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LATIN AMERICAN ENERGY ORGANIZATION

Energy Requirements Until the Year 2000

The Surinam Case Executive Report

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Executive Report

Table of Contents

1. OBJECT AND PRESENTATION

With the celebration of the co-operation agreement in April 1985, between Energia de São Paulo - ESP (CESP, Eletropaulo, CPFL and COMGÁS) and OLADE, technicians of both organizations began a study for estimating energy requirements in Member Countries of OLADE until the year 2000.

Energy requirements and investments were appraised under the point of view of an energy strategy oriented to the optimization of energy end uses, that is, under the rationalization of energy end uses through structural changes in the technologies used in the machines and processes that use energy.

Such an estimate for the Surinam case was obtained by the collaboration of technicians of various governmental bodies and coordinated by the technicians of ESP (Claudio Antonio Scarpinella and Edmundo Nozomi Kaneko) and shown in the technical paper "Potencial de Conservação até o ano 2000 - Suriname" (Conservation Potential Until the year 2000 - Surinam). The data shown here is the best obtained in the face of the lack of consistent and disaggregated data. However, the eventual inaccuracy does not affect the qualitative conclusions of this report.

The purpose of this Executive Report, in turn, is that of showing the conclusive comments, at energy policy level, of the consequences, benefit potentialities and, mainly, governmental actions required to implement an energy economic strategy oriented to energy end uses that really result in a better improvement of the detected saving potential.

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2. INTRODUCTION

The sum up of individual forecasts of Member Countries of OLADE on the requirements of investments for energy supply systems until the year 2000 reaches an approximate figure of US$ 500 billion and is, therefore, significantly higher than the present external debt of these countries. Such forecasts were obtained in almost every country, using classical econometric methods of demand forecast.

Recent technological developments that took place in industrialized countries after the international oil crisis, in order to increase energy efficiency of the energy end uses and fuel substitution, lead to a forecast that there exists a significant feasible energy conservation potential with almost null technological risks for the Member Countries of OLADE. The use of such a potential could be made in a minor or greater degree, depending on the measures adopted on the part of the government of each country, individually, through the reschedule of its economy aiming at increasing its efficiency.

The study of energy saving potential carried out under the coordination of the technicians of ESP with technicians of the energy sector of Surinam, was prepared on the basis of an analysis of the possibilities of energy conservation in Surinam through technological improvement in the equipment and processes that use

energy. It is necessary, however, to note that this study had no intent to carry out an exhaustive research of the potentialities to save energy in Surinam, because of the time required and the lack of real, and consistent data sufficiently disaggregated from energy end uses, and that it shows by itself the little interest that developing countries have shown in the past with regard to the problem of how and with which apparatuses, equipment, machines and processes the energy was being used.

As a doctrine, one has adopted as a principle to focus attention on energy end uses, since in the past the questions of energy supply have almost always prevailed in Surinam. The technical study carried out focused on the following end uses: energy use in industry (of bauxite, emphasizing the electrolysis and steam generation), self-propelled vehicles and household appliances.

The adoption of technologies for energy end uses of greater technological efficiency may lead to a substantial capital saving on the side of electric energy generation as well as to the reduction of the need to import liquid fuels with the consequent saving of foreign funds.

A well-conceived program, therefore, may result in a greater profitability for state owned Companies of the energy sector, besides the economy of expenditures on the part of the consumers and economy in the import of by-products.

3. GENERAL ASPECTS OF THE REPUBLIC OF SURINAM

Surinam is located in the northeast coast of South America,

southern region of Great Caribbee. Independent since 1975, it covers an area of 163.000 km² with a population around 390.000 inhabitants of which more than half live in the neighbourhood of Paramaribo, its capital city. The greatest part of the remaining population is centered in the coastal band that represents 3% of the area of the country.

The economic activities are highly centered in some modern sectors which also encompass the exports and energy demand: the bauxite, crop and processing of rice, and wood exploitation sectors, whose greatest production part is destined to export.

Demographic data shows life average rates higher than the average data of South and Central America: Per capita income (1982): US$ 2,860; natural rate of population growth 2,5%; illiteracy rate around 20% of the population older than 15 in 1980.

A great immigration took place in the latest 10 years, which was connected both to the independence process and posterior political alterations, and as a result nowadays 100.000 people from Surinam live abroad. In the recent years the trend is in reverse, with the occurrence of a small immigratory excess in 1983.

Table I summarizes the share of economical activities in Surinam in the recent years. The most relevant aspects shown are the following:

- The relative position of the bauxite mining and processing sector that properly comprises mining and the manufacture of both Alumina and Aluminum. One should also observe the remarkable drop in its value produced between 1980 and 1983.

- The outstanding growth both in absolute values and in the relative position of industries in general, whose production value reached the same level as that of the bauxite industry.

The country is self-sufficient in terms of food; a sector of highly updated rice production with surpluses that are exported.

As for industries in general they are closely related to industries linked to the agricultural and livestock sector - food and beverage, and other light industries such as clothing, footwear besides brickyards and cement products, most of them with small capacity.

No exports of manufactured products are remarkable, only exports of processed products such as rice, shrimps and wooden half-finished products.

