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Acknowledgement

The Ethiopian delegates' mission to Brazil for ethanol gasoline blended fuel project was very successful. We would like to thank His Excellency Ambassador Renato Xavier for the tremendous support given and for the trouble free arrangement made. About 90% of the intended visit was successfully attended. Thanks to Natnael and Rafael who coordinated the program. The visit to Afro-Brazilian Chamber of Commerce was last minutes request to fill the time prolonged due to program change. Great attention was given by Rafael and managed to meet Honorable Adalberto Camarago, Ex Congressman and Federal Legislator, and House of representatives. Hon. A. Camarago is the founder and the President of the Chamber. He was elected four times and decorated five times at different ranking positions. It was an opportunity to meet him and Mr. Domingos, Secretary of the Chamber. Mr. Camarago; we would like to thank you for the tremendous support and assistance given for the team. The facilities provided to ease our trip to DEDINI was exceptional. We promise to do our best to link Ethiopia with Afro-Brazilian Chamber for our common advantage.

We would like to thank Mr. Alfred Szwarc of UNICA for the wonderful explanation given about ethanol fuel and technical recommendations forwarded to the team. Henery Joseph Jr. presentation had been remarkable. The team had acquired considerable knowledge and equipped with useful handout for further reference. We want to take a moment to tell you how pleased we were visiting Petrobras. Your recommendation and guidance had been stimulant to increase our wish to see the corporate even though it was prearranged. You are right Petrobrass is a model company one has to see.

Alessandro, please accept our grateful thanks for the key role you played in making us look good. Your support behind the scenes did not go unnoticed and we want to thank you for your personal support. Not only did you deliver the

planned presentation and factory visit of Wayne Dresser, you went the extra mile and served our mission as though you were one of our staff. For that we are most grateful and wanted you to know how much we appreciated.

We would like to thank Mrs. Maria Antonia and Mr. Vangar Fracass of National Petroleum Agency for detailed presentation. The delegates, in particular from Ethiopian Petroleum Enterprise are highly satisfied sharing experience of the agency as they are running similar work in line to petroleum.

The delegates' visit program completed on Monday March 27, and meeting between the six delegates composed of Ethiopian Petroleum Enterprise, Finchaa Sugar Factory and Y.B Petroleum S.C was conducted to check and evaluate the outcome of the mission. All participants believed the visit to be a great story and success. All participants forwarded their grateful thanks to Petrobras who made the mission complete. Dear Mr. Jao Carlos, What would we say except giving our heart felt thanks for everything you did to make our assigned duties such a pleasure. Our next move will be much easier thanks to you and your staff. We had a great show at the research center and logistic terminal. Your staff, in particular Tatiana should be commended for providing great service and attention to all our last minute requests.

1. Introduction

1.1 Composition of the Ethiopian Delegates

The Ethiopian delegates mission drawn from Yetebaberut B. Petroleum S.C., Finchaa Sugar Factory and Ethiopian Petroleum Enterprise made an industry visit to Brazil. The composition of the delegates is presented as follows:

- Ato Tesfaye Mekonnen Yetebaberut B. Petroleum S.C
- Ato Getahun Mengistu Yetebaberut B. petroleum S.C
- Ato Tegenie G/Hawariat..... Finchaa Sugar Factory
- Ato Negera Beshana Finchaa Sugar Factory
- Ato Worku Gosaye..... Ethiopian Petroleum Enterprise
- Ato Dinku Abawa Ethiopian Petroleum Enterprise



Fig. 1 Photo, Ethiopian Delegates Mission at Petrobras Biodiesel Research Center in Rio De Janeiro City, Brazil.
From left to right: Ato Worku Gosaye, Ato Negera Beshana, Ato Tegenie G/Hawariat, Ato Tesfaye Mekonnen, Ato Dinku Abawa, Ato Getahun Mengistu.

1.2 Objectives of the Visit

The principal objectives of the visit program were:

- To provide the delegates with an opportunity to visit some operating plants which would help acquire knowledge, transfer of know-how and to assess and explore opportunities in Brazil.
- To study in detail and draw the benefits of the vast experience of Brazil in use of ethanol gasoline blends as automobile fuels.

