoint it is critical to national development that these nonconventional oil reserves be incorporated into national reserves—and sold commercially at a profit. Unless it finds the crude required to replace the current 800 million barrel annual depletion of its proven reserves, Venezuela could well have its development handicapped. This, in turn, would adversely affect supplies to the East Coast of the United States. The recent Venezuelan decision to reduce its oil output by 6 percent in 1980 indicates what might be in store unless it begins to produce its heavier crudes. Some adroit statesmanship will be demanded in the years immediately ahead on the part of both the United States and Venezuela if effective formulas and arrangements are to be arrived at which benefit the energy and development interests of both nations.

- The options involved in assisting Latin America and the Caribbean to avoid becoming even more technologically dependent than they are at present by rapidly expanding the supply of the scientific and technical human resources required for a massive development of energy resources. According to OAS reports, while the Soviet Union, Western Europe, the United States, and Latin America may have equivalent levels of population, Latin America possesses less than one-eighth the number of trained engineers and scientists as found in these other areas. Sophisticated petrochemical, nuclear, or fusion energy sources demand highly trained technical manpower or they will not become available for use. This point was indirectly reinforced by

U.S. NUCLEAR EXPORT POLICY

the argument of Dr. Melvin Gottlieb, director of Princeton's Plasma Physics Lab and a world authority on fusion power. Dr. Gottlieb, after a visit to Brazil, warned that unless Latin America moves into the new systems of fusion power now—while the process is open to all comers—it may get frozen out at a later date when the process becomes commercial and is subjected to patent rights and royalties.¹⁰ This would inevitably lead to newer forms of technological dependence. For Latin America to step up its efforts in high technology energy development it must nevertheless embark upon some unprecedented training efforts in science and technology related to energy. Many of these efforts could take place through regional interchange, if such countries as Mexico and Venezuela were to train petroleum engineers and technicians from other American nations. The strongest approach, however, might be to establish a regional energy educational fund which would operate over a ten-year period, would require repayment in some form by those participating, and would function on a large scale. No doubt there might be a 25 percent fallout rate or more as not all those accepting the opportunities would return to their own countries to work, especially if employment opportunities are limited. If such a scheme were viewed as a major investment in the future energy development of the entire region, such negative features would not, however, serve to undermine the overall effort.

- The opportunity for placing the relationship between Mexico and the United States on a sounder footing. It is often overlooked that U.S. trade with Mexico is greater than its trade with all of Africa combined. Mexico has indicated that its new-found oil wealth will not be squandered by exporting vast quantities of crude oil in such a way that its development process is retarded rather than advanced. At the same time Mexico's appropriate export mar-

¹⁰ Melvin Gottlieb, "An Energy Overview," *Vital Speeches of the Day*, July 15, 1979, pp. 596-600.

ket for its natural gas, which it has been flaring off at the rate of 300 million cubic feet a day, in the United States. There is, in turn, no reason broader petrochemical and other markets cannot be developed in Mexico for major areas of the Southwestern United States. While the United States might pay premium prices at first to encourage a wide energy exchange with Mexico, in the long term costs should decline somewhat as its neighbor moves into a more advanced economic stage. The September 1979 agreement that Mexico would ship gas to the U.S. market is a hopeful sign for improved future relations between the two countries, but the difficulties of the two previous years over these gas shipments indicate the need for foreign policy rather than domestic energy considerations to be dominant in future U.S. dealings with its closest neighbor.

- The consideration of various proposals for regional energy funds, including those designed to encourage exploration for oil and natural gas or to promote use of alternative fuels such as gasohol.

The Outlook

Whether these and similar issues will be dealt with over the next few years by the American family nations is not merely a matter for the United States to decide. Consistent with their regional and world interests and responsibilities, however, the various OAS member countries can contribute to the shaping of multilateral policies for regional development, including those for the energy field. Despite its overriding postwar commitment to globalism and to orderly world markets, a commitment farsightedly grounded in a determination to avoid the kinds of regional hegemonial spheres of influence which led to the Second World War, it would neither be out of policy character nor against its own self-interest for the United States to pull its own oar in the common task of encouraging more intensive development of the energy resources of the Western Hemisphere.

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The Department of Defense budget for fiscal year 1980 lays the foundation for America's military posture through the next decade. In this analysis, Lawrence J. Korb compares the fiscal 1980 budget with the spending plan of the previous year, identifying shifts in U.S. defense priorities. Key deterrent force issues are highlighted, as well as conventional force structure changes that reflect Carter administration initiatives to upgrade NATO alliance capabilities. Also examined are the proposed changes in the military retirement system, the possible future match up of U.S. and Soviet strategic forces in light of SALT II, and an assessment of recent "real" growth in U.S. defense spending.

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This first issue of AEI's expanded *Review* seeks to bring order to a foreign policy concern that has been complicated by serious disagreement within the United States over our real national interest in Africa. Guest editor Helen Kitchen distills from the national debate six options for American policy. Her clarification of critical policy choices provides not a formula for success, but rather the basis for a broadly informed debate on Africa.

U.S. Security Interests and Africa South of the Sahara

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A parade of events today challenges the United States to define and coordinate its diplomatic, economic, and military aims in the vast territory of sub-Saharan Africa. Yet, major questions concerning America's security interests in the subcontinent remain unanswered as public debate over the basic design of our African policy continues. General Bruce Palmer, Jr., former *Review* co-editor, describes the regional panorama of societies, economies, governments, and armed forces in order to establish what have been—and are likely to become—America's security interests in Africa south of the Sahara. He offers his own view of what the analysis portends for U.S. security policy generally and military planning in particular.

U.S. Arms Sales Abroad: A Policy of Restraint?

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In few questions of national policy are fundamental economic, military, and foreign policy concerns melded so completely as in the sales of American arms abroad. Current U.S. policy imposes restrictions on weapon sales which range from the recipient nation's level of economic development to its efforts in protecting human rights. Proponents of restraint weigh the ultimate gains in collective security to be greater than the costs borne by the United States in lessened global influence and domestic employment. Others believe that self-imposed restrictions strike at basic U.S. strengths and yet hold little prospect of achieving their noble aims without arms control agreements among the world's principal arms suppliers. Opposing views on this transcending policy question are presented by former Senator Dick Clark and General Bernard A. Schriever.

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In May 1972, the U.S. and the U.S.S.R. concluded three years of formal negotiations with the signing of the first Strategic Arms Limitation agreements, called SALT I—which were approved by the United States and entered into force on October 3, 1972. The second series of talks spans more than half a decade. The central issues of SALT II and the critical choices raised for America's leaders are outlined in essays by J. William Fulbright and Maxwell D. Taylor.

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APPENDIX B

1. Energy-Related statements by the President of the Republic, General Ernesto Geisel and Shigeaki Ueki, Minister of Mines and Energy.

PRESIDENT GEISEL:

"...In the critical economic field, the evolution of world situation, including our own country, has confirmed the judicious orientation Brazil has followed since 1974 as a consequence of the crisis caused by the sharp increases in petroleum prices."

"...The impact thus sustained was in fact the beginning of a new era for all modern industrial community. It started a process which by means of successful developments, will be extended until new sources of energy progressively assume the role which today is primarily performed by petroleum".

"...The energy problem is not solely a government concern, but affects the whole Nation. Everyone must participate and, in order that such participation may be free, it is necessary above anything else that everyone should understand the problem, its importance and seriousness."

"...Measures adopted for rationalization, as everyone may be aware of, were many. Some of them were aimed at reducing consumption of fuel oil, replacing it wherever possible by coal, or by electric power; others were designed to decrease consumption of diesel oil, also through the utilization of electric power."

"...The Brazilian Nuclear Program was conceived as an "integrated program". We have Uranium deposits; we will have this Uranium milled; we will have this Uranium enriched and have the fuel fabricated; plants will generate the necessary power and later, the waste will be reprocessed to permit a better energy utilization. It is therefore an integrated, complete program, characterized by its essentially peaceful nature."

MINISTER UEKI:

"...The Federal Government's efforts to reduce consumption of petroleum by-products have continued with a view to limiting the increase of demand not essential to development".

"...On the other hand, the measures we have adopted in respect to petroleum, have also produced results that we consider to be quite satisfactory".

"...The replacement of oil - based fuels by coal, through present processes, should result in a daily economy of 20 thousand dollars, in the Southern region of this Country alone".

"...A greater use of electric power in urban transportation should be a goal for all sectorial spheres".

"...Thanks to the tariff equalization policy adopted for the electric power sector which eventually proved to be a stimulus, the use of this energy is showing a significant increase.

"...Today, the intalled capacity in this Country is 23 million kws., but by 1981 we shall require 55 million kws".

"...In 1978 alone, approximately one billion dollars will be invested in the Itaipu project which signifies a great effort in the Brazilian electric power sector.

"...Brazil is a country which to date has taken advantage of its high hydraulic potential. Thanks to copious rivers and their unequal stream levels, we have practically succeeded in supplying our electric power needs. In this field our expansion has been extraordinary".

"...To develop rural electrification; possibly also to rationalize consumption by demanding a better control of engine tuning, and avoiding, particularly in diesel-powered trucks, undue alteration of injection pumps. Also, efforts are being made to stimulate mass transportation, car pools, etc."

"...In respect of nuclear energy, several financing agreements have been signed, standing out among them, that one made with a combined group of banks of the Federal Republic of Germany, for plants II and III of Admiral Alvaro Alberto Nuclear Power Station. Financing arrangements have also been negotiated for developing the uranium enrichment technology based on the nozzle jet process and, for the engineering design of a uranium, milling plant in Poços de Caldas".

"...Planning of the National energy sector, until recently limited to analysing the use of conventional sources, after the petroleum crisis has been extended also to the study of alternative sources for electricity generation with a view to reducing thermoelectric generation on the basis of imported fuels".

"...We must become aware of the necessity of developing new equipment tailored to national characteristics, including a better utilization of energy and mineral substances from national sources in order to relieve Brazil of undesirable dependence on external sources".

"...The 1973 world crisis, one can say, aroused the consciousness of the Nation to a solution of problems it created".

"...Having in view future prospects and, if a lesson was learned from the past concerning the evolution of the world mineral and energy situation, one can foresee a constant restraint leading always to the rational use of these resources".

"...Brazil continues to offer growing and firm prospects for new and considerable undertakings, and the problems related to the Balance of Payments have not shaken the confidence of foreign entrepreneurs in the attractive potentialities of this Country as a whole".

2. Introduction

The present National Energy Balance introduces several changes in comparison with the previous year. New tables have been included for the purpose of reflecting the energy situation within this Country. A major change relates to the situation of the "unrenewable" National energy resources on Dec. 31, 1977, added to the hydraulic potentiality at that date.

For forecasts of effective primary energy requirements for the period 1978/1987, it has been followed the internationally adopted procedure more frequently used in studies of the same kind, that is, the statistical correlation based on average GPD growth rates of 5%, 7% and 9% fixing an intermediate basis of 7% per year. The projections therefore seek to maintain consistency with a structural tendency of economy, not being comparative with short term forecast results, where aspects of business conditions prevail.

Projections for each energy source have also been brought up to date in relation to project schedules, as in the case of the start-up of the first nuclear plants. In their turn, the retrospective series have been maintained, except for those relating to alcohol, for the reasons stated in the part pertaining to each source.

3. Brazilian energy policy

The overall objectives, general and sectorial guidelines of the energy policy are described in the 1977 National Energy Balance and continue to be valid. In brief, the energy policy is characterized by three basic points:

a) **Conservation of Energy and Rationalization of its Use:** discourage and even halt superfluous, improper and squandering use of energy. Whenever recommendable, preferential tariff will be adopted in the utilization of most suitable sources in each case, as well as the most economic and convenient manner of its use. In short, the Government considers "conservation", among all methods, to be the best source of energy.

b) **Energy Substitution:** substituting internally produced sources, with emphasis on those considered "renewable" wherever technically and economically advisable, for those foreign sources which Brazil is dependent on (petroleum and metallurgical coal). Among those substitutions which should contribute to significant results at the end of this decade, the following may be mentioned:-

- alcohol, steam coal and electric power for petroleum by-products, through subsidies to substitute sources.
- locally-produced for imported coal, by adopting metallurgical processes that can be better tailored to the Brazilian product.

c) **Expansion of present availabilities and search of new energy sources:** expand National reserves and develop new sources of energy not yet utilized or poorly used, by means of the following scope of measures:

- by intensifying the activities of petroleum exploration in this Country by PETROBRAS, especially on the Continental Shelf, where more promising results have been achieved. The effort should be complemented in pre-determined areas by firms who have signed contracts contained the risk clause. There will also be continued exploration in foreign countries by subsidiaries of PETROBRAS established for this purpose.

- emphasis on the harnessing of economically usable hydraulic potentials, as they provide "renewable energy". The electric systems will be developed and operated in such a manner as to make most use of available hydraulic energy, taking into account the different hydrologic characteristics, among the basins.
- implement the utilization of uranium as an alternative source of energy. Continue the intensive prospecting and development efforts with a view to identifying new uranium ore deposits. The prospects for uranium deposits in this country may be considered as promising in view of the extensive area and geological characteristics of Brazil.
- encourage diversification of the use of domestic coal. More efficient techniques in the exploitation of deposits, especially in mining, should be adopted aiming at an increase in productivity.
- goals include intensification of shale oil exploration whether in terms of new deposits, better knowledge of the characteristics of reserves already discovered or even in the sense of improving the economic feasibility of the Brazilian process for utilization of this abundant source of energy.
- under the coordination of the Ipiranga Project, use of alternative sources of energy is being developed, taking into account the multiple regional and economic aspects of this country. Mention should be made of developments in the use of small water-falls and the biomass, besides the studies that are being carried out on solar and wind energy.

4. Comments on brazilian energy

Although a high correlation between the gross domestic product (GDP) and the overall demand for energy in a country is generally observed, the indices concerning energy intensity vary from one country to another. This index represented by the quantity of primary energy per Product unit, is a function of the nature of the sources used, their efficient use, and the national economic structure.

One of the characteristics of a Nation's, development stage, is that the coefficients of income elasticity for primary energy consumption, presents a progressive declining tendency as a result of the technological advancement towards a constant efficiency in the evolution of its economies in which the tertiary sector and those industries of great technologic sophistication and low energy utilization tend to predominate. In developing nations, the opposite occurs: that coefficient, in the short and medium term tends to increase to the extent of their economic growth. Among other reasons, this fact results from the introduction of energy consumption figures until then not allowed for in statistics, such as those figures on the substitution of oil-consuming equipment for animal traction; the same effect is produced by substituting local inputs for imported ones. Such inputs as aluminum, steel, nickel, fertilizers, and others require a large quantity of energy for manufacture.

In the case of Brazil, the annual average ratio, for the period 1977/87, between the relative variations of primary energy consumption and of the GDP should decrease, after a past period in which this coefficient reached high values, until the effects are felt of the first measures resulting from the petroleum crisis in 1973. Therefore, based on the behavior of primary energy consumption, it may be stated that this country is passing through a transition from one stage of development to another.

Another aspect to be pointed out is the per capita consumption of energy. This rate shows an upward trend in all countries. Naturally, it is much higher in developed countries. But, as the per capita income gap between developed and developing countries is relatively reduced, it is natural that the relative difference in values of energy consumption per inhabitant should equally tend to decrease.

It is worth noting that in Brazil, electrification is an ever present aspect in all economic sectors. In the primary sector, rural electrification is attaining sizeable proportions; in the secondary sector, the examples are numerous, having already been mentioned substitutes for the importation of basic, important inputs. Finally, transportation is the most striking example in the service sector, especially in the light of the policy for development of transportation in the principal brazilian populated centers.

APPENDIX C

FEDERATIVE REPUBLIC OF BRAZIL

THE BRAZILIAN NUCLEAR
PROGRAM



TABLE OF CONTENTS

ANNEXES

Annex I	- Brazil - FRG : Agreement on Co-operation in the Field of Peaceful Uses of Nuclear Energy	1
Annex II	- Brazil-FRG-IAEA:Agreement for the Application of Nuclear Safeguards	11
Annex III	- Treaty for the Prohibition of Nuclear Weapons in Latin America	25
Annex IV	- Treaty on the Non-Proliferation of Nuclear Weapons	43

ANNEX I

BRAZIL-FRG : AGREEMENT ON COOPERATION IN
THE FIELD OF PEACEFUL USES OF NUCLEAR ENERGY

AGREEMENT BETWEEN THE GOVERNMENT OF THE FEDERAL REPUBLIC OF GERMANY AND THE GOVERNMENT OF THE FEDERATIVE REPUBLIC OF BRAZIL CONCERNING CO-OPERATION IN THE FIELD OF PEACEFUL USES OF NUCLEAR ENERGY

The Government of the Federal Republic of Germany and the Government of the Federative Republic of Brazil,

RELYING ON the friendly relations existing between their States and determined to enhance these relations ;

BEARING IN MIND AND IN CONTINUATION OF the Agreement between the Contracting Parties of 9th June 1969 Concerning Co-operation in Scientific Research and Technological Development ;

CONSIDERING the Co-operation Agreement of 9th June 1961 between the European Atomic Energy Community and the Government of the Federative Republic of Brazil Concerning the Peaceful Uses of Atomic Energy ;

CONSIDERING the progress of the scientific co-operation between their States, in particular in the field of peaceful uses of nuclear energy ;

CONVINCED that the successful scientific co-operation between their States in the field of peaceful uses of nuclear energy creates favourable conditions for industrial co-operation in this field ;

BEARING IN MIND that such co-operation will be of economic and scientific advantage for both Contracting Parties ;

HAVING REGARD TO the Guidelines for Industrial Co-operation Between the Federal Republic of Germany and the Federative Republic of Brazil in the Field of Peaceful Uses of Nuclear Energy of 3rd October 1974 ;

HAVE AGREED as follows:

Article 1

(1) The Contracting Parties shall further, within the framework of the present Agreement, the co-operation between organizations engaged in scientific and technological research and enterprises in both States ; such co-operation shall comprise:

- prospecting, extraction and processing of uranium ores as well as the production of uranium compounds;
- construction of nuclear reactors and other nuclear installations, as well as their components;
- uranium enrichment and enrichment services;
- manufacture of fuel elements and reprocessing of irradiated fuels.

(2) The above co-operation shall include the exchange of the necessary technological information.

(3) Considering the importance of financing, including the granting of credits, for such cooperation, the Contracting Parties shall endeavour to finance and to grant credits under conditions which are as favourable as possible within the framework of the regulations prevailing in both States.

Article 2

The Contracting Parties declare that they adhere to the principle of non-proliferation of nuclear weapons.

Article 3

(1) Each Contracting Party, upon request by an exporter, shall grant export licences pursuant to its legal provisions, for the supply of source and special fissionable material, all equipment and materials especially designed or prepared for the production, use or processing of special fissionable material, as well as for the communication of relevant technological information, to the territory of the other Contracting Party.

(2) Such supply or communication requires that the receiving Contracting Party shall have concluded a safeguards agreement with the International Atomic Energy Agency which ensures that such material, equipment and installations, the source or special fissionable material, produced, processed or used by them, as well as the relevant technological information are not used for nuclear weapons or other nuclear explosive devices.

Article 4

(1) Nuclear material, equipment and installations, as well as relevant technological information exported or communicated from the territory of a Contracting Party to the territory of the other Contracting Parties to third States, which were non-nuclear weapon States on 1st January 1967 if a safeguards agreement as provided by Article 3 has been concluded with respect to the receiving State.

(2) Sensitive nuclear material, equipment and installations, as well as relevant technological information which are exported or communicated from the territory of a Contracting Party to that of the other Contracting Party, may be exported, re-exported or communicated to third States only with the agreement of the supplying Contracting Party.

(3) Sensitive nuclear material, equipment and installations mean:

- a) uranium with an enrichment more than 20% in the isotope 235, uranium 233 and plutonium, with the exception of small quantities of such material as are, for example, for laboratory purposes;
- b) installations for the manufacture of fuel elements if such installations are used for the manufacture of fuel elements containing material referred to under (a) above;
- c) installations for the reprocessing of irradiated fuel elements;

- d) installations for the enrichment of uranium.

Article 5

- (1) Each Contracting Party shall take the measures necessary to ensure the physical protection of nuclear material, equipment and installations in its territory, and in the case of transport between the territories of the Contracting Parties as well as to third States.
- (2) Such measures shall be designed to avoid, as far as possible, any damage, accident, theft, sabotage, attack, deviation, interference, exchange and other risks.
- (3) The Contracting Parties shall arrange for appropriate measures in this respect.

Article 6

The Joint Commission established by the Agreement of 9th June 1969 Concerning Co-operation in Scientific Research and Technological Development shall take due account of the activities to be carried out under the present Agreement and shall, where necessary, make recommendations for its further implementation.

