1985 INTERNATIONAL ROUNDTABLE ON RENEWABLE ENERGY

COUNTRY POLICY PAPER #1

The Brazilian National Alcohol Program:

Incentives and Subsidies

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CHAPTER I

THE BRAZILIAN ALCOHOL PROGRAM*

In this chapter we first briefly review the overall evolution of the energy sector from 1973 to 1983 as a background for this paper's discussion of the alcohol program. Turning to the program itself, we discuss the first phase of the national alcohol program (1975-79/80) including developments in the sugar industry and technology which helped strengthen its implementation at the time. Broad outlines of the programs' evolution in its second phase (post-1979) are presented. We then briefly review some of the goals and major problems related to the program.

Energy Sector Evolution 1973-83

At the time of the first petroleum crisis in 1973 Brazil was heavily and increasingly dependent on petroleum, and specifically imported petroleum. Ten years later the picture had changed substantially. The official index of net dependence on foreign sources of primary energy (overwhelmingly petroleum) had fallen from 34.2% to 22.2% in 1983 (see Table I.1). Though this index probably underestimates the true weight of foreign primary energy sources, it gives an idea of the basic change which has been occurring in Brazil's foreign energy dependence. The table also shows that the various forces leading to this change only began to have significant overall impact beginning about 1980, the time of the second petroleum crisis and the beginning of a severe economic recession that has lasted until today.

This change can be attributed to two basic parameters. First, as shown in Table I.2, the fraction of final energy demand supplied by petroleum derivatives has fallen significantly, from 44% to 34%. At the same time, since 1979/80 petroleum and natural gas supply from domestic sources has increased rapidly (figure I.1). As a consequence crude petroleum imports have been falling strongly (Table I.12).

The reasons for the declining share of petroleum in final energy demand shown in Table I.2 are complex and go beyond the scope of this paper. Factors such as structural change in the economy and the economic crisis are an important part of the context. Improvements in energy efficiency have occurred especially in industry and transport but are difficult to estimate.

Substitution of petroleum by other resources (together with increased petroleum production) has been the principal priority in energy policy. A range of formal programs have been developed with this objective, including:

- o the substitution of gasoline by alcohol

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*Tables for each chapter are located at the end of the respective chapter.

- the substitution of fuel oil by wood, charcoal, and coal (depending on the industry.
- the substitution of petroleum derivatives by electricity - most notably in the current program substituting electricity for derivatives used for process heat
- steady growth in hydroelectric capacity relative to thermal generating capacity - some of which is oil-fired.

The intensity of the change in the profile of energy use resulting from all these factors is perhaps best appreciated by looking at the relative growth at the margin that occurred during 1973-83 for different types of energy carriers. This is shown in Table I.3 of the total growth in energy consumption of 46.8 million tonnes of petroleum equivalent that occurred over these ten years;

- 53.7% was supplied by electricity (overwhelmingly hydro)
- 22.2% by solid industrial fuels (wood, coal, coke, charcoal, bagasse)
- 7.1% by alcohol

In comparison, only 15.7% was supplied by increased consumption of petroleum derivatives. It is interesting that the absolute growth in alcohol consumption was almost equal to half that of all petroleum derivatives.

The changes in relative sectoral demand for energy have been less dramatic. Table I.4 shows sectoral shares for total energy, petroleum derivatives, and electricity in 1973 and 1983. Industrial electricity demand as a percentage of total electricity demand remained very stable (53/54%) though the share of petroleum derivative consumption fell significantly at the same time that the share of total energy increased to 39%. This is due to the important growth in solid fuel demand in this sector.

The transport sector has remained by far the largest consumer of petroleum derivatives, being responsible for 53% - a figure which has hardly changed over time. There has been, however, a dramatic change in the relative importance of diesel and gasoline. Gasoline consumption has fallen sharply both as a result of the alcohol program and of price-induced shifts to diesel primarily in road freight.

This brief overview has been intended to give the reader some insight into the context within which the alcohol program has evolved in Brazil. It can be seen that while the impact of the substitution in quantitative terms is far from being the largest, it has been quite significant. Furthermore it is the only important substitution program to date which addresses the transport sector, the dominant petroleum consuming sector in Brazil.

Introduction to the Alcohol Program

The higher prices of petroleum since 1973 have had a substantial impact on the Brazilian economy. In 1972 petroleum importation was equivalent to 13.5%

of the country's exports. In 1980, with the continuing higher prices of petroleum, petroleum importation reached US $9.8 billion, corresponding to 48.7% of exports. This situation together with the capacity and problems of the sugar industry were the most important factors stimulating the development of a national ethyl alcohol program.

In November of 1975, the Federal Government created the National Alcohol Program (NAP), but it was only in 1977 that a legal and regulatory act established basic criteria for the expansion of alcohol production and also established the National Alcohol Commission, the organization responsible for implementation of the program.

During an initial period from its creation until 1980, the NAP's political support came from an association of government interests, equipment manufacturers, and sugar and alcohol producers. Two important groups represented by Petrobras (the state-owned company which has the monopoly for petroleum exploration, exploitation, and refining) and the private sector automobile industry adopted a political posture of skepticism regarding the viability and results of the NAP.

The sugar and alcohol manufacturers have a strong historical relationship with the government, since sugar and alcohol commercialization in the internal market is a state monopoly. The government, through the Sugar and Alcohol Institute (IAA), controls the prices of sugarcane, sugar and alcohol, and the production quotas of each sugar mill and distillery. Consequently the sugar manufacturers had no difficulty in responding to the government's initiative. They also viewed alcohol as a new and promising market, since the export sugar market was disappointing throughout most of this period (see Figure I.2).

Lacking the direct collaboration of the car manufacturers, the NAP was designed for the production of absolute (dehydrated) alcohol (see Table I.5) which was to be blended directly with gasoline in amounts that neither disturb the engine efficiency nor require any adaptation in Otto engines. This situation only changed in 1980/81 when enough production of dehydrated alcohol was achieved to blend with all the gasoline, and simultaneously the car industry was faced with a serious crisis as a consequence of the country's economic situation. From this date on, the car industry decided to start the manufacturing of automobiles fueled by pure ethanol (hydrated alcohol) (see Table I.6).

The lack of technology for the use of pure ethanol in automobiles was made evident by the various problems that were encountered: corrosion of parts in contact with ethanol, difficult start-up mainly in cool weather, and low fuel efficiency. Pure alcohol car sales, which had increased rapidly in 1980, fell drastically in 1981, due to these technological problems (see Table I.6). Only in 1982 when the car manufacturers incorporated several technological improvements together with a package of government incentives, did sales go up again. Today alcohol automobiles represent nearly 90% of new automobiles sales in the internal market.

Another factor that contributed to the early decrease in consumers' confidence in pure alcohol cars was the adaptation of used gasoline vehicles to enable them to use alcohol. This was done by unqualified people and without any effective government quality control, despite a nominal program for this purpose.

The Initial Period of the NAP

The NAP was rapidly established because during the earlier years it could take advantage of another government program for the modernization of the sugarcane industry that was already fully operational. During its initial phase the NAP had the benefit of financial supports from the Special Export Funds (SEF) created in December, 1965 and from studies (Act of August, 1971) for the establishment of a policy to stimulate sugar mill modernization and the elaboration of new quotas for cane growers. The SEF program was established with funds collected from sugar exportation, and had the purpose of correcting distortions in the sugar sector by means of the following two programs:

(a) financing the consolidation, incorporation, and relocation of sugar mills, in order to eliminate small and medium plants of low efficiency located in areas with low potential;

(b) financing the technological improvement of the sugarcane industry with modern equipment. Due to the SEF program, the sugar mill profile in Brazil was significantly modified (see Table I.7).

Mills with sugar production below 18,000 t/year were considered small units and uneconomical. Out of a total of 249 units, 148 were considered small (60%). After the SEF program, only 18% of total units remained in the small category. Through this program 43 sugar mills considered not economically acceptable were closed, but with no social problems since there were planned actions to compensate for this.

The SEF program also modified the profile of cane growers. Before that program, 93.6% of the growers delivered less than 3,000 t/year, a level below the economic quantity. Today, a great part of the growers deliver nearly 5,000 t/year.

By the end of the SEF program Brazilian sugar production capacity had increased from 5.4 million tons (1971/72) to nearly 9.2 millions (1978). The increased sugarcane milling capacity enabled the production of alcohol from sugarcane in Annexed Distilleries* (see Table I.8) and the NAP showed results in 1978, only one year after its full legal establishment.

The first regulatory measures of the NAP sought to consolidate the program for production and utilization of alcohol in the shortest possible time. For this goal the NAP used two very simple incentives: very attractive financing conditions and the guarantee of alcohol purchase at adequate prices. The implantation of the NAP was possible due to four basic conditions which assured its success during the first years:

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* Annexed Distilleries are distilleries attached to existing sugar mills.

(a) ethanol technology production was mature at the industrial level. Sugarcane juice was already fermented to obtain sugarcane alcoholic beverages.

(b) sugarcane production technology was also mature and there are adequate climactic conditions for growing sugarcane in practically all populated regions of the country.

(c) there was in Brazil an equipment manufacturing industry, for both industrial and agricultural equipment, which was well developed and whose inputs were more than 90% of domestic origin.

(d) alcohol consumption during the first period of the NAP was assured by means of a government act that imposed the mixture of dehyrated alcohol with gasoline, at levels that do not require any modification of Otto cycle engines.

Sugarcane alcohol industrial technology is considered very simple in Brazil, since it has been practiced and developed for almost five centuries. The process, without any modern technological improvement, presented in 1975 a global efficiency of 65-75%; i.e., it could recover up to 75% of the theoretical potential ethanol from sugarcane. At present, after intensive development of the technology, Brazilian distilleries achieve 80-90% recovery.

Sugarcane is also a very simple crop to grow and it is resistant enough to be exploited with no need of excessive phytossanitary control by farmers. It also gives good yields in poor soil conditions. The average yield in Sao Paulo State (where nearly 70% of present Brazilian alcohol is produced - See Table I.9) is 70-75 tonnes of sugarcane per hectare, while in other states it varies from 45 to 60 t/ha, approximately (See Table I.10). Agricultural technology was enhanced by the utilization of new varieties developed in breeding programs and by new crop cultivation procedures which allow economical exploitation of 5-6 successive harvests instead of 3-4 as was common up to 1975.*

It is important to emphasize that the NAP had no technical problems to impede its progress as long as sugarcane was used as the feedstock. But there are examples of technical barriers for the utilization of cassava (manioc) and wood for ethanol production. Four or five plants were built to operate with cassava and they have presented process problems for as long as 3 years. Although Brazil is the largest world cassava producer, it is now known that there is a lack of technology for planting in large contiguous areas, because of phytossanitary problems with the crop and the necessity to develop implements and agricultural machines mainly for harvesting. Regarding ethanol from cellulose, Brazil has an excellent technology for forestry production with high yields (25 solid cubic meters of wood per hectare per year), but the available technology of batch acid hydrolysis presents serious problems of economic viability (see Table I.11).

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*Sugarcane grows back after cutting and thus can be harvested a number of times over a period of several years.

The equipment manufacturers' know-how was a significant aspect favoring the development of the NAP, since it was not necessary to incur high costs for licenses or imports. As an example, the distillation columns are built according to the Brazilian historical experience, assisted by the adaptation of international engineering codes. Thus, the columns are built with very thin inox plates in order to achieve lower costs.

