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Biofuels India

Conserving resources, protecting the environment

Sustainable Fuel for the Energy and Transport Sector

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EDITORIAL

Biodiesel: Why India should go for it!

by Sudhir Singhal, Senior Advisor (Energy and Environment), WII

The core of Energy Policy of a country is to ensure energy security. There is also a relationship between the rate of growth of the economy and energy consumption. Our GDP is growing today at above seven percent and is perceived to sustain this for a long time. India's energy basket is considerably dependent upon petroleum products and is necessarily required for transport, agriculture, industry, domestic and other sectors. It is possible to switch over to electric energy for industry and domestic sectors as has already been done in some countries, where virtually no petroleum energy is used. However, transportation is a different story altogether. Our commercial vehicles and personal transportation is almost entirely dependent upon petroleum and are likely to remain so for a long time. To this, if we add the scenario of the impact of high crude oil prices and the challenges in pricing of petroleum products, our difficulties of sustaining high GDP growth begin to surface. We have to, therefore, go back again to the drawing board on our National Energy Policy.

India's transportation fuel requirements are unique in the world. We consume almost six to seven times more diesel fuel than gasoline, whereas in the rest of the world, almost all the other countries use more gasoline than diesel fuel. Thus, our search for alternatives in India has to have a different emphasis. This is where biodiesel is comparatively much more important for us than for others. Other alternatives are also of significance and we need to plan for them as well. It would perhaps be prudent on our part to prioritize efforts and investments to develop petroleum fuel alternatives, particularly for transport and engine applications, for both short and long term.

It would appear that biofuels, more particularly biodiesel, would stand out for both short and medium term interests, possibly for about next 25 years. After that, it is quite possible for new energy technology developments to be commercially viable. But, even for that, we will have to wait and watch. The medium to long-term future could well be hydrogen, fuel cells, EVs, and some others.

The awareness and knowledge base for biofuels in India, more particularly for biodiesel, has grown by leaps and bounds. We already

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ProBIOS: Promotion of Biofuels for Sustainable Development in South and Southeast Asia

Working Conference on Biofuels Promotion organized at Asian Institute of Technology, Thailand

Winrock International India (WII), a Non-Government Organization, working in the field of biofuels is implementing a project known as Promotion of Biofuels for Sustainable Development in South and South-east Asia (ProBIOS)". The overall objective of the project is to promote the use of biofuels in India and neighboring countries. WII is being assisted by the consortium of consultants led by the two European Union partner organizations, The Energy Research Centre for Netherlands (ECN), Netherlands, and Research Centre for Energy, Environment and Technology (CIEMAT), Spain, under the "Operations and Practical Dialogue" component under Asia Pro Eco Program of the European Commission.

As part of ProBIOS project, a working conference was organized in Thailand at Asian Institute of Technology (AIT) on 30 March 2007, which attracted 50 participants. The participants were from Nepal, Bangladesh, India and Thailand. The Thai representation came from various stakeholders including industry, academia, NGOs and agencies engaged in promotion of biofuels, equipment manufacturer and Thai government officials.

The welcome address was delivered by Mr. Amit Kumar, Program Manager, WII, where he mentioned that although there was a common agreement to the benefits involved on the issue of biofuels, the desired level of awareness in government officers and other stakeholders was yet to be achieved. This conference was a part of the program designed to create awareness and enhance capacity building amongst government officials and other stakeholders in participating countries. The idea behind this conference was to share experience and lessons learnt which would help to eliminate the barriers in participating countries to promote biofuels use for sustainable development in the region.

In the opening session, welcoming all the participants, Dr. Animesh Dutta, AIT Coordinator for the project gave a brief introduction of the conference and elaborated its objective. A welcome address was given by Professor Said Irandoust, President, AIT. He highlighted AIT's role in regional research and capacity building. He also mentioned that biofuels have emerged as an alternative to fossil fuel and can reduce the global carbon input from the transportation sector to a reasonable level. Quoting that how European countries have adopted biofuels, Professor Irandoust said that the barriers in Asian context both at technical and policy level should be dealt with a greater importance. According to him, the high potential of biofuels in Asian context as mentioned by experts could be realized by careful and informed practice.