Article 7

Upon request by a Contracting Party, the Contracting Parties shall consult on the implementation of the present Agreement and, if necessary, enter into negotiations concerning its review.

Article 8

- (1) The Contracting Parties shall endeavour to settle differences concerning the interpretation of the present agreement through diplomatic channels.
- (2) If the differences cannot be settled by these means, an arbitration procedure shall take place as provided by Article 10 of the Agreement of 7th June 1972 between the Contracting Parties Concerning the Entry of Nuclear Ships into Brazilian Territorial Waters and their Stay in Brazilian Ports.

Article 9

The present Agreement shall not affect the obligations of the Federal Republic of Germany resulting from the Treaties instituting the European Economic Community and the European Atomic Energy Community

Article 10

The present Agreement shall equally apply to the Land Berlin unless the Government of the Federal Republic of Germany otherwise notifies the Government of the Federative Republic of Brazil within the three months following entry into force of the present Agreement.

Article 11

- (1) The present Agreement shall be brought into force as soon as possible by an Exchange of Notes.
- (2) The duration of the present Agreement shall be 15 years from the date fixed in the Exchange of Notes referred to in (1) above and shall be extended automatically for periods of 5 years each, unless cancelled by a Contracting Party not later than 12 months before its expiry.
- (3) The safeguards and physical protection measures required by the present Agreement shall not be affected by the expiry of the present Agreement.

DONE in Bonn on 27th June 1975 in two originals, one in the German and one in the Portuguese language, both being equally authentic.

ANNEX II

BRAZIL-FRG-IAEA : AGREEMENT FOR THE
APPLICATION OF NUCLEAR SAFEGUARDS

AGREEMENT OF 26 FEBRUARY 1976 BETWEEN THE INTERNATIONAL ATOMIC ENERGY AGENCY, THE GOVERNMENT OF THE FEDERATIVE REPUBLIC OF BRAZIL AND THE GOVERNMENT OF THE FEDERAL REPUBLIC OF GERMANY FOR THE APPLICATION OF SAFEGUARDS

WHEREAS the Government of the Federative Republic of Brazil and the Government of the Federal Republic of Germany have concluded an Agreement concerning Co-operation in the Field of the Peaceful Uses of Nuclear Energy on 27 June 1975 (hereinafter referred to as 'the Bilateral Agreement');

WHEREAS the International Atomic Energy Agency (hereinafter referred to as 'the Agency') is authorized by its Statute to apply safeguards, at the request of the Parties, to any bilateral or multilateral arrangement;

WHEREAS the Government of the Federative Republic of Brazil and the Government of the Federal Republic of Germany have requested the Agency to apply its safeguards to nuclear material supplied, transferred or produced under the Bilateral Agreement;

WHEREAS the Board of Governors of the Agency (hereinafter referred to as 'the Board') has acceded to that request on 24 February 1976;

NOW THEREFORE, the Agency, the Government of the Federative Republic of Brazil and the Government of the Federal Republic of Germany hereby agree as follows:

PART I

DEFINITIONS

Article 1

For the purpose of this Agreement:

- (a) "Inspectors Document" means the Annex to Agency Document GC(V)/INF/39;
- (b) "Nuclear facility" means:
 - (1) A principal nuclear facility as defined in paragraph 78 of the Safeguards Document as well as a critical facility or a separate storage installation; or
 - (2) Any location where nuclear material in amounts greater than one effective kilogram is customarily used;
- (c) "Nuclear material" means any source or special fissionable material as defined in Article XX of the Agency's Statute;

- (d) "Relevant technological information" means information designated as such by either contracting Government transferring such information on the design, construction or operation of a nuclear facility or specified equipment or on the preparation, use or processing of nuclear material or specified material, in all forms in which such information can be transferred, but excepting technological information available to the public;
- (e) "Safeguards Document" means Agency Document INF CIRC/66/Rev.2;
- (f) "Specified equipment" means any equipment which is especially designed or prepared for the processing, use or production of nuclear material or specified material;
- (g) "Specified material" means any material which is especially prepared for the processing, use or production of nuclear material.

PART II

UNDERTAKINGS BY THE CONTRACTING GOVERNMENTS AND BY THE AGENCY

Article 2

The Government of the Federative Republic of Brazil and the Government of the Federal Republic of Germany undertake that none of the following items shall be used for the manufacture of any nuclear weapon or to further any other military purpose or for the manufacture of any other nuclear explosive device:

- (1) Nuclear material or any nuclear facility transferred from one of the said States to the other;
- (2) Any nuclear facility which is designed, constructed or operated in one of the said States on the basis of or by the use of relevant technological information transferred from the other;
- (3) Nuclear material, including subsequent generations of produced special fissionable material, which has been produced, processed or used on the basis of or by the use of:
 - (a) Any nuclear facility or nuclear material referred to in this Article;
 - (b) Any other item referred to in Article 7, paragraph 1; or
 - (c) Any relevant technological information transferred from one of the said States to the other.

Article 3

1. The contracting Government of the State concerned, on the occasion of the first transfer of relevant technological information from that State to the other, shall communicate to the Agency an adequate description of the relevant technological information transferred if the information relates to any of the following areas of co-operation:

- (a) Production of nuclear material compounds of a purity suitable for use in the fuel cycle;
- (b) Manufacture of nuclear reactors, other nuclear facilities or their components;
- (c) Uranium enrichment;
- (d) Fabrication of fuel elements; and
- (e) Reprocessing of irradiated fuel.

2. Without restricting the generality of Article 2, any nuclear facility or specified equipment designed, constructed or operated, within a period of twenty years after the communication made to the Agency under paragraph 1 above, in the State to which relevant technological information has been transferred shall be deemed to be designed, constructed or operated on the basis of or by the use of transferred relevant technological information if its design, construction or operation is based on the same or essentially the same physical or chemical process or processes as those specified, and communicated to the Agency in accordance with paragraph 1 above, by the contracting Government of the State from which the relevant technological information has been transferred.

Article 4

1. The Agency undertakes to apply safeguards on the nuclear material referred to in Article 2 so as to ensure as far as it is able that such nuclear material is not used for the manufacture of any nuclear weapon or to further any other military purpose or for the manufacture of any other nuclear explosive device. The Agency shall also apply the relevant provisions of the Safeguards Document to the nuclear facilities referred to in Article 2 with a view to assuring the effective application of safeguards on nuclear material.

2. Safeguards shall not be applied in mining or ore processing activities.

Article 5

The contracting Governments undertake to facilitate the application of safeguards provided for in this Agreement and to co-operate with the Agency and with each other to that end.

PART III

INVENTORIES, LISTS AND NOTIFICATIONS

Article 6

1. The contracting Government of the State from which the transfer is made shall notify the Agency of:

- (a) Any transfer to the other State of nuclear material, a nuclear facility, specified equipment or specified material;

(b) Any transfer to the other State of relevant technological information.

2. Any nuclear facility or specified equipment which is designed, constructed or operated on the basis of or by the use of relevant technological information transferred from one State to the other shall be notified to the Agency by the contracting Government of the State to which the relevant technological information had been transferred. The contracting Government of the State from which the relevant technological information had been transferred is under the obligation to consult promptly the other contracting Government if in the view of the former there is reason for a notification to the Agency under this paragraph. The contracting Governments shall jointly or severally inform the Agency promptly if any disagreement should arise between them as to whether a particular nuclear facility or specified equipment should be notified to the Agency in accordance with this paragraph.

3. Whichever contracting Government is concerned shall notify the Agency of any other nuclear facility which is required to be listed in the Inventory in accordance with Article 7, paragraph 1 (b).

Article 7

1. The Agency shall establish and maintain an Inventory with respect to each of the said States. The Inventory shall be divided into three parts:

(a) The Main Part of each Inventory shall list:

- (i) Nuclear material, any nuclear facility, specified equipment and specified material transferred from the other State to the State concerned;
- (ii) Any nuclear facility and specified equipment which is designed, constructed or operated in the State concerned on the basis of or by the use of relevant technological information transferred from the other State;
- (iii) Specified material which has been prepared or produced in the State concerned on the basis of or by the use of specified equipment or relevant technological information transferred from the other State;
- (iv) Nuclear material, including subsequent generations of produced special fissionable material, which has been produced, processed or used in the State concerned on the basis of or by the use of any item referred to in the main Part of the Inventory or any relevant technological information transferred from the other State.

If nuclear material has been substituted for any nuclear material referred to in (i) and (iv) above in accordance with paragraph 25 or 26 (d) of the Safeguards Document, the substituted material shall be listed in place of the nuclear material referred to in (i) and (iv) above.

(b) The Subsidiary Part of each Inventory shall list:

- (i) Any nuclear facility while it contains any specified equipment or specified material listed in the Main Part of the Inventory;
- (ii) Any nuclear facility while it contains, uses, fabricates, or processes any nuclear material listed in the Main Part of the Inventory.

(c) The Inactive Part of each Inventory shall list any nuclear material which would normally be listed in the Main Part of the Inventory but which is not so listed because:

(i) It is exempt from safeguards in accordance with the provisions of paragraph 21, 22 or 23 of the Safeguards Document; or

(ii) Safeguards thereon are suspended in accordance with the provisions of paragraph 24 or 25 of the Safeguards Document.

2. The Agency shall also establish and maintain a List with respect to each recipient State containing a description of such relevant technological information as has been notified under Article 6, paragraph 1 (b).

3. The Agency shall send copies of both Inventories and of the Lists referred to in paragraph 2 above to both contracting Governments every twelve months and also at any other times specified by either contracting Government in a request communicated to the Agency at least two weeks in advance.

Article 8

1. The notification provided for in Article 6, paragraph 1(a) shall normally be made to the Agency not more than two weeks after the nuclear facility, nuclear material, specified equipment or specified material arrives in the State concerned, except that shipments of source material in quantities not exceeding one metric ton shall not be subject to the two weeks notification requirement but shall be reported to the Agency at intervals not exceeding three months. The notification provided for in Article 6, paragraph 2 shall normally be made at as early a stage as possible.

2. Notifications under Article 6, paragraphs 1(a) and 2 shall include, to the extent relevant, the nuclear and chemical composition, the physical form and the quantity of the material, the type and capacity of the specified equipment or nuclear facility involved, the date of shipment, the date of receipt, the identity of the consignor and consignee, and any other relevant information.

3. The contracting Governments also undertake to give the Agency as much advance notice as possible of the transfer of large quantities of nuclear material, any nuclear facility or specified equipment.

4. The notification provided for in Article 6, paragraph 1(b) shall be made at as early a stage as possible.

5. The general contents, form and timing of the notifications referred to in paragraph 4 above shall be agreed between the Parties to this Agreement.

Article 9

1. The contracting Government concerned shall notify the Agency, by means of its reports pursuant to the Safeguards Document, of any special fissionable material produced during the period covered by the report in or by the use of any of the items described in Article 7, paragraphs 1(a) and (b). Upon receipt of the notification, the Agency shall list such produced material in the Main Part of the Inventory. The Agency may verify the calculations of the amounts of such material. Appropriate adjustments in the Inventory shall be made by agreement between the Agency and the contracting Government concerned. Pending final agreement between the Agency and the contracting Government concerned, the Agency's calculations shall be used.

2. The contracting Government concerned shall notify the Agency, by means of its reports pursuant to the Safeguards Document, of any other nuclear material required to be listed in the Main Part of its Inventory pursuant to Article 7, paragraph 1(a)(iv). Upon receipt of the notification, the Agency shall list such nuclear material in the Main Part of the Inventory.

Article 10

1. Whenever any item listed in the Main Part of the Inventory for one of the said States is transferred to the other State the required changes shall be made in the respective Inventories as of the date when the item in question has been received in the State concerned provided that the notification required by Article 6, paragraph 1 has been received by the Agency.

2. The contracting Government concerned shall notify the Agency of any transfer of an item listed in the Main Part of its Inventory to a recipient which is in neither of the said States. Such item may be transferred, and shall upon transfer be deleted from the Inventory, only if arrangements have been made by the Agency to apply safeguards with respect to such item. When any of the following items is transferred, the contracting Governments shall jointly notify the Agency of such transfer and the item in question shall be deleted from the Inventory only upon receipt by the Agency of such joint notification:

- (a) Uranium enriched in uranium-235 to more than 20%, uranium-233 and plutonium, but excepting small quantities of such materials as needed, for example, for laboratory purposes;
- (b) Fuel element fabrication plants for the fabrication of fuel elements containing uranium enriched in uranium-235 to more than 20%, uranium-233 or plutonium;
- (c) Plants for the reprocessing of irradiated fuel elements;
- (d) Uranium enrichment plants.

Joint notifications shall also be used in the case of the transfer of major critical components of any of the plants referred to in (b), (c) and (d) above.

3. Relevant technological information may be transferred to a recipient which is in neither of the said States only if the Agency has made arrangements to apply safeguards in connection with the use of the information transferred.

Article 11

1. Whenever nuclear material, specified equipment or specified material listed in the Main Part of the Inventory for one of the said States is to be transferred to a nuclear facility within that State which is not yet listed in that Inventory, the notification required pursuant to Article 6, paragraph 2 shall be made to the Agency before such transfer is effected. No such transfer may be made until the Agency has confirmed that it has made arrangements in accordance with Article 15, paragraph 2, with respect to that facility.

2. The notification referred to in paragraph 1 above shall be made to the Agency sufficiently in advance to enable the Agency to make the arrangements referred to therein before the transfer is effected. The Agency shall promptly take any necessary action. The contents of such notification shall conform, as far as appropriate, to the requirements of Article 8, paragraph 2.

Article 12

The Agency shall exempt from safeguards nuclear material under the conditions specified in paragraph 21, 22 or 23 of the Safeguards Document and shall suspend safeguards with respect to nuclear material under the conditions specified in paragraph 24 or 25 of the Safeguards Document.

Article 13

Nuclear material shall be deleted from the relevant Inventory and Agency safeguards thereon shall be terminated as provided for in paragraphs 26 and 27 of the Safeguards Document. Nuclear facilities, specified equipment and specified material listed in the Main Part of the Inventory shall be deleted from the relevant Inventory as and when the Agency determines that such nuclear facilities, specified equipment or specified material have been consumed, are no longer usable for any nuclear activity relevant from the point of view of safeguards or have become practicably irrecoverable. The Agency shall also terminate safeguards under this Agreement on nuclear material deleted from the relevant Inventory as provided for in Article 10, paragraph 2.

PART IV

SAFEGUARDS PROCEDURES

Article 14

In applying safeguards, the Agency shall observe the principles set forth in paragraphs 9 through 14 of the Safeguards Document.

Article 15

1. The safeguards procedures to be applied by the Agency are those specified in the Safeguards Document, as well as such additional procedures resulting from technological developments as may be agreed upon between the Agency and the contracting Government concerned.
2. The Agency shall make subsidiary arrangements with each contracting Government concerning the implementation of safeguards procedures which shall include appropriate containment and surveillance measures as well as any procedures necessary for maintaining and verifying the correctness of the Inventory with respect to specified equipment and specified material.
3. The Agency shall have the right to request the information referred to in paragraph 41 of the Safeguards Document and to make the inspections referred to in paragraph 51 thereof.

Article 16

If the Board determines that there has been any non-compliance with this Agreement, the Board shall call upon the contracting Government concerned to remedy such non-compliance forthwith, and shall make such reports as it deems appropriate. In the event of failure by the contracting Government concerned to take fully corrective action within a reasonable time, the Board may take any other measure provided for in Article XII.C of the Agency's Statute. The Agency shall promptly notify both contracting Governments in the event of any determination by the Board pursuant to the present Article.

PART V

AGENCY INSPECTORS

Article 17

Agency inspectors performing functions pursuant to this Agreement shall be governed by the Inspectors Document. However, paragraph 4 of the Inspectors Document shall not apply with regard to any nuclear facility or nuclear material to which the Agency has access at all times in accordance with the Safeguards Document. The actual procedures to implement paragraph 50 of the Safeguards Document in the Federative Republic of Brazil and in the Federal Republic of Germany shall be agreed between the Agency and the contracting Government concerned before the nuclear facility or the nuclear material is listed in the Inventory.

Article 18

The contracting Governments shall apply the relevant provisions of the Agreement on the Privileges and Immunities of the Agency to Agency inspectors performing functions under this Agreement and to any property of the Agency used by them.

PART VI

PHYSICAL PROTECTION

Article 19

Each contracting Government shall keep the Agency informed of the measures it will take for ensuring the physical protection of nuclear material, nuclear facilities and specified equipment.

PART VII

FINANCE

Article 20

Each Party to this Agreement shall bear any expense incurred in the implementation of its responsibilities under this Agreement. However, the Agency shall reimburse a contracting Government in respect of any special expenses, including those referred to in paragraph 6 of the Inspectors Document, incurred by that contracting Government or persons under its jurisdiction at the written request of the Agency. Such reimbursement shall be due only if the contracting Government concerned notified the Agency accordingly before the expense was incurred. These provisions shall not prejudice the allocation of expenses attributable to a failure by a Party to comply with this Agreement.

Article 21

1. The contracting Government of the State concerned shall ensure that any protection against third-party liability, including any insurance or other financial security, with respect to a nuclear incident occurring in a nuclear installation in that State shall apply to the Agency and its inspectors when carrying out their functions under this Agreement as that protection applies to its nationals.
2. Any claim by either contracting Government against the Agency or by the Agency against either contracting Government in respect of any damage, other than damage arising out of a nuclear incident, resulting from the implementation of safeguards under this Agreement, shall be settled in accordance with international law.

PART VIII

INTERPRETATION AND APPLICATION OF THE AGREEMENT
AND SETTLEMENT OF DISPUTES

Article 22

At the request of any of the Parties to this Agreement there shall be consultations about any question arising out of the interpretation or application of this Agreement.

Article 23

1. The Parties shall endeavour to settle by negotiation any dispute arising from the interpretation or application of this Agreement.

2. If a dispute is not settled by negotiation or as may otherwise be agreed by the Parties concerned, it shall be submitted, on the request of any of the Parties concerned, to an arbitral tribunal composed as follows:

- (a) If the dispute involves only two of the Parties to this Agreement, all three Parties agreeing that the third is not concerned, the two Parties involved shall each designate one arbitrator, and the two arbitrators so designated shall elect a third, who shall be the Chairman. If within thirty days of the request for arbitration either Party has not designated an arbitrator, either Party to the dispute may request the President of the International Court of Justice to appoint an arbitrator. The same procedure shall apply if within thirty days of the designation or appointment of the second arbitrator, the third arbitrator has not been elected; or
- (b) If the dispute involves all three Parties to this Agreement, each Party shall designate one arbitrator, and the three arbitrators so designated shall by unanimous decision elect a fourth arbitrator, who shall be the Chairman, and a fifth arbitrator. If within thirty days of the request for arbitration any Party has not designated an arbitrator, any Party may request the President of the International Court of Justice to appoint the necessary number of arbitrators. The same procedure shall apply if, within thirty days of the designation or appointment of the third of the first three arbitrators, the Chairman or the fifth arbitrator has not been elected.

3. A majority of the members of the arbitral tribunal shall constitute a quorum, and all decisions shall require the concurrence of at least a majority. The arbitral procedure shall be fixed by the tribunal. The decisions of the tribunal, including all rulings concerning its constitution, procedure, jurisdiction and the division of the expenses of arbitration between the Parties shall be binding on all Parties. The remuneration of the arbitrators shall be determined on the same basis as that of ad hoc judges of the International Court of Justice.

Article 24

Decisions of the Board concerning the implementation of this Agreement, except such as relate only to Articles 20 and 21, shall, if they so provide, be given effect immediately by the Parties, pending the final settlement of any dispute.

PART IX

FINAL CLAUSES

Article 25

Any amendment of this Agreement shall require the consent of the Parties. If the Agency modifies the Safeguards Document, the scope of the safeguards system or the Inspectors Document, this Agreement shall be amended if both contracting Governments so request in order to take account of any or all such modifications. Such extensions of the Safeguards Document as may be approved by the Board to provide for special safeguards procedures in respect of plants for separating the isotopes of nuclear material shall be applicable under this Agreement.

Article 26

This Agreement shall also apply to Berlin (West), provided that the Government of the Federal Republic of Germany does not make a contrary declaration to the Director General of the Agency and to the Government of the Federative Republic of Brazil within three months of the date of entry into force of this Agreement.

Article 27

This Agreement shall enter into force upon signature by or for the Director General of the Agency, by the authorized representative of the Government of the Federative Republic of Brazil and by the authorized representative of the Government of the Federal Republic of Germany.

Article 28

1. This Agreement shall remain in force until, in accordance with this Agreement:
 - (a) Safeguards have been terminated on all nuclear material, including subsequent generations of produced special fissionable material, subject to safeguards under this Agreement; and
 - (b) All other items have been deleted from the Inventories.
2. If, after this Agreement has ceased to be in force, a nuclear facility or specified equipment is designed, constructed or operated in either State on the basis of or by the use of relevant technological information transferred from the other, this Agreement shall forthwith be reinstated.

