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08935

Distr.
LIMITED

ID/WG.293/24
19 March 1979

ENGLISH

United Nations Industrial Development Organization

Workshop on Fermentation Alcohol for Use as
Fuel and Chemical Feedstock in Developing Countries

Vienna, Austria, 26 - 30 March 1979

NECESSARY CONDITIONS TO PROMOTE AND REALIZE A POLICY FOR ENERGY AND CHEMICALS BASED ON "GREEN PETROL"*

by

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id.79-1988

CAN GREEN PETROL BE A PERMANENT SOURCE OF ENERGY FOR DEVELOPING COUNTRIES AND FOR ALL THE WORLD ?

The lectures which have been delivered by highly qualified experts have indicated that alcohol produced from biomass can be utilized and that new technology can improve its utilization either for fuel or for chemical processing.

The conclusion of this seminar will be to show to the developing countries that the industrialized nations have at their disposal all the necessary technology to support a Green Petrol policy.

WHAT IS GREEN PETROL ?

This expression covers alcohol issued from the fermentation and the distillation of any vegetable sources. Those have to be chosen according to their yield in alcohol. The feasibility study necessary for each country determine the best. Most of these sources and the most adequate such as sugar cane are located within 30 degrees South and North of the equator.

But before starting any sale of this technology and the necessary equipment which follows, it is most important to open the door of the countries to this policy and to see whether these countries can dispose of the vegetable sources to produce alcohol in sufficient quantity.

The purpose of this study is to answer the following questions:

- Which vegetable sources and where are they located ?
- How Green Petrol policy can be put into operation effectively ? In other words, what are the necessary approaches and studies to induce the countries to consider alcohol as permanent source of energy like the sun, wind and hydraulic power ?

CHAPTER I

WHICH ARE THE BASIC RAW MATERIAL FOR PRODUCING GREEN PETROL

We have indicated above that Green Petrol covers all vegetable sources which, by distillation, can produce alcohol through the process of photo-synthesis. In fact, any vegetable which contains some sugar or starch can yield alcohol through a distillation process. But the yields are different.

WOOD

Forest can be a source of supply for alcohol. Besides the distillation of wood pulp slops (yield 2% sugar), there are in temperate climate some possibilities of cultivating certain kinds of wood like willow and poplars which give a relatively good return in alcohol.

The Swedish institute said for instance that Sweden could, in theory, supply all its energy requirements from 93,000 square kilometers (57,790 square miles) of land devoted to short-rotation forestry.

Practical experiments at the College of Forestry show that the forced raising of selected strains of willow and poplar yield up to 30 tons of biomass per hectare per year. This is equivalent to a gross energy yield of about 135,000 kilowatts - 16 times more than in ordinary forestry. A recent survey disclosed that about one million hectares (2.47 million acres) of Swedish soil could be allocated to energy plantations. This would be enough to meet roughly a tenth of the nation's electricity needs.

The production of wood in the world is very important. It appeurs from the following figures :

COUNTRIES	PRODUCTION
World	1.178
Western Europe	31
Eastern Europe + U.S.S.R	97
North America	18
The South Sea Islands	8
Latin America	224
Far East	350
Near East	42
Africa	253
Others	155
TOTAL.....	1.178 millions cubic meter

In the developing countries the fire wood represents 1/3 of the energetic resources. In certain countries it represents 3/4 of energy consumed. Half of the wood taken from the forest of the whole world is used as fire wood. This raise a very serious ecological problem which explains the erosion of the land, the change of climate and the drought which exists in different countries: Africa, Northern Thailand, etc.

We think that should it be possible to replace wood partially in developing countries by alcohol, this would be of great improvement for these countries.

We are not studying either the energy coming from grass biomass (1). The estimated grass land area of the developing

(1) Please refer to "Energy from Biomass from developing countries", a very thorough study made by Messrs. JS BENE, HW BEALE, HC MARSHALL from International Development Center, Ottawa.

world is about 1500 million hectares but no study has been made so far to see in what conditions, at what cost price such products could be converted into alcohol. We will make the same observation for aquatic plants. In fact, the production resulting from the distillation of above items is mostly Methanol.

It can of course be used for fuel purpose but with less advantages than Ethyl alcohol. Also the range of chemical products made out of Methanol is less large than the ones which can be produced with Ethyl alcohol. The yield is also very low: 40 liters of Methanol for 1 tonne of dry wood. I am mentioning this to indicate that we do not intend to ignore these potentialities. But I prefer to concentrate our discussion on Ethyl alcohol because its technology is very well known and it is easy to obtain. It must be understood that in any feasibility study related to the Organization of a production of alcohol for a specific country, all these sources of energy have to be studied, even if they may be considered as negligible.

Which are the vegetable products to be used on a large scale for producing Green Petrol without jeopardizing the quantity of any of these products already utilized for feeding the people? It is necessary first to feed the man, then to give him energy in order to facilitate his work and to increase his efficiency. Table (1) summarizes these products with their estimated yield in alcohol.

We have summarized in different tables the production of the main distillable products.

Purpose of this documentation is to give an idea on which country one could find supply for making Green Petrol, assuming that the quantities produced can be increased.

This possibility concerns most countries in getting better yield and increased land cultivated in order to supply human food requirements and the production of feed-stock for making Green Petrol.

These tables will also show for each production the quantity produced by developing country.

If the grain production is specially located in developed countries, the production of rice concerns the developing countries.

We have not included China which is a closed market, so far.

The quantities which are exported could eventually be released for domestic uses when the importing countries are self sufficient as it is happening now in India for cereals.

The production of the distillable products is potentially very great without jeopardizing the requirements for food.

CEREALS

The world produces 1,459 million of cereals, of which 168 million are exported (see tables 2, 3, 4, 5, 6). Among these, maize, wheat, millet, sorghum and rice are among the most produced. Their production is based on an average yield of 250 liters per metric ton, which is a good result and justifies an equipment of distilleries, because they can be assured of regular feed-stock. When we look at the map, we see that most of these cereals are produced in developing countries (170%). There is no surplus of production, except in wheat and corn, especially in the United States and in Canada. Corn can be considered as a source of energy for

the Western world. The efforts made in the United States are noteworthy. They intend to produce 10 billion gallons of alcohol from corn equivalent to 400 million hectolitres of alcohol to mix with 100 billion of gasoline at the ratio of 10%. This programme will save 30,000,000 tons of petrol or 3.5 billion US $. The United States have this capacity of production, with the idle land subsidized by the tax payers. Some other countries, important producers of cereals (Argentina, Brazil, Australia and South Africa (1)(2)), could do it as well.

POTATOES AND SWEET POTATOES (Table 7)

The production is important but the big surplus are occasional. However, countries like Columbia, U.S.A and Central America could increase the production above the quantity necessary for feeding the population. The yield in alcohol is estimated according to the quality of the crop to 100 litres per metric ton for potatoes and 170 litres for sweet potatoes. The conversion into alcohol may be very useful for the wasted quantity which may appear when the crop is very important o which may exi t permanently in different countries. We have to appreciate whether the distillery equipment can be set with only this feed-stock. But it is interesting to consider that the potatoes wasted or in excess can be the supplementary feed-stock to the sugar cane. The distillation of the sugar cane lasts usually 120/150 days and the equipment remains idle the rest of the year.

AGRUMES/PINEAPPLE (Table 8)

The yield is very low. 25 litres per ton for pineapple, 35 litres per ton for Agrumes. Here also, the conversion into alcohol can be a solution for rejected fruit or excess

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(1) The U.S.A have edicted many dispositions to encourage the product of ethanol out of corn and to blend alcohol with gasoline up to 10 % to reduce the demand for oil.

(2) South Africa has just decided to produce alcohol out of corn and sugar cane to meet the non delivery of Iranian oil

of production which cannot find the outlet in the world market.

