

WORLD ENERGY DATA SYSTEM

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VOLUME I COUNTRY DATA AF—CO

OFFICE OF PROGRAM MANAGEMENT SUPPORT

ARGONNE NATIONAL LABORATORY

ARGONNE, ILLINOIS 60439



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WORLD ENERGY DATA SYSTEM

(WENDS).

VOLUME I,
COUNTRY DATA,

AF-CO

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June 1979

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THE WORLD ENERGY DATA SYSTEM

The World Energy Data System (WENDS) is a managerial level information bank containing organized data on those countries and international organizations that may have critical impact on the world energy scene. The system was developed by the Office of Program Management Support at Argonne National Laboratory for the Office of International Affairs of the Department of Energy (DOE). The Office of International Affairs also provided funds for the collection of the following information:

- Country data which provides general background information on the economy, government, and energy orientation.
- Similar compilations of information concerning energy-related international organizations.
- Summaries of energy-related international agreements.

Nuclear fission information was collected for the Plans and Analysis Division, Office of Nuclear Energy Programs, DOE. It includes the following:

- Nuclear facility profiles which provide resumes of facts concerning specific installations.
- Nuclear program summaries, that is, overviews of the fission R&D programs in selected countries.

All the WENDS data contains references to enable verification and expansion of the information. Since all data sources are non-classified, complete information is not always available. The Office of Program Management Support at Argonne welcomes any information that will complete these synopses in future publications. Please address comments to:

WENDS
Office of Program Management Support
Building 362
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9700 South Cass Avenue
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This compendium of international energy-related information was compiled from a computerized database and is now available in a series of volumes. The total set of information is as follows:

<u>Volume</u>	<u>Title</u>	<u>Contents</u>
I	COUNTRY DATA Afghanistan, Algeria, Argentina, Australia, Austria, Bangladesh, Belgium, Bolivia, Brazil, Burma, Canada, China, Colombia	Review of background information for each country listed.
II	COUNTRY DATA Czechoslovakia, Denmark, Egypt, Finland, France, Germany (East), Germany (West), Greece, Guinea, India, Indonesia, Iran, Italy, Japan, Korea (South)	
III	COUNTRY DATA Libya, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Niger, Nigeria, Norway, Pakistan, Peru, Philippines, Poland, Portugal	
IV	COUNTRY DATA Senegal, South Africa, Soviet Union, Spain, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Turkey, United Kingdom, United States, Upper Volta, Venezuela, Yugoslavia	
V	INTERNATIONAL ORGANIZATION DATA Asian Development Bank, European Economic Community, Inter-American Development Bank, International Atomic Energy Agency, International Energy Agency, Nuclear Energy Agency, United Nations, World Bank	Review of background information for each international organization listed.

VI INTERNATIONAL AGREEMENT
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Summaries of energy-
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and by energy
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PROFILES

Algeria, Argentina,
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Belgium, Bolivia, Brazil,
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Fact sheets on nuclear
facilities, with
indexes by facility
type and by country.
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U.S. installations
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PROFILES

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NUCLEAR FACILITY
PROFILES

India, Indonesia, Iran,
Ireland, Israel, Italy,
Japan, Korea (South), Mada-
gascar, Mexico, Namibia,
Netherlands, Niger, Norway,
Pakistan, Peru, Philippines,
Poland

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NUCLEAR FACILITY
PROFILES

Portugal, Puerto Rico,
Romania, South Africa,
Soviet Union, Spain,
Sweden, Switzerland,
Taiwan, Thailand, Turkey,
United Kingdom, Venezuela,
Vietnam, Yugoslavia, Zaire,
Zambia

XI

NUCLEAR FISSION
PROGRAM SUMMARIES
Argentina, Brazil, China,
France, Germany (West),
India, Iran, Israel,
Italy, Japan, Peru,
Pakistan, Saudi Arabia,
South Africa, Spain,
Taiwan, United Kingdom,
Soviet Union, Venezuela

Overviews of fission
R&D programs in 19
foreign countries.

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INTRODUCTION TO COUNTRY DATA

ORIENTATION

WENDS includes four volumes of energy-related information concerning 57 countries.

ORGANIZATION

The information for each country is grouped together and numbered as a unit, with each page number preceded by the State Department tags code. The countries themselves are in alphabetical order by country name. The table of contents indicates the countries and corresponding tags codes contained in this volume. Within each country grouping most of the following topics are addressed:

Country Background

- Economic Profile

- Demographic Profile

- Professional Labor Force Participation Profile

- Educational Resources

Government Background

- Energy Policy: Basic Legislation

- Governmental Structure for Energy Policy and R&D

- Organization for Implementation of Energy Policy and R&D

Energy Background

- Energy Policy and Objectives

- Desired Degree of Energy Self-Sufficiency

- Indigenous Energy Resources

- Patterns of Energy Sources and Uses

- Projections of Demand

- Projections of Energy Supply, Imports, and Exports

- Environmental Considerations

- Commercial Applications

- Power Production Facilities

- Energy Industries

Energy R&D Activities

- Energy R&D: Status and Outlook

- Energy R&D: Budget

- Energy R&D: Priorities

- Energy R&D: Impact

- Government Supported Energy R&D in Industry, Universities and National Laboratories

- Energy R&D Role of Private Industry

International Activities

- Involvement in International Energy R&D Organizations

- Assessment of International Activities

Key References

- Notes and Evaluations

CONTENTS

Each page of discussion contains the country name, the topic title, the initials of the researcher, and the date on which the page was prepared. The treatment of a particular discussion topic is similar for each country in order to facilitate comparative analysis.

In the table of contents each topic title is identified by a topic code. On the notes and evaluation page this code provides a short-hand method of determining which specific documents were used to prepare that page of information.

WENDS. COUNTRY DATA

AF: AFGHANISTAN

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COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ECONOMIC DATA PROFILE

BW 09 MAY 78

GNP (1975-1976 million \$)-2,100-2,300 (Note 1)	INFLATION RATE-10%
PER CAPITA INCOME (\$) -120-130	DISPOSABLE INCOME (\$) -...
EXPORTS (million \$) -250	IMPORTS (million \$) -280
MONETARY UNIT-Afghani	
TOTAL ENERGY R&D BUDGET (million \$) -311.98	
EXCHANGE RATE (1US\$=) -50 Afghanis (Free Rate) 45 Afghanis (Official Rate)	

TRANSPORTATION SYSTEM DESCRIPTION-

Excellent paved roads connect the capital to Kandahor and Herat and to Iranian, Soviet, and Pakistan borders. Other roads primitive and impassable at times.

Country is landlocked and its problem of access and transport have raised questions about worth of mining its resources. There are no seaports or railroads. Largest single project of current seven year plan, (now in question because of coup in April 1978), is 1,810 kilometer railroad linking with Iranian and Pakistan rail systems. Iranians have promised to pay for it.

In 1976, a London firm began weekly container service to Kabul via Eastern Europe in attempt to overcome trade problems caused by lack of seaport.

There are two international and 29 local airports.

Note 1-Afghanistan year runs from March 21st to March 20 of following year. American sources and some non Afghan economists say GNP estimate is too high. They think \$1.5 billion is more reasonable.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
DEMOGRAPHIC DATA PROFILE

BW 09 MAY 78

LAND (million sq km)-.647	ARABLE LAND (million sq km)-.097-.129
POPULATION (millions)-12.18	POPULATION DENSITY (sq km)-26.3
(Note 1)	
LITERACY %-10	% RURAL POPULATION-85 (Note 3)
LIVE BIRTHS/THOUSAND-49.8	DEATHS/THOUSAND-26.4
MEDIAN AGE/MALES-...	MEDIAN AGE/FEMALES-...
AVERAGE FAMILY SIZE-...	NET MIGRATION (millions/yr)-...
PRIMARY SCHOOL GRADS-...	SECONDARY SCHOOL GRADS-...
(Note 2)	
INDUSTRIAL WORKERS-27,000	PROFESSIONAL WORKERS-...
AGRICULTURAL WORKERS-3.29	COLLEGE GRADS-...
million	
POPULATION GROWTH %-2.3	UNEMPLOYED-...

Note 1-There has never been an official census.

Note 2-Education through the third grade is mandatory (when accessible). It is provided free to all Afghanis through state supported schools.

Note 3-Includes rural and nomadic population.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
PROFESSIONAL LABOR FORCE PARTICIPATION PROFILE

BW 09 MAY 78

In 1966, there were reported to be 4,923 scientists and engineers and 3,320 technicians.

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COUNTRY DATA--REPUBLIC OF AFGHANISTAN
KEY TECHNICAL EDUCATIONAL RESOURCES

BW 09 MAY 78

LOCATION

University of Nangarhar
Kabul University

Jelalabad
Kabul

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ENERGY POLICY: BASIC LEGISLATION

BW 09 MAY 78

AREAS OF BASIC LEGISLATION AFFECTING ENERGY POLICY

Constitution, which was annulled by new rulers after recent coup, states that resources such as mines, large industry, and such are the nation's property and their administration belongs to the state.

The 1974 Foreign and Domestic private Investment Law requires 51% Afghan ownership of all enterprises.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

BW 09 MAY 78

Nur Muhammed Taraki replaced President Mohammed Daoud in a coup d'etat in April, 1978. Taraki is Premier, President, Chairman and Secretary of the Central Committee and Chairman of the Revolutionary Council.

Supreme authority rests with Central Committee of Taraki's party.

There is a 21-member cabinet to administer the country. A 35-member National Revolutionary Council handles daily policy making. Five of the 35 are from the military.

OTHER PARTS OF THE ENERGY STRUCTURE

Cadastral Survey Institute makes nationwide geodetic surveys.

Atomic Energy Commission is part of Faculty of Science, Kabul University.

Department of Mines and Geology carries out geological and mineralogical research and exploration, maintains a library and publishes BULLETIN OF GEOLOGY OF AFGHANISTAN.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D BW 09 MAY 78

NON NUCLEAR

Reorganization of Ministries taking place after recent coup.

NUCLEAR

Atomic Energy Commission at Faculty of Science, Kabul University
headed by Dr. F. M. Raoufy.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ENERGY POLICY OBJECTIVES

BW 09 MAY 78

The current seven year plan, 1355-1361, (1976/77-1982/83) emphasizes the following:

land transportation	29.7%
industry	19.1%
irrigation	18.2%
mining and petrochemicals	8.9%
energy	8.1%

Plan indicates Afghanistan intends to become self-sufficient in agriculture.

Critics of current plan say the government has not decided whether to go for growth or for social infrastructure and justice. Further, two-thirds of plan's financing comes from foreign sources.

Plan's status is questionable since the April 1978 coup. New regime has expressed interest in land reform and nationalization of whatever it feels is worth it.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
INDIGENOUS ENERGY RESOURCES

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	RESOURCES	RESERVES	LOCATION OF IDENTIFIED RESERVES
COAL (million tonnes)	85	...	Baghlan and Samangan Province
CRUDE OIL (million tonnes)	(Note 1)	12.65 megatonnes	Between Mazar, Sharif, and Andkhui
SHALE OIL (million tonnes)	(Note 2)	...	...
NATURAL GAS (billion cubic feet)	...	141.6 cu. kilometers	Jozjan Province
URANIUM (thousand tonnes U308)	(Note 3)	...	...
RENEWABLE			
HYDROELECTRIC (billion kWh/year)	...	...	...
GEO THERMAL (billion kWh/year)	...	...	...

Note 1-Additional oil deposits in extractable amounts discovered in Arghan dab Valley.

Note 2-Promising layers of oil bearing shale found in north during exploratory survey in 1936.

Note 3-Afghanistan known to have uranium deposits.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN

PROJECTIONS OF ENERGY SUPPLIES, IMPORTS, AND EXPORTS

BW 09 MAY 78

RESOURCE	1975	%US	1985	%US	2000	%US
COAL (million tonnes)						
INDIGENOUS SUPPLY	189.4		...		...	
	thousand tons					
IMPORTS	...		...		...	
EXPORTS	...		...		...	
CRUDE OIL (million tonnes)						
INDIGENOUS SUPPLY	...		...		...	
IMPORTS	...		...		...	
EXPORTS	...		...		...	
SHALE OIL (million tonnes)						
INDIGENOUS SUPPLY	...		...		...	
NATURAL GAS (billion cubic feet)						
INDIGENOUS SUPPLY	...		...		...	
IMPORTS	...		...		...	
EXPORTS	2850 (Note 1)					
	million cubic meters					
URANIUM (kilotonnes U308)						
INDIGENOUS SUPPLY	...		...		...	
IMPORTS	...		...		...	
EXPORTS	...		...		...	

Note 1--Most natural gas piped to the Soviet Union in payment for imports and debts.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
COMMERCIAL APPLICATIONS

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Middle management in government ministries is missing. University of Nebraska at Omaha has trained upper and mid-level government administrators as part of U.S. State Department contract.

Lack of money keeps salaries of minor officials low. New regime has expressed its objective to increase wages and bring down inflation.

Sudden and unexplained changes in personnel also cited as problem affecting the running of government departments.

There is shortage of skilled personnel. Seasonal and local shortages exist in some areas due to migration of workers to Iran and other OPEC countries.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
POWER PRODUCTION AND ENERGY CAPABILITY

BW 09 MAY 78

POWER PRODUCTION

TYPE PLANT	TOTAL GWe	0-499	500-800	800+ MWE	(Plants in each range)
COAL	...	...	...	...	Existing
	...	...	...	...	Planned
GAS	...	...	...	...	Existing
	...	...	...	...	Planned
OIL	...	...	...	...	Existing
	...	...	...	...	Planned
GEO THERMAL	...	...	...	...	Existing
	...	...	...	...	Planned
HYDROELECTRIC	...	...	...	...	Existing
	150.40 (MW)	4	...	...	Planned
NUCLEAR	...	...	...	...	Existing
	...	...	...	...	Planned
SOLAR	...	...	...	...	Existing
	...	...	...	...	Planned
OTHER	...	...	...	...	Existing
(Diesel)	3.9 (MW)	2	...	...	Planned

ENERGY PRODUCTION

SOURCE	LBS	OUTPUT LAST YR	RESERVES	TOTAL OUTPUT TO DATE
COAL MINES	...	189.4 thou tons	...	...
STRIP MINES	...	...	...	...
OIL WELLS	...	-	...	...
NATURAL GAS	...	2,543 cu. meters	...	...
U MINES	...			
GEO THERMAL SOURCES-...				
HYDRO POTENTIAL ...				
INSOLATION ...				
REFINING CAPACITY-...				
WELLS DRILLED LAST YEAR				
GAS-... OIL-... DRY-...				

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ENERGY INDUSTRIES

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Coal mining-1
Petroleum and gas products-1
Electricity, gas and such-16

Major projects in current seven year plan:
oil refinery
petroleum products storage

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ENERGY R&D: STATUS AND OUTLOOK

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Afghanistan is listed by United Nations as one of the least developed of the developing countries. Potential exists for development of its coal, natural gas, and petroleum resources but transportation, lack of skilled personnel, and government efficiency remain problems. Development of projects is through long range plans with foreign assistance necessary for their realization.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ENERGY R&D: BUDGET

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SEVEN YEAR DEVELOPMENT PLAN 1355-1361 (1976/77-1982/83)

	MILLIONS OF \$ CY 1976
Agriculture and Irrigation	950.01
Mines and Petrochemicals	342.99
Industry	734.29
Energy	311.98
Land Transport	1,142.03
Air transport	24.36
Communication	47.96
 TOTAL NATIONAL BUDGET	 3,850.67

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ENERGY R&D: PRIORITIES

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The seven year plan identifies the following areas of importance:

- 1-coal mining
- 2-mineral exploration
- 3-mineral and geological surveys
- 4-gas/oil exploration
- 5-oil refinery
- 6-power and irrigation projects

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ENERGY R&D: ROLE OF PRIVATE INDUSTRY

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Under Daoud government, medium and small scale investments allocated to private sector and large scale investment reserved for public sector.

Foreign and Domestic Private Investment Law (1974) requires 51% Afghan ownership of enterprises. However, prior to coup, government offered incentives such as tax and tariff exemptions to investors. New rulers say they will nationalize when necessary.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN

INVOLVEMENT IN INTERNATIONAL ENERGY R&D ORGANIZATIONS

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ORGANIZATION

DEGREE OF
INVOLVEMENT IN 1976

IAEA

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COUNTRY DATA--REPUBLIC OF AFGHANISTAN
ASSESSMENT OF INTERNATIONAL ACTIVITIES

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Energy R&D cooperation will likely depend upon new government's
philosophy and aid from foreign donors.

COUNTRY DATA--REPUBLIC OF AFGHANISTAN
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WENDS COUNTRY DATA

AG: ALGERIA

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COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ECONOMIC DATA PROFILE

BW 06 MAR 78

GNP (1975 million \$)-13,000	INFLATION RATE-15%
PER CAPITA INCOME (\$) -780	DISPOSABLE INCOME --
EXPORTS (million \$)-4900	IMPORTS (million \$)-6800
MONETARY UNIT-Algerian Dinar	EXCHANGE RATE (1US\$=-4 Dinar
TOTAL ENERGY R&D BUDGET (million\$)-179.9 (Note 1)	

TRANSPORTATION SYSTEM DESCRIPTION

Algeria has a highly developed transportation network with 75,637 km of roads and a 3,862 km railroad system which is 100% government owned. The railroad system is being modernized with new rolling stock and expanded track system.

The principal international airport is near Algiers. There are 3 smaller jet airports and 50 other medium airfields throughout the country.

There are 9 well-equipped major commercial ports.

Note 1: 1977 budget for the Ministry of Higher Education and Scientific Research

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
DEMOGRAPHIC DATA PROFILE

BW 09 MAR 78

LAND (million sq km)-2.38
POPULATION (millions)-17.3
LITERACY %-25-30
LIVE BIRTHS/THOUSAND-48.7
MEDIAN AGE/MALES--
AVERAGE FAMILY SIZE--
PRIMARY SCHOOL GRADS--
INDUSTRIAL WORKERS-252,000
AGRICULTURAL WORKERS-1,800,000
POPULATION GROWTH %-3.2

ARABLE LAND (million sq km)-.68
POPULATION DENSITY (/sq km)-7.2
% RURAL POPULATION-57
DEATHS/THOUSAND-15.4
MEDIAN AGE/FEMALES--
NET MIGRATION (millions/yr)--
SECONDARY SCHOOL GRADS--
PROFESSIONAL WORKERS--
COLLEGE GRADS--
UNEMPLOYED-20% urban, 30% rural

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
PROFESSIONAL LABOR FORCE PARTICIPATION PROFILE

BW 09 MAR 78

ENGINEERING MANPOWER

Between 1960 and 1977, estimated enrollment in engineering field is 14,700. During the same period, total graduates in all fields is estimated at 39,000.

SCIENTIFIC MANPOWER

Estimated enrollment in the natural sciences between 1960 and 1977 is 66,300. During the same period, total graduates in all fields is estimated at 39,000.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
KEY TECHNICAL EDUCATIONAL RESOURCES

BW 06 MAR 78

LOCATION

Centre Universitaire de Tlemcen
Universite d'Alger
Universite d'Oran
Universite de Constantine
Universite des Sciences et de la
Technologie d'Alger

--
Algiers
Oran
Constantine
Algiers

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ENERGY POLICY: BASIC LEGISLATION

BW 06 MAR 78

AREAS OF BASIC LEGISLATION AFFECTING ENERGY POLICY

- 1-Societe Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures (Sonatrach) established in 1963 initially for providing oil and gas transport.
- 2-Sonatrach's scope extended to all other phases of the hydrocarbon industry (refining, liquefaction, industrial transformation in addition to transporting and marketing) in 1966.
- 3-Foreign-owned oil companies nationalized and concessions abolished in 1971.
- 4-Fundamental Law on Hydrocarbons, under which foreign companies interested in exploration and exploitation must form joint companies with Sonatrach which will hold a minimum share of 51%, passed in 1972.
- 5-Centre des Sciences et de la Technologie Nucleaire established in 1976.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

BW 06 MAR 78

EXECUTIVE--PRESIDENT

Houari Boumedienne is President of the Republic and Head of State. Ministers appointed by the President.

Minister of Energy and Petrochemicals--Mohamed Ghozali
Minister of the Environment, Land Improvement, and Water
Resources--Ahmed Ben Cherif
Minister of Higher Education and Scientific Research--
Abdellatif Rahal
Minister of Light Industry--Belaid Abdesselam
Minister of Heavy Industry--Mohamed Liassine

LEGISLATIVE--National Popular Assembly
Prepares and votes the law.

OTHER PARTS OF THE ENERGY STRUCTURE

Centre des Sciences et de la Technologie Nucleaire (CSTN)
research in nuclear, solid and electronic physics. (A. Bennini,
Director)

Sonatrach responsible for oil policy. Sid Ahmed Ghozali is
President/Director-General.

Societe Nationale d'Electricite et de Gaz (SONELGAZ)
responsible for electric power. Also transports and
distributes natural and manufactured gas obtained from
Sonatrach.

Societe Nationale de Recherche d'Eau et d'Amenagement
(SN REAH) responsible for water research and planning.

Societe Nationale de Recherche et d'Exploitation Minieres
(SONAREM) is state-owned mining enterprise.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D BW 06 MAR 78

NONNUCLEAR

Sonatrach, responsible to Ministry of Industry, has operational control over oil exploration and development, oil and natural gas pricing, domestic energy supply. It controls about 80% of Algeria's 1977 oil production of 1.0 million barrels per day. Sid Ahmed Ghozali is President/Director-General.

SN REAH researches and plans water projects.

SONAREM is state-owned mining enterprise. In 1977, it requested bids for prefeasibility study of Algeria's uranium reserves.

High Council on Scientific Research is under the Ministry of Higher Education and Scientific Research.

NUCLEAR

Centre des Sciences et de la Technologie Nucleaire (CSTN)
A. Bennini, Director, researches nuclear, solid, and electronic physics.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ENERGY POLICY AND OBJECTIVES

BW 06 MAR 78

Development of LNG export industry is the single most important aspect of Algerian energy policy. It is expected that by 1980, natural gas will be Algeria's most important foreign exchange. Finding long-term markets for the gas is a major concern. After considerable delay, the first shipment of LNG from Algeria arrived at Cove Point, Md., March 13, 1978. Exports to the U.S. will amount to 365 million cu. ft. annually.

Ambitious industrial and agricultural projects whose financing is dependent on the oil sector are under way. Revenues from oil and natural gas account for 85% of national account. The major development goal is to be industrialized by the time oil and gas reserves are depleted.

Sonatrach has launched extensive geophysical surveys in an effort to discover new reserves. Outside observers do not anticipate the discovery of any appreciable reserves.

Feasibility studies for possible construction of nuclear power plants are under way. Financial constraints will not allow purchase of a power reactor before late 1970's or early 1980's. A plant is not likely to be operational before late 1980's.

COUNTRY--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

BW 06 MAR 78

Algeria is energy self-sufficient for now, but may become a net importer of coal to meet her industrialization plans.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
INDIGENOUS ENERGY RESOURCES

BW 09 MAR 78

NONRENEWABLE	RESOURCES	RESERVES	LOCATION OF IDENTIFIED RESERVES
COAL (million tonnes)	--	2.5	--
CRUDE OIL (Note 1) (million tonnes)	2235 (a) 6939 (b)	788 (a) 1899 (b)	The Hassi Messaoud Basih, Grand Erg Oriental Basin Paleozoic Basin
SHALE OIL (million tonnes)	--	--	--
NATURAL GAS (trillion cu ft)	106 (a)	87.6	Hassi R'Mel, Rhourde Shibarghan
URANIUM (Note 2) (thousand tonnes U308)	28	50	Ahaggar
RENEWABLE			
HYDROELECTRIC (megawatts)	1,000 (a) 1,500 (b)	300	Kabyha
GEO THERMAL (billion kWh/year)	--	--	--

(a) low and (b) high case range

Note 1: Another estimate sets potential ultimately recoverable oil reserves at 1460-14,600 million tonnes.

Note 2: Algeria is thought to have substantial uranium ore resources, though estimates vary considerably. Exploration and assessment studies have been done, but production of uranium concentrates is not expected to begin until 1982.

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
 PATTERNS OF ENERGY SOURCES AND USES

BW 09 MAR 78

CONSUMING SECTOR

	HOUSEHOLD & COMMERCIAL	INDUS- TRIAL	TRANSPOR- TATION	ELECTRICAL GENERATION	TOTAL
COAL (million tonnes)	--	--	--	--	2.09
PETROLEUM (million tonnes)	--	--	--	--	2.9
NATURAL GAS (billion cu m)	--	--	--	--	4.5
NUCLEAR POWER (billion kWh)	--	--	--	--	--
HYDROPOWER (kWh)	--	--	--	--	1210
GEOTHERMAL POWER (billion kWh)	--	--	--	--	--
UTILITY ELECTRI- CITY DISTRIBUTED (billion kWh)	--	--	--	--	3.745

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
PROJECTION OF DEMAND

BW 09 MAR 78

RESOURCE	STANDARD PHYSICAL UNITS			TRILLION Btu		
	1975	1985	2000	1975	1985	2000
COAL (million tonnes)	--	--	--	--	--	--
CRUDE OIL (million tonnes)	--	8.53	--	--	338.7	--
SHALE OIL (million tonnes)	--	--	--	--	--	--
NATURAL GAS (billion cu ft)	81.27	706.71	--	81.27	706.71	--
NUCLEAR POWER (bill. kWh/year)	--	--	--	--	--	--
HYDROELECTRIC (bill. kWh/year)	--	--	--	--	--	--
GEO THERMAL (bill. kWh/year)	--	--	--	--	--	--
SOLAR ELECTRIC (bill. kWh/year)	--	--	--	--	--	--
OTHER	--	--	--	--	--	--
URANIUM (kilotonnes U308)	--	--	--	--	--	--
HEAT RATE (Btu kWh)	--	--	--	--	--	--

Note: Algeria's electrical output is likely to lag behind demand due to financial reasons.

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
PROJECTIONS OF ENERGY SUPPLIES, IMPORTS, AND EXPORTS

BW 09 MAR 78

RESOURCE	1975	%US	1985	%US	2000	%US
COAL (thousand tons)						
INDIGENOUS SUPPLY	.09		4.5		9	
IMPORTS	--		--		--	
EXPORTS	--		--		--	
CRUDE OIL (See Note) (million tones)						
INDIGENOUS SUPPLY	51.23		42.66 (a)		--	
IMPORTS	--		95.98 (b)		--	
EXPORTS	42.33	55	16.53		--	
SHALE OIL (million tonnes)						
INDIGENOUS SUPPLY	--		--		--	
IMPORTS	--		--		--	
EXPORTS	--		--		--	
NATURAL GAS (See Note) (billion cu ft)						
INDIGENOUS SUPPLY	706.71		5300.35		--	
IMPORTS	--		--		--	
EXPORTS	135.77	3.6	1593.28	22	--	
URANIUM (kilotonnes U308)						
INDIGENOUS SUPPLY	0		--		--	
IMPORTS	0		--		--	
EXPORTS	0		--		--	

CRUDE OIL NOTE: 55% of 1976 oil projection exported to U.S.
(a) low and (b) high case range.

NATURAL GAS NOTE: Refers only to LNG exports. Percent is of total
natural gas exports. LNG exports to US account
for 35% of total LNG exports.

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ENVIRONMENTAL CONSIDERATIONS

BW 06 MAR 78

Flaring of natural gas is expected to decrease from the current level of 20-30% to 1% of total production in 1985. This is, however, due to expansion of the gas industry more than for environmental reasons.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
COMMERCIAL APPLICATIONS

BW. 06 MAR 78

For the foreseeable future, Algeria will depend on foreign sources in all energy and energy-intensive industries. There is a shortage of skilled labor, especially scientists, engineers, and technicians. The government has expanded its educational system with special emphasis on technical schools in response to this need. Employment in the oil industry has increased, but outsiders observe that labor productivity has declined.

The prospects appear poor for any new major oil discoveries.

Planned production of natural gas reserves will deplete known supply within two decades unless additional discoveries are made.

In October 1977, an agreement was signed for an Algeria-Italy pipeline. Gas is to flow from late 1981 for a period of 25 years. Arrangements are in effect to transport LNG from Algeria to both the U.S. and Canada. The Natural Energy Board of Canada has recently granted licenses to Tenneco of Houston, Texas to import Algerian LNG via pipeline from New Brunswick, Canada beginning in 1981.

Obtaining a stable market for natural gas is a major concern of the government. Several 10-20 year agreements are being negotiated.

Plans for coal production are limited to meeting the needs of the domestic steel industry. Algeria may become an importer of coal to meet her industrialization goals.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
POWER PRODUCTION AND ENERGY CAPABILITY

BW 09 MAR 78

TYPE PLANT	POWER PRODUCTION				MWe (Plants in each range)
	TOTAL GWe	0-499	500-800	800+	
COAL	--	--	--	--	EXISTING
	--	--	--	--	PLANNED
GAS	--	--	--	--	EXISTING
	--	--	--	--	PLANNED
OIL	--	--	--	--	EXISTING
	--	--	--	--	PLANNED
GEOTHERMAL	0	0	0	0	EXISTING
	0	0	0	0	PLANNED
HYDROELECTRIC	--	--	--	--	EXISTING
	--	--	--	--	PLANNED
NUCLEAR	0	0	0	0	EXISTING
	--	--	--	--	PLANNED
SOLAR	0	0	0	0	EXISTING
	--	1	--	--	PLANNED
OTHER	0	0	0	0	EXISTING
	--	--	--	--	PLANNED

SOURCE	LBS	ENERGY PRODUCTION		TOTAL OUTPUT TO DATE
		OUTPUT LAST YR	RESERVES	
COAL MINES	--	.003 million tonnes	--	--
STRIP MINES	--	--	--	--
OIL WELLS	1,100	53.5 million tonnes	1390.83 million tonnes	433.3 million tonnes
NATURAL GAS	--	353.3 billion cu ft	72,220 billion cu ft	1,478 billion cu ft
U MINES	--	--	--	--

GEOTHERMAL SOURCES- 70 known thermal springs, but no geothermal plants exist or are planned in the near-term. Generating capacity is however, expected to be 50 MWe in 2000.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
POWER PRODUCTION AND ENERGY CAPABILITY (CONT'D)

BW 09 MAR 78

HYDRO POTENTIAL- Total hydroelectric generating power not likely
to surpass 1,000-1,500 megawatts by year 2000.

INSOLATION- --

REFINING CAPACITY- 128.0 thousand barrels per day

WELLS DRILLED LAST YR (1974)

GAS-8 OIL-49 DRY-15

NUCLEAR NOTE: Nuclear powered electric generating capacity is
expected to be between 1.0 and 3.0 thousand MWe by
2000.

SOLAR NOTE: Solar powered electric energy generating capacity
is expected to be between 0 and 10 MWe in 1985 and
between 20 and 150 MWe in 2000.

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ENERGY INDUSTRIES

BW 09 MAR 78

Iron and Steel Complex-1
Petrochemical Complex-1
Fertilizer Plants-2
Intermediate Petroleum Products Complex-1
Refineries-3
Oil Exploration and Production Groups-9
Pumps and Irrigation Equipment-1
LNG Plants-2 existing, some underway
Methanol and Resin Complex-1
Plastics Complex-1

Being Planned: 2 steel plants
1 steel rolling mill
2 fertilizer plants
2 natural gas treatment plants
2 natural gas reinjection stations

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ENERGY R&D: STATUS AND OUTLOOK

BW 06 MAR 78

Research and development activity outside the higher education system is limited to minor work on hydrocarbons.

In terms of policy, Algeria would likely participate in multilateral R&D in nuclear energy, solar and geothermal resources on a small scale, if asked. However, due to financial constraints, activity would be limited.

Algeria has limited hydraulic energy and coal potential but substantial geothermal, solar, and nuclear energy potential. Each is 10-25 years from extensive development, but opportunity for R&D in alternative technologies exists.

Algeria signed an agreement with the French National Office of Scientific Research in 1977 for a study of solar energy potential.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ENERGY R&D: BUDGET

BW 06 MAR 78

ADMINISTRATIVE BUDGET 1977

MILLIONS OF \$
CY 1977

Ministry of Higher Education and Scientific Research	179.9
Ministry of Industry and Energy	8.8
State Secretariat for Water Resources	33.0

SUBTOTAL 221.7

TOTAL NATIONAL ADMINISTRATIVE BUDGET 3962.5

DEVELOPMENT BUDGET 1977

SECTOR

MILLIONS OF \$
CY 1977

Industry	105
Water	202.5

SUBTOTAL 307.5

TOTAL DEVELOPMENT BUDGET 2975.0

Exchange Rate Used:

1 US \$ = 4 Algerian dinars

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ENERGY R&D: PRIORITIES

BW 06 MAR 78

Oil production is expected to increase in order to compensate for loss of revenue caused by delays in marketing natural gas.

Exploitation of oil and gas reserves has taken precedence over creation of more employment-generating industries and agriculture.

The 1978-1981 development plan will emphasize the expansion of energy industries and agriculture in an effort to boost GNP to an annual increase of 10 percent.

An extension of areas under irrigation is planned in order to achieve the goal of attaining self-sufficiency in food production. More dams are being planned.

In 1975 the Minister of Higher Education and Scientific Research promised increased nuclear energy research efforts.

Gas and water injection are used for secondary recovery programs and also require extensive investment.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ENERGY R&D: ROLE OF PRIVATE INDUSTRY

BW 06 MAR 78

The role of private industry in energy R&D is regulated by the government.

Most exploration drilling is left to foreign operators. Sonatrach reimburses any successful driller up to 15% of exploration expenses. It then assumes 51% of development costs. Foreigners then can take their 49% in crude oil, paying royalties and other government duties.

Algeria would like to lessen dependence on and its trade deficit with France. Firms from other countries are likely to be awarded contracts that once would have gone to French firms.

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
INVOLVEMENT IN INTERNATIONAL ENERGY R&D ORGANIZATIONS BW 09 MAR 78

ORGANIZATION	DEGREE OF INVOLVEMENT IN 1976
UN	--
OAPEC	--
OPEC	--
Organization of African Unity	--
Organization of Non-Aligned States	--
IAEA	--

The Centre des Sciences et de la Technologie Nucleaire was established in 1976 and is now being organized with several new specialized laboratories being formed. The IAEA has been asked to provide a number of short-term (6 months) consultants to advise on the optimal manner of structuring, equipping, and operating the various specialized laboratories of the Center. Assistance to Algeria from the IAEA is estimated at \$42,000 for 1978 to support this study.

Note: During 1976, Algeria was occupied with writing her new Constitution and getting ready for elections. Her international activities were decreased as a result. Traditionally, she has been most active in Arab affairs, OPEC, and with the non-aligned states.

-- not available

COUNTRY DATA--DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA
ASSESSMENT OF INTERNATIONAL ACTIVITIES

BW 06 MAR 78

The two major tenets of Algeria's political philosophy, independence (no country can be politically independent until it is economically independent) and nonalignment (avoidance of exclusive alliance with one of the super powers and prohibition of foreign military bases) will be major factors in any potential international cooperation. Algeria has been a major figure in pushing for a new international economic order, and now that her new Constitution has been passed and elections held, Algeria may become more active once again in international affairs.

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WENDS COUNTRY DATA

AR: ARGENTINA

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COUNTRY DATA--ARGENTINA
ECONOMIC DATA PROFILE

AVL 30 SEP 78

GNP(billion\$):47 in 1975
PER CAPITA GNP:\$1,840 in 1975
EXPORTS(billion \$):2.7 in 1976
MONETARY UNIT:PESO

INFLATION RATE: 156% in 76-77
NATIONAL INCOME PER CAPITA
(\$): 1,922 in 1974
IMPORTS(billion\$): 1.6 in
1976
EXCHANGE RATE:1US\$=788.50
PESO as of JUNE 1978

TOTAL ENERGY R&D BUDGET:
\$3.7 billion(1975-1985)

TRANSPORT SYSTEM DESCRIPTION

Argentina's transport network is concentrated in the East Central provinces. In 1976 there were 39,780 km. of railways. Main railways connect with Chile, Bolivia, Brazil, Paraguay, and run parallel to branches of the Pan American Highway. In 1976 Argentina had 433,000 km. of roads, of which 41,400 km. were paved. In 1976 two road links between Argentina and Uruguay were opened. River steamers operate on the Plate, Paraguay, Parana, Uruguay rivers. Internal air services are well developed and Aerolineas Argentinas, as well as many foreign airlines, operate international schedules.

Argentina's vehicle registration was the following for 1976 (in thousands): Private vehicles:2345; Buses:35; Trucks: 983; Trailers:87; Total:3450

Note:Consumer prices were used to determine inflation rate.