Methanol production is another alcohol technology under development in Brazil, principally by CESP - Companhia Energetica de Sao Paulo. This technology can use wood gasification as a source of synthesis gas. No commercial plants using wood or other biomass are in operation. Among all these alternatives for alcohol production based on biomass, sugarcane ethanol appears to be the one with the lowest cost (see Table I.11) though there is considerable uncertainty regarding these estimates.

Goals of the NAP

In the initial period, the NAP goal was the production of 3 billion liters by 1980 (See Table I.5). This was to be done by means of Annexed Distilleries, utilizing the milling capacity and sugarcane from the sugar sector that had been made available by the SEF program. Since 1979, with increasing new uses for alcohol, mainly as pure (hydrated) alcohol fuel for automobiles, alcohol production has increased primarily in autonomous distilleries and in new agricultural areas where sugarcane has not traditionally been important (see Tables I.8 and I.9). In 1979 the goal of 10.7 billion liters per year was set for 1985. Since 1979, hydrated alcohol production has increased its share of total production. For the 1987/88 season the goal for total production is to reach 14.3 billion liters. Up until now actual production has increased close to the original goals.

Simultaneously with the substitution of gasoline, alterations were made in the refining structure of petroleum (see Table I.13), all of which is totally processed in Brazilian refineries. Some of these changes are a response to the substitution of gasoline by alcohol, which made it possible to import less petroleum and to increase the amounts of other derivatives, in accordance with the needs of comprehensive energy program.

Problems Related to the NAP

Among the problems related to the NAP, the most important are:

(a) The NAP is stimulating the expansion of the sugarcane crop, which is occupying lands that have been traditionally used for food production. Sugarcane is maintained as a more profitable business in comparison with traditional food crops, and this is also causing an increasing price of land in the areas of cane expansion. The expansion of alcohol production has occurred mainly in the most developed states.

(b) there are some serious problems with the labor force employed for sugarcane harvesting, a very labor-intensive activity. Sugarcane harvesting is mostly manual (nearly 80%) and because it is a seasonal activity realized during 6 months of the year, there is a significant problem of seasonal unemployment. Many sugar mills and distilleries are offering fixed jobs to laborers and paying them all legal benefits, but in some cases it is difficult to avoid social problems, probably because all this is insufficient to erase the bad image created by the long history of temporary employment practice and its continuation in some mills. The social question of labor and seasonal activity is an old problem, antedating the NAP. Before the NAP the seasonal labor problem was attenuated by the employment of laborers in other crops in the same region during the off-season. However today with cane expansion, a larger number of laborers are required for cane harvesting, while fewer areas of food crops are available in the sugar cane region and when available they are highly mechanized. Sugarcane labor is the best paid rural labor. The workers also have a strong union in many regions. It is necessary to remain specially attentive to the labor problem.

(c) It has been very common to criticize the NAP for pollution caused mainly by vinasse (stillage), the liquid effluent of ethanol distillation. However, during these past years the technology of using vinasse as a fertilizer of sugarcane fields has been fully developed. Its application on the soil helps economize on conventional fertilizer use and leads to an increment of 20 - 30% in cane yields, due to its potash and organic matter content. Vinasse is not considered a polluting effluent anymore.

(d) There are serious questions regarding the overall economics of the program as conceived. There is little doubt that alcohol is more expensive to produce per unit of energy than regular gasoline, even allowing for higher efficiency in its use. The problem is to know how much more and what cost trends exist. The price structure for many inputs is distorted so that it is difficult to derive the true cost, and even more difficult to judge how costs would evolve if these distortions did not exist. In addition, it is very difficult to determine the cost of the gasoline produced by Petrobras, which is virtually treated as a secret and is not necessarily the same as the world market price that analysts invariably use.

In the chapters which follow we shall delve more deeply into one aspect of this last problem - the complex of price structures and incentives which makes the task of accurate cost analysis and optimization so difficult.

TABLE I.1

EVOLUTION OF DEPENDENCE ON IMPORTED ENERGY

	Percent of total primary energy demand from foreign sources
1973	34.2
1974	34.0
1975	35.7
1976	36.9
1977	36.2
1978	37.5
1979	37.5
1980	34.4
1981	30.5
1982	27.0
1983	22.2

Source: National Energy Balance 1984

TABLE I.2

BREAKDOWN OF SOURCES OF SUPPLY FOR FINAL ENERGY DEMAND*
IN 1973, 1980, and 198

	Percent 1973	1980	1983
Industrial solid fuel (1)	11.9	13.0	15.8
Other solid biomass (2)	22.7	14.4	13.7
Alcohol	0.3	1.7	2.9
Electricity	21.1	29.8	33.6
Oil derivatives and natural gas	44.0	41.1	34.0

* Final energy demand is as defined in the National Energy Balance (small discrepancies occur due to detailed omissions); this includes some of the consumption of the energy sector (though not transformation losses).

(1) Coal, coke, industrial charcoal, industrial wood, bagasse

(2) Wood and charcoal consumed in residential, agricultural, commercial, and public sectors.

Source: National Energy Balance 1984

TABLE I.3

BREAKDOWN OF ENERGY SUPPLY GROWTH FROM 1973-83 BY TYPE OF ENERGY CARRIER

	Absolute Growth 1973-83 (thousand tonnes petroleum equiv.)	Share of total growth
Solid Industrial Fuels (1)	10,391	22.2
Other solid biomass (1)	- 404	-0.9
Alcohol	3,337	7.1
Electricity	25,141	53.7
Natural Gas	1,021	2.2
Petroleum derivatives	7,359	15.7
TOTAL	46,845	100.0

(1) See notes to Table I.2

Source: National Energy Balance

TABLE I.4

SECTORAL BREAKDOWN OF FINAL ENERGY DEMAND 1973/83

	Total		Petroleum derivatives		Electricity	
	1973	1983	1973	1983	1973	1983
Industrial	35.7	39.2	28.5	22.3	53.7	53.4
Transport	24.5	20.9	54.5	53.4	1.1	0.7
Energy	3.1	6.0	6.3	7.7	1.4	1.7
Residential/Comm./Public	31.6	28.7	7.8	10.7	42.8	41.9
Agriculture	5.1	5.4	3.0	5.8	1.0	2.3

Source: National Energy Balance 1984

TABLE I.5

ALCOHOL, SUGARCANE AND SUGAR PRODUCTION SINCE NAP START UP IN 1975

SEASON	ALCOHOL - 10^6 M^3				SUGARCANE	SUGAR
	ABSOLUTE	HYDRATED	TOTAL	% HYDRATED	10^6 T	10^6 T
1975/76 (1)	0.23	0.32	0.55	58.1	68.3	5.9
1976/77	0.30	0.36	0.66	54.9	87.8	7.2
1977/78	1.18	0.29	1.47	19.9	104.6	8.3
1978/79	2.10	0.39	2.49	15.9	109.7	7.3
1979/80	2.71	0.68	3.39	20.0	117.3	6.6
1980/81	2.10	1.60	3.70	43.2	132.1	8.1
1981/82	1.45	2.79	4.24	65.7	133.3	7.9
1982/83	3.55	2.27	5.82	39.0	166.7	8.6
1983/84	2.47	5.40	7.87	68.6	210.0	9.1
1984/85 (2)	2.30	6.75	9.05	74.7	228.0	8.5

Source: IAA

(1) until 1975/77 ethanol production recorded here was obtained from molasses fermentation (residual molasses from sugar manufacturing)

(2) estimate

TABLE I.6
VEHICLE PRODUCTION BY BRAZILIAN AUTOMOTIVE INDUSTRY (X 10^3)

YEAR	AUTOMOBILES		PICK-UPS		TRUCKS		BUSES		TOTAL	
	A	G	A	G/D	A	D	A	D	A	G/D
1979	4.47	9.57	0.15	61	0.01	93	-	13	4.63	1,124
1980	241	737	13.3	58	0.01	102	-	14	254	911
1981	123	499	4.9	64	1.1	75	0.01	13	129	652
1982	223	493	13.7	73	0.9	46	0.01	10	237	622
1983	562	210	28.1	54	2.1	33	-	6	592	304

Source: ANFAVEA A = Alcohol G = Gasoline D = Diesel

TABLE I.7

Results of the modernization program of the Special Export Fund,
in terms of quantity of sugar mills per class of sugar production capacity
in North/Northeast and Center/South region, from 1971/72 to 1978

Sugar Production t/year	North/Northeast		Center - South		Total	
	71/72	78	71/72	78	71/72	78
6,000	14	5	11	2	25	7
6,000 - 18,000	49	14	74	16	123	30
18,000 - 36,000	26	34	41	23	67	57
36,000 - 60,000	8	22	19	54	27	76
60,000 - 90,000	-	12	6	10	6	22
90,000 - 120,000	-	1	-	4	-	5
120,000	-	-	1	9	1	9
TOTAL	97	88	152	118	249	206

Source: IAA

Medium capacity sugar mills: 18,000 - 60,000 t/year.

TABLE I.8

Evolution of the number, type and alcohol production of distilleries

Season	Number of distilleries An	Aut.	Total	Alcohol production (10^6 m^3) An	Aut.	Total	Autonomous Alcohol Production %
1975/76	124	6	130	0.5	0.05	0.55	9.5
1977/78	137	13	150	1.33	0.14	1.47	9.8
1979/80	155	41	196	3.04	0.35	3.39	10.3
1982/83	167	104	271	4.26	1.56	5.82	20.0
1983/84	158	146	304	5.11	2.76	7.87	35.0

Source: IAA

An = Annexed distillery (distillery attached to existing sugar mills)
Aut= Autonomous distillery

TABLE I.9

Evolution of Alcohol Production by States

Regions States	Alcohol Production 1975/76 10^3 m^3	%	1979/80 10^3 m^3	%	1983/84 10^3 m^3	%
North - Northeast	94	16.9	569	16.8	1,126	14.3
Alagoas	27	4.9	226	6.6	550	7.0
Pernambuco	65	11.7	235	6.9	265	3.4
Paraiba	1	0.1	67	2.0	168	2.1
Others	1	0.1	41	1.2	143	1.8
Center - South	462	83.1	2,827	83.2	6,741	85.7
Sao Paulo	362	65.1	2,472	72.8	5,398	68.6
Parana	20	3.6	92	2.7	492	6.2
Minas Gerais	16	2.9	76	2.2	270	3.4
Rio de Janeiro	55	9.9	139	4.1	203	2.6
Goias	2	0.4	7	0.2	154	2.0
Mato Grosso do Sul	-		14	0.4	111	1.4
Others	7	1.2	27	0.8	113	1.4
Brazil	556	100.0	3,396	100.0	7,867	100.0

Source: IAA

TABLE I.10
Evolution of sugarcane yields (t/ha) in the main producing States

Season	Sao Paulo	Rio de Janeiro	Minas Gerais	Alagoas	Pernambuco
74/75	68	40	53	54	48
75/76	54	43	41	37	41
76/77	62	36	46	68	51
77/78	77	47	58	58	51
78/79	70	46	50	59	52
79/80	71	42	59	57	50
80/81	75	37	57	65	54

Source: IAA

TABLE I.11

Production Cost of Ethanol and Methanol

Product	Production costs US$/liter
Sugarcane ethanol (1)	0.202
Cassava ethanol (1)	0.321
Wood ethanol (1)	0.370
Wood methanol (2)	0.230

Source: (1) Moreira & Serra; (2) CESP

TABLE I.12

EVOLUTION OF CONSUMPTION, PRODUCTION AND IMPORTATION OF CRUDE PETROLEUM

Barrels Thousand/day	1972	1975	1979	1980	1981	1982	1983
Consume	610	840	1,122	1,098	1,016	1,018	961
Production	170	176	171	187	220	266	339
Importation	514	714	1,004	872	844	737	622
Production/consume	28%	21%	15%	17%	21%	26%	35%
Petroleum price in Brazil -US$/barrel	2.84	12.27	18.36	30.72	36.59	35.25	32.00
Importation 10^6 US$	538	3,055	6,639	9,811	10,335	9,301	7,426