Speaking about the necessity of regional cooperation in the sector, Professor Irandoust mentioned the role AIT could play as a nodal or coordinating agency and enhance the facilitation process. Professor Irandoust hailed the effort of Thai government for successfully implementing their biofuels program and mentioned it as an example for other nations in the region. Professor S. Kumar, Dean SERD, AIT hoped that the workshop would be very beneficial to the students and also spoke about the initiatives of AIT and its outreach efforts.

Mr. A.K. Goel, Director, Petroleum Conservation Research Association (PCRA) also made a presentation which provided insight on the situation of biofuels in India, aimed at helping the participants to work on promotion of biofuels. During his presentation, Mr. Goel briefed about the Indian energy scenario and status of energy use and need. He mentioned how Jatropha and Karanj were the two main crops in India being used for biofuels production. He mentioned how even President of India, Honorable Dr. A.P.J. Abdul Kalam also advocated and endorsed biofuels use. Mentioning that India had enough land available for the plantation needed for biofuels, he said that the initiatives have been taken to grow the crop and would take time to get the right quantity.

Mr. Goel mentioned about the technical issues involved and explained the chemistry of biofuels production as practiced in India, which was quite informative and educative for the participants. The presentation touched upon the changes in policy to facilitate biofuels market and the economic incentives for biofuels producers. He mentioned about several capacity building programs designed by PCRA to develop a knowledge pool for biofuels production and promotion.

Revealing that Thailand had much higher capacity of biofuels production than the need, Dr. Dutta emphasized on the use of by-products efficiently and also mentioned that continuity in supply chain was very important to make it commercially viable

Dr. Dutta also made a presentation "Roadmap of biofuels in Thailand". Dr. Dutta mentioned that this study had particularly taken a life cycle analysis approach to look through different segments of biofuels production in Thailand. He mentioned that Thai government was promoting palm and jatropha for biodiesel feed and energy crop such as cassava and sugarcane for ethanol. While tax instruments were used skillfully to promote biofuels, fluctuating raw material market was hampering the scenario for biofuels in Thailand, he said. Revealing that Thailand had much higher capacity of biofuels production than the need, he emphasized on the use of by-products efficiently and also mentioned that continuity in supply chain was very important to make it commercially viable. So a stock of feed crop was to be maintained by additional plantations.

Other presenters included Mr. Shaquib Quoreshi from Bangladesh, Mr. Megesh Tiwari from Nepal, Mr. Arvind Reddy from India and Mr. Samuel Martin from AIT. A field trip to Thai Alcohol PLC, a local ethanol plant running successfully was also arranged as part of the workshop. The plant visit started with a presentation followed by a complete tour of the facility.

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have a technology, production and R&D base. Given some encouragement, our benefits would be manifold. First is the supplementing of our energy basket, particularly that of petroleum diesel, thus, reducing our dependence on imports and high crude prices. The second, and perhaps even more important is the growth of a technology base for byproducts, where we must have a global vision and a detailed long term planning to become a world leader. This will not happen without biodiesel growth. Therefore, promoting biodiesel first is important and of considerable national significance. Unfortunately, today, this benefit cannot be quantified in monetary terms. For that we will have to wait till the product usage grows. Parallel to this, as is well known and widely publicized, are the multiple benefits of utilisation of wastelands, greening of large areas of the country, environmental and climate change gains, providing employment and livelihood to huge rural populations, a part of which today may be well below the poverty line and/or unemployed.

It seems to me that in effect what we need is to arrive at a national consensus on this issue quickly and channel our efforts in a balanced and focused manner without frittering away our scarce resources.

Till then we will have to wait for the proverbial penny to drop!

Environmental Perspectives of Biofuels for Transportation Compared to Conventional Fuels

Objective and Scope

Early comprehensive Life Cycle Assessments (LCAs) that compared biofuels with fossil fuels already appeared in the beginning of the 1990s. Since then the public, scientific and political interest in biofuels has continuously grown and also the number of biofuels and assessed parameters have increased and the methodology for assessment has also improved.

Many LCAs have concluded that biofuels are more or less CO_2 neutral. The findings, however, vary considerably at times. It also has to be noted, that some environmental disadvantages are associated with biofuels, such as negative implications on acidification or eutrophication in some cases. These environmental implications vary enormously with different biofuels, but also depend on the use of different raw materials.