COUNTRY DATA--ARGENTINA
DEMOGRAPHIC DATA PROFILE

AVL 30 SEP 78

LAND(million sq km):2.8

POPULATION:(millions)25.7

LITERACY:93%

LIVE BIRTHS/THOUSANDS:

21.8 in '76

MEDIAN AGE MALE:27 in '75

AVERAGE HOUSEHOLD SIZE:3.8

in '70

PRIMARY SCHOOL GRADS:

3,579,364 in '75

INDUSTRIAL WORKERS--

AGRICULTURAL WORKERS--

POPULATION GROWTH:1.3%, 70-75

ARABLE LAND (million sq km)

0.24

POPULATION DENSITY(/sq km):

9, in 1976

% RURAL POPULATION:26.2 in
1976DEATHS/THOUSANDS:8.8 in
'76

MEDIAN AGE FEMALE:28 in '75

NET IMMIGRATION(million/yr):

0.024 in '73

SECONDARY SCHOOL GRADS:

124,058 in '75

PROFESSIONAL WORKERS--

COLLEGE GRADS:23,991 in '70

UNEMPLOYED:0.088 million,
in '75

-- Data not available

COUNTRY DATA--ARGENTINA
PROFESSIONAL LABOR FORCE PARTICIPATION PROFILE

AVL 30 SEP 78

TOTAL STOCK OF SCIENTISTS, ENGINEERS, TECHNICIANS FOR 1974

SCIENTISTS AND ENGINEERS:	390,000
TECHNICIANS:	2,050,000
TOTAL:	2,440,000

TOTAL RESEARCH AND DEVELOPMENT MANPOWER FOR 1974

NATURAL SCIENCES:	3,000
ENGINEERING AND TECHNOLOGY:	1,170
MEDICAL SCIENCES:	1,780
AGRICULTURE:	1,130
SOCIAL SCIENCES AND HUMANITIES:	1,020
TOTAL:	8,100

COUNTRY DATA--ARGENTINA
KEY TECHNICAL EDUCATIONAL RESOURCES

AVL 30 SEP 78

INSTITUTION

LOCATION

Universidad Argentina Dela Empresa	Buenos Aires
Universidad Catolica De Cordoba	Cordoba
Universidad Catolica De Salta	Salta
Universidad Catolica De Santiago Del Estero	Santiago Del Estero
Universidad De Moron	Moron (Buenos Aires)
Universidad Juan Agustin Naza	Mendoza
Universidad Del Salvador	Buenos Aires

COUNTRY DATA--ARGENTINA
ENERGY POLICY:BASIC LEGISLATION

AVL 30 SEP 78

AREAS OF BASIC LEGISLATION AFFECTING ENERGY POLICY

- 1-Yacimientos Petroliferos Fiscales (YPF) formed in 1922 as a public corporation authorized to formulate national petroleum policy.
- 2-Gas Del Estado: State Gas Corporation established in 1946.
- 3-Agua y Energia Electrica (A&EE) one of the state owned power utilities established in 1950.
- 4-Argentine Nuclear Energy Commission (CNEA) created in 1950.
- 5-Yacimientos Carboniferos Fiscales (YCF) the State's coal mining enterprise was established in 1958.
- 6-Yacimientos Mineros de Agua de Dionisio established in 1958 is a state mining enterprise.
- 7-Hidroelectrica Norpatagonica S.A. established in 1967 is the state owned hydroelectric company.
- 8-Energia de la Provincia de Buenos Aires (DEBA) provincial energy supply utilities.
- 9-National Institute for Industrial Technology (CONICET) conducts some energy related R&D.
- 10-National Geoheliophysical Commission (CNEGH) is responsible for Argentina's solar energy program.
- 11-Petroquimica Bahia Blanca established in 1971.
- 12-Petroquimica Comodoro Rivadavia established in 1971.
- 13-National Council for Scientific and Technological Research.
- 14-Petroquimica General Mosconi S.A.Y.C. established in 1971.
- 15-National Institute for Hydraulic Science and Technology.
- 16-Agreement for Cooperation signed June 29, 1969: A thirty year comprehensive research and ownership agreement with the U.S.
- 17-Agreement with the U.S. for Scientific and Technological Cooperation signed April 7, 1972.
- 18-GOA Decree No. 3183 outlining Argentina's nuclear objectives and policies signed November 2, 1977.
- Effective April 2, 1977 GOA raised gasoline prices about 90% while other fuel prices were maintained at the same level in an effort to contain inflation.
- 20-Energy Plan released in February of 1977 by the Secretariat of Energy (1978-85).
- 21-Risk Contract Law No. 21778 passed in April of 1978 has modified and clarified rules for future exploration contracts with private companies.

COUNTRY DATA--ARGENTINA

GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

AVL 30 SEP 78

EXECUTIVE-PRESIDENT-(General Jorge Rafael Videla assumed the Presidency on 29 MAR 76 after Maria Peron was deposed) heads the executive branch which also includes a Vice President and Cabinet. The executive branch proposes programs and budgets and carries out approved programs.

LEGISLATIVE-a bicameral Congress consisting of the Senate(69 members)and the Chamber of Deputies(243 members). Congress has the responsibility for passing legislation affecting government programs in energy R&D and annual budgets.

State Secretary for Science and Technology exercised principal R&D responsibility. Reporting to him are:

National Research Council (CONICET)-administers numerous basic research institutes

National Geoheliophysical Commission (CNEGH)-responsible for Argentine solar energy program

State Secretary for Energy (Guillermo Zubaran)-the principal government of Argentina energy official handles primary energy policy and oversees the following state owned energy companies:

Gas Del Estado (gas company)

YFC (coal company)

YPF (petroleum company)

electric utilities

State Secretary for Industrial Development (Raymundo Podesta)-responsible for the National Industrial Technology Institute (INTI) which conducts some energy related R&D.

National Atomic Energy Commission (CNEA)-reports directly to the President's office and has rather complete responsibility for developing nuclear power program including building, operating, and licensing nuclear power plants.

COUNTRY DATA--ARGENTINA

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/AVL 30 SEP 78

NATIONAL ATOMIC ENERGY COMMISSION(CNEA)

PRESIDENT-Castro Madero

Director of Projects(Cosentino), Director of R&D (Erramuspe)

Director of Operations (Aguirre), Director of Logistics (Irigoin)

Radiological Protection & Safety/Safeguards Dept (Gonzalez)

Advisory Council on Licensing of Nuclear Installations (Carrea)

Advisory Council on Radioisotope Applications

Safeguards Committee

MINISTRY OF CULTURE AND EDUCATION

MINISTER-Juan Catalan

State Minister for Science and Technology (vacant)

Undersecretary (vacant)

Advisor-International Relations (Cross)

Nat'l Council for Scientific and Tech.Research (Molero,Acting)

Chief of International Relations (Ciarrapico)

National Commission for Geoheliophysical Studies (Carbeta)

MINISTRY OF ECONOMICS

State Secretary for Energy (Zubaran)

Undersecretary for Hydroelectric and Thermal Energy (Bronstein)

Water and Electric Energy (Vicien)

Greater Buenos Aires Electric Services (Briozza)

State Secretary for Industrial Development (Podesta)

Undersecretary (Ballester)

National Institute of Industrial Technology (Rodriguez)

State Secretary for Transportation and Public Works (Camba)

Undersecretary for Environmental Planning (Dorado)

Undersecretariat for Hydraulic Resources

National Institute for Hydraulic Science and Technology (Perez)

State Secretary for Mining (Prota)

National Geological Service (Zuccolillo,Acting)

COUNTRY DATA--ARGENTINA
ENERGY POLICY AND OBJECTIVES

AVL 30 SEP 78

NUCLEAR:

To give high priority of national interest to the development, use and control of nuclear energy.

To develop an integrated industry insuring sufficient production of nuclear inputs according to the needs of the nation.

To make efforts for the organization of a Latin American system of cooperation in the nuclear area.

To promote bilateral agreements with other countries.

To develop all forms of utilization of nuclear technology propulsion.

To assure the country of protection of its population and of the environment against possible harmful effects of nuclear origin.

NON-NUCLEAR:

The Energy plan issued in February of 1977 calls for an investment of approximately \$20 billion US dollars. The fundamental change in the plan is the increased use of renewable resources, especially hydroelectricity. The goals for non-renewable resources are:

1-Relatively lower oil consumption.

2-Increased use of nuclear energy, coal, and natural gas.

COUNTRY DATA--ARGENTINA

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

AVL 30 SEP 78

NUCLEAR

The nuclear program is designed to be self-sufficient in uranium. The objective is to develop an integrated industry according to the needs of the nation.

NON-NUCLEAR

There is a desire to move toward independence in petroleum which is currently around 85% self sufficient, by 1986.

The emphasis on hydroelectric power development is due largely to the desire for independence and minimization of fossil fuel needs for electricity generation.

There exists a willingness to accept the need to continue importing coal and gas to some degree.

COUNTRY DATA--ARGENTINA
INDIGENOUS ENERGY RESOURCES

AVL 30 SEP 78

	ECONOMICALLY RECOVERABLE RESERVES	RESERVES	LOCATION OF IDENTIFIED RESERVES
NON-RENEWABLE			
COAL (megatonnes)	100		Patagonia
CRUDE OIL (megatonnes)	344.4		Patagonia, Cuyo
SHALE OIL (megatonnes)	45		Rincon Blanco
NATURAL GAS (million G. calories)	1766		Patagonia
URANIUM (thousand tonnes U3O8)	6885 (\$35/kg)		Planta Malarque, Chubut, Sierra Pintada Mendoza, Los Adobo, Salta
HYDROELECTRIC (Gwh/year)	191,000		Comajue, Noreste
GEOHERMAL (Gwh/year)	--		

--Data not available

COUNTRY DATA--ARGENTINA
PATTERNS OF ENERGY SOURCES AND USES

AVL 30 SEP 78

SOURCES	HOUSEHOLD COMMERCIAL	CONSUMING SECTOR INDUSTRIAL	TRANSPORT- ATION	ELEC- TRIC	TOTAL
COAL (thousand tonnes)	0	862	11	532	1405
PETROLEUM (thousand tonnes)	1,827	6,506	7,014	6,213	21,560
NATURAL GAS (Tera Calories)	0	67,913	0	11,985	79,898
NUCLEAR POWER (million kwh)				2,572	2,572
HYDROPOWER (million kwh)				5,000	5,000
GEOHERMAL (million kwh)	0	0	0	0	
UTILITY ELEC- TRICITY DISTRIB. (million kwh)	7,091	17,116	245	-	24,652

NOTE: Total includes non energy uses, transformation losses,
and energy sector uses.

COUNTRY DATA--ARGENTINA
PROJECTIONS OF DEMAND

AVL 30 SEP 78

RESOURCE	STANDARD PHYSICAL UNITS			THOUSAND TONS COAL EQUIV.		
	1976	1985	2000	1976	1985	2000
COAL (thousand tonnes)	1408	4100	12800	1408	-	-
CRUDE OIL (thousand tonnes)	23527	44300	58900	34585	-	-
SHALE OIL (thousand tonnes)	-	-	-	-	-	-
NATURAL GAS (tera calories)	79898	-	-	11417	-	-
NUCLEAR POWER(million kwh/yr)	2572	-	-	316	-	-
HYDROELEC- TRIC POWER (million kwh/yr)	5000	17700	42800	615	-	-
GEOHERMAL (million kwh/yr)	0	0	0	0	0	0
OTHER(billion kwh/yr)-see note	-	-	-	-	-	-
URANIUM (kilotons U308)	-	-	-	-	-	-

Note:Wind energy, Tidal Power, Biomass.

- - Not available.

COUNTRY DATA--ARGENTINA

PROJECTION OF ENERGY SUPPLY, IMPORTS, AND EXPORTS

AVL 30 SEP 78

RESOURCES	1976	%US	1985	%US	2000	%US
COAL (thousand tonnes)						
INDIGENOUS SUPPLY	615		1350		3280	
IMPORTS	802		2750		9520	
EXPORTS	1		-		-	
CRUDE OIL (thousand tonnes)						
INDIGENOUS SUPPLY	20800		38340		92890	
IMPORTS	2979		5960		-	
EXPORTS	0		-		33990	
SHALE OIL						
INDIGENOUS SUPPLY	-		-		-	
NATURAL GAS (tera calories)						
INDIGENOUS SUPPLY	63995		-		-	
IMPORTS	15903		-		-	
EXPORTS	0		-		-	
URANIUM (kilotonnes U308)						
INDIGENOUS SUPPLY	60 (1975)					
IMPORTS	-		-		-	
EXPORTS	-		-		-	

- Not available.

COUNTRY DATA--ARGENTINA
ENVIRONMENTAL CONSIDERATIONS

AVL 30 SEP 78

There are no restrictions to date on energy development vis-a-vis its effects on the environment. Environmental concerns have been incorporated into the country's nuclear energy policy, but as of yet, there has been no national policy in regards to environment.

COUNTRY DATA--ARGENTINA
COMMERCIAL APPLICATIONS

AVL 30 SEP 78

The new Risk Contract Law passed in April of 1978 will make it more attractive for private companies, both Argentine and foreign, to participate in exploration and extraction in the petroleum and gas fields.

In 1977 and 1978 Yacimientos Petroliferos Fiscales signed 14 contracts with private companies for the reactivation of many oil fields formerly run by the YPF administration. The private operators will invest substantial amounts in both primary and secondary programs.

A Contract for the exploration and exploitation of oil in a large area in Tierra Del Fuego, both on and offshore, was recently awarded to Bidas SA/Arfranco/Deminey(West Germany)/Total(France).

COUNTRY DATA--ARGENTINA

POWER PRODUCTION AND ENERGY CAPABILITY

AVL 30 SEP 78

POWER PRODUCTION FOR 1978

OIL	22.9million t.o.e.
COAL	0.6million t.o.e.
GAS TURBINE	2.1(1,000 GWH)
HYDRAULIC PLANT	5.4 (1,000 GWH)
NUCLEAR PLANT	2.4 (1,000 GWH)
STEAM	16.7 (1,000 GWH)

ENERGY CAPABILITY

SOURCE	PRODUCTION	RESERVES
OIL(CRUDE)	438,500 b/d(first months '78)	39.2 million cubic meters(71)
NATURAL GAS	8,239 million cubic meters for 1978	200,378.5 mill. cubic meters (es
COAL	945 (1,000) tons	455 mill. cubic meters, '73 est.
URANIUM	50.0 tons U in '76	60,000 tons '73
HYDRO POWER	1.2(m.t.o.e.)in '76 2.1(m.t.o.e.)projected figure	30,000MW '73 estimate

WELL COMPLETION

	TOTAL WELLS	TOTAL FOOTAGE (1,000 ft.)	TOTAL WILDCATS	SUCCESSFUL WILDCATS
1974	606	4,285	117	
1975	552	3,387	78	22

COUNTRY DATA--ARGENTINA
ENERGY INDUSTRIES

AVL 30 SEP 78

NUCLEAR

There are no domestic reactors in Argentina, although Argentine industry has participated in the construction of the Atucha and Cordoba-1 Reactors. In the near term, Argentina will continue to contract with foreign vendors to act as prime contractors, but will increase the contribution by domestic industry. By 1985, the Argentine government expects domestic industry to be able to provide 80% of the equipment and services for reactor construction. Those reactors that have been supplied are by Siemens Ag, AECL, and Italimpianti.

NON NUCLEAR

Petroquimicia Comodora Rivadavia: Petrochemicals industry; Pres. Rear Admiral Eduardo Emilio Davion

Petroquimicia Bahia Blanca: Petrochemicals industry; Pres. Gen. Diego Ernesto Urricariet

Petroquimica General Mosconi S.A.I.yC.: Industry for the Manufacturing of petrochemicals; Pres. Gen. Emiliano Silvio Flouret.

Hidroelectrica Norpata Gonica S.A.: State hydroelectric company.

Gas del Estado: State gas corporation

Agua Energia Electrica: State owned power utility.

Yacimientos Carboniferos Fiscales (YCF): Coal mining enterprise.

Yacimientos Mineros de Agua de Dionisio: Mining enterprise.

Yacimientos Petroliferos Fiscales (YPF): Markets hydrocarbon resources.

COUNTRY DATA--ARGENTINA
ENERGY R&D:STATUS AND OUTLOOK

AVL 30 SEP 78

NUCLEAR

Nuclear R&D has by far absorbed the greatest part of the overall R&D energy budget. CNEA expects to increase its Research and Development activities by IAEA assistance in the following areas:

- Analytical Chemistry of nuclear fuels
- Nuclear Materials
- Fuel Elements
- Nuclear Metallurgy
- Nuclear Physics
- Nuclear Structure
- Radiation Physics

NON NUCLEAR

Argentina has significant deposits of coal, oil, natural gas, uranium, as well as under-developed hydroelectric potential. Current use of these resources does NOT reflect the country's energy resource endowment. The government is taking steps to achieve a more rational use of the different resources through the construction of hydroelectric power plants, and the expansion of coal mining activity. The Government is also planning to achieve oil self sufficiency by 1985, and to this end plans to further intensify the exploration efforts.

ELECTRICITY GENERATION

The government plans to have 26 hydroelectric plants, 7 thermal power plants, 2 pumped storage plants underway by 1980 in an effort to increase generating capacity from the present 7621 MW to 15,085 MW by 1980. Argentina and Brazil have completed a study concerning possible hydroelectric development along the upper Uruguay River.

HYDROCARBONS

Argentina's hydrocarbons production has been increasing at a slightly faster pace than consumption. The closing of the gap between production and consumption will depend on several economic trends, as well as the degree of success achieved by YPF and private companies in finding and developing new reserves, and in improving secondary recovery operation. The new Risk Contract Law passed in April is an example of the government action for the exploration and development of its oil and gas deposits. The Argentine government has expressed high hopes of achieving self sufficiency by 1985.

GEOTHERMAL

Efforts so far have been directed towards exploration which is just now beginning.

COUNTRY DATA--ARGENTINA
ENERGY R&D: BUDGET

AVL 30 SEP 78

1975-85

\$3.7 billion

Note: Nuclear R&D has been allotted the greatest
portion of this budget.In 1977 the Energy Secretariat released the estimated budget
of the Energy Plan for the next 10 year period (1977-87).

In millions of \$

OIL	9,500
ELECTRIC POWER	8,200
NATURAL GAS	1,800
COAL	450
TOTAL	19,950

Note: Budget for nuclear R&D not included in the above figures.

COUNTRY DATA--ARGENTINA
ENERGY R&D: PRIORITIES

AVL 30 SEP 78

The first priority, according to the Argentine Government, is nuclear energy, above solar, geothermal, coal, and wind energy. The emphasis will be on development, production, use, and control of nuclear energy. The wish is to draw up short, medium, and long term plans for nuclear R&D to achieve the necessary technology to support the nuclear program. Development of national capability is needed for designing, planning, management, construction, implementation, and operation of installations required for nuclear program.

COUNTRY DATA--ARGENTINA
ENERGY R&D:IMPACT

AVL 30 SEP 78

PROJECTED ARGENTINE ENERGY BALANCE, 1978-85 (million tonnes oil equiv.)

DEMAND	1978	1979	1980	1981	1982	1983	1984	1985
Industry	18.4	19.4	20.5	21.5	22.5	23.5	24.6	25.8
Mining, Construction, Transportation, and Agriculture	10.4	11.0	11.7	12.2	12.8	13.4	14.0	14.6
Commerce and Public Services	2.4	2.6	2.9	3.2	3.4	3.7	4.0	4.4
Residential	6.8	7.1	7.3	7.5	7.9	8.3	8.7	9.0
TOTAL DEMAND	38.0	40.1	42.4	44.4	46.6	48.9	51.3	53.8
PRIMARY SUPPLY								
Hydro Power	2.3	2.7	3.3	3.9	4.1	4.6	4.7	5.3
Nuclear Power	.6	.6	.6	1.1	1.6	1.6	1.6	1.6
Veg. Fuels	1.8	1.8	1.7	1.7	1.7	1.6	1.6	1.5
Crude Oil and Products	25.9	26.5	27.3	28.1	28.8	29.7	30.4	31.1
Natural Gas	10.4	11.3	12.2	13.8	14.7	15.5	16.2	16.8
Coal	1.3	1.5	1.8	1.9	2.1	2.3	2.5	2.7
Total Gross Primary Supply	42.3	44.3	46.8	50.5	52.9	55.1	57.0	59.0
Total Net Primary Supply	36.8	38.6	40.7	43.9	46.0	48.0	49.6	51.3

COUNTRY DATA--ARGENTINA

GOVERNMENT.SUPPORTED ENERGY R&D IN IND.,UNI. & NAT LABS

AVL 30 SEP 78

INDUSTRY	PROGRAM AREA	KEY INDIVIDUALS
1.Bariloche Atomic Research Center	Low temperature physics, metal physics, ionbeam physics, electromechanics	
2.Constitutuyentes Atomic Center	Radiation damage, physics of neutrons, kinetics of reactors	
3.Ezeiza Atomic Center	Radioisotope Production	
4.Synchrocyclotron (CNEA headquarters)	CNEA programs in physics, biology, chemistry, radio-biology	
5.University of Rosario	R-A-4 reactor training	
6.University of Cordoba	R-A-0 reactor	
7.National technological University	Technology research	
8.Agua y Energia Electrica	State Water and Electricity Board	Gen.Administrator Ing.Pedrovicien
9.Gas del Estado	State Gas Corporation	Gen.Administrator Ing.Gabriel Augustin Meoli
10.Hydroelectrica Norpata Gonica S.A.	State hydroelectric company	Pres.Ing.Mario Luis Pineiro
11.Yacimientos Mineros de Agua	State Mining enterprise	Pres.Col.Oscar A.Grondona
12.Yacimientos Carboniferos Fiscales	State Coal mining enterprise	Gen.Administrator Roberto Miguel Berwick
13.Yacimientos Petroliferos Fiscales (YPF)	Formulates national petroleum policy, and develops, processes, and markets hydro-carbons.	Pres.Ing.Raul Augustin Ondarts

COUNTRY DATA--ARGENTINA
ENERGY R&D:ROLE OF PRIVATE INDUSTRY

AVL 30 SEP 78

The Argentine Government, in an attempt to increase both reserves and production, has adopted several measures that will increase participation by private companies in oil and gas activities. These measures range from de-nationalization of ESSO's and SHELL's service stations and re-negotiation of crude prices with AMOCO and Cities Service, to passing a new Risk Contract Law, and contracting out thirty seven areas for exploration, development, or secondary recovery.

COUNTRY DATA--ARGENTINA

INVOLVEMENT IN INTERNATIONAL ENERGY ORGANIZATIONS

AVL 30 SEP 78

ORGANIZATION

DEGREE OF INVOLVEMENT

IAEA

VERY ACTIVE

COUNTRY DATA--ARGENTINA

ASSESSMENT OF INTERNATIONAL ACTIVITIES

AVL 30 SEP 78

There was evidence in the first two years of the new military junta which took power on March 24, 1976, that Argentina showed a considerable interest in Science and Technology with US cooperation in this field. Furthermore the new Foreign Investment Law, judged to be one of the most liberal in Latin America, reverses the restrictive bias of the earlier 1973 law and establishes a new climate distinctly favorable to private foreign investment. The law permits foreign investment in all sectors of the economy. The nuclear field remains by far the most active in which Argentina receives and provides international R&D assistance.

COUNTRY DATA--ARGENTINA
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| 9. Projection of demands for 3E have been taken from: Stobbs, Fox, Allen op. cit. | - |
| 10. IAEA press-release TRANSFER OF NUCLEAR FUEL FOR A RESEARCH REACTOR IN PERU. IAEA May 1978. | LDC |
| 11. State Dept. Airgram A-72 from AMEMBASSY BUENOS AIRES June 14, 1978 UNCLASSIFIED. | LDC |
| 12. State Dept. Airgram A-77 from AMEMBASSY BUENOS AIRES June 15, 1978 UNCLASSIFIED. | LDC |
| 13. State Dept. Airgram A-78 from AMEMBASSY BUENOS AIRES June 19, 1978 UNCLASSIFIED. | LDC |

COUNTRY DATA--ARGENTINA
NOTES AND EVALUATIONS

AVL 30 SEP 78

LOCATION

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-References thus indicated are available at public libraries.

WENDS COUNTRY DATA

AS: AUSTRALIA

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COUNTRY DATA--AUSTRALIA
ECONOMIC DATA PROFILE

DLR 01 FEB 78

GNP (1975, billion \$)-83
PER CAPITA INCOME (\$)-6050
EXPORTS (1975, billion \$)-11.9
MONETARY UNIT-dollarINFLATION RATE--
DISPOSABLE INCOME--
IMPORTS (1975, billion \$)-10.0
EXCHANGE RATE (1US\$=)-.8 Australian
dollars

TOTAL ENERGY R&D BUDGET--

TRANSPORTATION SYSTEM DESCRIPTION

Twelve international airlines operate regularly in and out of Australia. Passenger ships travel between the U.S. West Coast and Sydney. Domestic airlines, trains, and buses provide reliable, comfortable, and reasonably priced service between major cities. Public transportation and taxi service is good.

--not available

COUNTRY DATA--AUSTRALIA
DEMOGRAPHIC DATA PROFILE

DLR 01 FEB 78

LAND (million sq km)-7.68
POPULATION (millions)-13.5
LITERACY (%)-98.5
LIVE BIRTHS/THOUSAND-17.3
MEDIAN AGE/MALES--
AVERAGE FAMILY SIZE--
PRIMARY SCHOOL GRADS--
INDUSTRIAL WORKERS-1,523,200
AGRICULTURAL WORKERS-666,400
POPULATION GROWTH (%)-1.7

ARABLE LAND (million sq km)-.46
POPULATION DENSITY (/sq km)-2
% RURAL POPULATION--
DEATHS/THOUSAND-8.1
MEDIAN AGE/FEMALES--
NET MIGRATION (thou/yr increase)-87
SECONDARY SCHOOL GRADS--
PROFESSIONAL WORKERS--
COLLEGE GRADS--
UNEMPLOYED-265,600

--not available

COUNTRY DATA--AUSTRALIA
ENERGY POLICY: BASIC LEGISLATION

DLR 07 FEB 78

- 1-Bureau of Mineral Resources, Geology and Geophysics established 1946.
- 2-Science and Industry Research Act 1949 established the Commonwealth Scientific and Industrial Research Organization (CSIRO) to carry out and promote scientific research in connection with Australia's primary and secondary industries, including energy industries.
- 3-Atomic Energy Act 1953 established the Australian Atomic Energy Commission (AAEC) for the purpose of encouraging uranium development, carrying out atomic energy research and, generally fostering the advancement of atomic energy technology.
- 4-National Coal Research Advisory Committee established 1964 to review research and channel government funds for coal R&D.
- 5-Ministry of Minerals and Energy established 1972, name subsequently changed to Ministry of National Resources.
- 6-Environment (Impact of Proposals) Act 1974 provides that matters significantly affecting the environment must be scrutinized by the Australian Government which may require the preparation and acceptance of an environmental impact statement.

COUNTRY DATA--AUSTRALIA

GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

DLR 07 FEB 78

LEGISLATIVE--a bicameral Parliament consists of the Senate (64 members) and the House of Representatives (127 members). Energy-related matters are handled by the Senate Standing Committee on Natural Resources.

EXECUTIVE--Governor General (Sir John Kerr) is the Queen's representative in Australia. Actual power is exercised by the Prime Minister (J. Malcolm Fraser) and the Federal Executive Council (Cabinet). These Ministers are responsible to the House of Representatives, of which they must be members.

The Ministry of National Resources (J. Douglas Anthony, Minister) has responsibility for overall energy development and electric power. The Ministry of Science (James Webster, Minister) is responsible for general science R&D and the Ministry of Environment, Housing and Community (Kevin Newman, Minister) is responsible for assessing the environmental impact of energy and other projects.

Whereas the Federal Government has traditionally taken the initiative with regard to the setting up of organizational structures and advisory mechanisms, the individual States are primarily responsible for their own energy needs, including the discovery, conservation and development of energy resources. The six States typically discharge their responsibilities through such agencies as Mines Departments and Electricity Commissions. The Government consults with the States through the Australian Minerals Council.

OTHER PARTS OF THE ENERGY STRUCTURE

- 1-Commonwealth Scientific and Industrial Research Organization (CSIRO)--carries out and promotes scientific research in connection with primary and secondary industries, including energy industries.
- 2-Australian Atomic Energy Commission (Prof. D.W. George, Chairman)--maintains overall responsibility for nuclear licensing and safety, research and development, and uranium resource evaluation. The AAEC works with the Ministry of National Resources to formulate plans for the development of uranium resources.
- 3-Bureau of Mineral Resources, Geology, and Geophysics (BMR)--provides support for development and administration of national policies for exploration, exploitation and management of mineral resources.

COUNTRY DATA--AUSTRALIA

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/DLR 08 FEB 78

The central position for implementation of energy policy and R&D is held by the Ministry of National Resources headed by the Minister, Douglas Anthony. The Ministry is responsible for overall energy development and electric power. It has the following divisions:

- 1-Hydrocarbons--monitors oil and gas supply, refining, pricing, marketing activities and issues onshore exploration licenses;
- 2-Uranium and Electric Power--promotes development of electric power industry and Australia's natural uranium resources;
- 3-Planning--formulates overall energy policy objectives.

Under the Ministry is one statutory corporation, the Australian Atomic Energy Commission (AAEC). The AAEC's research responsibility is discharged through the following divisions of the Research Establishment of the Nuclear Science and Technology Branch:

- 1-Chemical Technology--processes raw materials to produce nuclear grade products, chemical aspects of reactor design and operation;
- 2-Instrument and Control--electronics research;
- 3-Isotope--radioisotope research and production, radiation studies;
- 4-Health and Safety--radiation biology and safety;
- 5-Engineering Research--monitors reactor performance and conducts heat transfer and engineering physics research;
- 6-Materials--fuel research, ceramic research;
- 7-Physics--fundamental theoretical and neutron physics;
- 8-Operations--operates main research reactor, designs and manufactures experimental equipment, collects and disposes of experimental wastes.

The AAEC has two advisory committees and operates two institutes in conjunction with Australian universities. These support entities are:

- 1-Atomic Energy Advisory Committee
- 2-Safety and Review Committee
- 3-Australian School of Nuclear Technology
- 4-Australian Institute of Nuclear Science and Engineering (AINSE)

Also under the Ministry of National Resources are two departmental research agencies:

- 1-Bureau of Mineral Resources, Geology and Geophysics (BMR)--provides support for development and administration of national policies for exploration, exploitation and management of Australia's mineral resources;
- 2-Division of National Mapping--mapping, evaluation and balancing resource development with regard to future requirements.

COUNTRY DATA--AUSTRALIA

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/DLR 10 FEB 78

(CONT)

Energy R&D is also conducted within the structure of the Ministry of Science (James Webster, Minister). The Commonwealth Scientific and Industrial Research Organization (CSIRO) carries out scientific research in connection with Australia's primary and secondary industries. CSIRO carries out energy R&D through its Minerals Research Laboratories consisting of the following divisions:

- 1-Minerology
- 2-Mineral Chemistry
- 3-Chemical Engineering
- 4-Mineral Physics

CSIRO also operates a Solar Energy Studies research unit.

Although the Federal Government normally takes the initiative for setting up organizational structures and advisory mechanisms, the individual States have primary responsibility for their own energy needs, including discovery, conservation and development of energy resources. The six States typically discharge their responsibility through agencies such as Mines Departments and Electricity Commissions.

COUNTRY DATA--AUSTRALIA
ENERGY POLICY AND OBJECTIVES

DLR 10 FEB 78

Australia has a privileged position in the world in regard to its energy resources. It possesses important domestic resources in coal, natural gas and uranium, which will probably protect it over a long period from direct repercussions of the world energy crisis. Nevertheless, the Government is concerned about the lack of a comprehensive energy policy at the national level. Up to this point, the initiatives of the Government toward that end have been subject to difficulties in the interpretation of the Constitution and the respective responsibilities of the State governments. Each State currently meets its own energy needs on the basis of its own fuel resources. It is hence possible to say that there exist six energy production systems in Australia, largely independent of each other.

At the national level an important decision was recently made to put off construction of the country's first nuclear power station. While making this decision, Australia remains conscious of the world's need for its uranium and is preparing for its development. On 25 AUG 77, the Fraser Government gave its approval for mining, milling and export of uranium, overturning the policy of the Whitlam Government (1972-1975) which stopped uranium production. This puts Australia in the paradoxical position of being one of the few industrial countries developing important world uranium reserves yet not producing nuclear energy. Also, under national initiative to develop solar energy, Australia stands at the vanguard of world research in that field.

A decision in favor of nuclear development as well as the recently approved development of natural gas reserves on the North West Shelf could serve to bring about a more cohesive policy enacted at the national level.

COUNTRY DATA--AUSTRALIA

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

DLR 02 FEB 78

In the short to mid-term Australia faces problems due to a lack of liquid fuel supply. In the short term, at least, the present trend away from self-sufficiency will continue, if for no other reason than that it would take three to five years to bring into production any new oilfield that might be discovered.

About 50% of Australia's energy comes from oil. Between 1976 and 1985, oil self-sufficiency is expected to decrease from 70% to 25%.

In the long term Australia's energy prospects look healthy due to:

- 1-Abundant coal resources;
- 2-Substantial reserves of natural gas and uranium, both capable of being developed to serve local and/or overseas markets;
- 3-Favorable geography for harnessing solar energy, together with the prospect that wealth and know-how will be available to adopt this and other new energy technology when it is developed.

COUNTRY DATA--AUSTRALIA
INDIGENOUS ENERGY RESOURCES

DLR 01 FEB 78

NONRENEWABLE	RESOURCES	RESERVES	LOCATION OF IDENTIFIED RESERVES
HARD COAL (million tonnes)	227,620	30,400	Eastern
SOFT COAL (million tonnes)	122,202	17,834	Eastern
CRUDE OIL (million tonnes)	818	229	Bass Strait, Western on-shore
NATURAL GAS (cubic km)	1,595	981	North West on-shore
URANIUM (thousand tonnes U308)	368.84	49.04	Northern Territory West Australia, South Australia, Queensland
RENEWABLE			
HYDRO POWER (billion kWh/yr)	53.5	16.9	Eastern
GEOHERMAL	0	0	

COUNTRY DATA--AUSTRALIA
PATTERNS OF ENERGY SOURCES AND USES

DLR 01 FEB 78

CONSUMING SECTOR-1975

	HOUSEHOLD & COMMERCIAL	INDUS- TRIAL	TRANSPOR- TATION	ELECTRICAL GENERATION	TOTAL
COAL (million tonnes)	0.19	10.15	0.02	25.07	35.43
PETROLEUM (million tonnes)	2.39	4.94	13.49	0.55	21.37
NATURAL GAS (cubic km)	1.20	1.85	0	0.78	3.83
NUCLEAR POWER (billion kWh)	0	0	0	0	0
HYDRO POWER (billion kWh)	0	0	0	15.22	15.22
GEOTHERMAL POWER (billion kWh)	0	0	0	0	0
UTILITY ELECTRI- CITY DISTRIBUTED (billion kWh)	22.69	35.72	0.7	14.89	74.0

COUNTRY DATA--AUSTRALIA
PROJECTIONS OF DEMAND

DLR 02 FEB 78

[illegible]

COUNTRY DATA--AUSTRALIA

PROJECTIONS OF ENERGY SUPPLIES, IMPORTS, AND EXPORTS

DLR 02 FEB 78

RESOURCE	1975	%US	1985	%US	2000	%US
HARD COAL (million tonnes)						
INDIGENOUS SUPPLY	61.7		note 1		--	
IMPORTS	0.02	0	--		--	
EXPORTS	30.47	0.36	--		--	
SOFT COAL (million tonnes)						
INDIGENOUS SUPPLY	28.2		note 1		--	
IMPORTS	0	0	--		--	
EXPORTS	0	0	--		--	
CRUDE OIL (million tonnes)						
INDIGENOUS SUPPLY	21.43		20.5		--	
IMPORTS	7.7	0	--		--	
EXPORTS	0.2	0	--		--	
NATURAL GAS (cubic km)						
INDIGENOUS SUPPLY	5.03	--	9.0		--	
IMPORTS	0	0	--		--	
EXPORTS	0	0	--		--	
URANIUM						
INDIGENOUS SUPPLY	0	--	--		--	
IMPORTS	0	0	--		--	
EXPORTS	0	0	--		--	
ELECTRICITY (billion kwh)						
INDIGENOUS SUPPLY	73.93		143.0		--	

NOTE 1: The combined production estimate for all types of coal for 1985 is 99 million tonnes.

--not available

COUNTRY DATA--AUSTRALIA
ENVIRONMENTAL CONSIDERATIONS

DLR 02 FEB 78

The Environment (Impact of Proposals) Act 1974-1975, passed on 17 DEC 74, states that matters which affect the environment to a significant extent must be fully examined and taken into account in relation to decisions or actions by the Australian Government. The Minister for the Environment may require that an environmental impact statement for a particular project be prepared, and any person may require the Minister to report on what environmental action has been taken.