Source: Petrobras

TABLE I.13

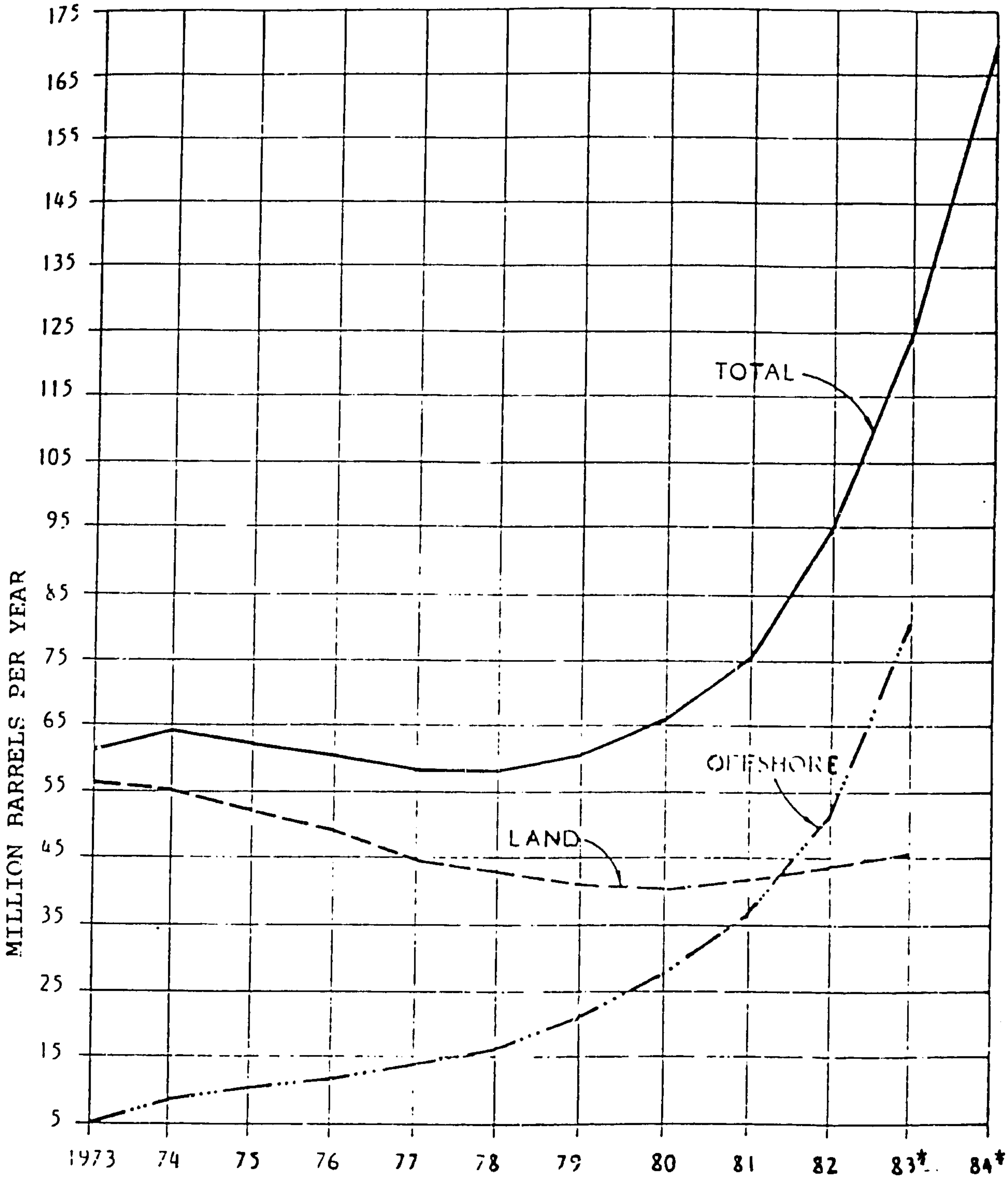
Evolution of Petroleum refining structure

Derivatives	1973	1979	1983
Gasoline	27.8	20.0	16.5
Diesel	23.7	28.5	33.4
Fuel Oil	31.9	29.4	22.8
Nafta	3.2	5.0	9.1
Kerosene	4.6	5.0	5.9
LPG	4.0	4.3	5.6
Others	4.8	7.8	6.7

Source: PETROBRAS

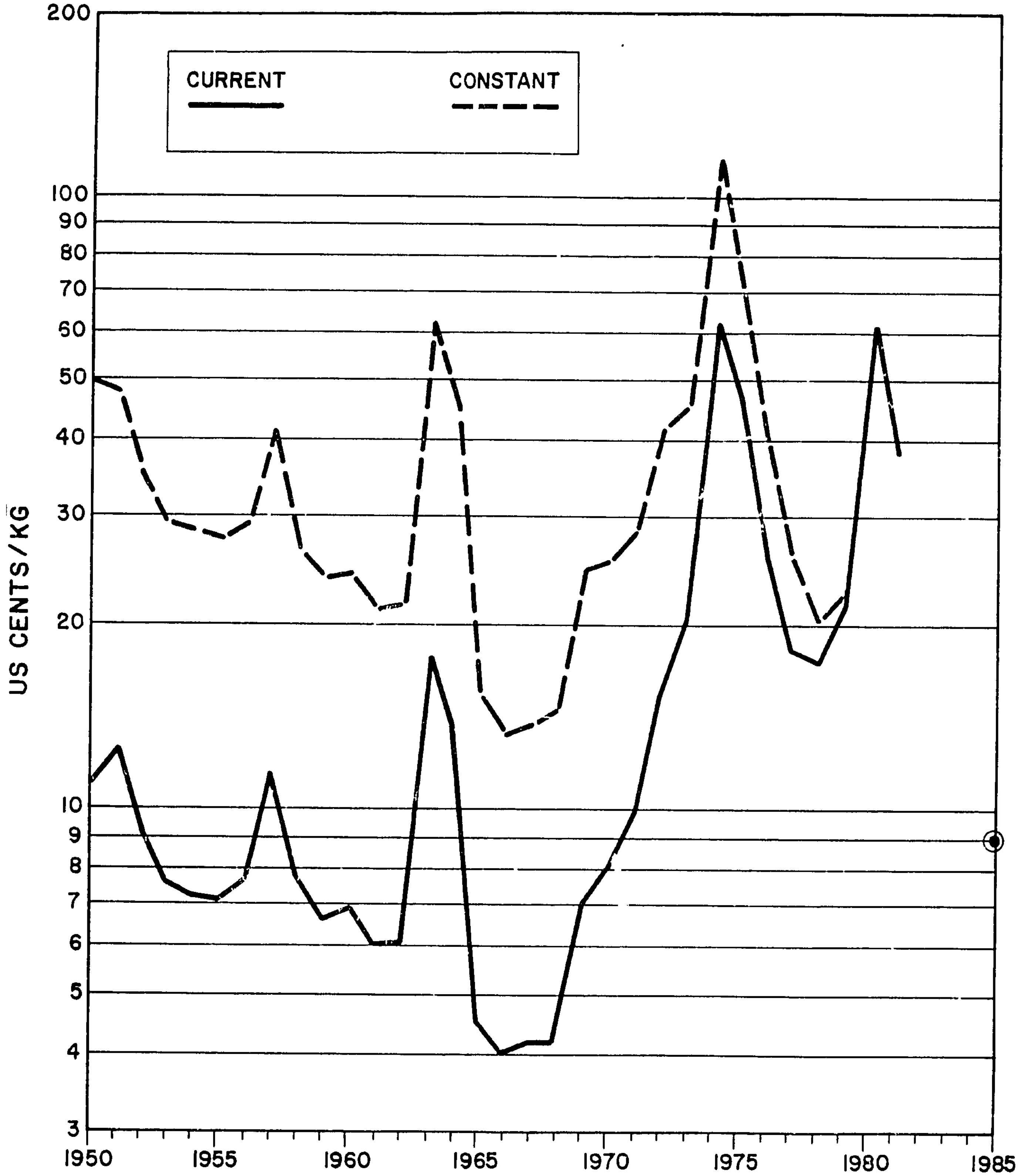
FIGURE I-1

EVOLUTION OF DOMESTIC LAND AND OFFSHORE OIL PRODUCTION



SOURCE: Conselho Nacional do Petroleo (*) Estimate

FIGURE I-2
SUGAR PRICES
(YEARLY AVERAGE)



NOTES: 1950 - 81 WORLD BANK
1985 APPROXIMATE AVERAGE PRICE FOR DELIVERY IN 1985 (NY MARKET) CURRENT US $

CHAPTER II

PRICE STRUCTURE OF GASOLINE AND ALCOHOL

This chapter reviews the complex calculations used in the formation of prices to the final consumer of gasoline and alcohol. In neither case are prices formed primarily by the market but rather are heavily administered and include such prominent elements as price equalization throughout the country. The tax component of each fuel's retail price is also estimated.

Gasoline

The refinery price of oil derivatives in Brazil is calculated on the basis of specific legislation, which establishes the calculation of a theoretical "medium price" for the derivatives from one barrel of oil (see Table II.1). Among oil derivatives we concentrate on the price structure for gasoline since the NAP is primarily aimed at its substitution.

The derivatives' theoretical "medium price" is based upon the evaluation of costs and profit per barrel that are assured by government legislation. This procedure, managed by Petrobras, can be criticized as an economic policy because it lacks the necessary incentive for company efficiency, i.e., its costs determine the price of the products while profits are guaranteed. The evaluation of the total "medium cost" considers four types of costs (3):

Type I - Costs due to the price of petroleum and other imported raw materials in international markets, and the currency exchange rate. It was not possible to confirm whether other international expenses (e.g. services of foreign firms) are included as well.

Type II - Cost due to labor expenses.

Type III - Other costs which are variable according to the internal economy.

Type IV - Costs due to depreciation, amortization, and remuneration of investments in the refining sector.

The dominant costs are the type I costs, which in May 1984 were responsible for 95.85% of the final cost of oil derivatives.(3)

Once the "medium price" of oil derivatives has been established, the price of each individual derivative (see Table II.1) is determined based on social, economic, and technical criteria. Gasoline is heavily taxed because it is used almost entirely for private automobile driving, whereas diesel is less taxed, being generally destined to basic truck, bus, and train transport. In practice, the gasoline price subsidizes fuel oil, naphta, kerosene, and LPG. LPG is highly subsidized since it is mainly used for cooking food both in rural and urban areas and is the principal fuel for this purpose.

The structure of the gasoline price to the consumer is shown in Table II.2 and from these data it is possible to verify that consumers pay 12.5% of taxes over the gasoline price. In relation to the derivatives "medium cost" (see Table II.1) the final gasoline price (Table II.2) is 2.26 times higher.

Alcohol

The ex-distillery price structures for absolute (dehydrated) and hydrated alcohol are presented in Table II.3. Absolute alcohol, which is used for blending with gasoline, has its cost at the blending center shown in Table II.4 and its final price to consumers at service stations in Table II.5. If we consider dehydrated alcohol in Sao Paulo State it can be seen that Petrobras' income alone (see Table II-5) adds 66% to the price of purchase from distilleries. Dehydrated alcohol is sold at the same price as gasoline on a volume basis.