Cut of 90 million dollars in economic aid in 1982, that represented one-third of Surinam budget, linked to the drop of international prices and decrease of aluminum production, has placed on severe pressures on the balance of payments of Surinam.

Such a situation is particularly severe for energy supply in Surinam - 80% of energy sources of the country is imported - oil by-products - and the national supply is only 20%, of which two-thirds are hydroelectric energy and one-third is wood and vegetal residues energy (Chart 4 - data from 1983). Still considering that the greater part of energy - 59% is used by the bauxite sector (75% of electric energy, 100% of fuel oil and 14% of diesel oil), whose sector was also responsible for 80% of the value of exports in 1983, you may have an idea of the critical role of energy supply and consumption in the country. Should the aluminum production increase again up to reaching the production capacity, the electricity consumption by the sector will pratically double in relation to the level of 1983.

4. SUPPLY VERSUS DEMAND

Invariably most of developing countries have always shown an absolute predominancy of the forces that justified to continuously increase the capacity of energy supply, while demand management was put to a second ground.

The reasons for such a predominancy are wide and controversial: for example, for some energy strategists of these countries energy supply was considered as a basic condition for the underdevelopment, in such a way that an increase of energy supply per capita was considered as directly proportional to the economic development. This premise, however, is only partially true, because the economic development level is also essentially linked to the efficiency with which the energy supplied is being used.

On the other hand, the predominancy of forces of economic interests involved in the construction and start-up operation of new energy supply sources are extremely powerful, with a small number of persons participating in the decision-making system, while the forces on the supply side are generally small and difficult to be mobilized because they cover thousands of consumers. Hence, the critical importance of the role of the Government to counterbalance and maintain these forces balanced.

The increase of international prices of oil in 1973/74 and 1979/80 brought on a rapid economic reschedule of the industrialized countries, followed by adjustments in the technological processes of energy uses that have resulted in a significant reduction of energy demand.

Practically in every country of Europe, Japan and United

States, energy consumption by unit of Gross Domestic Product has undergone a significant reduction over the latest 13 years. The same event has not taken place in the developing countries that, on the contrary, have been presenting exactly adverse results. This fact results, among other factors, from the lesser readyness of developing economies to rapidly make structural adjustments in the face of new economic situations.

A basic factor is the capacity of technological adjustments in view of new requirements to improve technological efficiency. Also, another basic factor is the policy of prices and tariffs that either encourages or discourages the adoption of new, more efficient technologies on the part of the energy consumers. The combination of these two factors results in minor or major degree of efficiency, which is shown, for example, by the average rate of fuel consumption by the fleet of passengers cars, which is 4 to 5 km/l in Venezuela; 8 to 9 km/l in Brazil and 13 km/l in Japan. Throughout the world on the market for cars carrying 4 to 5 passengers there already exist those that run 20 to 25 km/l. An increase in the efficiency of fuel consumption is able to cause dramatic reductions in the requirements of future supply of energy.

5. END USE ORIENTED STRATEGY

The end use oriented strategy is intended to improve the economic and energy efficiency through the improvement of the thermodynamical efficiency of the equipment and processes related to energy end use. Within this scope, conservation in order to only diminish specific energy consumption, does not necessarily produce

an improvement on the economic and energy efficiency, and this conservation, therefore, has to be made only if economically justifiable. However, more often than not, energy conservation effectively does lead to an increase in economic and energy efficiency.

One of the main reasons for the existence of an increasing potential for economic and energy efficiency in developing countries results from the fact that in most of these countries energy consumption standards were based on the example of industrialized countries, without accompanying the high efficiency technological standards recently developed in these countries. On the other hand, greater efficiency means higher standards in performance either in imported technologies or in those developed in the country. In this way, selectivity conditions should also be imposed on more efficient imported technologies, especially those that meet national interests.

6. IMPLEMENTATION OF A CONSERVATION PROGRAM: AN EXAMPLE

The implementation of a program for energy and economic efficiency increase is an extremely complex task due to several reasons. One of the major reasons is the need of carrying out several governmental related actions, and execute them concurrently by several agencies with the private sector.

Following we present an example for more efficient cars as an illustration of this program.

Considering a series of actions and policies that are planned by the government for the consumer market, aiming at encouraging the purchase of more efficient vehicles, these policies are as follows: availability of financing only for more efficient automobiles; the requirement that automobiles importers show perfomance figures provided by government authorized bodies to the public of automobiles available for sale; an awareness campaign with the consumer on the economic importance of efficiency in his monthly expenditures.

It is necessary that the management of this program prepare the state bodies in order that they are coordinated with other related bodies, with a view to consistently act, as well as to create the corresponding institutional bodies to make the program operational.

All these actions necessarily involve at least the Ministries of Natural Resources and Energy, Transportation and Agriculture, and their Departments as those of production and distribution of electricity, of water supply, as well as companies as Staatsolie, EBS, ABS - National Statistics Bureau and National Planning Bureau.

Besides this multifaced nature, it is necessary in organizational terms to emphasize that the whole system shall operate evenly, under the risk of failure if one of its components does not operate well. Hence, the complexity of the implementation of this program and the consequent need of Government political willingness.