COUNTRY DATA--AUSTRALIA
COMMERCIAL APPLICATIONS

DLR 02 FEB 78

On 25 AUG 77 the Government of Australia gave its approval for mining, milling and export of uranium from Australia. However, since the granting of the approval, there has been no rush by potential uranium producers to begin development of their respective deposits. Reasons for this lag include:

- 1-Government announcement that it was considering the implementation of a resource tax to skim off the super profits expected from uranium mining ventures. A resource tax would not be unexpected by uranium developers, but since the exact nature of the pending tax is unknown, caution is being exercised by the companies.
- 2-For many of the fields, an Aboriginal land rights issue must be resolved, after which a compensation settlement would have to be negotiated between the company and the Aborigines.
- 3-Some companies have yet to get approval of their environmental impact statements.

COUNTRY DATA--AUSTRALIA
ENERGY R&D: STATUS AND OUTLOOK

DLR 09 FEB 78

SOLAR

Australia has favorable geography for harnessing solar energy. Under Government initiative Australia stands at the vanguard of world research. A new research facility for the world headquarters of the International Solar Energy Society (Melbourne) is viewed as a step toward Australia's aim to derive, by year 2000, the equivalent of four-fifths of its current overall energy consumption. In actual terms, it is estimated that solar power could meet up to 20% of the country's total primary energy demand by 2000. Recent commercial applications include a more efficient and durable solar panel and operation of the country's first solar hot water heating plant. A more efficient and less expensive solar collector using glass instead of copper is being developed. The collector is expected to produce temperatures of more than double that of conventional collectors.

NUCLEAR

An important decision was recently made to put off construction of the country's first nuclear power station. Nuclear power is not expected to contribute greatly to energy demand this century with a total capacity of only 2000 MW forecast for 1992. Australia carries on a limited amount of nuclear power R&D, but has no mid-or long-term R&D framework. Consequently, there exists little basis for a nuclear industry. Australia has one of the world's largest shares of uranium reserves. In AUG 77, approval was given for mining, milling and export of uranium for the first time since 1971. Without a nuclear power program, production will be almost entirely for export. Future production is somewhat uncertain due to the government imposed limit on foreign participation to not more than 25% equity. Australia and Japan are conducting a feasibility study for establishing uranium enrichment facilities in Australia.

COAL

Australia has abundant coal resources, enough to last for some hundreds of years. In the long term it appears that coal-to-oil conversion is Australia's best hope for guaranteed supplies of liquid fuel. In MAY 77, it was announced that a \$1300 million coal-to-oil plant may be set up with West German aid by the 1980's. In OCT 77, Australian Coal Industry Research Labs announced it is firing up its coal-to-oil mini-pilot plant. R&D is being conducted on fluidized-bed combustion for treating coal wastes.

OIL AND GAS

Oil production has peaked and the relatively small reserves are declining. The chances of adding to proven oil reserves are considered poor. By 1985 oil self-sufficiency is expected to drop from the current 70% to 25%. Natural gas reserves should suffice to meet demand into the next century at least. The chances for increasing proven reserves are considered good. In AUG 77, approval was given for the North West Shelf Gas Project to proceed. The first step toward development is a \$A50 million feasibility study which was scheduled to begin in late 1977. Exports of LNG for 53% of production over a 20-year period have been approved.

COUNTRY DATA--AUSTRALIA

GOV'T SUPPORTED ENERGY R&D IN INDUSTRY, UNIV & NATL LABS/DLR 08 FEB 78

UNIVERSITIES	PROGRAM AREAS	KEY INDIVIDUALS
Australian National University, Center for Resource and Environmental Studies (CRES)	Environmental and resource analysis	Prof. Stuart Harris
University of New South Wales, Institute of Nuclear Engineering	Nuclear	
University of Sydney	Solar collectors	
Flinders University, Institute of Solar and Electrochemical Energy Conversion	Solar energy, electrochemical fuel cells, electrical transportation	
Australian School of Nuclear Technology	Nuclear technology, radioisotopes techniques and applications, health physics, siting and hazards evaluation of nuclear power plants	J.L. Symonds, Chairman

LABORATORIES

Research Establishment, Australian Atomic Energy Commission	Nuclear power, production and use of radioisotopes, analytical chemistry, neutron diffraction, neutron activation analysis, dosimetry, radiation chemistry, radiation damage studies, radiation biology	K.F. Adler, General Manager
Baas Becking Geobiological Research Lab	Mineral deposits of stratiform type, uranium mapping	

COUNTRY DATA--AUSTRALIA

ENERGY R&D: ROLE OF PRIVATE INDUSTRY

DLR 08 FEB 78

The role of private industry in energy resource development is substantial with most primary energy resources being owned or developed by non-government organizations. The following companies are active in R&D:

URANIUM

- 1-Queensland Mines Ltd.
- 2-Ranger Uranium Mines Pty. Ltd.
- 3-Western Mining Corporation Ltd.
- 4-Pancontinental Mining Ltd.
- 5-Getty-Oil Development Company Ltd.
- 6-Noranda Mines Ltd.
- 7-Conzinc Riotinto of Australia Ltd.

COAL

- 1-Conzinc Riotinto of Australia Ltd.
- 2-Western Mining Corporation Ltd.

SOLAR

- 1-Beasley Industries
- 2-Solarex Pty. Ltd.

OIL AND GAS

- 1-Broken Hill Proprietary Company Ltd.
- 2-Conzinc Riotinto of Australia Ltd.
- 3-Ampol Petroleum Ltd.
- 4-British Petroleum Company of Australia Ltd.
- 5-Esso Australia Ltd.
- 6-Mobil Oil Australia Ltd.
- 7-Petroleum Refineries Pty. Ltd.
- 8-Shell Australia Ltd.
- 9-H.C. Sleigh Ltd.

There are several industrial research associations which serve the interests of the companies which set them up. Some of the associations are partly financed with government grants.

- 1-Australian Coal Industry Research Laboratories--coal R&D
- 2-Australian Mineral Industries Research Association (AMIRA)
- 3-Australian Mineral Development Laboratories (AMDEL)--contract research and consulting in analytical chemistry, mineralogy and petrology, mineral engineering and materials technology
- 4-Australian Petroleum Exploration Association--facilitates exchange of information, establishes standards and discusses methods of oil exploration
- 5-Petroleum Information Bureau--promotes knowledge and use of petroleum products by collecting and disseminating information
- 6-Institution of Engineers--has an Energy Task Force which examines and reports on all forms of energy in relation to their significance to the Australian economy

COUNTRY DATA--AUSTRALIA

INVOLVEMENT IN INTERNATIONAL ENERGY R&D ORGANIZATIONS

DLR 08 FEB 78

ORGANIZATION

DEGREE OF INVOLVEMENT

IAEA

Active

CCMS

NEA

Association for Centrifuge
Enrichment (ACE)

COUNTRY DATA--AUSTRALIA
KEY REFERENCES

DLR 10 FEB 78

LOCATION

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COUNTRY DATA--AUSTRALIA
NOTES AND EVALUATIONS

DLR 10 FEB 78

LOCATION

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- 3-Guide to World Science, vol. 18, Australia and New Zealand, Francis Hodgson, Guernsey, British Isles, 1975. (2A, p.22; 2B, p.25; 2C, p.101-108; 4E, p.101-108, 166, 175; 4F, p.192-194) --
- 4-The Far East and Australasia 1976-77, Europa Publications, London, 1976. (1B, 2B, 4E, 4F) --
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- 6-Description of the Solar Energy R&D Programs in Many Nations, Prepared for the U.S. Energy Research and Development Administration, Division of Solar Energy, by Atlas Corp., Santa Clara, California, FEB 76. (3B) IA
- 7-National Basic Intelligence Factbook, CIA, JUL 76 (1A, 1B) IA
- 8-"The Energy For Australia", Petroleum Gazette, JUL 76. (3B, 4A) --
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- 10-CCMS Solar Energy Pilot Study: Report of the Annual Meeting, Committee on the Challenges of Modern Society, 13-15 SEP 76., Copenhagen, Denmark (2B, 4F) IA
- 11-Australia Atomic Energy Program, Department of Energy, International Affairs, SEP 76. (4E, 5A) IA
- 12-Australian Atomic Energy Commission, News Release, no. 150, 26 NOV 76. (4A) IA
- 13-1976 Statistical Yearbook, United Nations, New York, 1977 (1B, p.72, 83, 89) --
- 14-Reviews of National Science Policy, Australia, Organization for Economic Co-operation and Development, Paris, 1977. (2A, p.25, 54, 69-71, 84-88; 2B, p.69-71, 84-88; 2C, p.69-71, 84-88; 3A, p.183-185; 4A, p.183-185; 4F, p.84-88; 5B, p.61) --
- 15-Predicasts, Inc. (Data Base), Cleveland, Ohio, 1978 (3F, 4A, 4E, 4F, 5B) IA
- 16-State Dept. Airgram A-106 from AMEMBASSY CANBERRA 02 SEP 77 Unclassified. (4A) IA
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- 19-The Role of Foreign Governments in the Energy Industries, Dept. of Energy, Office of International Affairs, OCT 77 (2A, 2B, 2C, 3A, 3B, 4A) IA
- 20-State Dept. Airgram A-154 from AMEMBASSY CANBERRA 16 NOV 77 Unclassified. (4A, enclosure 1 p.10-11) IA
- 21-International Data Collection and Analysis (Draft), Prepared for U.S. Dept. of Energy, by Nuclear Assurance Corporation, DEC 77. (3C, 3D, 3E, 3F, 4A) IA

COUNTRY DATA--AUSTRALIA
NOTES AND EVALUATIONS (CONT)

DLR 08 FEB 78

22-State Dept. Airgram A-176 from AMEMBASSY CANBERRA 30 DEC 77 IA
Unclassified (4E)

--References thus indicated are available at public libraries.

WENDS COUNTRY DATA

AU: AUSTRIA

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COUNTRY DATA--AUSTRIA
ECONOMIC DATA PROFILE

AVL 30 SEP 78

GNP (Billions \$)-(1977) 46.5	Inflation Rate-11% (Using GDP Deflator) (1977)
Exports (Billions \$)-(1977) 9.81	Nat. Income/capita(\$)-(1977) 5680
Per Capita GNP (\$)-(1977) 6200	Imports (Billions \$)-(1977) 14.18
Monetary unit - Schilling	Exchange Rate (1US\$=)-14.990 Schillings (June 1978)

Total Energy R&D Budget (Million \$) - 234.55

TRANSPORTATION SYSTEM DESCRIPTION

Austria has a highly developed system of public transport by road, rail, air and river. The Danube provides Austria with an artery particularly important for the transport of coal, steel, petroleum and other raw materials. A passenger service is maintained on the Upper Danube and between Vienna and the Black Sea. There are six commercial airports. Railways total about 5,900 Km., roads 103,000 Km., and commercial waterways 351 Km.

COUNTRY DATA--AUSTRIA
DEMOGRAPHIC DATA PROFILE

AVL 30 SEP 78

Land (Million sq. Km.)-0.08
Population (Millions)-7.5
(1977)

Literacy %--

Live Births/thousands-11.6
(1975)

Median Age/Males- 29 (1975)

Average Family Size--

Primary School Enrollement-
513,027 (1974)Agricultural Workers-365,000
(1976)Population Growth % - 0.3%
(1970-75)Arable Land (Million sq. Km.)-0.016
Population Density-(/sq. Km.) 94
(1976)

% Rural Population-48.1%

Deaths/Thousands-12.6
(1975)

Median Age/Females- 35 (1975)

Net Immigration (Millions/yr.)-0.0006
(1975)Secondary School Enrollement-
904,695 (1974)Professional Workers-854,000
(1976)

College Grads --

Unemployed (Millions) - 0.055

-- Unavailable

COUNTRY: AUSTRIA
PROFESSIONAL LABOR FORCE PARTICIPATION PROFILE

AVL 30 SEP 78

PROFESSIONAL LABOR FORCE PROFILE

Total Stock of Scientists, Engineers, Technicians

Total - N.A.

Scientists and Engineers - 118,294 (1977)

Technicians - N.A.

Total R&D of Manpower(thousands)

Total -	1870 (1972)
Natural Sciences -	75
Engineering & Technology	1779
Medical Sciences -	1
Agriculture -	11
Social Sciences & Humanities	4

N.A.. - not available

COUNTRY DATA--AUSTRIA
KEY TECHNICAL EDUCATIONAL RESOURCES

AVL 30 SEP 78

There were in (1974-75) 143 schools of technical and industrial training (including schools of hotel management and catering) with 3,435 teachers and 36,415 pupils.

Institutions
-----Location

Universitate in Innsbruck	Innsbruck
Technische Hochschule in Graz	Graz
Montanistische Hochschule in Leoben	Leoben/St. Eiermark
A Mining College	Leoben
Technische Hochschule in Vienna	Vienna
An Agriculture College at Vienna	Vienna
Austrian Study Society for	-
Atomic Energy	

COUNTRY DATA--AUSTRIA
ENERGY POLICY: BASIC LEGISLATION

AVL 30 SEP 78

AREAS OF BASIC LEGISLATION AFFECTING ENERGY POLICY AND R&D

- A. 1938 - Germany promulgated a bituminous law which later applied to Austria. The law declared petroleum, natural gas, and other hydrocarbons to be government property, granted oil exploration and exploitation rights to the state.
- B. Energy policy formulation is constrained by the federal structure of the Austrian Constitution. The federal government has either direct influence or control in energy matters. In general the federal government attempts to work via internal treaties in order to establish uniform standards and policy.
- C. Mining Act of 1954 governs prospecting of uranium ores.
- D. (SGAE) - The Austrian Company for Nuclear Research was set up in 1956 for the purpose of studying basic science and peaceful applications of nuclear energy.
- E. The Atomic Liability Act of 1964 was amended in 1976; it covers damage resulting from nuclear incidents.
- F. Radiation Protection Act of 1969 defines competence of government and contains most of the provisions concerned with radiation protection.
- G. Act of December 1969 promotes electricity producing enterprises.
- H. Security Control Act of 1972 implements IAEA safeguards.
- I. In 1967, a Research Promotion Law was passed.
- J. Federal Ministries Law - 1973.
- K. In January 1974, an Energy Advisory Board was established within the Trade Ministry to advise on basic policy issues. This Board developed a national energy research policy published as the energy plan.
- L. A law has been promulgated in June 1976 establishing an international energy R&D program.
- M. The Government Advisory Council on Energy Conservation (1974) is the central forum for energy conservation.
- N. 1977 - Industrial Research Fund.

COUNTRY DATA--AUSTRIA
GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

AVL 30 SEP 78

LEGISLATIVE - National Council composed of 183 delegates.

EXECUTIVE - Office of the Chancellor (Dr. Bruno Kreisky) is legally a federal ministry. Responsibility for administration of federal law rests with the federal ministries. Ministry of Trade Commerce & Industry has primary responsibility over energy matters, including development of the National Energy Plan. The Energy Advisory Board is composed of representatives of ministries with energy functions, other government agencies and industrial scientists was set up in January, 1974 for the purpose of advising the Trade Minister on basic energy policy issues.

The following Ministries are charged with energy responsibilities:

Ministry -----	Responsibility -----	Key Individuals -----
Trade, Commerce, & Industry	Analysis of energy problems and energy management, National Energy Plan	Dr. Josef Staribacher Minister Dr. Wilhelm Frank Energy Section
Science & Research	Establishment of energy research program and priorities.	Dr. Hertha Finberg Minister
Construction & Technology	Standardization of electric plants & facilities, nuclear plant licensing.	Mr. Josef Moser Minister
Federal Chancellery	Overall coordination of nuclear matters, energy questions with OECD (and IEA)	Dr. Bruno Kreisky Chancellor
Health & Environmental protection	Nuclear power plant licensing.	Dr. Ingrid Leodolter Minister
Agriculture & Forestry	Nuclear power plant licensing.	Dr. Oskar Weitts Minister

A. Austrian Study Society for Atomic Energy - Dr. Wilhelm Erbacher, Dr. Hans Gruemn, Wolfgang Baderle.

B. Seibersbore Reactor Center - Mr. Andreas Hasselhahn

C. Nuclear Power Plant Planning- Comp.- Christian Held, Dr. Friedrich Janitschek

D. Nuclear Research Center

COUNTRY DATA--AUSTRIA

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/AVL 30 SEP 78

A. Implementation of nuclear energy and R&D is carried out by the same organizations. Except that the Austrian Study Society for Atomic Energy is involved in nuclear R&D implementation.

B. The Nuclear Research Center has as its main activities - Reactor Safety, Process heat, Liquid sodium cycles, Pre-stressed concrete, R.P.V.

C. R&D activities are focussed in the field of nuclear reactor safety research. An implementation agreement was concluded under IEA auspices and other international agreements in the case of the following: LOFT, PBF and HACDEN.

COUNTRY DATA--AUSTRIA
ENERGY POLICY AND OBJECTIVES

AVL 30 SEP 78

The Government of Austria national energy policy was set forth in the Energy Plan adopted by the Austrian Cabinet in 1975. The Plan was developed by the Trade Ministry in cooperation with the Energy Advisory Board and industry working groups. The primary objective appears to be a decrease in the country's need for foreign oil.

Main objectives of the Government of Austria Energy Policy are:

- A. Energy supply must be carefully planned.
- B. Energy planning and energy policy must be fundamentally reflected in the Government's economic and social policies.
- C. The criteria for energy supply are: the national economy and the population should be supplied energy sufficiently, safely, economically, at the same time satisfying environmental requirements.
- D. The above mentioned criteria should constitute the basis for the formulation of goals and for the optimization and implementation of the planning process.
- E. Energy R&D should be a priority field with adequate financial support.
- F. Energy R&D should be dealt with new materials supply matters.
- G. Exploration should be considered as research.
- H. In 1977, priorities have been adopted to conserve nuclear material. Emphasis on solar, geothermal, oil and gas, development of superconducting materials for power generators.
- I. Priority for research has been established in the following areas: Methods for improved utilization of existing energy, energy conservation, transportation and storage of energy supplies, environmental problems associated with energy extraction and use, socio-economic aspects of energy problems.
- J. Improved efficiency in the use of domestic sources planned to increase domestic energy production.
- K. Diversification of imported energy sources.
- L. Increase in storage capacity with the goal of achieving 70 day energy reserves by 1976 and 90 day reserves by 1980.
- M. Systematic exploration for coal, oil, natural gas, uranium and thorium within the country.

COUNTRY DATA--AUSTRIA

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

AVL 30 SEP 78

The Government of Austria's objective is to maintain the present level of imports at 37%. The criteria for energy supply are: That the national economy and the population should be supplied energy sufficiently, safely, economically, simultaneously and also satisfying environmental requirements.

- A. The government has implemented a number of conservation measures with regard to its own energy utilization.
- B. Plans to increase domestic energy production by 1985, concentrated in the development of hydro and nuclear based electricity generating capacity.
- C. In order to limit the country's dependence on foreign energy supplies, it is felt conservation measures must be adopted and indigenous energy supply should be increased.
- D. Hydropower is the main indigenous energy resource. Austria intends to expand this source.
- F. Additional resources are being made available for exploiting new coal reserves.
- G. Plans for the further expansion of conventional power and compensation programs for the eliminated nuclear facilities, are in progress.
- H. Public utility companies (EVU), the Austrian Train Company, and industry owned power plants, supply all of Austria's electricity needs.

COUNTRY DATA--AUSTRIA
INDIGENOUS ENERGY RESOURCES

AVL 30 SEP 78

	"RECOVERABLE RESERVES"	RESERVES	LOCATION OF IDENTIFIED RESERVES
NONRENEWABLE			
HARD COAL	0	10	
(mega tonnes)			Tertiary Foreland
SOFT COAL	104	368	
(mega tonnes)			
CRUDE OIL	25	N.A.	
(mega tonnes)			
SHALE OIL	N.A.	N.A.	
(mega tonnes)			
NATURAL GAS	15	N.A.	
(million G Cal)			
URANIUM	0	0	
(thousand tonnes)			
(U308)			
RENEWABLE			
HYDRO POWER	27.25	43.9	
(GWh/year)			
GEOTHERMAL	0	0	
(TWh/year)			

COUNTRY DATA--AUSTRIA
PATTERNS OF ENERGY SOURCES AND USES

AVL 30 SEP 78

	HOUSEHOLD COMMERCIAL	INDUS- TRIAL	TRANSPOR- TATIONAL	ELECTRICAL GENERATION	TOTAL
COAL (Thousand tonnes)	1,599	1,710	291	2,302	8,987
PETROLEUM (Thousand tonnes)	3,523	3,173	3,018	1,205	20,394
NATURAL GAS (Tera Calories)	6,104	24,745	0	9,561	45,739
NUCLEAR POWER (Million KWh)				0	
HYDRO POWER (Million KWh)				20,510	
GEO THERMAL (Million KWh)				0	
UTILITY ELECTRICITY (Distributed) (Million KWh)	13,699	12,676	1,895	0	33,143

Blank spaces indicate not known or not available.

Note: Total includes transmission and distribution losses and energy sector uses.

COUNTRY DATA--AUSTRIA
PROJECTIONS OF DEMAND

AVL 30 SEP 78

RESOURCE	STANDARD PHYSICAL UNITS			THOUSAND t.c.e.		
	1976	1985	2000	1976	1985	2000
COAL (Thous. tonnes)	8,987			8,987		
Coke and Lignite						
CRUDE OIL (Thousand tonnes)	9,354	9,700	13,330	16,363		
SHALE OIL (Thousand tonnes)	-			-		
NATURAL GAS (Tera calories)	45,739	7,700	1,260	6,536		
NUCLEAR POWER (Billion KWh/year)	0			0		
HYDROELECTRIC POWER (Million KWh/year)	20,516	3,300	4,730	2,523		
GEO THERMAL (Billion KWh/year)	0					
OTHER (See note) (Billion KWh/year)						
URANIUM (Kilotonnes U308)	0.374 (1975)					

HEAT RATE
(Btu/KWh)

Note: Wind energy, tidal power, biomass

Blank spaces indicate not known or not available.

COUNTRY DATA--AUSTRIA

PROJECTIONS OF ENERGY SUPPLIES, IMPORTS, AND EXPORTS

AVL 30 SEP 78

RESOURCE	1976	%US	1985	% US	2000	% US
COAL (thousand tonnes)						
INDIGENOUS SUPPLY	4,830		2,440		1,570	
(Coke & Lignite)						
IMPORTS	4,319		3,360		5,830	
(Coal, Coke & Lignite)						
EXPORTS	68					
(Coal, Coke & Lignite)						
CRUDE OIL (thousand tonnes)						
INDIGENOUS SUPPLY	1,931		1,470		940	
IMPORTS	7,387		8,230		12,360	
EXPORTS	39					
SHALE OIL						
INDIGENOUS SUPPLY						
NATURAL GAS (tera calories)						
INDIGENOUS SUPPLY	20,950					
IMPORTS	25,932					
EXPORTS	0		19,800		3,880	
URANIUM (kilotonnes U308)						
INDIGENOUS SUPPLY						
IMPORTS						
EXPORTS						

Blank spaces indicate not known or unavailable.

COUNTRY DATA--AUSTRIA
ENVIRONMENTAL CONSIDERATIONS

AVL 30 SEP 78

Apart from radiation protection and water pollution control, environmental protection in Austria is the responsibility of the Lander. The Federal Government is however endeavoring by means of internal treaties with the Lander to ensure that uniform measures for air pollution control are introduced.

The Government tries to draw the attention of the firms in the oil industry to the needs of the energy economy, so as to introduce a change from profit-maximization to crude-oil saving processes which incidentally would have environmental advantages.

The Government budgets the amount of \$0.574 million for environmental problems associated with energy.

There is an environmental protection agency. (agency head & senior staff member, Environmental Planner Stirmak, Air Pollution Analyst Graz.)

IIASA - Proposed to conduct a research program on the design and management of regional energy environmental systems in Austria. The research is to be conducted in concert with energy environmental institutions in Austria, in order that the products of this research could be useful to the Austrian community. Such research, it is felt, must take national, subnational and regional characteristics into account.

COUNTRY DATA--AUSTRIA
COMMERCIAL APPLICATIONS

AVL 30 SEP 78

A. Austria has signed agreements concerning technical information and mining technology clearing houses, in order to encourage projects in energy R&D.

B. Joint Government/Industry participation research organizations have been set up.

The research projects by nationalized firms include high degree of development of technologies in energy R&D.

C. Government measures have been introduced to facilitate energy R&D and commercial application in the private sector. The main instrument to facilitate energy R&D activities in the private sector is the "Forschungsforder Ungsfods Der Gewerblichen Wirtschaft". It partially finances energy R&D projects submitted to it by industrial firms. Energy R&D contracts with the private sector are provided by the Federal Ministries for Buildings and Construction, Commerce and Industry, as well as by the Federal Ministry for Science and Research. The energy R&D investments of the private sector are generally tax-deductible.

COUNTRY DATA--AUSTRIA
POWER PRODUCTION AND ENERGY CAPABILITY

AVL 30 SEP 78

Austria possesses no domestic fuel cycle facilities and none are planned.

PRODUCTION (MWE)

	1973	1978	1985
Oil	2.6	2.2	1.7
Gas	2.0	2.0	1.0
Coal	0.8	1.2	0.8
Nuclear	-	-	-
Hydro	4.3	(5.3)	(7.2)

PETROLEUM

Total Wells (1975)	Total Footage (1,000 ft.)	Total Wildcats (1975)	Successful Wildcats (1975)
78	450	37	9
Total Wells (1974)	Total Footage (1,000 ft.)	Total Wildcats (1974)	
80	491	24	

Number of Rigs

September 30, 1977	June 30, 1977	September 30, 1976
7	10	7

POWER GENERATION

Type Plant	0-499	500-800	800+MWe	
Oil/Gas	2			U
	2			P
Oil	2			P
	5			O
Gas	1			O
Coal	1			P
Hydro	3			U
		1	1	U
	2			U
	16			P
Brown Coal	4			O
Nuclear	1			O
				P

N.B. O = Operational P = Planned S = Shutdown
U = Under Construction

COUNTRY DATA--AUSTRIA
ENERGY INDUSTRIES

AVL 30 SEP 78

There are no nuclear reactor vendors in Austria and in view of the extremely limited domestic market no companies would be expected to enter the field.

Austrian industry is able to supply a wide range of components and equipment for nuclear reactors. For the major components, the most important of these companies is Vereinigte Oesterreichische Eisen-Und Stahlwerke and Alpine Montan AG (Voest-Alpine) which supplies parts for large pressure vessels and complete smaller vessels.

Current capacity is small and due to lack of orders, other markets are being sought.

There are no plans for expansion. There is no vested interest in current technology.

Austria will continue to rely on nuclear power plants purchased abroad from experienced vendors supplying proven technology.

COUNTRY DATA--AUSTRIA
ENERGY R&D: STATUS AND OUTLOOK

AVL 30 SEP 78

A comprehensive government report to Parliament as required by the Research Promotion Law on the status and outlook of research in general, including energy research, was completed in 1976 by the Ministry of Science and Research.

Nuclear energy has fallen in Austria's energy priorities: As such, the outlook for nuclear energy research is for its continuation at a low level.

COUNTRY DATA--AUSTRIA
ENERGY R&D: BUDGET

AVL 30 SEP 78

The Industrial Research Fund has allocated \$120,000 for 1977. Major projects require that at least 50% be funded by industrial contractors. Government energy R&D expenditures are included in the general R&D budget and energy R&D budget figures are not available.

AS 16.98 = US \$1.00 (January to April 1977 average)

	Millions of Schillings	1977 Millions of US\$
Group I (A)		
A. Conservation (Industry, residential and commercial, transportation, others)	6.114	0.369
Group II (B+C+D)	2.080	0.125
B. Oil and Gas (Enhances oil, oil shale and tarsands, gas)	0.090	0.005
C. Coal (Coal combustion, coal conversion, others)	-	-
D. Nuclear Fission (LWR, HTR, other convertor reactors, fuel cycle)	1.990	0.120
Group III (E-J)	3.250	0.196
E. Solar (Heating & cooling, photo electric, thermal electric)	1.960	0.118
F. Wind	-	-
G. Ocean	-	-
H. Biomass	-	-
J. Geothermal	1.290	0.078
Group IV (K+L)		
K. Fast Breeder		
L. Nuclear Fusion		
M. Other Sources		
N. Supporting Technologies (Electric power conversion transmission and distribution, energy storage, energy systems analysis, others)		
TOTAL GOVERNMENT R&D BUDGET	3,890	234,55 \$
TOTAL GOVERNMENT BUDGET	240,767	14,517,15 \$

COUNTRY DATA--AUSTRIA
ENERGY R&D: PRIORITIES

AVL 30 SEP 78

The Government of Austria's energy research program adopted by the Cabinet in December 1974 defines energy R&D priorities. Emphasis is given to:

- A. Solar energy (development of solar collectors and application for heating buildings and generating electricity).
- B. Geothermal Energy.
- C. Development of supra-conductive materials for power generators.
- D. Other priority areas for research are:
 - a. Methods for improved utilization of existing energy sources and development of new sources.
 - b. Energy conservation.
 - c. Transportation and storage of energy supplies.
 - d. Energy conversion.
 - e. Environmental problems associated with energy extraction and use.
 - f. Socio-economic aspects of energy problems
- E. Reactor safety.
- F. Radioactive waste
- G. Oil and gas.

COUNTRY DATA--AUSTRIA
ENERGY R&D: IMPACT

AVL 30 SEP 78

- A. A wind energy conversion unit bearing an output of 8 KWE is being built and meteorological data are being collected to determine potentialities of the wind energy technology for Austria.
- B. The Energy Research Project focuses on the development of non-conventional energy technologies such as solar energy, wind energy and geothermal energy.
- C. Mining Technology Clearing House Service--implementation agreements were signed; Development of solar heat and cooling and solar heated hot water systems have been initiated, along with development of solar collectors and application of solar energy for heating buildings and generating electricity.
- D. Since there are no reactor vendors in Austria, there is no major vested interest in current technology.
- E. Austria will continue to rely on nuclear power plants purchased abroad from experienced vendors supplying proven technology.

	Number	1977	1990
New Reactors to Reach Sustained Operation		1	1
	GWE	0.7	1.3
Other Generation Equipment		GWE	
	1976-1980		1986-1990
A. Coal			
On sustained operation			
Of which peak load			
B. Oil and Gas	0.9		0.7
On sustained operation			
Of which peak load			
C. Hydro	1.6		1.6
On sustained operation			
Of which peak load			

REACTORS ON SUSTAINED OPERATION--GWE

	1976	1977	1978	1990
A. Operation	-	0.7	0.7	3.3
B. Capacity Currently Under Construction	0.7	-	1.3	-

The time from the beginning of construction to sustained operation is 7 years.

COUNTRY DATA--AUSTRIA

GOVERNMT.SUPPORTED ENERGY R&D IN IND., UNI. & NAT.LABS AVL 30 SEP 78

INDUSTRY, UNIV.	PROGRAM AREAS	KEY INDIVIDUALS
Austrian Study Society for Atomic Energy (Government holds 50.46% interest, private firms 49.34%.)	Prestressed concrete reactors, liquid metal technology for fast breeders, liquid metal application for topping cycles for fossil-fired power stations, materials and coated particles for high temperature gas-cooled reactors, conditioning of radioactive waste, decontamination of reactor effluents.	Dr. W. Erbacher Pres., Supervisory Board Dr. Hans G. Grueml, Tech. Dir. Wolfgang Baderle Commercial Division
Austrian Space Agency (Government owned)	Joint government/industry Solar Energy research	
Seibersdorf Reactor Center		Mr. Andreas Hasselhorn
Nuclear Power Planning Company		Christian Held
Nuclear Research Center	Reactor safety, process heat, liquid sodium cycles, pre-stressed concrete RPV	

COUNTRY DATA--AUSTRIA
ENERGY R&D: ROLE OF PRIVATE INDUSTRY

AVL 30 SEP 78

Industry's role in energy R&D is modest. R&D is conducted primarily by large nationalized industries, but frequently in co-operation with private firms.

R&D projects at nationalized firms include:

Company	Projects
Austrian Oil Administration	Prospecting for hydrocarbons, geothermal exploration, solar and wind energy
Vereingte Edelstahlwerke (specialty Steel Producer)	Multi-cycle power systems (triple cycle vapor process), construction materials for use at very low temperature, liquid radioactive waste concentration techniques.
ELIN UNION (electrical equipment)	Extra-high voltage transformers, high performance generators, superconducting material for electrical generators.
Voeest-alpine (Steel)	Nuclear power plant components (pressure steel vessels), RPV
Austrian Study Society for Atomic Energy	Prestressed, concrete RPV, sodium technology, fuels radioactive waste.

The major role of private industry appears to be supportive with respect to the government.

COUNTRY DATA--AUSTRIA

INVOLVEMENT IN INTERNATIONAL ENERGY ORGANIZATIONS

AVL 30 SEP 78

ORGANIZATION

DEGREE OF INVOLVEMENT

IAEA	Active-Contribution in 1975: \$186,000
World Power Conference	Moderately Active-Contribution in 1975: \$10,046
NEA	Active-Contribution in 1975: \$117,000
IEA	Active

DETAIL ON IEA PARTICIPATION

Technology Areas--Current Projects

COAL

- A. Technical information service.
- B. Mining Technology Clearing House Service
- SOLAR (Austria is the lead country for small solar electric power systems)
 - A. Development of solar heating, cooling & solar-heated hot water systems.
 - B. Development of components for these systems
 - C. Thermal performance testing of solar collectors.
 - D. Inference of isolation parameters for existing meteorological records.

RADIOACTIVE WASTE

Disposal of waste into geologic formations.

NUCLEAR SAFETY

- A. Power Burst Facility (PBF), Idaho.
- B. Heavy section steel technology program (HSST) or NL.
- C. Loss of fluid test facility (Loft), Idaho.
- D. Plenum fill experiment (PFG); Richland, Washington.
- E. International nuclear process heat research program with Germany and Switzerland.

WASTE HEAT

- A. Use of waste heat
- B. Heat Demand Map
- CONSERVATION (Austria is the lead country for a heat pump program and an energy cascading program).
 - A. Evaluation of heat pump development programs.
 - B. Heat cascading--triple cycle vapor process.

DETAIL ON NEA PARTICIPATION

Radioactive waste.

COUNTRY DATA--AUSTRIA
ASSESSMENT OF INTERNATIONAL ACTIVITIES

AVL 30 SEP 78

- A. As a small country, Austria is particularly dependent on co-operation with other countries. This suggests that such co-operation be intensified within the framework of the IEA.
- B. As a small country, Austria is not in a position to take part in all energy research and development projects, but Austria is the lead country in a number of projects. This is evidence of the importance Austria attaches to such activities.
- C. As a small neutral country, Austria is especially in favour of international cooperation in the energy sector and attaches the utmost importance to its intensification.
- D. Austria is playing a constructive and intermediary role in all the relevant international fora.
- E. Participation in various additional projects is under consideration.
- F. The Austrian Parliament last fall approved GOA authority to consent to be bound by the (IEA) International Energy Program. GOA is delaying the notification of ratification to the IEA pending parliamentary approval for implementing legislation.

COUNTRY DATA--AUSTRIA
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AVL 30 SEP 78

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COUNTRY DATA--AUSTRIA
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AVL 30 SEP 78

LOCATION

- | | LOCATION |
|--|----------|
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WENDS COUNTRY DATA

BG: BANGLADESH

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COUNTRY DATA--BANGLADESH
ECONOMIC DATA PROFILE

CJB 05 DEC 77

GNP (current billion\$)--6.05	INFLATION RATE--22% (1976)
PER CAPITA INCOME(\$)--77 (1972-73)	DISPOSABLE INCOME--
EXPORTS (million \$)--378 (1974-73)	IMPORTS (million \$)--1,165 (1974-75)
MONETARY UNIT--taka	EXCHANGE RATE (1 US\$=) 14.48 tak
TOTAL ENERGY R&D BUDGET--\$22.4 Million (Science and Technology Research)	

TRANSPORTATION SYSTEM DESCRIPTION-

Basically very primitive and disjointed, however, country does possess a natural advantage (navigable channels) in carrying produce by cheap water routes (8,000 km). Bangladesh has approximately 2,874 km of railways (1975) in both meter and broad gauge and approximately 24,000 km of roadways. The Bangladesh Biman (Bangladesh Airways) has domestic flights from Dacca and international services to Calcutta and London.