The structure of the cost of hydrated alcohol (for use as a pure motor fuel) at service stations is shown in Table II.6, while its final consumer price at service stations is in Table II.7. As can be seen, the final consumer price (Cr$ 396.00) is lower than its cost (Cr$ 406.95) at the service station. This situation occurred in this particular case because in February 1984 there was a price adjustment for alcohol producers which amounted to almost 50%, due to the high inflation rates (see Table III.1). This adjustment could be compensated only after another alcohol price adjustment for the consumer, an adjustment which is made more often than that for producer prices. Due to high inflation rates there must exist periodic price adjustments, which are not simultaneous for alcohol producer and consumer (see Table II.8).

An additional complication relevant here is specific legislation that presently sets the hydrated alcohol price to consumer at 64% of the gasoline consumer price, in order to guarantee to consumers the economic viability of alcohol automobiles.

These factors lead to either of the following situations:

(a) When the alcohol price to consumers at the service station is higher than the calculated retail cost at the service station a surplus appears that is passed to the government (see Table II.9, data for January 1984).

(b) The contrary situation generates a deficit (see Table II.7 and II.9 for April), which is covered by the Price Uniformization Fund, maintained by the IOF tax (see Table II.2 footnote 2).

The prices of absolute and hydrated alcohol with taxes have always been maintained lower than the oil derivatives' "medium cost" (see Tables II.1 and II.3).

The percentages of taxes from alcohol and gasoline varies according the time of year (see Table II.9); during some periods absolute or hydrated alcohol generate more taxes than gasoline, as occurred in January 1984.

Commercialization costs in January and April of 1984 were respectively (as a percentage of the final price to the consumer): 13.2% to 16.1 for hydrated alcohol, 8.6% to 10.5% for absolute alcohol, and 7.9% to 9.6% for gasoline.

As can be seen, there is a significant administrative apparatus for fuel pricing, of which a main characteristic is flexibility for policy adjustments throughout the fuel sector. From the brief review above it can be concluded that the retail price of petroleum and alcohol fuels is not set by the market but is the result of regulatory policy.

TABLE II.1

COST OF PETROLEUM DERIVATIVES EX-REFINERY AND "MEDIUM COST" IN APRIL 1984

DERIVATIVE	CR$/LITER
Toluene	975.55
Extraction Solvent NR-5	744.46
Gasoline	500.16
Kerosene (technical grade)	372.27
Diesel	357.18
"MEDIUM COST"	297.73
Kerosene (aviation)	289.73
Fuel oil	198.73
Asphalt	182.83
Naphta (for petrochemistry)	169.43
LPG	129.50
Naphta (for fertilizers)	31.91

Source: Petrobras

TABLE II.2
PRICE STRUCTURE OF GASOLINE IN DIFFERENT STATES, ON APRIL 1984

Cr$/liter gasoline

	SAO PAULO SP	RS	MT	BA	PA
			SAME VALUE AS SAO PAULO		
Subtotal Ex-refinery cost	500.16				
Fuel Tax (1)	48.69				
IOF (repass to CNP) (2)	26.16				
Social Security Tax (3)	21.00				
Refinery PIS/PASEP (4)	4.53				
Refinery FINSOCIAL (5)	3.02				
Subtotal ex-refinery price	603.56				
Distribution costs (6)	13.76				
Distribution FINSOCIAL (5)	3.12				
Sales costs (7)	48.20				
Sales FINSOCIAL (5)	3.36				
TOTAL	672.00	672.00	672.00	672.00	672.00
Freight	(2.90)	(2,52)	(44.12)	(5.08)	(2.39)
(TOTAL TAXES) (8)	(83.72)	(83.72)	(83.72)	(83.72)	(83.72)

Source: PETROBRAS

(1) Fuel Tax is calculated over the CIF price of imported petroleum and its total value is distributed between derivatives according to their economic and social importance: 78% for lubricant oils. 29% for gasoline, 6.5% for diesel and kerosene, and 4.0% for LPG; fuel oil, naphta (for petrochemistry and fertilizers), aviation kerosene and other ones, are not taxed.

(2) IOF charge on Financing Operations, Insurance and Money Exchange over imported petroleum prices). Actually this charge is 15.0% over the CIF price of imported petroleum, and its total value is distributed between derivatives according to their economic and social importance and their share of production from one oil barrel: 39./% for gasoline, 26.5 for diesel, 10.5% for LPG, 6.8 for fuel oil "E", 4.7% for fuel oil "A", 1.2% for naphta (petrochemistry), etc. It is null for asphalt, naphta for fertilizer industry, aviation kerosene,toluene, solvents and others. These funds are repassed to the CNP (National Petroleum Council) to build up the Price Uniformization Fund, which guarantees uniform prices throughout the country.

(3) Social Security Tax - 6% of ex-refinery gasoline price; it is applied for all automotive fuels, including alcohol, gasoline and diesel.

(4) PIS/PASEP Social Tax (Labor Social Integration Program) - 0.75% of private refineries price, or 0.8% of state refineries price - all derivatives.

(5) FINSOCIAL (Social Program) - 0.5% of fuel price - all derivatives.

(6) Distribution charges Comprises costs and profit rates of fuel distribution companies (includes oil derivatives and alcohol); they are established from cost analysis.

(7) Sales charges comprises costs and profit of service stations, and are established from a cost analysis.

(8) Total taxes: see footnote 5 in Table II.9

(9) Freight paid by IOF, see also Footnote 4 in Table II.9

TABLE II.3
EX-DISTILLERY PRICE STRUCTURE OF DEHYDRATED AND HYDRATED ALCOHOL, IN APRIL 1984
(PRICE PAID TO THE ALCOHOL PRODUCER), FOR DIFFERENT REGIONS AND STATES

Cr$/liter alcohol

	NORTH/NORTHEAST		RIO DE JANEIRO STATE		MINAS GERAIS & E. SANTO STATES		OTHER STATES (SAO PAULO)	
	D	H	D	H	D	H	D	H
Parity value (1)	296.34	279.93	296.34	279.93	296.34	279.93	296.34	279.93
Sugarcane PIS/PASEP (2)	2.32	2.24	1.80	1.73	1.54	1.49	1.47	1.42
Sugarcane FINSOCIAL (2)	1.54	1.50	1.22	1.17	1.03	0.98	0.98	0.93
Sugarcane ICM (3)	52.64	50.73	40.80	39.32	34.94	33.67	33.35	32.14
Parity Price	352.84	334.40	340.16	322.15	333.85	316.07	332.14	314.42
Alcohol PIS/PASEP (2)	2.68	2.54	2.59	2.45	2.54	2.40	2.52	2.39
Alcohol FINSOCIAL (2)	1.79	1.69	1.72	1.63	1.69	1.60	1.68	1.59
Purchase price from alcohol producer	357.31	338.63	344.47	326.03	338.08	320.07	336.34	318.40

Source: IAA D = dehydrated alcohol H = Hydrated alcohol

(1) Parity value - see explanations in Chapter III, item 2
(2) see foot notes of Table II.2. Sugarcane price at Sao Paulo: Cr$ 30,560.35, with taxes and Cr$ 24,983.09 without taxes.
(3) ICM (Tax on Sales of Goods) with respect to oil derivatives, only asphalt and some other minor ones are taxed - 17% over the product price.

TABLE II.4

DEHYDRATED ALCOHOL COST IN BLENDING CENTERS (GASOLINE AND DEHYDRATED ALCOHOL)
IN APRIL 1984, FOR DIFFERENT STATES

Cr$/liter alcohol

	SAO PAULO	R.G. DO SUL	M. GROSSO	BAHIA	PARA
Purchase price from alcohol producer (1)	336.34	336.34	336.34	357.31	357.31
Freight (2)	2.90	2.30	71.39	2.33	31.00
Service Charges (3)	5.93	5.93	5.93	5.93	5.93
Social Security Tax (4)	21.00	21.00	21.00	21.00	21.00
Absolute alcohol cost at blending center	366.17	365.57	434.66	368.57	415.24

Source: IAA/CNP
(1) See Table II.3
(2) Freight between distilleries and blending centers
(3) Service charges of the blending center: 2.0% of the parity value of alcohol
(4) See footnote 3 of Table II.2

TABLE II.5
PRICE STRUCTURE OF DEHYDRATED ALCOHOL ON APRIL 1984 FOR DIFFERENT STATES

Cr$/liter alcohol

	SAO PAULO	R.G.DO SUL	M.GROSSO	BAHIA	PARA
Absolute Alcohol cost at blending center (1)	366.17	365.57	434.66	368.57	415.24
Petrobras Income (2)	237.40	238.70	168.70	216.99	188.32
Price at the blending center	603.56	603.56	603.56	603.56	603.56
Subtotal:					
Distribution charges (3)	13.76	13.76	13.76	13.76	13.76
Distribution FINSOCIAL (3)	3.12	3.12	3.12	3.12	3.12
Sales charges (3)	48.20	48.20	48.20	48.20	48.20
Sales FINSOCIAL (3)	3.36	3.36	3.36	3.36	3.36
PRICE TO CONSUMER	672.00	672.00	672.00	672.00	672.00

Source: IAA/CNP/CENAL
(1) See Table II.4
(2) Petrobras income: this income is for gasoline and absolute alcohol uniformization prices, since absolute alcohol is commercialized as gasoline. These funds are utilized for the alcohol storage financing program
(3) See footnotes of Table II.2

TABLE II.6

HYDRATED ALCOHOL COST AT SERVICE STATIONS IN APRIL 1984, FOR DIFFERENT STATES

Cr$/liter alcohol

	SAO PAULO	R.G. DO SUL	M.GROSSO	BAHIA	PARA
Purchase price from alcohol producer (1)	318.40	318.40	318.40	318.40	318.40
Freight (2)	2.70	2.30	71.39	2.33	31.00
Social Security Tax (3)	21.00	21.00	21.00	21.00	21.00
Distribution Costs (3)	12.73	12.73	12.73	12.73	12.73
Distribution FINSOCIAL (3)	1.74	1.74	1.74	1.74	1.74
Sales Costs (3)	48.20	48.20	48.20	48.20	48.20
Sales FINSOCIAL (3)	1.98	1.98	1.98	1.98	1.98
TOTAL COST	406.75	406.35	475.44	426.62	455.28

Source: CNP

(1) See Table II.3
(2) Freight between distilleries, distribution centers and service stations
(3) See footnote of Table II.2

TABLE II.7

HYDRATED ALCOHOL PRICE TO CONSUMERS SERVICE STATIONS, IN APRIL 1984 FOR DIFFERENT STATES

Cr$/liter alcohol

	SAO PAULO	R.G. DO SUL	M. GROSSO	BAHIA	PARA
Hydrated alcohol cost at service station (1)	406.95	406.35	475.44	426.62	455.28
Uniformization quota (2)	(10.95)	(10.35)	(79.44)	(30.62)	(59.28)
Consumer Price	396.00	396.00	396.00	396.00	396.00

Source: IAA/CNP/CENAL
(1) See Table II.6
(2) Uniformization Quota - See footnote 2 in Table II.2

TABLE II.8
EVOLUTION OF THE CONSUMER'S PRICE OF GASOLINE,
DIESEL AND ALCOHOL, AND PRODUCER'S PRICE OF ALCOHOL
EVOLUTION OF CURRENCY EXCHANGE RATE