In order to analyze the advantages and disadvantages of different biofuels, this paper collates, analyzes and compares international publications that provide scientifically reliable and comprehensive statements about biofuels. The considered publications mostly meet the standard practice for life cycle analysis (LCAs), as defined by ISO 14040 – 14043. This means that not only the whole life cycle of a particular product is accounted for in terms of its ecological implications, but also any by-products arising from its production. The environmental effects of these by-products can, under certain circumstances, tip the balance with regard to the overall ecological effects of the main product.

Most biofuels that are currently in use such as vegetable oil and biodiesel from rapeseed, bioethanol from sugarcane and corn, etc., as well as biofuels that are currently not mass produced such as BTL and bio-hydrogen are considered. The advantages and disadvantages in respect to a range of environmental impacts (including greenhouse gas emissions, energy consumption, acidification, eutrophication, ozone depletion) are first demonstrated for biodiesel from rapeseed (RME) as an example. Afterwards, the energy and greenhouse gas balance results are presented and interpreted for all considered biofuels. The investigated comparisons are shown in *Table 1*.

The basis for this analysis is a comprehensive Institute for Energy and Environmental Research (IFEU) study for the "Research Association for Combustion Engines" [IFEU 2004], in which more than 800 studies

Table 1: Biofuels considered in this paper and their fossil fuel counterparts

Biofuels	Fossil fuel counterparts
Bioethanol	
Bioethanol from sugarcane	Gasoline
Bioethanol from corn	Gasoline
Bioethanol from wheat	Gasoline
Bioethanol from sugar-beets	Gasoline
Bioethanol from lignocellulose	Gasoline
Bioethanol from potatoes	Gasoline
Bioethanol from molasses	Gasoline
ETBE	
ETBE from wheat	Fossil MTBE
ETBE from sugar-beets	Fossil MTBE
ETBE from lignocellulose	Fossil MTBE
ETBE from potatoes	Fossil MTBE
Biodiesel	
Biodiesel from rapeseed	Fossil diesel fuel
Biodiesel from sunflowers	Fossil diesel fuel
Biodiesel from soybeans	
Disadvantages?	Fossil diesel fuel
Biodiesel from canola	Fossil diesel fuel
Biodiesel from coconut oil	Fossil diesel fuel
Biodiesel from palm oil	Fossil diesel fuel
Biodiesel from animal grease	Fossil diesel fuel
Biodiesel from used cooking grease	Fossil diesel fuel
Vegetable oil	
Vegetable oil from rapeseed	Fossil diesel fuel
Vegetable oil from sunflowers	Fossil diesel fuel
Biomethanol	
Biomethanol from lignocellulose	Gasoline / Methanol from natural gas
MTBE	
MTBE from lignocellulose	Fossil MTBE
DME	
DME from lignocellulose	Fossil diesel fuel
BTL	
BTL from agriculture	Fossil diesel fuel
BTL from residues	Fossil diesel fuel
Biogas	
Biogas from organic residues	Gasoline/ Natural gas

contd…

Biofuels	Fossil fuel counterparts
Biogas from cultivated biomass	Gasoline/ Natural gas
Hydrogen	
Gaseous Hydrogen from lignocellulose	Gasoline/ Hydrogen from natural gas
Gaseous Hydrogen from organic residues	Gasoline/ Hydrogen from natural gas
Liquid Hydrogen from lignocellulose	Gasoline / Hydrogen from natural gas

have been taken into account. Furthermore, several specific studies such as IFEU 2006 for BTL, IFEU & WI 2006 for palm oil production, as well as WWI 2006, JRC 2006 and VIEWLS 2006 have been used and additional research has been conducted.

Procedure

All regenerative fuels were balanced over their whole life cycles i.e. everything from inputs such as fertilizers and pesticides to the actual fuel consumption in a vehicle is taken into account. The same applies to the fossil fuel counterparts. Both options are finally compared against each other (see the example for bioethanol in *Figure 1*).

