브라질 에너지 統計

GENERAL FEATURES OF THE ENERGY ECONOMY

In 1987 Brazil had about 141 million inhabitants for an area of approximately 8,500,000 km^2, thus showing an extremely low demographic density as well as large tropical areas available for the development of renewable energy sources.

As of 1970, a high rate of industrialization in the country together with several other factors has caused an increase in energy consumption per capita in a way such that it rose from 32 GJ in 1970 to 45 GJ in 1980 and 50 GJ in 1987.

As the country greatly depended on external energy, mostly crude oil (in 1970 about 80% of oil was imported), and the prices for this fuel soared in the years of 1973 and 1979, as tighter policy for the energy sector was stablished from 1979 onwards, aiming at three basic targets, as follows: 1. Increasing the Brazilian Production of Crude Oil; 2. Conservation of Energy; 3. Substitution of Alternative Domestic Sources for Petroleum.

As to the first time –"Increasing the Brazilian Production of Crude Oil" – PETROBRÁS policy has been shifted so that it would concentrate on the quest for petroleum rather than on the marketing and development of its refining capacity. In the company's global budget the production and exploitation sector has risen from 35% to over 80%.

This new policy has brought about immediate results, and petroleum production, which amounted to 166,000 barrels per day in 1979, increased to 460,000 barrels per day in 1984, surpassing 560,000 barrels per day in 1987.

Petroleum reserves grew by 9,2% from 1979 to 1987. Net imports of oil in 1987 were below those in 1973 and were quite close to 50% of imports in 1979, which were about 1 million barrels per day.

Thus in 1987 crude oil imports accounted for 46% of domestic consumption while in 1979 it was of 85%.

The net expenditure of foreign currency reserves with petroleum imports amounted to US$ 3.1 billion in 1987 while as its sharpest point it amounted to US$ 9.7 billion in 1981.

Concerning the second target –"Energy Conservation" – the following steps have been taken: setting real prices for oil derivates, closing gas stations on Saturdays and Sundays, greater control of speed of vehicles on the roads, fiscalizing Diesel powered truck performance, managing industries by means of auditing and waste cuts, etc.

Punctually, some industries reduced energy consumption through measures aimed at cubing waste.

Currently the National Program for Electric Power Conservation (PROCEL) is being developed and its results appear to the promising.

As to the third target – "Substitution of Alternative Domestic Sources for Petroleum" – several steps have been taken.

The pricing policy, already mentioned above, has had an outstanding role in replacing oil derivates has prices for alternative sources have already always been more attractive.

Further important measures were: setting special interest rates for loans to purchase and modify production equipment, fostering consumption of alternative energy and assuring a market for those energy sources.

Measures taken to set fuel oil quotas for the industry have also cause a significant replacement of this energy sources.

Substituting alcohol for gasoline, as well as electricity, coal and wood for fuel oil, were the two main facts which have contributed the most for substantial cut in the oil derivates consumption.

Consumption of oil derivates, which had been rising at a rate of 6.7% a year up to 1979, decreased since then at the mean rate of 3.5% a year up to 1984. From 1984 onwards, as the international price of petroleum decreased, oil derivates consumption has risen again however still lower in 1987 than in 1979.

Consumption of fuel oil dropped from 351,000 barrels per day in 1979 to 218,000 barrels per day in 1987. Gasoline consumption dropped from 271,000 barrels per day to 152,000 barrels per day during the same period of time.

The accumulated economy of foreign currency achieved since 1979, which was due to the reduction of oil derivates consumption as well as to the increase of the Brazilian production of crude oil, is estimated in 37.8 billion dollars.