- To look for all possible cooperation from Brazil.

1.3 Country Background of Brazil

Brazil is a Federative Republic of representative democracy, with 26 states, 5,561 municipalities and one Federal District, where its capital Brasilia is located. Covering an area of 8,514,215.3 km², it is Latin America's largest and the world's fifth largest country.

With a continent-size, Brazil has contrasts. The Southeast region, where the rich, modern state of Sao Paulo is located, has a population density of 76.31 people per square kilometer. The capital of this state is the largest city in Latin America and one of the ten largest in the world.

The North region, which includes the largest portion of the Amazon Rain Forest, the world's largest biodiversity reserve, has 3.35 inhabitants per km². Brazil has around 13 percent of the planet's fresh water reserves, and nearly 45 percent of the Brazilians live in areas that are strongly influenced by rural activity.

The population, which amounts to 170.655 million –and grow rates by 1.6 percent per year–, communicates perfectly in Portuguese, which allows an efficient dissemination of messages by newspapers, the Internet, telephone, radio and television. The country has 32 million urban homes and 5 million rural ones with television.

Not only is Brazil the world's leading sugar and ethanol producer and exporter, but also stands out in the agricultural and industrial areas worldwide.

The Brazilian light vehicle fleet of around 18 million units consumes 27.5 billion liters of fuel per year: 16 billion liter per year of 'A' gasoline and 11.5 billion liters per year of hydrated or anhydrous ethanol. The 'A' type, a pure gasoline, is the refining standard. In the retail fuel market, all of the gasoline has a 25 percent addition of hydrous ethanol. For each liter of pure gasoline, 0.72 liters of fuel ethanol is consumed in Brazil.

The Brazilian currency is Real and the exchange rate is R\$ 2.13 per USD.

2. Mission Activities in Brazil

2.1 Visit to Association of the Sugarcane Agroindustry (UNICA) (March 15, 2006)



Fig. 2 Photo taken during the meeting.

The first meeting was held between the representatives of the Association of the Sugarcane Agroindustry (UNICA) of Sao Paulo State and the Ethiopian team. The representative of UNICA, Mr. Alfred Szwarc, assistant to the president, briefly explained about UNICA. Mr. Alfred stated that UNICA is a private organization which is Brazil's sugar and ethanol industry's leading institutional representation entity.

He also pointed out that the institution has a Council composed of industry representatives and a board of directors consisting of dedicated professionals and supported by a team of consultants specialized in environmental, technological, international trade, social responsibility, legal, union and communication issues.

Following the briefings of Mr. Alfred, Ato Tesfaye Mekonnen, principal coordinator of the team and General Manager of Y.B. Petroleum S.C, highly appreciated UNICA on behalf of the team. Ato Tesfaye briefly explained the objective and purpose of the mission to the representatives of UNICA. He also stated that Y.B. Petroleum S.C. is a local company engaged in energy industry in general and petroleum products in particular. On the other hand, Ato Tegene Gebrehawariat and Ato Worku Gosaye also explained about Finchaa Sugar Factory and Ethiopian Petroleum Enterprise respectively.

Having understanding on the objectives and purpose of the mission, Mr. Alfred delivered short presentation on Ethanol-gasoline blending in general and the vast experience of Brazil in particular. He underlined that the blending system is not a complicated process as it can be done easily provided that the necessary inputs are available and secured.

According to Mr. Alfred, the main requirements to undertake fuel blending are:

- Anhydrous (fuel grade) ethanol;
- High grade gasoline;
- Technical know-how on transportation, handling and storage procedures with special attention of avoiding water contamination.

Regarding the blending method, he recommended that we apply the '**in-line automatic blending mechanism**'.

Mr Alfred, from his experience suggested that

- It is better to start with E5 (5% ethanol and 95% gasoline) and
- Creating public awareness is also a very crucial activity that should be carried out in collaboration with the concerned stakeholders.

Technical questions raised by the team were also clearly answered.

2.2 Visit to National Association of Manufacturers of Automotive Vehicles, (March 15, 2006)

The Ethiopian team conducted its second meeting with the Brazilian vehicle manufactures association. The representatives of the association who were present during the discussion, viz.