Article 29

1. With respect to the Federal Republic of Germany, the provisions of the Treaty of 1 July 1968 on the Non-Proliferation of Nuclear Weapons as well as of the Treaties establishing the European Economic Community and the European Atomic Energy Community and of the Agreement of 5 April 1973 in Implementation of Article III (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons shall not be affected by this Agreement.
2. The said Agreement of 5 April 1973, shall, as long as it remains in force, have the effect of suspending the application of safeguards under this Agreement in the Federal Republic of Germany.

ANNEX III

TREATY FOR THE PROHIBITION OF
NUCLEAR WEAPONS IN LATIN AMERICA

TREATY FOR THE PROHIBITION OF NUCLEAR WEAPONS IN LATIN AMERICA

PREAMBLE

In the name of their peoples and faithfully interpreting their desires and aspirations, the Governments of the States which sign the Treaty for the Prohibition of Nuclear Weapons in Latin America.

DESIRING to contribute, so far as lies in their power, towards ending the armaments race, especially in the field of nuclear weapons, and towards strengthening a world at peace, based on the sovereign equality of States, mutual respect and good neighbourliness.

RECALLING that the United Nations General Assembly, in its Resolution 808 (IX), adopted unanimously as one of the three points of a co-ordinated programme of disarmament "the total prohibition of the use and manufacture of nuclear weapons and weapons of mass destruction of every type",

RECALLING that militarily denuclearized zones are not an end in themselves but rather a means for achieving general and complete disarmament at a later state,

RECALLING United Nations General Assembly Resolution 1911 (XVIII), which established that the measures that should be agreed upon for the denuclearization of Latin America should be taken "in the light of the principles of the Charter of the United Nations and of regional agreements",

RECALLING United Nations General Assembly Resolution 2028 (XX), which established the principle of an acceptable balance of mutual responsibilities and duties for the nuclear and non-nuclear powers, and

RECALLING that the Charter of the Organization of American States proclaims that it is an essential purpose of the Organization to strengthen the peace and security of the hemisphere,

CONVINCED:

That the incalculable destructive power of nuclear weapons has made it imperative that the legal prohibition of war should be strictly observed in practice if the survival of civilization and of mankind itself is to be assured.

That nuclear weapons, whose terrible effects are suffered, indiscriminately and inexorably, by military forces and civilian population alike, constitute, through the persistence of the radioactivity they release, an attack on the integrity of the human species and ultimately may even render the whole earth uninhabitable.

That general and complete disarmament under effective international control is a vital matter which all the peoples of the world equally demand,

That the proliferation of nuclear weapons, which seems inevitable unless States, in the exercise of their sovereign rights, impose restrictions on themselves in order to prevent it, would make any agreement on disarmament enormously difficult and would increase the danger of the outbreak of a nuclear conflagration,

That the establishment of militarily denuclearized zones is closely linked with the maintenance of peace and security in the respective regions,

That the military denuclearization of vast geographical zones, adopted by the sovereign decision of the States comprised therein, will exercise a beneficial influence on other regions where similar conditions exist,

That the privileged situation of the signatory States, whose territories are wholly free from nuclear weapons, imposes upon them the inescapable duty of preserving that situation both in their own interests and for the good of mankind,

That the existence of nuclear weapons in any country of Latin America would make it a target for possible nuclear attacks and would inevitably set off, throughout the region, a ruinous race in nuclear weapons which would involve the unjustifiable diversion for warlike purposes, of the limited resources required for economic and social development.

That the foregoing reasons, together with the traditional peace-loving outlook of Latin America, give rise to an inescapable necessity that nuclear energy should be used in that region exclusively for peaceful purposes, and that the Latin American countries should use their right to the greatest and most equitable possible access to this new source of energy in order to expedite the economic and social development of their peoples.

CONVINCED FINALLY:

That the Military denuclearization of Latin America - being understood to mean the undertaking entered into internationally in this Treaty to keep their territories forever free from nuclear weapons - will constitute a measure which will spare their peoples from the squandering of their limited resources on nuclear armaments and will protect them against possible nuclear attacks on their territories, and will also constitute a significant contribution towards preventing the proliferation of nuclear weapons and a powerful factor for general and complete disarmament, and

That Latin America, faithful to its tradition of universality, must not only endeavour to banish from its homelands the scourge of a nuclear war, but must also strive to promote the well-being and advancement of its peoples, at the same time co-operating in the fulfilment of the ideals of mankind, that is to say, in the consolidation of a permanent peace based on equal rights, economic fairness and social justice for all, in accordance with the principles and purposes set forth in the Charter of the United Nations and in the Charter of the Organization of American States,

HAVE AGREED AS FOLLOWS:

Obligations

Article 1

1. The Contracting Parties hereby undertake to use exclusively for peaceful purposes the nuclear material and facilities which are under their jurisdiction, and to prohibit and prevent in their respective territories:

- (a) The testing, use, manufacture, production or acquisition by any means whatsoever of any nuclear weapons, by the Parties themselves, directly or indirectly, on behalf of anyone else or in any other way, and
- (b) The receipt, storage, installation, deployment and any form of possession of any nuclear weapons, directly or indirectly, by the Parties themselves, by anyone on their behalf or in any other way.

2. The Contracting Parties also undertake to refrain from engaging in, encouraging or authorizing, directly or indirectly, or in any way participating in the testing, use, manufacture, production, possession or control of any nuclear weapon.

Definition of the Contracting Parties

Article 2

For the purposes of this Treaty, the Contracting Parties are those for whom the Treaty is in force.

Definition of territory

Article 3

For the purposes of this Treaty, the term "territory" shall include the territorial sea, air space and any other space over which the State exercises sovereignty in accordance with its own legislation.

Zone of application

Article 4

1. The zone of application of this Treaty is the whole of the territories for which the Treaty is in force.

2. Upon fulfilment of the requirements of article 28, paragraph 1, the zone of application of this Treaty shall also be that which is situated in the western hemisphere within the following limits (except the continental part of the territory of the United States of America and its territorial waters): starting at a point located at 35° north latitude, 75° west longitude; from this point directly southward to a point at 30° north latitude, 75° west longitude; from there directly eastward to a point at 30° north latitude, 50° west longitude; from there, along a loxodromic line to a point at 5° north latitude, 20° west longitude; from there, directly southward to a point at 60° south latitude, 20° west longitude; from there, directly westward to a point at 60° south latitude, 115° west longitude; from there directly northward to a point at 0° latitude, 115° west longitude; from there, along a loxodromic line to a point at 35° north latitude, 150° west longitude; from there, directly eastward to a point at 35° north latitude, 75° west longitude.

Definition of nuclear weapons

Article 5

For the purposes of this Treaty, a nuclear weapon is any device which is capable of releasing nuclear energy in an uncontrolled manner and which has a group of characteristics that are appropriate for use for warlike purposes. An instrument that may be used for the transport or propulsion of the device is not included in this definition if it is separable from the device and not an indivisible part thereof.

Meetings of signatories

Article 6

At the request of any of the signatory States or if the Agency established by Article 7 should so decide, a meeting of all the signatories may be convoked to consider in common questions which may affect the very essence of this instrument, including possible amendments to it. In either case, the meetings will be convoked by the General Secretary.

Organization

Article 7

1. In order to ensure compliance with the obligations of this Treaty, the Contracting Parties hereby establish an international organization to be known as the "Agency for the Prohibition of Nuclear Weapons in Latin America", hereinafter referred to as "the Agency". Only the Contracting Parties shall be affected by its decisions.
2. The Agency shall be responsible for the holding of periodic or extraordinary consultations among Member States on matters relating to the purposes, measures and procedures set forth in this Treaty and to the supervision of compliance with the obligations arising therefrom.
3. The Contracting Parties agree to extend to the Agency full and prompt co-operation in accordance with the provisions of this Treaty, of any agreements they may conclude with the Agency and of any agreements the Agency may conclude with any other international organization or body.
4. The headquarters of the Agency shall be in Mexico City.

Organs

Article 8

1. There are hereby established as principal organs of the Agency a General Conference, a Council and a Secretariat.
2. Such subsidiary organs as are considered necessary by the General Conference may be established within the purview of this Treaty.

The General Conference

Article 9

1. The General Conference, the supreme organ of the Agency, shall be composed of all the Contracting Parties; it shall hold regular sessions every two years, and may also hold special sessions whenever this Treaty so provides or, in the opinion of the Council, the circumstances so require.
2. The General Conference:
 - (a) May consider and decide on any matters or questions covered by this Treaty, within the limits thereof, including those referring to powers and functions of any organ provided for in this Treaty.
 - (b) Shall establish procedures for the control system to ensure observance of this Treaty in accordance with its provisions.
 - (c) Shall elect the Members of the Council and the General Secretary.
 - (d) May remove the General Secretary from office if the proper functioning of the Agency so requires.
 - (e) Shall receive and consider the biennial and special reports submitted by the Council and the General Secretary.
 - (f) Shall initiate and consider studies designed to facilitate the optimum fulfilment of the aims of this Treaty, without prejudice to the power of the General Secretary independently to carry out similar studies for submission to and consideration by the Conference.
 - (g) Shall be the organ competent to authorize the conclusion of agreements with Governments and other international organizations and bodies.
3. The General Conference shall adopt the Agency's budget and fix the scale of financial contributions to be paid by Member States, taking into account the systems and criteria used for the same purpose by the United Nations.
4. The General Conference shall elect its officers for each session and may establish such subsidiary organs as it deems necessary for the performance of its functions.
5. Each Member of the Agency shall have one vote. The decisions of the General Conference shall be taken by a two-thirds majority of the Members present and voting in the case of matters relating to the control system and measures referred to in article 20, the admission of new Members, the election or removal of the General Secretary, adoption of the budget and matters related thereto. Decisions on other matters, as well as procedural questions and also determination of which questions must be decided by a two-thirds majority, shall be taken by a simple majority of the Members present and voting.
6. The General Conference shall adopt its own rules of procedure.

The Council

Article 10

1. The Council shall be composed of five Members of the Agency elected by the General Conference from among the Contracting Parties, due account being taken of equitable geographic distribution.
2. The Members of the Council shall be elected for a term of four years. However, in the first election three will be elected for two years. Outgoing Members may not be re-elected for the following period unless the limited number of States for which the Treaty is in force so requires.

3. Each Member of the Council shall have one representative.
4. The Council shall be so organized as to be able to function continuously.
5. In addition to the functions conferred upon it by this Treaty and to those which may be assigned to it by the General Conference, the Council shall, through the General Secretary, ensure the proper operation of the control system in accordance with the provisions of this Treaty and with the decisions adopted by the General Conference.
6. The Council shall submit an annual report on its work to the General Conference as well as such special reports as it deems necessary or which the General Conference requests of it.
7. The Council shall elect its officers for each session.
8. The decisions of the Council shall be taken by a simple majority of its Members present and voting.
9. The Council shall adopt its own rules of procedure.

The Secretariat

Article 11

1. The Secretariat shall consist of a General Secretary, who shall be the chief administrative officer of the Agency, and of such staff as the Agency may require. The term of office of the General Secretary shall be four years and he may be re-elected for a single additional term. The General Secretary may not be a national of the country in which the Agency has its headquarters. In case the office of General Secretary becomes vacant, a new election shall be held to fill the office for the remainder of the term.
2. The staff of the Secretariat shall be appointed by the General Secretary, in accordance with rules laid down by the General Conference.
3. In addition to the functions conferred upon him by this Treaty and to those which may be assigned to him by the General Conference, - the General Secretary shall ensure, as provided by article 10, paragraph 5, the proper operation of the control system established by this Treaty, in accordance with the provisions of the Treaty and the decisions taken by the General Conference.
4. The General Secretary shall act in that capacity in all meetings of the General Conference and of the Council and shall make an annual report to both bodies on the work of the Agency and any special reports requested by the General Conference or the Council or which the General Secretary may deem desirable.
5. The General Secretary shall establish the procedures for distributing to all Contracting Parties information received by the Agency from governmental sources and such information from non-governmental sources as may be of interest to the Agency.
6. In the performance of their duties the General Secretary and the staff shall not seek or receive instructions from any Government or from any other authority external to the Agency and shall refrain from any action which might reflect on their position as international officials responsible only to the Agency; subject to their responsibility to the Agency, they shall not disclose any industrial secrets or other confidential information coming to their knowledge by reason of their official duties in the Agency.

7. Each of the Contracting Parties undertakes to respect the exclusively international character of the responsibilities of the General Secretary and the staff and not to seek to influence them in the discharge of their responsibilities.

Control system

Article 12

1. For the purpose of verifying compliance with the obligations entered into by the Contracting Parties in accordance with article 1, a control system shall be established which shall be put into effect in accordance with the provisions of articles 13-18 of this Treaty.

2. The control system shall be used in particular for the purpose of verifying:

- (a) That devices, services and facilities intended for peaceful uses of nuclear energy are not used in the testing or manufacture of nuclear weapons,
- (b) That none of the activities prohibited in article 1 of this Treaty are carried out in the territory of the Contracting Parties with nuclear materials or weapons introduced from abroad, and
- (c) That explosions for peaceful purposes are compatible with article 18 of this Treaty.

IAEA safeguards

Article 13

Each Contracting Party shall negotiate multilateral or bilateral agreements with the International Atomic Energy Agency for the application of its safeguards to its nuclear activities. Each Contracting Party shall initiate negotiations within a period of 180 days after the date of the deposit of its instrument of ratification of this Treaty. These agreements shall enter into force, for each Party, not later than eighteen months after the date of the initiation of such negotiations except in case of unforeseen circumstances or force majeure.

Reports of the Parties

Article 14

1. The Contracting Parties shall submit to the Agency and to the International Atomic Energy Agency, for their information, semi-annual reports stating that no activity prohibited under this Treaty has occurred in their respective territories.

2. The Contracting Parties shall simultaneously transmit to the Agency a copy of any report they may submit to the International Atomic Energy Agency which relates to matters that are the subject of this Treaty and to the application of safeguards.

3. The Contracting Parties shall also transmit to the Organization of American States, for its information, any reports that may be of interest to it, in accordance with the obligations established by the Inter-American System.

Special Reports requested by the General Secretary

Article 15

1. With the authorization of the Council, the General Secretary may request any of the Contracting Parties to provide the Agency with complementary or supplementary information regarding any event or circumstance connected with compliance with this Treaty, explaining his reasons. The Contracting Parties undertake to co-operate promptly and fully with the General Secretary.
2. The General Secretary shall inform the Council and the Contracting Parties forthwith of such requests and of the respective replies.

Special inspections

Article 16

1. The International Atomic Energy Agency and the Council established by this Treaty have the power of carrying out special inspections in the following cases:

- (a) In the case of the International Atomic Energy Agency, in accordance with the agreements referred to in article 13 of this Treaty;
- (b) In the case of the Council:

(i) When so requested, the reasons for the request being stated, by any Party which suspects that some activity prohibited by this Treaty has been carried out or about to be carried out, either in the territory of any other Party or in any other place on such latter Party's behalf, the Council shall immediately arrange for such an inspection in accordance with article 10, paragraph 5.

(ii) When requested by any Party which has been suspected of or charged with having violated this Treaty, the Council shall immediately arrange for the special inspection requested in accordance with article 10, paragraph 5.

The above requests will be made to the Council through the Secretary General.

2. The costs and expenses of any special inspection carried out under paragraph 1, subparagraph (b), sections (i) and (ii) of this article shall be borne by the requesting Party or Parties, except where the Council concludes on the basis of the report on the special inspection that, in view of the circumstances existing in the case, such costs and expenses should be borne by the Agency.
3. The General Conference shall formulate the procedures for the organization and execution of the special inspections carried out in accordance with paragraph 1, subparagraph (b), sections (i) and (ii) of this article.
4. The Contracting Parties undertake to grant the inspectors carrying out such special inspections full and free access to all places and all information which may be necessary for the performance of their duties and which are directly and intimately connected with the suspicion of violation of this Treaty. If so requested by the authorities of the Contracting Party in whose territory the inspection is carried out, the inspectors designated by the General Conference shall be accompanied by representatives of said authorities, provided that this does not in any way delay or hinder the work of the inspectors.
5. The Council shall immediately transmit to all the Parties, through the General Secretary, a copy of any report resulting from special inspections.

6. Similarly, the Council shall send through the General Secretary to the Secretary-General of the United Nations, for transmission to the United Nations Security Council and General Assembly, and to the Council of the Organization of American States, for its information, a copy of any report resulting from any special inspection carried out in accordance with paragraph 1, sub-paragraph (b), sections (i) and (ii) of this article.

7. The Council may decide, or any Contracting Party may request, the convening of a special session of the General Conference for the purpose of considering the reports resulting from any special inspection. In such a case, the General Secretary shall take immediate steps to convene the special session requested.

8. The General Conference, convened in special session under this article, may make recommendations to the Contracting Parties and submit reports to the Secretary-General of the United Nations to be transmitted to the United Nations Security Council and the General Assembly.

Use of nuclear energy for peaceful purposes

Article 17

Nothing in the provisions of this Treaty shall prejudice the rights of the Contracting Parties, in conformity with this Treaty, to use nuclear energy for peaceful purposes, in particular for their economic development and social progress.

Explosions for peaceful purposes

Article 18

1. The Contracting Parties may carry out explosions of nuclear devices for peaceful purposes—including explosions which involve devices similar to those used in nuclear weapons—or collaborate with third parties for the same purpose, provided that they do so in accordance with the provisions of this article and the other articles of the Treaty, particularly articles 1 and 5.

2. Contracting Parties intending to carry out, or to cooperate in carrying out, such an explosion shall notify the Agency and the International Atomic Energy Agency, as far in advance as the circumstances require, of the date of the explosion and shall at the same time provide the following information:

- (a) The nature of the nuclear device and the source from which it was obtained,
- (b) The place and purpose of the planned explosion,
- (c) The procedures which will be followed in order to comply with paragraph 3 of this article,
- (d) The expected force of the device, and
- (e) The fullest possible information on any possible radioactive fall-out that may result from the explosion or explosions, and measures which will be taken to avoid danger to the population, flora, fauna and territories of any other Party or Parties.

3. The General Secretary and the technical personnel designated by the Council and the International Atomic Energy Agency may observe all the preparations, including the explosion of the device, and shall have unrestricted access to any area in the vicinity of the site of the explosion in order to ascertain whether the device and the procedures followed during the explosion are in conformity with the information supplied under paragraph 2 of this article and the other provisions of this Treaty.

4. The Contracting Parties may accept the collaboration of third parties for the purpose set forth in paragraph 1 of the present article, in accordance with paragraphs 2 and 3 thereof.

Relations with international organizations

Article 19

1. The Agency may conclude such agreements with the International Atomic Energy Agency as are authorized by the General Conference and as it considers likely to facilitate the efficient operation of the control system established by this Treaty.
2. The Agency may also enter into relations with any international organization or body, especially any which may be established in the future to supervise disarmament or measures for the control of armaments in any part of the world.
3. The Contracting Parties may, if they see fit, request the advice of the Inter-American Nuclear Energy Commission on all technical matters connected with the application of this Treaty with which the Commission is competent to deal under its Statute.

Measures in the event of violation of the Treaty

Article 20

1. The General Conference shall take note of all cases in which, in its opinion, any Contracting Party is not complying fully with its obligations under this Treaty and shall draw the matter to the attention of the Party concerned, making such recommendations as it deems appropriate.
2. If, in its opinion, such non-compliance constitutes a violation of this Treaty which might endanger peace and security, the General Conference shall report thereon simultaneously to the United Nations Security Council and the General Assembly through the Secretary-General of the United Nations, and to the Council of the Organization of American States. The General Conference shall likewise report to the International Atomic Energy Agency for such purposes as are relevant in accordance with its Statute.

United Nations and Organization of American States

Article 21

None of the provisions of this Treaty shall be construed as impairing the rights and obligations of the Parties under the Charter of the United Nations or, in the case of States Members of the Organization of American States, under existing regional treaties.

Privileges and immunities

Article 22

1. The Agency shall enjoy in the territory of each of the Contracting Parties such legal capacity and such privileges and immunities as may be necessary for the exercise of its functions and the fulfilment of its purposes.
2. Representatives of the Contracting Parties accredited to the Agency and officials of the Agency shall similarly enjoy such privileges and immunities as are necessary for the performance of their functions.

3. The Agency may conclude agreements with the Contracting Parties with a view to determining the details of the application of paragraphs 1 and 2 of this article.

Notification of other agreements

Article 23

Once this Treaty has entered into force, the Secretariat shall be notified immediately of any international agreement concluded by any of the Contracting Parties on matters with which this Treaty is concerned; the Secretariat shall register it and notify the Contracting Parties.