7. REASONS FOR A CONSERVATION PROGRAM IN SURINAM

For the particular case of Surinam, the main reasons for the adoption of a program for energy and economic efficiency increase are as follows:

a) The increase in the consumption of oil by-products implies increasing expenditures of imports, whose expenditures have already totalled around 25% of the total amount of imports of the country in 1983. Also, the increase of electric energy consumption implies increasing expenditures, since the basis of supply in Paramaribo region and in isolated localities (except in the bauxite sector facilities) is of diesel generating units. Thus, any reduction in fuel or electricity consumption results in a maximum benefit through the reduction of an oil by-product consumption, which is necessarily imported.

b) Because of the importance the bauxite sector has in the energy matrix of Surinam that, on the other hand, concentrates investment decisions and operation in two companies - Suralco and Billiton, such a sector has the potentiality of favouring great reductions in energy consumption, even with moderate improvements of energy efficiency.

c) The investments in the energy sector and mainly in the electric sector have been for a long time capital intensive and work extensive. Typically, in some countries of Latin America, for each dollar invested, from 40 to 50 times more permanent employments are created in the agricultural and livestock sector than in the energy sector. In

the transportation sector up to 12 times more employments are created. This data of investments versus employment creation, and the present context of a high foreign debt and low prospects for the export of aluminum make the problem of capital priority, which is scarce, extremely important for the economy of Surinam. On the other hand, the experiences of other countries show that the investments on the demand side, to save one energy unit, require, in general, less capital than the investment on the supply side to generate and distribute the same quantity of energy. This is true, for example, in that shareholders of energy utilities in USA are encouraging the top management of the companies to invest in the conservation, expecting the obtainment of greater profitability. In fact, a reduction of the capital requirement should represent a significant relief for EBS.

d) The forecasts of trends for the early 1980's in Surinam lead to an increase of the participation of the industrial sector not linked to the bauxite sector both in the economy and in energy consumption. If energy systems in industries present low efficiency, they may impair the competitiveness of industries, in which the cost of energy is very representative on the total industrial costs.

8. MAIN THEMES FOR DISCUSSION

The main issues for the implementation of a program for energy and economic efficiency increase that shall be examined in

detail are the following:

a) Price and Tariff Policy

Prices and tariffs represent the main factor of potential distortion and the most powerful tool for the improvement of energy efficiency of an economic system. Experience has shown us that realistic prices and tariffs based on real economic costs of each energy sector, also taking into account the opportunity costs, directly affect consumption standards of the population.

The fact that Surinam has no oil refinery makes necessary to set domestic prices of oil by-products in accordance with the medium-term trends of international prices. For example, if transitory drops of international prices lead the government to move in the same way in the pricing for domestic market, such a fact may discourage investments in conservation measures related to fuels consumption. The same can be said about the electric energy tariff that is linked to the diesel oil price. In any case, energy prices and tariffs are the major tool in search of consumption efficiency.

b) Tax and Monetary Incentives

The government is responsible for the creation of an environment of action for private and government owned sectors to invest in the improvement of energy efficiency. Tax and monetary incentives are some of the tools used by the government in order to make such an environment a real fact. Incentives must assure that the government does not lose its revenues more than the productive sectors, and that consumer market becomes encouraged to improve energy efficiency.

c) Efficiency Patterns

Energy consumption patterns are the keys to the perfect knowledge of energy market. These patterns shall be established after being verified their economy as well as their technical feasibility. The experience of industrialized countries shows that efficiency patterns cause a significant impact on investment decisions. For example, in the residential sector, these patterns were highly effective on moving preference of consumers toward more efficient household appliances. The requirement of indicative labels of energy consumption attached to household appliances will be effective in drawing the attention of consumers, and influencing the purchase decision, as well.

d) Other Issues

Other issues shall be dealt with, namely:

- The need of reliable statistical data on energy consumption for each end use trying to assure sound bases for the setting up of a strategy oriented to energy end uses and to monitor the development of the program.

- Definition of financial funds to support the investments required for the implementation of a program for efficiency increase.

- Estimating the energy conservation potential in order to assure a positive balance of the benefits of the program.

9. ENERGY PRODUCTION AND CONSUMPTION IN SURINAM

The following charts show the present situation of energy production and consumption in Surinam. Energy production data is normally more acccurate and consistent than the data about energy end uses. The latest data was estimated in the best way available for the moment.

The most remarkable facts resulting from the analysis of this data are the following:

1) Consumption of oil by-products is very expensive for the country: domestic production of crude oil (that is used as fuel oil in the bauxite sector) estimated for 1985 (1200 bbl/day average) did not reach 25% of the fuel oil consumption and is expensive to be extracted. By-products, all of them imported, corresponded, in value, to 26% of the country's import.

2) Although part of electricity is hydroelectricity, and there are projects that foresee further developments of hydric potential, the marginal cost of electric energy production is presently determined by the operation cost of diesel units of EBS, that is liable for at least 30% of the electricity consumption not linked to the bauxite sector.