- Henery Joseph President of Energy and Environment Commission,
- Paulo Sotero Executive Director, and
- Aurelio Santana Technical Director,

warmly welcomed and received the Ethiopian team at their pleasant office.



Fig. 3 Photo taken during the presentation.

Following the welcoming, Henery Joseph delivered his brief presentation to the team on the following points:

- Automotive industry of Brazil;
- The Brazilian automotive market;
- The ethanol fuel and its application;

- The technology to use ethanol fuel;
- Possible and necessary vehicle modifications when using ethanol-gasoline blended fuel;
- Main benefits of using ethanol as vehicle fuel;
- The Brazilian ethanol fuel program;
- Production of the Brazilian ethanol;
- The Brazilian Government support to proalcohol (official name of ethanol-gasoline blended fuel in Brazil); and
- Flex Fuel Vehicles (FFV) in Brazil.

Flex Fuel Vehicles are vehicles designed to be fueled with gasoline or ethanol or any blend of gasoline ad ethanol.

The President concluded his presentation by summarizing that ethanol as a vehicular fuel has significant benefits such as:

- Customer satisfaction (high performance of vehicle and low price);
- Saving oil consumption; and
- Being environmentally friendly product.

He also pointed out that the Flex Fuel Vehicles contribute to the introduction of renewable fuel into the market.

Finally, he suggested that for countries like Ethiopia it is good to start with 'pilot blending plant'.

Questions that were raised by the team were also briefly answered.

2.3 Visit to Afro- Brazilian Chamber of Commerce (March 16, 2006)

The Ethiopian team after arriving at Sao Paulo City has requested the External Relations of the Ministry of Foreign Affairs of the Brazilian Government to arrange a meeting with the Chamber of Commerce. Accordingly, the requested meeting has been arranged through the Office of the External Relations.

The Ethiopian team met Mr. Alberto Camargo, Ex-Federal Congressman and President of Afro-Brazilian Chamber of Commerce and his colleagues at Chamber's office located in Sao Paulo City. The President and his colleagues

welcomed the team and a brief introduction about the Chamber was presented by the President. The President pointed out that because of the short notice received from the Office of External Relations it was not possible to organize a very formal meeting to their expectations and level of standards.



Fig. 4 Photo taken during the meeting. From Left to right: Negera Beshana, Bruno Leone, Tegenie G/Hawariat, Alberto Camargo, Tesfaye Mekonnen, Abel da Silva Domingos, Worku Gosaye & Getahun Mengistu.

The President, continuing his lively discussion, has requested us to present our areas of interest and what we need from the Chamber.

Ato Tesfaye Mekonnen on behalf of the Ethiopian team highlighted Ethiopia 's long history, and huge investment potential and presented the objectives and purpose of the mission. Ato Tesfaye also underlined that this mission would like to serve as a bridge in order to create a network between the Chamber of Commerce of Ethiopia and that of Afro-Brazilian.

Last but not least, the team has requested the President to make the necessary arrangements for site seeing of selected companies through the Chamber, and the President said that it is his keen interest to support the team to the best he can.

2.4 Visit to DEDINI (March 20, 2006)



Fig. 5 Photo taken during the discussion.

The visit to DEDINI, located 160 km North of Sao Paulo city, was arranged and facilitated by Afro-Brazilian Chamber of Commerce.

The meeting was held between the Ethiopian team and two representatives of DEDINI. The objective and purpose of the mission in general and the interest to visit DEDINI in particular was explained to the representatives of the company.

Detailed presentation on the principal activities and mission of the company were delivered. During the presentation it was explained that the company's scope of activities comprise:

- Feasibility studies;
- Process design and engineering;
- Equipment design;
- Equipment fabrication;
- Electro-mechanical erection;
- Commissioning and start-up;
- After sales service;
- Plant optimization; and
- Supply of complete plants on turnkey contracts.

It was also stated that the company owns 11 engineering and manufacturing facilities conveniently located in four major centers of the country.

In general (as learnt during the presentation and discussion) the company's high reputation can be summarized as follows:

- It has its own technology for sugar mills and fuel ethanol plants under turnkey system.
- It has its own technology for alcohol distillery plants under turnkey system
- It has its own foundry and machinery workshop.
- It supplies steam boilers.