--not available

COUNTRY DATA--BANGLADESH
DEMOGRAPHIC DATA PROFILE

CJB 05 DEC 77

LAND (millions sq km)- 0.14
POPULATION (millions)- 80
LIVE BIRTHS/THOUSANDS- 231.7 (1970-75)
POPULATION GROWTH - 3%
MEDIAN AGE MALES--
UNEMPLOYED--
PRIMARY SCHOOL GRADS--
COLLEGE GRADS--
PROFESSIONAL WORKERS--

ARABLE LAND - 66%
POPULATION DENSITY(sq km)- 571
NET MIGRATION (millions/
year)- .150
MEDIAN AGE/FEMALES--
AVERAGE FAMILY SIZE--
SECONDARY SCHOOL GRADS--
INDUSTRIAL WORKERS--
AGRICULTURAL WORKERS--

--not available

COUNTRY DATA--BANGLADESH
PROFESSIONAL LABOR FORCE PARTICIPATION PROFILE

CJB 05 DEC 77

SCIENTISTS & ENGINEERS (S&E)	23,500
engaged in R&D	1,649
TECHNICIANS (T)	16,907
engaged in R&D	763
TOTAL (S&E)+(T) =	40,407
engaged in R&D =	2,412

COUNTRY DATA--BANGLADESH
KEY TECHNICAL EDUCATIONAL RESOURCES

CJB 05 DEC 77

University of Dacca
University of Rajshhi
University of Chittagong
University of Jahangirnagar
University of Mymensingh -- engineering
University of Khulna -- agriculture

There are 600 additional degree and intermediate colleges of which
34 are run by the government.

COUNTRY DATA--BANGLADESH
ENERGY POLICY: BASIC LEGISLATION

CJB 05 DEC 77

Appropriate plans for the energy sector are highly dependent on the growth prospects of the Bangladesh economy and the determinants of that growth, as well as on the availability of capital.

- 1-First five-year plan launched in 1973 with a view to ensuring economic progress -- expenditures estimated at TK 44,550 million. Striving for "food self-sufficiency" to release much needed foreign exchange to be devoted to industrial development. Annual growth rate for power and gas projected at 11 percent.
- 2-Responsibilities for energy field distributed among four Ministries.
- 3-Supporting "Atoms for Peace" -- striving for additional contracts through International Atomic Energy Agency.
- 4-Reviewing alternative uses of major energy source, natural gas. Research into (LNG) as export product.
- 5-Increase of existing electrical power.
- 6-Oil exploration in Bay of Bengal contracted out.
- 7-Power Development Board -- charged with the operations necessary for development of power for industrial, municipal, and domestic use.
- 8-Revision of investment policy, establishment of new industries and modernization and expansion of old ones - 1975.
- 9-Modernization of Chittagong steel mills.
- 10-Technical assistance provided to train engineers and technicians.
- 11-Standard Institution established to prescribe international standards for industrial products.
- 12-Emphasis on the development of scientific and technological research considered essential for exploring the possibilities and potentialities of resources and finding new ways and means for economic development.
- 13-Scientific and Industrial Research Council, Science Museum, National Council of Science and Technology, Atomic Energy Commission.
- 14-Established the Mineral Exploration, Corporation and Petro-Bangla responsible for conducting exploration, extraction, refining and marketing of petroleum and mineral resources of the country.

COUNTRY DATA--BANGLADESH

GOVERNMENT STRUCTURE FOR ENERGY POLICY AND R&D

CJB 05 DEC 77

PRESIDENT (currently inapplicable: martial law in effect) Chief
Martial Law Administrator--Major General Ziaur Rahman; controls all
areas of energy policy

COUNCIL OF MINISTERS--Prime Minister responsible to the President

Four Ministries responsible for different facets of energy policy:

- 1-Minister of Education and Scientific, Technological Research
and Atomic Energy (Syed Ali Ahsan)
- 2-Minister of Petroleum and Minerals (Ashsique Hussain Khan)
- 3-Minister of Flood Control, Water Development and Power (DCHL/A
Admiral Khan)
- 4-Minister of Industries (Jamaluddin Ahmed)

PARLIAMENT--1975 Amendment to the Constitution essentially made the
Parliament an impotent body with no effective power over the
President.

OTHER PARTS OF THE ENERGY STRUCTURE

- 1-Power Development Board (Post 1973) (Chairman Assafuddowleh)
- 2-The Scientific and Industrial Research Council--to help economic
upliftment of the country through exploitation of the local
resources.
- 3-Science Museum--imparting scientific and technological education
to the students and the public. Application of science and tech-
nology.
- 4-Council of Science and Technology (1975)--to help government in
formulation of policies and drawing up of plans for rapid develop-
ment and extension of science and technology in the country.
- 5-Atomic Energy Commission (1973)--peaceful use of Atomic Energy
 - a) Atomic Energy Centre
 - b) Electronics Laboratory
 - c) Research Complex--under development (10 years to complete); to
include:
 - (1) Institute of Nuclear Technology
 - (2) Institute of Nuclear Medicine
 - (3) Institute of Electronics
 - (4) Institute of Space and Atmospheric Research
 - (5) Institute of Environment Science and Health Physics
 - (6) National Computer Centre
 - (7) Nuclear Training Institute
- 6-Mineral Exploration Corporation
- 7-Petro-Bangla

COUNTRY DATA--BANGLADESH

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY & R&D CJB 05 DEC 77

Present government stresses central control.

- 1-Budget allocation primary funding feature (1975)
 - Industry -- 710 million TKS
 - Other -- 470 million TKS
- 2-Planning Commission established (1973) to develop complete development plan, including energy objectives.
- 3-Directives of Planning Commission carried out by four Ministries mentioned, in their respective areas of responsibility.
- 4-Government controls investment policy -- private and public; extended guarantee of immunity against nationalization to 15 years.
- 5-Atomic Energy Commission -- supportive of increased solicitation of research contracts.

COUNTRY DATA--BANGLADESH
ENERGY POLICY OBJECTIVES

CJB 05 DEC 77

Bangladesh is one of the poorest countries in the world, and is striving to accomplish substantial growth development through its initial five-year development plan. Intertwined with overall developmental goals are initiatives to increase existing use of energy resources and to develop others. The primary objectives include:

- 1-Concentrated efforts to develop natural gas potential either in its new state or as possible export potential in the form of LNG.
- 2-Petro-Bangla has been involved in the exploration for oil in the coastal areas of Bangladesh. Refinery potential is expected to increase from the only existing source.
- 3-Considerable emphasis will be placed on advanced technology developments under the Ministry of Scientific & Technological Research & Atomic Energy.
- 4-Under the Ministry of Industries, new investment policies will allow increased investment by the private sector from TK 30 million to TK 100 million (1975).
- 5-The Power Development Board has supported increased power potential between the East and West sectors striving to establish a reliable national grid.

Bangladesh is plagued with a dearth of foreign exchange which is needed to finance many of these projects. A considerable amount of technology and equipment is currently attainable only through imports. In addition, Bangladesh currently imports almost all of the oil it consumes. Increased prices in 1973 resulted in several balance of payments deficits.

Politically, Bangladesh is currently under martial law. The political situation is unsteady. However, the aggregate use of commercial energy has been rising steadily with slight interruption due to political, military and natural disruptions. Degree of success in food self-sufficiency will determine quantity of foreign exchange available for purchase of energy needs.

COUNTRY DATA--BANGLADESH

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

CJB 05 DEC 77

A goal such as energy self-sufficiency seems a very distant realistic possibility. Extreme energy poverty is evident in analyzing the total commercial and noncommercial energy/person on an annual basis in tons of oil equivalent -- .07 tons per capita or less than .0014 barrels of oil daily/person.

Bangladesh is in a transitional stage. Former traditional sources of energy were firewood, jute stick, dung and vegetable wastes, accounting for a total noncommercial energy use (1973-74) of 169 trillion BTU's while total commercial use of energy equalled 72 trillion BTU's. Efforts are being made to place a heavier reliance on commercial energy use.

Existing uncertainties coupled with the lack of consistent data preclude any concise projection of energy needs. Much is contingent on the overall development plan and success of the country.

- 1-Develop natural gas to its potential -- unsure of which direction to take; either consume domestically or export in form of LGW. Arthur D. Little projects that a consumption rate of 480 million cubic feet per day, Bangladesh has sufficient natural gas to last about a century.
- 2-Increase electrical power potential. As of 1975, generation capacity had been raised to 660 megawatt with total length of transmission lines at 8415 kilometers. Construction of a 40 megawatt generation station was started in March, 1975. (total expenditure of TK 290 million).
- 3-Projected oil potential is unsure (offshore).
- 4-Bangladesh hopes to build a nuclear power plant at Roopers by 1980. Nuclear capacity of 200 MW by 1984, along with 1234 MW from other sources.

COUNTRY DATA--BANGLADESH
INDIGENOUS ENERGY RESOURCES

DLR 15 JUN 77

NONRENEWABLE	RESOURCES	RESERVES	LOCATION OF IDENTIFIED RESERVES
COAL (million tonnes)	700	--	Western zone
PEAT (dry to 20% moisture) (million tons)	--	133	Faridpur, Khulna
NATURAL GAS (trillion cubic feet)	--	9.36	Eastern zone
OIL	0	0	
URANIUM	0	0	
RENEWABLE HYDROELECTRIC (GWh/yr)	893	--	Chittagong Hill Tracts

COUNTRY DATA--BANGLADESH
PATTERNS OF ENERGY SOURCES AND USES

DLR 15 JUN 77

USE OF ENERGY BY SECTOR FOR 1973-1974 (Trillion Btu)

CONSUMING SECTOR	COAL	OIL	GAS	ELECTRICITY	TOTAL
Agriculture, Forestry, Fisheries	0	1.35	0	0.13	1.48
Manufacturing, Construction	3.74	10.28	6.84	12.38	33.23
Transport	1.53	8.13	0	0	9.66
Other sectors, Households	0.06	16.24	0.26	4.18	20.74
TOTAL	5.33	36.00	7.10	16.69	65.11

(Fuel use by the electric power sector is recorded under Electricity)

COUNTRY DATA--BANGLADESH
PROJECTIONS OF DEMAND

CJB 05 DEC 77

RESOURCE	STANDARD			TRILLION BTU		
	1976-77	86-87	2000-01	76-77	86-87	2000-01
NATURAL GAS (billion cu.ft)	13.2	52.9	126.4	12.4	49.8	118.9
COAL (million tonnes)	.016	.034	.748	6.6	13.6	29.7
FUEL OIL (million tonnes)	.372	.314	.702	14.8	12.5	27.9
DIESEL OIL (million tonnes)	.304	.720	1.612	12.1	28.6	64.0
SUPERIOR KEROSENE (million tonnes)	.677	1.342	2.924	26.9	53.3	116.1
MOTOR SPIRIT (million tonnes)	.076	.154	.287	3.0	6.1	11.4
JET PROPELLANT (million tonnes)	.035	.055	.098	1.4	2.2	3.9
JUTE BATCHING OIL (million tonnes)	.030	.038	.050	1.2	1.5	2.0
ELECTRICITY (million KWh)	73-74 825.1	83-84 1715.94	2000 5603.00	28.1	5.85	19.10

NUCLEAR 250MW 500 MW 1000MW
(Based on conditions prevailing in 1973, the IAEA did not foresee
nuclear power before 1990).

COUNTRY DATA--BANGLADESH

PROJECTIONS OF ENERGY SUPPLIES, IMPORTS, AND EXPORTS

CJB 05 DEC 77

NATURAL GAS

With an indigenous supply of 9.36 trillion cubic feet, Bangladesh had no imports or exports recorded. According to one study, Bangladesh may have a supply sufficient for 100 years. However, future planning might dictate the production of LNG for export purposes, which would then exhaust existing natural gas supplies at a more rapid rate.

COAL

Major reserves of good quality coal have been discovered in the Bogra region. However, commercial extraction from these reserves may require advanced and expensive techniques since the reserves are located at depths of 2,700 to 3,000 feet under alluvial cover. With the increase in the price of oil in 1973, the increase of coal consumption rose five-fold. The percentage of coal relative to oil rose from 6% in 1972 to 40% in 1974. Depending on the accepted projected growth rate of total energy consumption, the total amount of coal needed will most likely have to be imported.

OIL

Dependency on imported oil is severe. In 1975 imports of crude oil reached a level of 5.6 million barrels and imports of refined products reached a level of 3.4 million barrels. The primary exporters to Bangladesh are United Arab Emirates, Iran, and Saudi Arabia. Fuel import expenditures are only second to food-grains in accounting for a major portion of the balance of payments deficit. Refinery capacity domestically is very limited mostly due to the increased costs of inputs such as crude. Presently exploring the Bay of Bengal for possible offshore oil potential. Companies involved are International Systems and Controls, Union Oil, Texas Pacific Petroleum, Arco Bangladesh, and Ashland oil.

NUCLEAR

At the present time no nuclear power is generated, imported or exported. The IAEA does not anticipate nuclear energy potential until 1990.

ELECTRICITY

In 1974 Bangladesh had a total industrial and public generating capacity of 45,665 thousand kilowatts. Production of 1.542 thousand million kilowatt hours was totally consumed. No electrical power was imported or exported. It does not seem likely that electric power will be exported or imported in the future. Production will reflect demand as closely as possible.

BG 14

COUNTRY DATA--BANGLADESH
ENVIRONMENTAL CONSIDERATIONS

CJB 05 DEC 77

Not a consideration at this time.

COUNTRY DATA--BANGLADESH
COMMERCIAL APPLICATION

CJB 05 DEC 77

At the present time, Bangladesh is under martial law. Application of R&D results are under the direct control and directive of the government. Central control apparatus dictates government approval for application of new technologies. Energy-related industries are operated by the government.

COUNTRY DATA--BANGLADESH
POWER PRODUCTION AND ENERGY CAPABILITY

CJB 05 DEC 77

TYPE PLANT	TOTAL MW	POWER PRODUCTION			
		0-50	50-100	100-105 (MW)	
HYDROELECTRIC	80	2	0	0	EXISTING
	50	1	0	0	PROJECTED
STEAM	412	10	5	0	EXISTING
	170	0	1	1	PROJECTED
DIESEL	83	5	0	0	EXISTING
	11	3	0	0	PROJECTED
GAS TURBINES	173	14	0	0	EXISTING
	0	0	0	0	PROJECTED

GROSS GENERATION BY TYPE (GWH) 1973-74

HYDRO -	243.4	TOTAL THERMAL -	1019.3
STEAM -	801.2	TOTAL HYDRO -	243.4
GAS TURBINES -	135.9	GRAND TOTAL -	1262.7
		TOTAL NUCLEAR -	0

SOURCE	LBS	ENERGY PRODUCTION		TOTAL OUTPUT TO DATE
		OUTPUT 1973-74	RESERVES	
NATURAL GAS 7		.33 trillion cu ft	9.36 trillion cu ft	122.5 trillion cu ft
COAL	--	--	--	--
OIL	--	--	--	--

HYDRO-POTENTIAL --LIMITED--TOTAL PRODUCTION CAPACITY AT 130 MW

REFINING CAPACITY -- 1 MILLION TONS/YEAR. TOTAL --

--not available

COUNTRY DATA--BANGLADESH
ENERGY INDUSTRIES

CJB 05 DEC 77

Chittagong Refinery -- 1
Petro-Bangla --
Steel Mills -- Chittagong

Equipment for energy industries is imported.

--not available

COUNTRY DATA--BANGLADESH
ENERGY R&D: STATUS AND OUTLOOK

DLR 10 JUN 77

NATURAL GAS

Proven reserves are of a very high quality and constitute an important indigenous source of energy. The present utilization of the gas fields is nominal, due in part to a very small pipeline system. A 180 km line under construction and a 200 km planned line could drastically change the pattern of energy consumption. Recently gas has been found in the West zone but the extent of the deposit is not known.

OIL

Extensive exploration has been conducted for more than 15 years without any positive results. Bangladesh has only one refinery but is planning for a second refinery around 1980.

HYDRO

The deltaic terrain does not have much hydroelectric potential. The only major hydro potential of the Karnafuli River has been harnessed to yield 80 MW capacity to which another 50 MW is being added at present. There is a possibility of another 100 MW from the same source for peaking purposes.

COAL

Substantial deposits of good quality coal were discovered in 1963. However, no production of coal from the deposits has been started yet and no firm decision has been taken about a production schedule. The deposits are at a depth of 2500-4500 feet and will require sophisticated and costly mining techniques, including freezing.

NUCLEAR

In view of the limited availability of indigenous energy resources, Bangladesh has shown an interest in nuclear power. A considerable amount of work has been carried out on the investigation of suitable power plant sites. The Bangladesh Atomic Energy Commission (BAEC) has prepared a scheme for installation of two 125 MWe reactors at Rooppur, the first unit for 1984 and the second in 1986. There are no proven uranium resources in Bangladesh, but traces of thorium have been found which may prove to be exploitable.

POWER TRANSMISSION

The Bangladesh power system suffers from inadequate transmission and distribution facilities. A 230-kV interconnector between the East and West zones was intended to be constructed by 1975. However, the project has been re-examined. Completion would not now be possible before 1980.

COUNTRY DATA--BANGLADESH
ENERGY R&D: BUDGET

CJB 05 DEC 77

Research and technical organizations in the country are financed by the government. No estimate as to the total annual expenditure is available. In the five-year development plan, the allocation for scientific and technical research is 1.6% or roughly 721 million TKS. The cost of equipment and training abroad are usually met through different technical assistance programmes and bilateral and multilateral arrangements with foreign countries and international agencies.

A detailed breakdown of allocation to government agencies, industry, or universities is unavailable.

In order to assist Bangladesh alleviate the impact of rising oil prices, it has received grants and interest-free loans from individual states and multilateral institutions. A special \$13.9 million loan from OPEC was obtained to assist in the importation of essential import commodities.

COUNTRY DATA--BANGLADESH
ENERGY R&D: PRIORITIES

CJB 05 DEC 77

A formal national science policy has yet to be formed. The most important shift has been away from non-commercial fuel sources to commercial fuel sources. Heavy reliance is being placed on the development of electrical power.

Basic guidelines for a policy have been spelled out to include:

- 1-Reorganization of existing government research laboratories and institutions;
- 2-Careful selection of problems of economic and sociocultural importance in each vital sector;
- 3-Raising the standards and improving the available facilities of existing institutions;
- 4-Establishing new institutions;
- 5-Improving the standards of scientific education;
- 6-Ensuring utilization and application of research results for commercial and extension purposes;
- 7-Creating centralized facilities for collection and dissemination of scientific information and findings;
- 8-Providing centralized facilities for manufacture and repair of scientific apparatus and instruments of all kinds.

Government laboratories are required to concentrate on practical problems of applied nature, while universities have been given greater freedom of choice in selecting research programmes which may include problems of a fundamental or theoretical nature. The University Grants Commission, allocates funds received from the Government among different universities.

The National Council of Science and Technology is empowered to assign priorities of research in various fields as well as in the reorganization of the research laboratories-institutes. A seemingly high priority item has been the training of personnel needed to conduct the necessary research.

Existing industrial research units in the country are:

- 1-Bangladesh Council of Scientific and Industrial Research
- 2-Central Testing Laboratory
- 3-Bangladesh Industrial Technical Assistance Centre
- 4-Bangladesh Standards Institution
- 5-Hazaribagh Leather Institute.

Under the Bangladesh Atomic Energy Commission is the Atomic Energy Centre in Dacca. Research work is conducted in the disciplines of experimental, theoretical, and solid state physics, nuclear, radiation and analytical chemistry, electronics, computer soft- and hardware, health physics, and technical physics. Its research facilities are also used by university students and teachers.

In 1975 Bangladesh received 9 research contracts totaling \$25,000 from the IEA and received additional equipment totaling \$35,000.

Present appraisal of priorities would be to develop those energy resources capable of assisting in the development scheme. Electricity; natural gas liquefaction, nuclear energy; offshore oil exploration, in that order.

COUNTRY DATA--BANGLADESH
ENERGY R&D: IMPACT

CJB 05 DEC 77

R&D impact has been negligible. Bangladesh is currently in the fourth year of its development plan. World oil prices place a heavy burden on its total foreign exchange resources. Many existing technologies must be imported and nuclear potential is not expected until 1984.

COUNTRY DATA--BANGLADESH

GOVERNMT. SUPPORTED ENERGY R&D IN IND., UNI. & NAT. LABS/CJB 05 DEC 77

Scientific and technological research is conducted under various ministries, in government agencies and in the universities.

AGENCIES:

- Council of Scientific and Industrial Research (CSIR)
- Atomic Energy Commission (AEC)
- National Scientific Documentation Centre (NSDOC)
- Museum of Science and Technology (MST)

UNIVERSITIES:

Dacca University--research degrees in the branches of physics, applied physics, chemistry, applied chemistry.

Research Centers:

- Institute of Statistical Research and Training
- Institute of Education and Research
- Jahangir Nagar University--basic sciences (mathematics, chemistry and physics)
- Rajshahi University--science faculty includes departments of physics and applied physics
- University of Chittagong--faculty of engineering and science
- Bangladesh University of Engineering and Technology, Dacca--civil, chemical, mechanical, metallurgical, and electrical engineering

The technical education program proposes the establishment of four new polytechnic institutes, upgrading six existing technical institutes into polytechnic institutes, and 112 vocational training institutes.

ATOMIC ENERGY COMMISSION--has research and development programmes covering the disciplines of agriculture, medicine, nuclear sciences and technology, nuclear power, and space and atmospheric research. The Commission's current program lay special emphasis on the development of electronic technology and instrumentation.

COUNTRY DATA--BANGLADESH
ROLE OF PRIVATE INDUSTRY

CJB 05 DEC 77

Strict government controls and lack of available capital places the R&D burden on the government. Some R&D might exist in the one steel mill in Bangladesh.

COUNTRY DATA--BANGLADESH

INVOLVEMENT IN INTERNATIONAL ENERGY ORGANIZATIONS

CJB 05 DEC 77

- 1-International Atomic Energy Agency (IAEA)
- 2-Law of the Sea Conference -- Deep-Seabed Minerals Committee
interest
- 3-International Nuclear Information System (INIS)
- 4-International Neutron Data (IND)

COUNTRY DATA--BANGLADESH
ASSESSMENT OF INTERNATIONAL ACTIVITIES

CJB 05 DEC 77

Bangladesh seems to be extremely interested in developing nuclear power and has been primarily involved in agreements that will assist in expanding its nuclear power potential.

A need for national R&D program, priorities, and foreign exchange is a prerequisite for strong international participation.

Bangladesh is a very poor country that will try to benefit from all international contacts that can aid in the development of its programs.

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COUNTRY DATA--COLOMBIA
NOTES AND EVALUATIONS

AVL 30 SEP 78

- 19) Conversion coefficients for 3E as in United Nations, WORLD ENERGY SUPPLIES 1971-75, U.N.: 1977 (Statistical Papers, Series J No. 20), except hydro and nuclear electricity generation computed at 35% efficiency (i.e. assumed 0.359 tonnes of coal required to generate 1000 KWh and heat value of 1,000 KWh equivalent to 0.123 tonnes of coal).

----Denotes Public Library material

M Denotes material available directly from the Government Ministry or Agency

LDC Denotes material from WENDS Project Library

COUNTRY DATA--BANGLADESH
NOTES AND EVALUATIONS

DLR 21 SEP 77

LOCATION

- | | |
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Nov 1975 (3C, p.19, 24, 28, 31, 32; 4A, p.19, 21,
24, 31, 32, 62) | IA |
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Nuclear Power Programme", International Conference
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| 3-Bangladesh Energy Study, U.N. Development Programme
Nov 1976 (3C, p.3-28, 3-29; 3D, p.1-6) | IA |

WENDS COUNTRY DATA

BE: BELGIUM

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COUNTRY DATA--BELGIUM
ECONOMIC DATA PROFILE

MAS 31 OCT 77

GNP (current million \$)-60,700	INFLATION RATE (1976)-11%
PER CAPITA INCOME (\$)-5,466	DISPOSABLE INCOME- --
EXPORTS (million \$)-25,851	IMPORTS (million \$)-27,912
MONETARY UNIT-Franc	EXCHANGE RATE (1 US\$=)-36.6 Francs
TOTAL ENERGY R&D BUDGET (million \$)=101.46	

TRANSPORTATION SYSTEM DESCRIPTION-The Belgian railway network is the densest in the world and comprises 2,659 miles of track operated by the government controlled Belgian National Railway Company. A regional railway network of over 8,000 miles also serves the country.

Belgium has an extensive road network connecting the major cities as well as the rural districts.

The inland waterways, rivers and canals not only serve Belgium but are linked with those in Germany and France. The merchant fleet is well established and the national airline, SABENA, is the third oldest and twelfth largest in the world.

COUNTRY DATA--BELGIUM
DEMOGRAPHIC DATA PROFILE

MAS 31 OCT 77

LAND (thousand sq km)-30.5
POPULATION (millions)-9.81
LITERACY %-98
LIVE BIRTHS/THOUSAND-12.6
MEDIAN AGE/MALES- --
AVERAGE FAMILY SIZE- --
PRIMARY SCHOOL GRADS- --
INDUSTRIAL WORKERS-1,493,000
AGRICULTURAL WORKERS-136,000
POPULATION GROWTH-.3%

ARABLE LAND (thousand sq km)-15.5
POPULATION DENSITY (sq km)-322
% RURAL POPULATION- --
DEATHS/THOUSAND-11.9
MEDIAN AGE/FEMALES- --
NET MIGRATION-24,904
SECONDARY SCHOOL GRADS- --
PROFESSIONAL WORKERS- --
COLLEGE GRADS- --
UNEMPLOYED-6.4%

--not known

COUNTRY DATA--BELGIUM

KEY TECHNICAL EDUCATIONAL RESOURCES

MAS 31 OCT 77

University of Liege (1971)
Free University of Brussels (1834)
Catholic University of Louvain (1425)
State University of Mons (1837)
State Faculty of Agronomic Sciences, Gembloux (1860)
State University of Ghent (1817)
Notre Dame De La Paix University Faculties at Mamur (1831)
State University Center at Antwerp (1965)
Royal Military School (1834)

COUNTRY DATA--BELGIUM

ENERGY POLICY: BASIC LEGISLATION

MAS 31 OCT 77

AREAS OF LEGISLATION AFFECTING ENERGY POLICY

- 1-The constitution of the Belgian electricity industry is based on the law of 10 March 1925 in regard to the production and distribution of electric energy.
- 2-The Atomic Energy Commission was established in 1950.
- 3-The canalized transport of gas products and other products is controlled by the law of 12 April 1965. Gas production is free; it is subject to regulations only in terms of labor laws and rules concerning the security and health of the laborers.
- 4-Petroleum and natural gas may only be researched and exploited under an exclusive license according to law no. 83 of 28 November 1939, confirmed by the law of 16 June 1947.
- 5-From the economic point of view, the construction and exploitation of petroleum refineries is not submitted to any regulation. Legislation, however, does exist regulating refineries from a technical point of view.
- 6-A National Energy Committee was established by royal decree on 12 December 1975 and mandated with 2 objectives: to give advice on implementing energy policy matters; and to follow up energy policy implementation and assess results. Minister for Science Policy is a member of the government delegation to the committee.
- 7-On 22 September 1976 the Interministerial Committee on Social and Economic Coordination endorsed a proposal formulated by the Ministry of Economic Affairs relating to a program for the rational use of energy.
- 8-A five-year (1973-77) nuclear technology R&D program is currently underway.
- 9-A national energy R&D incentive program was approved by the Council of Ministers on 25 June 1975 and covers the entire energy sector, excluding nuclear.
- 10-The Minister for Economic Affairs was authorized to take all appropriate measures to secure energy resources for the country in the 1975 Budget Appropriation Law. The law applies until 31 December 1977.
- 11-Economic Legislation in 1976 provides for government subsidies to support industrial investments for energy conservation measures.

COUNTRY DATA--BELGIUM

GOVERNMENTAL STRUCTURE FOR ENERGY POLICY R&D

MAS 25 OCT 77

EXECUTIVE--Belgium is a parliamentary democracy under a constitutional monarch, and technically the source of all executive authority is King Baudoin I. In fact, however, the Council of Ministers (Cabinet) is responsible for governmental decisions. The Council of Ministers, led by the Prime Minister (Leo Tindemans) holds office as long as it retains the confidence of the Parliament.

LEGISLATIVE--Parliament is a bicameral body consisting of the Chamber of Representatives (212 members) and the Senate (total of 181 Senators-50 elected by provincial councils, 25 by fellow Senators, and the remainder by direct election) The two bodies share equal legislative power.

General aspects of energy policy are determined by the Government acting on proposals from the Minister of Economic Affairs (F. Herman), who has primary responsibility for energy matters. Energy R&D policy is formulated at the interministerial level by the Ministerial Committee of Science Policy (composed of representatives from various ministries) and the Interministerial committee of Science Policy (composed of Senior officials from the Ministries of Economic Affairs, Public Education Communications, Public Works, Health, Labor, Foreign Affairs, and Agriculture).

OTHER PARTS OF THE ENERGY STRUCTURE

The Minister of Economic Affairs receives support from the following Departments on energy matters:

Energy Administration (M. Frerotte) The five major areas are
Energy Policy Coordination, Coal Economy, Electrical Energy,
Petroleum and Natural Gas, Commission for Atomic Energy.

Mine Administration (J. Medaets)
Bureau of Planning (R. Maldague)

COUNTRY DATA--BELGIUM

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/MAS 31 OCT 77

Energy matters, whether nuclear or non-nuclear, come under the jurisdiction of the Minister of Economic Affairs, though separate organizations do exist for the implementation of policy and R&D.

NUCLEAR

- 1-Atomic Energy Commission (CEA) has primary responsibility for coordinating all activities relating to nuclear energy, including inputs for the development of policy. The Commission is the national organization responsible for distributing communications of EURATOM and other international organizations. The CEA manages the nuclear programs and oversees the cooperative efforts of the various government departments.
- 2-Nuclear Energy Research Center (CEN) is responsible for research in applied nuclear energy. The Center also trains specialists in nuclear technologies for future positions in industry as well as in education. Members of the governing board are nominated by the Minister of Economic Affairs. The Center maintains a computer-based technical information Services (INIS), and operates two research reactors, two critical assemblies, and one experimental PWR nuclear power reactor. The research laboratory is located at Mol.
- 3-Energy Administration: Nuclear Applications Department is responsible for promoting the industrial application of nuclear technology and ensures contact between the Nuclear Energy Research Center and professional groups, scientific organizations, and specialized industries.

NON-NUCLEAR

- 1-Office of Industrial Promotion is an autonomous public body administered by representatives from private and public sectors involved in research, development and investment. The Office is under the aegis of the Minister of Economic Affairs and the Minister for Science Policy. Set up in 1970, it is a permanent link between public authorities and research centers, investors and private firms.
- 2-Science Policy and Programming Services, a specialized department of the Prime Minister's Services, concentrates on developments relating to health protection, environment and social progress. In terms of energy, the Service gives government assistance all along the chain from research to the economic and social applications of R&D results.
- 3-Institute for the Encouragement of Scientific Research in Industry and Agriculture (IRSIA) provides administrative and financial support to industries carrying on applied research. It is a public institution under the authority of the Minister of Economic Affairs and the Ministry of Agriculture.
- 4-National Institute for Extractive Industries (INIEX) also under Ministry of Economic Affairs and is charged with encouraging and implementing research in the extractive industries.

COUNTRY DATA--BELGIUM
ENERGY POLICY AND OBJECTIVES

MAS 28 OCT 77

The energy policy objectives adopted by the government in June 1977 call for:

- 1-Maximization of energy conservation, rational and specific use of energy, optimum use of waste heat;
- 2-The safeguard of permanent supplies under any circumstances;
- 3-Supplying the industrial sector with energy at the most economic price levels and taking full account of specific requirements;
- 4-Diversification of energy supplies;
- 5-Increased government control of the energy sector;
- 6-Formulation of an energy policy (which includes the preceding steps) to be presented to Parliament before the end of 1977;
- 7-Development of coal gasification techniques as a priority measure.

More specifically, national energy policy has been broken down into the following short, medium, and long-term goals:

SHORT-TERM GOALS (1975-85)

- 1-To moderate the increase in total energy consumption by promoting energy savings to its maximum level and reorienting certain forms of consumption;
- 2-To reduce the country's dependence on imported petroleum;
- 3-To diversify the sources of energy supply by widening the range of forms of energy as well as the number of producing countries from which supplies are obtained;
- 4-To conclude long-term supply agreements;
- 5-To maintain coal production at an annual level of at least 7 million tonnes;
- 6-To plan the supply, processing, production, storage, and distribution of energy.

MEDIUM-TERM GOALS (1985-2000)

- 1-To save energy by fundamental improvements in technologies and shifts in economic production structures;
- 2-To accelerate the application of certain new energy forms;

LONG-TERM GOALS (beyond 2000)

- 1-To develop alternative energy sources.

New Government policy expected in mid-November 1977

COUNTRY DATA--BELGIUM

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

MAS 29 OCT 77

Belgium has virtually no important domestic energy resources. In recent years imports have amounted to 89 percent of total energy resources available. The government hopes to reduce imports to below 80 percent.

COUNTRY DATA--BELGIUM
INDIGENOUS RESOURCES

MAS 28 OCT 77

Other than a declining coal industry dating from the 19th century, Belgium has virtually no indigenous energy resources.

NONRENEWABLE	RESOURCES	RESERVES	LOCATION OF IDENTIFIED RESERVES
COAL (million tonnes)	253	127	Campine Field, Limburg
RENEWABLE			
HYDROELECTRIC	--	.5	

COUNTRY DATA--BELGIUM

PATTERNS OF ENERGY SOURCES AND USES

MAS 31 OCT 77

	DOMESTIC	INDUS- TRIAL	TRANSPOR- TATION	ELECTRICAL GENERATION	TOTAL
COAL					
(million tonnes)	.203	3.2	.011	.229	3.643
PETROLEUM					
(million tonnes)	--	6.5	4.8	1.5	12.8
NATURAL GAS					
(billion cu ft)	.084	.176	.003	.051	.314
NUCLEAR, HYDRO & GEOTHERMAL					
(billion kWh)	19	19.76	1.04	17.43	38.23

COUNTRY DATA--BELGIUM
PROJECTIONS OF DEMAND

MAS 31 OCT 77

RESOURCE	STANDARD PHYSICAL UNITS			TRILLION BTU		
	1974	1985	2000	1974	1985	2000
COAL (million tonnes)	8.73	10.69	7.72	242.7	297.2	214.6
OIL (million tonnes)	22.1	30.5	41.4	1029.4	1214.1	1643.3
NATURAL GAS (billion cu. ft.)	338.7	449.7	690.7	343.5	449.7	690.7
NUCLEAR POWER (billion kWh/yr)	2.7	33.6	194.4	9.55	170.7	664.1
HYDROELECTRIC (billion Kwh/yr)	1.94	3.61	3.61	6.64	12.33	12.33

COUNTRY DATA--BELGIUM

PROJECTIONS OF ENERGY SUPPLIES, IMPORTS, AND EXPORTS

MAS 31 OCT 77

RESOURCE	1974	1985	2000
COAL (million tonnes)			
INDIGENOUS SUPPLY	5.3	3.43	3.43
IMPORTS	4.2	7.26	4.29
EXPORTS	.91	0	0
CRUDE OIL (million tonnes)			
INDIGENOUS SUPPLY	0	0	0
IMPORTS	22.1	30.5	41.4
EXPORTS	0	0	0
SHALE OIL (million tonnes)	0	0	0
NATURAL GAS (billion cubic feet)			
INDIGENOUS SUPPLY	0	0	0
IMPORTS	338.7	449.7	690.7
EXPORTS	0	0	0

COUNTRY DATA--BELGIUM
ENVIRONMENTAL CONSIDERATIONS

MAS 30 OCT 77

No specific legislation exists regarding environmental considerations as related to energy and energy R&D other than regulations for nuclear reactor safety. A special commission for nuclear energy has examined all problems related to nuclear reactors, including environmental problems, and has made recommendations for all future nuclear plants.

The Prime Minister's Science Policy and Programming Service has responsibility for environmental implications of energy R&D.

COUNTRY DATA--BELGIUM
COMMERCIAL APPLICATIONS

MAS 27 OCT 77

Several administrative bodies have been established by the government to assist in the transfer of results of R&D programs to the commercial and industrial sectors. These include:

- 1-Institute for the Encouragement of Scientific Research in Industry and Agriculture;
- 2-Office of Prototypes of the Ministry of Economic Affairs;
- 3-Office of Industrial Promotion.

Economic legislation in 1976 included provisions granting government subsidies to support industrial investments for energy conservation measures leading to energy savings beyond 12 percent. Private firms may obtain low interest loans as well as short-term tax exemption for investments which lead to saving energy or reducing the total consumption of energy.

COUNTRY DATA--BELGIUM
ENERGY R&D: STATUS AND OUTLOOK

MAS 27 OCT 77

Short and medium-term energy R&D policy and goals have been defined in a five-year plan for nuclear energy technology R&D (1973-77) and also in a national energy R&D program adopted by the government in June 1975.

A waste saving and secondary raw material saving R&D program is currently underway.

A coal gasification R&D program is aimed at improving the supply of coal, and coal extraction techniques have long been the subject of R&D programs.

R&D programs are well-established in the area of nuclear power (sodium-cooled fast breeder reactors, proven reactors, gas reactors, reactor safety, and fuel cycle). Belgium currently has three reactors in operation with four more to be in place by 1982. All seven are pressurized water reactors.