DATE	CONSUMER PRICE CR$/L			US$	PRODUCER PRICE (2)	
	GASOLINE(3)	DIESEL	ALCOHOL	VALUE (1)	CR$/l	US$/gl
17/02/78	7.30	4.00	-	16.495	4.29	0.98
17/08/78	8.40	4.60	-	18.565	4.93	1.00
09/02/79	9.60	5.40	6.72	21.790	5.76	1.00
24/05/79	10.20	5.80	6.72	24,755	7.49	1.14
20/07/79	10.20	8.70	6.72	26,115	7.49	1.09
04/09/79	14.30	8.70	6.72	27,775	10,31	1.40
22/11/79	22.60	12.00	11.49	32,040	10.31	1.22
18/03/80	26.00	12.00	11.40	46,300	10.31	0.83
23/03/80	28.00	12.50	11.40	46,800	10.31	0.83
29/05/80	30.00	13.50	18.20	50,810	14.94	1.11
16/06/80	34.50	15.00	18.20	52,315	14.94	1.08
31/07/80	38.00	15.70	18.20	53,880	14.94	1.05
03/10/80	45.00	17.30	24.70	57,590	20.81	1.37
04/12/80	51.00	20.00	27.50	62,515	20.81	1.26
03/02/81	60.00	26.00	32.00	69,540	25.09	1.37
17/04/81	66.00	32.50	42.00	79,860	25.09	1.19
28/06/81	75.00	42.00	48.00	91,400	34,66	1.44
20/10/81	85.00	50.00	52.00	112,720	45.26	1.52
14/02/82	104.00	62.00	64.00	136,750	46.42	1.28
23/05/82	125.00	75.00	73.00	161,080	55.74	1.31
18/07/82	132.00	75.00	77.00	176,280	68.69	1.47
16/09/82	114.00	84.00	84.00	202.270	87.77	1.64
29/12/82	167.00	102.00	98.00	244.860	87.77	1.36
10/03/83	210.00	130.00	123.00	396.030	108.33	1.04
09/06/83	303.00	191.00	178.00	504,470	144.77	1.09
17/08/83	353.00	232.00	208.00	641,020	144.77	0.85
10/11/83	445.00	300.00	262.00	856,000	216.51	0.96
26/01/84	564.00	387.00	332.00	1,065,000	216.78	0.77
18/04/84	672.00	469.00	396.00	1,395,000	316.49	0.86

(1) Currency exchange rate (Cr$/US$)
(2) Ex-refinery hydrated alcohol price, include taxes
(3) Gasoline and dehydrated alcohol are blended and have same price per liter

TABLE II.9
CASH DISTRIBUTION OF FUEL SALES IN SAO PAULO STATE, IN JANUARY AND APRIL 1984

Cr$/liter

	GASOLINE		DEHYDRATED ALCOHOL		HYDRATED ALCOHOL	
	J	A	J	A	J	A
Sugarcane and Alcohol production Sectors (1)	-	-	202.98	296.34	192.01	279.93
Petrobras (2)	257.95	297.73	263.14	237.40	-	-
Transferences by way of price structure for other oil derivatives (3)	176.85	202.43	-	-	-	-
Transferences inside fuel sector, by way of CNP (4)	39.54	23.26	-	-	50.30	(10.95)
Government (5)	45.15	83.72	49.25	67.48	45.94	63.19
City and State	36.02	54.51	21.24	33.35	20.47	32.14
Federal	9.13	29.21	28.01	34.13	25.47	31.05
Commercialization sector (6)	44.51	64.86	48.63	70.79	43.75	63.83
Distributors	12.45	13.76	16.51	19.69	11.69	12.73
Sellers	29.70	48.20	29.70	48.20	29.70	48.20
Transporters	2.36	2.90	2.42	2.90	2.36	2.90
TOTAL (Final price to Consumer)	564.00	672.00	564.00	672.00	332.00	396.00

Source: CENAL

J = January - A = April

(1) Funds that remain in this sector, after deduction of taxes and commercialization costs: parity value of alcohol; see Table II.3.

(2) Funds received by sales of gasoline and absolute alcohol. Gasoline: oil derivatives 'medium cost'; see Table II.1. Dehydrated alcohol: Petrobras income; see Table II.5.

(3) Represents the quota included in gasoline price for subsidizing other oil derivatives. It is the difference between gasoline cost and oil derivatives 'medium cost' as shown in Table II.1.

(4) Funds for prices uniformization in the country and also for support of hydrated alcohol price at 64% of gasoline price.
IOF (repass to CNP) minus freight because gasoline freights from distribution center to service station is also payed by IOF funds; see Table II.2.

(5) Final destination of taxes over fuel prices. Gasoline: fuel tax. social security tax, refinery PIS/PASEP, refinery FINSOCIAL, distribution FINSOCIAL and Sales FINSOCIAL; See Table II.2
Dehydrated alcohol: Sugarcane PIS/PASEP, sugarcane FINSOCIAL, sugarcane ICM, alcohol PIS/PASEP, alcohol FINSOCIAL, social security tax, distribution FINSOCIAL and Sales FINSOCIAL; See Tables II.3, II.4 and II.5.
Hydrated alcohol: idem absolute alcohol; see Tables II.3 and II.6.

(6) Correspond to distribution companies, service stations and transport companies
Gasoline: see Table I.2
Dehydrated alcohol: see Tables II.4 and II.5
Hydrated alcohol: see Table II.6

CHAPTER III

INCENTIVES AND SUBSIDIES

This chapter reviews the wide range of incentives, other than the price of alcohol, that have been used to stimulate the production of alcohol and its acceptance in the marketplace as an automotive fuel. These measures are roughly divided into three categories - financial, fiscal and legal. All of these have played an important role, though in strict economic terms financial incentives were probably the most important. Behind all of these there has been an intensive and continuous advertising campaign in all media of communications which has strongly influenced potential users to favorably regard ethanol as a national fuel.

FINANCIAL INCENTIVES

1 - Loans

(a) Loans for the Alcohol Industrial Sector

Official credits are available for the acquisition of equipment and for installation, expansion, and modernization of distilleries. All peripheral investments such as building construction, pollution control equipment, assembly of equipment, transportation expenditures, engineering fees, training of technicians, technical assistance, etc., also quality for credits.

From the beginning of 1976 to the end of 1978 the financial conditions were extremely favorable:

- official credits for up to 100% of the total investment
- interest rates of 17%/year (or 15%/year in the less developed areas of the country) when the annual inflation rate was 37.2%
- first principal payment (grace period) - after 3 years
- last principal payment - after 12 years

From the end of 1978 to the end of 1980, the annual interest was 40% of the inflation rate plus 5%. In this period the average annual interest was 32%.

By 1981 the financial conditions had changed to:

- official credits of up to 70% of the investment for annexed distilleries, 80% for autonomous distilleries, and 90% for cooperatives
- annual interest rate of 70% of the inflation rate plus 5%, up to an absolute maximum of 45-55% total interest charges per year (depending on the region). In this period the total interest remained at the maximum of 55% per year, while annual inflation was 95.6%
- first principal payment (grace period) - after 3 years
- last principal payment - after 12 years

Presently official credit conditions are nearer those of the real market. In the most developed areas the interest rate includes total correction for inflation plus 5% per year.

A serious problem that is being noted is the non-observance of the initial financing conditions by some alcohol producers, and the continuation of government support. This information is very recent and its evaluation is difficult. As presently understood, autonomous distilleries that received official loans from September 1979 to June 1981 have not paid the inflation correction charge since January 1983. The government has now permitted the capitalization of this amount into the principal of the debt. That amount should be capitalized under the initial loan conditions, i.e., 5% interest per year and 65% of annual inflation correction (in non-subsidized regions). However, because the initial loan conditions also state that the total financing charges (interest and inflation correction, also called monetary correction) cannot exceed 55%, the distilleries are receiving an additional subsidy. This can be appreciated when we consider that in 1984 inflation was 215%, and 65% of that means 118% (capitalized on a monthly basis rather than 50-55%). It is estimated that this procedure of debt renegotiation will cost the government approximately US$ 55 million.

There are also other outstanding loans taken out by sugar and alcohol producers directly from private national and international banks, with government guarantee, that are being renegotiated.

(b) Loans for the Agricultural Sector

The situation is very much the same as for the industrial sector. Very favorable conditions were set at the beginning of the NAP as follows:

- credits of up to 100% of the investment
- interest rate - 7%/year
- first principal payment (grace period) - after 2 years
- last principal payment - after 3 years

The successful evolution of the program did not require the maintenance of this level of incentive and year after year more severe conditions were introduced. Presently full inflationary correction is applied and the interest rate is 3%/year. Agricultural credit terms for the NAP have been similar to those for agriculture in general, though accessibility has been better.

(c) Subsidies for Sugarcane and Alcohol as a Consequence of Negative Interest Rates

The use of official credits with interest rates below standard market loan rates to subsidize investments in certain sectors is a common practice in the world. What is striking about the official credits for the NAP, as shown above, is that their total interest rates have rather consistently been substantially below the rate of inflation. Furthermore, these negative interest rates have prevailed over a period of high and rising rates of inflation, the current rate being over 200% per year (see Table III.1, which also shows net credit flows). In this environment, finance begins to take on unusual characteristics, which are useful to review.

In Brazil, it is common practice to express the overall interest rate as the sum of two components: a "monetary correction" which is applied to the principal to adjust it for inflation (and thus is continuously changing) and an "interest charge" which can be stable. By way of simplified illustration as to what happens when the "monetary correction" is less than complete, Figure III.2 shows the result of assuming a 50% monetary correction to a loan over a period of 5 years, during which inflation follows the recent history in Brazil. It can be seen first that the real value of the principal falls dramatically, as do annual interest charges (see Figure III.1). By the end of five years, the value of the principal is less than 17% of the original loan. If one compares this situation (with an "interest charge" of, say, 5%) to a more normal international situation (say 10% rate of interest with inflation fully discounted) then the accumulated interest charges paid plus principal are similarly less than a fifth of what they would otherwise be. It may be thought that this is an extreme case, but in fact the monetary correction since 1978 has in practice been even lower for most official credit. If the 55% overall interest rate ceiling noted in the previous section has in fact been maintained, then the implied monetary correction is considerably lower than that assumed here. In the case of loans for the industrial sector the greater part of the loan has thus been a disguised grant in most cases. In the case of agricultural investments the subsidy element is less because the loans are shorter term, thus limiting the cumulative impact of negative interest rates. On the industrial side they involve repayment of the principal after the third and until the twelfth year.

We have not tried to make a quantitative estimate of the subsidy in official credit to the NAP. Information and calculating requirements are large and would require another work at least as large as this if done with care. It should be remembered, too, that what the government gives with one hand it often takes with another. For example, payments from the government are often made late without any monetary correction. There is clearly a great need to quantitatively estimate net subsidies, but the task should be undertaken with full respect for its difficulty.

2 - Technical Coefficients Used in Determining Ex-Distillery Alcohol Prices

The price of alcohol purchased by the government is calculated on the basis of the price of the standard white sugar commercialized in the internal market, and considering alcohol at the distillery loaded in the vehicle in which it will be transported.

This parity price and its underlying parity coefficient are officially intended to remunerate equally the use of sugarcane for alcohol or sugar. Taking into account this parity coefficient and assuming that the costs of producing alcohol and sugar from a tonne of cane are the same, the price of raw material will also be the same for both processors.

A problem with this official procedure is that there is no reason to simply assume that the costs of producing alcohol and sugar from a ton of cane are the same. Sugar is in fact likely to be more expensive.

Beyond this, there has been a marked trend in the evolution of this parity coefficient over time that appears in reality to have reduced the cost of raw material for the alcohol producer relative to the sugar producer. This tendency makes less and less technical sense even though it is expressed as being technical. It is, in fact, a disguised political norm. Unfortunately, the effect of this is to protect the least efficient alcohol producers.