Following the presentation, Ato Tegenie G/Hawariat, representative of Finchaa Sugar Factory, stated that Finchaa's ethanol plant was supplied on turnkey system by DEDINI. He added that the plant has a high performance and efficiency.

The Ethiopian team observed that DEDINI has strong capability to undertake projects as it has more than 85 years of vast experience both in Brazil and overseas.

2.5 Visit to National Petroleum Agency (ANP) (March 21, 2006)



Fig. 6 Photo taken during the meeting

On the 21st March 2006, the Ethiopian team visited the National Petroleum Agency in Rio De Janeiro City. Mr. Vangar Fracass and Ms. Maria Antonia

representing the petroleum agency welcomed and received the team at their pleasant office.

Firstly, Ato Tesfaye Mekonnen, principal coordinator of the team, clearly stated the objectives and purpose of the mission and why the team wanted to visit ANP.

As the representatives of ANP were well prepared to deliver a presentation, Mr Vanger Fracass delivered a detailed presentation. During the presentation, the main points discussed were:

- ANP as a state company:
 - implements national policy on crude oil and its products, natural gas and bio fuels,
 - manages crude oil and natural gas reserves, etc;
- the Brazilian experience with ethanol fuel;
- Ethanol-gasoline blend rate worldwide:
 - USA (E-10 and E-85 for flex fuel);
 - Canada (E-10 and E-85 for flex fuel);
 - Sweden (E-5 and E-85 for flex fuel);
 - India (E-5)
 - Australia (E-10)
 - Thailand (E-10)
 - China (E-10)
 - Peru (E-10)
 - Japan (E-10)
 - Paraguay (E-7)
 - Brazil (E-20 and any blend rate for flex fuel)

Regarding Brazilian biodiesel program, it was stated that initially, they started with B2 (2% Biodiesel and 98% gas oil) and has a plan to increase to B5 (5% Biodiesel and 95% gas oil) after 2013.

2.6 Visit to Petrobrass (March 21, 2006)

The visit to Petrobras was the team's central point as it was suggested by all the companies visited so far. The Ethiopian team was highly impressed the moment it arrived to the very tall and beautiful building about 24 floors.

Mr. Jao Carlos, Executive Manager for International Area, and Ms. Tatiana Kolling Do Vale, Senior International Analyst, on behalf of Petrobras welcomed and received the team at a pleasant meeting hall.

Firstly, Ato Tesfaye Mekonnen, on behalf of the team clearly stated the objectives and purpose of the mission with emphasis on:

- Brazilian experience on Ethanol fuel;
- Petroleum and natural gas exploration and production potential in Ethiopia;
- Brazilian experience on biodiesel; and
- Lubricants distribution.



Fig. 7 Photo taken during the presentation.

Ato Tesfaye invited Petrobras to invest in the exploration and production activities of petroleum and natural gas in Ethiopia. He also handed over the exploration map of Ethiopia and rules and regulations of the Ministry of Mines and Energy of the Federal Democratic Republic of Ethiopia to the Executive Manager.

The Manager, on his side, highly appreciated the interest and the efforts made by the delegates. Regarding the exploration and production activities he remarked that his company's technical people will review the documents and further discussion shall be held then after.

Concerning ethanol fuel and biodiesel, even though they received the notice very late the executive manager promised that he would try his best to arrange a site seeing program soon.

Then, the Executive Manager delivered detailed presentation on the international activities of Petrobras. During the presentation, the following points were stated:

- Petrobras's operations outside the country are made through the International Business Area, and now include all oil and energy industry operational chain. The scope of activities comprises from oil and natural gas exploration and production, efficiency, gas processing, retail commercialization and transport through pipeline to petrochemicals production and electrical power generation, distribution and transmission.
- Both in Brazil and abroad, Petrobras's corporate mission, operational quality, and principles and values are accomplished. The company searches for profits and efficiency with business ethics, social and environmental responsibility, respect to cultural diversity and contribution to local and regional development.
- International Area Assets, operation and Business are now extended over 15 countries in three different continents. There are six business units operating as companies in Argentina, Angola, Bolivia, Columbia, United States, and Nigeria. Also, there are activities in other nine countries: Venezuela, Mexico, Ecuador, Peru, Uruguay, Tanzania, Iran, Libya and China.