COUNTRY DATA--BELGIUM
ENERGY R&D: BUDGET

MAS 27 OCT 77

MILLIONS OF \$
CY 1976

CONSERVATION

Industry	0.5
Residential and Commercial	0.38
Transportation and Others	2.0
Others	5.0

SUBTOTAL 7.88

OIL AND GAS

.569

COAL

Coal Conversion	.833
Others	2.27

SUBTOTAL 3.103

SOLAR

Heating and Cooling	.181
Photo Electric	.361

SUBTOTAL .542

BIOMASS

.21

NUCLEAR FISSION

Light Water Reactor	3.972
High Temperature Reactor	.597
Other Converter Reactors	4.156
Fuel Cycle	2.196

SUBTOTAL 10.921

NUCLEAR FUSION

2.81

FAST BREEDER REACTOR

54.38

SUPPORTING TECHNOLOGIES

Electric Power Conversion	5.0
Transmission and Distribution	3.86
Energy Storage	.74
Energy Systems Analysis	.56
Others	10.77

SUBTOTAL 20.93

TOTAL 101.46

COUNTRY DATA--BELGIUM
ENERGY R&D: PRIORITIES

MAS 01 NOV 77

Energy R&D policy is defined in the five-year plan (1973-77) for nuclear energy technology and also in the national energy R&D program adopted in 1975. The following priorities have been established:

- 1-Nuclear energy
- 2-Energy conservation
- 3-In situ coal gasification
- 4-Solar heating and cooling
- 5-Solar photo-voltaic conversion through development of the technology of thin films of Cds or GaAs.
- 6-Geothermal energy (study of possible uses of low enthalpy geothermal energy)
- 7-Systems modelling

COUNTRY DATA--BELGIUM
ENERGY R&D: IMPACT

DLR 28 FEB 78

NON-RENEWABLE PRIMARY ENERGY SAVINGS FROM
NEW TECHNOLOGIES

TRILLION BTU

	1985	2000
SOLAR HEATING	0	11
INSULATION	25.62	61.67
FAST BREEDER	0	3.51
COAL CONVERSION	-5	-113.85

COUNTRY DATA--BELGIUM

GOV'T SUPPORTED ENERGY R&D IN IND, UNIV & NAT'L LABS

MAS 01 NOV 77

Government support to research associations and projects in the industrial sector is given through the Institute for the Encouragement of Scientific Research in Industry and Agriculture (IRSIA). IRSIA acts as a major clearing house and is an indispensable link between industry and the universities.

INDUSTRY	PROGRAM AREA	KEY INDIVIDUAL
ACEC Belgonucleaire Cockerill	Proven nuclear reactors Plutonium Recycling vapor generators for proven reactors	
UNIVERSITIES		
Free University of Brussels	National system modelling Improvement of industrial processes	
Catholic University of Louvain	National system modelling Energy Conservation, Waste treatment	
University of Liege State University of Ghent	Energy Conservation Solar energy utilization Wastes treatment	
Catholic University at Leuven	National system modelling Energy conservation Solar energy utilization Wastes treatment	
Free University of Brussels Polytechnic Faculty of the State University at Mons	Wastes treatment Energy conservation Solar energy utilization	
LABORATORIES		
Center for Study of Nuclear Energy (Mol)	Nuclear reactors	
National Institute for Extractive Industries	Coal exploration and extraction techniques	
Bureau of Planning Centre scientifique et technique de la construction	National system modelling Energy conservation	

COUNTRY DATA--BELGIUM

ENERGY R&D: ROLE OF PRIVATE INDUSTRY

MAS 01 NOV 77

Total industrial energy R&D expenditures for 1977 were US \$21.9 million. However, little or no information is available regarding specific programs in energy R&D in private industry. Some industries do have on-going programs, but fear competition. Consequently, much of the private research is done in secret. From evaluation of available budgets, it is apparent that R&D projects in the private sector are in the fields of "supporting technologies"--oil and gas, nuclear fission, solar energy, and wind.

COUNTRY DATA--BELGIUM

INVOLVEMENT IN INTERNATIONAL ENERGY R&D ORGANIZATION

MAS 01 NOV 77

ORGANIZATION

DEGREE OF INVOLVEMENT 1976

IEA	Active
IAEA	Active
EURATOM	Active
EURACHEMIC	Active
NATO	Active
OECD	Active
EEC	Active
CERN	Active

DETAILS ON INTERNATIONAL ENERGY AGENCY

TECHNOLOGY AREA

CURRENT PROJECTS

Coal	Technical Information Service World Coal Reserves and Resources Data Bank Mining Technology Clearing house
Nuclear Power	Exchange of Technical Information on Nuclear Reactor Safety
Solar Heating & Cooling	Performance of Systems R&D Coordination on Component Testing Collectors Instrumentation Package Use of Meteorological Information

Belgium participates in the Working Parties for energy R&D in: energy conservation, coal technology, nuclear safety, radioactive waste, high temperature reactors for process heat, geothermal energy, solar heating and cooling, solar electricity production, biomass conversion, ocean energy systems, wind power, nuclear fusion, hydrogen production from water and waste heat utilization.

COUNTRY DATA--BELGIUM
ASSESSMENT OF INTERNATIONAL ACTIVITIES

MAS 01 NOV 77

Belgium maintains a traditional policy of contributing everything it possibly can to international cooperation. This level of cooperation is limited predominately as a result of budget and intellectual property constraints.

There are indications that Belgium foresees future cooperation in the areas of solar energy, wind power, energy storage systems, and fusion power as desirable.

COUNTRY DATA--BELGIUM
KEY REFERENCES

MAS 02 NOV 77

LOCATION

- | | |
|---|----|
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| 3-"The Mineral Industry of Belgium and Luxembourg,"
BUREAU OF MINES MINERALS YEARBOOK, Vol. 3, Washington,
D.C.: U.S. Department of the Interior, 1976. | -- |
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Sub-group (Secretariat Note) IEA, 3 February 1977. | IA |
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Belgium, IEA, 7 March 1977. | IA |
| 7-The Role of Foreign Governments in Energy Industries
Department of Energy, 1977. pp. 95-103. | -- |

COUNTRY DATA--BELGIUM
NOTES AND EVALUATIONS

DLR 28 FEB 78

LOCATION

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|---|----|
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| 7-"The Mineral Industry of Belgium and Luxembourg," BUREAU OF MINES MINERALS YEARBOOK, Vol. 3, Washington, D.C.: U.S. Department of the Interior, 1976 (1A) | -- |
| 8-STATESMAN'S YEARBOOK. 1976-77, New York: St. Martin's Press, 1976, pp. 768-77 (2B) | -- |
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| 15-Standing Group on Long-Term Cooperation, Review of Belgium. IEA, 7 March 1977 (5B) | IA |

WENDS COUNTRY DATA

BL: BOLIVIA

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COUNTRY DATA--BOLIVIA
ECONOMIC DATA PROFILE

CSH 15 MAR 78

GNP (current million \$)-5.33	INFLATION RATE-6.2%
PER CAPITA INCOME (\$)-230	DISPOSABLE INCOME (\$)--
EXPORTS (million \$)-.518	IMPORTS (million \$)-.558
MONETARY UNIT-Bolivian Peso	
EXCHANGE RATE (1US\$=)-20 Bolivian Pesos	
TOTAL ENERGY R&D BUDGET (million \$)--	

TRANSPORTATION SYSTEM DESCRIPTION

Bolivia is a landlocked country dependent on railroads, highways and airlines for both internal and external transportation.

Five railways connect Bolivia with foreign seaports on the Atlantic and Pacific coasts (2,310 miles of track). These leave either La Paz or Santa Cruz and connect with Buenos Aires, Sao Paulo and Arica or Antofagasta, Chile. Railways to the Atlantic are used primarily for export of agricultural commodities and those to the Pacific for mineral exports.

In early 1970's there were about 16,000 miles of roads. (600m. of first class highway) Most roads are crushed stone or graded earth. The primary routes are from La Paz to Oruro, from Cochabamba to Santa Cruz or Chimore and from Santa Cruz to the north.

Bus service runs to Peru from La Paz and connects principal cities and towns through Bolivia.

Lloyd Aereo Boliviano (75% state owned) is responsible for internal air transport and connects with international airports in Buenos Aires, Santiago, Lima and Sao Paulo. About 30 small airports are located within Bolivia. The Andes make transportation very difficult.

COUNTRY DATA--BOLIVIA
DEMOGRAPHIC DATA PROFILE

CSH 15 MAR 78

LAND (million sq km)-1.1
POPULATION (millions)-5.5
LITERACY %-40
LIVE BIRTHS/THOUSAND-44
MEDIAN AGE/MALES-15
AVERAGE FAMILY SIZE--
PRIMARY SCHOOL GRADS--
INDUSTRIAL WORKERS--
AGRICULTURAL WORKERS--
POPULATION GROWTH %-2.6

ARABLE LAND (million sq km)-.02
POPULATION DENSITY (/sq km)-5
% RURAL POPULATION-63
DEATHS/THOUSAND-19.1
MEDIAN AGE/FEMALES-16
NET MIGRATION (millions/yr)--
SECONDARY SCHOOL GRADS--
PROFESSIONAL WORKERS--
COLLEGE GRADS--
UNEMPLOYED-87,500

COUNTRY DATA--BOLIVIA
KEY TECHNICAL EDUCATIONAL RESOURCES

CSH 15 MAR 78

LOCATION

University of Saint Francis Xavier
University of San Anders
University of San Simon
University of Thomas Frias
University of Oruro
University of Gabriel Rene Moreno
University of Juan Misael Saracho
University of Jose Ballivan
Catholic University of Bolivia

La Paz

Cochabamba
Potosi

Santa Cruz
Tarija

COUNTRY DATA--BOLIVIA
BASIC LEGISLATION

CSH 15 MAR 78

- 1-General law on hydrocarbons (decree #10170):
 - Established state/ownership of hydrocarbon resources.
 - Created YPFB (state petroleum corporation).
 - Allows for production-sharing agreements with foreign oil companies.
- 2-Taxation on mining and hydrocarbon industries based on royalty payments and export taxes (Decree # 11154).

COUNTRY DATA--BOLIVIA
GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

CSH 15 MAR 78

EXECUTIVE--President

Controls all areas of industrial and economic policy including all energy policy.

President - General Hugo B. Suarez

Minister of Energy and Hydrocarbons - Gen. Guillermo Jimenez Gallo is responsible for all energy R&D policy clarification and implementation.

Minister of Planning and Coordination - Gen. Juan Lechin Suarez is responsible for integrating energy policy into overall national development policy.

Ministry of Mines - Gen. Alfonso Villapardo Armaza will be responsible for research and development of lithium resources as a source of energy.

LEGISLATIVE--Chamber of Deputies and Senate

Constitutionally responsible for promulgation of all legislation and policy regarding energy but is currently non-functional. The executive branch of the military regime in power has assumed the responsibilities of the legislative branch.

OTHER PARTS OF ENERGY STRUCTURE

Comision Boliviana de Energia Nuclear (Director Francisco Mariaca Salas and Forge Doria Medina - Technical Managing Engineer) is responsible for nuclear energy poilicy making and R&D implementation.

COUNTRY DATA--BOLIVIA

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/CSH 15 MAR 78

NUCLEAR

Comision Boliviana de Energie Nuclear (CCBOEN) (Director-Francisco Mariaca Salas and Technical Managing Engineer - Forge Doria Medina) establishes relations with international and foreign nuclear organizations. Also coordinates research in the nuclear field, training of nuclear technicians and maintenance of library on nuclear science.

National Council on Nuclear Energy - Director General Juan Lechin Suarez within Ministry of Mining and Metallurgy (Gen. Alfonso V. Armaza) coordinates government policy on nuclear energy R&D.

NON-NUCLEAR

Ministry for Energy and Hydrocarbons (Gen. Guillermo Jimenez Gallo) is responsible for the development and implementation of non-nuclear energy policy and R&D.

Centro de Tecnologia Petrolena researches various fields concerning petroleum and natural gas. Funds are channelled into this organization via the Yacimientos Petroliferos Fiscales Bolivianos (YPFB) the state petroleum company (President - Eng. Rolando Prada M.).

Bolivia Institute of Petroleum - research in petroleum geology.

Geological Service of Bolivia within the Ministry of Mines is responsible for geological surveys, assessment of energy resources and training of geological specialists.

National Academy of Science is the governing body for scientific activities. There are no legal provisions to enforce its policies and has very limited funds.

COUNTRY DATA--BOLIVIA
ENERGY POLICY OBJECTIVES

CSH 15 MAR 78

No explicit statement of energy policy objectives is available. However, budget allocations and R&D activities have followed definite trends implying the following objectives and priorities.

- 1-Further exploration and development of petroleum resources
- 2-Attempts to utilize currently wasted natural gas deposits
- 3-Development of identified deposits of uranium and other nuclear fuels and research in nuclear power generation
- 4-Some attention to non-traditional sources of energy - e.g., geothermal, but very low priority.

COUNTRY DATA--BOLIVIA

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

CSH 15 MAR 78

Bolivia is self-sufficient in its energy production and consumption, but desires to increase petroleum exports and potentially develop uranium deposits for export in the future.

COUNTRY DATA--BOLIVIA
INDIGENOUS ENERGY RESOURCES

CSH 15 MAR 78

NON-RENEWABLES	RESOURCES	RESERVES	LOCATION OF IDENTIFIED RESERVES
COAL (million tonnes)	0	0	-
CRUDE OIL (million tonnes)	4 billion bbl	2.1	Sub Andean region Antiplano, Chaco- Basin.
SHALE OIL (million tonnes)	-	-	-
NATURAL GAS (billion cubic feet)	11,000	250	Sub Andean region Antiplano, Chaco- Basin
URANIUM (thousand tonnes U3O)	-	-	Yauricoya, Experanza, Chullchucani
RENEWABLE			
HYDROELECTRIC (billion kWh/year)	-	.75	Rio Beni Lake Titicaca
GEO THERMAL (billion kWh/year)	-	0	Antiplano, Southwest Area.

COUNTRY DATA--BOLIVIA
PATTERNS OF ENERGY SOURCES AND USES

CSH 15 MAR 78

CONSUMING SECTOR

	HOUSEHOLD & COMMERCIAL	INDUS- TRIAL	TRANSPOR- TATION	ELECTRICAL GENERATION	TOTAL
COAL (million tonnes)	0	0	0	0	0
PETROLEUM (million tonnes)	-	-	-	-	.769
NATURAL GAS (billion cu ft)	-	-	-	-	6.67
NUCLEAR POWER (billion kWh)	0	0	0	0	0
HYDROPOWER (billion kWh)	-	-	-	-	.0002
GEOTHERMAL (trillion kWh)	0	0	0	0	0
UTILITY ELECTRICITY DISTRIBUTED (billion kWh)	16	30	-		46.

- not available

COUNTRY DATA--BOLIVIA
PROJECTIONS OF DEMAND

CSH 15 MAR 78

RESOURCE	STANDARD PHYSICAL UNITS			TRILLION Btu		
	1975	1985	2000	1975	1985	2000
COAL (mill. tonnes)	0	0	0	0	0	0
CRUDE OIL (mill. tonnes)	.769	-	-	-	-	-
SHALE OIL (mill. tonnes)	-	-	-	-	-	-
NATURAL GAS (bil. cu ft)	6.67	-	-	-	-	-
NUCLEAR POWER (bil kWh/yr)	0	-	-	0	-	-
HYDROELECTRIC (bil kWh/yr)	.747	-	-	-	-	-
GEO THERMAL (bil kWh/yr)	0	0	-	0	0	-
SOLAR ELECTRIC (bil kWh/yr)	0	-	-	-	-	-
OTHER (bil kWh/yr)	-	-	-	-	-	-
URANIUM (kilotonnes U3O8)	0	-	-	0	-	-
HEAT RATE (Btu/kWh)	-	-	-	-	-	-

COUNTRY DATA--BOLIVIA

PROJECTIONS OF ENERGY SUPPLIES, IMPORTS, AND EXPORTS

CSH 15 MAR 78

RESOURCE	1975	%US	1985	%US	2000	%US
COAL (million tonnes)						
INDIGENOUS SUPPLY	0		0		0	
IMPORTS	0		0		0	
EXPORTS	0		0		0	
CRUDE OIL (million tonnes)						
INDIGENOUS SUPPLY	2.101		-		-	
IMPORTS	0		0		0	
EXPORTS	1.374		-		-	
SHALE OIL (million tonnes)						
INDIGENOUS SUPPLY	0		0		0	
NATURAL GAS (billion cubic feet)						
INDIGENOUS SUPPLY	59.4		-		-	
IMPORTS	0		0		0	
EXPORTS	1.546		-		-	
URANIUM (kilotonnes U3O8)						
INDIGENOUS SUPPLY	-		-		-	
IMPORTS	0		-		-	
EXPORTS	0		-		-	

COUNTRY DATA--BOLIVIA
COMMERCIAL APPLICATIONS

CSH 15 MAR 78

Commercial Project Applications are screened by the INI (National Investment Institute). Certain incentives are offered to projects which coincide with INI's top priorities including mining-metallurgical projects and petroleum related projects.

All petroleum exploration and development must be carried out via production-sharing agreements with the YPFB (state petroleum corporation).

The established 30% taxation rate on profits in all industries may be lowered for INI approved projects, but not below 15%.

There is an additional 30% tax on remitted profits.

The application of a new energy technology is facilitated by a decree (No. 09798) establishing common treatment for foreign and domestic capital, trademarks, licenses, patents and royalties. Disputes can be settled via the Director of Norms and Technology in the Ministry of Industry & Commerce.

Foreign investors now receive certain investment guarantees such as convertibility of funds and a 7-year guarantee of stable tax rates and export duties.

COUNTRY DATA--BOLIVIA
POWER PRODUCTION AND ENERGY CAPABILITY

CSH 15 MAR 78

TYPE PLANT	TOTAL gWe	POWER PRODUCTION			MWe (Plants in each range)
		0-499	500-800	800+	
COAL	0	0	0	0	Existing
	0	0	0	0	Planned
GAS	0	0	0	0	Existing
	-	-	-	-	Planned
OIL	110	-	-	-	Existing
	-	-	-	-	Planned
GEOTHERMAL	0	0	0	0	Existing
	-	-	-	-	Planned
HYDROELECTRIC	236	-	-	-	Existing
	-	-	-	-	Planned
NUCLEAR	0	0	0	0	Existing
	.0001	1	-	-	Planned
SOLAR	0	0	0	0	Existing
	-	-	-	-	Planned
OTHER	0	0	0	0	Existing
	-	-	-	-	Planned

SOURCE	#	OUTPUT LAST YR	RESERVES	TOTAL OUTPUT TO DATE
COAL MINES	0	0	0	0
STRIP MINES	0	0	0	0
OIL WELLS	278	35,456 bbl/day	2.1 mill. tonnes	200,912,589 bbl/day
NATURAL GAS	-	6.67	11,000 bill. cubic feet	-
U MINES	0	0	0	0

GEOTHERMAL SOURCES-None

HYDRO POTENTIAL INSOLATION-Not measured

REFINING CAPACITY-37,100 bbl/day, additional 40,000 bbl/day planned for 1978.

WELLS DRILLED LAST YEAR-

GAS-1

OIL-3

DRY-11

COUNTRY DATA--BOLIVIA
ENERGY R&D: STATUS AND OUTLOOK

CSH 15 MAR 78

Bolivia has an advanced earth science satellite technology program for land use and mineral prospecting project support.

Technical ability is highest in the areas of mining and hydrocarbons.

Some facilities are available and utilized for nuclear power research. This area is expanding now as a result of the identification of uranium resources in the country.

There is an interest in exploring the geothermal potential identified by Italy's AGIP, but technical and scientific ability in this area is limited.

COUNTRY DATA--BOLIVIA
ENERGY R&D: BUDGET

CSH 15 MAR 78

No breakdown of budget allocations for energy related areas available.

Total budget = \$3.32 million
1US\$ = 20 pesos

COUNTRY DATA--BOLIVIA
ENERGY R&D: PRIORITIES

CSH 15 MAR 78

- 1-Petroleum exploration and development
- 2-Harnessing of abundant natural gas
- 3-Exploitation of recently discovered uranium resources

COUNTRY DATA--BOLIVIA

GOVERNMT. SUPPORTED ENERGY R&D IN IND., UNI. & NAT. LABS/CSH 15 MAR 78

UNIVERSITIES	PROGRAM AREA	KEY INDIVIDUAL(S)
University of St. Francis Center of Nuclear Medicine	nuclear medicine research	-
University of San Andreas Cosmic Physics Lab Bolivian Institute of Geo- physics Center of Materials Research Center for Scientific and Technical Documentation	-	-
Technical University of Oruro Research Institute for Mining and Metallurgy	geological surveys, mineral resource development (inc. uranium)	-
University of Thomas Frias Engineering Research Institute	-	-
LABORATORIES		
Research Institute for and Metallurgy	geological surveys; mineral resource development (inc. uranium)	-
Centro de Tecnologia Petrolena	various types of petroleum related research	-
Bolivian Institute of Petroleum	research in petroleum geology	-

COUNTRY DATA--BOLIVIA

ENERGY R&D: ROLE OF PRIVATE INDUSTRY

CSH 15 MAR 78

Only a small amount of research is carried on by private industry in Bolivia. Several exploration and development agreements have been made with private foreign oil concerns for further development of hydrocarbons.

Some research is conducted in the metallurgy laboratory of the mining bank of Bolivia.

COUNTRY DATA--BOLIVIA

INVOLVEMENT IN INTERNATIONAL ENERGY R&D ORGANIZATIONS CSH 15 MAR 78

ORGANIZATION	DEGREE OF INVOLVEMENT
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IAEA (Note 1)	Active
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Bolivia has signed the NPT.

Note 1-Total IAEA technical assistance to Bolivia through 1967 =
\$455,000.

COUNTRY DATA--BOLIVIA
ASSESSMENT OF INTERNATIONAL ACTIVITIES

CSH 15 MAR 78

Research and development in all fields in Bolivia suffers from lack of coordination, lack of well-defined priorities and lack of funds and manpower. Bolivia has recently adopted a "Development Strategy" and an Enabling Law to implement this strategy. In conjunction with this a study has been undertaken with OAS to evaluate the national scientific-technical infrastructure and to improve its structure and functioning. The National Council of Scientific and Technical Research will have increased power to coordinate and fund R&D activities.

Bolivia is very eager to cooperate on an international scale in energy R&D, but its activities are limited due to the lack of funds and the poor infrastructure mentioned above.

R&D in petroleum related fields is currently being carried out in conjunction with several private petroleum companies.

In the nuclear and alternative energy fields (especially geothermal) the government is anxious to increase international cooperation.

COUNTRY DATA--BOLIVIA
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CSH 15 MAR 78

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COUNTRY DATA--BOLIVIA
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CSH 15 MAR 78

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WENDS COUNTRY DATA

BR: BRAZIL

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COUNTRY DATA--BRAZIL
ECONOMIC DATA PROFILE

AVL 30 SEP 78

GNP (1977 Billion \$)-107.0	INFLATION RATE(% 1976-77)-44.7
EXPORTS (1976 Billions \$)-11.8	IMPORTS (1976 Billion \$)-12.8
GNP PER CAPITA(1975 \$)-1450	NATIONAL INCOME PER CAPITA(\$)-
MONETARY UNIT -CRUZEIROS	1203 (1975)
TOTAL R&D BUDGET-Not available	EXCHANGE RATE(/US \$ 7/78)-17.7

TRANSPORTATION SYSTEM - Transport services are limited by jungles, river, and mountains. Over large areas, the airplane is the only practicable means of transport.

ROADWAYS

Most are unpaved or in disrepair. Because of these conditions, the operating costs of the trucking industry are very high. From the viewpoint of Brazil's international financial position, this is quite important because an estimated 70% of the operating cost of the trucking industry requires foreign exchange to pay for gasoline, lubricating oil, and spare parts. Highways are the principal mode of transport, accounting for 70% of the freight and 90% of the passenger traffic in 1974. In 1970, there were 2,700,000 motor vehicles in use.

RAILWAYS

The large area of Brazil is serviced by a rail network of only 32,000 kms. which is distributed among 40 lines, many of which are inadequately interconnected. There are three gauges. The equipment is old, poorly maintained, and inefficiently operated. Over 50% of the locomotives are over 30 years old. Traffic density is light in the Northeast and very high in the South. Approximately 80% of the mileage is owned by the Federal Government and the rest is owned by private and mixed companies.

SHIPPING

In terms of tons-per-kilometer, ships carry about as much as railroads. Two government-owned companies (Lloyd Brasileiro and the National Company of Coastal Navigation) handle 50% of all shipping freight. The principal port is Rio de Janeiro. The river system has a total of 42,700 kms. which are navigable.

AIR-TRANSPORT

Although there are over 1000 airports in Brazil, only a handful have paved runways or can handle large craft. Airplanes carry about 1% of the amount of cargo carried by railroads.

NEW PROJECTS

Three major projects include the 5000 km. Trans-Amazon Highway, the Cuiba-Santamaria Highway which will run North-South, and the 3555 km. of Trans-Brasilia project.

N.B. The rate of inflation was calculated on the basis of of consumer prices.

COUNTRY DATA--BRAZIL
DEMOGRAPHIC DATA PROFILE

AVL 30 SEP 78

Land (million sq. km)-8.5
Population (million)-110.1
(1976)
Literacy (%) -66.0 (1970)
Live Births/thousand-37.1
(Between 1970-75)
Median Age/Male-18 (1975)
Average Household size-5.1
(1970)
Primary School enrollment
(1972 millions)-14.1
Industrial Workers
(1970 millions)-7.6
Agricultural Workers
(1970 millions)-13.1
Population Growth(%)-3
(Between 1970-75)

Arable Land (million sq.km)-
0.2619
Population Density (/sq.mile)-
13 (1976)
% Rural Population-44(1976)
Deaths /Thousands-8.8 (Bet-
ween 1970-75)
Median Age Female-20(1975)
Net Migration--
Secondary School enrollment
(1973 millions)-1.5
College Graduates
(1973 millions)-1.38
Unemployed
(1973 millions)-.968
Professional Workers
(1970 millions)-7.4

--not known

COUNTRY DATA--BRAZIL
PROFESSIONAL LABOR FORCE PARTICIPATION PROFILE

AVL 30 SEP 78

Total R&D Manpower	1974
Natural Sciences	--
Engineering & Technology	--
Medical Science	--
Agriculture	--
Social Science &	--
Humanities	

Total	16,545
-------	--------

Total Stock of Scientists, Engineers & Technicians
1970

Scientist and Engineers	541,328
Technicians	1,177,494
Total	1,718,882

--not known

COUNTRY DATA--BRAZIL
KEY TECHNICAL EDUCATIONAL RESOURCES

AVL 30 SEP 78

Institution	Location
Universidade do Amazonas	Manaus
Universidade Federal de Alagoas	Manceio
Fundacao Universidade Regional de Blumenau	Blumenau
Universidade Estadual de Campinas	Campinas
Universidade de Caxias do Sul	Caxias do Sul
Universidade Federal Fluminense	Rio de Janeiro
Universidad Federal de Goias	Goiania
Universidade do Estado da Guanabara	Rio de Janeiro
Universidade de Itauna	Itauna
Universidad Federal de Juiz de Fora	Juiz de Fora
Fundacao Universidade Federal de Mato	Cuiaba
Universidad de Mogi das Cruzes	Mogi das Cruzes
Universidade Federal de Ouro Preto	Ouro Preto
Universidade Catlica de Pelotas	Pelotas
Universidade Federal do Rio Grande do Sul	Porto Alegre
Ponificia Universidade Catolica do Rio de Janeiro	Rio de Janeiro
Universidade Federal do Rio de Janeiro	Rio de Janeiro
Universidade Catolica do Salvador	Salvador
Universidade P/O Desenvolvimento do Estado de Santa Catarina	Florianopolis
Universidade Municipal de Taubate	Taubate
Universidade de Uberlandia	Uberlandia
Associacao Universitaria Santa Ursula	Botofogo

COUNTRY DATA--BRAZIL
ENERGY POLICY: BASIC LEGISLATION

AVL 30 SEP 78

- 1-National Research Council set up in 1951.
- 2-Oil production was reserved for the state by Decree Law 2004.
- 3-Institute for Atomic Energy set up in 1956.
- 4-National Commission for Nuclear Energy established in 1956.
- 5-Decree Law 1279 (IULCLG)- involved prospection of nuclear minerals, 1969.
- 6-Authorization of National Nuclear Energy Commission to set up Brazilian Company for nuclear technology in 1971.
- 7-Resolution in 1971 of the National Nuclear Energy Commission on promotion of development of nuclear technology.
- 8-Reorganization of the bodies in the field of theoretical and applied nuclear research in 1972.
- 9-Federal Decree 73030 (Oct.30, 1973) created the Special Secretariat for the Environment (SEMA), an autonomous agency within the Ministry of the Interior, charged with responsibility of assessing quality of physical environment and the national use of Brazil's natural resources.
- 10-Law No.6189 (Dec.16,1974) restructured the nuclear sector and organized Nuclebras.
- 11-National Solar Energy R&D Plan was approved at the end of 1974
- 12-National Hydrogen R&D Plan was completed early in 1975.
- 13-The Federal Republic of Germany and Brazil signed an agreement on cooperation in the field of peaceful uses of nuclear energy, June 27, 1975.
- 14-National Alcohol Plan, adopted in 1975, sets forth an annual production goal of 3 billion litres of alcohol by 1980.
- 15-Tripartite Agreement on safeguards was executed with the Federal Republic of Germany and IAEA on Feb. 26,1976.
- 16-The Second Basic Plan for Scientific and Technological Development (Decree No.77,355 of March 1976) enumerates basic Brazilian industrial goals vis a vis foreign competition.
- 17-Decree No.80-266 of August 31,1977 establishes a reserve of nuclear ore, their concentrates, or chemical compounds of nuclear elements, and provides for stockpiling of special fissile and fissionable material.
- 18-Decree No.81,107 (Dec.22,1977) establishes pollution control standards for Brazilian industry.
- 19-Decree No.81,236 (Feb.20,1978) extends previous law (Decree No.79,153/77) regarding the rationalization of fuel consumption.
- 20-The Second National Plan (1975-79) sets out basic priorities and policy objectives; proposed a policy of industrial decentralization that will be followed as an attempt to make the best use of Brazil's natural resources and provide a quality environment.

COUNTRY DATA--BRAZIL

GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

AVL 30 SEP 78

EXECUTIVE

The 1967 constitution, extensively revised Oct. 20, 1976, grants the president (currently, Pres. Geisel - Gen. Figueira has been designated as his successor) very broad powers in both the legislative and executive spheres. The revised constitution, while maintaining Brazil's status as a federal republic in which the central government retains broad powers, allows states to establish congruent constitutions and governments. Financial dependence by states on the central government contributes to strong centralization. Under Article 58 the President is empowered to rule by decree without prior legislative approval. All important energy policy decisions are made by the president in his capacity as chairman of the National Economic Council of which the Minister of Mines and Energy is a member.

The Ministry of Mines and Energy (Minister - Shigeaki Ueki) is the next highest level of executive authority in the energy field and there are lateral inputs from the Planning Secretariat (SEPLAN). All matters concerning energy fall under the jurisdiction of the Government of Brazil acting through the Ministry of Mines and Energy.

LEGISLATIVE

The bi-cameral system comprises a House and Senate. The powers of both bodies have been sharply reduced. The legislature can do little to check the power of the President, who can recess the Congress if it disagrees with his policies.

OTHER PARTS OF THE ENERGY STRUCTURE

1-PETROBRAS - BRAZILIAN PETROLEUM INDUSTRY

2-NUCLEBRAS - BRAZILIAN NUCLEAR INDUSTRY (President - Paulo Nogueira Batista)

3-ELETROBAS - BRAZILIAN ELECTRICAL CENTER (President - Mario Behring)

COUNTRY DATA--BRAZIL

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/AVL 30 SEP 78

MINISTRY OF MINES AND ENERGY (MME) - exercises Government of Brazil jurisdiction over essentially all energy matters. The main policy formulation bodies are:

National Department for Water and Electric Power (DANNE)
National Department for Mineral Production (DNPM)
National Commission for Nuclear Energy (CNEN) (Chairman - Prof. Hervasion G.de Carvalho)
National Petroleum Council (CNP)
CNEN is also responsible for nuclear power plant licensing.

The following government-controlled companies handle R&D activities:

Brazilian Electrical Center (ELECTROBRAS)
Brazilian Nuclear Industry (NUCLEBRAS)
Brazilian Petroleum Company (PETROBRAS)
ELECTRICAL ENERGY RESEARCH CENTER- performs principal R&D activities for ELECTROBRAS.

Federal labs supporting NUCLEBRAS:
Institute of Nuclear Engineering
Institute of Radioactive Research
Institute for Radioprotection and Dosimetry
Agricultural Nuclear Energy Center (CENA)

Institute of Atomic Energy of the State of Sao Paulo also provides support to NUCLEBRAS.

A new research lab (CEPEL) went on stream April, 1978 responsible for near term technology R&D, especially in high voltage transmission technology.

The Planning Secretariat (SEPLAN) is responsible for preparing the National Development Plan (PND I & II) including the energy sector.

The National Council for Science and Technology Development (CNP) prepares S/T development annex to PND including energy R&D.

The National Financing Agency for Studies and Projects (FINEP) studies energy alternatives and technology and initiates R&D projects.

The Mineral Resources Survey (CPRM) conducts resource surveys.

COUNTRY DATA--BRAZIL
ENERGY POLICY AND OBJECTIVES

AVL 30 SEP 78

- 1-The Second National Plan 1975-79 puts forth three major areas for attention; energy, urban development, and the environment. Elements of the plan contain an emphasis on basic industry, scientific and technological research, and energy production based on hydro-power, nuclear energy and fossil fuels.
- 2-Conservation of energy and the environment are major components of Brazil's strategy. Entrepreneurs, both state and private when importing equipment and technology for the production of capital and intermediate goods make efforts to import the most recent technology for controlling pollution and conserving energy.
- 3-Brazil seeks to reduce its heavy dependence on external fuel sources through increased petroleum prospecting, development of its shale oil and development of anhydrous alcohol derived from sugar cane, manioc, and/or sweet potatoes to serve as gasoline additives. Risk reduction in domestic fossil fuel exploration is achieved by a system to prospect in other countries under the arrangement that Brazil receives its compensation in kind (25%).
- 4-Although very controversial within Brazil, the Government has adopted a system of offering "risk contracts" whereby foreign oil companies are invited to prospect. However, compensation is not in kind, but in currency.
- 5-Brazil seeks to diversify energy sources as petroleum substitutes through the accelerated development of hydro-electric projects, the development of nuclear power, the increased use of coal in thermal plants and the development of coal gasification applications. The electrification of railways and the development of alternative technologies (primarily solar and hydrogen) are also current objectives.
- 6-Transportation policy is aimed at reducing the dependence on trucking and on private automobile use by urban commuters.
- 7-The fuel pricing system is designed to encourage conservation of imported and scarce domestic fuel resources.
- 8-Fundamental nuclear objectives are: to develop a large nuclear energy program using proven reactor types (LWR at present and FBR eventually), and to achieve self-sufficiency in nuclear reactor construction, operation and fuel resources.
- 9-The first nuclear reactor, Angra I, is scheduled to come on line this year and two more commercial reactors should be on stream by 1984.

COUNTRY DATA--BRAZIL

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

AVL 30 SEP 78

The Government of Brazil is extremely conscious of the cost of energy dependency. Particular policies have been formulated in each resource area without specific target levels of self-sufficiency, except for nuclear, where Brazil hopes to develop its uranium production so as to be entirely self-sufficient by the late 1980's. Oil and gas provided over 80% of total primary energy in 1975 and approximately 80% of it was imported. It hoped that energy policy and plans will reduce this share to 30% by the year 2000.

COUNTRY DATA--BRAZIL
INDIGENOUS ENERGY RESOURCES

AVL 30 SEP 78

	RECOVERABLE RESERVES	LOCATION OF IDENTIFIED RESERVES
NON		
RENEWABLE		
COAL	1,790	Rio Grande do Sul,
(megatonnes)		Santa Catarina
CRUDE OIL	196	North East, Sergipe
(megatonnes)		Bahia
SHALE OIL	-	South, South East
(megatonnes)		
NATURAL GAS	322	North East
(million G.cal)		
THORIUM	584.4	
(Elemental) (\$25/Kg)		
(thousand tonnes)		
URANIUM	0.9	Pocos de Caldaís, Minas,
(thousand (\$38/Kg)		Ceara, Goias, Figueira
tonnes) (U308)		Parana
RENEWABLE		
HYDROELECTRIC	519,277	Amazon Basin and spread
(Gwh/yr)		through the country
GEO THERMAL	0	

COUNTRY DATA--BRAZIL
 PATTERNS OF ENERGY SOURCES AND USES

AVL 30 SEP 78

1976	HOUSEHOLD COMMERCIAL	INDUS- TRIAL	TRANS- PORTATION	ELECTRICAL GENERATION	TOTAL
COAL (thousand tonnes)	0	4,053	53	2,503	6,623
PETROLEUM (thousand tonnes)	3,157	22,730	15,749	649	46,650
NATURAL GAS (Tera calories)	0	6,787	0	0	6,787
NUCLEAR POWER (million KWh)				0	
HYDROPOWER (million KWh)				84,468	
GEOHERMAL (million KWh)				0	
UTILITY ELECTRICITY (Distributed) (million KWh)	18,454	44,545	636	-	210,722

Note: Total includes transformation and distribution losses
 and uses in the energy sector.