The key parity coefficient is the relationship between alcohol and sugar. Theoretically it is possible to produce (with 100% efficiency) 39.8 liters of alcohol from the same raw material that yields 50 kg of sugar (sucrose), plus 5.8 liters (based on IAA norms) from the molasses which is a by-product from the production of that quantity of sugar. The initial parity coefficient allowed for 37.67 liters per 50 kg sack of sugar, corresponding to an efficiency of 90.8% (considering only fermentation and distillation). This efficiency is only obtained in distilleries with excellent equipment and control and would in principle make the operation of medium quality distilleries unviable. This was probably the motive for reducing the parity coefficient to 35 liters per 50 kg sack. This corresponds to an efficiency of 86%, which could already be regarded as somewhat low. Nevertheless, the coefficient was subsequently reduced further, to levels corresponding to 81% and then only 76% efficiency (31.67 liters per sack), which is extremely low.

With the technology widely available in Brazil it is perfectly feasible for distilleries to operate with efficiencies in the range of 80-90% (including only losses in fermentation and distillation). In this light the parity coefficient is at best a minimum standard. If this minimum standard is compared with the more reasonable 88% efficiency it can be seen that a distillery can produce 4 liters more per each 50 kg of white sugar. The windfall resulting from this is equivalent to 11.2% more income from alcohol sales than assumed by the parity coefficient used for pricing. It is also equivalent to 20% of total sugarcane costs. At the same time this low (76% efficiency) coefficient permits extremely inefficient plants to operate. There is no standard for gradually improving the efficiency of such plants.

For alcohol production from residual molasses, there is a similar story of an artificially low parity coefficient. The effect is relatively much smaller. One point is worth noting, however. The assumed efficiency for alcohol production from molasses is 83% instead of the 76% for production from cane juice. There is absolutely no technical justification for such a distinction.

A distinct yet related issued bearing on coefficients used for pricing concerns standards for the purchase price of sugarcane based on its assumed sucrose sugar content. In Sao Paulo, for example, a tonne of newly mature sugarcane considered to be of almost minimum quality can produce 70 liters of dehydrated alcohol in efficient distilleries. Standard calculations show that this tonne of cane would produce 105 kg of sugar (sucrose). Nevertheless the IAA assumes that only 94 kg of sucrose could be produced. In this way the ethanol (or sugar) producer receives 11 kg of sucrose for which the sugarcane producer is not paid. In the case of ethanol this implies a windfall of 6.6 liters whose value is equivalent to 17% of the value of a tonne of sugar cane. This represents a transfer of resources from the agricultural sector (to a significant degree, smaller "independent" cane producers) to the distilleries or sugar mills (generally larger actors).

Considering the case of alcohol and the two coefficients discussed here it can be said in summary that efficient distillery operators can obtain about 20% more alcohol from a tonne of cane than the standard coefficients assume.

3 - Subsidy for Cost Equalization in Producing Regions

The price of standard white sugar is equal in all regions because the government maintains a subsidy for sugar manufacture which is variable according to the region. This subsidy for sugar cost equalization is passed on to alcohol. This subsidy is to compensate for different sugarcane crop yields, cultivation systems, industrial efficiency, etc., in order to maintain the same alcohol producer price throughout the country.

Table III.2 shows that the alcohol cost equalization subsidy is nil in Sao Paulo and other states of the Center-South regions. Combining this information with the data in Table I.9, in the 1983/84 season, it can be calculated that approximately 79% of alcohol production was not subsidized, 2.5% had a very small subsidy, 4.5% had a medium subsidy (Cr$ 104,1/liter) and 14% a high subsidy (Cr$ 213,6/liter).

4 - Subsidy to Alcohol as a Raw Material for the Chemical Industries

From 1975 to 1982 the chemical industries with authorized production of ethene, acethaldehyde and derivatives, had a guaranteed supply of alcohol at a price of up to 35% of that of one kilogram of ethene. Since 1982, the alcohol price has been based on the naphta price and has been set at 100% and 170% of the latter for chemical industries with and without an alternative petrochemical route, respectively. Naphta for chemical industries is highly subsidized (see Table II.1). This pricing process means that chemical-related industries, with an alternative petrochemical route paid 48% of the consumer's ethanol price in April 1984.

5 - Permission for the Alcohol Producer to Use Its Own Produced Alcohol as Fuel

Through a decree, the Federal Government allowed the full replacement of all conventional fuel directly used in sugar cane plantations, sugar mills and distilleries, with ethanol until 1989 (4). The major aim of this decision is to develop technologies for the replacement of diesel oil by ethanol, since Otto engines have been out of use in trucks, tractors, and agricultural machines since the middle of the 1970s.

Technologies available for diesel substitution include returning to the use of efficient Otto engines especially designed for high compression ratios, dual-fuel injection (ethanol & diesel), or the addition of cetane enhancers (i.e. DENTEG) to ethanol allowing its use in regular diesel engines.

Up to now the performance of Otto engines has been quite poor, requiring over 2 times more ethanol (on a volume basis) than diesel oil (in diesel engines) for the same mileage (1). Ethanol plus DENTEG also has a performance inferior to diesel oil (1.6 times more fuel on a volume basis). Since the price of diesel oil is only 70% that of gasoline, and 108% that of hydrated alcohol the use of ethanol to displace diesel oil is not economical under such conditions of performance in the general marketplace.

Nevertheless, over one thousand trucks with Otto engines are running on pure ethanol and a few hundred are running on a mixture of ethanol and cetane enhancers. To achieve this level of use, the government allows the ethanol producer to use its own product instead of buying it through the service station. This measure avoids all expenses and taxes related to distribution, transportation, and sales. Since the opportunity cost to the producer of using alcohol under these circumstances is only 45-50% of the market price for consumers, this special use may be economically viable from the producer's point of view.

Moreover, this also implies a subsidy to alcohol producers, who can use a fuel without actually expending any money, because they already have paid for the costs of alcohol production that is stored.

6 - Refund of Alcohol Storage Cost and Ethanol Loss by Evaporation

The distillery receives credit for financing the cost of storage of alcohol, and also a refund for the amount of alcohol lost during storage due to alcohol evaporation from storage tanks.

7 - De-Subsidization of Conventional Fuels

Up to the end of the 1970s, diesel oil was sold significantly cheaper than gasoline, as a deliberate policy to stimulate the wider use of diesel engines, which are more efficient than Otto engines, in trucks and agricultural equipment. Also, during that time gasoline was the most consumed oil derivative and enough money was collected from its sale price to support the average price of the oil products under the policy followed by the oil industry in Brazil (see Tables II.1 and II.9).

The rapid increases in the price of gasoline and the presence of ethanol in the market brought down the marked demand of the former, changing significantly the profile of oil derivatives (see Table I.13). Diesel became the fuel responsible for driving the volume of crude oil importation. In order to promote diesel conservation, remunerate the oil industry while keeping a reasonable gasoline price, and create possibilities for ethanol competition, the price of diesel in relation to gasoline was significantly increased (diesel is presently quoted at 70% of the gasoline price).

8 - Special Electricity Rates for the Alcohol Sector

It is well known that deriving ethanol from sugarcane has a significant advantage over many other biomass-based conversion processes because bagasse is a by-product that can be used as an additional energy source. With the rational use of bagasse, sugarcane mills and distilleries can be self-sufficient in energy and even export electricity. Unfortunately, reality is quite different and presently in Brazil many mills are net importers of electricity from the grid. This tendency is more pronounced in annexed distilleries where sugar and ethanol are produced simultaneously. The main reasons for this incompatibility between theory and practice are:

(a) hydroelectric energy is quite inexpensive: industries pay around 20 mills/kWh;

(b) the technologies used in biomass boilers and in the co-generation system are of low efficiency; this is a natural consequence of the NAP policy of minimum capital investment;

(c) lack of commercial market for any surplus bagasse;

(d) lack of a general policy which assures a market for the surplus electricity generated by industries.

Item (a) is already an disinventive to efforts at conservation, but the real situation is still worse, because the sugar and ethanol industries pay even less than most industries for their electricity; they have special lower rates. Since the industrial activity is seasonal they are qualified to pay only for the amount of consumed kWh being free of any payment for the demand capacity (kW) (Brazilian industrial electricity tariffs are calculated with these two parameters). This practice is common for all kinds of industries but the special rates free of the demand (kW) charge are available only during the rain season. The sugarcane crop occurs in the Southeast exactly during the dry season, when hydro capacity is most limited, but the industry is qualified to pay the special low rates based on a specific resolution of the Government. The quantified effect of such subsidy on the final price of ethanol is not readily available.

However, remembering that 60 to 70% of the ethanol price is due to the sugarcane price, this subsidy has a small effect on the final price (at most only a few percent) when compared with other subsidies.

9 - Special Credit Conditions for Alcohol-Powered Automobiles

Since 1981 credit terms for the purchase of pure ethanol vehicles have been established that are more generous than those for gasoline. The loan re-payment period allowed by law was extended to 36 months for new ethanol automobiles, while for gasoline vehicles the period is only 24 months. This incentive is still valid.

FISCAL INCENTIVES

1 - Automobile Annual Licensing Fee

The annual licensing fee for automobiles is a strong function of the kind of fuel used. Pure ethanol vehicles pay less, as can be seen in Table III.3. To estimate how important this incentive is, we begin with the fee rate - alcohol automobiles pay 1% of the car price (an average over the year allowing for inflation) and gasoline cars pay 3%. Presently the average new automobile price is about US$ 7,000. Taking in account the consumption of 2,000 l of ethanol per year on new cars, and that hydraged alcohol is quoted at US$ 0.344/liter, the annual fuel expenditure for alcohol will be about US$ 700. We conclude that the difference in licensing fee on new cares is approximately equivalent to 15% of the annual fuel consumption.

2 - Automobile Sales Tax

Very substantial taxes of different origin are added to the manufacturers' price for a new automobile, doubling its final price. In 1980, when automobile sales were at their lowest level, one of the measures adopted by the Government was the reduction of the Federal Sales Tax for pure ethanol vehicles only. This decision yielded a consumers' price differential of nearly 5% between pure ethanol and gasoline cars of the same model. This difference has gone down over the last two years to approximately 1%. The original tax privilege was preserved. The now almost similar final price is a consequence of an increase in the pure ethanol car's costs of production, which requires a few more expensive parts and engineering. The IPT Tax (Industrialized Products Tax) for gasoline automobiles is 33% and for alcohol cars is 27%.

3 - Tax Exemption for Taxis

As noted above, the total amount of taxes almost doubles the manufacturer's automobile price. In 1982, when the economic recession was strongly felt in Brazil, the volume of available ethanol exceeded by far the demand. The large alcohol stocks also created storage difficulties. To reduce this problem and promote employment opportunities in the automobile industry, the government eliminated all taxes over new cars provided they were bought by licensed taxi drivers. With the regular price reduced almost by half, practically all the taxis fleet was renewed, increasing by 70,000 units the total sales of automobiles, which represents more than 10% of the annual production for the internal market. This measure was applied from June 1982 to December 1983 and resulted in a reduction in tax revenues of nearly US$ 150 million. The net result of such a subsidy is hard to quantify and we cannot neglect the one-time, promotional aspect of the campaign.

4 - Deferred Tax Payment

The taxes on sugarcane are included in the ex-distillery price of alcohol as shown in Table II.3. This means that they are not paid at the time that sugarcane is commercialized, but only when the alcohol is sold by the distillery.