Settlement of disputes

Article 24

Unless the Parties concerned agree on another mode of peaceful settlement, any question or dispute concerning the interpretation or application of this Treaty which is not settled shall be referred to the International Court of Justice with the prior consent of the Parties to the controversy.

Signature

Article 25

1. This Treaty shall be open indefinitely for signature by:
 - (a) All the Latin American Republics, and
 - (b) All other sovereign States situated in their entirety south of latitude 35° north in the hemisphere; and, except as provided in paragraph 2 of this article, all such States which become sovereign, when they have been admitted by the General Conference.
2. The General Conference shall not take any decision regarding the admission of a political entity part or all of whose territory is the subject, prior to the date when this Treaty is opened for signature, of a dispute or claim between an extra-continental country and one or more Latin American States, so long as the dispute has not been settled by peaceful means.

Ratification and deposit

Article 26

1. This Treaty shall be subject to ratification by signatory States in accordance with their respective constitutional procedures.
2. This Treaty and the instruments of ratification shall be deposited with the Government of the Mexican United States, which is hereby designated the depositary Government.
3. The Depositary Government shall send certified copies of this Treaty to the Governments of signatory States and shall notify them of the deposit of each instrument of ratification.

Reservations

Article 27

This Treaty shall not be subject to reservations.

Entry into force

Article 28

1. Subject to the provisions of paragraph 2 of this article, this Treaty shall enter into force among the States that have ratified it as soon as the following requirements have been met:
 - (a) Deposit of the instruments of ratification of this Treaty with the Depositary Government by the Governments of the States mentioned in article 25 which are in existence on the date when this Treaty is opened for signature and which are not affected by the provisions of article 25, paragraph 2;
 - (b) Signature and ratification of Additional Protocol I annexed to this Treaty by all extra-continental or continental States having *de jure or de facto* international responsibility for territories situated in the zone of application of the Treaty;
 - (c) Signature and ratification of the Additional Protocol II annexed to this Treaty by powers possessing nuclear weapons;
 - (d) Conclusion of bilateral or multilateral agreements on the application of the Safeguards System of the International Atomic Energy Agency in accordance with article 13 of this Treaty.
2. All signatory States shall have the imprescriptible right to waive, wholly or in part, the requirements laid down in the preceding paragraph. They may do so by means of a declaration which shall be annexed to their respective instrument of ratification and which may be formulated at the time of deposit of the instrument or subsequently. For those States which exercise this right, this Treaty shall enter into force upon deposit of the declaration, or as soon as those requirements have been met which have not been expressly waived.
3. As soon as this Treaty has entered into force in accordance with the provisions of paragraph 2 for eleven States, the Depositary Government shall convene a preliminary meeting of those States in order that the Agency may be set up and commence its work.
4. After the entry into force of this Treaty for all the countries of the zone, the rise of a new power possessing nuclear weapons shall have the effect of suspending the execution of this Treaty for those countries which have ratified it without waiving requirements of paragraph 1, sub-paragraph (c) of this article, and which request such suspension; the Treaty shall remain suspended until the new power, on its own initiative or upon request by the General Conference, ratifies the annexed Additional Protocol II.

Amendments

Article 29

1. Any Contracting Party may propose amendments to this Treaty and shall submit its proposals to the Council through the General Secretary, who shall transmit them to all the other Contracting Parties and, in addition, to all other signatories in accordance with article 6. The Council, through the General Secretary, shall immediately following the meeting of signatories convene a special session of the General Conference to examine the proposals made, for the adoption of which a two-thirds majority of the Contracting Parties

present and voting shall be required.

2. Amendments adopted shall enter into force as soon as the requirements set forth in article 28 of this Treaty have been complied with.

Duration and denunciation

Article 30

1. This Treaty shall be of a permanent nature and shall remain in force indefinitely, but any Party may denounce it by notifying the General Secretary of the Agency, if, in the opinion of the denouncing State, there have arisen or may arise circumstances connected with the content of this Treaty or of the annexed Additional Protocols I and II which affect its supreme interests or the peace and security of one or more Contracting Parties.

2. The denunciation shall take effect three months after the delivery to the General Secretary of the Agency of the notification by the Government of the signatory State concerned. The General Secretary shall immediately communicate such notification to the other Contracting Parties and to the Secretary-General of the United Nations for the information of the United Nations Security Council and the General Assembly. He shall also communicate it to the Secretary-General of the Organization of American States.

Authentic texts and registration

Article 31

This Treaty, of which the Spanish, Chinese, English, French, Portuguese and Russian texts are equally authentic, shall be registered by the Depositary Government in accordance with article 102 of the United Nations Charter. The Depositary Government shall notify the Secretary-General of the United Nations of the signatures, ratifications and amendments relating to this Treaty and shall communicate them to the Secretary-General of the Organization of American States for its information.

Transitional Article

Denunciation of the declaration referred to in article 28, paragraph 2, shall be subject to the same procedures as the denunciation of this Treaty, except that it will take effect on the date of delivery of the respective notification.

In witness whereof the undersigned Plenipotentiaries, having deposited their full powers, found in good and due form, sign this Treaty on behalf of their respective Governments.

Done at Mexico, Distrito Federal, on the Fourteenth day of February, one thousand nine hundred and sixty-seven.

ADDITIONAL PROTOCOL I

The undersigned Plenipotentiaries, furnished with full powers by their respective Governments,

CONVINCED that the Treaty for the Prohibition of Nuclear Weapons in Latin America, negotiated and signed in accordance with the recommendations of the General Assembly of the United Nations in Resolution 1911 (XVIII) of 27 November 1963, represents an important step towards ensuring the non-proliferation of nuclear weapons,

AWARE that the non-proliferation of nuclear weapons is not an end in itself but, rather a means of achieving general and complete disarmament at a later stage, and

DESIRING to contribute, so far as lies in their power, towards ending the armaments race, especially in the field of nuclear weapons, and towards strengthening a world at peace, based on mutual respect and sovereign equality of States,

HAVE AGREED AS FOLLOWS;

Article 1

To undertake to apply the statute of denuclearization in respect of warlike purposes as defined in articles 1, 3, 5 and 13 of the Treaty for the Prohibition of Nuclear Weapons in Latin America in territories for which, *de jure* or *de facto*, they are internationally responsible and which lie within the limits of the geographical zone established in that Treaty.

Article 2

The duration of this Protocol shall be the same as that of the Treaty for the Prohibition of Nuclear Weapons in Latin America of which this Protocol is an annex, and the provisions regarding ratification and denunciation contained in the Treaty shall be applicable to it.

Article 3

This Protocol shall enter into force, for the States which have ratified it, on the date of the deposit of their respective instruments of ratification.

In witness whereof the undersigned Plenipotentiaries, having deposited their full powers, found in good and due form, sign this Protocol on behalf of their respective Governments.

ADDITIONAL PROTOCOL II

The undersigned Plenipotentiaries, furnished with full powers by their respective Governments,

CONVINCED that the Treaty for the Prohibition of Nuclear Weapons in Latin America, negotiated and signed in accordance with the recommendations of the General Assembly of the United Nations in Resolution 1911 (XVIII) of 27 November 1963, represents an important step towards ensuring the non-proliferation of nuclear weapons,

AWARE that the non-proliferation of nuclear weapons is not an end in itself but, rather, a means of achieving general and complete disarmament at a later stage, and

DESIRING to contribute, so far as lies in their power, towards ending the armaments race, especially in the field of nuclear weapons, and towards promoting and strengthening a world at peace, based on mutual respect and sovereign equality of States,

HAVE AGREED AS FOLLOWS:

Article 1

The statute of denuclearization of Latin America in respect of warlike purposes, as defined, delimited and set forth in the Treaty for the Prohibition of Nuclear Weapons in Latin America of which this instrument is an annex, shall be fully respected by the Parties to this Protocol in all its express aims and provisions.

Article 2

The Governments represented by the undersigned Plenipotentiaries undertake, therefore, not to contribute in any way to the performance of acts involving a violation of the obligations of article 1 of the Treaty in the territories to which the Treaty applies in accordance with article 4 thereof.

Article 3

The Governments represented by the undersigned Plenipotentiaries also undertake not to use or threaten to use nuclear weapons against the Contracting Parties of the Treaty for the Prohibition of Nuclear Weapons in Latin America.

Article 4

The duration of this Protocol shall be the same as that of the Treaty for the Prohibition of Nuclear Weapons in Latin America of which this protocol is an annex, and the definitions of territory and nuclear weapons set forth in articles 3 and 5 of the Treaty shall be applicable to this Protocol, as well as the provisions regarding ratification, reservations, denunciation, authentic texts and registration contained in articles 26, 27, 30 and 31 of the Treaty.

Article 5

This Protocol shall enter into force, for the States which have ratified it, on the date of the deposit of their respective instruments of ratification.

IN WITNESS WHEREOF the undersigned Plenipotentiaries, having deposited their full powers, found in good and due form, sign this Additional Protocol on behalf of their respective Governments.

ANNEX IV

TREATY ON THE
NON-PROLIFERATION OF NUCLEAR WEAPONS

TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS

The States concluding this Treaty, hereinafter referred to as the "Parties to the Treaty".

CONSIDERING the devastation that would be visited upon all mankind by a nuclear war and the consequent need to make every effort to avert the danger of such a war and to take measures to safeguard the security of peoples,

BELIEVING that the proliferation of nuclear weapons would seriously enhance the danger of nuclear war,

IN CONFORMITY with resolutions of the United Nations General Assembly calling for the conclusion of an agreement on the prevention of wider dissemination of nuclear weapons,

UNDERTAKING to cooperate in facilitating the application of International Atomic Energy Agency safeguards on peaceful nuclear activities.

EXPRESSING their support for research, development and other efforts to further the application, within the framework of the International Atomic Energy Agency safeguards system, of the principle of safeguarding effectively the flow of source and special fissionable materials by use of instruments and other techniques at certain strategic points,

AFFIRMING the principle that the benefits of peaceful applications of nuclear technology, including any technological by-products which may be derived by nuclear-weapon States from the development of nuclear explosive devices, should be available for peaceful purposes to all Parties to the Treaty, whether nuclear-weapon or non-nuclear-weapon States,

CONVINCED that, in furtherance of this principle, all Parties to the Treaty are entitled to participate in the fullest possible exchange of scientific information for, and to contribute alone or in cooperation with other States to, the further development of the applications of Atomic energy for peaceful purposes,

DECLARING their intention to achieve at the earliest possible date the cessation of the nuclear arms race and to undertake effective measures in the direction of nuclear disarmament,

URGING the cooperation of all States in the attainment of this objective,

RECALLING the determination expressed by the Parties to the 1963 Treaty banning nuclear weapon tests in the atmosphere in outer space and under water in its Preamble to seek to achieve the discontinuance of all test explosions of nuclear weapons for all time and to continue negotiations to this end,

DESIRING to further the easing of international tension and the strengthening of trust between States in order to facilitate the cessation of the manufacture of nuclear weapons, the liquidation of all their existing stockpiles, and the elimination from national arsenals of nuclear weapons and the means of their delivery pursuant to a treaty on general and complete disarmament under strict and effective international control,

RECALLING that, in accordance with the Charter of the United Nations, States must refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the Purposes of the United Nations, and that the establishment and maintenance of international peace and security are to be promoted with the least diversion for armaments of the world's human and economic resources,

HAVE AGREED AS FOLLOWS:

Article I

Each nuclear-weapon State Party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly; and not in any way to assist, encourage, or induce any non-nuclear-weapon State to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices, or control over such weapons or explosive devices.

Article II

Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.

Article III

1. Each non-nuclear-weapon State Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in accordance with the Statute of the International Atomic Energy Agency and the Agency's safeguards system, for the exclusive purpose of verification of the fulfillment of its obligations assumed under this Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices. Procedures for the safeguards required by this article shall be followed with respect to source or special fissionable material whether it is being produced, processed or used in any principal nuclear facility or is outside any such facility. The safeguards required by this article shall be applied on all source or special fissionable material in all peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere.

2. Each State Party to the Treaty undertakes not to provide: (a) source or special fissionable material, or (b) equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards required by this article.

3. The safeguards required by this article shall be implemented in a manner designed to comply with article IV of this Treaty, and to avoid hampering the economic or technological development of the Parties or international cooperation in the field of peaceful nuclear activities, including the international exchange of nuclear material and equipment for the processing, use or production of nuclear material for peaceful purposes in accordance with the provisions of this article and the principle of safeguarding set forth in the Preamble of the Treaty.

4. Non-nuclear-weapon States Party to the Treaty shall conclude agreements with the International Atomic Energy Agency to meet the requirements of this article either individually or together with other States in accordance with the Statute of the International Atomic Energy Agency. Negotiation of such agreements shall commence within 180 days from the original entry into force of this Treaty. For States depositing their instruments of ratification or accession after the 180-day period, negotiation of such agreements shall commence not later than the date of such deposit. Such agreements shall enter into force not later than eighteen months after the date of initiation of negotiations.

Article IV

1. Nothing in this Treaty shall be interpreted as affecting the inalienable right of all Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with articles I and II of this Treaty.
2. All the Parties to the Treaty undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy. Parties to the Treaty in a position to do so shall also cooperate in contributing alone or together with other States or international organizations to the further development of the applications of nuclear energy for peaceful purposes, especially in the territories of non-nuclear-weapon States Party to the Treaty, with due consideration for the needs of the developing areas of the world.

Article V

Each Party to the Treaty undertakes to take appropriate measures to ensure that, in accordance with this Treaty, under appropriate international observation and through appropriate international procedures, potential benefits from any peaceful applications of nuclear explosions will be made available to non-nuclear-weapon States Party to the Treaty on a non-discriminatory basis and that the charge to such Parties for the explosive devices used will be as low as possible and exclude any charge for research and development. Non-nuclear-weapon States Party to the Treaty shall be able to obtain such benefits, pursuant to a special international agreement or agreements, through an appropriate international body with adequate representation of non-nuclear-weapon States. Negotiations on this subject shall commence as soon as possible after the Treaty enters into force. Non-nuclear States Party to the Treaty so desiring may also obtain such benefits pursuant to bilateral agreements.

Article VI

Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control.

Article VII

Nothing in this Treaty affects the right of any group of States to conclude regional treaties in order to assure the total absence of nuclear weapons in their respective territories.

Article VIII

1. Any Party to the Treaty may propose amendments to this Treaty. The text of any proposed amendment shall be submitted to the Depositary Governments which shall circulate it to all Parties to the Treaty. Thereupon, if requested to do so by one-third or more of the

Parties to the Treaty, the Depositary Governments shall convene a conference, to which they shall invite all the Parties to the Treaty, to consider such an amendment.

2. Any amendment to this Treaty must be approved by a majority of the votes of all the Parties to the Treaty, including the votes of all nuclear-weapon States Party to the Treaty and all other Parties which, on the date the amendment is circulated, are members of the Board of Governors of the International Atomic Energy Agency. The amendment shall enter into force for each Party that deposits its instrument of ratification of the amendment upon the deposit of such instruments of ratification by a majority of all the Parties, including the instruments of ratification of all nuclear-weapon States Party to the Treaty and all other Parties which, on the date the amendment is circulated, are members of the Board of Governors of the International Atomic Energy Agency. Thereafter, it shall enter into force for any other Party upon the deposit of its instrument of ratification of the amendment.

3. Five years after the entry into force of this Treaty, a conference of Parties to the Treaty shall be held in Geneva, Switzerland, in order to review the operation of this Treaty with a view to assuring that the purposes of the Preamble and the provisions of the Treaty are being realized. At intervals of five years thereafter, a majority of the Parties to the Treaty may obtain, by submitting a proposal to this effect to the Depositary Governments, the convening of further conferences with the same objective of reviewing the operation of the Treaty.

Article IX

1. This Treaty shall be open to all States for signature. Any State which does not sign the Treaty before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.

2. This Treaty shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United States of America, the United Kingdom of Great Britain and Northern Ireland and the Union of Soviet Socialist Republics, which are hereby designated the Depositary Governments.

3. This Treaty shall enter into force after its ratification by the States, the Governments of which are designated Depositaries of the Treaty, and forty other States signatory to this Treaty and the deposit of their instruments of ratification. For the purposes of this Treaty, and forty other States signatory to this Treaty and the deposit of their instruments of ratification. For the purposes of this Treaty, a nuclear-weapon State is one which has manufactured and exploded a nuclear weapon or other nuclear explosive device prior to January 1, 1967.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Treaty, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession, the date of the entry into force of this Treaty, and the date of receipt of any requests for convening a conference or other notices.

6. This Treaty shall be registered by the Depositary Governments pursuant to article 102 of the Charter of the United Nations.

Article X

1. Each Party shall in exercising its national sovereignty have the right to withdraw from the Treaty if it decides that extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other Parties to the Treaty and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.

2. Twenty-five years after the entry into force of the Treaty, a conference shall be convened to decide whether the Treaty shall continue in force indefinitely, or shall be extended for an additional fixed period or periods. This decision shall be taken by a majority of the Parties to the Treaty.

Article XI

This Treaty, the English, Russian, French, Spanish and Chinese texts of which are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Treaty shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

APPENDIX D

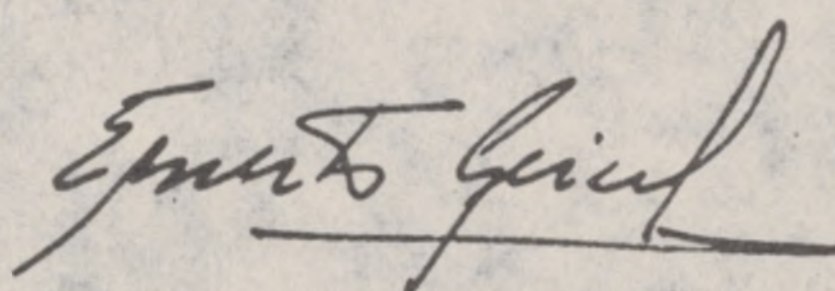
FEDERATIVE REPUBLIC OF BRAZIL

THE BRAZILIAN NUCLEAR PROGRAM

1977

All of us - People and Government - have the responsibility of promoting Brazil's economic , social and political development. In order to attain this development, which is essential to the well-being of all, it is indispensable to count upon adequate energy sources - among which the utilization of the atom stands out, today and in the near future.

The purpose of this document is to provide public information about the "Brazilian Nuclear Program", which is fully supported by the will of the Nation. This Program is based on our own efforts, together with external cooperation, and on the acceptance of safeguards that ensure its strictly peaceful application.

A handwritten signature in dark ink, appearing to read "Ernesto Geisel", with a horizontal line drawn beneath the name.

Brasília, March 1977.

1. Brazil's Energy Problem: The Need for the Nuclear Option.

The Brazilian decision to implement an important nuclear program for peaceful purposes is based on a careful evaluation of the energy needs of the country and of the possible options to meet such needs.

2. With its large territorial dimensions and 110 million inhabitants, Brazil needs to secure a constant, reliable supply of energy for its economic development and for the well-being of its population. The analysis of the structure of the country's energy mix shows a tendency towards the growing use of oil. Between 1940 and 1973, oil consumption jumped from 9% to 46% of total energy consumption, and hydroelectricity consumption rose from 7% to 21%. Furthermore, from the standpoint of reliance on foreign supply the analysis shows that, while at the beginning of that period more than 85% of the energy generated in the country was of domestic origin, in 1973 40% had to be imported. This increasing reliance on oil was a result of well-known market factors which discouraged the use of other sources of energy throughout the world.

3. The oil crisis demonstrated that Brazil could no longer plan its economic development on the basis of a fuel which

had become expensive and the availability of which was uncertain. In fact, in addition to its newly increased cost (which in itself recommends that it be put to nobler, more rational use) oil became, for various reasons, a commodity marked by the uncertainty of supply, compelling consumers to build up large and burdensome reserve stocks. In the long run, one must face the additional prospect of gradual depletion of the world's reserves, which is leading even large oil exporters to undertake significant programs for an alternative supply of energy, focused on the nuclear option. Brazil intends to be in a position to meet its future energy needs without depending on external sources of supply, in order to avoid a recurrence of the situation the country is facing today, when it has to impose a heavy burden on its population in order to provide itself with one of the main sources of energy required.

4. The utilization of new sources of energy which will certainly be a characteristic of the world in the last quarter of this century represents, therefore, a universal imperative. In the context of an undeniable world energy crisis a large number of countries are faced with the crucial question of finding an alternative at competitive cost which is technically reliable and, above all, guaranteed as to its supply. These are the foundations for the definition of Brazil's energy policy.