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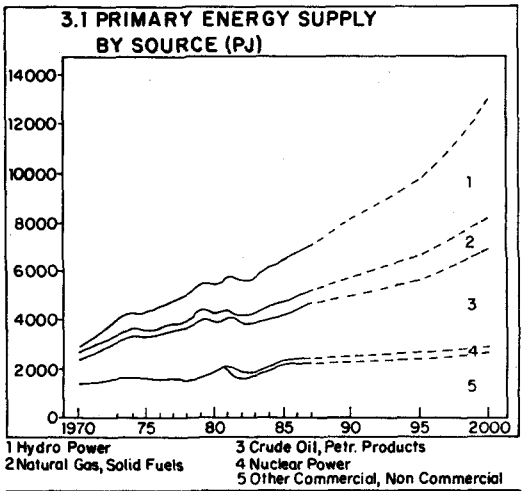
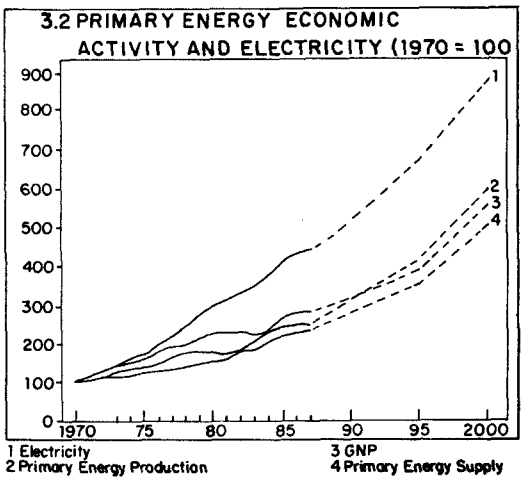
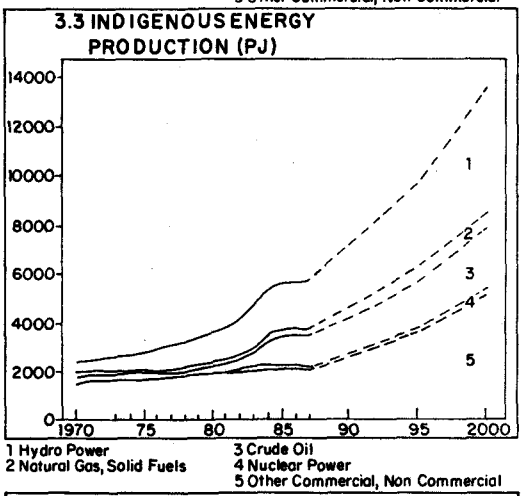
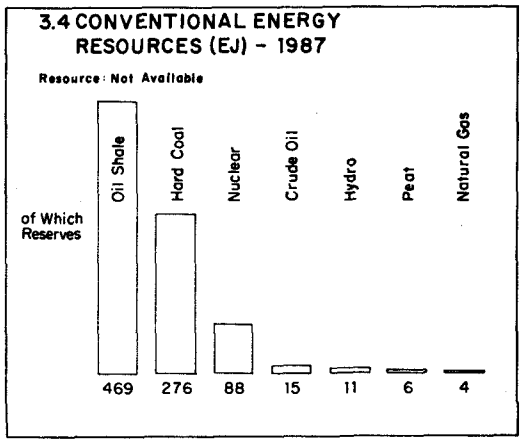
SOURCE OF ALL DATA: Ministério das Minas e Energia
Comissão Nacional de Energia – CNE
70056 – Brasília, DF
Brazil

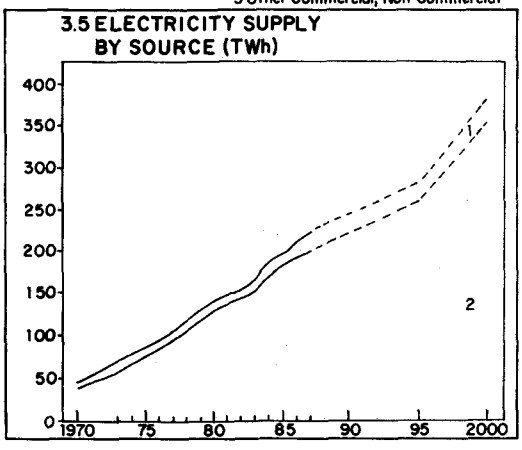
'90 WEC 執行理事會(EA) 개최국인 브라질의 에너지 分野 現況을 파악하기 위하여 브라질의 에너지 統計資料를 게재한다.