LEGAL INCENTIVES

1 - Guarantee of Alcohol Purchase by Government

The government controls alcohol production every year by issuing production quotas to all ethanol producers. As a natural consequence of such powerful control it assumes the responsibility for acquisition of the authorized production. Even so, there is some delay between production and acquisition, since the crop production is seasonal and the final product is bought on a monthly basis all year around. Any excess production above the quota limit does not qualify for guaranteed acquisition and must be sold on the external market.

2 - Alcohol Quality Control for Consumer Protection

The pure ethanol consumer has received more attention from the regulatory authorities than gasoline consumers. Quite often authorities introduce new regulatory measures to preserve the alcohol quality. As examples we have:

(a) all ethanol is distributed through the state oil company (Petrobras), which is responsible for its quality at the final service stations.

(b) densimeters must be installed at the pumps in service stations, to control the total amount of water mixed with ethanol (hydrated ethanol).

3 - Reduction of Conventional Fuels Quota

The amount of oil derivatives used by industries and commercialized by service stations is controlled annually by means of quotas. The policy is most oriented to replacement of diesel, LPG, and fuel oil in industries by alternative fuels. Nevertheless, this policy has influence over the gasoline market which has not been controlled up to now because gasoline consumption is falling faster than the rate set by the authorities. This specific policy helps ethanol commercialization in a few cases, such as its use in alcohol producers' truck fleets and inducing a small growth in the sales of Otto engine trucks. The justification for the use of such a more expensive option is based on the difference in the investment cost in favor of Otto engines.

4 - Guarantee of Alcohol Demand

Ethanol, in the early stage of the NAP, was introduced compulsorily in the market through the gasoline and absolute ethanol blend. Government action required that all gasoline sold in some selected States contain up to 18% of alcohol. This percentage was increased in 1980 to 20% and slowly spread to other states as soon as alcohol became available in the region. Today the upper limit is 22% (5) and its use is compulsory in all the country. The initial phase caused many problems since the amount of ethanol in the blend was variable as a function of the availability of the product in each region.

5 - Procurement

The automobile industry and the Federal Government signed an agreement in 1979 for the production and commercialization of 300,000 new vehicles to use pure ethanol in the following year. This decision occurred with almost no preliminary planning since the automobile manufacturers had been very skeptical, up to that date, about the possibility of this new product being welcomed by the market.

The few previous experiments supporting the technical feasibility of using conventional gasoline engines to run on pure ethanol were carried out at bench scale at the Aeronautic Technical Institute (ITA) and by an experimental fleet of a few hundred Volkswagen automobiles owned by the Telephone Company of Sao Paulo. This company, mostly owned by the Federal Government, equipped in two years (1978/79) half of its maintenance fleet with pure ethanol vehicles and evaluated their performance in comparison with the conventional vehicles operated under the same conditions.

Furthermore, the Federal and State Government almost forced State-owned companies to purchase pure ethanol automobiles when they replaced their fleets. These cars carried visible identification promoting the new fuel use, and guaranteed a demand for pure alcohol as a combustible fuel.

6 - Elimination of High Octane Gasoline

After 1979 the main concern of the NAP was the use of hydrated ethanol as a pure fuel. Such a new product would need a parallel distribution and commercialization system for the retail market, that is, new pumps and storage tanks at the service stations. To avoid more investments, the government cancelled the use of the existing system for high octane gasoline sales. This action caused few problems, because high octane gasoline was commercialized in small quantities at that time, as a result of its high price and the fact that very few Brazilian vehicles were equipped with high compression engines (the few that existed were able to run on the gas-ethanol blend, which has an octane number near 80).

The storage tanks originally designed for gasoline were slowly subject to corrosion and required replacement at the service stations. But the government decision allowed the immediate introduction of pure ethanol in thousands of locations in just a few months.

7 - Production of Alcohol-Powered Automobiles

As already discussed in the introduction, the automotive industry did not believe in the goals of the second phase of the NAP. The action of the government was to argue, mostly through the Office of Industrial Technology (STI), the possibility of a short-term collapse of the automotive industry as a consequence of the shortage of hard currency to guarantee oil importation at a growing level. This argument was strong enough to convince the automobile manufacturers to sign with the government a cooperation agreement in 1979, with the objective of producing 300,000 ethanol cars in the next year.

Obviously, since the time space to carry out the commitment was very short and there was a lack of confidence in the future of the program on the part of most of the vehicle producers, the quality of the product put in the marketplace was very unsatisfactory. The ethanol engines were the same as those used for gasoline vehicles and did not take advantage of the high octane value of the new fuel. Other problems, such as difficulties in starting the car and frequent clogging of the fuel injection line, added to the low mileage rate (approximately 60%, on a volume base, of that obtained with gasoline), created a bad image of the product with the consumer. Sales fell 90% in less than one year. Market complaints and the decision of the authorities to reduce oil importation resulted in an effort by the producers to quickly solve the problems of alcohol automobiles. The best indicator that the problems are solved is the higher price of pure ethanol used cars built after 1982 as compared with similar ones that used gasoline.

8 - Extended Guarantee for Alcohol-Powered Automobiles

Vehicle manufacturers offer a better guarantee for the pure ethanol car. The engine has a full guarantee for two years independent of mileage while the guarantee for gasoline engines is 12 months or 15,000 km, whichever is less.

9 - Extended Availability of Alcohol at Service Stations

Liquid fuels in Brazil are sold in service stations which have permission to operate between 6:00 AM and 8:00 PM every weekday. On Saturday and Sunday no service was available after the second oil crisis. In 1981 this legislation was modified adding Saturday as a normal weekday, but only for the sale of hydrated ethanol. This decision was strongly promotional since the lack of fuel on Saturday and Sunday was a barrier against long weekend trips. The incentive was eliminated in 1984 when permission for normal service on Saturdays was extended to all kinds of fuels.

10 - Guarantee of Competitive Prices for Alcohol Consumers

As alcohol aims to substitute for gasoline, the hydrated alcohol price was assured by government since the beginning of NAP never to exceed a maximum of 64% of the gasoline price. During the initial marketing period of pure alcohol-powered automobiles, that rate was set in 59% (May 1982 to July 1984), in order to give a higher incentive for their purchase.

Hydrated alcohol automobiles consume, on the average, 20 percent more fuel on a volume basis than regular gasoline automobiles, so that the difference in price turns alcohol economically attractive for the consumer.

TABLE III.1

LOANS FOR INDUSTRIAL AND AGRICULTURAL SECTOR, AND ANNUAL INFLATION RATES

YEAR	ANNUAL INFLATION RATE %	INDUSTRIAL SECTOR US$ X 10^6	AGRICULTURAL SECTOR US$ X 10^6	TOTAL US$ X 10^6
76	37.2	52	7	59
77	30.1	196	100	296
78	36.2	282	78	360
79	47.2	196	119	315
80	50.8	401	278	679
81	95.6	640	500	1,140
82	97.8	486	134	620
83	156.6	293	13	306
84	215.3	N.A	N.A	N.A

Source: CMN/CNAL
N.A. Not Available

TABLE III.2

SUBSIDIES FOR COST EQUALIZATION IN DIFFERENT COUNTRY REGIONS, SEPTEMBER 1984

PRODUCT	RIO DE JANEIRO CR$	MINAS GERAIS E ESP. SANTO CR$	NORTH/NORTHEAST REGION CR$	SAO PAULO AND CENTER/SOUTH STATES
Absolute alcohol	104,10	5,89	213,64	0
Hydrated alcohol	98,33	5,56	201,81	0

Source: IAA
Money exchange ratio: Cr$ 2,242/Dollar

TABLE III.3

VEHICLES ANNUAL LICENSING FEES

CR$ X 1,000

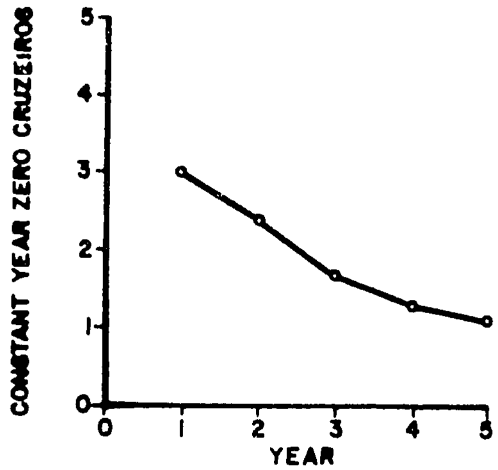
	1985		1984		1983		1982	
	A	G	A	G	A	G	A	G
Till 50 HP	174.6	405.0	133.8	309.9	121.8	281.7	110.4	256.2
51 to 69 HP	206.8	480.6	159.6	367.5	145.2	334.2	131.7	304.2
70 to 100 HP	304.2	702.9	232.5	537.3	211.5	488.7	192.0	444.6
101 to 150 HP	399.6	936.9	305.7	716.4	278.2	651.6	252.6	592.2
over 151 HP	500.4	1,173.6	382.8	897.6	348.3	816.3	316.5	741.6

A= Alcohol; G= Gasoline

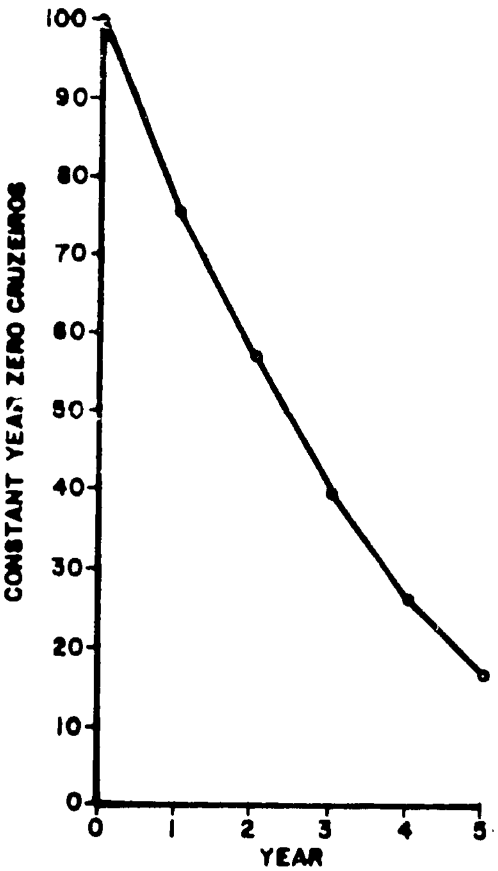
IMPACT OF 50 % MONETARY CORRECTION
ON A 100 CRUZEIRO LOAN OVER FIVE
YEARS WITHOUT PAYMENT OF PRINCIPAL
(ALL VALUES IN CONSTANT CRUZEIROS OF TIME WHEN LOAN MADE)

FIGURE III.1

A INTEREST PAYMENTS OVER FIVE YEARS WITH AN INTEREST CHARGE OF 5%



B REAL VALUE OF PRINCIPAL OVER FIVE YEARS



NOTE: IN BOTH CASES THERE WOULD BE NO DECLINE IF MONETARY CORRECTION WERE 100 %

1-45

CHAPTER IV

CONCLUSIONS

The scope of this work may appear somewhat narrow for an international audience. However, it is fundamental. Without negating the value of work of a more general nature, we feel that the time is propitious for work that delves into the detailed aspects of how one of the only two large-scale liquid synfuel industries in the world actually functions.

One reason for this view is that due to political changes in general in Brazil and the evolution of the NAP, which has reached a point of maturity, the atmosphere is more propitious for evaluation of the program, including many of its more obscure complexities. This situation implies both an opportunity and a responsibility for analysts to carefully review the detailed structure and operation of the program with rigorous objectivity. As can be seen from the text, this really is quite a complex problem and will demand considerable effo t. With regard to this paper, we have restricted ourselves to the more modest task of describing rather than quantifying the impact of pricing and incentive policies.