3) The bauxite industry, according to data of 1983, uses 5.9% of PLG, 13.7% of diesel oil, 75% of electricity and the totality of fuel oil used in Surinam. Moreover such a sector has the only hydroelectric power plant in the country, as well as it generates the total thermoelectric capacity amounting 325 MW, around 5 times the installed capacity of

the electric public sector. Thus, energy planning and dynamics issues in Surinam are inextricably linked to those of the bauxite industry. Among other things, the aluminum market recession, besides imposing a general decrease on the level of national economic activity, affected the availability of electric energy resulting from the cogeneration in the manufacture of alumina.

10. ENERGY SAVING POTENTIAL

Because of the recessive situation of the bauxite sector on the occasion of the research, and significant uncertainties about its future due to the outlook of the depletion of mines presently under exploration, there are no adequate forecasts for global trends of consumption. However, it is possible to evaluate the effect of technological changes toward more energy efficient equipment for some end uses, for which we have some information on especific consumptions.

In transportation, considering petrol only (almost only used for passengers cars), the total consumption which in 1983 was 63.8 million liters may reach from 94.5 to 135.9 million liters. The adoption of measures aiming at improving the fleet efficiency of the present average consumption from 8 km/l to 11 km/l would result in a saving of 25.8 to 37.1 million liters of petrol.

An estimated consumption of electric energy foreseen for the year 2000 of 196 GWh could be reduced in 93 GWh, thus totalling 103

GWh, if only considered the street, commercial and residential lighting and refrigerators and domestic air conditioning. The bauxite sector might have a gradual reduction reaching around 23% and 44% of electric energy, which would mean for the production level of 30.000 t/year of aluminum (half the present installed capacity) a saving around 150 and 250 GWh. Naturally, to the saving obtained from the operational costs in electric energy generation we must add the reduction of the requirement of investments in the capacity of generation, transmission and distribution of electric energy.

11. CONCLUSIONS AND RECOMMENDATIONS

The major difficulty in the preparation of this work was the lack of specific data about the profile of energy end use by different sectors that make up the energy structure of Surinam. Due to this lack of data we propose the implementation of a system of data collection on the specific consumption with regard to end uses with the residential, commercial, industrial and state sectors.

1. INFORMATION FOR GOVERNMENTAL ACTION

We propose a gradual implementation of an information system on energy end uses within the planning sector of the Ministry of Natural Resources and Energy.

a) For the residential sector it is convenient to prepare a data collection with representative samplings per consumer

classes, aiming at establishing an energy consumption profile in the residential sector. This data collection would allow for the analysis of the main appliances from which a significant reduction in energy consumption could be achieved:

- LPG stoves
- wood stoves
- refrigerators and freezers
- air conditioning apparatuses
- incandescent and fluorescent bulbs
- irons
- TV sets
- radios and sound sets.

b) The analysis of the transportation sector can be improved by the preparation, together with the import sector and the register of traffic department, of performance characteristics of running vehicles aiming at determining the profile of car, bus and load truck fleets.

From the data collection conducted on the running fleet we could develop guidelines for a new policy of vehicles import, aiming at reducing the consumption of oil by-products in the transportation sector.

Then, it is necessary to delineate the basic characteristics of the fleet of:

- cars
- buses
- trucks
- trains
- fluvial navigation boats
- coastwise shipping boats
- airplanes

c) The industries not directly related to the bauxite sector have been significantly increasing their participation in the Gross Domestic Product: from 1980 to 1983 their participation increased from 8.6% to 12%. This growth is a great evidence of the increasing importance of the industrial sector not linked to the bauxite one and will require a special attention on the part of the governmental authorities. It is necessary to determine the rate of increase of energy consumption and establish guidelines for an energy conservation program in this sector.

It will be necessary to make an energy study for all new industrial and agricultural meaningful projects aiming at checking the dependence on imported energy sources, possibilities of domestic sources use (wood, charcoal, vegetal residues, crude oil of Tambaredjo) and specific energy consumption of the various energy sources.

The main topics to be discussed in the industrial sector are:

- metallurgical and chemical industries processes
- electric motors
- explosion engines
- oil fed ovens and stoves
- electric ovens and stoves
- systems of steam generation
- electrolytic cells
- incandescent and fluorescent bulbs, etc.

The same guidelines should be applied to the public, commercial, agricultural and mining sectors that must include the following items:

- PUBLIC AND COMMERCIAL SECTORS
  - air conditioning
  - fluorescent lighting in offices
  - street lighting

- AGRICULTURAL SECTOR

  - tractors
  - irrigation system
  - grain drying systems

- MINING SECTOR

  - tractors
  - trucks
  - electric motors
  - diesel and petrol engines

c) Bauxite Sector

To start a study with SURALCO to verify the feasibility of increasing the availability of energy from Affobakka power plant for the EBS System with new investments, in order to increase energy efficiency in the Aluminum factory.

A possible investment on the part of the Surinam Government in this activity would be deemed as an alternative of investment in electric energy generation for the region of Paranam-Paramaribo.

To study with SURALCO and Billiton the reduction of fuel oil consumption in Alumina production.

It is necessary to know the characteristic capacities as well as the energy specific consumption of all these

apparatuses and equipment.

The degree of importance and detail to be obtained depends on the resources available for the collection of this data. The introduction of the information system must be gradual and begin with the most important blocks of energy consumption.