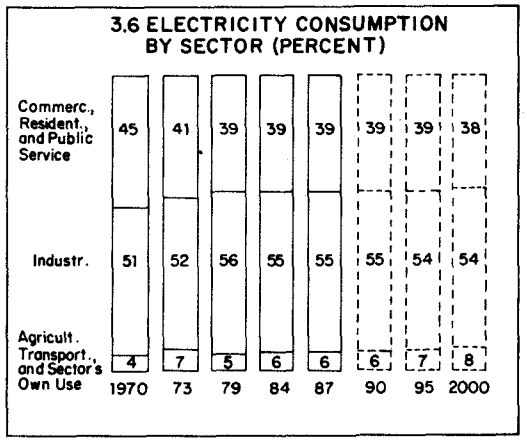












4.1. GENERAL ENERGY DATA	1970	1973	1979	1980	1984	1985	1986	1987
Population 10^6	96	103	119	121	133	136	138	141
GNP 10^9 US$ (1980)	104	147	214	232	228	248	271	280
GNP 10^9 Cr$ (1980)	5.453	7.745	11.259	12.222	11.982	13.044	14.250	14.765
GNP / Capita US$ (1980)	1.083	1.427	1.798	1.917	1.714	1.824	1.964	1.986
GNP / Capita Cr$ (1980)	56.802	75.194	94.613	101.007	90.089	95.911	103.260	104.715
Primary Energy Supply								
Total PJ	3.053	3.941	5.505	5.500	6.249	6.583	6.918	7.157
Total Mtoe	73	94	132	131	149	157	165	171
Per Capita GJ	32	38	46	45	47	48	50	50
Per GNP MJ /US$ (1980)	29	27	26	24	27	27	26	26
Per GNP MJ / Cr$ (1980)	1	n	n	n	1	n	n	n
Electricity Supply								
Total TWh	47	65	125	137	178	193	208	219
Per Capita KWh	490	631	1.050	1.132	1.338	1.419	1.507	1.553
Per GNP Wh / US$ (1980)	452	442	584	591	781	778	768	779
Per GNP Wh / Cr$ (1980)	9	8	11	11	15	15	15	15

4.2. PRIMARY ENERGY SUPPLY (PJ)	1970	1973	1979	1980	1984	1985	1986	1987
Indigenous Production								
(1) *Solid Fuels*	46	46	95	102	143	145	137	124
Crude Oil E NGL	339	353	353	388	990	1.175	1.232	1.226
Natural Gas	3	5	33	38	71	86	102	106
Nuclear Power	–	–	–	–	57	41	15	47
Hydro Power	410	596	1.201	1.328	1.717	1.838	1.880	1.911
(2) Other Commercial	148	191	337	380	638	777	702	845
(3) Non Commercial	1.338	1.330	1.280	1.321	1.423	1.406	1.401	1.361
Total Production	2.284	2.521	3.299	3.557	5.084	5.468	5.469	5.620
(Mtoe)	55	60	79	85	121	131	131	134
Imports (+)								
Solid Fuels	63	58	140	153	234	249	261	316
Crude Oil	732	1.436	2.092	1.818	1.366	1.146	1.264	1.313
Refined Petroleum Products	36	64	41	94	25	64	79	95
Natural Gas	–	–	–	–	–	–	–	–
Electricity	–	n	1	–	n	22	97	157
Others	–	–	–	–	–	–	–	–
Total Imports	831	1.558	2.274	2.065	1.625	1.481	1.701	1.881
(Mtoe)	20	37	54	49	39	35	41	45
Exports (-)								
Solid Fuels	–	–	–	–	–	–	2	–
Crude Oil	3	35	–	2	–	–	–	–
Refined Petroleum Products	38	109	57	77	364	331	265	294
Natural Gas	–	–	–	–	–	–	–	–
Nuclear Power	–	–	–	–	–	–	–	–
Electricity	n	n	1	2	1	n	n	n
(4) Others	–	2	3	8	21	18	7	1
Total Exports	41	146	61	89	386	349	274	295
(Mtoe)	1	3	1	2	9	8	7	7
Marine-Bunkers (-)	na	na	na	na	na	na	na	na
Change in Stocks (±)	-21	8	-7	-33	-74	-17	-22	-49
Total Primary Energy Supply	3.053	3.941	5.505	5.500	6.249	6.583	6.918	7.157
(Mtoe)	73	94	132	131	149	157	165	171