BANANAS (Table 9)

The production is important: 56,000,000 Tons. The export amounts to 7,000,000 T. about. There is presently an excess of production in the world. Central America and Panama are organizing a joint action for finding an outlet for 1 million tons of bananas. The yield in alcohol is relatively good; it is estimated at 250 litres average (Green banana: 300/350 litres, Ripe banana: 100/110 litres). This return justifies the set-up of a distillery provided there is sufficient quantity to be used. 1 million tons of bananas for example would represent a production of 250 million litres of alcohol or 2.5 million hectolitres or more than 52 million gallons, necessitating at least 2 or 4 distilleries. The distillation could be made with a special preliminary equipment in using the distillation equipment for molasses and sugar cane. It could be treated after termination of the distillation of the sugar cane. This quantity refers to a part of the world (Central America) but could be increased world-wide by all the wasted bananas which exist in the various producing countries.

PAPAYA

The same thing can be said about Papaya which is also a tropical fruit which is produced in large quantity. Although no statistics appear in the report of FAO, the estimated yield is not very high (130 litres per metric ton), but is worth being considered because the price of the raw material is generally cheap.

DATES AND FIGS (Table 10)

The distillation of the first gives about 200 litres per metric ton and for the figs 260 litres. The production of

these fruit is located in limited countries: Iraq, Iran, Portugal ; in these countries the production can be increased. Table n°9 summarizes the quantities produced in the world for most of these products and the yield for each product.

MANIOC (Cassava) - (Tables 10 and 10 bis)

It is a big production and an easy one in tropical countries (Thailand, Philippines, Indonesia, West Africa, Brazil, Central America). The production being very often a natural one makes it an easy one. The yield is about 160/170 litres per metric ton. The processing of Manioc/Cassava into alcohol requires a lot of enzymes. Brazil has indicated a national programme of production of alcohol 25% based on Manioc. It is one of the Raw Material which can be considered as permanent, regular source of energy (1). The only objection is that to produce one litre of cassava alcohol this necessitates 0.8 litre of fuel. But very important studies are made to reduce this consumption of fuel.

SUGAR CANE (Tables 12 and 12 bis)

Among the vegetable material which can be converted successfully into alcohol, sugar cane appears as the best.

WHY ?

1°/ Because its cultivation is spread all over the world. There are 110 sugar producing countries of which 69 grow sugar cane, 31 grow sugar beet, 10 grow cane and sugar beet.

2°/ The sugar production technology is well known and the equipment in sugar plants represents in the world 2496 sugar plants of which 1015 beet sugar plants, 1481 cane sugar plants, taking into account only the plants which have a capacity above 400 tons a day.

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(1) Special study of Mr. Emo Roque de Oliveira reproduced by Licht International Molasses Report (31.12.78): Ethanol renewable fuel for Brazil.

3°/ The production of sugar has increased in very big quanti'ies as it appears on Table n°12.D. For the past 10 years, the production has risen from 65 million tons to 93 million tons, reflecting the possibility of increased production, especially in the sugar cane producing countries.

4°/ Sugar cultivation is spread over 22 million hectares of which 9 million for sugar beet and 13 million for sugar cane. The cultivation of this vegetable is the means of living of millions of people and it is an important economical and social factor of the development of many countries.
Furthermore, the export of sugar which represents about 31 million tons is the source of more than 6,000 million foreign currency earnings, which are badly needed by developing countries.

5°/ Possibility of having their surplus of sugar cane produced absorbed by the production of Green Petrol and to regulate their sugar market.

6°/ The possibility of increasing the production of sugar cane is tremendous. The countries which have this possibility of production, especially the tropical countries, are in a very favourable position as a world energy reserve provided they can find the financing for setting up distilleries. It is interesting to realize that the investments required are without comparison with the amount of money which is spent every year in researches of complementary energy: coal liquefaction, shale oil. The same remark can be made with the price of nuclear energy with a plant costing between $1\frac{1}{2}$ billion and $2\frac{1}{2}$ billion $ and having a working life of 10/15 years.

The yield is between 65 and 70 litres per ton of sugar cane (Table n°13). In our calculation, we will retain 70 litres. For invert molasses we calculate that 6.5 tons of sugar cane are necessary to produce one ton of cane invert molasses.

If we take the average production of sugar cane per hectare (60 tons)(1) we can say that the production of alcohol is about 420 litres/ha. The process is well known and the possibility of distilling sugar cane will bring a new outlet to the cane growers in having the sugar juice going to the distillery to produce alcohol instead of going to sugar production.

In disposing of two outlets instead of one, the sugar producing countries have the possibility of regulating their sugar market. I have explained how the Green Petrol policy can help the sugar market on two seminars which were held in December 1978:

- one in London before the consumption committee of the International committee of the International Sugar Organisation,
- the other one before the Sugar Commission of the Common Market.

WHAT ARE THE SUGAR PRODUCTS WHICH CAN PRODUCE ALCOHOL

We must avoid any misunderstanding and make a distinction between molasses, by-product of sugar and direct distillation of sugar beet and sugar cane.

a) MOLASSES

Any production of sugar leads to a production of juice which usually contains 50 % sugar and which is called Molasses.

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(1) It could be increased.

Normally, the production of molasses represents 1/3 of the production of sugar ; but it varies considerably according to the equipment of the sugar plant and according to the quality of the crop.

Equipment of the plant:

The quality of the equipment of a sugar plant depends on the quantity of sugar which can be extracted from beet or cane, which varies also according to the crop. When the beet or cane are very high quality, it is possible to extract more sugar and consequently to reduce the quantity of molasses. But the molasses production taken as a whole (34/35 million tons all over the world, with about 6 million tons available for export) does not provide a sufficient quantity to organize an energy policy based on alcohol because the quantity would be too small. Practically all the molasses produced are already utilized by the producing countries, either for making alcohol for domestic requirements (human and industrial) or for cattle food. Furthermore, the quantities of molasses available for export will be decreasing every year on account of the increased consumption of alcohol for human consumption in the different countries in line with the increased standard of living ; also for feeding cattle.

b) DIRECT UTILIZATION OF BEET AND SUGAR CANE FOR DISTILLATION

There is only one country, France, which distillates directly beet for producing alcohol. For a limited quantity: 1,400,000 hectolitres to protect some privileged producers ; the yield is about 100 litres per ton of beet and the price of this alcohol, which depends on the price of beet, is taxed by the French Government: Frs 266 per hectolitre, roughly US.$ 62.

It appears that the only reliable source of alcohol in big quantities is the distillation of sugar cane converted

mostly in inverted molasses.

Estimation of a Limited Programme

In a leaflet called "Green Petrol" I have examined what quantities of sugar cane would be necessary to produce a quantity of alcohol in order to blend it at a ratio of 15 % with gasoline in the developing countries, leaving aside Brazil which has organised completely its policy. The estimation which, of course, has to be checked country by country located 30 degrees North and South of the equator, represents 10 million tons of alcohol, or 120 million hectolitres.

1 - The area necessary to produce 10,000,000 M.T. of ethanol or 120 million hectolitres.
Based on the yield, 1 hectare of sugar cane gives 60 tons cane and, noting 1 ton of cane can produce 70 litres of ethanol, we arrive at a figure of 42 hectolitres per hectare. The area necessary to produce 120,000,000 hectolitres is about 3,000,000 hectares.
The cost of field equipment is estimated at 1,000 US.$ per hectare.
The investment represents for that part:
2,857,000,000 US.$.

2 - The equipment needed to distill 120,000,000 hectolitres would be around 240 distilleries, each one having a capacity of 500,000 hectolitres, the price for each plant estimated at 25,000,000 US. with all complementary equipment for anti-pollution, i.e. a total of:

240 x 25,000,000 = 6,000,000,000 US. $

The total investment would be:

2,857,000,000 US.$
\+ 6,000,000,000 US.$
= 8,857,000,000 US.$

rounded off

9,000,000,000 US.$
\+ 1,000,000,000 US.$
= 10,000,000,000 US.$

In order to replace 15 % of the petrol by 15 % ethanol in the developing nations (apart from Brazil), a national and/or international investment of 10,000 million US. $ would be needed.

But this will enable the nations concerned to make an annual saving in foreign currency of about US.$ 1,000 million (1), and without outside expenditure except for fertilizers and the machines to cut the cane, subject to some equipment which could be produced domestically.

We repeat this is only an estimate of the amount of investments considered. The figures quoted above are only meant to give an idea of the magnitude of the project.