5. In defining the country's new energy mix, the Government considered it convenient to make increasing use of electricity. However, the same reasons that militate against increasing the reliance on oil led it to discard the hypothesis of developing conventional thermo-electric production on a significant scale. As to the hydroelectric option, which has been the mainstay of the development of electricity production in Brazil, it is now

approaching its natural economic limits. On the assumption of a sharp rate of increase in the national consumption, which has been doubling each seven years, the prospects are for the exhaustion — within the next decade — of the possibilities of hydroelectric power harnessing in the most industrialized regions of the country, where nearly 80% of national demand is concentrated, as well as in the Northeast. The forecast for the turn of the century is for requirements of 180,000,000 to 200,000,000 kw of installed capacity for the generation of electricity, a level of demand which in any case exceeds the hydroelectric potential existing in the country, even if the latter were entirely usable from the economic and technical points of view.

6. The Government considers nuclear energy to be the only viable alternative, in view of the degree of technical reliability it has already reached on a commercial scale as well as of the competitiveness of its production costs against the new backdrop of the oil economy. The continuing, smooth operation of nearly 150 nuclear power plants in 18 countries having logged more than 900 reactor-years of commercial service, and the existing plans to increase this installed capacity in the world from 70,000,000 kw to 400,000,000 kw by 1985 constitute in themselves a precise indication of the degree of economic viability and technical reliability which has been reached already by nuclear-powered generation of electricity. There now exist more than sixty nuclear power plants in the U.S. only. According to the U.S. Energy Research and Development Administration, the U.S. alone will require 450 nuclear power plants of 1,000,000 kw each by the year 2000.

7. For Brazil, it is then a question of promoting a joint utilization of hydroelectric resources and of nuclear energy: in the medium term, through the complementation of hydroelectric power plants by nuclear power stations; in the longer term (in the nineties), through the increasingly predominant utilization of nuclear energy in relation to the amount of electricity to be generated.
8. Technical studies carried out in 1973-74 had already demonstrated the need to have some 10,000,000 kw of nuclear power on stream in Brazil by 1990, to complement a hydroelectric capacity of the order of 60,000,000 kw. According to this plan, two plants of 1,200,000 kw each should go into operation in 1982 and 1983. This implied the need to make decisions about their construction eight years in advance, that is in 1974, which was done by the Government. These plants will join Angra I, with its capacity for 600,000 kw, expected to be inaugurated in 1978.
9. Brazil was faced with the urgent and unquestionable economic need to define its nuclear policy. In choosing the type of reactor to be used in the nuclear power plants, the best technical performance as well as operational safety in terms of generating electricity were taken into account. At the same time, the initial capital outlay should be the lowest. Based on the experience of technologically more advanced countries such as the U.S., the Federal Republic of Germany, France and Japan, the Brazilian choice was along the line of light water/enriched uranium reactors.
10. In addition to the choice of technology, a factor which had to be considered was the vulnerability of supply of the fuel required to carry out the program. Recent historical developments had demonstrated the dangers of relying heavily on

external sources for the satisfaction of the basic input needs of the economy. In order to avoid what had happened in the case of oil, it was imperative that the solution in the case of nuclear energy were one which enabled the country to reach the indispensable autarky in the medium term. Therefore, in exercising the technical option it was also necessary to take into account the need to ensure the full transfer to Brazil of the technologies involved in each of the areas of the fuel cycle corresponding to the type of reactor adopted. In other words, it was not acceptable to replace one form of dependence by another. The economic growth of the country, or its mere subsistence, cannot be dependent upon third countries' decisions as to prices and supplies of essential fuels. Incidentally, the dangers of such dependence may be exemplified by the situation created when the suppliers of enrichment services contracted abroad could not ensure the provision of such services for the second and third nuclear power plants under construction in Brazil, due to subsequent priority allocation of the services available to domestic consumption in the supplying country and to other foreign customers.

11. Considering the magnitude of the problem for its development and the existence within its territory of considerable uranium reserves and promising geological indications, Brazil cannot be denied the right to enrich uranium in the country as a means of ensuring the internal supply. In addition to the indispensable autarky, this solution will allow for significant foreign exchange savings resulting from the import substitution of the enrichment services. The same reasoning applies to the re-processing of the fuel burned in the reactors. The re-utilization of uranium and plutonium as mixed oxide fuel in the light-water reactors which Brazil is going to build will permit sub-

stantial savings in uranium ore and in enrichment services, in addition to savings in plutonium storage costs. According to ERDA's recent estimates, the savings in uranium ore as a result of such re-utilization is of the order of 26% .

12. The consideration of the problem of supply cannot be separated from the question of the possible impact on the balance of payments of the purchases of nuclear fuel, should the latter be made abroad. Apart from the vulnerability issue, one should not overlook the fact that the volume of resources required to pay for such imports would represent a heavy burden for the country, one which, depending on the performance of exports under various possible circumstances of the international economy, may even prove impossible to take on.

II. The Agreement concerning Cooperation in the Field of the Peaceful Uses of Nuclear Energy between Brazil and the Federal Republic of Germany.

13. In the external sphere, Brazil sought to obtain the necessary support for the execution of its nuclear program from the countries which possess the technology of light water/enriched uranium reactors and of the various stages of the corresponding fuel cycle.

14. The Federal Republic of Germany — with whom Brazil had an ongoing cooperation program in the nuclear field based on the General Agreement on Cooperation in the Scientific Research and Technological Development Sectors, of 1969 — met the conditions which made possible the understanding, since it met the Government's chief concern, namely to obtain the transfer of the adequate technology required to set up an autarkic nuclear industry for peaceful purposes including the complete fuel cycle. The Agreement concerning Cooperation in the Field of the Peaceful Uses of Nuclear Energy was signed in Bonn on June 27, 1975 by the Ministers of External Relations of the two countries. Approved by the Brazilian Congress, it went into effect November 18 of the same year. Simultaneously with the Agreement, an industrial Protocol was also signed in Bonn between the Brazilian Minister of Mines and Energy and

the Minister for Technological Research of the FRG, laying down the specific guidelines for each area of cooperation. These intergovernmental instruments are complemented by contracts between Empresas Nucleares Brasileiras S.A. (NUCLEBRÁS) and various German enterprises, providing for the establishment of joint ventures and for the transfer of technology and equipment to carry out the various undertakings in each of the areas of cooperation, namely:

- uranium prospection, mining and processing, as well as production of uranium compounds;
- construction of reactors and other nuclear facilities, as well as their components;
- uranium enrichment and enrichment services;
- manufacturing of fuel elements and reprocessing of irradiated fuels.

15. The Agreement with the FRG is in full operation. In the last few months, a comprehensive set of contracts was signed referring to:

- a) the setting-up of joint ventures involving NUCLEBRÁS and numerous German enterprises;
- b) the supply of equipment not yet produced in Brazil;
- c) the provision of services of basic engineering of nuclear power stations and of other facilities related to the fuel cycle;

- d) the financing required for the importation of equipment and services;
- e) the transfer of technical information in the area of product, manufacturing and operational engineering.

The various NUCLEBRÁS subsidiaries were set up, and are now implementing the Agreement.

16. In order to ensure that the cooperation will achieve its exclusively peaceful purposes, the Agreement has its foundations in the following provisions:

- the affirmation of the principle of non-proliferation of nuclear weapons;
- the obligation to submit all nuclear equipment, installations and material, as well as the technological information transferred, to the safeguards of the International Atomic Energy Agency (IAEA);
- the commitment not to use any of the items listed above for the manufacturing of nuclear weapons or other nuclear explosive devices;
- the commitment not to re-export said items, unless the third country has equally signed a safeguards agreement with the IAEA;
- the commitment not to re-export sensitive equipment, installations and materials, as well as not to transmit relevant technological information, unless the supplying Contracting Party consents thereto;

- the commitment to provide physical protection to nuclear equipment, installations and materials in order to preserve them from the undue interference of third parties.

17. The Agreement with the FRG and its complementary instruments are essential to the Brazilian nuclear program. They constitute a whole and cannot be divested of any of their interdependent, complementary elements. They are designed for exclusively peaceful purposes and provide the full guarantee that they will not lend themselves to the proliferation of nuclear weapons.

III. The Application of International Safeguards.

18. The unquestionably peaceful purpose of the Brazilian nuclear program naturally led Brazil and the FRG to propose to the International Atomic Energy Agency (IAEA) the text of a safeguards Agreement which was negotiated with the Agency in January 1976. The Agreement among the government of the Federative Republic of Brazil, the government of the Federal Republic of Germany and the International Atomic Energy Agency on the Application of Safeguards was approved on February 25, 1976 by the Board of Governors of the IAEA, where all countries which supply nuclear equipment were represented, among others. Such approval, without any modification of the text negotiated by Brazil and the FRG with the Agency meant the unequivocal endorsement by the international community of the German-Brazilian cooperation in the field of the peaceful uses of nuclear energy. Therefore, such international Agreements not only constitute a valid, legally-binding and complete obligation, but they also substantiate a form of cooperation fully approved by the international community.

19. The Agreement signed with the FRG and the safeguards Agreement which Brazil and the FRG signed with IAEA establish a system of controls which exceeds the safeguard requirements

contained in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The system involves: the application of safeguards not only to materials, equipment and installations, but also to the transfer of technology; the possibility of reinstating the Agreement with the IAEA in case the technology transferred comes to be utilized after its expiration; the acceptance of the obligation not only not to manufacture atomic weapons or other nuclear explosive devices, but also not to promote any military use with the cooperation received; the acceptance of a commitment to adopt measures for physical protection against sabotage or diversion of nuclear materials; the obligation to demand the application of safeguards to exports to third countries, even if these happen to be nuclear-weapon countries.

20. The IAEA has an important role to play in the administration of the safeguards system. Through the span of twenty years it has accumulated experience in this field and has established an important set of international standards to detect any diversion of nuclear materials as well as an efficient mechanism to apply such standards. The IAEA safeguards system aims at eliminating the risks of undue utilization of the equipment and technology transferred with exclusively peaceful purpose, and seeks to reconcile the prevention of such risks with the satisfaction of the legitimate and unquestionable needs of a large number of countries which must resort to nuclear energy for their progress.

IV. Brazil and the Non-Proliferation of Nuclear Weapons.

21. Brazil is a peaceful country. By historical inclination and by constitutional precept it favors negotiated solutions for international conflicts. The Brazilian people live in harmony with all their neighbors. The national temper abhors any expansionist or hegemonic ambitions. The main concern of the Nation is its integrated and harmonious economic and social development in cooperation, to the extent possible, with the other Nations — developing or developed ones — to which Brazil lends its solidarity and from which it expects the same treatment in return. In accordance with these basic principles, Brazil's international action places the greatest emphasis on the creation of an atmosphere conducive to international peace and security and to the economic and social development of mankind.

22. The arms race contributes to increase both international tensions and the danger of armed conflicts, in addition to diverting resources indispensable to the economic and social progress of the peoples of the world. Furthermore, due to the huge technological gaps among Nations, the arms race tends to favor forms of political domination among them, which represents a step back in relation to the purposes and principles

of the United Nations Charter, to which Brazil subscribes and gives its support. Brazil is in favor of disarmament under conditions which discourage States from seeking ways and means to strengthen their military position. With all the more reason Brazil is in favor of nuclear disarmament.

23. Since 1958, several international agreements directly or indirectly connected with the question of proliferation of nuclear weapons have been negotiated and concluded:

- a) the Antarctic Treaty of 1959 (which bans military activities on that continent — declared denuclearized area — and prohibits nuclear tests or the disposal of radioactive wastes);
- b) the Treaty Banning Nuclear Tests in the Atmosphere, in Outer Space and Under Water, of 1963;
- c) the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, of 1967 (which contains provisions about the placing in orbit of objects carrying nuclear weapons);
- d) the Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco), of 1966;
- e) the Treaty on the Non-Proliferation of Nuclear Weapons, of 1968; and
- f) the Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea Bed and the Ocean Floor and in the Subsoil Thereof, of 1971.

24. Brazil has signed all these Agreements with the exception of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), for its discriminatory character.

25. Indeed, the NPT seeks to legitimize a distribution of power which is unacceptable, because it results from the stage at which States found themselves at the date of its signature, as regards the application of nuclear weapons technology. As a result of this stratification, the Treaty requires strict control by the IAEA over the dissemination of the peaceful uses of the atom while, in relation to the nuclear-weapon countries, no barrier is erected to the vertical proliferation of nuclear armaments, as evidenced by the continuing growth and sophistication of their nuclear weaponry. Additionally, as far as security is concerned the NPT does not provide for any efficient system of protection for non-nuclear-weapon countries. This lack of protection does not apply only to the danger of nuclear attack. Since the countries armed with nuclear weapons continue to increase their atomic weaponry at a fast pace, the volume of highly radioactive waste they produce has become a considerable menace to the world. Official sources from a nuclear power have estimated that such volume, in that country, is 55 times larger than the amount of waste produced by its programs for the use of the atom for peaceful purposes.

26. Brazil, on the other hand, is a party to a Treaty which not only prohibits the manufacture or possession of nuclear weapons but also keeps any signatory from accepting the storage or emplacement in its territory of weapons belonging to nuclear-weapon countries. The Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco), which preceded the NPT itself, carries in its Additional Protocol I the

obligation of continental or extracontinental powers which have **de jure** or **de facto** international responsibility over territories situated in its area of enforcement to prohibit nuclear weapons in these territories. Furthermore, the Treaty of Tlatelolco contains, in its Additional Protocol II, a provision committing nuclear powers not to utilize nuclear weapons in Latin American countries, nor threaten these countries with such utilization. The full enforcement of the Treaty of Tlatelolco depends at the moment upon the acceptance of this commitment by those powers. Having signed the Treaty, Brazil has committed itself, according to the canons of International Law, not to perform any act which defeats the objectives of the Treaty, to which there corresponds the guarantee that the other signatories will do likewise.

27. The true sense of non-proliferation is to ban the diffusion of nuclear weapons, not the dissemination of nuclear technology for the benefit of Man. Given adequate controls, the access to the technology for the peaceful uses of nuclear energy should not be subjected to discriminatory restrictions, whether between nuclear-weapon and non-nuclear-weapon countries or among non-nuclear-weapon countries themselves. Incidentally, in providing that safeguards should not constitute an obstacle to the economic and technological development of the Parties or to international cooperation in the field of peaceful nuclear activities, including the processing, utilization or production of nuclear materials for peaceful objectives, the NPT itself recognizes **ipso facto** that, for these purposes, there is no distinction between signatories and non-signatories. It also creates for the former the obligation not to erect barriers to the cooperation for the development of the peaceful utilization of nuclear energy, under the IAEA safeguards.

28. It is a source of deep concern for Brazil that the gradual curbing of international cooperation may frustrate the expectations of countries to utilize this avenue for the fulfillment of their legitimate aspirations in matters nuclear. The lack of international cooperation on an equitable basis may equally frustrate the very objectives of the universal non-proliferation of nuclear weapons, by stimulating the development of nuclear technology outside the safeguards systems. As demonstrated by the Brazilian nuclear program itself, Brazil is convinced that international cooperation is the best way to ensure the objectives of development of the utilization of nuclear energy for peaceful purposes at the same time as those of the non-proliferation of nuclear weapons. For this reason, it intends to proceed to the full implementation of its program and it will execute fully the Agreement with the FRG concerning Cooperation in the Field of the Peaceful Uses of Nuclear Energy as well as the Agreement on the Application of Safeguards signed with that country and the IAEA.

APPENDIX E

ARGENTINA

POWER DEVELOPMENT 1979-81

During the 1978-1981 three-year period substantial investments will be made by Argentina tending to develop new sources of power; to increase electric power supplies on the one hand, and to attain self-sufficiency for its oil requirements—by the middle of the year 1980—on the other.

To this end, Argentina will invest almost 8,000 million dollars during the three-year period. Among other things, it is expected to obtain the following benefits: a 27 per cent increase in the installed power-generating capacity; an increase of almost 58 per cent in the electric power-generating capacity; larger power supplies from hydroelectric projects and thermo-nuclear plants; a 17 per cent increase in the production of crude oil and a ten per cent increase in the output of processed oil as well as a fifty per cent reduction of imports. All this to be achieved in the aforementioned three-year period.

A detail account of the electric power and fuels sectors will make possible a better understanding of the work being carried out in this particular field of action.

ELECTRIC POWER SECTOR

The first evidence of the existence of an electricity public utility service in the country dates back to the year 1882 when an illumination system with incandescent lamps was produced as a novelty on the occasion of the staging of a Continental Exhibition in the area of what is today the San Martin public square in this federal capital.

Some years later, in 1895, a permanent round-the-clock electric lighting service was inaugurated in Buenos Aires.

A year later, a 300-kilowatt hydroelectric power plant was inaugurated in the Zonda ravine in the province of San Juan. It was the first installation of its kind to be set up in Latin America.

A second hydroelectric power plant was installed in 1900 at Carcarana, in the province of Santa Fe, while thermic machinery plants with an electric-power generating capacity of more than 10,000 kilowatts were installed in Buenos Aires.

New electric power producing companies were being set up in Argentina as consumption increased in the large urban centres throughout the country.

Towards the end of the second decade of the present century, electric power supplies were being made available to the largest cities in the interior of the republic by the following companies: Ansec, South American Public Services Company (SU DAM), and Swiss-Argentine Electricity Company.

The first electric power services cooperative was formed in 1927 at Punta Alta, in the province of Buenos Aires. As a result of the initiative, many new cooperatives were formed amounting to an overall total of 62 in 1940.

As from 1943, a new political factor was introduced into the electricity problem with the establishment of the National Energy Administration. A year later, that is, in 1944, the basis was laid down for setting up of the Water and Electric Power Board which actually came into being in 1947.

The National Atomic Energy Commission for the development of technology for the peaceful use of atomic energy was set up towards the second half of the decade of the nineteen-fifties.

An important programme for the development of hydroelectric projects and the building of the Atucha atomic energy plant was begun in the decade of the nineteen-sixties. The programme of works was of a scope and importance unknown to the country as yet.

Considerable delay was registered in the progress of the works planned for the time during the early years of the decade of the nineteen-seventies.

It is opportune at this stage to stress the great progress made in the field of electric power services during the past three years.

During the period, an additional 1,850 MW electric power capacity has been added, 1,425 of which were generated by hydroelectric plants. That strong impetus given to hydroelectric sources of power led to a reversion of the power-generating structure, since the supplies of electric power from hydroelectric sources increased from 21.0 per cent in 1975 to 27.0 percent in 1978, a substantial saving of perishable fuels being thus achieved.

ELECTRIC POWER—KILOWATT-HOUR/PER CAPITA—PUBLIC UTILITY AND PRIVATE PRODUCTION

Year	Inhabitants (thousands) ¹	Production (gigawatt-hour)	Importation (gigawatt-hour)	Per capita (gigawatt-hour)	Total (kilowatt-hour)
1974-----	25,217	27,949.3	95.2	28,044.5	1,112
1975-----	25,552	29,480.1	119.2	29,599.3	1,158
1976-----	25,888	30,216.2	90.5	30,306.7	1,171
1977 ² -----	26,226	32,477.0	80.6	32,557.6	1,241
1978 ³ -----	26,561	33,482.0	77.0	33,559.0	1,264

¹ Data I.N.D.E.C. 31/12.² Provisional³ Partial estimates.

The priority consideration given to the development of hydroelectric projects led to the completion, in some cases, and to rapid progress in others, of undertakings, such as "El Chocon," which incorporated a 200-MW power-generating unit thus completing the planned equipment; "Planicie Banderita," which incorporated a 450-MW unit which not only generated electric power but also helped to regulate and avoid floods of the Neuquén river waters, attaining similar results in this respect to those obtained with the building of the "Arroyito" compensator dam ensuring the safety of residents in downriver areas from "El Chocon." Mention should also be made of the termination of the "Futaleufú" and "Cabra Corral" projects as well as the progressive rhythm of the works in connection with the development of the "Agua del Toro," "Los Reyunos," "Rio Grande," and other projects.

To have a general idea of the great effort carried out during the aforementioned three-year period, it is sufficient to bear in mind that the investments made by companies and organizations participating in the works amounted to almost 3,000 million dollars.

CONSUMPTION OF POWER

[Thousands of TEP]

	1974	1975	1976	1977	1978
Mineral coal-----	1,001.8	1,097.0	1,085.0	918.7	1,000
Petroleum by products-----	23,101.2	21,876.3	22,669.7	23,797.0	23,665
Natural gas-----	7,689.5	8,065.3	8,449.3	8,674.6	8,416
Hydroelectricity-----	1,463.6	1,519.7	1,456.0	1,671.1	2,199
Nuclear-----	246.4	599.4	612.3	389.7	689
Vegetal fuels-----	2,118.6	2,150.0	1,964.1	1,36.5	1,850
Total-----	35,621.1	35,307.7	36,236.4	37,287.6	37,819

As regards minor undertakings, mention should be made of the thermic power plants of Independencia (Tucumán), San Pedro (Jujuy), Posadas (Misiones), Frias (Santiago del Estero), Tucumán Norte (Tucumán), Sierra Grande (Rio Negro), Corrientes (Corrientes), Presidencia Roque Saenz Pena (Chaco) and many others.