COUNTRY DATA--BRAZIL
PROJECTIONS OF DEMAND

AVL 30 SEP 78

	STANDARD PHYSICAL UNITS			THOUSAND TONNES COAL EQUIVALENT		
	1976	1985	2000	1976	1985	2000
RESOURCE						
COAL (thousand tonnes)	6,623	-	-	6,623	-	-
CRUDE OIL (thousand tonnes)	46,267	105,200	110,400	68,012	-	-
OIL(thousand tonnes)	-	-	-	-	-	-
NATURAL GAS (tera calories)	6,787	9,000	10,000	970	-	-
NUCL- EAR POWER (million KWh/year)	0	-	-	0	-	-
HYDRO- ELECTRIC POWER (million KWh/year)	81,468	-	-	10,021	-	-
GEO- THERMAL (million KWh/year)	0	-	-	0	-	-
OTHER(see note)- (million KWh/yr	-	-	-	-	-	-
URANIUM	-	-	-	-	-	-

NOTE: Wind energy, tidal power, biomass

- not available

COUNTRY DATA--BRAZIL

PROJECTIONS OF ENERGY SUPPLIES, IMPORTS AND EXPORTS

AVL 30 SEP 78

RESOURCE	1976	% US	1985	% US	2000	% US
----------	------	------	------	------	------	------

COAL(thousand tonnes)

INDIGENOUS SUPPLY	3,256		3,430		4,820	
IMPORTS	3,252		16,270		40,580	
EXPORTS	0					

CRUDE OIL(thousand tonnes)

INDIGENOUS SUPPLY	8,121		21,390		20,860	
IMPORTS	40,996		83,810		89,540	
EXPORTS	2,850		-		-	

SHALE OIL

INDIGENOUS SUPPLY -

NATURAL GAS

(tera calories)

INDIGENOUS SUPPLY	6,787					
IMPORTS	0					
EXPORTS	0		19,020		10,140	

URANIUM(kilotonnes U308)

INDIGENOUS SUPPLY

IMPORTS

EXPORTS

COUNTRY DATA--BRAZIL
ENVIRONMENTAL CONSIDERATIONS

AVL 30 SEP 78

1-The Ministry of the Interior is responsible for assuring a quality physical environment.

2-There is no comprehensive environmental program in Brazil, but there are various special programs which address particular problem areas.

3-Decree entered into force January, 1978, gives the federal government exclusive right to order the closure of polluting plants in industries of high national interest, which are stated to be those with state ownership and those refining petroleum or producing arms, petrochemicals, cement, ferrous metals and fertilizers. It establishes three designations of areas for industrial use and restricts the location of plants considered potential polluters to specific industrial areas.

4-The State Environmental Agency (CETESB) initiated a program called "Operation Winer" to run from May 1978 to August 1978 which is designed to control concentrations of industrial and automobile pollution in Sao Paulo. This is stop gap measure to be used until permanent regulations and control can be implemented.

5-The President sanctioned Law No. 6453 (October 1977) which established civil liability for nuclear damage.

6-Conservation of resources is also the responsibility of the Ministry of the Interior (acting thorough SEMA).

7-Specific measures have been detailed for various resources. Oil and gasoline are conserved through measures such as price increases, speed control on highways, closing of gas stations on weekends, and increased parking fees and tolls. Between 1976 and 1977, this resulted in a 3.8% decrease in consumption.

COUNTRY DATA--BRAZIL
COMMERCIAL APPLICATIONS

AVL 30 SEP 78

1-On the whole, the Government of Brazil has a policy of self-reliance which some feel has frustrated the introduction and application of foreign R&D. In spite of this overall policy, the Government has managed to attract much foreign R&D capacity and has used fiscal and financial instruments within Brazil to stimulate the early application of all energy R&D.

2-The Government of Brazil uses a system of "risk contracts" as a means to encourage foreign companies to explore for oil. At present, Brazil has temporarily suspended issuing new contracts.

3-Public utilities have been granted an exemption of customs duties, federal excise tax and state sales tax to be used in high priority projects.

4-Decree No. 80.103 of 8/77 authorized the Minister of Finance to guarantee loans to Eletrobras to implement high priority electricity projects.

5-Decree Law No. 1.567 of 8/77 has extended the tax incentives under Article 3 of Decree No. 1531/77 to local projects including energy.

6-Decree No. 1.565 of 7/77 exempts Petrobras from import regulations regarding materials for production of crude oil or natural gas.

COUNTRY DATA: BRAZIL
POWER PRODUCTION AND ENERGY CAPABILITY

AVL 30 SEP 78

TYPE PLANT	TOTAL MWe	POWER PRODUCTION			(Plants in each range)
		0-449	500-800	800+MWe	
Hydro	15,860	22	4	5	Existing
	6,280	7	0	3	Planned
Thermal	642	2	0	0	Existing
	426	1	0	0	Planned
Oil	3,488	2	1	2	Existing
	2,230	1	0	1	Planned
Coal	800	1	1	0	Existing
	250	1	0	0	Planned
Nuclear	0	0	0	0	Existing
	3,086	0	1	2	Planned

N.B Planned refers to plants actually under construction but not yet on stream. Plants which are expanding existing capacity are treated as existing plants.

PETROLEUM

Total Wells (1975)	Total Footage (1,000 ft.)	Total Wildcats (1975)	Successful Wildcats(1975)
228	1,308	87	17
Total wells (1974)	Total Footage (1,000 ft.)	Total Wildcats (1974)	Successful Wildcats
176	1,198	86	
Number of Rigs 30 Sept '77	30 June '77	30 Sept ' 76	
45	43	43	

COUNTRY DATA--BRAZIL
ENERGY R&D: STATUS AND OUTLOOK

AVL 30 SEP 78

NUCLEAR - The 1975 nuclear cooperation agreement with West Germany was reaffirmed in February 1978 and further agreement was signed relating to the development and safety of gas-cooled Fast Breeder Reactors, uranium enrichment, and treatment of nuclear waste. Indigenous R&D capabilities are expected to improve. Local pressure exists for a nuclear program to ensure self-sufficiency in uranium.

ELECTRICITY -The State Government of Sao Paulo is continuing its efforts to develop hydro plants on the Parana River and Itaipu Binancioanl has received loans to build a hydro plant there. Tri-lateral Hydro talks between Brazil, Argentina, and Paraguay are underway for a major project on the River Centrais Electricas De Minas Gerais (CEMIG). Centrais Electrias De Santa Catarina, and Electrobras have each received substantial credit to expand generating capacity. This massive investment underscores the Government of Brazil's reliance on hydro development.

GEO THERMAL - It is not given high priority because of the Government of Brazil's estimates of relatively poor prospects in Brazil.

COAL CONVERSION (GASIFICATION) - coal studies (physical, chemical and geological characteristics of coal, including energy and ash content, sulfur and volatility of coal). Also studies on pre-gasification processing, process development, gas utilization and new techniques for coal utilization in steel production are under way. Apart from this, a program is to be launched in 1978 to stimulate the use of coal instead of oil.

SHALE OIL -Petrobras announced in March 1978 that it plans to proceed with the construction of a shale oil plant in the state.

OIL -Peterobras inaugurated a four-year strategic exploration program which calls for the drilling of 500 wells by 1981.

SOLAR -It is considered capable of playing an important supporting role on a medium and long-term basis in Brazil's energy matrix. R&D is being conducted in the following areas; solar collectors, dryers, stills and refrigeration, thermal engines, photovoltaic effect, bioconversion, solar architecture, solar power generation, energy storage and solarimetry.

WIND -Current activities include feasibility studies, development and constuction of small and medium-scale wind powered generators and pumps.

COUNTRY DATA--BRAZIL
ENERGY R&D: STATUS AND OUTLOOK

AVL 30 SEP 78

HYDROGEN - The R&D program was designed at the beginning of 1975. It incorporates two different but interrelated projects: (1) feasibility studies designed to answer questions concerning the applicability of available technologies that could result in short term industrial development and (2) research projects designed to foster research in new and established areas in which development of Brazilian know-how was thought to be necessary. Feasibility studies and research projects involve electricity production and hydrogen production, storage, transportation and utilization.

METHANOL - There are studies underway to test the feasibility of the pyrolysis of organic matter, in particular organic waste, to obtain chemical products (fuel), either in the liquid or gaseous state.

ALCOHOL - The R&D in this area is designed to test the feasibility of all-alcohol automobile engines. Also, the Federal Government is attempting to engineer a significant expansion of alcohol production derived either from sugar cane or manioc or both.

COUNTRY DATA--BRAZIL
ENERGY R&D: BUDGET

AVL 30 SEP 78

CATEGORY	MILLIONS OF DOLLARS			TOTAL-3 YR
	1975	1976	1977	
Nuclear	38.7	44.1	52.7	144.0
Hydroelectric				75.0
Fossil Fuels				66.0
Non-Conventional				
Solar	.8	.9	1.1	2.8
Hydrogen	1.0	1.3	1.7	4.0
Bioconversion	.5	.6	.8	1.8
Conservation	.2	.3	.4	.9

Exchange rate used:

CR \$9.02 to 1 US Dollar

COUNTRY DATA--BRAZIL
ENERGY R&D PRIORITIES

AVL 30 SEP 78

1-The Brazilian National Development Plan places research priorities on energy, transportation, and communications.

2-The Minister of Mines and Energy (Ueki) has listed four non-conventional energy R&D priorities; shale oil, low grade coal utilization, solar, and nuclear.

3-Hydro power is seen as a major element in achieving an energy balance in Brazil. There are numerous hydro development schemes under way, primarily on the Parana River and at Hiapu.

4-Oil exploration is a priority stressed by the Government and incentives are being provided to foreign and domestic exploration teams.

5-Nuclear R&D priorities are the acquisition of technology and trained personnel, establishment of nuclear capacity, and establishment of indigenous nuclear construction, operation, regulation, and fuel cycle capabilities.

6-Coal utilization R&D is stressed as a means of reducing dependence on imported fuel.

7-R&D in Anhydrous alcohol to reduce oil dependence is also underway.

COUNTRY DATA--BRAZIL
ENERGY R&D: IMPACT

AVL 30 SEP 78

	STANDARD UNIT	1985	2000
Nuclear	TWh	20.2	270.5
Crude Oil	Millions Tons	105.2	110.4
Natural Gas	Cubic Km.	.9	1.1
Hydro Power	TWh	192.0	271.7
Uranium(U308)	Thousand Tons	1.23	-
Coal	Million Tons	19.7	45.4

N.B These figures are taken from NAC report June 1978 and appear to be the most reliable estimates available at present.

COUNTRY DATA--BRAZIL

GOVERNMENT-SUPPORTED ENERGY R&D IN IND., UNI., & NAT. LABS AVL 30 SEP 78

Operating companies within the Ministry of Mines and Energy:

PETROBRAS-fossil energy R&D (coal, crude oil, oil shale)

ELECTROBRAS-hydrogen economy, hydro and thermal electricity,
and tides

NUCLEBRAS-reactor and nuclear fuel technology, and mineral
exploration

Government-supported universities:

UNIVERSITY OF COMPINAS-solar collectors, dryers, refrigeration,
and architecture, photovoltaic effect,
hydrogen economy

FEDERAL UNIVERSITY OF RIO DE JANEIRO-solar collectors, energy
storage

FEDERAL UNIVERSITY OF PARAIBA-solar dryers, stills and refri-
geration, thermal engines,
solarimetry

UNIVERSITY OF SAO PAULO-hydrogen economy

SUPERIOR SCHOOL OF AGRICULTURE-radioisotope application, bio-
conversion, solarimetry

Laboratories:

ELECTRICAL ENERGY RESEARCH CENTER-hydroelectric, high voltage
transmission

AERONAUTICAL TECHNOLOGY INSTITUTE-solar collectors, thermal
engines, energy storage

MARINE SCIENCE INSTITUTE-wind energy, ocean thermal

INSTITUTE FOR SPACE ACTIVITIES-wind energy

NATIONAL INSTITUTE FOR SPACE RESEARCH-solarimetry

INSTITUTE OF NATIONAL TECHNOLOGY (INT)-production of alcohol
from manioc and other sources

AEROSPACE RESEARCH CENTER (CTA)-conducts R&D on alcohol/gaso-
line, and pure alcohol-fuel
engines

Other organizations:

NATIONAL METEOROLOGICAL DEPT-wind energy

MUNICIPAL GAS COMPANY-hydrogen economy

STATE GAS COMPANY OF RIO-hydrogen economy

COUNTRY DATA--BRAZIL

ENERGY R&D: ROLE OF PRIVATE INDUSTRY

AVL 30 SEP 78

1. Nuclear - Essentially none. Private industry is being strongly encouraged in the areas of commercial heavy mechanical components, equipment, and services needed for the Brazilian nuclear power program.

2. Non-Nuclear - The energy sector is a near-government monopoly where indigenous private sector contributes only at the production and control level. Foreign private corporations have entered into R&D agreements with the Government of Brazil. BP just drilled the first private offshore well. Petrobras, with the aid of private technology and equipment is rapidly completing activities in the Guaroupa field. Exploration and development activities by private companies are a key part of Brazil's intense efforts to expand petroleum potential in the next four years.

COUNTRY DATA--BRAZIL

INVOLVEMENT IN INTERNATIONAL ENERGY R&D ORGANIZATIONS AVL 30 SEP 78

ORGANIZATION	DEGREE OF INVOLVEMENT
International Electro-Technical Committee	Active
International Conference on Large High Voltage Electric Systems	Active
World Association of Industrialized Technology	Active
IAEA	Active
Research Organizations	Active
UNCTAD	Moderately Active
IANEC	Very Active

COUNTRY DATA--BRAZIL
ASSESSMENT OF INTERNATIONAL ACTIVITIES

AVL 30 SEP 78

1-The Government of Brazil seeks to retain a tight political reign on energy cooperation and is not yet prepared to turn the subject over to experts.

2-Brazil has not signed the Nuclear Non-Proliferation Treaty and seeks to keep pace with emerging nuclear technology.

3-Areas of technical cooperation might include: a) Coal-mining technologies, beneficiation, utilization, blending and training of personnel in gasification techniques. b) Alcohol production from biomass. c) Industrial and transportation conservation. d) Hydrolysis techniques.

4-There is currently a decline in U.S./Brazil energy cooperation due to the closing down of the A.I.D. program and failure to develop new efforts. Brazil is interested only in mutually beneficial (technically) cooperative efforts. The U.S. and Brazil entered into a 30 year Power Agreement For Cooperation, effective September 1972.

5-Technical assistance is actively sought in the area of nuclear safety. A Tri-lateral agreement including IAEA and the Government of West Germany has been concluded.

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AVL 30 SEP 78

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value of 1,000 Kwh equivalent to 0.123 tonnes of
coal). | |

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WENDS COUNTRY DATA

BM: BURMA

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COUNTRY DATA--BURMA
ECONOMIC DATA PROFILE

DYF 22 DEC 77

GDP (Current million \$)-2.9
PER CAPITA INCOME (\$)-94
EXPORTS (million \$)-188
MONETARY UNIT-Kyat
TOTAL ENERGY R&D BUDGET (million \$)--
INFLATION RATE--
DISPOSABLE INCOME (\$)-3,385
IMPORTS (million \$)-147
EXCHANGE RATE-7.12

TRANSPORTATION SYSTEM DESCRIPTION-The chief artery of traffic is the river Irrawady, which is navigable as far as Bhamo, 900m. inland. The Irrawady delta has nearly 2,000m. of navigable waters and some parts of the Salween and the Chindwin are navigable. An agreement was signed with the W.B. in 1973 for a 33 million credit to help rehabilitate the waterways and railways. Railways have been modernized by the introduction of diesel engines and in 1974 comprised 2600 track miles. Burma Airways Corp. provides internal and international air services. All the railways, domestic air services and the other major inland water facilities are owned and operated by the state.

Note: Burmese currency, the Kyat, is pegged to the SDR.

--not available

COUNTRY DATA--BURMA
DEMOGRAPHIC DATA PROFILE

DYF 22 DEC 77

LAND (million sq km)-676,552
POPULATION (millions)-31,140,000
LITERACY %-70
LIVE BIRTHS/THOUSAND-39.5
MEDIAN AGE/MALES-48.6
AVERAGE FAMILY SIZE--
PRIMARY SCHOOL GRADS--
INDUSTRIAL WORKERS-1.547
AGRICULTURAL WORKERS-7.973
POPULATION GROWTH %=2.5

ARABLE LAND (million sq km)--
POPULATION DENSITY (/sq km)-46
% RURAL POPULATION--
DEATHS/THOUSAND-15.8
MEDIAN AGE/FEMALES-51.5
NET MIGRATION (millions/yr)--
SECONDARY SCHOOL GRADS--
PROFESSIONAL WORKERS--
COLLEGE GRADS--
UNEMPLOYED %-119.8

--not available

COUNTRY DATA--BURMA
KEY TECHNICAL EDUCATIONAL RESOURCES

DYF 22 DEC 77

LOCATION

Arts and Sciences University
Arts and Sciences University

Rangoon
Mandalay

Note: All public higher education was consolidated into two large universities and their affiliated colleges. The Arts and Sciences University, Rangoon, has ten affiliated colleges. The Arts and Sciences University, Mandalay has five.

COUNTRY DATA--BURMA
ENERGY POLICY: BASIC LEGISLATION

DYF 22 DEC 77

AREAS OF BASIC LEGISLATION AFFECTING ENERGY POLICY

- 1-Ministry of Industry (II) established 1974.
- 2-In 1974 the Burmese Government leased several off-shore drilling tracts to four foreign oil companies--two from the United States.
- 3-A UNDP financial study was recently commissioned to make recommendations for a stop-gap development program to meet the short and medium-term load growth (1976/77-1985/86) and, at the same time to identify the most suitable and least cost hydro-electric development to meet the long term needs of the power sector.

COUNTRY DATA--BURMA
GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

DYF 22 DEC 77

EXECUTIVE--PRESIDENT

Controls all areas of energy policy.

President U Ne Win is also chairman of the 29-member State Council which is in charge of energy implementation.

The Ministry of Industry II (Col. Maung Cho) is responsible for energy R&D.

Changes in rates are also subject to the review and approval of EPC's advisory board.

COUNTRY DATA--BURMA

ORGANIZATIONS FOR IMPLEMENTATION OF ENERGY POLICY & R&D DYF 22 DEC 77

NON-NUCLEAR

The implementation of the non-nuclear energy policy and R&D is directed by the Ministry of Industry II (Col. Maung Cho).

- 1-The electric power corporation EPC is a government owned enterprise supervised by the Ministry of Industry II. The corporation was established in 1972 in accordance with a government decree, taking the functions, assets, liabilities and powers of the former electricity supply board. EPC is responsible for the installation of new electric power stations, and for the systematic consolidation, extension, removal and reconditioning of the existing power supply system and for the implementation of schemes with a view to developing electric power.
- 2-The managing director of EPC has responsibility for the overall management of the corporation under the direction of the Minister of Industry II. He is assisted by the EPC Advisory Board which consists of a chairman, seven members and a secretary. The managing director serves as chairman of the board.

COUNTRY DATA--BURMA
ENERGY POLICY AND OBJECTIVES

DYF 22 DEC 77

The electricity power corporation (EPC) intends to establish the power station at the main oil field. At present Gub Myanma oil corporation is flaring about 20 million cubic feet of gas a day at this field, and EPC wishes to utilize this wasted energy source to generate electricity.

EPC intends to purchase three gas turbine generators for this power plant with an estimated total value of about 12 million dollars. The US firm involved is Curtis Wright and EPC has narrowed its list to two other competitors, John Brown LTD of UK, and Hitachi, Japan.

1-Natural Gas turbine power station project

Location: Mann oil field

Objective: To generate electric energy for Mann oil field, Mimba and Malun areas utilizing natural gas available at Mann oil field.

Present plans call for 16,400 kw industry type gas generating sets with auxiliary equipment.

2-Natural Gas turbine power station project

Location: Prome

Objective: To generate energy by utilizing natural gas available at Prome range oil field.

Present plans call for one 8,000 kw industrial type gas turbine generating set with auxiliary equipment.

3-Kyunchaug Natural Gas turbine power station extension project

Location: Kyunchaug

Objective: To increase existing capacity of the station by adding one gas turbine generating set.

Present plans call for one 18,100 kw industrial gas turbine generating set with auxiliary equipment such as gas and distillate oil handling system.

4-Myanaug Natural Gas turbine power-station extension project

Location: Myanaug

Objective: To add three more gas turbine generating sets to existing capacity.

Present plans call for three 16,400 kw Industrial type gas turbine generating sets with auxiliaries.

COUNTRY DATA--BURMA

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

DYF 22 DEC 77

Burma has hydro potential, natural gas and petroleum. However, the petroleum produced in Burma is considered too light for steam turbine operation. It is unlikely that additional hydroprojects will be completed before the late 1980's. They are costly, therefore EPC hopes to extend gas turbine generation because of the lower construction costs and shorter construction period.

COUNTRY DATA--BURMA
INDIGENOUS ENERGY RESOURCES

DYF 22 DEC 77

NONRENEWABLE	RESOURCES	RESERVES	LOCATION OF IDENTIFIED RESERVES
COAL (million tonnes)	1.50 (metric)		Kalewa
CRUDE OIL (million barrels)	1.06	7.11	Minbu
SHALE OIL (million barrels)	--	63.000	--
NATURAL GAS (billion cubic feet)	--	150	--
RENEWABLE			
Hydroelectric	263	773	--
--not available			

COUNTRY DATA--BURMA
POWER PRODUCTION AND ENERGY CAPABILITY

DYF 22 DEC 77

GENERATING FACILITIES

PLAN	NO OF PLANTS	INSTALLED CAPACITY (MW)
Hydro	2	168.5
Thermal	2	60.0
Gasturbine	2	103.5
Diesel	--	56.0

SUBSTATIONS

POWER	NO OF SUBSTATIONS	INSTALLED CAPACITY (MW)
230 kw	2	153
132 kw	3	91
66 kw	--	--

--not available

COUNTRY DATA--BURMA
ENERGY R&D: STATUS AND OUTLOOK

DYF 22 DEC 77

The net output value of power rose 31% over the previous year. Additional power stations increased Burma's installed capacity by about 18%. Mineral production including petroleum climbed 15% above the previous period but the results of offshore oil exploitation have been very disappointing. Most foreign firms which contracted to explore for oil in Burma's waters have completed their obligations without any significant finds are in the process of terminating operations.

COUNTRY DATA--BURMA
KEY REFERENCES

DYF 22 DEC 77

- 1-AREA HANDBOOK FOR BURMA, U.S. Government Printing Office,
Washington, D.C., 1968. .
- 2-Department of State Airgram, Department of Commerce, 1977.
- 3-Oil and Gas Journal, Annual Issue, 12/27/76.
- 4-Factbook, July 1976.
- 5-International Marketing Information Series, U.S. Department of
Commerce, 1977.
- 6-Background Notes, Department of State, 1976.

WENDS COUNTRY DATA

CA: CANADA

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COUNTRY DATA--CANADA
ECONOMIC DATA PROFILE

DLR 14 OCT 77

GNP (1976 \$Million)-185000
EXPORTS (1976 \$Million)-38000
IMPORTS (1976 \$Million)-36900
PER CAPITA INCOME (\$)-6830
MONETARY UNIT-dollar
EXCHANGE RATE-fluctuates within 3 or 4 cents of U.S. dollar

TRANSPORTATION SYSTEM DESCRIPTION

Canada has an extensive and efficient road and rail system, and the St. Lawrence-Great Lakes waterway carries an enormous amount of traffic, allowing ocean ships to serve western ports on Lake Superior.

COUNTRY DATA--CANADA
DEMOGRAPHIC DATA PROFILE

DLR 14 OCT 77

LAND (million sq km)-9.98
ARABLE LAND (million sq km)-.79
POPULATION (millions)-22.9
POPULATION DENSITY (/sq km)-2.3
POPULATION GROWTH (%)-1.5
LITERACY (%)-99
LIVE BIRTHS/THOUSAND-15.5
DEATHS/THOUSAND-7.4
AGRICULTURAL WORKERS-542,000
UNEMPLOYED-447,000

COUNTRY DATA--CANADA
ENERGY POLICY: BASIC LEGISLATION

DLR 14 OCT 77

- 1-Eldorado Nuclear established as Federal Crown Corporation in 1942.
- 2-Atomic Energy Control Board established in 1946.
- 3-Atomic Energy of Canada established in 1952.
- 4-National Energy Board established in 1960.
- 5-Pan-Arctic Oils Ltd. (joint government/industry company) established in 1966.
- 6-Department of Energy, Mines and Resources established in 1966 by restructuring previously existing Department of Mines and Technical Surveys, long active in resource assessment and fossil fuel fields.
- 7-Cape Breton Development Corporation (Federal agency mining coal in that region of Nova Scotia) established in 1968.
- 8-Interdepartmental Task Force and Panel on Energy R&D to coordinate and plan Federal Energy R&D activities, together with supporting Office of Energy Research and Development, established in January 1974, and May 1975 respectively.
- 9-Office of Energy Conservation established within Department of Energy, Mines and Resources, January 1974.
- 10-Petroleum Administration Act passed by Parliament in April 1975.
- 11-Petro-Canada established as Federal Crown Corporation in July 1975.

COUNTRY DATA--CANADA

GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

DLR 14 OCT 77

LEGISLATIVE-a bicameral Parliament composed of a 104-member Senate and a 264-member House of Commons.

EXECUTIVE-Prime Minister (Pierre Trudeau) is the head of the government and presides over the Cabinet which is responsible for federal energy policy in Canada. The following Ministries have energy responsibilities:

MINISTRY	RESPONSIBILITY	MINISTER
Energy, Mines and Resources (EMR)	Overall policy responsibility	Alastair Gillespie
Science and Technology	Fundamental scientific research	Charles Drury
Industry, Trade and Commerce	Fosters energy R&D in industry	Donald Jamieson
Environment	Monitors the effect of energy production, use and regulation	Jeanne Sauve

Below the Cabinet level are the following organizations with energy responsibility:

NATIONAL RESEARCH COUNCIL-interagency committee which has evolved as the most powerful energy R&D policy group. It is currently chaired by Dr. Charles Smith, Senior Assistant Deputy Minister of EMR.

NATIONAL ENERGY BOARD-must license the export of oil, natural gas and electricity.

ATOMIC ENERGY OF CANADA LIMITED (AECL)-responsible for reactor operations and nuclear R&D. AECL currently spends 70% of Canada's budget for energy research.

ELDORADO NUCLEAR LIMITED-responsible for mining, milling and refining of raw materials used in nuclear operations.

ATOMIC ENERGY CONTROL BOARD-acts as lead program agency advising the executive staff on international safeguards and handles all domestic aspects of licensing and regulating the nuclear industry.

COUNTRY DATA--CANADA

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/DLR 14 OCT 77

MINISTRY OF ENERGY, MINES AND RESOURCES (EMR)

MINISTER-Alastair Gillespie

Geological Survey of Canada-resource availability

Office of the Senior advisors-who report to the Deputy Minister or the Senior Assistant Deputy Minister. These offices are principally concerned with resource availability and technical assistance in policy formulation, both domestic and international.

Mines Branch-mining in all of its phases, including coal and oil sands.

Minerals Resource Branch-primarily data collecting and reporting.

Science and Technology-headed by an Assistant Deputy Minister who is responsible for the following:

Office of Energy, Research and Development
Office of Energy Conservation

In addition, the following organizations report independently to the EMR Minister:

Atomic Energy of Canada Limited (AECL)
Eldorado Nuclear Limited
Atomic Energy Control Board

COUNTRY DATA--CANADA
ENERGY POLICY AND OBJECTIVES

DLR 17 OCT 77

The Government of Canada announced that it has adopted energy self-reliance as the overall objective of the national energy strategy. In order to meet this objective the following policy elements have been identified to provide a coordinated framework for the development of specific programs and measures:

- 1-appropriate energy pricing
- 2-energy conservation
- 3-increased exploration and development
- 4-increased resource information
- 5-interfuel substitution
- 6-new delivery system
- 7-emergency preparedness
- 8-increased research and development
- 9-greater Canadian content and participation

COUNTRY DATA--CANADA
DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

DLR 17 OCT 77

The Government of Canada has adopted energy self-reliance as its national energy objective. In doing so, Canada has specifically rejected the concept of self-sufficiency noting that while it might be desirable, it is clearly not a realistic objective in the next ten years, nor a sure possibility even in 15 years. Therefore, Canada does not necessarily want to eliminate oil imports but instead wants to reduce their vulnerability to arbitrary changes in price or prolonged interruptions in supply. Specific targets for energy self-reliance within ten years are:

- 1-To move domestic oil prices toward international levels; and to move domestic prices for natural gas to an appropriate competitive relationship with oil over the next 2-4 years
- 2-To reduce the average growth rate of energy use in Canada, over the next ten years, to less than 3.5% per year
- 3-To reduce the net dependence on imported oil in 1985 to one-third of total oil demands
- 4-To maintain self-reliance in natural gas until such time as northern resources can be brought to market under acceptable conditions
- 5-To double, at a minimum, exploration and development activity in the frontier regions of Canada over the next three years, under acceptable social and environmental conditions

COUNTRY DATA--CANADA
INDIGENOUS ENERGY RESOURCES

DLR 17 OCT 77

NONRENEWABLE	RESOURCES	RESERVES
OIL (billion barrels)	-	9
NATURAL GAS (trillion cubic feet)	71.5	57
NATURAL GAS LIQUIDS (billion barrels)	9.5	8.2
COAL (billion tonnes)	-	9
URANIUM (thousand tonnes)	568	144

COUNTRY DATA--CANADA
PROJECTIONS OF DEMAND

DLR 17 OCT 77

RESOURCE		HIGH-PRICE SCENARIO			LOW-PRICE SCENARIO	
		1975	1985	1990	1985	1990
OIL (thousand b/d)		1749	2359	2739	2482	2887
NATURAL GAS (billion cu. ft./yr.)		1450	2328	2868	2499	3101
COAL (million tons)		28	50	63	53	67
ELECTRICITY (billion KWh)		266	443	566	479	614
TOTAL ENERGY (trillion Btu's)		7867	11668	14186	12433	15190

The high-price scenario is based on the assumption that the price structure of domestic energy adjusts to current levels of international oil prices by the late 1970's. The price of domestic oil, delivered to Toronto, would increase to about \$13 per barrel, in 1975 dollars. The low-price scenario assumes that domestic energy prices will remain at their end-1975 level in real terms and further increases will reflect only the general rate of inflation.

COUNTRY DATA--CANADA
ENVIRONMENTAL CONSIDERATIONS

DLR 17 OCT 77

Department of the Environment established 1970, provides advice and guidelines for environmental protection and development of environmentally-based renewable energy resources.

Fisheries Act (1970), Clean Air Act (1971), Environmental Contaminants Act (1975) regulate emissions and contaminants from all energy producing and energy consuming activities.

Atomic Energy Control Act (1946) created the Atomic Energy Control Board which regulates the use of nuclear materials and nuclear power facilities, including mines and processing plants, based on human health and environmental standards set by the Department of National Health and Welfare and the Department of the Environment.

The Environmental Assessment and Review Process (established by the Cabinet 1973) requires that for any project or activity undertaken by a federal agency, using Federal Government funds or on federal lands, a preliminary review be made of the likely environmental effect; and that if the effect is significant, an environmental impact statement be prepared which is processed and, if necessary, formally reviewed by an Environmental Assessment Panel responsible to the Minister of the Environment. The review may include public hearings.

The provincial governments have provincial environmental authorities, legislation, and environmental review processes which, while varying, cover similar subjects in areas where the provinces have responsibility.

COUNTRY DATA--CANADA
COMMERCIAL APPLICATIONS

DLR 17 OCT 77

Although the results of R&D projects may be attractive, there is a difficulty to proceeding to commercial application in some cases because of the relative smallness of the home market and the relative difficulty in obtaining access to others.

Development of original technologies in Canada is hampered by external ownership of many industries who conduct their R&D elsewhere.

There is difficulty in realizing full benefits of original technical developments due to inadequate protection for patent and know-how rights in the international sphere.

COUNTRY DATA--CANADA
ENERGY R&D: STATUS AND OUTLOOK

DLR 18 OCT 77

R&D in the nuclear system (from resources through heavy water R&D efficiency through reactor research), oil sands and heavy oils, coal, transportation of energy commodities, transmission of electricity, conservation technology and some renewable source technologies are underway in the federal energy R&D program.

It is expected that the current expansion of the nuclear program based upon the CANDU reactor system will continue with attendant R&D projects.

Increased emphasis is being placed upon oil sand, heavy oil and coal R&D projects.

R&D in conservation technology and in the renewable source technologies are expected to receive more support.

Efforts to develop priorities for new energy R&D to match constrained financing are continuing.

COUNTRY DATA--CANADA
ENERGY R&D: BUDGET

DLR 18 OCT 77

EXPENDITURES (\$millions-Canadian)

ENERGY R&D TASK	1975-76	1976-77
CONSERVATION	8.6	10.4
OIL AND GAS	10.5	12.0
COAL	2.8	5.3
NUCLEAR (including uranium resources)	84.8	85.9
RENEWABLE (see note below)	1.6	2.6
TRANSPORTATION AND TRANSMISSION	4.9	6.6
TOTAL	113.2	122.8

Note: Renewable includes hydro and tidal, solar, wind, geothermal and biomass.

COUNTRY DATA--CANADA
ENERGY R&D: PRIORITIES

DLR 18 OCT 77

The Ministry of Energy, Mines and Resources has designated the following priorities:

- 1-Conservation
- 2-Liquid and gas fuels
- 3-Coal
- 4-Nuclear energy
- 5-Renewable energy (solar, wind and geothermal)
- 6-Transportation and transmission

The principal sub-priority items within the nuclear field are (in order):

- 1-Advanced CANDU
- 2-CANDU with a thorium cycle
- 3-New technology for heavy water production

COUNTRY DATA--CANADA
ENERGY R&D: IMPACT

DLR 23 FEB 78

NON-RENEWABLE PRIMARY ENERGY SAVINGS FROM
NEW TECHNOLOGIES

TRILLION BTU

	1985	2000
SOLAR HEATING	.09	2.94
WASTE HEAT (Coupled Production)	1.14	34.63
WIND CONVERSION	0	28
IRON/STEEL INDUSTRY	35.58	91.27
TAR SANDS	222.61	740.99

COUNTRY DATA--CANADA

GOV'T SUPPORTED ENERGY R&D IN IND, UNIV & NAT'L LABS

DLR 18 OCT 77

INDUSTRY	PROGRAM AREA	KEY INDIVIDUAL
Atomic Energy of Canada Limited	Heavy water and reactor development	Dr. A.J. Mooradian
Hydro-Quebec	Electrical production and transmission	Dr. Lionel Boulet
Ontario Hydro	Electrical production and transmission	Mr. F.J. Simpson
Alberta Oil Sands Technology and Research Authority	Oil sands and heavy oil extraction research	Dr. C.W. Bowman
Eldorado Nuclear Limited	Uranium and thorium extraction research	Mr. R.G. Dakers
UNIVERSITIES		
University of Alberta	Hydrocarbon Research Institute	Dr. O.P. Strausz
University of Calgary	Petroleum Recovery Institute	Mr. Peter Benn
LABORATORIES		
Research Council of Alberta	Fossil fuel research	Dr. E.J. Wiggins
Energy Research Laboratories of Dept. of Energy, Mines & Resources	Fossil fuel research	Dr. B.I. Parsons
Biomass Institute	Biomass and solar research	Mr. E.E. Robertson
National Research Council of Canada	Renewable energy sources, including solar, wind, waves and biomass. Fusion research and special scientific studies.	Dr. E.P. Cockshutt
Department of Agriculture	Biomass research	Dr. C.G.E. Downing
Department of the Environment	Environmental aspects of the energy industries; forestry and water studies; program to assist industry, including energy industry, overcome emissions.	
Bruce Research Institute	Solar and wind energy	Dr. T. Laward

COUNTRY DATA--CANADA

ENERGY R&D: ROLE OF PRIVATE INDUSTRY

DLR 18 OCT 77

Principal oil companies active in exploration and production research, reservoir engineering, and in studies of methods of building Northern pipelines; several are engaged in in-situ recovery studies in the oil sands.

Several large electrical and manufacturing firms participate in aspects of the nuclear development program.

Canadian government policy is to contract the performance of as much of the Federal R&D program to industry as possible.

Incipient Federal coal conversion program aims to fund necessary activities in Canada at about the 50% level but with work to be performed preferably by potential users in the industrial sector.