It would be antieconomic and useless to survey all capacities and specific consumptions; statistically significant surveys through sampling are totally satisfactory and can be raised initially from pre-existing statistical basis, information from EBS and Staatsolie, and systematic and periodical interviews with the largest industrial, commercial and transportation companies, and maintenance companies and wholesalers of apparatuses and equipment that use energy. Naturally, the most important blocks of energy end uses should deserve more attention.

- follow-up of the current state of the art of mentioned equipment and processes, aiming at detecting in advance new opportunities, in order to get greater efficiencies in energy end uses.

2. GENERAL RECOMMENDATIONS

For imported durable consumer goods, the main effective tool is to impose selective custom duties that heavily burden equipment of greatest specific consumption of energy. From specialized and governmental publications of various countries, it is possible to establish a comparison of specific consumptions as to the quantity of kilometers run with one liter of fuel by cars and buses, the average consumption of a 300 liters refrigerator, quantity of LPG monthly used in a stove by a medium-size family, etc.

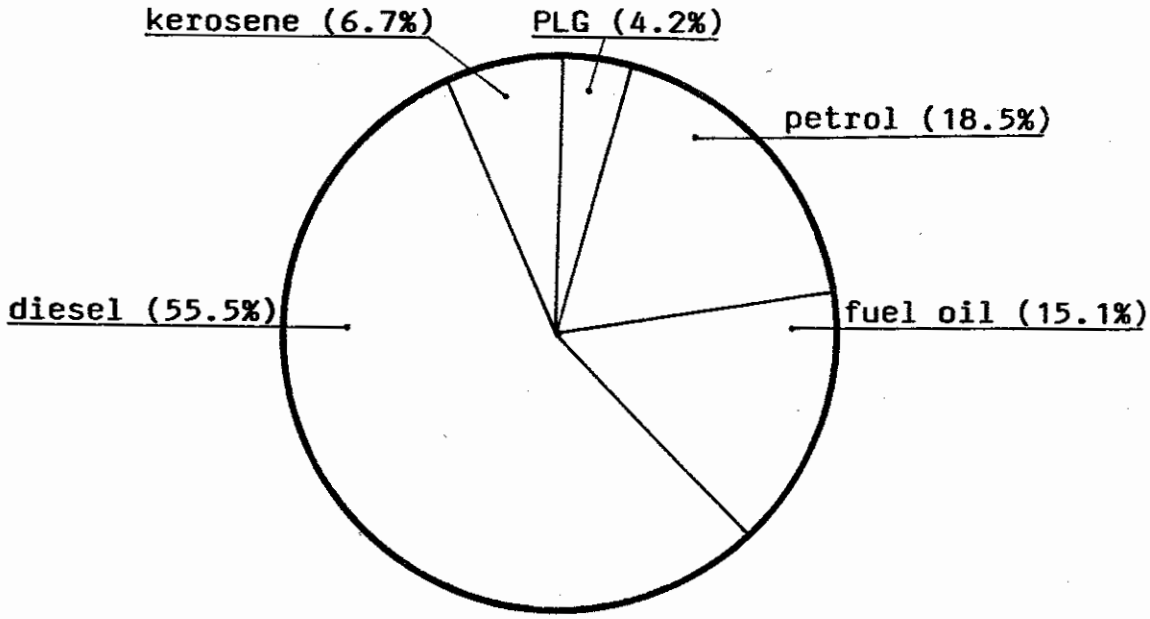
This arrangement should be accompanied by explanations to population through the media and by dealers of durable goods.

TABLE 1: Gross Domestic Product (millions of florins)

YEAR	1980	1981	1982	1983
Farming, livestock-raising, and fishing	136	153.7	152.3	146.9
Forestry and wood processing	27	30.2	25.7	26.2
Mining and bauxite processing	273	243.0	204.8	202.0
Industry	131	174.2	188.6	200.4
Water, gas and elec.	37	34.8	37.0	37.4
Construction	52	59.8	60.3	60.3
Commerce, restaurants and hotels	244	224.5	229.4	224.5
Transportation, storage and communication	65	96.9	100.8	104.7
Financial institutions	139	168.2	180.7	193.2
Lodging services	72	71.3	74.2	76.3
Government	318	314.8	337.1	349.8
Other services	30	33.0	32.4	35.1
Gross Domestic Prod.	1524	1615.4	1615.4	1661.2