Also agricultural reference systems have been taken into account and all additives and co-products were included. The latter were balanced as credits. For further details and the underlying assumptions see (Borken et al. 1999, Gärtner & Reinhardt 2001, IFEU et al. 2000, Kaltschmitt & Reinhardt 1997 and Patyk & Höpfner 1999). The evaluation is based on an

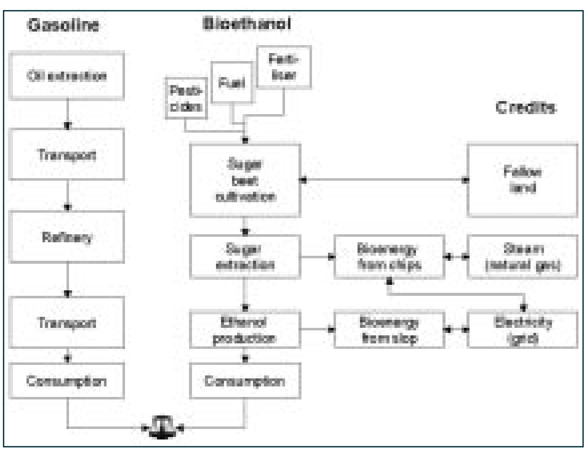

Figure 1: Schematic life cycle comparison "bioethanol from sugar beet versus gasoline"

inventory analysis and impact assessment.

For all processes, the respective energy and materials have been balanced as inputs and emissions as outputs. More than 26 inputs (e.g. natural gas, brown coal, limestone) and output (e.g. CO_2, CH_4, SO_2, NO_x, HCl) parameters were examined quantitatively in the Life Cycle Inventory (LCI) Analysis. The comparison of all considered biofuels has a focus on the impact categories "energy consumption" and "greenhouse effect". For the category "energy consumption", the energy content of all finite primary energy carriers was added up in order to obtain the Cumulated Energy Demand (CED). For the aggregation of CO_2 equivalents (greenhouse effect), the following factors were used: CO_2: 1; CH_4: 21; N_2O: 310 – referring to kg CO_2/kg of the respective substance ([IPCC 2001]). Similar procedures were followed for the assessment of acidification (SO_2 equivalents) [CML ET AL. 1992] and eutrophication (PO_4 equivalents).

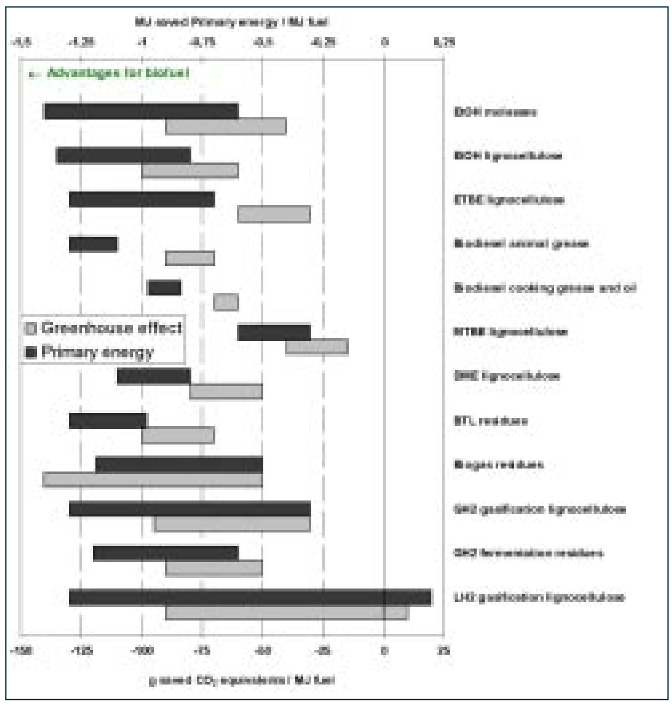

Figure 2: Exemplification of environmental impacts of RME compared to conventional diesel fuel
(Source: Own calculations and updates based on [IFEU 2003])

Figure 2 gives the results for the comparison "biofuel versus fossil fuel" as described before, the comparison is with biodiesel, from rapeseed versus ordinary diesel fuel. The results for "primary energy" and "greenhouse effect" are in favor of RME, while the other results are in favor of fossil diesel fuel. That means that an objective decision in favor of the biofuel or the fossil fuel is not possible. Therefore, a final conclusion must consider subjective value systems. If for instance, the depletion of fossil resources and the greenhouse effect are ranked highest, an overall final assessment in favor of biofuels can be justified.