Industry/Provincial/Federal joint underground gasification trial beginning in Alberta in 1976.

There is a strong national position in the field of research and development of hydraulic turbines.

COUNTRY DATA--CANADA

INVOLVEMENT IN INTERNATIONAL ENERGY R&D ORGANIZATION

DLR 18 OCT 77

ORGANIZATION	DEGREE OF INVOLVEMENT
IAEA	Active
IEA	Active
EEC	Inactive
CCMS	Active
NEA	Inactive

DETAILS OF INTERNATIONAL ENERGY AGENCY

TECHNOLOGY AREA

CANADIAN INVOLVEMENT

Energy R&D strategy study

Participant

Coal

Monetary support

Economic Assessment

Technical Information Service

Mining Technology Clearing House
Service

Nuclear Safety

Signatory to implementing
agreementThermonuclear Fusion-Intense Neutron
SourceSignatory to implementing
agreement

COUNTRY DATA--CANADA
ASSESSMENT OF INTERNATIONAL ACTIVITIES

DLR 18 OCT 77

The main objective in entering into international cooperative agreements in the field of energy R&D is to extend the national program in such a way as to:

- 1-save funds by cooperating on projects otherwise undertaken in parallel;
- 2-reduce technical risk in undertaking new technologies;
- 3-save time in the introduction of new technologies;
- 4-gain access to certain specialized apparatus or services;
- 5-cover off-research areas of possible future interest which cannot at present be adequately covered by the national program.

Cooperation at the international level, whether bilateral or multilateral, is desirable when any or all of these objectives can be met.

The main difficulties of cooperation in the international sphere are:

- 1-delays in the formulation of projects in an agreed way;
- 2-management problems, particularly when difficulties are encountered that require fast decisions and additional funding;
- 3-problems of a legal nature arising when the collaboration of private companies is desirable;
- 4-intellectual property management.

The main difficulties for Canada in respect of international cooperation revolve around the necessity of developing the national R&D program before making external commitments.

COUNTRY DATA--CANADA
KEY REFERENCES

DLR 18 OCT 77

LOCATION

- 1-An Energy Strategy for Canada: Policies For
Self-Reliance, Ministry of Energy, Mines and
Resources, Canada, 1976
- 2-State Dept Telegram 00202 from AMEMBASSY OTTAWA
16 JAN 76 (unclassified)

IA

IA

COUNTRY DATA--CANADA
NOTES AND EVALUATIONS

DLR 23 FEB 78

LOCATION

- | | |
|---|-----|
| 1-Canada Nuclear Energy Program Summary, 1975 (2B, 5B) | IA |
| 2-An Energy Strategy for Canada: Policies For
Self-Reliance, Ministry of Energy, Mines and Resources,
Canada, 1976 (3A, p.126; 3B, p.123-4, 147-8; 3E, p.73-4,
80-1; 4B, p.145) | IA |
| 3-"Canada", The Statesman's Year-Book 1976-77 (1B,
p.241, 253; 2B, p.239) | -- |
| 4-State Dept Telegram 00202 from AMEMBASSY OTTAWA 16 JAN 76
Unclassified (2B, 1 of 1 p.1-4; 2C, 1 of 1 p.2-3; 4C,
2 of 3 p.3) | IA |
| 5-State Dept Telegram 00317 from AMEMBASSY OTTAWA 26 JAN 76
Unclassified (5A) | IA |
| 6-State Dept Airgram A-161 from AMEMBASSY OTTAWA 05 MAR 76
Unclassified (4C, p.1) | IA |
| 7-State Dept Telegram 00127 from AMCONSUL CALGARY 19 MAR 76
Unclassified (3C) | IA |
| 8-Handbook of Economic Statistics 1976, CIA, SEP 76
(3C, p.78) | IA |
| 9-Canada Questionnaire on National Programs of Energy R&D
IEA/CRD/Energy R&D Strategy Report, Appendix D, 13 AUG 76
(2A, 3G, 3H, 4A, 4E, 4F, 5A, 5C) | IA |
| 10-Canada uranium mineral reserves, Predicasts, Inc. (data
base), Cleveland, Ohio, 1977 (3C) | DOE |
| 11-Brussels Office Activity Report, Period FEB 16-28, 1977
(5B, p.1) | IA |
| 12-State Dept Background Notes on Canada, MAR 77 (1A, p.1,
6; 1B, p.1; 2B, p.1) | -- |
| 13-An Initial Multi-National Study of Future Energy Systems
and Impacts of Some Evolving Technologies, Jointly
prepared by Brookhaven National Laboratory and
Kernforschungsanlage Juelich, MAR 77 (4D, p.48-49) | IA |

--References thus marked are available at public libraries

WENDS COUNTRY DATA

CH: CHINA

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COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ECONOMIC DATA PROFILE

EHF 06 MAR 78

GNP (1976 million \$)-324,000	PER CAPITA GNP (\$)-340
GROWTH PROJECTION (thru 1980)-6.0 to 6.5% per annum	
INFLATION RATE-domestic prices controlled; reliance on rationing	
EXPORTS (1976 million \$)-6,900	IMPORTS (1976 million \$)-6,000
of which Energy-source Goods-800	
MONETARY UNIT-Renminbi (yuan)	EXCHANGE RATE (Jan 78, 1US\$=)-
	1.70 yuan

NOTE: No nationwide statistics have been published by Chinese authorities since 1960. All data provided here and elsewhere are the educated guesses of Western experts.

TRANSPORTATION SYSTEM DESCRIPTION

HIGHWAY MILEAGE (1976 th kms)-820	RAILWAY MILEAGE (1976 th kms)-50
of which All-weather (%) -25	WATERWAYS, INLAND (1974 th kms)-
Improved earth (%) -25	168
Unimproved (%) -50	PIPELINES, OIL (1976 th kms)-4.7
VEHICLES (1969)-409,000 trucks	(#)-9
(est) 60,000 cars	(1975)-914,000 trucks
30,000 buses	8,300 mainline locomotive
MERCHANT MARINE TONNAGE (1976)-7	556 merchant ships
million DWT	
PORTS (1974)-9 major	AIRPORTS (1974)-7 international
10 secondary	

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
DEMOGRAPHIC DATA PROFILE

EHF 06 MAR 78

LAND (million sq kms)-9.59	ARABLE LAND (million sq kms)-1.05
POPULATION (1976 millions)-951	POPULATION DENSITY (/sq km)-99
	Density varies from under 10
	in the West to over 100 in East
LITERACY (1975 %)-50-55	% RURAL POPULATION-85
BIRTHS/THSND (1977)-24.1	DEATHS/THSND (1977)-8.8
MEDIAN AGE/MALES (1977)-20	MEDIAN AGE/FEMALES (1977)-21
INDUSTRIAL LABOR FORCE (1972)-30 million	
COAL INDUSTRY WORKERS (1978)-3 million	
POPULATION GROWTH (1975 %)-2	TARGET POPULATION GROWTH 1980
	(%)-1.5

NOTE: No nationwide statistics have been published by Chinese authorities since 1960. All data provided here and elsewhere are the educated guesses of Western experts.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
PROFESSIONAL LABOR FORCE PROFILE

EHF 06 MAR 78

TOTAL SCIENTIFIC AND ENGINEERING MANPOWER (1975)-1,300,000
"SCIENTISTS" PRODUCED DURING PERIOD 1970-75 - 200,000
(training at or beyond the middle-school level)

Disruptive impact of Cultural Revolution period is still evident. Although official policy once again encourages and supports advanced education and research, many scientific personnel have yet to fully resume their former activities and the first university students admitted under new exam procedures did not begin their studies until February 1978. According to the head of the Chinese Academy of Sciences, various fields of work are keenly feeling the shortage of successors for scientific and technical endeavors. Science and education are lagging so far behind that they are seriously hindering the realization of the four modernizations--agriculture, industry, science and technology, and defense.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
KEY TECHNICAL EDUCATIONAL RESOURCES

EHF 06 MAR 78

LOCATION

Chinese University of Science and Technology (under the Chinese Academy of Sciences)	Anhwei
People's University of China	Peking
Peking University	Peking
Amoy University	Fukien
Futan University	Shanghai
Inner Mongolia University	Huhehot
Lanchow University	Lanchow (Kansu Province)
Nankai Univeristy	Tientsin
Nanking University	Nanking
People's University of North East China	Changchun (Kurin Province)
North-West University	Sian (Shensi Province)
Shantung University	Tsingtao
Sun Yat-sen University	Canton
Szechuan University	Chengtu
Tsinghua University	Peking
Wuhan University	Wuhan (Hupeh Province)
Yunnan University	Kunming

At the beginning of the Cultural Revolution (1966), the major educational institutions were closed. In 1974, the Chinese reported that there were over 167,000 students again enrolled in institutes of higher education. A large new enrollment increase is expected to follow the recent reinstitution of nationwide entrance exams.

With postgraduate training at universities almost completely abolished from 1966 to 1977, research institutes took over much of the responsibility for training. Given the present political climate, enrollment in graduate programs is expected to increase.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY POLICY: BASIC LEGISLATION

EHF 06 MAR 78

AREAS OF BASIC LEGISLATION AFFECTING ENERGY POLICY

- 1-"Four Modernizations" program proposed by Premier Chou En-lai was ratified by Fourth National People's Congress January 1975. Program calls for economic modernization by year 2000. Sectors assigned priority include agriculture, industry, science and technology, and the military.
- 2-1975 National Coal Conference set out program for coal industry modernization.
- 3-National Conference on Learning from Taching in Industry, May 1977, expanded original Chou En-lai proposals, issuing specific guidelines for economic growth through year 2000-and beyond.
 - a-Construction by year 2000 of ten new Taching-size oil fields;
 - b-Accelerated development of industry, particularly of iron and steel, petroleum, coal, power, chemical, machine building and other basic industries, to meet needs of mechanizing agriculture and strengthening military;
 - c-Overtaking of U.S. economically by period 2006-16;
 - d-Division of China into six great economic regions by 1985.
- 4-China Petroleum and Natural Gas Corporation established latter half 1977 as part of petroleum industry restructuring.
- 5-China Oil and Gas Exploration and Development Corporation merged into the new Petroleum Corporation 1977.
- 6-Ministry of Petroleum and Chemical Industry divided into a Ministry of Petroleum and a Ministry of Chemical Industry 1978.
- 7-State Scientific and Technological Commission reestablished 1978.
- 8-State Economic Commission established 1978.
- 9-Two multi-year plans presently guide the Chinese economy; a ten-year plan (1976-85) and the Grand Plan, which extends into the next century.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

EHF 06 MAR 78

EXECUTIVE--CHAIRMAN (Chinese Communist Party)

Defacto control of all areas of national energy policy is in the hands of Chinese Communist Party. Party leaders hold key positions in government and economy.

Party Chairman (Hua Kuo-feng) is constitutional head of Military Affairs Commission and defacto Chief of State.

Politburo Standing Committee is the highest Party body and one with final state and party policymaking authority. Politburo appears to share highly centralized responsibility for energy planning with the State Planning Commission.

State Council, headed by the Premier (Hua Kuo-feng) and First Deputy Premier (Teng Hsiao-ping), is responsible for the execution of energy policy. Ministries with primary energy responsibility include:

- 1-Ministry of Petroleum responsible for oversight of both the petroleum and natural gas industries;
- 2-Ministry of Coal Industry (Minister Hsia Han) responsible for oversight of the large-mines coal industry;
- 3-Water Conservancy and Electric Power Ministry responsible for oversight of the large-scale electric power industry;
- 4-Foreign Trade (Li Ch'iang) responsible for overseeing the foreign trade corporations and for negotiating trade agreements.

LEGISLATIVE--State and Party CONGRESSES

National Party Congress meets from time to time to ratify party policy. The Congress elects a 319-member Central Committee, which in turn elects the Politburo and the top party leaders.

National People's Congress is constitutionally China's Supreme legislative body. It has met rarely in practice; the recent February 1978 Congress was only the fifth since 1949. The People's Congress endorses state policy plans, nominations to the State Council, and amendments to the Constitution.

OTHER PARTS OF THE ENERGY STRUCTURE

- 1-State Planning Commission (head Yu Ch'iu-li) is an arm of both the State Council and Party Central Committee. It develops the national economic and energy plans, and coordinates the activities of the primary energy ministries with the ministries having lesser energy involvement such as Foreign Affairs, Economic Relations with Foreign Countries (Minister Chen Mu-hua) and the seven machine-building ministries.
- 2-Chinese Academy of Sciences (head Fang Yi) conducts advanced energy research, both basic and applied. A Ministry-level institution, the Academy emerged during 1977 as a leading organization in the new Grand Plan modernization drive.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

EHF 06 MAR 78

- 3-State Scientific and Technological Commission (head Fang Yi)
established in 1958, abolished during Cultural Revolution
and recently reestablished to provide top-level coordination
of science and technology under the State Planning Commission.
- 4-Scientific and Technological Commission for National Defense
responsibilities include nuclear weapons R&D.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
 ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/EHF 06 MAR 78

NUCLEAR

Civilian nuclear program is limited to R&D. China has no commercial reactors.

- 1-Institute of Atomic Energy, Chinese Academy of Sciences, Peking, which does basic nuclear research, has a study group looking at China's future power program including possible development of nuclear power.
- 2-Shanghai Nuclear Physics Institute, Peking University, Nanking University and Tsinghua University conduct general nuclear research.

NON_NUCLEAR

State Planning Commission coordinates the implementation of non-nuclear energy policy and plans, energy supply and R&D, and international affairs, by the various ministries and levels of government.

- 1-State Scientific and Technological Commission (headed by Fang Yi), a subcommission of the State Planning Commission, coordinates energy R&D.
- 2-Chinese Academy of Sciences (headed by Fang Yi) conducts much advanced energy R&D. It shares jurisdiction over many of its research institutes with provincial governments. Energy R&D is also conducted by ministries, universities, and provincial and local governments.
- 3-State Economic Commission, established February 1978, headed by Kang Shih-en, former Minister of Petroleum and Chemical Industries. SEC energy field responsibilities are as yet unclear.
- 4-Ministry of Petroleum, recently shorn of chemical industry responsibilities, administratively oversees the petroleum and natural gas industries.
- 5-China Petroleum and Natural Gas Corporation (President Sun Ching-wen, who is also Petroleum Industry Vice-Minister) is an independent entity reporting administratively to the Petroleum Ministry. Its present enterprises are:
 - a-China Oil and Gas Exploration and Development Corporation responsible for finding and developing new oil fields;
 - b-North East Branch Petroleum Corporation (Director Li Yukeng) responsible for oil production in the North East Region;
 - c-North China Branch Petroleum Corporation responsible for North Region oil production;
 - d-North West Branch Petroleum Corporation responsible for North West Region oil production;
 - e-Refining Corporation;
 - f-Petrochemical Corporation which may have been removed from the Petroleum Corporation as part of recent Ministry restructuring.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/EHF 06 MAR 78
(CONT)

New Branch Corporations are to be added eventually.

- 6-Ministry of the Coal Industry (Minister Hsia Han) administratively oversees the large-mines coal industry. Coal development is considerably less centralized than either oil or natural gas. Much coal development seems to result from local or provincial initiative.
- 7-China National Mining Committee (Chairman Hsu Tsai-lien is also Coal Industry Vice-Minister). Responsibilities not clear.
- 8-Ministry of Water Conservancy and Electric Power administratively oversees large-scale power industry. Small-scale power sources come under local jurisdiction.
- 9-Ministry of Foreign Trade oversees the nine state foreign trade corporations and negotiates trade agreements.
- 10-China National Metals and Minerals Import and Export Corporation handles foreign sales of Chinese primary energy resources. Other trade corporations handle the trade in technology and equipment.
- 11-National Conferences devoted to priority areas whip up support for announced policy and ensure coordination of national and local programs. Last coal conference was 1975, petroleum 1977. 1978 schedule includes education and science.
- 12-Six Great Regions are being reestablished for economic coordination and planning purposes. Regional administrations for both oil and coal production are being set up.
- 13-Provincial-level energy policy execution and R&D oversight is the responsibility of Science and Technology Bureaus. Local-level energy program implementation is the responsibility of Science and Technology Groups. Local and provincial governments also originate policy and R&D programs of their own appropriate to local conditions. Local research institutes concentrate on applied research and intermediate technologies.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY POLICY AND OBJECTIVES

EHF 06 MAR 78

MODERNIZATION PLANS

The Grand Plan for modernization of the economy, announced during 1977, calls for accelerated development of the primary energy and basic industrial sectors as well as greatly increased attention to science and technology, in order to meet the needs of a mechanizing agriculture and a strengthening military.

A comprehensive and independent economic base is to be achieved by 1985 (end of Ten-year Plan), and full modernization is to come by about 2010.

OIL OBJECTIVES

"Ten more Taching-type" oil fields by the 2000 was the oil industry objective announced at the 1977 Taching Conference. To achieve this objective, drilling and exploration would have to be greatly stepped up, both on and offshore.

Strategic concerns appear to be spurring a shift of petroleum development activity away from the Soviet border (Taching in Northeast and Dzungarian Basin in Northwest) to areas along the Gulf of Chihli (Po Hai) and offshore.

COAL OBJECTIVES

Announced goal for the coal industry as of 1977 is to double output in ten years and triple it by the turn of the century. Accelerated mechanization and modernization of existing mines is to be the main means of achieving the goal.

Local, small collieries already account for about 30% of total coal output. The government encourages their continued proliferation. It also encourages local use of low-grade coal substitutes such as stone and sapropelic coal, particularly for local power generation. Desire is to free large-mines output for use by heavy industry and for export.

NUCLEAR

No nuclear power development plan yet appears to have been formulated.

NATURAL GAS

Production and use is still largely confined to Szechuan Province. No evidence yet of plans for a nationwide development program.

HYDROPOWER

Peking is strongly encouraging further local development of hydropower as part of expanded irrigation and earthmoving projects.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY POLICY AND OBJECTIVES (CONT)

EHF 06 MAR 78

EXPORTS

Increased export of petroleum to pay for advanced technology and equipment imports was first acknowledged as official policy during January 1978. Largest expressed oil export goal is for export of 1 million barrels of oil per day to Japan by 1980. Possible export of millions of tons of coal per year has also been referred to in Chinese statements.

CONSTRAINTS

Technical: Coal extraction is becoming increasingly difficult and costly. Further development must rely on larger inputs of capital rather than cheap manpower. Achieving stated oil objectives will require greatly increased import of foreign technology and equipment, and perhaps movement offshore.

Serious inefficiency in production and consumption of energy has yet to receive much attention in policy planning.

Economic: Funds available for investment in energy sector are limited. Petroleum industry may have to be slighted if present shortages of coal and electricity are to be overcome. Whatever the final breakdown, the economy is probably capable of absorbing nearly all energy produced, leaving little for export. The government appears willing, however, to accept slower overall growth if increased energy exports are necessary to gain accelerated growth of priority sectors.

Human: China presently lacks an adequate pool of scientific and engineering manpower.

Political: Policy decisions are made and implemented at provincial and local levels as well as in Peking, making difficult formulation of a comprehensive national energy policy.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

EHF 06 MAR 78

China is energy self-sufficient. No significant imports of any major energy resource have occurred since the 1950's, and past experience indicates Peking would accept lower domestic economic growth rather than once again become dependent on any foreign source of energy supply.

Temporary, local shortages of coal and electricity are routine, despite basic self-sufficiency. Caused in the past by errors of planning and problems of transportation, coal shortages have become more serious since 1973 due to labor troubles, transportation bottlenecks and the 1976 earthquake. A campaign of "rigid economy" in consumption of coal, oil and electricity was announced during 1977.

Given anticipated increases in domestic demand, it is unlikely that China will soon have a large energy surplus available for export unless the government chooses deliberately to restrain domestic demand growth, at least in nonpriority sectors.

As great a degree of regional and even local energy self-sufficiency as is possible also appears to be desired by Peking. Each of the six Great Regions is to have its own coal production bases by 1985.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
INDIGENOUS ENERGY RESOURCES

EHF 06 MAR 78

NONRENEWABLE	RESOURCES	RESERVES	LOCATION OF IDENTIFIED RESERVES
COAL (billion tonnes)	1,000 (World Energy Conference 1974 est)	80	Northeast, East and South near Ch'ang-sha
CRUDE OIL ONSHORE (billion tonnes)	5.6-9.3 (CIA 1977 est)	2.2	Far West, North and Northeast, South
OFFSHORE	Unknown	Unknown	
SHALE OIL	--	--	Northwest, North, Northeast, South
NATURAL GAS (billion cubic meters)	--	--	Szechuan and Tsai- dam Basins, and in oil fields near Canton and Shanghai
URANIUM (thousand tonnes U308)	20-100	--	
RENEWABLE			
HYDROELECTRIC (billion kWh/yr)	1,320	--	Southwest, upper reaches of Yellow River and East Chin

NOTES:

TOTAL RESOURCES

China is an energy resources super power. Of the world's eight most populous developing nations, only Mexico has larger per capita reserves of fossil fuels and hydro energy. In absolute reserves, China ranks first in this eight-nation ranking.

COAL

With about 20% of world total, coal reserves rank third in world.

CRUDE OIL

"...there probably is greater uncertainty in estimating oil reserves in China than for any other region of the world. The Chinese themselves have not yet amassed all the necessary data. Off-shore reserves, although possibly very large, are as yet the subject of conjecture only." -CIA 1977

Largest onshore oil reserves are in the West, but for strategic and economic reasons the most heavily exploited fields are in the Northeast (Taching) and North (Shengli, Takang). With production at Taching, China's largest producing field, in serious decline, speculation that China will soon move offshore is mounting. Possible offshore basins include Po Hai, Kiangsu, Taiwan, and Liu-chou (Gulf of Tonkin east to Hong Kong).

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
INDIGENOUS ENERGY RESOURCES (CONT)

EHF 06 MAR 78

NATURAL GAS

Reliable reserve/resource estimates not yet possible.

URANIUM

China is probably among the world's five top uranium resource countries.

HYDROPOWER

China is potentially the richest hydropower country in the world, but 3/4 of this resource potential is located in the thinly populated and lightly industrialized Southwest.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
PATTERNS OF ENERGY SOURCES AND USES

EHF 06 MAR 78

COMMERCIAL SOURCES

(1974 Vaclav Smil est)	CONSUMING SECTOR (million tonnes coal equivalent)					TOTAL
	ELECTRIC GENERATION	INDUS- TRIAL	TRANS- PORT	AGRICUL- TURAL	RESIDEN/ COMMERCIAL	
COAL	28.6	112.3	22.3	2.5	85.5	251.2
CRUDE OIL	3.0	52.7	4.1	15.1	1.0	76.2
NATURAL GAS	2.0	26.0	--	--	18.6	46.6
HYDRO	--	2.5	--	0.6	0.2	3.3
TOTAL ENERGY	33.6	193.7	26.4	18.2	105.3	377.2

(1976 CIA est)	INDUSTRY & CONSTRUCTION	AGRICUL- TURE	TRANSPOR- TATION	RESIDEN/ COMMRL	TOTAL
TOTAL ENERGY	307	32	25	133	407
COAL					330
of which Small Mines					-109
of which Large Mines					-221
CRUDE OIL					113
NATURAL GAS					50
HYDROELECTRIC					4

NON-COMMERCIAL SOURCES (million tonnes coal equivalent)	TOTAL
BIOMASS (wood, grass, crop residues, etc.)	80
ANIMATE	80
TOTAL NON-COMMERCIAL SOURCES	160

Perhaps 1/4 to 1/3 of energy being consumed in China still comes from traditional, non-commercial sources. As do other countries in the midst of shifting to commercial energy sources, China has a high commercial energy/GNP growth elasticity. The present ratio is about 1.5.

UTILITY ELECTRICITY

DISTRIBUTED

(billion kWh)	(1977)--145
	(1976)--129
	(1975)--121; of which thermal-91; hydroelectric-30

Approximately 10-20% of China's coal is used for thermal generation of electricity.

--not available

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
PROJECTIONS OF DEMAND

EHF 06 MAR 78

REQUIRED ENERGY GROWTH-as a function of economic growth (based on
an energy-GNP growth elasticity of 1.47)

GNP GROWTH PROJECTION	REQUIRED ENERGY GROWTH
High-8%	11.8%
Medium-6%	8.8%
Low-4%	5.9%

PROJECTIONS OF TOTAL ENERGY DEMAND
(million tonnes coal equivalent)

(CIA 1977 est)	1976	1980	1985
High Growth	--	760	1336
Medium Growth	497	722	1182
Low Growth	--	678	1012

PROJECTED ANNUAL GROWTH RATES IN ENERGY CONSUMPTION
(by sector, 1977-85)

(CIA 1977 est)	AGRICUL- TURE	INDUSTRY	TRANSPOR- TATION	RESIDEN/ COMMRCL
High Growth	20%	13%	6%	5%
Medium Growth	17.5%	11.5%	5%	4%
Low Growth	15%	10%	4%	3%

--not available

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
PROJECTIONS OF ENERGY SUPPLY, IMPORTS, AND EXPORTS

EHF 06 MAR 78

RESOURCE	1976	1977	1978	1980
COAL (million tonnes)				
TOTAL PRODUCTION	448	490	500-540	--
CRUDE OIL (million tonnes)				
TOTAL PRODUCTION	83.6	--	--	120-140
INDIGENOUS SUPPLY	75.8	--	--	--
EXPORTS	7.8	--	--	--
SHALE OIL (million tonnes)				
TOTAL PRODUCTION	(1971) 2			
NATURAL GAS (billion cubic meters)				
INDIGENOUS SUPPLY	37			
TOTAL ENERGY including also hydro				
	1976	1980	1985	
SUPPLY (million tonnes coal equivalent)				
(production minus losses)				
HIGH Supply Growth	--	762	1444	
MEDIUM Supply Growth	497	701	1151	
LOW Supply Growth	--	647	937	

PROJECTED PRODUCTION BY SOURCE-% share of total

	COAL	OIL	GAS	HYDRO	TOTAL
1976	65.0	24.6	9.8	0.8	100
1980, med proj.	59.0	28.8	11.5	0.7	100
1985, med proj.	49.6	35.5	14.3	0.6	100

NOTES:

COAL--China's large Kailuan mines, source of about 10% of large-mine production, were hard hit by the 1976 earthquake. 1977 output was 12.5 tons, about half that of 1975. Intensive repair work is continuing. Coal exports remain small, reflecting internal shortages.

EXPORT VALUE (1976 million \$)-

COAL-95

CRUDE OIL-665

PETROLEUM PRODUCTS-175

IMPORT VALUE (1976 million \$)-

PETROLEUM AND PRODUCTS-45

--not available

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENVIRONMENTAL CONSIDERATIONS

EHF 06 MAR 78

Heavy use of coal is a major cause of the high level of air pollution in many Chinese cities. Reliance on coal energy has been declining and the pollution problem may be at least a secondary reason. There is some evidence of research dedicated to pollution abatement and at least some Chinese officials have expressed public concern about the level of coal pollution. Both Chinese and Western commentators express skepticism about whether any eventual air standards could be enforced in face of increasing pressure for faster economic expansion.

Chinese crude, although low in sulphur, has a high paraffin content. Prior to importing it in large quantities, foreign countries would need to make expensive adjustments to their refineries. To date, the Chinese have refused to adjust their prices in recognition of this difficulty. Oil from eventual offshore wells should prove less troublesome.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
COMMERCIAL APPLICATIONS

EHF 06 MAR 78

RESEARCH CAPABILITY

Following a decade of political and economic turmoil, China lacks adequate personnel and facilities for extensive basic research. Recent renewed attention to science and education should begin correcting this deficiency.

FOREIGN TECHNOLOGY

Present U.S. law prohibits export to Communist countries of certain goods--including oil-exploration equipment and computers that might be used for military purposes. Senator Henry M. Jackson (Dem., Washington) has asked the Energy Secretary to establish a task force to evaluate Chinese requests for purchase of American petroleum technology.

Need of the Chinese to import foreign technology in order to develop their energy resources may not be as great as frequently characterized. The Chinese already produce their own oil rigs, refineries and basic coal mining equipment; and despite an inadequate supply of fully-trained technical personnel, they have proven adept at developing a domestic production capability after import of only several units of an advanced technology product.

Potential for use of foreign technology to speed development of Chinese oil may be limited in any event. Chinese basins are of the continental lacustrine type, while primary expertise of Western oil producers is the exploitation of marine sedimentary deposits.

FOREIGN EQUIPMENT

Despite technical capability and emphasis on self-reliance, imports of foreign equipment could still rise dramatically due to shortages of key commodities such as steel and as a result of accelerated priority development of such basic industries as mining, petroleum, chemicals and electric power.

FINANCING

A relaxation of the aversion to use of foreign credit to finance imports appears to be in progress. Deferred payment periods are lengthening, witness the recent Sino-Japanese Trade Agreement with payments spread over eight years.

FOREIGN INVESTMENT

Present policy forbids all forms of direct foreign investment including joint ventures. Self-reliance appears destined to remain a cardinal principle of Chinese energy and economic development policy. Should some form of foreign participation be allowed in the future, policy and managerial control can be expected to remain firmly in Chinese hands.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
POWER PRODUCTION AND ENERGY CAPABILITY

EHF 06 MAR 78

TYPE PLANT	Total GWe	POWER PRODUCTION (1976 capacity)				
		0-30	30-299	300-500	500+MWe (Plants in each range)	
THERMAL	23.9	--	92	11	2	EXISTING
HYDROELECTRIC	13.5	--	--	--		
Major Plants	9.5	--	44	3	6	EXISTING
Small, rural	4.0	65,000	--	--	--	EXISTING

NOTES:

Thermal--Roughly 75% of thermal plants are coal-fired; the remaining 25% fired with crude or residual oils. Natural gas contributes only a minute share of generating capacity.

Hydroelectric--The 65,000 small, rural stations typically average a capacity of about 50 kw, but larger units are being introduced. Due to greater inefficiency in use, hydro sources account for only about 20-25% of power produced, while constituting 36% of installed capacity.

Nuclear--China has no nuclear power stations, has built one experimental power reactor. She is fully capable of building commercial reactors whenever the costs appear to warrant it.

PROJECTED GENERATION CAPACITY--(1976) 37.4 GWe
(1977) 43 GWe
(1980) 65.4 GWe
(1985) 132.0 GWe

SOURCE	OUTPUT 1976	ENERGY PRODUCTION	
		RESERVES	TOTAL OUTPUT TO DATE
COAL			
Large Mines	300 MILLION TONNES	80 BILLION TONNES	--
Small Mines	148 MILLION TONNES		
OIL WELLS	84 MILLION TONNES	2.2 BILLION TONNES (onshore)	504 MILLION TONNES
NATURAL GAS	37 BILLION CUBIC (1975)	700 BILLION CUBIC METERS	--

BIOGAS--There were some 410,000 biogas digesters in China in 1976, according to Chinese sources. Most were located in a few counties of Szechuan Province.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
POWER PRODUCTION AND ENERGY CAPABILITY (CONT)

EHF 06 MAR 78

HYDRO POTENTIAL-is very large but often remotely located.

OIL FIELDS-about 100 onshore oilfields, of which largest are at
Taching, Shengli, Takang and Karamai.

REFINING CAPACITY (1977)-45 million tonnes.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY INDUSTRIES

EHF 06 MAR 78

PETROLEUM PROSPECTOR-1 (China Oil and Gas Exploration and Development Corporation)

PETROLEUM EXTRACTION FIRMS-3 (branches of the Petroleum Corporation)

REFINERY OPERATOR-1 (Refining Corporation of the Petroleum Corporation)

REFINERIES-about 40

COAL EQUIPMENT-All equipment for new mines opened during 1977, including "new" types of hoisting machines, automatic control devices, excavators and scraper conveyors, was reportedly designed and produced domestically.

COAL TRANSPORTATION FIRM-1 (China Railway)

ELECTRICAL GENERATION EQUIPMENT MANUFACTURERS-12 major plants

ELECTRICAL TRANSMISSION EQUIPMENT-6 major plants

(Electrical equipment and components are also produced by many smaller plants, especially for use in the countryside.)

ENERGY EXPORTING FIRM-1 (State trading company)

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY R&D: STATUS & OUTLOOK

EHF 06 MAR 78

R&D in such areas as petroleum (onshore), coal, power generation, power transmission and small-scale biogas is well established. Major energy technology is generally behind the West, but improving steadily.

Shortcomings of Chinese science and technology frequently cited by visitors include duplication of research, a lack of basic research and a shortage of advanced personnel.

Greater attention to energy R&D can be expected as the government strives to keep energy output in pace with renewed growth, agricultural mechanization, military modernization and increased energy exports. Greater import of coal equipment, electrical equipment and off-shore oil technology can also be expected.

INEFFICIENCY

Inefficiency is great in production and consumption of all types of energy and has worsened in recent years. Large amounts of energy could be freed through efficiency gains for either domestic or export use. The biggest potential for such gains is from natural gas.

PETROLEUM

Onshore drilling equipment and techniques are considered excellent. But production at Taching, China's largest field, is now in serious decline, leading to speculation that China will soon move heavily into development of off-shore fields. Resources in the Po Hai are already being explored. This bay is close to centers of industry, population and onshore drilling, and is not disputed international waters.

COAL

Plans for increased coal production call for further tapping of existing reserves and achieving capacity at existing fields rather than new exploration and development. The Chinese appear quite good at long-wall mining. Deepness of most deposits explains lack of open-pit mining.

Coal production is complicated at present by problems of transportation and utilization as well as by labor troubles and increasing costs of extraction. Coal liquefaction or gasification are alternatives the Chinese may have to consider if past production growth rates are to be maintained.

THERMAL POWER

Thermal power generation capability is growing steadily. China's first plant with capacity over 1000 MW became operational in 1974.

HYDRO POWER

The number of small, rural hydropower stations has increased dramatically in recent years. Total hydro potential is great but will remain largely untapped until the Chinese develop transmission equipment capable of bringing power from the hydro-rich but isolated Far West.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY R&D: STATUS & OUTLOOK

EHF 06 MAR 78

NUCLEAR

The Chinese have the technological and resource capability to build small nuclear power plants but have yet to do so.

NATURAL GAS

Due to failure to develop a system of pipelines, nearly all natural gas is consumed in Szechuan Province near its area of production. Fully 50% is thought to be lost between wellhead and final user.

SOLAR

Solar energy R&D is under way. Much of China has excellent climate for tapping solar energy but this potential remains largely unrealized. As with hydroenergy, the most suitable regions are also the most isolated and there is not of yet any practical way to transport solar energy.

GEOTHERMAL

R&D has begun with China's first experimental geothermal power generator which became operational at 86 kw in 1971.

BIOGAS

The use of biogas digesters to produce methane is well established in Szechuan Province.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY R&D: BUDGET

EHF 06 MAR 78

No recent budget information is available. However, during the 1952-65 period, the science budget was the fastest growing section of the state budget. By 1965, the ratio of government scientific expenditures to total government expenditure was thought to approximate the U.S. ratio of 16.3%. This growth trend should return as the latest modernization plans take hold.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY R&D: PRIORITIES

EHF 06 MAR 78

Generally accepted priorities for both general and energy R&D are now becoming established following more than a year of post-Mao leadership infighting.

Statements by Chairman Hua and Deputy Premier Teng frequently quoted in the Chinese press instruct that by the end of the century China must catch up to and surpass advanced world scientific and technological levels.

In a September 1977 statement, the Central Committee set the year 2000 as the target date for having machinery in use in every possible place, automation of industry, and "electrification of town and country." Science must be given priority over the other three modernizations--agriculture, industry and national defense.

Early 1978 official editorial statements publicly identify four major weaknesses in the Chinese economy: electrical power, iron and steel, transportation and agriculture. Intention to increase investment in these areas has been announced.

OIL

Extraordinary attention given development of the oil industry in past years cannot be expected to continue in face of continued coal and electricity shortages, and great weaknesses in transportation. In the opinion of the CIA, investment for even a 15% oil industry growth will be hard to come by. While rate of oil production growth is expected to slow, commitment to oil exploration and research should continue strong as China shifts toward offshore sources.

COAL

Clear evidence of the serious attention now given the coal industry was the enormous commitment of both labor and capital assigned to rapid rebuilding of the coal industries after the 1976 earthquake. Attempts to open new mines during the past few years yielded disappointing results. Future attention can be expected to be concentrated on intensified development of existing mines.

The two-stage program for mechanization and technological improvement of the coal industry set out at the 1975 National Coal Conference included:

- 1-State 1 (1975-1980)--Comprehensive mechanization of several major mines, and general mechanization of large and medium-sized coalfields;
- 2-State 2 (1980-85)--Comprehensive mechanization of most large and medium coalfields and some further mechanization of smaller fields.

POWER

In face of continued serious power shortages, the Central Committee has ordered a nation-wide campaign to conserve electricity and instructed the government to give highest priority to power industry development. Rapid power development is essential to achievement of the announced economic modernization goals.