Such investment is not impossible to achieve. Firstly, it is made over a period of time (about 2 years is needed to build a distillery, and during this period the land must be planted with sugar cane or cassava). Some comparisons will help to appreciate the relative size of this investment.

It is almost the price of 5 nuclear energy installations.

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(1) Today the saving would represent at least 1,500 million US.

It is effectively the price of 69,000,000 tons of petroleum, (about 3 % of world production), or 1/3 of the budget deficit of USA., 2.5 % of the total armament expenditures last year, 0.3 % of the oil receipts.

This is a safe source of energy, one which can be renewed each year; thanks to the sun, water and manpower, elements present in a large number of countries adapted to sugar cane or manioc production. Ethanol (Green Petrol) seems to be a sure source of energy which should be developed on account of its vegetable origin.

ALCOHOL PRICE

Is the utilization of alcohol as a source of energy economical

We must face immediately the objection raised by the high price of alcohol comparatively to some other sources of energy. We will make two preliminary remarks:

1) Nobody knows the price of alternative sources of energy such as: solar, wind, nuclear, coal liquefaction, etc.
   Estimated cost of shale oil, for instance, is about the equivalent of 25 $ per barrel. Coal liquefaction arrives at the same price.

2) Nobody knows what will be the future oil price within 10 years from now, but some studies made by reliable organizations such as Exxon, Shell and so on indicate for 1985 a price of 25 $ per barrel (1). We must realize that we are already on a rising trend since

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(1) The Iranian crisis has created a shortage of oil or a fear of shortage and prices for Arabian light spot have reached US $ 23 per barrel paid.

the OPEC posted price in force in 1978 ($ 12.70 per barrel will be at the end of 1979 $ 14.50).

Today the price of dehydrated alcohol based on the parity of the floor sugar price of 11 cents indicated by the International Sugar Organization comes around 400 $ per ton. The price of gasoline must be quoted 200 US $ like Naphta (the naphta price has raised from 140 to 190 during 1978). Consequently, the price of alcohol is about twice the price of gasoline but it is a wrong and short-sighted view of the problem, because :

a) the comparison must be made also with the retail prices of gasoline and alcohol which very often equals out. It must be understood that in this case the difference is negligible, and governments as an encouragement for its use have been foregoing taxes on alcohol. It must also be noted that in paying for alcohol at $ 400 you are in a position to pay the growers of sugar cane the parity of the sugar price at 11 cents per lb. which is the floor price of the International Sugar agreement.

b) Furthermore, the countries are equipping themselves with an independent source of energy which is priceless.

All these reasons and others contribute to minimize the effect of the higher price for blended gasoline in favor of increased economic benefits for developing countries in the long run.

It appears from the above explanation that sugar cane is the best material for producing alcohol.

Consequently, the action for promoting Green Petrol must develop in the countries where sugar cane grows already and can be increased. These regions could become in the future a "new Middle East".

CHAPTER II

WHICH ARE THE DEVELOPING COUNTRIES WHO CAN PRODUCE GREEN PETRO

We have examined in Chapter I the main agricultural and vegetable products which can be converted into alcohol and used as a renewable source of energy every year.

There are about 92 countries who can benefit namely of this possibility, thanks to their climate, their soil and their population. They are specially fit to produce tropical distillable products:

- in Africa ..... 37 countries
- in Asia ..... 22 "
- in America (North & South and Caribbean). 27 "
- in the South Sea Islands ..... 6 "

TOTAL ..... 92 countries

They should be interested by the policy of Green Petrol to have a permanent source of energy.

Among the above, there are three countries where Green Petrol is in force and who consider alcohol as their permanent source of energy. They have taken the necessary measures to carry out such policy to their best advantages.

There are 10 countries where the idea of Green Petrol has been accepted, however they have not yet fully organized their realization of the policy.

We have all the remaining countries which are not taking benefit of their rich soil.

There are, of course, besides the above countries, some others located outside of the equator where sugar cane can be produced, however it requires a preliminary study to bring about a positive statement.

We stated in the previous chapter the possibility of United States producing Green Petrol to a great extent with corn and Sweden with special wood.

CHAPTER III

POLITICAL, SOCIAL AND ECONOMIC CONDITIONS TO ACHIEVE GREEN PETROL POLICY

The necessity for developing countries to use their national source of energy

It is a MUST for them for the following reasons:

1. Comparison between developing and developed countries of the quantity of energy consumption is significant.

	Per capita consumption Kg. of coal equivalent 1975 (*)
Low income countries	52
Middle income countries	524
Industrialized countries	5,016

2. The above first two categories represent 127 countries and a population of 2,820 million.
   Those figures give you an idea of the magnitude of the problem.
   How will it be possible for developing countries to have the financial resources to import enough petroleum to meet their energy requirement, which is absolutely necessary to improve their living condition, their industry and agriculture ? Therefore, it is a MUST for them to find, on their own territories, alternative resources such as

(*) Report on the Development in the World (World Bank, 9178)

sugar cane or cassava which help them to meet their energy requirements.

3. For the sake of a discussion, I remind you of the following advantages of such action :

a) To enable developing countries to have a source of energy of their own is priceless.
The situation of oil coming from the Arabian Gulf brings support to this assertion. Nobody can guarantee not only in quantity but also in availability of the quantity of oil which will be coming from the Arabian Gulf.

b) The developing countries will be able to reduce the expenses of petroleum which, due to the rising trend in price and consumption, may bring important savings in foreign currencies.

c) It will give an impetus to the national agricultural economy by cultivating more land and creating more job opportunities as well as in equipping their countries industrially.

d) At last, but not least, it enables the countries having some excess of vegetable production such as sugar cane or cassava to have the possibilities to see these surplus disappear through the conversion into alcohol. It will also help the sugar market in offering to cane sugar an alternate outlet.

Three years of experience in proposing the Green Petrol Policy to be adopted by various governments among developing countries have taught me that the best idea, the soundest and the most logical solution to a problem is not accepted easily when first introduced.

The example of Brazil was not sufficient enough to convince most of the countries to accept, on their government level,

the idea of considering alcohol as a permanent source of energy, especially where t.e conditions are best fit.

To produce a renewable source of energy on their own land without digging 3000 meters deep for searching oil, and of course with less cost for research has taken three years to be accepted by governments such as Thailand and Philippines.

The industrial technology is not the most difficult item to sell, it is the intellectual technology which is most difficult when it obliges people to take a different approach in solving the problem of energy shortage and to meet the necessities to carry on such a policy as Green Petrol.

The following are the conditions I would like to touch upon in order to make Green Petrol policy successful in developing countries.

1. Political conditions

Little can be achieved if the government of a country does not have a serious concern or insight to the energy shortage in the world and for his country. When the government of a country faces the problem of energy in full view and realizes the impossibility to meet all the energy requirements by the importation of oil, it becomes clear that it has to find on its land with its national resources, a source of energy of its own.

2. Social conditions

The production of Green Petrol may raise some problems which we do not intend to solve here at this time because it varies according to countries. However it must be indicated that Green Petrol policy necessitates two kinds of workers;

- Those who cultivate the cane, collect it and transport it to the distillary plant.
  In most countries, it is a traditional type of work utilizing manpower specialized for many years and is abundant in the Asian countries. It is not the case in some countries like Africa where it may be necessary to import manpower which can be found in some other countries, provided the living conditions are acceptable.
  One can reckon, on average, on one worker to cultivate and collect the cane from every 70th hectares harvested.
  Today, the cutting of cane which is considered as a manual labour can be helped by machine at the ratio of, on average, one cutting machine for 170 hectares for each campaign.
  Some machines harvest up to 400 hectares each campaign.
- Another category of workers is those who will work on the distillery plant.
  They require non-specialized workers, about 40 per distillery of 200,000 hectolitres and 10/12 specialized employees like engineers, surveyors and laboratory workers.
  This technical assistance can be found among Europeans or from people coming from countries having an experience in running of distillery (Brazil, Egypt, India) with perfect knowledge of this type of work.

3. Economic conditions

The production of vegetable sources which are suitable for producing alcohol, such as sugar cane, cassava and others has to be organized and well planned. It must be sufficient to meet the alcohol requirements necessary, for blending gasoline with 15% alcohol and for starting some chemical venture if any.