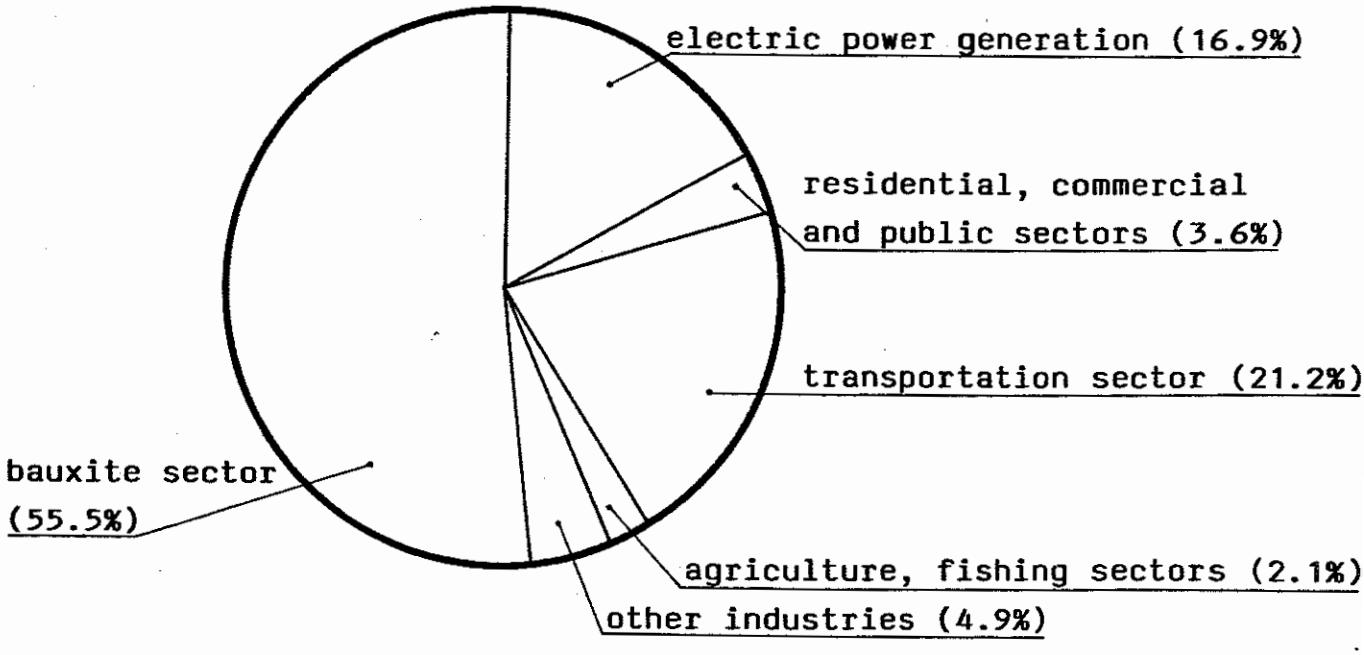
SOURCE: National Economic Profile, ABS

TOTAL OIL BY-PRODUCTS CONSUMPTION
(63 000 OET)