As regards transmission systems, it is satisfactory to report that 377 kilometres of 500-kV lines were completed during the aforementioned period plus 550 kms of 350-kV lines, 240 kms of 220-kV lines, 2,194 kms of 132-kV lines, and 7,224 kms of lines with tensions ranging from 13.2 kV to 66 kV.

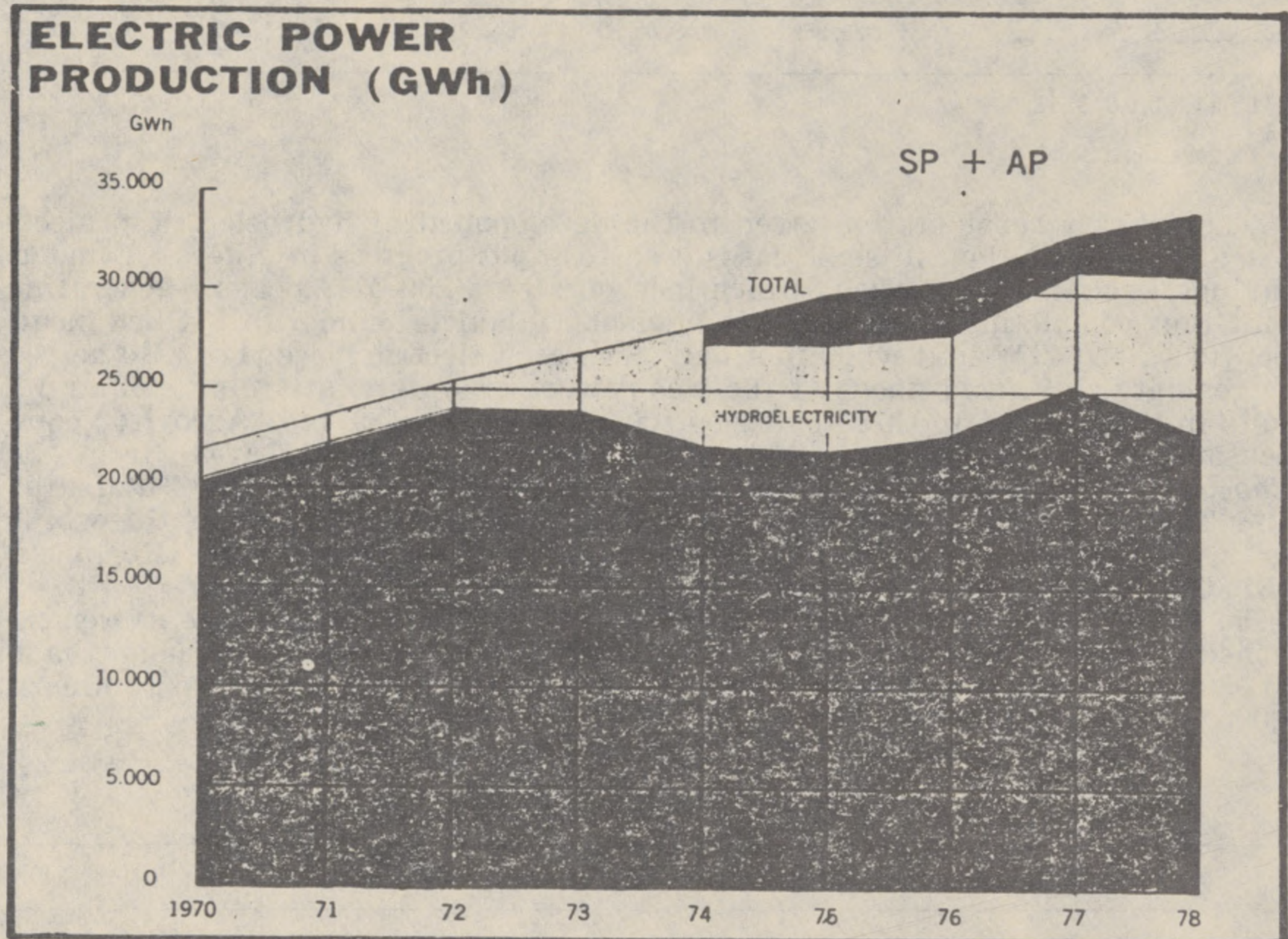
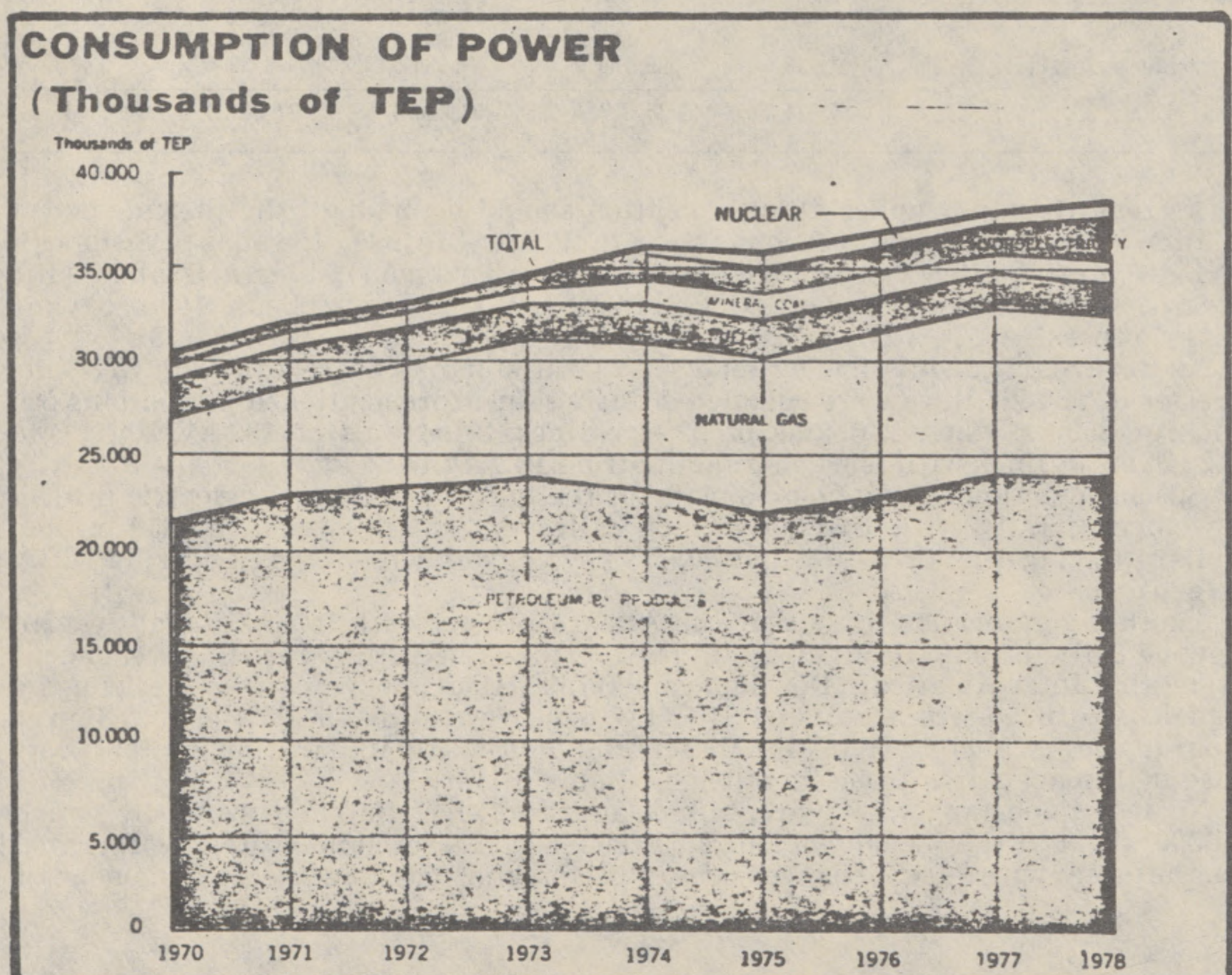
Special mention should also be made of the Salto Grande hydroelectric project developed jointly with Uruguay which called for an investment of 850 million dollars during the 1976-1978 period, 55 per cent of which were contributed by Argentina.

Another significant fact is that the Alicurá project with initial difficulties can now be fully developed having obtained the funds necessary for its development from the Inter-American Development Bank. Also important is a decision by which two turbo-steam units of 310-MW each, owned by the Water and Power Board, were transferred to the Water and Power Administration of the province of Buenos Aires to be installed in Bahia Blanca.

No less important was a programme of rural electrification works by which 21,500 rural farms benefited and 4,500,000 hectares of land were incorporated to the area with electricity services, thus making possible the development of

modern techniques for the benefit of grain and cattle farms and improving the general living standards of the country's farmers. This programme, carried out also during the 1976-78 period, was completed with credits amounting to 69,526,000 dollars.

Finally, the Special Fund for Development of Electric Power Supplies in the Interior of the Republic granted credits to provinces and cooperatives for an overall amount, at 1978 price levels, of approximately 500 million dollars.



NONCONVENTIONAL SOURCES

With regard to nonconventional sources of power and their maintenance, the draft of a decree has been completed approving a five-year Geothermic Exploration Programme and assigning funds to enable the State to finance that programme as well as part of a research programme on new sources of energy sponsored by the National Science and Technology secretariat. The decree also assigned funds for studies and dissemination of information on the rational use of all sources of energy.

As regards the development of geothermic research, it is proposed that the State take charge of the initial reconnaissance stages and feasibility studies to gather information designed to awaken interest among private companies in carrying out the more costly development and exploitation stages which could be undertaken by contract, similar to risk contracts in the petroleum industry.

In the field of aeolic or solar energy, it is believed that impetus should be first given to an appraisal of the characteristics of the natural energy-originating resource, such as gauging the intensity and frequency of winds and of solar radiation.

FUELS SECTOR

The existence of petroleum in the country is known ever since the 17th century, but studies for its exploitation were not begun until the second half of the 19th century.

The first discovery was made at Comodoro Rivadavia (Chubut) in 1907. As from that time, rational and scientific searches for hydrocarbons were intensified and important results were attained at Plaza Huincul (Neuquen), in 1918.

Later, in 1928, the first positive results were obtained in the province of Salta and during the second half of the year 1931 explorations were begun in the province of Mendoza where petroleum was discovered at Tupungato three years later.

New wells were discovered at Caleta Olivia (Santa Cruz) in 1944 an event which marked the beginning of a new stage in the history of the Argentine oil-fields.

The last provinces in which new oil wells were discovered were: Tierra del Fuego (1950), Rio Negro (1959), La Pampa (1968) and Jujuy (1969).

At present the country's confirmed petroleum reserves amount to 386 million cubic metres while natural gas reserves total 432,000 million cubic metres.

The country's accumulated oil production since the beginning of the exploitation of the wells until 1978 amounts to about 497 million cubic metres while gas production totals 171,000 million cubic metres.

There are 25,360 wells in the country, 6,662 of which are actively producing oil while there are 197 gas-producing deposits.

A total of 857 wells were drilled in 1978; of those 688 produce oil, 29 are gas-producing wells, while 140 were unproductive.

There are 13 refining plants in the country, with a daily processing capacity of 114,300 cubic metres.

As from April 1976 to date, the National Oilfields Administration has signed 33 contracts in exploitation areas of the provinces of Chubut, Santa Cruz, Neuquen, Rio Negro, Mendoza and Salta. Most contracts were awarded to local firms operating with national capital, including some important industrial enterprises operating for the first time in this particular sector by merging with traditional contractors of the National Oilfields Administration.

Although some time must elapse before it will be possible fully to appreciate the results of this policy, a satisfactory increase in the national production of crude oil is already evident.

YACIMIENTOS PETROLIFEROS FISCALEN—(GOVERNMENT OIL FIELDS)

The Department of State Oil Fields was created by decree on June 3rd 1922, the initial object being to increase the exploration of petroleum. Later on, YPF was transformed into a State Oil Company, taking definite shape as a State owned concern in 1977, adapting its structure to the requirements of modern management.

During the first years of its existence, YPF, the State Oil Company, installed its first petrol pump, inaugurated a refinery in the City of La Plata for the purpose of producing petrol, kerosene, fuel oil and later on, aviation petrol. In 1926 it introduced its own products on the fuels market. To the Comodoro Rivadavia (Chubut) and Plaza Huincul (Neuquen) fields, those in Salta were added in 1928,

and later still Mendoza, Santa Cruz, Tierra del Fuego, Jujuy, La Pampa and Rio Negro.

At present, FYP's six distilleries produce low and high grade petrol, kerosene, gas oil, diesel oil, fuel oil, aviation petrol, lubricants, asphalts, propane, butane and fuels for jet propulsion. Its processing capacity is 64,070 m³ per day.

As for storage possibilities, YPF owns 26 plants spread throughout the national territory.

Through tenders and contracts, both Argentine and foreign companies have a share in the search, exploitation, maintenance and refining of petroleum.

YPF, a company dedicated to the management and exploitation of Argentine hydrocarbons, works also at international level, providing its own technology.

Yacimientos Petroliferos Fiscales, with a billing of 1,400 million dollars in 1978, is the leading company in Argentine industry.

RISK CONTRACTS

The Risk Contracts Law will enable exploration and exploitation work to take place in the country without the State having to undertake the highly costly investment required. It will thus be free to use available funds in other areas of government. Adequate legislation is designed to ensure juridical security and economic stability for the contracts which, because of the very nature of their object, must necessarily extend overlong periods of time.

Besides, Law 21,778 clearly reverses the monopolistic tendency of the State, existing before March 1976, which was derogative of the valuable contribution that can be provided by private companies—operating both with national or foreign capital—towards the discovery and development of new oil fields.

Under the terms of Law 21,778, contracts have been awarded for exploration, and the eventual exploitation, of two areas on land—Picun Leufu in the province of Nuequen and Acambuco in the province of Salta, and of another two in the southern area of the continental platform at Rio Gallegos and Magallanes. The contracts, corresponding to two maritime areas which were recently approved by government Decree 1,511/79, call for an investment of 135 million dollars which will be contributed by a Dutch-Argentine consortium.

As a result of tenders already issued and those to be issued in the coming months before the end of the year, it is expected that risk contracts covering another ten areas will have been awarded before June of the coming year of 1980. The areas involved are five on land in the provinces of Neuquén, Mendoza and Río Negro and another five at sea under the names of Tierra del Fuego Este I, Tierra del Fuego Este II, Talud Colorado, Central San Jorge and Northern San Jorge.

It would be unwise to venture to forecast the eventual results of the work covered by these contracts because of the fortuitous nature of oil explorations.

Nevertheless, the discoveries made in the Strait of Magellan by companies operating for the Chilean State Oil Company and the substantial investment of 135 million dollars made by a group of companies which already carried out years ago reconnaissance work in the southern sea basin years ago, are concrete facts giving rise to reasonable optimism regarding the results of the search currently under way in the Argentine epicontinental sea.

POWER DEVELOPMENT

Argentina has now drawn up a power development programme based on realistic economic and technical factors with clearly defined targets and reliable estimates on power resources and on the investment possibilities of private and public sectors.

As a result, it is now reasonable to suppose that within a few years Argentina will have acquired self-sufficiency in oil, a vital requirement to ensure development without the heavy burden of oil imports which are not very large but that nevertheless, assume a certain degree of importance because of the high cost of petroleum in the international markets as a consequence of recent world events.

As a means of ensuring self-sufficiency, Argentina must increase present production levels and maintain adequate oil reserves. To this end, a great effort and substantial investments must be made in primary and secondary exploitations works and in exploration activities to improve current production levels and increase reserves.

This urgent programme of work is beyond the operational and financial possibilities of the public sector and even of an organization of the importance and

capacity of the State Oil Company and, consequently, it is necessary to call on private sectors to ensure the success of the programme.

The development of the fuels (petroleum, gas, coal) sector alone of the first stage of the National Power Development Programme, which extends until 1985, calls for an investment of 12,000 million dollars, 5,000 million of which must be contributed by private sources.

PRIVATE SECTOR SHARING

The issuance of tenders for contracts covering exploitation by areas is an effective and practical method to materialize and channel contributions from private sectors. Most satisfactory results have been obtained in this way to date when just over two years have elapsed since the issuance of the first tenders.

Participation since 1978 of private companies holding contracts by areas for drilling, exploitation and secondary recovery works, led to an increase in oil production that year amounting to 26,255,000 cubic metres, which represented a 4.8 per cent increase over the production total for the previous year of 1977.

Proof of the stimulating effect of the participation of private sectors is the 60 per cent increase in production levels registered jointly in the assigned areas as compared with previous production levels.

Invitations were also issued for contracts for the "exploration, development, and eventual exploitation" of new oil wells out at sea, facing the National Territory of Tierra del Fuego, where some companies already holding concessions are about to begin work.

The aforementioned competitions are basically designed to attain higher production levels of petroleum while tenders issued for bids for "risk contracts on land and out at sea" are mainly designed to increase the country's oil reserves to cover its future requirements.

GAS PRODUCTION

With the backing of the Inter-American Development Bank, which granted a loan of 87,000,000 dollars to the State Gas Company (Gas del Estado), one of the most important works undertaken by the present government was tendered, the corresponding contracts awarded and the work carried out. The above reference is to the General San Martín Gas Pipeline, which has now been in operation since the beginning of the year and daily carries from Tierra del Fuego gas which until now was either reinjected or allowed to blow off. The project entails yearly savings of about 140 million dollars.

The pipeline consists of three sections: the first one of about 100 kilometres in length, which joins the production point at San Sebastián in Tierra del Fuego with Cape Santo Espíritu at the southern entrance to the Magellan Strait; the second section is an underwater arc joining the north of the island with Cape Vírgenes, at the extreme continental end of Santa Cruz: it is 37 kilometers long and lies on the sea bottom. The third section, 40 kilometers long, runs from Cape Vírgenes to the compressor plant at El Cóndor, where it connects up with the Austral pipeline which reaches Buenos Aires.

PRODUCTION OF PETROLEUM, GAS AND COAL

Period	Petroleum (thousand m ³)	Natural gas (million m ³)	Coal for marketing (thousands tons)
1974	24,022.3	7,499.5	625.2
1975	22,968.3	7,811.0	502.6
1976	23,147.4	8,229.1	614.3
1977	25,047.3	8,584.9	533.6
1978	26,263.9	8,400.6	434.2
April 78	2,129.1	651.1	14.6
May 78	2,243.7	747.7	14.3
June 78	2,096.1	762.1	20.3
July 78	2,174.3	812.2	35.9
August 78	2,251.1	705.4	55.4
September 78	2,223.4	782.7	60.7
October 78	2,329.1	741.2	75.0
November 78	2,256.3	699.2	72.9
December 78	2,312.4	694.8	43.8
January 79	2,391.2	611.5	22.4
February 79	2,069.3	548.0	41.4
March 79	2,293.0	701.7	46.4
April 79	2,223.0	720.8	84.5

The first and third sections, constructed on land, are, in general terms, not different from the pipelines already constructed.

It is the underwater section which is uncommon as this had to be constructed in one of the most inhospitable areas in the world, at the mouth of the Magellan Strait, where the winds reach 180 kilometres per hour and the strong currents create waves which at times exceed 10 and 12 metres in height.

The work was carried out by a French-Argentine consortium, which, in spite of the adverse conditions in which the work was started, was able to comply with the contract.

While this work was in progress, Gas del Estado enlarged the compressor plant at Pico Truncado, installed a new one at San Julián and carried out various accessory works for the General San Martín pipeline, increasing the injection and transport capacity of the Austral Gas pipeline.

Similar works were carried out on the North Gas pipeline with the object of increasing the volumes from Bolivia and the North of the Argentine from 7 to 10 m³/day.

PETROCHEMICS

As regards the plant at General Cerri provisions have been made to speed up the work so as to finish the installation by next May.

As is already known, this plant is of outstanding importance to the national economy, because it will handle eighteen million m³/day of natural gas, from which high quality gases will be extracted.

General Cerri will provide about 300,000 tons of liquid petroleum gas per year, which implies the almost total coverage of present imports of a product whose price is rapidly escalating on the international market: the estimated savings are in the order of about 120 million dollars under this heading.

But what is more important, through operating this plant, 280,000 tons of ethane are extracted for the production of 200,000 tons of ethylene which supply the raw material necessary for the operation of satellite plants of the Bahía Blanca Petrochemical Complex.

TOLL GAS PIPELINE

In accordance with the guidelines laid down for encouraging private enterprise, during 1978 the State Gas Company called for tenders and awarded contracts under the toll system for the entire flow from the Río Neuquén Fernández Oro (Río Negro province), Cañadón Piedras and Cañadón Alfa (Tierra del Fuego) oil fields. The execution of these contracts at the expense of the favoured companies, has meant a saving of investment for the State Gas Company of about 50 million dollars, the conclusion of the work being expected during 1980. Some of them, Cañadón Piedras for example, for next winter, which will increase gas injection into the Transmagellanic pipeline.