An evaluation of the expenses involved must be studied:

- for development and cultivation of the land,
- for equipping the countries with a sufficient number of distilleries.

It is also important, after the evaluation of all the expenses, to see how they will be financed: private capital, loans from international organizations.from bankers. Those problems must be examined within the frame of what I would call an intellectual engineering.

Necessity of a Feasibility Study

All these actions must be carefully investigated through a feasibility study which will examine the problem from all angles based on facts and figures to bring about a practical and positive solution.

This study will determine the price of alcohol which has to be guaranteed by the Governments or paid by them in order to encourage the investment and give an insurance to the investors that there will be a return.

Conclusion

To achieve Green Petrol policy successfully, the following principles must be accomplished.

A) The Government of the country declares Green Petrol Policy as a permanent source of energy taking its place in addition to the other sources.

B) After this policy is being adopted, the Government proceeds to its realization in organizing the production of necessary vegetables, the installation of distilleries and the distribution of alcohol among different uses.

C) To encourage investments and obtain loans from International Organizations for equipping the country with distilleries and machineries, Government must fix an

attractive price for alcohol. Failing to do this, there will be neither investments nor distilleries, unless the Government intends to build and run the distilleries by themselves.

CHAPTER IV

GREEN PETROL AS WORLD RESERVE OF ENERGY

We have focused our study on the production of alcohol from various vegetable sources in developing countries to meet their requirements partially for both fuel and ethylene.

This study offers a larger vision of this scheme in giving some knowledge regarding the possibility of producing alcohol in much larger quantities throughout the world. Facing continuous demand, researches for all sources of energy becoming more costly, more difficult and full of surprises, it may well happen that alcohol becomes a reserve of energy for the world.

The quantity of alcohol necessary to meet a world requirement to have a blended gasoline with 15 % alcohol can be calculated as follows:

- for example, we estimate the consumption of gasoline in the world at : 600,000,000 M.T. (1)
- 15 % of this quantity represents : 90,000,000

The problem is to know whether such quantity can be produced. We can give a positive answer. We see that the quantity of alcohol required represents nine times the figures which are given in pages 13 to 15. Therefore, by extrapolation, we can calculate the area, the investments and the number of distilleries.

If we proceed by extrapolation from the figures quoted we see that such policy would require:

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(1) United Nations Statistics.

a) Area to be cultivated

9 x 2,857,000 hectares = 25,713,000 hectares.
There is enough space in Africa, Asia and America to find such land.
The total arable land resources of the world are estimated at about 1.5 thousand million hectares (1).

b) Production

We have seen in the previous tables and comments in Chapter I, the different vegetables which can be produced. Table n°14 gives an idea of the total production of these distillable vegetable products.
The typical example, the market of sugar cane could be increased by placing Green Petrol among the permanent source of energy.

c) Investments

These will amount to about 90 billion US $ (1/6 of the budget of U.S.A, 1/4 of the armament expenses in 1977).

d) Distilleries

240 x 9 = 2,160 (See page 13, Chapter one, at the bottom)
The realization of all scheme now appear to be possible. Without under-estimating the practical difficulties for achieving such programme, it appears to be feasible and most certainly less costly than the petroleum researches and it is surer because there is no risk.
The growth of vegetable/agricultural product can be organized to be developed. When they are distilled into alcohol, these sources of energy can be stored easily and without risk of evaporation.

Conclusion

In a world which is so hungry for enorgy and which makes so many researches, sugar cane and eventually cassava appear as the best producers of alcohol. They are not the only ones and they constitute complementary source of energy for the world.

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(1) "America's Agricultural Future" by David Pimmentel and John Krummel.

CONCLUSION

We hope that this paper has been able to bring a new realistic vision of how can Green Petrol be a permanent source of energy for developing countries and for all the world.

In addition to the scientific and industrial technologies which have been widely studied in the different workshops, we have tried to demonstrate that previous to the sale of the material of any technologies, it is necessary to open the doors of the countries and also, and not the least, to open the minds of the governments'officials of developing countries.

We repeat, as a conclusion, that it is an obligation for the countries so short in energy and so short with means of payment for the import of oil, that these countries exploit their natural vegetable resources which can produce alcohol to be used as a source of energy and as a chemical raw material.

The possibility of having the source of energy renewed every year reminds us of a sentence which was spoken by a very qualified expert of the OPEC in 1977 when I was explaining the Green Petrol to him: "you are bringing us a renewable source of energy while we are working on an exhaustive source of energy".

The governments of developing countries are now confronted with this huge responsibility towards their present and future citizens with the following dilemma:

- Do nothing and wait for some miraculous help incurring the risk - and the present events prove that it can become a reality - to have to pay very high prices and eventually to have the resource in oil curtailed by rationing,

- Or exploit their national resources as quickly as possible in order to be ready to face the fallacious, uncertain future of oil resources.

SOCIETE DU PETROLE VERT
24, rue Royale
75008 PARIS

TABLE 1

EQUIVALENCES

tons/litres of alcohol

SUGAR CANE	CASSAVA	POTATOES	CEREALS & GRAINS	BANANAS (*)	PINEAPPLE
70 l.	160 l.	130 l.	350 l.	250 l	25 l.
1000 t = 700 hl	1000 t = 1600 hl	1000 t = 1300 hl	1000 t = 3500 hl (wheat, corn, rye, barley, buckwheat, sorghum, rice)	1000 t = 2500 hl	1000 t = 350 h

(*) green : 300 / 350
ripe : 100 / 110 (cellulose ?)

CITRUS FRUIT	DATES (*)	FIGS	CAROBS	PAPAYA	SWEET POTATOES
35 l.	200 l.	260 l.	180 l.	130 l	170 l.
1000 t = 350 hl	1000 t = 2000 hl	1000 t = 2600 hl	1000 t = 1800 hl	1000 t = 1300 hl	1000 = 1700 hl

(*) fresh : 125
dry : 350/400

Estimate by Mr. Pouligny, 27.09.78

SOCIETE DU PETROLE VERT
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75008 PARIS

SUMMARY OF WORLD CEREALS-TOTAL

PRODUCTION AND EXPORTS 1977

TABLE 2

(FAO Statistics, MAY 1

COUNTIRES	AREA 1000 HA	YIELD KG/HA	PRODUCTION 1000 MT	EXPORTS 1000 MT	LOCAL COMSUMPTION	% EXPORTS TOTAL PRODUCTION
WORLD	745.704	1957	1.459.012	168.753	1.209.259	11,6
AFRICA	70.773	929	65.731	2.650	63.081	4,o
N.C. AMERICA	102.853	3145	323.471	94.338	229.133	29,1
SOUTH AMERICA	36.973	1723	63.722	18.739	44.983	29,4
ASIA	324.985	1758	571.377	9.687	561.690	1,7
EUROPE	69.691	3317	231.166	26.735	204.431	11,5
OCEANIA	15.281	1021	15.597	11.924	3.673	76,4
U.S.S.R.	125.149	1502	187.948	4.680	183.268	2,5
of which DEVELOPING COUNTRIES	307.199	1390	426.914	27.160	399.754	6,3
AFRICA	56.476	761	42.976	145	42.831	0,3
LAT. AMERICA	49.920	1676	83.668	18.876	64.792	22,5
NEAR EAST	37.988	1410	53.556	1.222	52.334	2,3
FAR EAST	162.797	1515	246.679	6.917	239.762	2,8
OTHERS	18	1978	35	0	35	-

February 1979

SOCIETE DU PETROLE VERT
24, rue Royale
75008 - PARIS

SUMMARY OF WORLD WHEAT

PRODUCTION AND EXPORTS 1977

TABLE 3
(FAO Statistics May 1978)