4.3. TRANSFORMATION SECTOR (PJ)	1970	1973	1979	1980	1984	1985	1986	1987
Conversion Losses	433	585	1.056	1.169	1.542	1.169	1.747	1.788
Energy Sector Own Use	58	101	248	246	411	478	457	527
Statistical Differences (±)	18	166	105	-74	61	-2	24	2
Total Use in Transformation	509	852	1.409	1.341	2.014	2.125	2.228	2.317
(Mtoe)	12	20	34	32	48	51	53	55

4.4. FINAL ENERGY DEMAND (PJ)	2.544	3.089	4.096	4.159	4.235	4.458	4.690	4.840
(Mtoe)	61	74	98	99	101	106	112	116

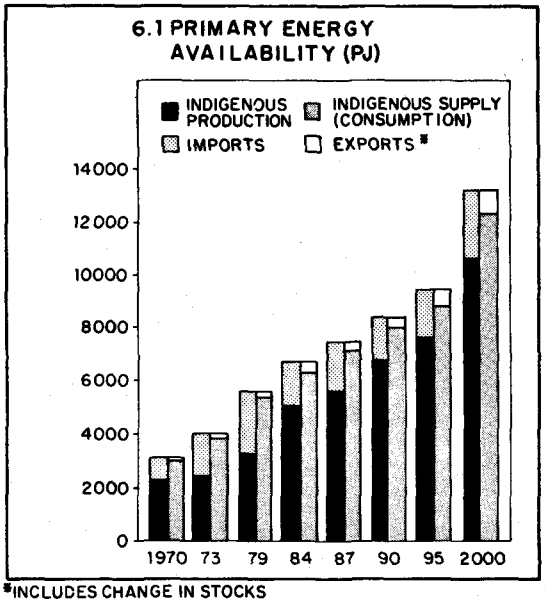
(1) Steam and metallurgical coal
(2) Sugar cane products
(3) Firewood and other industrial and biomass residues
(4) Includes alcohol