Another reason that the moment is propitious is that sugar exports world-wide are confronting a structural crisis that goes beyond traditional commodity market "swings." This can be seen rather clearly in Figure I-2, which shows that 1985 world prices are less than 2/3 the lowest price (in 1981 US$) ever reached since WW II. The market for sugar is now inexorably contracting in terms of its share of the world sweetener market for both "cultural" and technical reasons. Due to protectionism in key importing markets in industrialized countries, the brunt of the adjustment must be borne by tropical sugarcane producers.

This trend was already evident in the decade of the 1970s as clearly shown in Figure VI.1. Not only did growth in the world sugar trade slow down, but whereas in the 1960s 63% of the growth in world exports had come from developing countries, in the 1970s less than 6% of a much smaller growth came fro developing countries. Industrialized country exports of sugar meanwhile accelerated. The vastly greater part of these accelerating exports were from high cost producers and were very heavily subsidized. "Protectionism" is an inadequate word for this phenomenon. All the forces at work in the seventies appear to be even stronger in the 1980s (e.g., important advances in the application of biotechnology).

The fundamental agro-industrial infrastructure in many tropical countries (mostly developing) is being rendered increasingly obsolete. Not even the most efficient producers are escaping this re-adjustment. Some of these countries are exploring the possibility of adapting that existing infrastructure to the production of alcohol. Decisions on this option would benefit from detailed and objective review of the operating experience of the NAP in Brazil.

In this paper we have concentrated on describing policies directly affecting the market environment in which alcohol is produced and consumed. As has been shown, this market is very highly regulated with administratively determined prices and quotas of production. Although alcohol is perhaps the extreme case, its highly regulated nature is shared by most other energy carriers as exemplified in the discussion of petroleum derivatives in Chapter II. One factor that has probably accentuated the administrative pricing/quota characteristics of the alcohol market is its institutional evolution from the pre-existing sugar industry. This traditional industry is strongly marked by the intervention of the state, not only in Brazil but in most countries where it exists.

We have concentrated in particular in this paper on the incentives offered to the alcohol industry by the government. Together they represent a very substantial set of incentives and subsidies, which is difficult, however, to quantify at present. Several observations are warranted:

- The existence of substantial incentives/subsidies, often half-hidden, is by no means peculiar to the alcohol industry. They are common and it would be a mistake to look at the NAP without taking this very general tendency with Brazil into account. It is pertinent to note that within the "parent" sugar industry large subsidies are the overwhelming rule worldwide. The largest subsidies occur in the high-cost producer industrialized countries (with the exception of a very few such as Australia), who has spent many billions of dollars to expend their market share of exports at the expense of producers in the developing countries who are generally more efficient (see Figure IV 1-B).

- We have not attempted to describe the disincentives, whether willful or not, resulting from government actions. There are indications that despite the incentives, profit levels are not as high as one would expect. This is a subject that needs to be addressed, but is difficult and requires that analysts look carefully at what is actually done rather than only at stated policies and decrees.

- A striking feature of a number of the incentives is that inefficient producers or practices are not punished - indeed, perversely, the incentives sometimes stimulate inefficient practices (e.g., the electricity subsidy). The overall incentive structure does not appear to be designed, if such a word can be used, to actively promote increasing efficiency and innovation. This works against the very interests of an industry that suffers from the high relative cost of its product and which sooner or later must confront economic reality.

At enormous cost Brazil has implanted its unique synfuel industry. This option was given too high a priority relative to other energy alternatives, but it is now virtually irreversibly established. Its future growth will probably be substantially reduced, and indeed the flow of credits has already diminished considerably. At the same time, at least parts of this experience are of great interest.

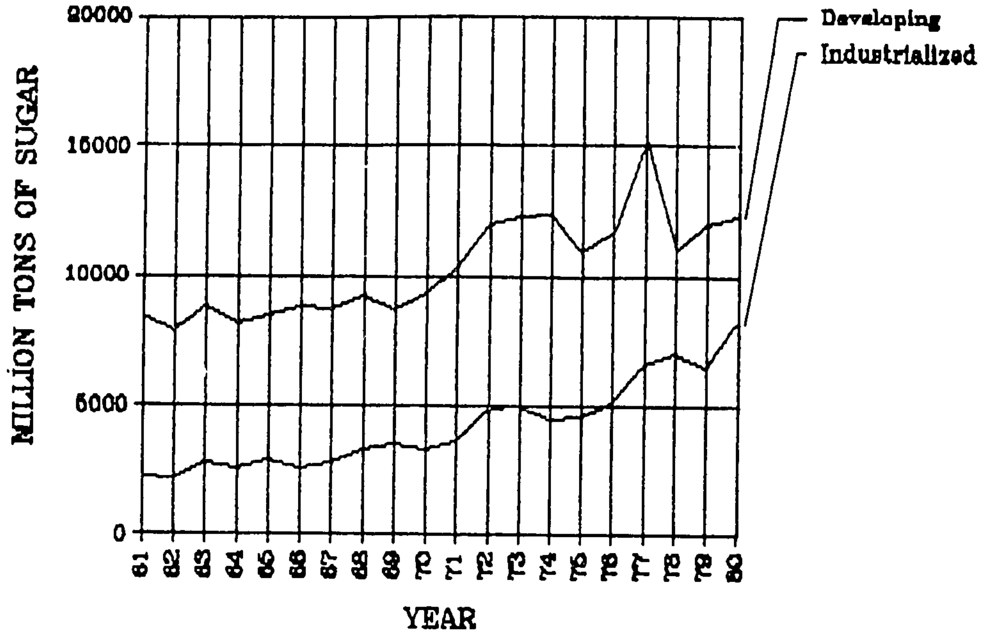
A key question is whether the industry (or its leaders) will try to adapt to the emerging more critical environment by actively seeking a market environment that stimulates efficiency and allows clearer identification of true costs, or will struggle to maintain the current paternalistic relationship with the government instead of a merely administrative one.

FIGURE IV.1

(A)

WORLD SUGAR EXPORTS

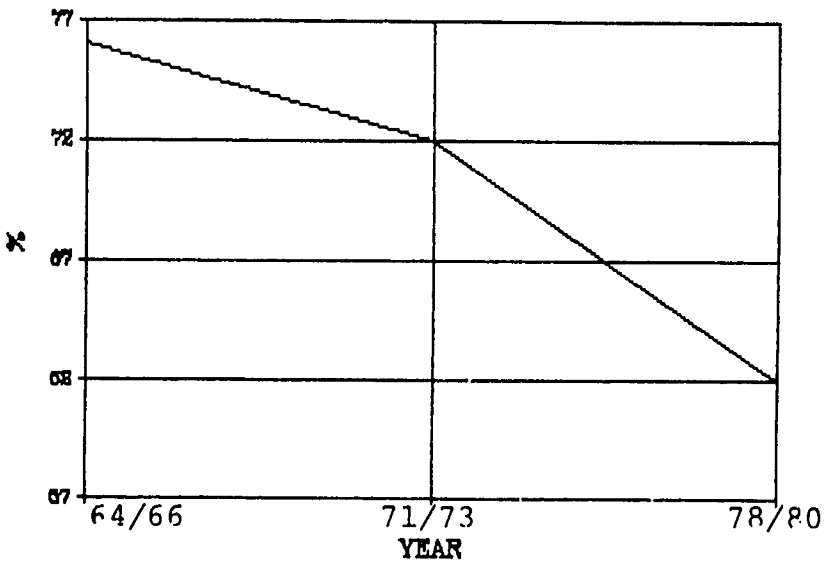
DEVELOPING & INDUSTRIALIZED COUNTRIES



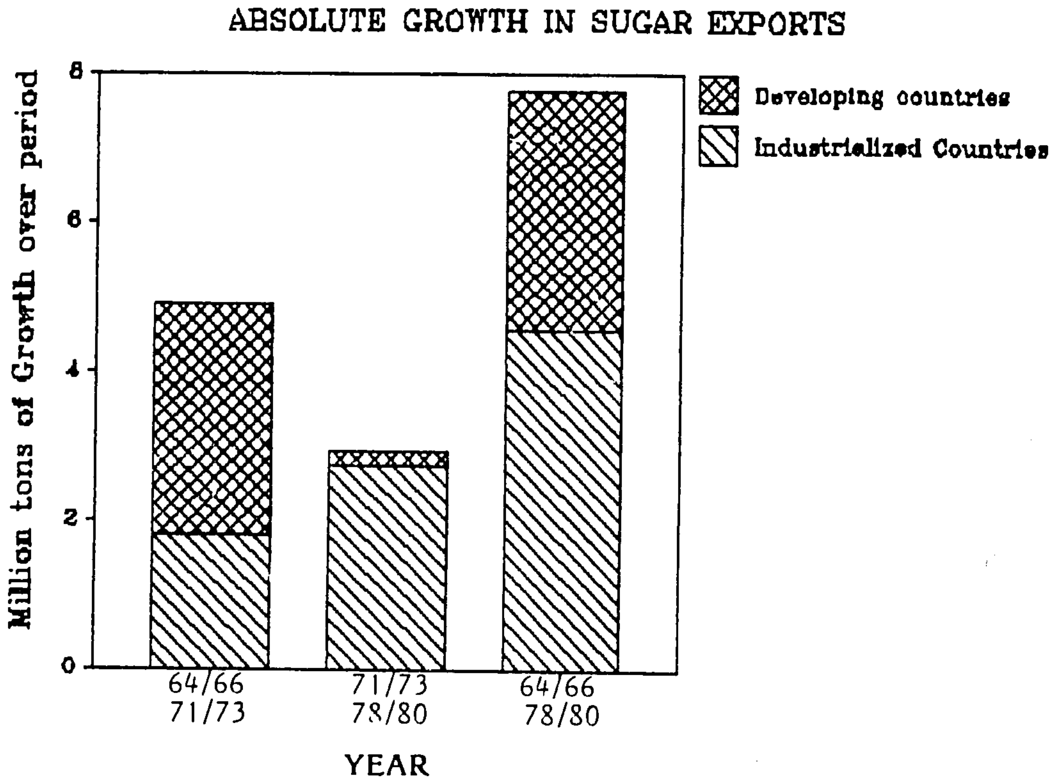
(B)

DEVELOPING COUNTRIES

SHARE OF TOTAL SUGAR EXPORTS



(C)


ABSOLUTE GROWTH IN SUGAR EXPORTS
Million tons of Growth over period
0
2
4
6
8
Developing countries
Industrialized Countries
64/66
71/73
71/73
78/80
64/66
78/80
YEAR

LIST OF ACRONYMS

ANFAVEA	ASSOCIACAO NACIONAL DOS FABRICANTES DE VEICULOS AUTOMOTORES (National Association of Producers of Self-Powered Vehicles)
CENAL	COMISSAO EXECUTIVA NACIONAL DO ALCOOL (National Alcohol Executive Commission)
CESP	COMPANHIA ENERGETICA DE SAO PAULO (Energy Company of Sao Paulo)
CMN	CONSELHO MONETARIO NACIONAL (National Monetary Council)
CNAL	CONSELHO NACIONAL DO ALCOOL (National Alcohol Council)
CNP	CONSELHO NACIONAL DO PETROLEO (National Petroleum Council)
IAA	INSTITUTO DO ACUCAR E DO ALCOOL (Institute of Sugar and Alcohol)
PETROBRAS	PETROLEO BRASILEIRO SA (State Oil Company)

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