COUNTRIES	AREA 1000 HA	YIELD KG/HA	PRODUCTION 1000 MT	EXPORTS WHEAT & FLOUR 1000 MT	LOCAL CONSUMPTION	% EXPORTS TOTAL PRODUCTION
WORLD	232,382	1,664	386,596	73,618	312,978	19%
AFRICA	8,555	960	8,217	247	7,970	3%
N.C. AMERICA	37,687	2,051	77,281	40,211	37,070	52%
SOUTH AMERICA	8,112	1,117	9,060	6,056	3,004	66,8%
ASIA	80,885	1,335	107,951	883	107,068	0,8%
EUROPE	24,819	3,317	82,235	15,057	67,268	18,3%
OCEANIA	10,294	944	9,720	8,196	1,524	84,3%
U.S.S.R.	62,030	1,484	92,042	2,966	89,076	3,2%
of which DEVELOPING COUNTRIES	64,639	1,312	84,830	6,953	77,877	8,2%
AFRICA	6,154	670	4,124	[illegible]	4,119	0,1%
LAT.AMERICA	8,884	1,301	11,557	6,110	5,447	52,9%
NEAR EAST	21,644	1,390	30,080	650	29,430	2,2%
FAR EAST	27,957	1,397	39,070	187	38,883	0,5%

THE FIRST TWENTY PRODUCING COUNTRIES

COUNTRIES	PRODUCTION 1000 MT
U.S.S.R.	92,042
U.S.A.	55.134
CHINA	40.003
INDIA	29.082
CANADA	19.651
FRANCE	17.450
TURKEY	16.715
AUSTRALIA	9.720
PAKISTAN	9.155
ROUMANIE	6.540
ITALY	6.329
IRAN	6.200
YOUGOSLAVIA	5.622
ARGENTINA	5.300
AFGHANISTAN	2.640
MEXICO	2.451
BRAZIL	2.066
EGYPT	1.872
SOUTH AFRICA	1.815
MOROCCO	1.288
TOTAL	331.075

= 85,6 % of total production, (386,596)

including :

DEV.PED ME = 261,153
DEV.PING ME= 125,443

SOCIETE DU PETROLE VERT
24, rue Royale
75008 PARIS

SUMMARY OF WORLD MAIZE

PRODUCTION AND EXPORTS 1977

TABLE 4

(FAO Statistics MAY 19 .)

COUNTRIES	AREA 1000 HA	YIELD KG/HA	PRODUCTION 1000 MT	EXPORTS 1000 MT	LOCAL COMSUMPTION	% EXPORTS PRODUCTION
WORLD	118.453	2952	349.676	57.122	292.554	16,3
AFRICA	20.134	1300	26.172	1.959	24.213	7,5
N.C. AMERICA	38.374	4612	176.984	40.581	136.403	22,9
SOUTH AMERICA	16.796	1849	31.051	6.897	24.154	22,2
ASIA	27.850	1957	54.497	2.162	52.335	3,9
EUROPE	11.845	4185	49.572	5.267	44.305	10,6
OCEANIA	91	4465	406	79	327	19,4
U.S.S.R.	3.362	3270	10.993	177	10.816	1,6
of which						
DEVELOPING COUNTRIES						
	56.315	1375	77.412	8.763	68.649	11,3
AFRICA	13.570	996	13.511	59	13.452	0,4
LAT.AMERICA	26.111	1618	42.247	6.899	35.348	16,3
NEAR EAST	2.134	2465	5.260	37	5.223	0,7
FAR EAST	14.495	1131	16.388	1.767	14.621	10,8
OTHERS	4	1473	6	0	6	-

THE FIRST TWENTY PRODUCING COUNTRIES

N°	COUNTRIES	PRODUCTION 1000 MT
1	USA	161.485
2	CHINA	33.615
3	BRAZIL	19.122
4	USSR	10.993
5	ROMANIA	10.103
6	YOUGOSLAVIA	9.856
7	SOUTH AFRICA	9.714
8	MEXICO	8.991
9	FRANCE	8.614
10	ARGENTINA	8.300
11	INDIA	6.800
12	ITALY	6.456
13	HUNGARY	6.150
14	CANADA	4.303
15	PHILIPPINES	3.037
16	INDONESIA	3.030
17	EGYPT	2.900
18	BULGARIA	2.555
19	SPAIN	1.885
20	KOREA	1.820
	Total	319.729

or, 91,4% de la productio totale
including (all developed countries = 236
(all developing countries= 11318

February 1979

SOCIETE DU PETROLE VERT
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SUMMARY OF WORLD : BARLEY-RYE-OATS-MILLET-SORGHUM-ETC...

TABLE 5

TOTAL PRODUCTION AND EXPORTS 1977

(FAO Statistics MAY 78

COUNTRIES	TOTAL PRODUCTION 1000 MT	TOTAL EXPORTS 1000 MT	LOCAL CONSUMPTION	% EXPORTS/ PRODUCTION
WORLD	356.235	27.195	329.040	7,6
AFRICA	22.040	186	21.854	0,8
N.C. AMERICA	62.106	11.176	50.930	18,0
SOUTH AMERICA	10.517	4.846	5.671	46,0
ASIA	74.995	396	74.599	0,5
EUROPE	97.517	5.674	91.843	5,8
OCEANIA	4.908	3.388	1.520	69,0
U.S.S.R.	84.153	1.529	82.624	1,8
of which DEVELOPING COUNTRIES				
	73.756	5.358	68.398	7,3
AFRICA	18.622	49	18.573	0,2
LAT. AMERICA	15.986	4.648	11.338	29,0
NEAR EAST	13.174	483	12.691	3,6
FAR EAST	25.970	178	25.792	0,7
OTHERS	4	0	4	0

SOCIETE DU PETROLE VERT
24, rue Royale
75008 PARIS

SUMMARY OF WORLD RICE PRODUCTION and EXPORTS 1977

TABLE 6
(FAO Statistics MAY 1978)

COUNTRIES	AREA 1000 HA	YIELD KG/HA	PADDY PRODUCTION 1000MT	HUSKED RICE PRODUCTION 1000 MT	HUSKED RICE EXPORTS 1000 MT	HUSKED RICE LOCAL CONSUMPTION 1000 MT	HUSKED RICE LOCAL CONSUMPTION %	% EXPORTS/ PRODUCTION
WORLD	142.842	2566	366.505	238.228	10.819	227.409	95,5	4,5
AFRICA	4.350	1804	7.847	5.100	256	4.844	95,0	5,0
N.C. AMERICA	1.662	3775	6.272	4.077	2.369	1.708	41,9	58,1
SOUTH AMERICA	6.590	1973	13.000	8.450	939	7.511	88,9	11,1
ASIA	129.191	2594	335.095	217.812	6.247	211.565	97,1	2,9
EUROPE	400	3845	1.536	998	738	260	26,0	74,0
OCEANIA	104	5351	555	361	260	101	28,0	72,0
U.S.S.R	546	4029	2.200	1.430	9	1.421	99,4	0,6
of which DEVELOPING COUNTRIES								
	93.377	2052	191.604	124.543	6.085	118.458	95,1	4,9
AFRICA	3.905	1425	5.567	3.618	32	3.586	99,1	0,9
LAT.AMERICA	7.341	2012	14.771	9.601	1.021	8.580	89,4	10,6
NEAR EAST	1.234	3927	4.848	3.151	249	2.902	92,1	7,9
FAR EAST	80.885	2057	166.394	108.156	4.783	103.373	95,6	4,4
OTHERS	12	2129	25	16	-	16	100,0	0

../...