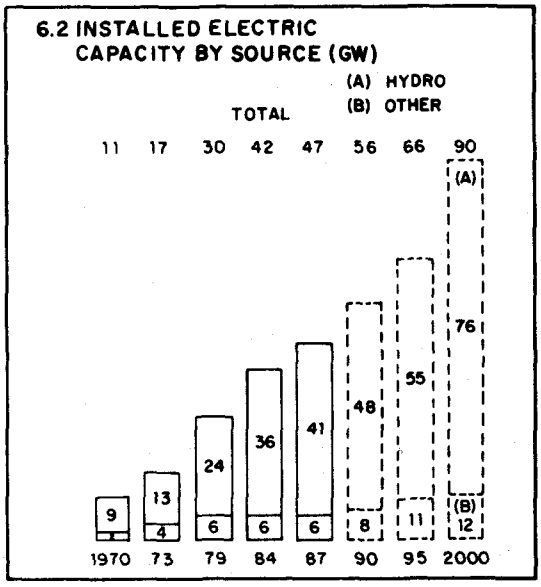
5.1. FINAL ENERGY DEMAND BY SOURCES AND SECTORS (PJ)	1970	1973	1979	1980	1984	1985	1986	1987
(1) Solid Fuels								
Industrial	48	55	137	151	239	264	272	297
Transport	1	n	1	1	1	1	1	n
Other	–	–	–	–	–	–	–	–
Total Solid Fuels	49	55	138	152	240	265	273	297
(Mtoe)	1	1	3	4	6	6	7	7
Refined Petroleum Products								
Industrial	232	368	599	586	260	260	282	310
Transport	529	767	1.039	989	910	955	1.035	1.033
Other	148	232	460	469	558	618	663	720
Total Refined Petroleum Products	909	1.367	2.098	2.044	1.728	1.833	1.980	2.063
(Mtoe)	22	34	51	49	42	45	47	50
(2) Gas								
Industrial	7	10	33	37	64	70	86	107
Transport	–	–	–	–	–	–	–	–
Other	6	8	22	24	30	34	32	34
Total Gas	13	18	55	61	94	104	118	141
(Mtoe)	n	n	1	1	2	3	3	3
Electricity								
Industrial	70	106	222	247	314	347	376	379
Transport	2	2	3	3	4	4	4	4
Others	63	86	161	178	237	252	270	289
Total Electricity	135	194	386	428	555	603	650	672
(Mtoe)	3	5	9	10	13	14	15	16
Others	1.395	1.396	1.325	1.376	1.520	1.513	1.543	1 5' 9
(Mtoe)	34	33	32	33	36	36	37	37
Distribution And Storage Losses	43	59	94	98	98	140	126	128
(Mtoe)	1	1	2	2	2	3	3	3
Total Final Energy Demand	2.544	3.089	4.096	4.159	4.235	4.458	4.690	4.840
(Mtoe)	61	74	98	99	101	107	112	116

5.2. ELECTRICITY SUPPLY BY SOURCES (TWh)	1970	1973	1979	1980	1984	1985	1986	1987
Solid Fuels	2	2	3	2	3	3	4	4
Oil Products	4	4	4	4	3	3	9	8
Gas	n	n	n	n	n	1	n	n
Nuclear Power	–	–	–	–	3	3	n	1
Hydro Power	40	58	117	129	167	179	183	186
Other	1	1	1	2	2	2	2	3
Net Imports	–	n	n	n	n	2	10	17
Total	47	65	125	137	178	193	208	219
Of which								
Public Supply	43	61	119	131	171	186	200	211
Autogeneration	4	4	6	6	7	7	8	8

5.3. SECTOR OIL SUBSTITUTION INDICATORS (OAR, OUR E OSR) (%)	1970	1973	1979	1980	1984	1985	1986	1987
(3) Oil Application Ratio (OAR)								
Industry	23	24	26	26	14	13	13	13
Transport	52	51	45	44	48	48	46	45
Commercial / Residential / Public	8	7	6	7	9	9	9	9
Agriculture	2	3	3	4	5	5	6	6
Electricity Generation	5	4	2	2	2	2	5	4
Oil Refining	5	7	8	8	10	9	8	9
Oil Use Ratio (OUR)								
Industry	26	31	30	28	11	10	11	11
Transport	97	98	95	93	85	84	81	81
Commercial / Residential / Public	7	9	10	11	11	12	13	14
Agriculture	7	18	34	38	38	39	43	42
Electricity Generation	9	7	4	3	2	2	5	4
Oil Refining	93	93	92	92	89	88	88	89

(1) Steam coal and coal coke
(2) City gas, coking gas and natural gas
(3) The denominator includes the total domestic consumption of oil products, including the internal consumption of the energy sector.





*INCLUDES CHANGE IN STOCKS

6.3. EXPLANATIONS AND DEFINITIONS

SYMBOLS AND ABBREVIATIONS EMPLOYED:

e = estimated data
na = not available data
– = magnitude zero
r = revised data in respect of previous issue

In rouding data, each figure has been rounded off to the nearest final digit. The sum of the parts may not therefore equal the total.