But where the importance of this new policy tending to lower the levels of public investment can be thoroughly appreciated, is in the Centro-Oeste Gas pipeline, which was also tendered under the toll system, offers being received from six consortiums made up by well known companies from abroad, all in association with local companies. In all, offers were received from 36 companies in various groups.

The consortium favoured in this tender will have to make an investment of 600 or 700 million dollars, which is the estimated amount for the construction and operation of the pipeline which will carry natural gas from Neuquén fields of Loma de la Lata to the various consumption centres in Greater Buenos Aires, Rosario, Mendoza, San Luis, San Juan and the south of Córdoba. The length of the trunk will be approximately 1,100 kilometres and in a first stage it will carry a flow of five million cubic metres per day, which, with the help of compressors, for which provision is made, will be increased to ten million cubic metres per day in two years time.

The gas pipeline, as well as providing natural gas to areas which have so far not been able to use this type of fuel, will join up with Northern pipeline, so contributing to an improvement in its carrying capacity. The economic side of this project is justified not only through system adopted for its financing, which is no burden on the public outlay, but also because as from the third year of operation it will replace imports of petroleum and fuel-oil equivalent to an approximate total of 250 million dollars per year.

On the operation side, this gas pipeline will supply the considerable requirements of the industrial areas in Córdoba, Rosario and Greater Buenos Aires,

providing greater security and quality of provision which at the moment is affected by the insufficient flow in the Northern Gas Pipeline.

In regard to the Cuyo area the Centro Oeste (West Centre) Gas Pipeline will bring about new development points and will take the place of large volumes of fuel-oil and liquid gas.

It should be pointed out that the proven recuperable reserves in the Neuquén Basin amount to 193,000 million cubic metres. This figure was reached when the field at Loma de la Lata was discovered, which alone contributed a reserve of 100 million cubic metres of recuperable natural gas.

To date, the level of proven reserves of gas is in the order of 432,000 million cubic metres, which is the equivalent of forty years' consumption: two and a half times that of the 1976 level.

While these large projects are under way, the State Gas Company is carrying out the necessary works to increase the transport capacity of the existing pipelines, through the installation of compressor stations and parallel sections, the construction of storage plants for natural and liquid gas at various points in the interior of the country. It co-operates with the local municipalities by providing technical assistance, all in accordance with plans which contemplate the laying of one million metres of pipelines per year and the expansion of the service of natural gas to the public to one hundred thousand users per year.

In the southwestern tip of the country in the province of Santa Cruz lies the coal deposit known as Rio Turbo. Cubic estimated reserves are 450 millions tons; a figure which should ensure supplies, if rationally exploited, for over a century.

These reserves, made up of five coal layers of varying widths, are spread over 55,000 hectares of land.

Mining exploitation of this region is in charge of the state oil company Yacimientos Petroliferos Fiscales. Over one million tons of coal are mined yearly, of which more than six hundred thousand are marketed. Coal mined is transported from deposits by rail up to Rio Gallegos, capital city of Santa Cruz province, where it is shipped and transported overseas to the main consumer centres.

APPENDIX F

STATEMENT MADE BY ARGENTINA'S PRESIDENT OF THE NATIONAL ATOMIC ENERGY COMMISSION REAR ADMIRAL CARLOS CASTRO MADERO ON "CONTRACT DECISIONS FOR ATUCHA II AND HEAVY WATER PLANT"

"In accordance with the policy of keeping the public informed on the development of the Argentine Nuclear Power Program, I am pleased to assemble once again journalists representing the written, oral and TV media, in order to communicate the decisions taken by the National Executive Power in connection with the construction of a heavy water plant and of Atucha II Nuclear Power Station, the latter being included in a four nuclear power station plan, as per Decree No. 302 of January 29, 1979.

It is obvious to say that this decision was reached after a thorough study of the advantages and drawbacks of the various proposals, however, on this occasion I feel we should mention this fact because of the bearing it will have upon the nuclear development of the country and upon the technological and industrial progress of Argentina.

We are aware that any choice like the present one may be subjected to partial or slanted analysis, in good faith or not, to prove that a given alternative is undoubtedly better than the rest by simply mentioning its advantages and ignoring its shortcomings. In the present case, we have received comments of this kind, oral and written, in public or in person and even in an anonymous way, many of them stirred up by great interest brought about by the calling for bids: we have also received constructive views aimed at helping with the study and evaluation originally carried out by CNEA and later on by the Inter-Ministerial Committee established for that purpose.

You may all rest assured that this decision was reached after carefully weighing advantages against disadvantages, taking into consideration that this was not simply a case of granting two isolated projects. The future orientation of the country's nuclear plan was at stake. For the evaluation of the proposals received—all of them excellent technical value—the elements for the appraisal that had to be used were numerous and dissimilar. This gave rise to a complex

group of technical, economic and financial parameters which, in turn, had to be interrelated with the country's experience based on existing nuclear installations, or in the process of being built, and its own capacity to carry out the work. On the other hand, the choice of a given type of reactor implied, on this occasion, the selection of a partner for the establishment of a mixed engineering company through which CNEA could achieve the greatest possible degree of skill to conduct this type of major project, with an increasing participation of local industry and engineering.

The decision to set up this engineering company is based—as was explained on a previous occasion—on the degree of autonomous development attained so far, which places CNEA in a position to associate, with the necessary level of competence, with foreign enterprises for the carrying out of any given project and leaving the power of decision on nuclear matters in the hands of the Argentine Government within the framework of international commitments, legally and politically harmonious with our concept of sovereignty.

The decision to achieve nuclear development with the greatest degree of autonomy implies, on the other hand, the need to avoid creating the conditions in which any given country could exercise political or technological domination: this could be averted by diversifying the origin of the various supplies as soon as feasible.

In view of the above, the decision should have a tendency simultaneously to comply with two additional points:

(1) To maintain future competition between the two present potential suppliers of natural uranium reactors and heavy water plants, and avoid being tied to a sole supplier for the other three nuclear power stations; and

(2) Make the offer sufficiently attractive from the economic angle so that a commercial enterprise would join the mentioned mixed engineering company despite the fact that its activities will result in the reduction of the goods and services which it would supply in the future.

Within the framework of this basic philosophy, CNEA carried out its evaluation, which was recommended unanimously by the Inter-Ministerial Committee for approval by the Executive Power.

By Decree No. 2441 of September 28, 1979, CNEA has been authorized to:

(1) Accept the offer presented by Sulzer Brothers Limited of Winterthur, Switzerland and to carry out negotiations for the signing of the respective contract for the construction of a heavy water plant of 250 tons per year.

(2) Accept the offer submitted by Kraftwerk Union Aktiengesellschaft of Erlangen, Federal Republic of Germany, to participate in the development of the Argentine nuclear plan and to carry out negotiations for the signing of the respective contracts for the establishment of an Engineering Enterprise, as a joint-stock company, and for the joint construction of Atucha II Nuclear Power Plant, equipped with a pressure container reactor, included in a four plant program, with the condition that the three remaining reactors may be equipped, in principle, with a steam pressure tube supply system;

(3) Sign both letters of intent with the above-mentioned companies, authorizing them to start the corresponding work up to a ceiling of two million Swiss francs and five million German marks respectively, expiration date October 31, 1979, renewable by mutual consent, until the signing of the eventual contracts.

The above letters of intent are being signed as work should start while the corresponding contracts are being negotiated as it is imperative that the respective installations be operational on the set dates, with the clause that the aforementioned amounts (2,000,000 F.S. and 5,000,000 G.M.) which are part of the total amount of the contract, will not be paid by CNEA if the mentioned contracts are not signed for reasons for which CNEA is not responsible. It is also stated that the respective contracts, once they have been signed, will be subject to the final approval of the National Executive Power. . . ."

APPENDIX G

COMISION NACIONAL DE ENERGIA ATOMICA
DIRECCION DE RADIOISOTOPOS Y RADIACIONES
DIVISION COMERCIALIZACION

LISTA DE PRECIOS DE MATERIAL RADIOACTIVO Y SERVICIOS ANEXOS PRECIOS
EN VIGOR A PARTIR DEL 1° DE ABRIL DE 1980

	Act. Bas. en mCi.	Precio	Act. Adic. en mCi.	Precio
A. COMPUESTOS RADIATIVOS				
A.1. Varios:				
Bismuto 206 (cittrato).....	1	\$114.000	1	\$45.200
Bromo 82 (bromuro de amonio).....	1	136.000	1	3.700
Calcio 45 (cloruro).....	1	190.000	1	27.000
Cesio 134 (cloruro).....	10	114.000	10	22.600
Cloro 36 (ácido clorhídrico).....	0.010	129.000	0.010	19.100
Cobre 64 (nitrato).....	1	153.000	1	27.000
Cromo 51 (cromato de sodio).....	1	67.000	1	7.600
Estroncio 85 (cloruro).....	0.500	173.000	0.500	73.000
Fósforo 32 (ácido ortofosforico).....	1	40.000	1	10.500
Fósforo 32 (ortofosfato disódico).....	1	49.000	1	10.500
Fósforo 32 (fosfato crómico coloidal 300-700 A°"B").....	5	110.000	1	16.000
Fósforo 32 (fosfato crómico coloidal 100-300 A°"CROP").....	5	110.000	1	16.000
Hierro 59 (cloruro).....	0.050	88.000	0.050	14.000
Iodo 131 (sin reductor ni portador).....	5	48.000	1	9.000
Iodo 131 (ioduro de sodio con reductor y portador).....	5	21.000	1	1.400
Iridio 192 (semillas).....	10	¹ 25.000	0.100	6.300
Mercurio 197 (neohidrina).....	1	82.000	1	46.000
Mercurio 197 (bicloruro).....	10	136.000	5	19.100
Molibdeno 99.....	100	² 205.000	100	123.000
Oro 198 agujas (cada magazine de 14 semillas).....		³ 375.000		
Oro 198 (suspensión coloidal 200-300 A°Protegida con PVP crecido).....	10	27.000	10	2.700
Oro 198 (suspensión coloidal 40-70 A°Protegida con gélatina germen).....	10	90.000	1	2.700
Potasio 42 (cloruro).....	1	136.000	1	3.700
Rubidio 86 (cloruro).....	1	90.000	1	19.100
Sodio 24 (cloruro).....	1	136.000	1	3.700
Tecnecio 99m (perteneciato de sodio).....	10	27.000	5	9.000
Tritio (agua tritiada).....	10	63.000	5	19.100
Yterbio 169 (solución).....	1	43.000	1	21.900
Yterbio 169 DTPA.....	1	43.000	1	21.900
A.2. Generadores:				
Indio 113m.....	50	3.151.000		
Indio 113m.....	100	5.000.000		
Tecnecio 99m (generador estéril conteniendo soporte, trípode y blindaje para frascos de 30 m).....	300	350.000		
Tc-JO Accesorios de elución para generador de Tc-99m.....		77.000		
In-JO Accesorios para elución de generador de In-113.....		85.000		
B. COMPUESTOS MARCADOS CON CARBONO 14				
Acetato de calcio 1-C 14.....	0.250	45.000	0.250	35.600
Acetato de Sodio 1-C 14.....	0.250	45.000	0.250	35.600
Acetato de litio 1-C 14.....	0.250	45.000	0.250	35.600
Acido benzoicocarboxilo-C 14.....	1	200.000	1	162.000
Acido fenilacético-C 14.....	1	407.000	1	323.000
Acido isocaproico 1 C 14.....	0.250	71.000	0.250	54.800
Acido isobutírico 1 C 14.....	1	271.000	1	180.000
Acido isovalérico 1 C 14.....	0.250	71.000	0.250	64.300
Acido glutámico 5 C 14.....	1	634.000	1	634.000
Acido aspártico 4 C 14.....	1	407.000	1	323.000
Acido pentanoico 1 C 14.....	1	226.000	1	190.000
Acido tartérico 1 C 14.....	1	226.000	1	180.000
Acido bromoacético 1 C 14.....	1	226.000	1	180.000

See footnotes at end of table.

COMISION NACIONAL DE ENERGIA ATOMICA—Continued

DIRECCION DE RADIOISOTOPOS Y RADIACIONES

DIVISION COMERCIALIZACION

LISTA DE PRECIOS DE MATERIAL RADIOACTIVO Y SERVICIOS ANEXOS PRECIOS
EN VIGOR A PARTIR DEL 1° DE ABRIL DE 1980

	Act. Bas. en mCi.	Precio	Act. Adic. en mCi.	Precio
DL Alamina 1 C 14.....	1	\$362.000	1	\$342.00 ⁰
Anhídrido acético 1 C 14.....	1	207.000	1	192.000
Anhídrido propiónico 1 C 14.....	1	297.000	1	252.000
Benzamida 1 C 14.....	1	226.000	1	148.000
Bicarbonato de sodio C 14 (solución).....	0.500	64.000	0.500	45.200
Bromuro de acetilo 1 C 14.....	1	136.000	1	116.000
Butanoato de sodio 1 C 14.....	0.250	64.000	0.250	64.300
Carbonato de bario C 14.....	1	64.000	1	27.400
Carbonato de sodio C 14 solución.....	0.500	55.000	0.500	41.100
Cloruro de benzoilo (carboxilo C 14).....	1	281.000	1	181.000
DL Glicocola 1 C 14.....	1	271.000	1	200.000
DL Leucina 1 C 14.....	1	427.000	1	316.000
DL Valina 1 C 14.....	1	427.000	1	316.000
Bromoacetato de metilo 1 C 14.....	1	342.000	1	316.000
Carbonato de potasio C 14 (sol.).....	1	136.000	1	110.000
Propanoato de sodio C 14.....	0.250	90.000	0.250	60.000
Acetilaminoantipiridina (acetilo C 14).....	1	136.000	1	110.000
Glutaraldehido C 14.....	1	271.000	1	200.000
C. COMPUESTOS MARCADOS CON IODO 131				
Albúmina (Risah).....	1	49.000	1	26.800
Albúmina coloidal para hígado o pulmón, bovina.....	1	100.000	1	46.000
Gamma-globulina.....	1	49.000	1	26.800
Fibrinógeno.....	1	136.000	1	36.400
Iodo Hipurato de sodio (hipurán).....	1	90.000	1	36.400
Bromosulfaleína.....	1	63.000	1	18.200
D. COMPUESTOS MARCADOS CON IODO 125				
Insulina.....	0.010	90.000	0.010	26.800
FSH.....	0.010	114.000	0.010	53.400
LH.....	0.010	114.000	0.010	53.400
Angiotensina I y II.....	0.010	114.000	0.010	53.400
HGH.....	0.010	114.000	0.010	53.400
Kit RIA Insulina (INS-J-1) 50 determinaciones.....	1	85.000		
Kit RIA Insulina (INS-J-1) 100 determinaciones.....	1	140.000		
E. ISOTOPO				
Be-7.....				
Na-22.....				
Cr-51.....				
Mn-54.....				
Fe-55.....				
Co-57.....				
Fe-59.....				
Co-60.....				
Zn-65.....				
Sr-85.....				
Rb-86.....				
Y-88.....				
Cd-109.....				
Sb-125.....				
Ba-133.....				
Cs-137.....				
Hg-203.....				
C-14.....				
P-32.....				
S-35.....				
Cl-36.....				
Ca-45.....				
Sr-90.....				
Tl-204.....				

See footnotes at end of table.

COMISION NACIONAL DE ENERGIA ATOMICA—Continued
DIRECCION DE RADIOISOTOPOS Y RADIACIONES
DIVISION COMERCIALIZACION

LISTA DE PRECIOS DE MATERIAL RADIOACTIVO Y SERVICIOS ANEXOS PRECIOS
EN VIGOR A PARTIR DEL 1° DE ABRIL DE 1980

	Act. Bas. en mCi.	Precio	Act. Adic. en mCi.	Precio
F. COMPUESTOS FARMACOLOGICAMENTE CONTROLADOS LISTOS PARA SER MARCADOS CON LAS SOLUCIONES DE ELUCION DE GENERADORES DE Tc-99m e In-113m				
Tc-99m:				
Tc-J1.....	Para centellografía pulmonar (MAA) albúmina-5 preparaciones.....			\$77.000
Tc-J2.1.....	Gluconato para centellografía renal-5 preparaciones.....			77.000
Tc-J2.2.....	Acido demercepto succinico para centellografía renal-5 preparaciones.....			77.000
Tc-J31.....	Coloide de sulfuro de antimonio para estudios esplénicos hepáticos-10 preparaciones.....			77.000
Tc-J32.....	Fitato de sodio para centellografía hepática 5 preparaciones.....			77.000
Tc-J4.....	Para centellografía de cerebro (DTPA) Ca-Na, 10 preparaciones.....			63.000
Tc-J5.....	Para centellografía placentaria y estudios circulatorios (albúmina) 5 preparaciones.....			77.000
Tc-J6.....	Pirosfosfato para centellografía ósea 5 preparaciones.....			63.000
Tc-J7.....	Citrato para centellografía tumoral renal 5 preparaciones.....			63.0000
Tc-J8.....	Pirosfosfato para centellografía circulatoria-glóbulos rojos-5 preparaciones.....			77.000
Tc-J9.1.....	Dimetil Hida para estudio de vías biliares 5 preparaciones.....			77.000
Tc-J9.2.....	Dietil Hida para estudio de vías biliares 5 preparaciones.....			77.000
Tc-J9.3.....	Parabutil Hida para estudio de vías biliares 5 preparaciones.....			77.0000
In-113:				
In-J1.....	Para centellografía pulmonar (MAA) albúmina 5 preparaciones.....			77.000
In-J3.....	Para centellografía hepática 10 preparaciones.....			63.000
In-J4.....	Para centellografía de cerebro (DTPA) 10 preparaciones.....			77.000
In-J5.....	Para centellografía placentaria y estudios circulatorios 5 preparaciones.....			77.000
In-J6.....	Para centellografía ósea (EDTMP) 5 preparaciones.....			77.000

¹ Más 3.300 por cada semilla o aguja.

² Para pedidos superiores a 300 mCi. deben consultarse precios.

³ Más 3.300 por cada semilla o aguja.

Nota: Y otras según requerimientos de los señores usuarios. Actividad: 1-100 uCi. (actividades mayores deberán consultarse), Soluciones partón se consideran como fuentez calibradas.

APPENDIX H

U.S./COLOMBIA DRAFT NUCLEAR AGREEMENT

AGREEMENT FOR COOPERATION BETWEEN THE GOVERNMENT OF THE UNITED STATES OF AMERICA AND THE GOVERNMENT OF THE REPUBLIC OF COLOMBIA CONCERNING CIVIL USES OF NUCLEAR ENERGY

The Government of the United States of America and the Government of the Republic of Colombia,

Considering their close cooperation in the development, use and control of peaceful uses of nuclear energy pursuant to the Agreement for Cooperation Between the Government of the United States of America and the Government of the Republic of Colombia Concerning Civil Uses of Atomic Energy, signed April 9, 1962 and amended on February 24, 1967;

Reaffirming their commitment to ensuring that the international development and use of nuclear energy for peaceful uses are carried out under arrangements which will to the maximum possible extent further the objectives of the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Treaty on the Non-Proliferation of Nuclear Weapons;

Desiring to continue and expand their cooperation in this field;

Affirming their support of the objectives of the Statute of the International Atomic Energy Agency ("IAEA") and their desire to promote full implementation of the Treaty for the Prohibition of Nuclear Weapons in Latin America; and

Mindful that peaceful nuclear activities must be undertaken with a view to protecting the international environment from radioactive, chemical and thermal contamination;

Have agreed as follows:

ARTICLE 1—SCOPE OF COOPERATION

1. The United States and Colombia shall cooperate in the use of nuclear energy for peaceful purposes in accordance with the provisions of this agreement and their applicable treaties, national laws, regulations and license requirements.

2. Transfers of information, material, equipment, and components under this agreement may be undertaken directly between the parties or through authorized persons under their jurisdiction. Such transfers shall be subject to this agreement and to such additional terms and conditions as may be agreed by the parties.

3. Material, equipment and components transferred from the territory of one party to the territory of the other party for peaceful purposes, whether directly or through a third country, will be regarded as having been transferred pursuant to the agreement only upon confirmation, by the appropriate Government authority of the recipient party to the appropriate Government authority of the supplier party, that such material, equipment or components will be subject to the agreement.

4. Cooperative under this agreement shall require the application of IAEA safeguards with respect to all nuclear activities within the territory of Colombia, under its jurisdiction or carried out under its control anywhere. Implementation of the safeguards agreement between Colombia and the IAEA concluded on July 27, 1979, pursuant to Article 13 of the Treaty for the Prohibition of Nuclear Weapons in Latin America shall be considered to fulfill the requirement stated in the foregoing sentence.