THE FIRST TWENTY PRODUCING COUNTRIES

(TABLE 6-Page 2)

N°	COUNTRIES	PRODUCTION
1	CHINA	85.457
2	INDIA	48.100
3	INDONESIA	15.103
4	BANGLADESH	12.545
5	JAPAN	11.050
6	THAILAND	8.834
7	VIETNAM	7.313
8	BURMA	6.150
9	BRAZIL	5.812
10	KOREA REP.	5.421
11	PHILIPPINES	4.648
12	KOREA D.P.R.	2.997
13	U.S.A.	2.925
14	PAKISTAN	2.831
15	NEPAL	1.485
16	EGYPT	1.476
17	MADAGASCAR	1.430
18	U.S.S.R	1.430
19	KAMPUCHEA	1.170
20	MALAISIE	1.119
		227.295

or, 95,4% of the total production
including (all developed countries = 16.751
(all developing countries = 221.477

February 1978

SOCIETE DU PETROLE VERT
24, rue Roayle
75008 PARIS

SUMMARY OF WORLD POTATOES
PRODUCTION and EXPORTS 1977

TABLE 7
(FAO Statistics MAY 1978)

COUNTRIES	AREA 1000 HA	YIELD KG/HA	PRODUCTION 1000 MT	EXPORTS 1000 MT	LOCAL CONSUMPTION	% EXPORTS/ PRODUCTION
WORLD	20.945	13.986	292.938	4.509	288.429	98,5
AFRICA	560	7.810	4.377	296	4.081	6,7
N.C. AMERICA	740	26.203	19.394	524	18.870	2,7
SOUTH AMERICA	977	9.536	9.321	102	9.219	1,1
ASIA	5.448	11.183	60.922	438	60.484	0,7
EUROPE	6.109	18.747	114.535	3.083	111.452	2,7
OCEANIA	43	23.013	990	28	962	2,8
U.S.S.R.	7.067	11.801	83.400	38	83.362	-
of which DEVELOPING COUNTRIES						
	2.776	9.998	27.758	773	26.985	2,8
AFRICA	432	5.936	2.565	115	2.450	4,5
ALT. AMERICA	1.060	9.666	10.245	123	10.122	1,2
NEAR EAST	396	13.578	5.381	439	4.942	8,2
FAR EAST	888	10.775	9.563	96	9.467	1,0
OTHERS	1	8.276	5	0	5	0

THE FIRST TWENTY DEVELOPING COUNTRIES

N°	COUNTRIES	PRODUCTION 1000 MT
1	U.S.S.R	83.400
2	CHINA	41.646
3	POLOGNE	41.300
4	U.S.A.	15.972
5	R.F.A.	11.251
6	R.D.A.	9.976
7	FRANCE	8.190
8	INDE	7.287
9	U.K.	6.598
10	NETHERLANDS	5.752
11	SPAIN	5.553
12	CZECHOSLOVAK	3.783
13	ROMANIA	3.738
14	JAPAN	3.737
15	ITALY	3.310
16	TURKEY	2.900
17	YUGOSLAVIA	2.854
18	CANADA	2.498
19	BRAZIL	1.900
20	ARGENTINA	1.777
	Total...	263.422

or, 89,9% of the total product
= 292.938

including(all developed countri
= 222.084
all developing countri
= 70.854

February 1979

OCIETE DU P:TROLE VERT
:4, rue Royale
:5008 PARIS

SUM ARY OF WORLD ORANGES MANDARINES LEMONS, GRAPEFRUIT and CITTUSFRUIT...(AC UMES)

TABLE 8

(FAO Statistics MAY 19 8)

COUNTRIES	PRODUCTION 1000 MT	EXPORTS 1000 MT	CONSOMMATION LOCALE et FABRICATIONS DIVERSES 1000 MT	% EXPORT contre Production Totale
WORLD	50.329	7.149	43.180	14,2
AFRICA	4.513	1.204	3.309	26,7
N.C. AMERICA	16.711	1.076	15.635	6,4
SOUTH AMERICA	10.796	141	10.655	1,3
ASIA	11.015	2.093	8.922	19,0
EUROPE	6.619	2.623	3.996	39,6
OCEANIA	475	12	463	2,5
U.S.S.R.	200	0	200	0
of which DEVELOPING COUNTRIES	21.406	2.224	19.182	10,4
AFRICA	2.442	737	1.705	30,2
LAT. AMERICA	13.650	304	13.346	2,2
NEAR EAST	3.323	1.101	2.222	33,0
FAR EAST	1.972	81	1.891	4,1
OTHERS	19	0	19	-

THE FIRST TWENTY PRODUCING COUNTRIES

N°	COUNTRIES	PRODUCTION 1000 MT
1	U.S.A.	13.860
2	BRAZIL	7.617
3	JAPAN	4.041
4	ITALY	2.864
5	SPAIN	2.761
6	MEXICO	1.936
7	ARGENTINA	1.484
8	INDIA	1.474
9	ISRAEL	1.427
10	CHINA	1.260
11	EGYPT	1.171
12	TURKEY	925
13	GREECE	816
14	MOROCCO	765
15	SOUTH AMERICA	720
16	ALGERIA	523
17	AUSTRALIA	440
18	ECUADOR	375
19	PERU	328
20	VENEZUELA	258
	Total	45.045

or, 89,5 of the total production =(50.329)

including (All developed countries 27,57
including (All developing countries.. 22,7

February 1979

SOCIETE DU PETROLE VERT
24, rue Royale
75008 PARIS

SUMMARY OF WORLD GREEN BANANAS and PLANTAINS

PRODUCTION and EXPORTS 1977

TABLE 9

(FAO Statistics MA)

COUNTRIES	PRODUCTION 1000 MT	EXPORTS 1000MT	LOCAL CONSUMPTION	% EXPORTS PRODUCTION
WORLD	56.489	6.825	49.664	12,1
AFRICA	17.392	309	17.083	1,8
N.C. AMERICA	8.163	3.503	4.660	43,0
SOUTH AMERICA	15.927	1.923	14.004	12,1
ASIA	13.584	1.053	12.531	7,8
EUROPE	399	32	367	8,0
OCEANIA	1.024	5	1.019	0,5
of which DEVELOPING COUNTRIES				
	54.809	6.425	48.384	11,7
AFRICA	17.092	309	16.783	1,8
LAT.AMERICA	24.087	5.226	18.861	21,7
NEAR EAST	306	5	301	1,6
FAR EAST	12.392	879	11.513	7,1
OTHERS	932	6	926	0,6

THE FIRST TWENTY PRODUCING COUNTRIES

N°	COUNTRIES	PRODUCTION 1000 MT
1	BRAZIL	6.188
2	INDIA	3.903
3	UGANDA	3.450
4	ECUADOR	3.280
5	COLOMBIA	3.277
6	INDONESIE	3.152
7	NIGERIA	2.000
8	RWANDA	1.902
9	ZAIRE	1.803
10	TANZANIA	1.580
11	THAILAND	1.546
12	PHILIPPINES	1.480
13	VENEZUELA	1.440
14	HONDURAS	1.425
15	COSTA-RICA	1.294
16	MEXICO	1.210
17	CAMEROON	1.125
18	PANAMA	1.100
19	BURUNDI	932
20	SRI LANKA	871
Total		42.958

or, 76% of the total production = 56.489
including (developed countries 650
(developing " " 55.83

February 1979

SOCIETE DU PETROLE V :RT
24, rue Royale
75008 PARIS

SUMMARY OF WORLD DATES
PRODUCTION an EXPORTS 1977

TABLE 10

(FAO Statistics MAY 1978

COUNTRIES	PRODUCTION 1000 MT	EXPORTS 1000MT	LOCAL CONSUMPTION 1000 MT	% EXPORTS/ PRODUCTION
WORLD	2249	358	1.891	16
AFRICA	905	16	889	1,8
N.C. AMERICA	25	5	20	20
ASIA	1302	327	975	25,1
EUROPE	17	9	8	53
of which DEVELOPING COUNTRIES				
	2205	342	1.863	15,5
AFRICA	312	15	297	4,8
LAT. AMERICA	3	-	3	0
NEAR EAST	1711	327	1.384	19
FAR EAST	180	-	180	0

PRINCIPAL PRODUCING COUNTRIES	
COUNTRIES	1000 MT
EGYPT	417
IRAQ	375
IRAN	300
SAUDI ARABIA	265
PAKISTAN	180
ALGERIA	140
SUDAN	106
MADAGASCAR	70
YEMEN	70
OMAN	50
U.S.A.	23
SPAIN	16
Total	2012

or, 89,5% of the total production

February 1979

SOCIETE DU PETROLE VERT
24, rue Royale
75008 PARIS

SUMMARY OF WORLD CASSAVA (MANIOC)

PRODUCTION 1977

TABLE 11

(FAO Statistics MAY 1978)

COUNTRIES	AREA 1000 HA	YIELD KG/HA	PRODUCTION 1000 MT
WORLD	12,575	8,761	110,167
AFRICA	6,731	6,576	44,263
N.C. AMERICA	115	6,437	739
SOUTH AMERICA	2,759	11,605	32,022
ASIA	2,951	11,160	32,932
OCEANIA	19	11,066	212
DEVELOPING COUNTRIES			
	12,374	8,755	108,335
AFRICA	6,688	6,599	44,132
LAT. AMERICA	2,874	11,399	32,760
NEAR EAST	43	3,047	131
FAR EAST	2,749	11,311	31,099
OTHERS	19	11,066	212

The First Twenty Producing Countries 1000 MT

Nº		
1	BRAZIL	26,511
2	ZAIRE	12,300
3	INDONESIA	12,169
4	THAILAND (1)	10,644
5	NIGERIA	10,600
6	INDIA	6,480
7	TANZANIA	4,000
8	GHANA	2,500
9	MOZAMBIQUE	2,450
10	COLOMBIA	2,113
11	PARAGUAY	1,700
12	ANGOLA	1,650
13	VIETNAM	1,500
14	MADAGASCAR	1,300
15	UGANDA	1,100
16	BURUNDI	902
17	CENTRAL AFRICA	900
18	CAMEROON	810
19	CONGO	769
20	SRI LANKA	750
	Total	101,148

or, 91.8 % of the total production = 110,167 (all developing countries)

REMARKS

There is no statistics concerning the Cassava exportations of Thailand, which is on the 4th rank as far as production is concerned, is one of the very few countries in the world to export cassava; practically everywhere else this product is consumed by the locals.