CONVERSION FACTORS

When hydro, nuclear or geothermal electricity is accounted for as primary energy in PJ or Mtoe a convention of 1 TWh of electricity = 2.6 TWh of primary energy has been used (table 4.2, diagram 3.1 and 3.3) and the conversion losses are included in table 4.3. Thus 1 TWh electricity = 2.6 TWh = 9.36 PJ of primary energy.

In table 5.1 is electricity final demand is given in PJ (1 TWh = 3.6 PJ).

In table 5.2 electricity supply amounts are in TWh.

S.I. MULTIPLIERS AND EQUIVALENTS

(k) = kilo	= 10^3	J	= 1 Joule = 0.239 cal = 1 Ws
(M) = mega	= 10^6	1 kWh final demand	= 3.6 MJ or 860 kcal
(G) = giga	= 10^9	1 Ton	= 1.000 kg
(T) = tera	= 10^{12}	1 kg	= 2.2046 lb.
(P) = peta	= 10^{15}	1 Btu	= 0.252 kcal = 1.055 kJ
(E) = exa	= 10^{18}	1 Therm	= 10^5 Blu = 25.200 kcal = 105.506 kJ
		1 Toe	= 42 GJ
		1 Tce	= 29.3 GJ

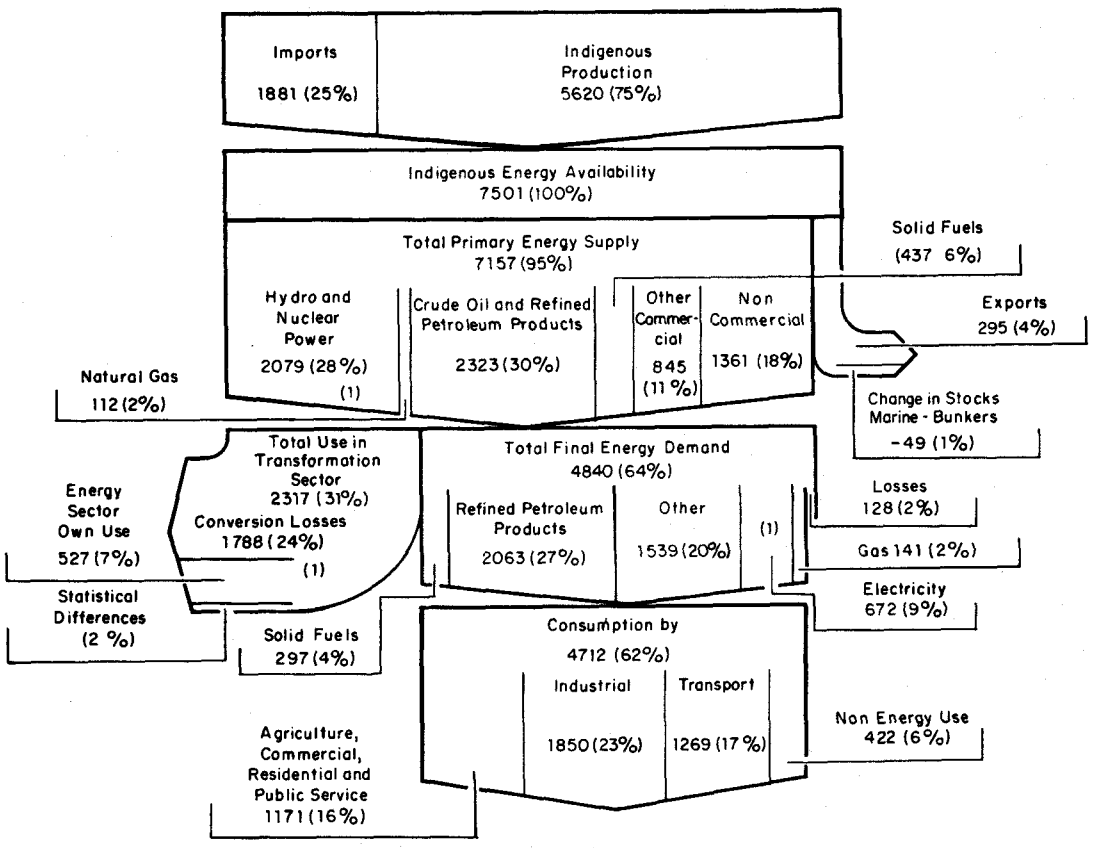
$$\text{OAR (Oil Application Ratio)} = \frac{\text{Oil Consumption in Sectory}}{\text{Total Oil Consumption in Country}}$$