Finally, Ato Tesfaye and Ato Tegenie, on behalf of the Ethiopian team, highly appreciated the representatives of Petrobras for the detailed presentation and for the site visits to be arranged.

2.7 Visit to Dresser Wayne (March 22, 2006)

Dresser Wayne company is located at the central part of Rio De Janeiro City. The meeting was held between Mr. Alecssandro, Customer Service Manager, and the Ethiopian team at his office. During the meeting Mr. Alecssandro shortly highlighted the main activities and mission of his company. It was stated that the company manufactures high performance and global quality pumps for oil companies and gas stations. We have also learnt that the company's products are highly recognized throughout the world and the company designs and manufactures special pumps applicable for the blended and alcohol products. As we saw many service stations in Brazil, all the pumps are supplied by Wayne Dresser.



Fig. 8 Photo taken during the discussion.

Following the introduction, the team visited the plant starting from the raw materials used to the final products. The operation of the plant is fully automated and the manufacturing process and the organizational structure of the company are of high standards.

2.8 Visit to Petrobras Biodiesel Research Center (March 23, 2006)

The representatives of the Biodiesel Research Center welcomed and received the team and detailed presentation was made. During the presentation the status of the biodiesel in Brazil and the challenges encountered to materialize biodiesel were clearly stated. Also, the benefits of biodiesel, production scheme, and economical feasibility were highlighted by the presenter.

Finally, the team visited the laboratory and pilot plant of the research center.



Fig. 9 Photo taken during the visit to Biodiesel pilot plant.

2.9 Visit to Petrotransport (March 23, 2006)

Petrotransport is part of Petrobras which is responsible for the blending of ethanol fuel with gasoline and the logistics: *storage, handling and transportation activities*. This visit was the most expected part of the visits as mentioned before.

The Plant Manager shortly highlighted the safety measures to be taken and security equipments in such environment.

After the explanation, the team visited the blending plant which is located in a compound of about 280,000 m² (See Fig. 10)