Out of a production of 10,644 thousands tons in 1977, Thailand exported 3,700 thousands of tons, 90% of which was sold to Northern Europe, more particularly to West Germany and Netherlands (industrial pigs breeding). Estimations for 1978 are 15,000 thousands tons for production and 6,500 for exportation, which would place Thailand on the 2nd rank of the cassava producing countries.

Brazil, with 26,511 thousand tons produced in 1977, exported only 1,000 tons, the total production being consumed locally, 60% of which used for cattle feeding.
Let us recall that Colombia (10th producing country with 2,113 thousands tons) exported 80% to the United States and 15% to Netherlands and Great Britain.

1) Including 3,700 exported

FEBRUARY 1979

)CIETE DU PETROLE VERT
., rue Royale
3008 PARIS

SUMMARY OF WORLD SUGAR CANE PRODUCTION 197?

TABLE 12 A
(FAO Statistics MAY 1978)

)UNTRIES	AREA 1000 HA	YIELD KG/HA	PRODUCTION 1000 MT
)RLD	13.206	55.845	737.483
RICA	932	64.393	60.027
C. AMERICA	2.825	56.025	158.277
UTH AMERICA	3.254	57.501	187.091
SIA	5.840	52.315	305.504
UROPE	5	62.571	331
EANIA	350	75.005	26.254
which			
VELOPING COUNTRIES	11.583	53.464	619.265
RICA	564	54.266	30.617
T. AMERICA	5.772	55.488	320.279
AR EAST	134	80.265	10.751
R EAST	5.058	50.390	254.857
HERS	55	50.175	2.761

THE FIRST TWENTY PRODUCING COUNTRIES

N°	COUNTRIES	AREA	PRODUCTION 1000 MT
1	INDE	2.872	154.023
2	BRESIL	2.217	120.095
3	CUBA	1.300	57.000
4	CHINA	664	46.240
5	MEXIQUE	480	31.500
6	PAKISTAN	788	29.381
7	U.S.A.	307	25.089
8	AUSTRALIE	295	23.493
9	PHILIPPINES	533	23.212
10	COLOMBIE	270	20.500
11	SOUTH AFRICA	250	19.770
12	ARGENTINA	346	16.000
13	INDONESIA	180	15.076
14	REP.DOMI=	160	11.048
15	PEROU	57	8.900
16	EGYPT	100	8.000
17	MAURITIUS	100	6.900
18	GUATEMALA	85	6.800
19	EQUATEUR	58	6.600
20	BANGLADESH	145	6.504
	TOTAL ...	11.207	636.131

or, 86,25% of the total production = 737.48

including (developing ME = 70.483
developed ME = 667.000

February 1979

SOCIETE DU PETROLE VERT
24, rue Royale
75008 PARIS

SUMMARY OF WOLRD SUGAR BEETS

Production 1977

TABLE 12 B
FAO Statistics MAY 1978

COUNTRIES	AREA 1000 HA	YIELD KG/HA	PRODUCTION 1000 MT
WORLD	9023	32155	290.119
AFRICA	56	30005	1.677
N.C. AMERICA	523	45719	23.892
SOUTH AMERICA	71	40088	2.839
ASIA	811	30570	24.785
EUROPE	3801	37782	143.626
U.S.S.R.	3761	24807	93.300
of which DEVELOPING COUNTRIES	610	30333	18.518
AFRICA	56	30005	1.677
LAT. AMERICA	75	39281	2.939
NEAR EAST	470	28738	13.525
FAR EAST	9	39803	377

THE FIRST TWENTY PRODUCING COUNTRIES

N°	COUNTRIES	PRODUCTION 1000 MT
1	U.S.S.R	93.300
2	FRANCE	24.500
3	U.S.A.	22.784
4	R.F.A.	20.294
5	POLAND	15.933
6	ITALY	11.000
7	SPAIN	8.285
8	CZECHOSLOVAK	8.270
9	CHINA	8.240
10	TURKEY	8.200
11	U.K.	7.525
12	ROMANIA	6.249
13	NETHERLANDS	6.017
14	YUGOSLAVIA	5.286
15	R.D.A.	5.264
16	IRAN	4.800
17	BELGIUM/LUX	4.500
18	HUNGARY	3.888
19	DENMARK	3.521
20	GREECE	2.900
	Total	270.756

or, 93 % of the total production = 290.119

including (developed countries 263.361
(developing countries 26.758

February 1979

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SUMMARY OF WORLD (1977)

TABLE 12 C

	SUGAR CANE production 1000 MT	SUGAR BEETS production 1000 MT	TOTAL 1000 MT	SUGAR (centrifugal raw) total Production 1000 MT	SUGAR (centrifugal raw) total Export 1000 MT	% EXPORTS PRODUCTION
WORLD	737.483	290.119	1.027.602	92.109	21.672	23,5
AFRICA	60.027	1.677	61.704	6.108	2.407	39,4
N.C.AMERICA	158.277	23.892	182.169	18.807	8.118	43,2
SOUTH AMERICA	187.091	2.839	189.930	14.198	3.424	24,1
ASIA	305.504	24.785	330.289	20.025	4.643	23,2
EUROPE	331	143.626	143.957	20.188	226	1,1
OCEANIA	26.254	0	26.254	3.718	2.853	76,7
U.S.S.R.	0	93.300	93.300	9.065	0	0
of which DEVELOPING COUNTRIES	619.265	18.518	637.783	46.297	17.217	37,2
AFRICA	30.617	1.677	32.294	3.168	1.237	39,0
LAT.AMERICA	320.279	2.939	323.218	27.437	11.542	42,1
NEAR EAST	10.731	13.525	24.276	2.794	0	-
FAR EAST	254.857	377	255.234	12.522	4.116	32,9
OTHERS	2.761	0	2.761	376	322	85,6

.../...

LOCAL CONSUMPTION 1000 MT	%
70.437	76,5
3.701	60,6
10.689	56,8
10.774	75,9
15.382	76,8
19.962	98,9
865	23,3
9.065	100 %
29.080	62,8
1.931	61%
15.895	57,9
2.794	100%
8.406	67,1
54	14,4

SUGAR CENTRIFUGAL RAW

THE FIRST TWENTY PRODUCING COUNTRIES

N°	COUNTRIES	PRODUCTION 1000 MT
1	U.S.S.R.	9.065
2	BRAZIL	8.900
3	CUBA	6.485
4	U.S.A.	5.429
5	INDIA	5.239
6	CHINA	4.821
7	FRANCE	4.248
8	AUSTRALIA	3.342
9	R.F.A	2.940
10	MEXICO	2.727
11	PHILIPPINES	2.685
12	THAILAND	2.294
13	SOUTH AFRICA	2.140
14	POLAND	1.900
15	ARGENTINA	1.667
16	DOMINICAN R.P.	1.361
17	ITALY	1.230
18	SPAIN	1.201
19	INDONESIA	1.200
20	TURKEY	1.140
	Total	70.016

or, 76% of the total production

including (all developed countries = 40.955
all developing countries = 51.154

+

SUGAR NONCENTRIFUGAL
(USED FOR LOCAL CONSUMPTION)