NUCLEAR

Development of nuclear power does not yet appear to be a priority.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY R&D: IMPACT

EHF 06 MAR 78

Traditional and conventional energy technologies can be expected to remain the major sources of energy in China through the end of this century. Coal gasification, coal liquefaction, shale oil mining, and nuclear power production are all within the realm of the possible for China, but unlikely to be developed as long as present coal, oil, hydro and natural gas sources remain more economical.

Prospecting and drilling offshore is still in too early a stage to be able to make any reliable estimate as to its coming impact on total national energy production.

Chinese inefficiency in production and consumption of energy is great, and is thought to have worsened in recent years. Natural gas offers biggest potential efficiency gains, with perhaps half of wellhead production being wasted before reaching final consumer.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA

GOVERNMT. SUPPORTED ENERGY R&D IN IND., UNI. & NAT. LABS/EHF 06 MAR 78

INSTITUTES--Following the virtual abolition of graduate education at Chinese universities during the Cultural Revolution, State research institutes are presently at the center of scientific and technological development. All research institutes are under government/party control.

Chinese Academy of Sciences

CAS institutes and those directly under government ministries conduct the most advanced research, both basic and applied. There are other, generally less advanced energy-related institutes in universities, factories or under lower levels of government.

Institute of Atomic Energy
(CAS), Peking

Devoted primarily to basic research, but also has an intensive study group analyzing the future power program of China, including the possible construction or purchase of a Pressurized Water Reactor or a CANDU.

Institute of High Energy
Physics (CAS), Peking

Devoted primarily to basic research--elementary particle physics.

Nuclear Physics Institute,
ShanghaiPeking Coal Scientific Research
InstituteShanghai Institute of Coal
Mining MachineryPetrochemical Industry
Institute

UNIVERSITIES

Academy of Coal Mining Science

Emphasizes applied research

Petroleum Academy, Peking

Emphasizes applied research

Peking University
Nanking University
Tsinghua University

Nuclear physics
research activities

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA

GOVERNMT. SUPPORTED ENERGY R&D IN IND., UNI. & NAT. LABS/EHF 06 MAR 78
(CONT)

Tientsin University

Trial projects underway to develop further both geothermal and solar electric power

Chinese University of Science & Technology (CAS), Anhwei

CONFERENCES

National Science Conference
March 1978

Plans for science and technology and mobilization of country for S&T modernization. New S&T policies emphasize creation of a core of highly-trained researchers dedicated to solving modernization problems.

INDUSTRY

Peking Steam Turbine
and Generator Plant

Developmental work with Tsinghua University

Shenyang Wire and Cable
Plant

Electric wire and cable research (PRC's major cable manufacturer).

Peking Department of
Power Industry

Jointly designed and built with the Peking University an experimental geothermal power station which opened in 1974.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ENERGY R&D: ROLE OF PRIVATE INDUSTRY

EHF 06 MAR 78

All Chinese industry is controlled by the national or local governments. Funds for R&D are allocated by political bodies. A certain amount of R&D is carried out by semi-autonomous rural communes, especially development of small coal mines and small hydropower stations.

Direct foreign investment is prohibited, and joint ventures have yet to be tried. Companies of all major Western countries have exported energy technology or equipment to the PRC. Many foreign experts have presented technical seminars at Chinese universities and institutes in recent years. Others are serving as advisers during construction or installation of factories and equipment purchased from abroad.

Many major and independent oil companies have explored waters off the coasts of Japan, Taiwan, and South Korea, which are also claimed by PRC. The PRC continues to carry out all its own offshore oil exploration.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA

INVOLVEMENT IN INTERNATIONAL ENERGY R&D ORGANIZATIONS

EHF 06 MAR 78

ORGANIZATIONS

DEGREE OF INVOLVEMENT

United Nations

Moderately active

The Peoples Republic of China is a member of most of the U.N. specialized agencies, and recently has participated in several conferences related to energy. These include: the Law of the Sea conference held in Caracas, Summer 1974; and the U.N. Sixth Special Session on Raw Materials and Development at U.N. Headquarters in New York, April 1974.

Though China is not a member of OPEC, the Government does support it. A potential obstacle to eventual membership would be the Chinese policy of offering "friendship" oil prices to friends and allies.

COUNTRY DATA--PEOPLES REPUBLIC OF CHINA
ASSESSMENT OF INTERNATIONAL ACTIVITIES

EHF 06 MAR 78

Three criteria are said by the Chinese to be governing their foreign trade: self-reliance, non-separation of politics and trade, and mutual benefit between partners.

Desire to modernize the economy by early in the 21st century is the factor giving greatest boost at present to Chinese international energy cooperation. China's new leadership appears committed to reliance on large imports of technology and equipment, if necessary, to complete modernization of priority energy and basic industrial sectors. Indeed, the dollar value of China's trade tripled between 1971 and 1975, and the non-Communist world's share rose to 85%.

Energy resources offer best possibility as export commodities with which to pay for desired imports. Reserves are large and still only barely tapped, while agricultural production has only just kept pace with population growth, and the industrial base is small.

Concern about Soviet military intentions is another factor spurring cooperation with the West and Japan. In part out of concern for strategic vulnerability, energy development has been shifting away from northern and western border areas. With this shift should come increased attention to offshore oil development, increasing opportunity for foreign technical involvement.

A desire to head off closer Soviet-Japanese energy cooperation in Siberia appears to lie behind recent greater Chinese interest in orienting its trade toward Japan. As of early 1977, Japan was China's largest trade partner, accounting for about 1/3 of the total.

Obstacles to international cooperation are still numerous. These include continued aversion to debt financing, ideological opposition to any sort of direct foreign investment, lack of normalized relations with the U.S., insistence on use of energy exports as a tool of diplomatic policy, unwillingness to cooperate in settling disputes over seabed boundaries off the Pacific mainland, and the very real possibility that without imposition of slower growth on the domestic economy almost no Chinese energy surplus may be available for export after the early 1980's.

Nonetheless, there is a clear desire to learn from abroad, especially concerning U.S. oil technology. Continued exchange of scientists and technicians, and import of advanced technology, can be expected to continue whatever the restrictions placed on future trade and investment.

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WENDS COUNTRY DATA

CO: COLOMBIA

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COUNTRY DATA--COLOMBIA
ECONOMIC DATA PROFILE

AVL 30 SEP 78

GNP (1975 billions \$)- 12.4	Inflation Rate (% 1976-77)-30
Exports (1976 billions \$)- 1.49	Imports (1976 billions \$)- 1.65
GNP Per Capita (1975 \$)- 530	National Income Per Capita (\$) - 440
Monetary Unit- Peso	(1975)
Total R&D Budget- Not Available. Exchange Rate (/U.S. \$, 7/78)- 39.025	

TRANSPORTATION SYSTEM

In the Western Andean region where over 80% of the population is concentrated, transportation is carried on by sea, river, land, and air. In the eastern region of the Orinoco and Amazon, transportation is limited to aircraft and riverboats.

ROADWAYS

There are about 46,500 kms. of roads of which 80% are unpaved. Two parallel trunk roads traverse the country from North to South and several roads run from East to West and serve to connect the two trunk roads. The western trunk road forms part of the Pan American Highway linking Colombia with Ecuador. It forks in the North linking into Central American and Venezuelan highway systems.

RAILWAYS

More than 3200 kms. of mostly narrow gauge railroad lines are owned by the government. The main line is Ferrocarril del Atlantice which runs from North to South for 1000 km. between Bogota and Santa Marta. At Puerto Berrio in the Magdalena Valley, the mainline connects with the railway which passes south through Medellin and Cali and Buenaventura (port city).

WATER TRANSPORT

Cargo ships ply the waters of both the Caribbean and the Pacific, which are joined to the north by the Panama Canal. The Caribbean ports of Cartagena, Barranquilla, and Santa Marta have relatively deep water and are equipped with modern services and port facilities. On the Pacific, Buenaventura is of easy access and has modernized installations, while Tumaco is in need of further development. Colombia has over 80 river ports and a dozen navigable waterways. At present, much cattle and passenger traffic is carried on the Magdalena River which is navigable from the Caribbean inland for 1440 kms.

AIRWAYS

Although Colombia has over 700 airfields, most can handle only light aircraft. Four national airlines provide national and international service and there are international airports at Bogota, Cali, Medellin, Baranquilla, and San Andres Islands.

NEW PRODUCTS

There is a plan to construct a new Jungle Edge highway to provide direct access to the largely uninhabited interior. A new port at Uraba is to be completed this year.

N.B. The rate of inflation was calculated on the basis of consumer prices.

COUNTRY DATA--COLOMBIA
DEMOGRAPHIC DATA PROFILE

AVL 30 SEP 78

Land (million sq. km.)- 1.14
Population (millions)- 24.3
(1975)
Literacy (%)- 80 (1973)
Live Births/thousand- 40.6
(1972-76)
Median Age/Male- 15 (1973)
Average Household Size- 5.9
(1973)
Primary School Enrollment
(1974 millions)- 3.792
Industrial Workers
(1973 millions)- 1.6
Agricultural Workers
(1973 millions)- 1.7
Population Growth (%)- 2.8
(Between 1970-75)

Arable Land (thous. sq. km.)- 0.3596
Population Density (/sq. km.)-21
(1975)
% Rural Population- 35.7 (1976)
Deaths/thousand- 9
(1972-76)
Median Age/Female- 16 (1973)
Net Immigration (millions/yr)- 0.083

Secondary School Enrollment
(1974)- 1,284,347
College Graduates- 11,739 (1973)
Unemployed- .856 million (1973)
Professional Workers
(1973 millions)- 1.9

COUNTRY DATA--COLOMBIA
PROFESSIONAL LABOR FORCE PARTICIPATION PROFILE

AVL 30 SEP 78

TOTAL RESEARCH & DEVELOPMENT MANPOWER
1971

Natural Sciences -	188
Engineering and Technology -	154
Medical Science -	127
Agriculture -	348
Social Science and Humanities -	323
Total -	1410

TOTAL STOCK OF SCIENTISTS, ENGINEERS AND TECHNICIANS

Scientists and Engineers --	
Technicians --	
Total --	

--Not Available

COUNTRY DATA--COLOMBIA
KEY TECHNICAL EDUCATIONAL RESOURCES

AVL 30 SEP 78

Institution	Location
Universidad de Antioquia	Medellin
Universidad del Atlantico	Barranquilla
Universidad de Caldas	Manizales
Universidad de Cartagena	Cartagena
Universidad Nacional de Colombia	Bogota
Universidad Industrial de Santander	Bucaramanga
Universidad del Tolima	Ibague
Universidad del Valle	Cali
Universidad Pedagogica y Tecnologica de Colombia	Tunja
Universidad Tecnologica del Magdalena	San Pedro Alejandrino
Universidad Tecnologica de Pereira	Pereira
Escuela Superior de Administracion Publica	Bogota
Fundacion Universidad de Bogota "Jorge Tadeo Lozano"	Bogota
Universidad Externado de Colombia	Bogota
Universidad de los Andes	Bogota
Universidad de Medellin	Medellin
Universidad Santiago de Cali	Cali
Escuela de Administracion y Finanzas y Tecnologias	Medellin

COUNTRY DATA--COLOMBIA
ENERGY POLICY: BASIC LEGISLATION

AVL 30 SEP 78

- 1-The Ministry of Mines & Energy was organized in 1974 and was charged with the responsibility for planning, coordinating, directing, and implementing national energy policy.
- 2-Decree No. 2301 of Oct 28, 1975 establishes the basic administrative structure of the Ministry, lists its various affiliates in each resource area, and details specific responsibilities with respect to policy formulation and implementation.
- 3-Basic oil laws are based on Law 37 of 1931 which has been modified several times. In 1953, Decree No. 1066 was promulgated (Petroleum Code) which, with certain modifications, is in force today.
- 4-Law 10 of 1961 established the conditions which govern concession contracts with respect to property rights, size of concessions, and reversion to the State.
- 5-Decree 2310 of 1974 abolished the concession contract system and per Art. 1 established that all exploration and exploitation of hydrocarbon resources on State land would come under the charge of COLPETROL (State Petroleum Company).
- 6-Decree 2310 also charged the Ministry of Mines & Energy with the duty of preventing the overlap of electrical services provided by diverse entities to the general public. It was charged with the task of evaluating electrical projects to determine whether they fit in with the national electrification plan.
- 7-Law 60 of 1967, Law 20 of 1969, Regulatory Decree 1275 of 1970, and Decree No. 2181 of 1971 deal with coal concessions and exploration licenses. Decree No. 2533 of 1973 establishes exclusive areas for state coal exploitation.
- 8-A Commission of Petroleum and Natural Gas Prices establishes pricing policy.
- 9-The National Plan 1975-78 established energy development objectives and priorities and the National Planning Dept. has an input in the policies of the Ministry of Mines & Energy.
- 10-A Comprehensive Environmental Code enacted in December 1974 by Presidential decree covers all major aspects of environmental protection.

OTHER AREAS OF BASIC LEGISLATION AFFECTING ENERGY POLICY

- 1-The Andean Common Market Legislation establishes the normative framework affecting the transfer of technology into Colombia. Basic criteria include effective contribution of technology to national development, local control over investments, and ownership of the resources over time.
- 2-The legislation specifically excludes foreign ownership of public utilities and communications industries.

COUNTRY DATA--COLOMBIA

GOVERNMENTAL STRUCTURE FOR ENERGY POLICY AND R&D

AVL 30 SEP 78

EXECUTIVE - The President of the Republic (Julio C. Turbay-Ayala took office August, 1978) has final executive authority in all policy areas including energy policy. The revised Constitution of 1886 grants the President very broad legislative, as well as executive, powers. Constitutional Articles 121 and 122 empower the President to rule by decree. Fundamental executive policies in energy are operationalized through the Ministry of Mines and Energy (new Minister is not yet appointed) and its affiliated agencies.

LEGISLATIVE - The Legislature is composed of a Senate and a House of Representatives whose effective power is rather limited in practice. On the departmental level, all affairs, executive and legislative are carried out by the Governors, who are appointed and can be removed by the President, and who are accountable only to the national government.

OTHER PARTS OF THE ENERGY STRUCTURE - The following public entities are linked to the Ministry of Mines and Energy:

1-INGEOMINAS - The National Geological and Mining Institute, which was formed in 1968, carries out research in hydro-geology, remote sensing, geochemistry, and geophysics. (Dir Michel Hermelin)
 2-IAN - The Institute of Nuclear Affairs was formed in 1959 and concentrates on R&D in isotopes and on the development of uranium resources for future applications (Dir Ernesto Villareal Silva)

3-ICEL - The Colombian Institute of Electrical Energy formulates national policy in the field of electrical energy.
 (Manager Dr. Thomas Held)

4-CORELCA - Electric Corporation of the Atlantic Coast
 (Manager DR. Jacobo Acosto Bendek)

STATE COMMERCIAL ENTERPRISES LINKED TO MINISTRY OF MINES & ENERGY

1-ECOPETROL-State Petroleum Enterprise (Pres. Juan Francisco Villareal)

2-ECOMINAS-State Mining Enterprise

3-CARBOCOL-State Coal Enterprise (Manager Hernan Garces)

COUNTRY DATA--COLOMBIA

ORGANIZATION FOR IMPLEMENTATION OF ENERGY POLICY AND R&D/AVL 30 SEP 78

NON-NUCLEAR

The implementation of non-nuclear energy policy and R&D is carried out by state-owned and by autonomous entities voluntarily submitting to coordination by the Ministry of Mines and Energy.

1-Ecopetrol-The Colombian Petroleum Enterprise is a state enterprise which participates with private concerns in refining, transport, and export of petroleum. (President Juan Francisco Villareal)

2-Carbocol-The State Coal Enterprise explores, mines, processes and markets coal. (Manager - Hernan Garces)

3-Electraguas-The Institute for Water Utilization and Development of Electrical Power is a semi-official undertaking operating on a nation-wide scale through 14 subsidiaries. It is concerned with the generation and distribution of electric power.

4-ICEL-The Colombian Institute of Electric Energy develops and coordinates the national electrification plan.

5-ISA-Interconnexion Electrica, S.A. is a private entity which plans and implements the interconnection of electric networks.

NUCLEAR

The Instituto De Asuntos Nucleares (IAN) is responsible for all nuclear affairs in Colombia. Dr. Silva directs the Institute which falls within the Ministry of Mines and Energy. Primary efforts have been in providing training in radioisotopes and radiochemistry and in conducting research in water and soil radioactivity and irradiation of potatoes to delay sprouting.

IAN activities are carried out by the following Divisions:

Chemistry and Radioisotopes
Radioisotopes Application
Geology and Mining
Medicine and Biology
Health Physics
Nuclear Physics
Electronics

COUNTRY DATA--COLOMBIA
ENERGY POLICY AND OBJECTIVES

AVL 30 SEP 78

Energy resources development is considered a leading link in Colombian development. The National Development Plan 1975-78 states a commitment to develop basic infrastructural necessities such as electricity, water, communications, and transportation, particularly for rural areas. The budget of the Ministry of Mines and Energy has risen by 143% in 1978 over 1977, a fact which reflects the level of commitment.

The policies of the Ministry of Mines & Energy as expressed in 1977 include:

1-Petroleum - Per 1976 pricing law, private entrepreneurs working in association with ECOPETROL are paid at world prices C.I.F. Cartagena for 40% of new production. Existing fields are also paid more for their crude - prices are negotiated on a field-by-field basis. Prices to consumers shall be raised gradually to equilibrium levels. It is hoped that new exploration will take place. The objectives of the Government are to reverse the trend of rising imports due to decreased domestic production and increased domestic consumption.

2-Natural Gas - Pricing policies similar to those for petroleum are employed so as to encourage new exploration. Newly tapped reserves will be channelled towards petro-chemical industries, will be exported in liquified form, and will be diverted for thermal uses, when essential.

3-Coal - Policy is under intense review with the objective of encouraging the development of such a valuable and abundant natural resource. Government policy is that gasifiable coal will be exported only to the extent that present and projected national requirements justify it.

4-Electricity Generation - Hydro and/or thermal production shall be undertaken so as to supply normal, peak and emergency demand. Current plans in progress shall be followed through, including the interconnection system and pricing policy is moving towards a cost-based system. Government policy emphasizes hydro power.

5-Uranium - There is a commitment to utilize proven reserves which have not yet been developed. Colombia has signed the Nuclear Non-Proliferation Treaty but has not ratified it.

6-Alternative Sources - The Government has undertaken to support efforts to develop alternative energy sources.

7-Conservation - The Government has undertaken a campaign designed to educate energy consumers to the fact that Government policies cannot hope to succeed without public support in the form of voluntary conservation measures.

COUNTRY DATA--COLOMBIA

DESIRED DEGREE OF ENERGY SELF-SUFFICIENCY

AVL 30 SEP 78

Colombia is self-sufficient in coal and gas and, until 1975 it was also self-sufficient in petroleum. For the medium to long-term, self-sufficiency in gas and coal is assured and government policy in this respect therefore, is focused on petroleum. Projected Ministry of Mines and Energy figures (1976) show that between 1975 and 1985, imports totalling 380 million barrels will be required. The goal of regaining self-sufficiency in petroleum is regarded as unrealistic at this time.

With respect to other resources, the Government is planning to export newly tapped LNG reserves, coal exports (after satisfying domestic needs) are being considered, and uranium exports are also being considered.

COUNTRY DATA--COLOMBIA
INDIGENOUS ENERGY RESERVES

AVL 30 SEP 78

	RECOVERABLE RESERVES	RESERVES	LOCATION OF IDENTIFIED RESERVES
NONRENEWABLE -----			
COAL (Megatonnes)	109		Guajira, Cesar, Bolivar Cordoba, Antioquia, Choco, Caldas, Santander, Boyaca, Cundinamarca, Valle del Cauca
CRUDE OIL (Megatonnes)	126		Valle del Magdalena Maracaibo, Putumayo, Llanos Orientales
SHALE OIL (Million tonnes)	-		
NATURAL GAS (Million G. cal)	494		Valle del Magdalena La Guajira, Caribe, Putumayo
URANIUM (U308) (Thousand Tonnes)			
RENEWABLE -----			
HYDROELECTRIC (GWh/yr)	300,000		Cundinamarca, Nortede, Santander, Bolivar, Antioquia, Narino, Valle del Cauca, Tolima
GEO THERMAL (Billion KWh/year)			

COUNTRY DATA--COLOMBIA

PATTERNS OF ENERGY SOURCES AND USES

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	HOUSEHOLD COMMERCIAL	INDUS- TRIAL	TRANSPOR- TATION	ELECTRICAL GENERATION	TOTAL
COAL (Thousand tonnes)	0	2,210	29	1,365	3,612
PETROLEUM (Thousand tonnes)	669	2,117	3,511	619	7,608
NATURAL GAS (Tera calories)	0	14,148	0	2,497	16,645
NUCLEAR POWER (Million KWh)	-	-	-	0	
HYDRO POWER (Million KWh)				10,080	12,856.6
GEO THERMAL (Million KWh)	-	-	-	0	
UTILITY ELECTRICITY (Distributed) (Millon KWh)	3,661	8,838	126	-	34,358

N.B. Total includes non-energy uses, transformation losses, energy sector uses.

COUNTRY DATA--COLOMBIA
PROJECTIONS OF DEMAND

AVL 30 SEP 78

	Standard Physical Units			Thousand T.C.E.		
	1976	1985	2000	1976	1985	2000
RESOURCE						
COAL (thousand tonnes)	3,612	10,935	13,095 (1990)	3,612	10,935	13,095
CRUDE OIL (thousand tonnes)	8,483	11,210	11,210	12,573	16,815	16,815
SHALE OIL (million tonnes)	0	0	0	0	0	0
NATURAL GAS (Tera Calories)	16,645	479	417	2,379	-	-
NUCLEAR POWER (million KWh/year)	0	0	0	0	0	0
HYDROELECTRIC POWER (million KWh/year)	10,080	-	-	1,240	-	-
GEOTHERMAL (billion KWh/year)	0	0	-	0	0	-
OTHER (See note) (billion KWh)						
URANIUM (U308) (kilotonnes)						
HEAT RATE (Btu/KWh)						

Note: Wind Energy, Tidal Power, Biomass

N.B. Natural Gas figures for 1985 and 2000 are expressed in
millions cu. ft./day.

SOURCE: Bases Para Un Plan Energetico Nacional

COUNTRY DATA--COLOMBIA

PROJECTIONS OF ENERGY SUPPLY, IMPORTS AND EXPORTS

AVL 30 SEP 78

1976 % U.S. 1985 % U.S. 2000 % U.S.

RESOURCE:

COAL (thousand tonnes)

Indigenous Supply	3,620	-	-	-	-
Imports	0				
Exports	90				

CRUDE OIL (thousand tonnes)

Indigenous Supply	7,553	-	3,700	-	1,400	-
Imports	930	-	7,520	-	9,810	-
Exports	0	-	0	-	0	-

SHALE OIL

Indigenous Supply	-				
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NATURAL GAS (Tera Calories)

Indigenous Supply	16,645	525	450
Imports	0	0	0
Exports	0	-	-

URANIUM (U308)

(kilotonnes)

Indigenous Supply	
Imports	
Exports	

N.B. Natural Gas figures for 1985 and 2000 are expressed in millions cubic ft./day.

Source: Bases Para un Plan Energetico Nacional

COUNTRY DATA--COLOMBIA
ENVIRONMENTAL CONSIDERATIONS

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The first comprehensive environmental code in the world was enacted in Colombia by Presidential Decree in December, 1974. Part I of the code includes sections regulating the environmental aspects of oil, gas, and mineral exploitation. The Code enumerates various means available to the Government to stimulate the environment's continuous protection and improvement, such as the use of mass communications media for educating the public, and the imposition of the duty of reporting the environmental impacts of projected activities. Also included are the instruments of zoning, technical assistance, taxation, tax rebates, and other economic incentives including loans or grants. Part II of the Code deals with renewable natural resources. Certain natural resources previously considered private are declared public. Included are all surface and underground waters and geothermal fields. Specific chapters relate to the use of primary energy sources such as land slopes, solar energy, and geothermal resources. Also included are sections on the conservation of renewable resources.

COUNTRY DATA--COLOMBIA
COMMERCIAL APPLICATIONS

AVL 30 SEP 78

1-Under the provisions of the Andean Foreign Investment Code, all transfers of technology must be scrutinized to meet certain criteria with respect to national development goals.

2-The Foreign Investment Code spells out certain requirements with regard to R&D, most notably that foreign firms are required to set-up local facilities and to train local personnel.

3-In Colombia, technology policy is influenced by the Department of National Planning (Private Investment Division) which screens the technology component of foreign investment proposals; by the Exchange Control Office which evaluates foreign technical assistance projects; by INCOMEX (Global Licences Committee) which evaluates applications to import machinery and other goods; and by the Royalties Committee which evaluates and screens foreign licensing contracts. At present, these screening agencies are not channelled into a comprehensive national policy program.

4-Prior to the Pricing Law of 1976 which raised the price of domestic crude and gas to near world prices, petroleum exploration and development were not economic in Colombia. The new law has now reactivated commercial explorations in both oil and gas. Furthermore, the large sums required for investments in resource development may not be available locally until such time as the various industries can be run on a cost basis.

5-Traditionally, energy budgets have been very small, thereby frustrating the commercial development of the sector. The budget has been growing steadily since 1975 when Colombia became a net importer of petroleum. It increased by 143% between 1977 and 1978.

6-Colombia lacks the foreign exchange to replace foreign investment in the energy sector. This has limited bargaining power and the ability to get technology and management on its own terms.

COUNTRY DATA--COLOMBIA
POWER PRODUCTION AND ENERGY CAPABILITY

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A set of figures showing the power generating sector by plant type, number of plants, and plant capacity is not available.

The following set of figures (1977) show a more aggregated breakdown of installed capacity:

PLANT TYPE	TOTAL MWe	% OF TOTAL SECTOR	OWNERSHIP
1. Hydro	2,733	67	Public
	19.6		Private
2. Thermal			
a) Coal	302.5	8	Public
	37.2		Private
b) Fuel Oil	222.4	7	Public
	44.6		Private
c) Gas	237.5	5.5	Public
	-		Private
d) Turbo Gas	304.6	8	Public
	39.3		Private
e) Diesel	169.3	4.5	Public
	22.2		Private
	-----	-----	
TOTAL	4,132.2	100.0	

At present, there are 22 hydro plants in operation, 9 more are under construction, 13 are in the feasibility or design stage, and 7 are in the prefeasibility stage.

PETROLEUM

Total Wells (1975)	Total Footage (1000 ft.)	Total Wildcats (1975)	Successful Wildcats (1975)
28	198	14	3
Total Wells (1974)	Total Footage (1000 ft.)	Total Wildcats (1974)	
3	278	24	

Number of Rigs

Sept. 30, 1977	June 30, 1977	Sept. 30, 1976
9	12	10

COUNTRY DATA--COLOMBIA
ENERGY R&D: STATUS AND OUTLOOK

AVL 30 SEP 78

NUCLEAR

1-Colombia's small technological capacity and lack of foreign exchange are such that the development of commercial nuclear technology is not a realistic nor an immediate priority. The first nuclear power plant is expected to be installed in the decade 1990-2000. The Institute of Nuclear Affairs (IAN) is thus primarily concerned with developing technical personnel, in geologic exploration, and in the study of various aspects of nuclear technology. Technology is being transferred to meet Colombia's present nuclear needs. IAN possesses a 10 KW research reactor as well as other basic equipment.

NON-NUCLEAR

1-Since 1975, Colombia has become a net petroleum importer and at a rate which has alarmed the government. Intensified efforts (10-year Exploration Plan) which call for the drilling of 800 wells (estimated cost is \$1 Billion U.S.) over the next decade are on foot. Lack of technical expertise and technology has resulted in a situation where the country is heavily dependent on foreign companies to carry out its petroleum development program.

2-The country is well-endowed in gas resources. Significant new discoveries in the Guajira peninsula have encouraged new explorations. As in the case of petroleum, most development work is carried out through joint venture contracts with foreign companies.

3-Hydro resources in Colombia are estimated to be approximately 100 million KW while total installed capacity is less than 4 million KW (1977). The development of this resource is seen as an integral part of national development and much R&D work is being carried out which attempts to identify all potential hydro projects with respect to size, location and cost. This effort is well under way. According to the Ministry of Mines and Energy, 180 projects covering the principal population centers are in their preliminary (160), prefeasibility (13) or design (7) stage. R&D covers the problem of distribution and of interconnecting the various systems.

4-Coal reserves in Colombia are thought to be the largest in Latin America. Local resources to develop the reserves are inadequate and Colombia has entered into various joint venture relationships with foreign entities. Local estimates indicate that liquified coal is not economic with present technology so no further R&D work is being carried out. The costs of coal gasification have also been found to be uneconomic in Colombia due to the existence of abundant LNG reserves. While synthetic crude from coal is estimated to be commercially viable, further R&D work is in progress with respect to technical and cost factors. Official opinion holds, on balance, that non-conventional uses for coal are not justified in the near future.

COUNTRY DATA--COLOMBIA
ENERGY R&D: STATUS AND OUTLOOK (CONTINUED)

AVL 30 SEP 78

NON-CONVENTIONAL

1-The Government is involved in a study of the relationship between energy and rural development. R&D is focused on conventional uses of solar energy such as water heating, cooking, and crop drying. The work is being carried out at various universities and national labs, but it appears that the budgets are small and that significant progress is far off.

2-R&D in the production of ethyl alcohol from sugar cane, yuca, and bananas, as a partial substitute for diesel fuel is being carried out. The fermentation technology exists in the country and a pilot plant is thought to be desirable.

3-R&D in the production of methyl alcohol for various uses such as a gasoline substitute, as a protein, and synthetic gas is being carried out. It is generally felt, however, that these uses are distant priorities.

4-Only one entity in the country (Central Hidroelectrica de Caldas) is carrying out R&D in geothermal energy. There are numerous hot springs around the country.

COUNTRY DATA--COLOMBIA
ENERGY R&D BUDGET

AVL 30 SEP 78

Small. Exact figures unavailable.

COUNTRY DATA--COLOMBIA
ENERGY R&D: PRIORITIES

AVL 30 SEP 78

There is no comprehensive energy plan in Colombia but the various entities which have an input into important policy are at present working out a basic approach to energy planning and the setting of priorities. It is nonetheless clear that certain priorities for R&D do exist.

The official view in Colombia holds that the energy crisis has three distinct aspects. These are the rate of growth of the population, the rising demand for energy resulting from economic and social development, and the continued dependence on non-renewable fossil fuels which manifests itself through increasing petroleum imports. Two principal energy R&D priorities are reflective of this view.

First, hydroelectric development to meet the rising demand for energy and to service the growing populations has been placed as a major priority. The Ministry of Mines and Energy has placed the development of petroleum resources to curb the erosion of foreign exchange reserves as a second major priority. Official estimates (1975) show that even if petroleum exploration increases two-fold, ie. twice as many wells are drilled each year for the next ten-years, by 1985 this will only manage to substitute for 50% of petroleum imports. Thus the Ministry of Mines and Energy has set another important medium-to-long term priority of substituting coal consumption for petroleum and necessary imports. In terms of nuclear R&D, the priorities are mainly long-range. Currently IAN is interested in developing a skilled manpower base and in following the latest developments in nuclear technology.

COUNTRY DATA--COLOMBIA
ENERGY R&D: IMPACT

AVL 30 SEP 78

Exact estimates of the impact on the energy sector of new energy technologies in the years 1985 and 2000 are not available. A reasonable assessment of the probable impact of present development efforts can be made based upon qualitative information.

1-The best estimates have it that the first nuclear power plant will come on stream in the last decade of this century.

2-Hydro R&D is concentrated on locating all potential dam sites and in formulating plans to service the populations near the sites. The ISA holds that 180 identified projects, which would increase generating capacity to 27 million KW, should come on stream within the next 30 years. Colombia's ability to finance these new projects is the crucial variable. At present, the industry relies on government incentives (equipment subsidies, tax breaks, etc.) to follow through on expansion plans. It is felt that unless overall economic performance improves, particularly with respect to inflation, then the chances for an efficient cost-based energy economy to emerge are dim in the short and perhaps the medium-term.

3-Expansion of coal output is a priority area which looks very bright. CARBOCOL has earmarked \$500 million for coal development, and various significant joint-ventures have been entered into which fairly indicate that national production could double by 1985.

4-The development of gas reserves looks very bright for the immediate and medium term. Various joint-ventures have proven successful and new proposals are in hand. Official natural gas reserve levels have risen dramatically in the past two years. The primary factor bearing on the extent of gas development appears to be the question of whether or not LNG will be consumed domestically or exported. There are strong lobbies on each side of this question, and, if the former course is adopted, all the economic constraints which apply to the other resources would also apply to gas.

5-The development of alternative technologies, solar and tidal in particular, are not felt to hold much promise for Colombia's immediate or medium-term needs.

6-Estimates of geothermal capacity show good potential in Colombia, but cost estimates for developing the resource indicate that the first commercial plant might come in the second half of the 1980's.

COUNTRY DATA--COLOMBIA

GOVERNMT. SUPPORTED ENERGY R&D IN IND.,UNI.& NAT. LABS AVL 30 SEP 78

UNIVERSITIES

- 1-National University (Bogota) - Staff members serve IAN staff and have access to IAN research facilities, as do graduate students.
- 2-University of the Andes (Bogota) - The Faculty of Engineering is involved in alternative technology development.
- 3-University of El Valle (Cali) - Radioisotopes.
- 4-Collegio de Estudios Superiores de Administracion (Bogota) - Energy Study Programme.
- 5-Escuela de Administracion, Finances, y Technologicas (Medellin).

LABORATORIES

- 1-National Nuclear Institute (IAN) - Radioisotopes and radio-chemistry, water and soil radioactivity.
- 2-National Cancer Institute - Medical Radioisotopes
- 3-Integrated Energy Research Center (CRI) - Alternative Energy Research, "Las Gaviotas" project.
- 4-Colombian National Fund for Scientific Research and Special Projects (Colciencias) - Formulates national science and technology policies.
- 5-Institute for Technology Investigation (IIT) - Research on technology matters.

OTHER

- 1-Colombian Institute of Electric Energy (ICEL) - Hydro.
- 2-National Institute of Geologic and Mining Research - Land and seismic surveys.
- 3-Central Hidroelectricas de Caldas - Geothermal R&D.

COUNTRY DATA--COLOMBIA
ROLE OF PRIVATE INDUSTRY

AVL 30 SEP 78

Private industry plays a significant role in energy R&D in Colombia. Indigenous private firms own and control a substantial part of the electricity generating facilities and, within the context of the energy policy objectives set by the Ministry of Mines and Energy, they carry out their own R&D activities. It has not been possible to ascertain whether, or to what extent, the government supports these efforts. In petroleum, foreign private companies play a major role in Colombia's R&D activities since the indigenous capabilities have not yet been fully developed. Petroleum is largely a state enterprise. In nuclear R&D private industry's role is small, if at all present. Nuclear affairs are the domain of the government assisted bases, primarily from the U.S., but also from France.

COUNTRY DATA--COLOMBIA

INVOLVEMENT IN INTERNAT'L ENERGY AND R&D ORGANIZATIONS AVL 30 SEP 78

ORGANIZATION

DEGREE OF INVOLVEMENT

IAEA	moderately active
IANEC	" "
OLADE	" "
UNCTAD	" "

COUNTRY DATA--COLOMBIA
ASSESSMENT OF INTERNATIONAL ACTIVITIES

AVL 30 SEP 78

The Andean Foreign Investment Code sets the normative framework for the transfer of technology to Colombia. Bilateral cooperation in energy R&D between private companies and Colombian state or private entities is governed by the Code. The pace at which foreign private investors have set up R&D facilities has not been very rapid because it is widely felt by the companies that the Code is designed to facilitate the flow of technology in only one direction: to Colombia. However, existing R&D agreements are being managed smoothly and there are no disputes with respect to such agreements. Also, Colombia's absorptive capacity for sophisticated energy technologies is felt to be largely limited, a fact which has hindered international R&D cooperation between Colombia and private foreign companies.

Public international R&D cooperation is of great importance to Colombia. The IAEA, IBRD, and the U.S. are the primary partners in R&D cooperation. Colombia is signatory to a tri-lateral (U.S. and IAEA) Safeguards Agreement and receives most technical assistance in nuclear technology from the U.S., though France has been an active provider also. The World Bank is currently engaged in a joint project "Las Gaviotas" which is attempting to develop alternative technologies for rural development. No debt financing problems are reported with respect to loans for technical or economic assistance.

Colombia's present and medium term needs are related to the development of its vast coal reserves and natural gas reserves. In these areas, technical cooperation could play a significant role. Development of Colombia's allegedly substantial uranium resources is an area where cooperation already exists and which will continue to benefit from such assistance. Government policy with respect to the early development of the resource is not clear. Some Colombians support the idea that uranium should be developed for export and others feel that Colombia should not encourage the position of being a primary exporter.

COUNTRY DATA--COLOMBIA
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