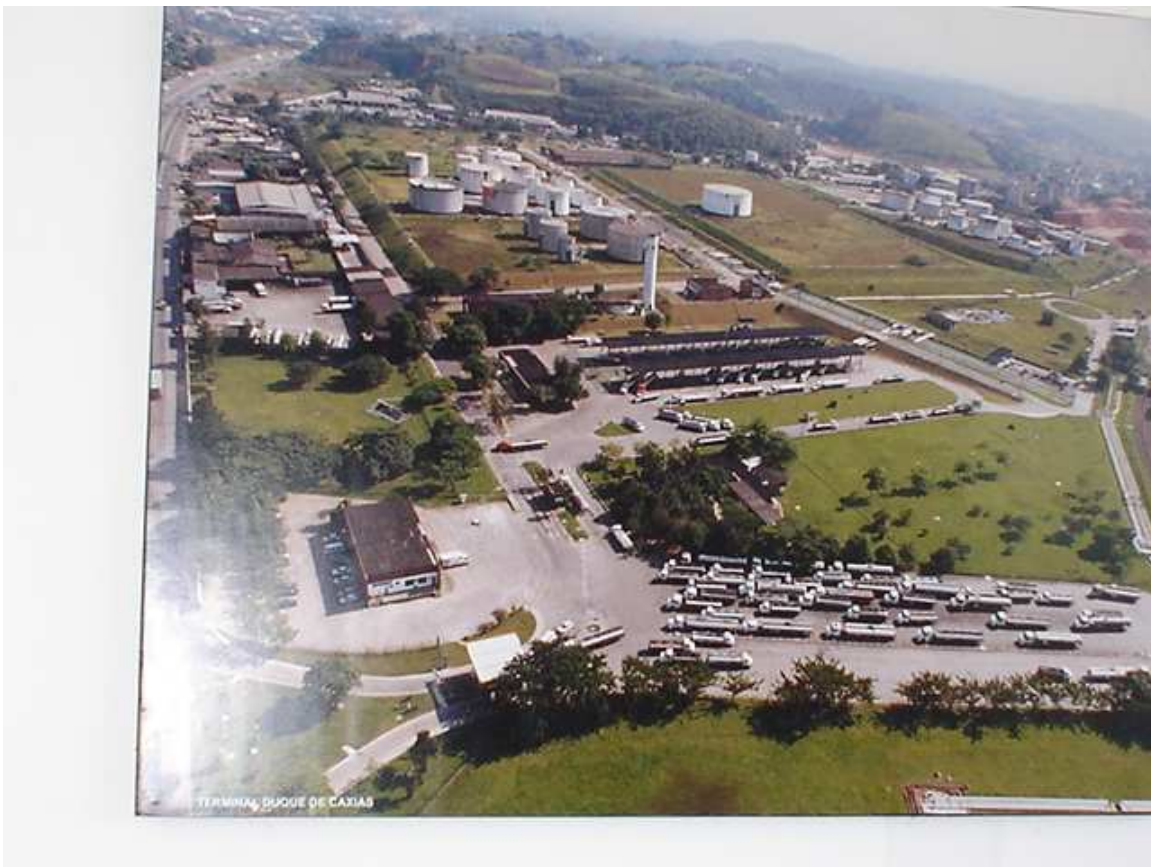


Fig. 10 Picture of Plant Layout of Petrotransport.

The blending method implemented there is the ' **in-line automatic blending** ', as schematically shown below:

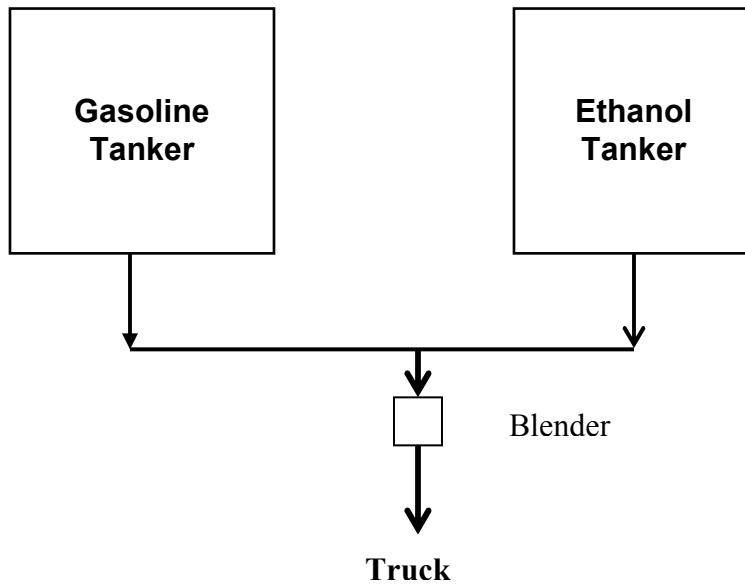


Fig. 11 Flow diagram of inline automatic blending mechanism.