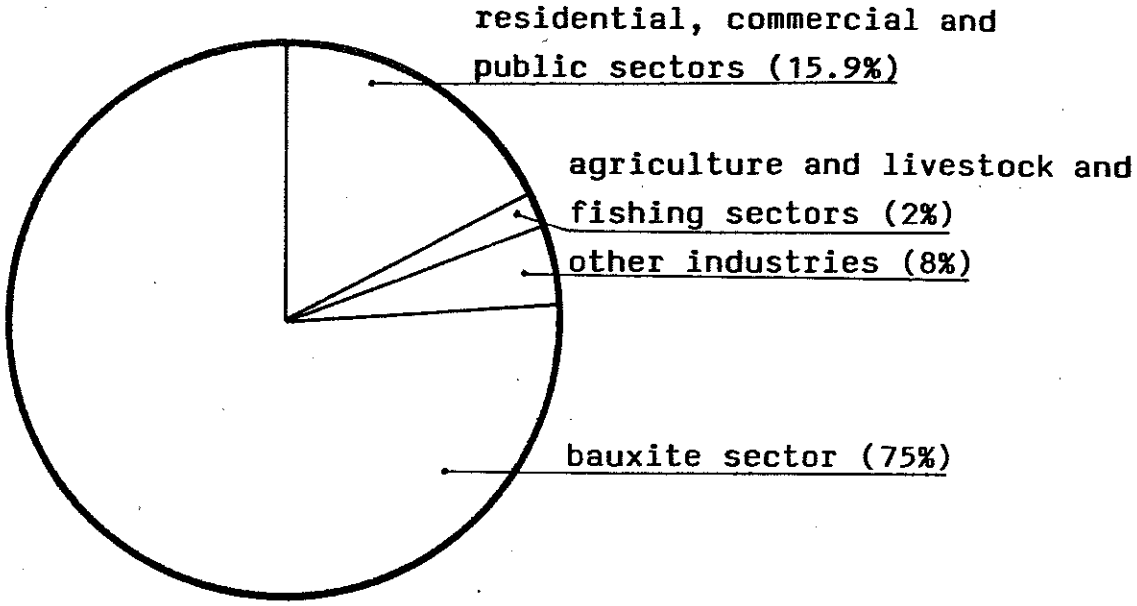


1983

OIL BY-PRODUCTS CONSUMPTION PER SECTOR

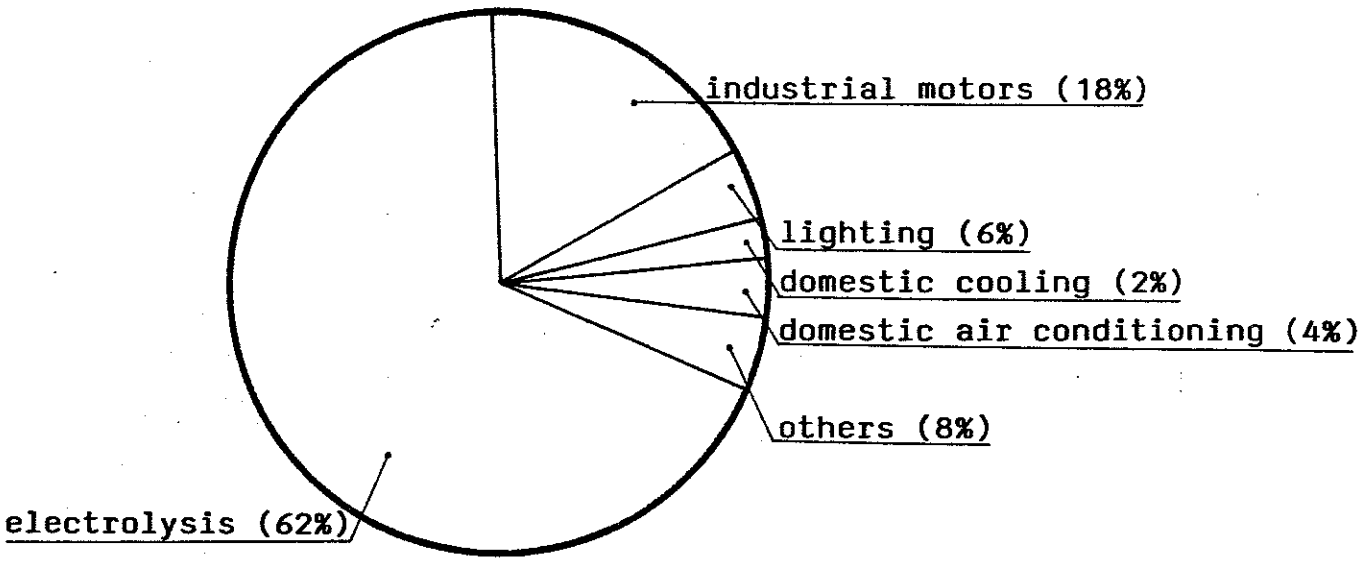


ELECTRICITY CONSUMPTION PER SECTOR



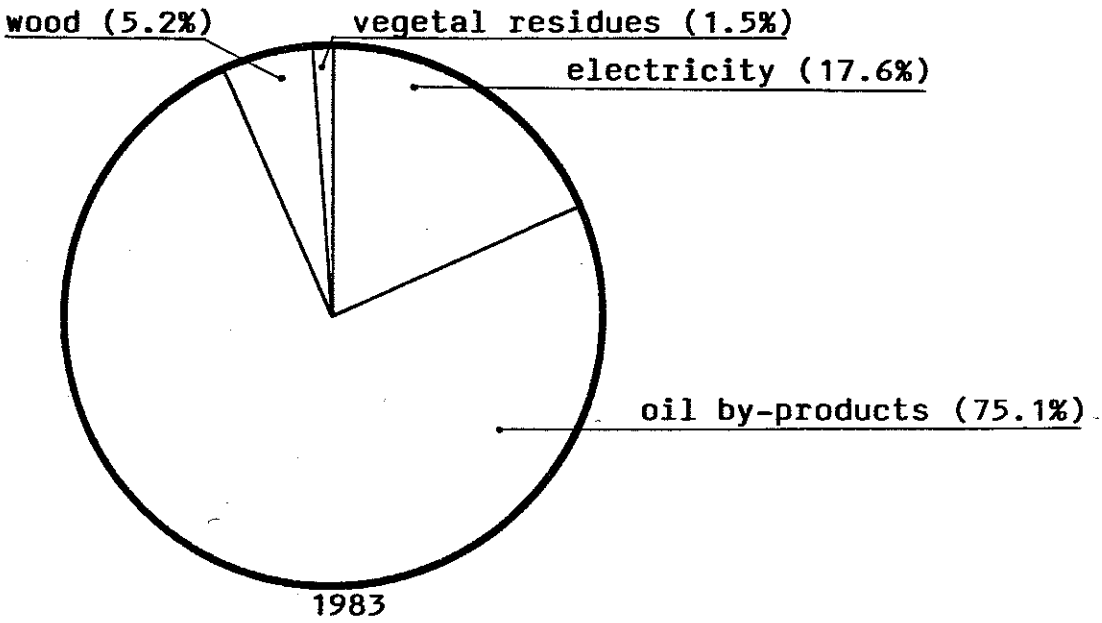
1983

ELECTRICITY END USES PER EQUIPMENT
(total = 1190 GWH)