PRINCIPAL PRODUCING COUNTRIES

COUNTRIES	PRODUCTION 1000 MT
INDIA	8.500
PAKISTAN	1.450
CHINA	867
THAILAND	700
COLUMBIA	859
BENGLADESH	370
INDONESIA	250
BRAZIL	200
BURMA	135
OTHERS	502
	13.833

TABLE 12C
Page(2)

TABLE 12.D

EVOLUTION OF THE WORLD SUGAR PRODUCTION

(Thousands of tons of raw sugar per campaign) (1)

CAMPAIGN (1)	WORLD PRODUCTION	BEETS SUGAR	CANE SUGAR	% BEETS	% CANE
1900-01	9,653	6,090	3,563	63.1	36.9
1910-11	16,824	8,668	8,156	51.5	48.5
1920-21	16,831	4,906	11,925	29.2	70.8
1930-31	27,863	11,921	15,942	42.8	57.2
1940-41	29,902	11,684	18,218	39.1	60.9
1950-51	33,576	14,102	19,474	42.0	58.0
1955-56	39,882	16,097	23,785	40.4	59.6
1960-61	55,442	24,266	31,176	43.8	56.2
1967-68	65,624	29,124	36,500	44.4	55.6
1968-69	68,609	30,451	38,158	44.4	55.6
1969-70	73,787	30,157	43,630	40.9	59.1
1970-71	73,026	30,181	42,845	41.3	58.7
1971-72 (2)	72,737	31,200	41,537	42.9	57.1
1972-73	76,724	31,035	45,691	40.4	59.6
1973-74	80,491	32,342	48,149	40.2	59.8
1974-75	79,051	29,061	49,990	36.8	63.2
1975-76	81,631	32,320	49,311	39.6	60.4
1976-77	87,537	33,356	54,181	38.1	61.9
1977-78	93,551	36,109	57,442	38.6	61.4

(1) This table gathers the figures of the national campaigns which dates differ according to the countries, by opposition to the Table of Balances issued at a fixed date.

(2) From this date, the conversion rate of raw sugar into white sugar, initially at 0.90, has increased to 0.92

The first six world producers supply half of the world sugar production : 49.8. million tons (Mt) in 1977-78

C.E.E.	: 12.5 Mt	CUBA	: 7.4 Mt
BRAZIL	: 8.8 Mt	INDIA	: 7.0 Mt
U.S.S.R	: 8.8 Mt	U.S.A (*)	: 5.6 Mt

(*)Hawaï and Porto-Rico included.

TABLE 13

EQUIVALENCE

- 1 ton of sugar cane = 153 kilos of cane invert at 75% sugar.
- Price sugar cane ton = US $ 12.
- One ton cane invert will cost about US $ 115.
- 6.5 tons of cane required to produce one ton of cane invert.

CANE INVERT

. 2.5 tons of cane invert are required to produce one Kl of absolute alcohol,

compared to 3.7 tons of molasses,

but it is costly to produce it.

SUGAR DISTILLATION

. 1.7 ton of raw sugar is required to produce 1 Kl of absolute alcohol compared to 3.7 tons molasses and 2.5 tons invert molasses.

The conversion of sugar into alcohol is more costly than distillation of molasses or cane invert.

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TABLE 14

PRINCIPAL AGRICULTURAL PRODUCTS ABLE TO DISTILLATION

(FAO Statistics MAY 1978)

PRODUCTS	WORLD		
	PRODUCTION 1977 (1000 MT)	EXPORTS 1977 (1000 MT)	
WHEAT	386,596	73,618 (*)	
MAIZE	349,676	57,122	
BARLEY-RYE-OATS-MILLET-SORGHUM	356,235	27,195	
RICE, PADDY	366,505	-	
HUSKED RICE	-	10,819	
SUGAR CANE	737,483	) 21,672	Sugar, Centrifu--gal RAW
SUGAR BEETS	290,119		
POTATOES	292,938	4,509	
APPLES	21,348	3,000	
AGRUMES	50,329	7,149	
GREEN BANANAS AND PLANTAINS	56,489	6,825	
DATES	2,249	358	
CASSAVA (Manioc)	110,167		See special Note annexed to Table "CASSAVA"
FIRE WOOD	1,178 Million cubic meters		

(*) Wheat + Flour (Wheat equiv.)

February, 1979

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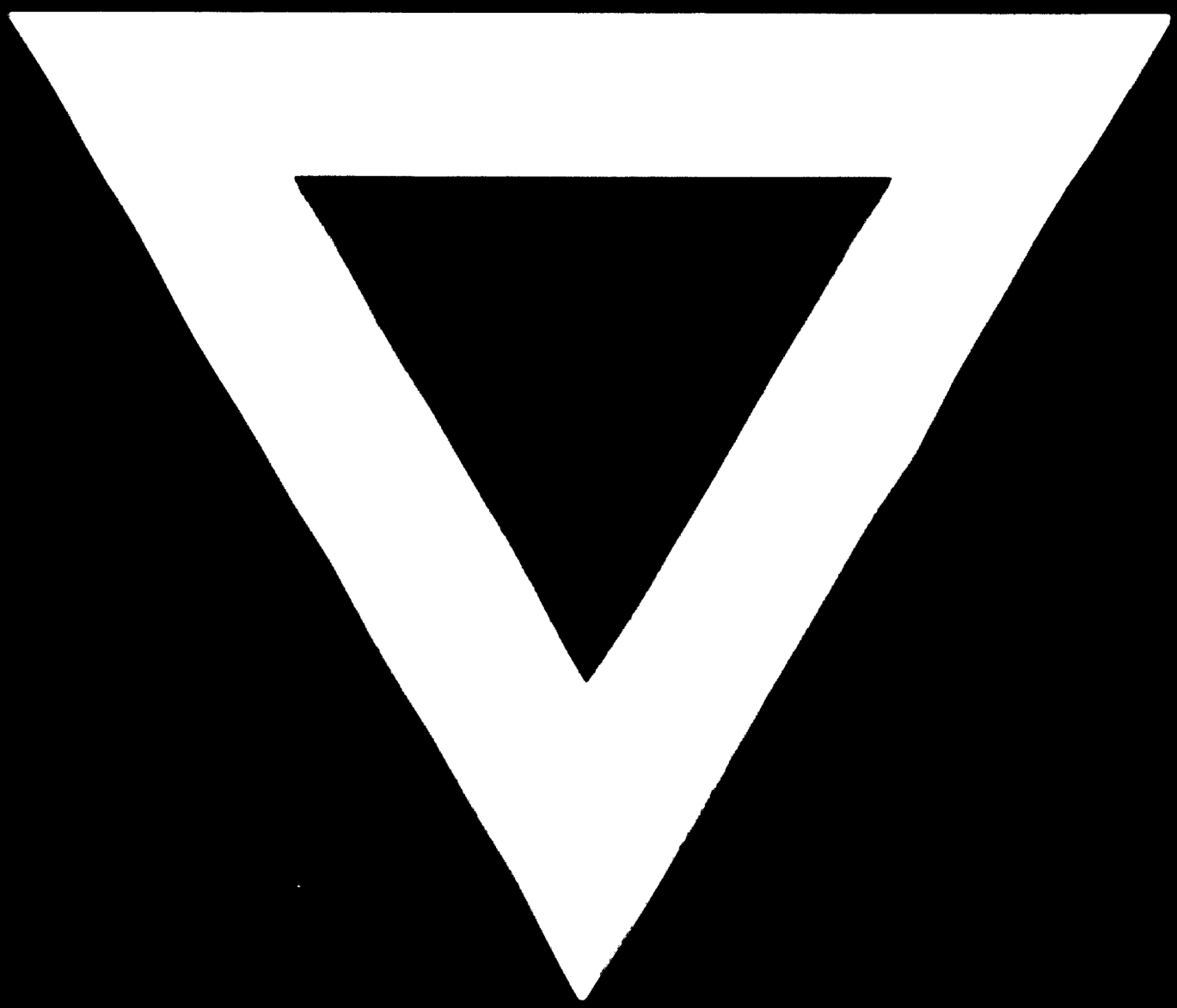

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