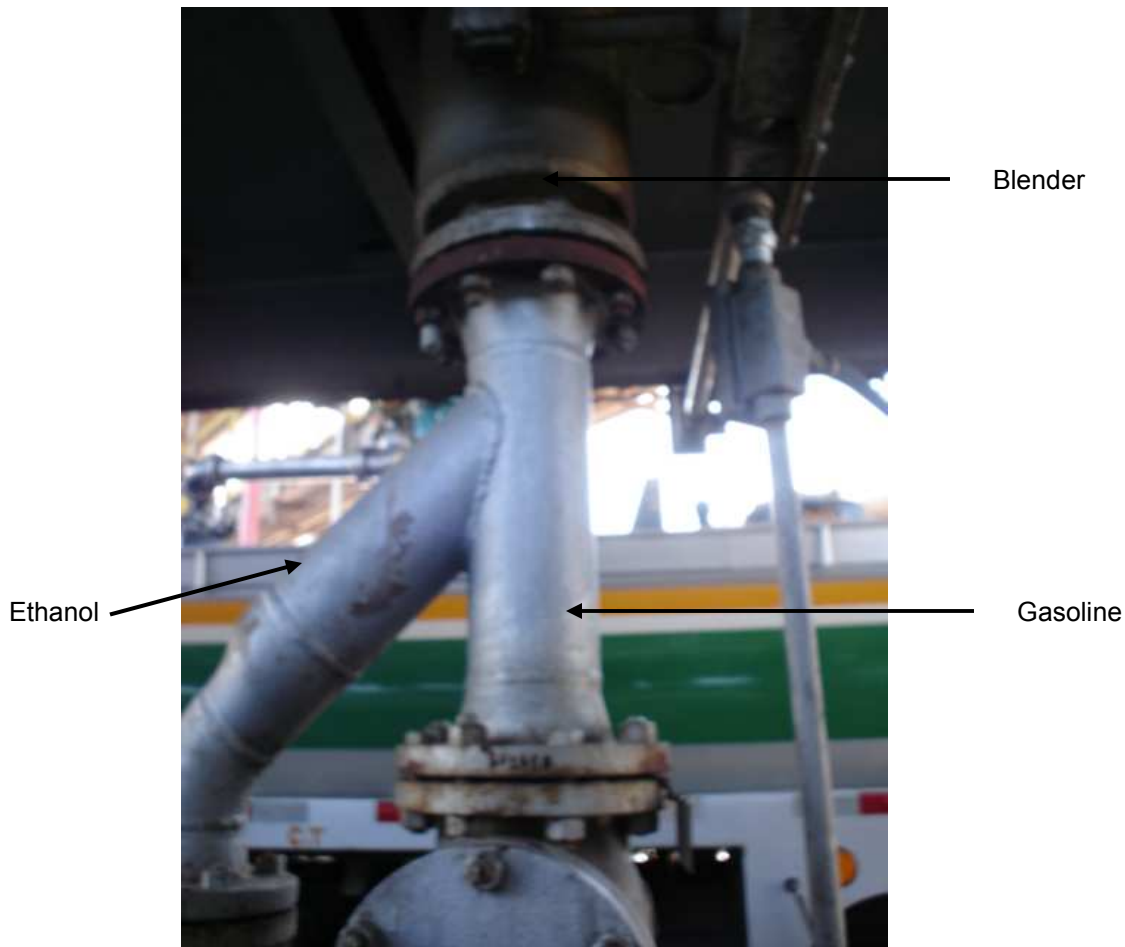


Fig. 12 Photo partially showing the in-line blending.

We observed that the blending mechanism is carried out as follows:

- Anhydrous alcohol (Ethanol) and gasoline are stored in separate tanks.
- The two pipelines from the storage tanks merge to one pipe prior to the blender (see Figs 11 & 12). The flow rates are automatically controlled.
- The mixing process is done by pressure only (pressure mixer).
- Finally, the blended fuel is dispensed on to trucks.

The truck driver after fulfilling all the necessary requirements gets permission to the station. He has his own password to access dispensing of the fuel (the product details including the quantity are computer controlled). Here, trucks are also scheduled with a computerization process to the right platform!



Fig. 13 Photo taken during trucks filling the blended fuel.

2.10 Visit to Model Service Stations (March 25, 2006)

The final visit was the visit to model service stations located in Rio De Janeiro City. During our visit we observed that:

- All stations sold gasoline blended with anhydrous ethanol (up to E25: 25% ethanol and 75 % gasoline).
- Three types of blended gasoline are sold: *Super gasoline, gasoline with additives and common gasoline. And they have different prices.*
- Pure alcohol (hydrated alcohol) as motor fuel is also sold.
- There is price variation at service stations (free market!).
- We have been informed that there is a quality control mechanism which gives a warning alarm during product adulteration.

The retail prices offered by one of the service stations during our visit are (R\$ per liter, 1 USD \cong 2.13 R\$):

➤ Super gasoline	2.947
➤ Gasoline with additives.....	2.789
➤ Common gasoline	2.645
➤ Pure alcohol	2.003

3. Outputs of the Visit

It is understood that a lot is expected from the visit program. During our stay in Brazil, we have tried our best to make use of the opportunities created in such resourceful, well developed and technologically advanced country.