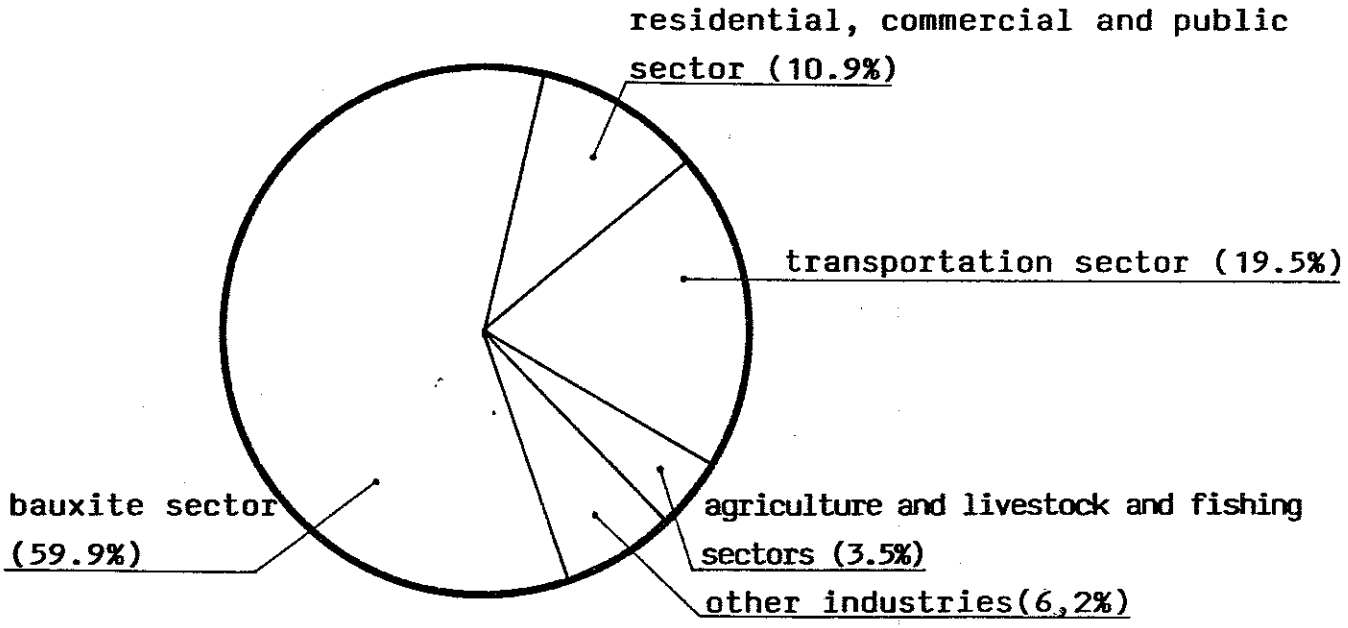


1983

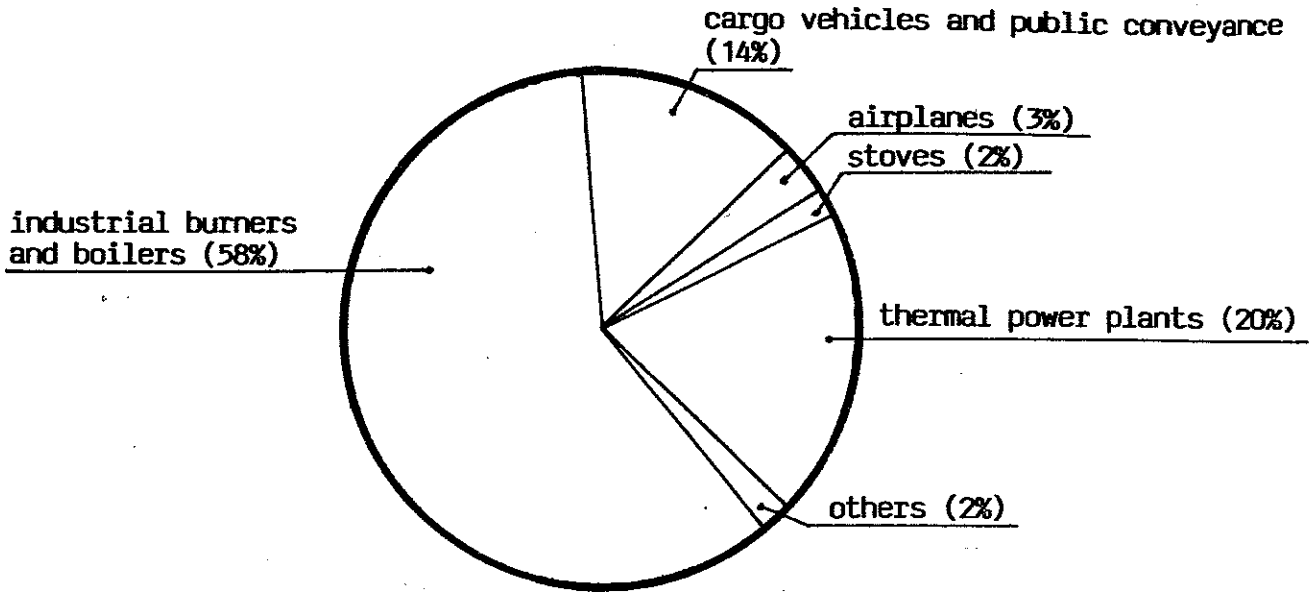
TOTAL ENERGY CONSUMPTION PER TYPE
(592 900 OET)



ENERGY END CONSUMPTION PER SECTOR



OIL BY-PRODUCTS END USE PER EQUIPMENT



ELECTRIC POWER GENERATION PER TYPE