$$\text{OUR (Oil Use Ratio)} = \frac{\text{Oil Consumption in Sectory}}{\text{Total Energy Consumption in Sector}}$$

CURRENCY CONVERSION

Local currencys is converted to 1980 US$ by deflating local currency values to 1980 values and using the 1980 U$ Dollar exchange rate (1 US$ = Cr$ 52,71).

DIAGRAM OF ENERGY FLOW 1987 (PJ)



(1) As nearly all the electricity consumed in Brazil is of hydraulic origin, the utilization of different conversion factors between the primary hydraulic energy and the demand of electricity causes the distortion that can be noticed above, showing an apparent increase in the conversion losses, which in reality does not exist in the case of Brazil.

ENERGY ADMINISTRATION
Ministério das Minas e Energia
Esplanada dos Ministérios, Bloco J
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RECENT PUBLICATION
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BRAZIL - ACTION FOR THE PETROLEUM SECTOR

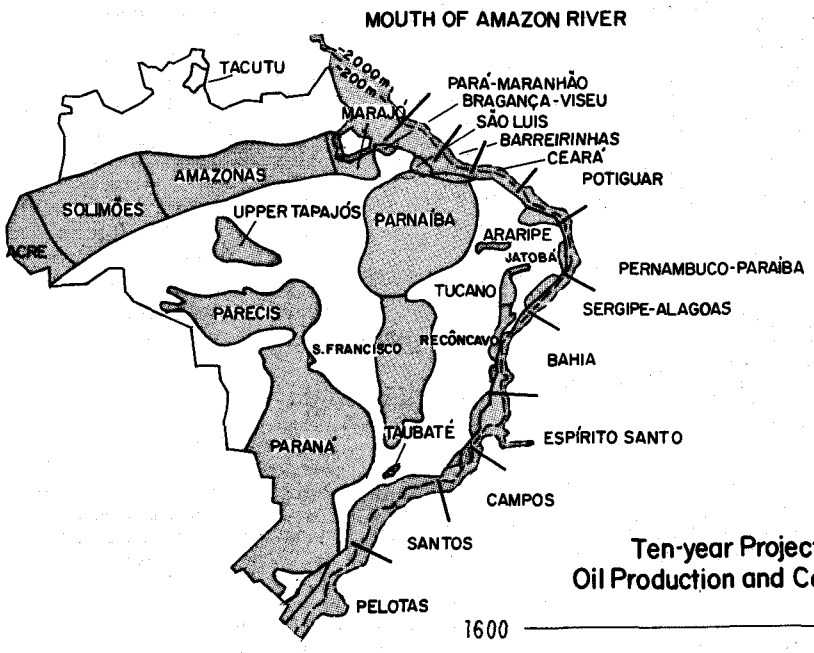
Brazil has the fifth largest sedimentary area in the world which has still barely been explored, and where possibilities for new discoveries are being revealed each day.

The drilling cost per meter offshore Brazil fell from US$ 1,645 to around US$ 1,000 between 1982 and 1987, or almost 40% down in five years. The same happened in the case of seismic data acquisition where, besides the drop in prices, a great deal of technological progress was made and assimilated by PETROBRÁS.