ARTICLE 2—DEFINITIONS

For the purposes of this agreement:

(A) "By-product material" means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material;

(B) "Component" means a component part of equipment or other item, so designated by agreement of the parties;

(C) "Equipment" means any production or utilization facility (including uranium enrichment and nuclear fuel reprocessing facilities), or any facility for the production of heavy water or the fabrication of nuclear fuel containing plutonium, or any other item so designated by agreement of the parties;

(D) "High enriched uranium" means uranium enriched to twenty percent or greater in the isotope 235;

(E) "Low enriched uranium" means uranium enriched to less than twenty percent in the isotope 235;

(F) "Major critical component" means any part or group of parts essential to the operation of a sensitive nuclear facility;

(G) "Material" means source material, special nuclear material or by-product material, radioisotopes other than by-product material, moderator material, or any other such substance so designated by agreement of the parties;

(H) "Moderator material" means heavy water, or graphite or beryllium of a purity suitable for use in a reactor to slow down high velocity neutrons and increase the likelihood of further fission, or any other such material so designated by agreement of the parties;

(I) "Parties" means the Government of the United States of America and the Government of the Republic of Colombia;

(J) "Person" means any individual or any entity subject to the jurisdiction of either party but does not include the parties to this agreement;

(K) "Peaceful purposes" include the use of information, material, equipment and components in such fields as research, power generation, medicine, agriculture and industry but do not include use in, research on or development of any nuclear explosive device, or any military purpose;

(L) "Previous agreement" means the Agreement for Cooperation between the Government of the United States of America and the Government of the Republic of Colombia Concerning Civil Uses of Atomic Energy, signed on April 9, 1962 and amended on February 24, 1967;

(M) "Production facility" means any nuclear reactor designed or used primarily for the formation of plutonium or uranium 233, any facility designed or used for the separation of the isotopes of uranium or plutonium, any facility designed or used for the processing of irradiated materials containing special nuclear material, or any other item so designated by agreement of the parties;

(N) "Reactor" means any apparatus, other than a nuclear weapon or other nuclear explosive device, in which a self-sustaining fission chain reaction is maintained by utilizing uranium, plutonium or thorium, or any combination thereof;

(O) "Restricted data" means all data concerning (i) design, manufacture, or utilization of nuclear weapons, (ii) the production of special nuclear material, or (iii) the use of special nuclear material in the production of energy, but shall not include data declassified or removed from the category of restricted data by the United States;

(P) "Sensitive nuclear facility" means any facility designed or used primarily for uranium enrichment, reprocessing of nuclear fuel, heavy water production, or fabrication of nuclear fuel containing plutonium;

(Q) "Sensitive nuclear technology" means any information (including information incorporated in equipment or an important component) which is not in the public domain and which is important to the design, construction, fabrication, operation or maintenance of any sensitive nuclear facility, or other such information which may be so designated by agreement of the parties;

(R) "Source material" means (i) uranium, thorium, or any other material so designated by agreement of the parties, or (ii) ores containing one or more of the foregoing materials, in such concentration as the parties may agree from time to time;

(S) "Special nuclear material" means (i) plutonium, uranium 233, or uranium enriched in the isotope 235, or (ii) any other material so designated by agreement of the parties; and

(T) "Utilization facility" means any reactor other than one designed or used primarily for the formation of plutonium or uranium 233.

ARTICLE 3—TRANSFER OF INFORMATION

1. Information concerning the use of nuclear energy for peaceful purposes may be transferred. Fields which may be covered include, but shall not be limited to, the following:

(A) Development, design, construction, operation, maintenance and use of reactors and reactor experiments;

(B) The use of material in physical and biological research, medicine, agriculture and industry;

(C) Exploration for and development of uranium resources;

(D) Fuel cycle studies of ways to meet future worldwide civil nuclear needs, including multilateral approaches to guaranteeing nuclear fuel supply and appropriate techniques for management of nuclear wastes;

(E) Safeguards and physical security of materials, equipment and components;

(F) Health, safety and environmental considerations related to the foregoing; and

(G) Assessing the role nuclear power may play in national energy plans.

2. This agreement does not require the transfer of any information which the parties are not permitted to transfer.

3. Restricted data shall not be transferred under this agreement.

4. Sensitive nuclear technology shall not be transferred under this agreement unless provided by an amendment to this agreement.

ARTICLE 4—TRANSFER OF MATERIAL, EQUIPMENT, AND COMPONENTS

1. Material, equipment and components may be transferred for applications consistent with this agreement. However, sensitive nuclear facilities and major critical components shall not be transferred under this agreement unless provided by an amendment to this agreement.

2. Low enriched uranium may be transferred for use as fuel in reactors and in reactor experiments, for conversion or fabrication, or for such other purposes as the parties may agree.

3. Special nuclear material other than low enriched uranium and material contemplated under paragraph 6 may, if the parties agree, be transferred for specified applications where technically and economically justified or where justified for the development and demonstration of reactor fuel cycles to meet energy security and non-proliferation objectives.

4. The quantity of special nuclear material transferred under this agreement shall not at any time be in excess of the quantity the parties agree is necessary

for any of the following purposes: the loading of reactors or use in reactor experiments, the efficient and continuous operation of such reactors or conduct of such reactor experiments, and the accomplishment of other purposes as may be agreed by the parties. If high enriched uranium in excess of the quantity required for these purposes exists in Colombia, the United States shall have the right to require the return of any high enriched uranium transferred pursuant to this agreement (including irradiated high enriched uranium) which contributes to this excess. If this right is exercised, the parties shall make appropriate commercial arrangements which shall not be subject to any further agreement between the parties as otherwise contemplated under articles 5 and 6.

5. Any high enriched uranium transferred pursuant to this agreement shall not be at a level of enrichment in the isotope 235 in excess of levels to which the parties agree are necessary for the purposes described in paragraph 4.

6. Small quantities of material, including special nuclear material, may be transferred for use as samples, standards, detectors, targets and such other purposes as the parties may agree. Transfers pursuant to this paragraph shall not be subject to the quantity limitations in paragraph 4.

7. The United States shall endeavor to take such actions as may be necessary to ensure a reliable supply of nuclear fuel to Colombia, including the export of nuclear material on a timely basis and the availability of the capacity to carry out this undertaking during the period of this agreement.

ARTICLE 5—STORAGE AND RETRANSFERS

1. Material transferred pursuant to this agreement and material used in or produced through the use of any material or equipment transferred pursuant to this agreement may be stored by either party, except that each party guarantees that no such plutonium or uranium 233 (except as contained in irradiated fuel elements) or high enriched uranium, over which it has jurisdiction, shall be stored in any facility that has not been agreed to in advance by the parties.

2. Material, equipment or components transferred pursuant to this agreement and any special nuclear material produced through the use of any such material or equipment may be transferred by the recipient party, except that such party guarantees that any such material, equipment, components or special nuclear material, over which it has jurisdiction, shall not be transferred to unauthorized persons or, unless the parties agree, beyond its territorial jurisdiction.

ARTICLE 6—REPROCESSING AND ENRICHMENT

1. Each party guarantees that material transferred to and under its jurisdiction pursuant to this agreement and material used in or produced through the use of any material or equipment transferred to and under its jurisdiction pursuant to this agreement shall not be reprocessed unless the parties agree. Each party guarantees that any plutonium, uranium 233, high enriched uranium, or irradiated source or special nuclear material transferred to and under its jurisdiction pursuant to this agreement or produced through the use of any material or equipment transferred to and under its jurisdiction pursuant to this agreement shall not, unless the parties agree, be altered in form or content, except by irradiation or further irradiation.

2. Each party guarantees that no uranium transferred to and under its jurisdiction pursuant to this agreement, and no uranium used in any equipment so transferred and under its jurisdiction shall be enriched after transfer unless the parties agree.

ARTICLE 7—PHYSICAL SECURITY

1. Each party guarantees that adequate physical security shall be maintained with respect to any material and equipment transferred to and under its jurisdiction pursuant to this agreement and with respect to any special nuclear material used in or produced through the use of any material or equipment transferred to and under its jurisdiction pursuant to this agreement.

2. The parties agree to the levels for the application of physical security set forth in the Annex, which levels may be modified by mutual consent of the parties. The parties shall maintain adequate physical security measures in accordance with such levels. These measures shall as a minimum provide protection comparable to that set forth in document INFCIRC/225/Revision 1 of the International Atomic Energy Agency entitled, "The Physical Protection of Nuclear Material", or in any revision of that document agreed to by the parties.

3. The adequacy of physical security measures maintained pursuant to this article shall be reviewed by the parties periodically and whenever either party is of the view that revised measures may be required to maintain adequate physical security.

4. Each party shall identify those agencies or authorities having responsibility for ensuring that levels of physical security are adequately met and having responsibility for coordinating response and recovery operations in the event of unauthorized use or handling of material subject to this article. Each party shall also designate points of contact within its national authorities to cooperate on matters of out-of-country transportation and other matters of mutual concern.

5. The provisions of this article shall be implemented in such a manner as to avoid hampering, delay or undue interference in the parties' nuclear activities and so as to be consistent with prudent management practices required for the economic and safe conduct of their nuclear programs.

ARTICLE 8—NO EXPLOSIVE OR MILITARY APPLICATION

Each party guarantees that no material, equipment or components transferred to and under its jurisdiction pursuant to this agreement and no material used in or produced through the use of any material, equipment or components so transferred to and under its jurisdiction shall be used for any nuclear explosive device, for research on or development of any nuclear explosive device, or for any military purpose.

ARTICLE 9—SAFEGUARDS

1. Material transferred to Colombia pursuant to this agreement and any source or special nuclear material used in or produced through the use of any material, equipment, or components transferred pursuant to this agreement shall be subject to safeguards in accordance with the agreement between Colombia and the IAEA for the Application of Safeguards in Connection with the Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco) concluded on July 27, 1979.

2. If the United States or Colombia becomes aware of circumstances which demonstrate that the IAEA for any reason is not or will not be applying safeguards in accordance with the agreement as provided for in paragraph 1, to ensure effective continuity of safeguards the parties shall immediately enter into arrangements which conform with IAEA safeguards principles and procedures and with the coverage required by that paragraph, and which provide assurance equivalent to that intended to be secured by the system they replace.

3. If either party becomes aware of circumstances referred to in paragraph 2, the United States shall have the rights listed below. These rights shall be suspended if the United States agrees that the need to exercise such rights is being satisfied by the application of IAEA safeguards under arrangements pursuant to paragraph 2.

(A) To review in a timely fashion the design of any equipment which is to be transferred pursuant to the agreement, or of any facility which is to use, fabricate, process, or store any material so transferred or any special nuclear material used in or produced through the use of such material or equipment;

(B) To require the maintenance and production of records for the purpose of assisting in ensuring accountability for material transferred pursuant to the agreement and any source material or special nuclear material used in or produced through the use of any material, equipment or components so transferred; and

(C) To designate personnel acceptable to Colombia who shall have access to all places and data necessary to account for the material referred to in subparagraph (B), to inspect any equipment or facility referred to in subparagraph (A), and to install any devices and make such independent measurements as may be deemed necessary to account for such material. Colombia shall not unreasonably withhold its acceptance of such personnel designated by the United States under this subparagraph. Such personnel shall, if either party so requests, be accompanied by personnel designated by Colombia.

4. Each party shall establish and maintain a system of accounting for and control of all material transferred pursuant to this agreement and any material used in or produced through the use of any material, equipment or components so transferred, the procedures of which shall be comparable to those set forth

in IAEA document INFCIRC/153 (corrected), or in any revision of that document agreed to by the parties.

5. Upon the request of either party, the other party shall report or permit the IAEA to report to the requesting party on the status of all inventories of any materials subject to paragraph 1 of this article.

6. Design information relevant to safeguards for new equipment required to be safeguarded under this agreement shall be provided to the IAEA upon its request in a timely fashion.

7. Each party guarantees it shall take such measures as are necessary to maintain and facilitate the application of safeguards provided for under this article.

8. The provisions of this article shall be implemented in such a manner as to avoid hampering, delay or undue interference in the parties' nuclear activities and so as to be consistent with prudent management practices required for the economic and safe conduct of their nuclear programs.

ARTICLE 10—MULTIPLE SUPPLIER CONTROLS

If an agreement between either party and another nation or group of nations provides such other nation or group of nations rights equivalent to any or all of those set forth under articles 5, 6, or 7 with respect to material equipment or components subject to this agreement, the parties may, upon the request of either of them, agree that the implementation of such rights will be accomplished by such other nation or group of nations.

ARTICLE 11—CESSATION OF COOPERATION

1. If either party at any time following entry into force of this agreement,
 - (A) does not comply with the provisions of articles 5, 6, 7, 8 or 9, or
 - (B) terminates, abrogates or materially violates an IAEA safeguards agreement,

the other party shall have rights to cease further cooperation under this agreement and to require the return of any material, equipment and components transferred under this agreement and any special nuclear material produced through their use.

2. If Colombia at any time following entry into force of this agreement detonates a nuclear explosive device, the United States shall have the same rights as specified in paragraph 1.

3. If either party exercises its rights under this article to require the return of any material, equipment or components, it shall, after removal from the territory of the other party, reimburse the other party the fair market value of such material, equipment or components. In the event this right is exercised, the parties shall make such other appropriate arrangements as may be required which shall not be subject to any further agreement between the parties as otherwise contemplated under articles 5 and 6.

ARTICLE 12—PREVIOUS AGREEMENT TERMINATED

1. The "Agreement for Cooperation Between the Government of the United States of America and the Government of the Republic of Colombia Concerning Civil Uses of Atomic Energy" signed on April 9, 1962, as amended, expired on March 28, 1977. The exchange of notes of March 28, 1977, which extended the terms and conditions of that agreement, as amended, with regard to material and equipment subject to it, shall terminate on the date this agreement enters into force.

2. Cooperation initiated under the previous agreement shall continue in accordance with the provisions of the present agreement. All the provisions of this agreement shall apply to material and equipment subject to the previous agreement.

ARTICLE 13—CONSULTATIONS AND ENVIRONMENTAL PROTECTION

1. The parties undertake to consult at the request of either party regarding the implementation of this agreement and the development of further cooperation in the field of peaceful uses of nuclear energy.

2. The parties shall consult, with regard to activities under this agreement, to identify the international environmental implications arising from such activities and shall cooperate in protecting the international environment from radioactive, chemical or thermal contamination arising from peaceful nuclear activities under this agreement and in related matters of health and safety.

ARTICLE 14—ENTRY INTO FORCE AND DURATION

1. Each of the parties shall provide the other party with written notification when it has complied with its applicable requirements for entry into force of this agreement. This agreement shall enter into force on the date on which the latter of such notification is received, and shall remain in force for a period of thirty (30) years. The parties may extend this term for additional periods.

2. Notwithstanding the suspension, termination or expiration of this agreement or any cooperation hereunder for any reason, articles 5, 6, 7, 8, 9 and 11 shall continue in effect so long as any material, equipment or components subject to these articles remains in the territory of the party concerned or under its jurisdiction or control anywhere, or until such time as the parties agree that such material, equipment or components are no longer useable for any nuclear activity relevant from the point of view of safeguards.

3. Each party shall have the right to terminate cooperation under this agreement after giving one year's notice of its intent to do so, subject to the conditions set forth in paragraph 2.

In Witness Whereof, the undersigned, being duly authorized, have signed this agreement.

Done at Bogota, this day of 1980, in duplicate, in the English and Spanish languages, both equally authentic.

FOR THE GOVERNMENT OF THE
UNITED STATES OF AMERICA.

FOR THE GOVERNMENT OF
THE REPUBLIC OF COLUMBIA.

ANNEX

Pursuant to paragraph 2 of article 7, the agreed levels of physical security to be ensured by the competent national authorities in the use, storage and transportation of the materials listed in the attached table shall as a minimum include protection characteristics as follows.

CATEGORY III

Use and storage within an area to which access is controlled. Transportation under special precautions including prior arrangements among sender, recipient and carrier, and prior agreement between entities subject to the jurisdiction and regulation of supplier and recipient states, respectively, in case of international transport specifying time, place and procedures for transferring transport responsibility.

CATEGORY II

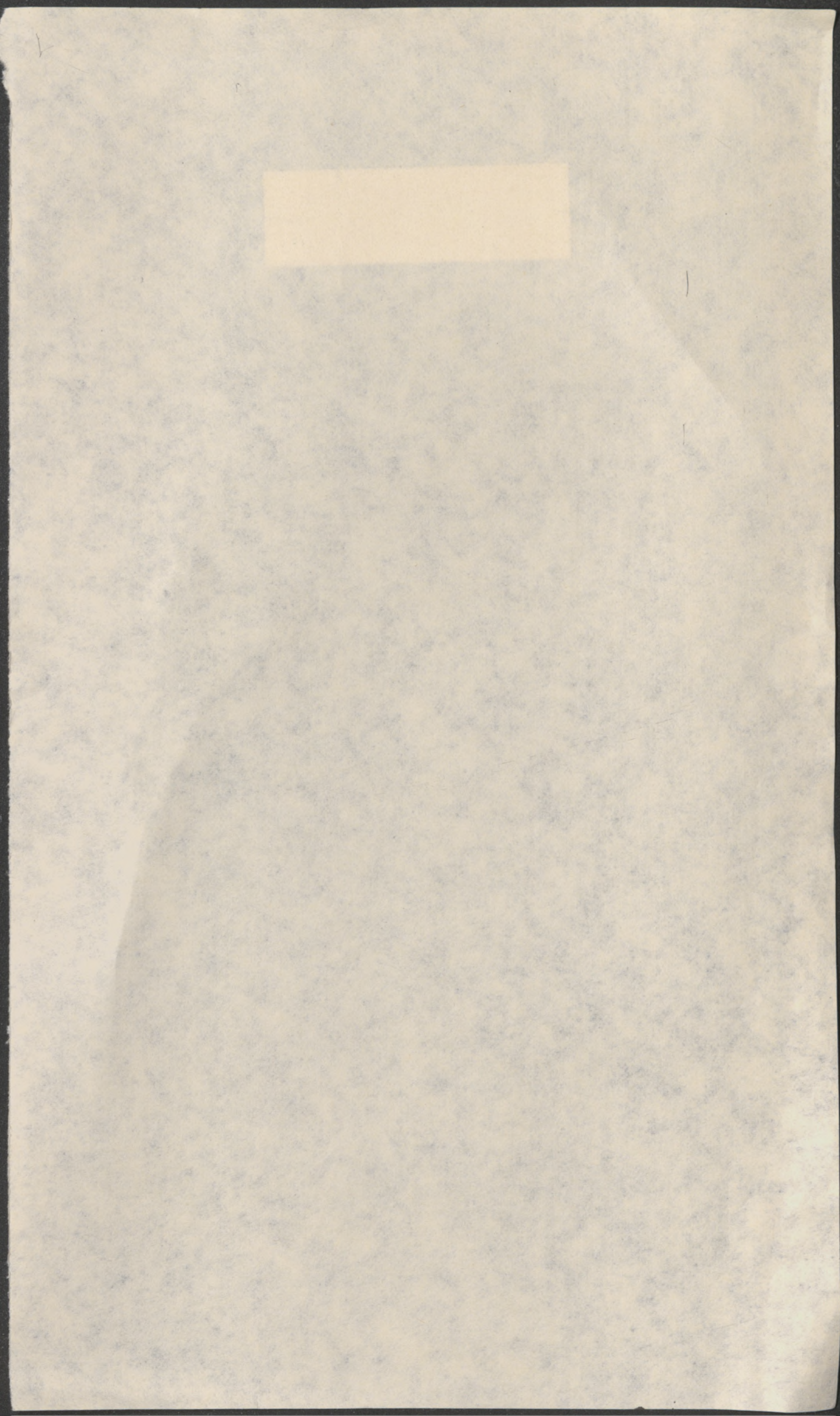
Use and storage within a protected area to which access is controlled, i.e., an area under constant surveillance by guards or electronic devices, surrounded by a physical barrier with a limited number of points of entry under appropriate control, or any area with an equivalent level of physical protection. Transportation under special precautions including prior arrangements among sender, recipient and carrier, and prior agreement between entities subject to the jurisdiction and regulation of supplier and recipient states, respectively, in case of international transport, specifying time, place and procedures for transferring transport responsibility.

CATEGORY I

Materials in this category shall be protected with highly reliable systems against unauthorized use as follows:

Use and storage within a highly protected area, i.e., a protected area as defined for category II above, to which, in addition, access is restricted to persons whose trustworthiness has been determined, and which is under surveillance by guards who are in close communication with appropriate response forces. Specific measures taken in this context shall have as their objective the detection and prevention of any assault, unauthorized access or unauthorized removal of material.

Transportation under special precautions as identified above for transportation of category II and III materials and, in addition, under constant surveillance by escorts and under conditions which assure close communication with appropriate response forces.





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