We can say that the team successfully accomplished its mission. Accordingly the main outputs gained from the visit are summarized as follows:

- The team has thoroughly learnt the vest experience of Brail on
 - Ethanol as motor fuel;
 - The blending mechanism;
 - Procedures on storage, handling, and transportation of fuels; and
 - Health, safety and environment.
- More over, it has been learnt that implementation of ethanol-gasoline blended fuel is not a difficult task. The team is a living witnesses on how they easily and effectively undertake the blending mechanism. And this has created a big confidence and courage among the team in order to materialize the intended project in our country.
- During marketing of the blended fuel, it has been learnt that prior attention shall be given on public awareness creation. The government and all concerned stakeholders should play a significant role in this area as this has been the experience of Brazil.
- Though the biodiesel program is in its infant stage, it has been learnt about the requirements, production technology and challenges to be encountered during the implementation phase.
- Attempts are made to get the support of technical expertise from Brazil (under process).
- The visit has created the opportunity to introduce Ethiopia to many Brazilian companies. It is believed that the visit contributed a lot to lay the foundation in order to start a good business relationship between the two countries. This might also indicate that Ethiopia needs to have its Embassy in Brazil.

- The visit created clearer picture of Ethiopia's potential on petroleum and natural gas to Petrobras (one of the top oil companies in the world). Petrobras has interest to explore the petroleum potential as it currently is doing in other African countries like Tanzania, Libya, etc.
- It is believed that the mission has created the opportunity to establish a relation between the Addis Ababa Chamber of Commerce and Afro-Brazilian Chamber of commerce.
- Last but not least, the practical exposure of the team to many companies is an indispensable advantage.

4. Conclusions and Recommendations

- The mission has been an exemplary cooperation between the two countries since the opening of the Embassy of Brazil in Addis Ababa. We honestly believe that this mission has created the opportunity for other institutions and stakeholders in order to explore the experiences built up in Brazil which will pave the way to broaden the possibilities of cooperation with successive initiatives of common interest.
- Generally, the mission successfully accomplished its purpose: *transfer of know-how on the use of ethanol gasoline blended fuel as automotive fuel is a case in point.*
- The mission has created the opportunity to extend the experience built up in Brazil regarding the promotion and use of ethanol as motor fuel to our country.
- The success of this mission will contribute to the advancement of ethanol production in the country.
- In the beginning of ethanol program, we strongly recommend that the Government should adapt some measures of incentive for marketing ethanol fuel:
 - Commit government owned vehicles to be the first consumer of the ethanol fuel.
 - Guarantee of low price for the blended fuel
 - Obligations for fuel stations to offer ethanol fuel, etc.

5. Project Implementation Program

5.1 Requirements

In order to implement the project, the main requirements are:

- Availability of inputs (raw materials): fuel grade ethanol and gasoline;
- Technical know-how;
- Finance;
- Public awareness creation;
- Depots (storage tankers); and
- Finally, retail outlets (service stations).

5.2 Problems Encountered and Supports Required

It is understood that the major inputs required for the intended project are already available and secured. Regarding technical know-how, Y.B. Petroleum S.C. has the capacity both financially and technically to undertake the aforementioned project and to operate the blending plant. It has started building its human resource development.

However, Y.B. Petroleum had bottle-necks problems regarding the acquisition of plot of lands for the construction of fuel stations at different places in Addis Ababa. It has been a year ago since we applied for the Addis Ababa City Administration to obtain land for the construction of fuel stations. However, the response from the City Administration was not quite responsive.

Considering that the Company is established fully by Ethiopian nationals and this project is not only ours but also belong to the nations, the support of the Government bodies especially Addis Ababa City Government, Ministry of Trade and Industry, Prime Minister's Office, Ministry of Mines and Energy, Ethiopian Petroleum Enterprise is highly responsible for the realization of this valuable project.

5.3 Implementation Period

The implementation period required for marketing ethanol-gasoline blended fuel in our country is presented below.

No	Activities	Time (months)						
		May	June	July	August	September	October	November
1	Design & contracting	_____						
2	Land acquisition and construction of depots and retail stations	_____	_____	_____	_____	_____	_____	_____
3	Distribution network						_____	_____
4	Retail price negotiation						_____	_____
5	Training							_____
6	Commissioning & start-up							_____