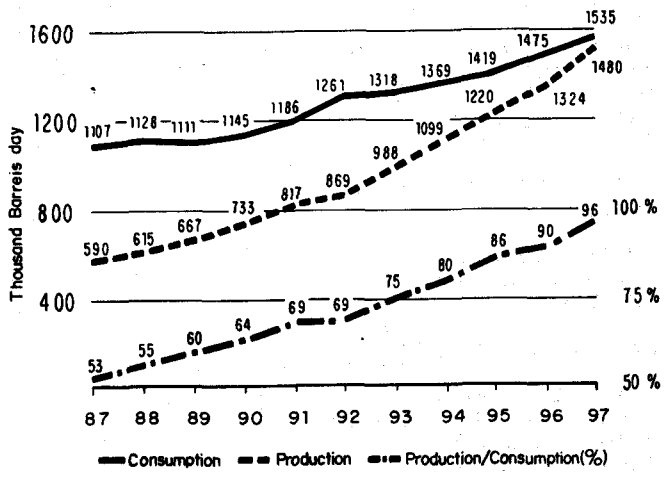
Projets for developing production indicate excellent profitability capacity with a return in less than two years. Although investments for deep water oil production are higher, the unit cost of recovering oil from such fields in Brazil will tend to be lower than international quotations forecast for the 90's, due to the deposits' high productivity.

With production levels projected for the next 10 years, Brazil will be able to meet about 75% of national demand for petroleum products in 1993 with its own output, based on an estimated growth of 5.5% per year for the Brazilian economy. In 1997, with a potential production of 1.5 million barrels per day and 70 million m^3 per day of natural gas, Brazil will gain even more independence in the energy sector.

Brazilian Sedimentary Basins



Ten-year Projection of Oil Production and Consumption



1989年(1~12月)世界 各國의 原子力發電所 稼動狀況

國 家[1]	爐 數	定格出力 (MW)	年間發電量 (백만kwh)	年間對比 伸張率(%)	'89年 稼動率(%)	'88年 稼動率(%)
미 국	110	103,658	555,145.4	+0.1	61.5	63.5
일 본	38	29,445	184,013.8	+6.0	72.2	70.7
프 랑 스	55	54,755	302,544.2	+10.1	62.4	58.0
서 독	22	23,944	149,052.9	+2.6	72.2	76.0
영 국	40	15,273	71,274.3	+12.3	55.1	55.9
카 나 다	18	12,919	83,235.9	-2.8	73.6	76.7
스 웨 덴	12	10,154	65,601.0	-5.5	74.3	77.1
대 만	6	5,146	28,276.2	-7.7	61.9	67.8
스 위 스	5	3,079	22,754.2	+0.3	83.7	83.1
스 페 인	10	7,857	56,118.7	+11.3	81.2	77.6
이 탈 리 아	2	1,132	0	0	0	0
한 국	9	7,616	47,364.1[2]	22.4	73.5	67.2
인 도	6	1,330	3,983.9	-34.3	34.5	52.0
벨 기 에	7	5,718	41,161.9	-4.5	80.5	85.3
핀 란 드	4	2,400	18,798.8	-2.5	89.9	91.2
네 덜 란 드	2	540	4,018.7	+6.7	80.3	82.3
헝 가 리	4	1,760	13,839.9	+2.9	89.8	86.9
남아공화국	2	1,930	11,730.0	+5.6	68.8	65.5
아르헨티나	2	1,005	5.039.4	-5.9	44.4	57.1
브 라 질	1	657	1,592.1	-	27.7	5.7
유 고	1	664	4,147.3	+0.3	71.3	70.9
파 키 스 탄	1	137	70.2	-	5.9	16.3
22個國 合計	357	291,119	1,669,762.9	+3.3	64.8	65.9

1) 蘇聯, 東獨, 체코, 불가리아 등의 社會主義 國家는 除外되었음.

2) 「韓電主要電力統計」에 의하면 韓國의 '89年 原子力發電量은 47,365GWh임.

資料 : 日本 社團法人 海外電力調査會