Results

As has been mentioned above, a comparison of several biofuels with their fossil counterparts was undertaken. The concluding assessment is discussed in the light of two issues: comparison of "biofuels versus their fossil counterpart" and on the question how the different biofuels compare against each other. Thus, the following comparisons can be identified:

- Biofuels from agriculture compared to fossil fuels and against each other
- Biofuels from residues compared to fossil fuels and against each other

Biofuels from agriculture compared to fossil fuels and against each other

As the area is the most restricting factor for producing biofuels from agriculture in Europe, all results are shown in relation to area (per hectare). *Figure 3* shows the results for the life cycle comparisons "biofuels from energy crops versus fossil fuels" for two environmental indicators chosen: energy consumption and greenhouse gases. The positive values indicate advantages for the fossil fuel and the negative ones advantages for the biofuels.

Most life cycle comparisons of "primary energy" and "greenhouse effect" are in favor of the biofuels. The only exception is biodiesel from palm oil, if certain plantations (e.g. rubber) are converted to palm oil plantations. Concerning palm oil, from an ecological perspective, the optimization of palm oil production as well as new plantations on devastated ground, which has previously been occupied by natural forest are the best options. Even better, in terms of energy savings is palm oil produced by cutting down tropical rain forests. But with this, the biodiversity of the tropical forest will be lost forever, which is also a factor, if the sustainability of using palm oil for energy is considered. Nevertheless, the results in IFEU & WI 2006 indicate that there is sufficient potential to use palm oil, as an energy carrier in the transport sector also, if the political and economic framework conditions are favorable.

BTL fuels have an ecological advantage over a range of other biofuels. However, there also are options in the temperate as well as tropical climate that lead to better results than BTL fuels. BTL has a special ecological potential compared to other biofuels if it is produced from short rotation wood and not

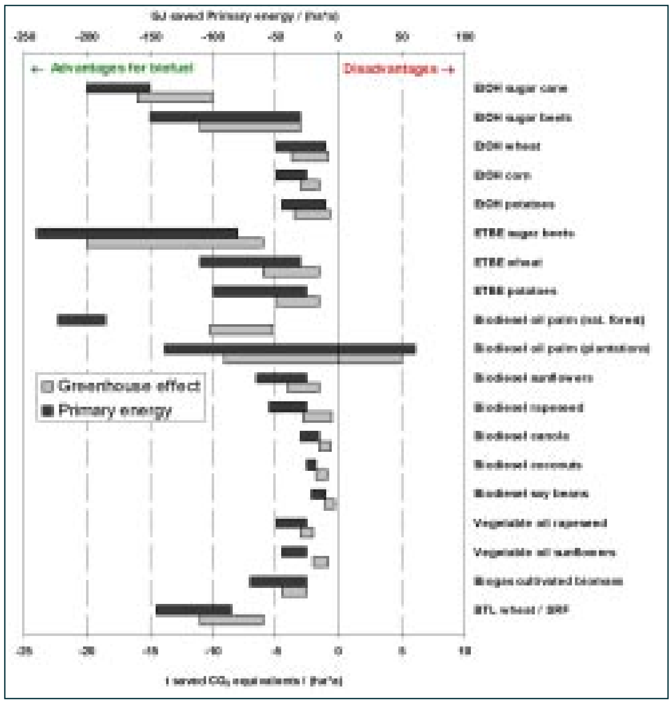

Figure 3: Advantages and disadvantages for greenhouse gases and primary energy for biofuels from agriculture compared to their fossil counterpart
(Source: [IFEU 2004], [IFEU & WI 2006], [IFEU 2006])

from cereals.

For more conclusions on all biofuels considered, please refer to "conclusions and outlook".

Biofuels from residues compared to fossil fuels and against each other

To compare the biofuels from residues against each other, the amount of fuel in terms of energy (MJ) has been selected as the reference units. *Figure 4* shows the results for the life cycle comparisons for "biofuels from residues versus fossil fuels". The positive values indicate advantages of the fossil fuel and the negative ones advantages of the biofuels.

The most important results are that the presented efficiencies have only small differences. In contrast to biofuels from energy crops, no ranking due to systematic advantages can be undertaken. With another analytical focus, which leads to the use of different relations, or under specific life-cycle conditions, different results can be obtained.

For more conclusions, please refer to "conclusions and outlook".

Conclusions and Outlook

The present assessment is based on the results of life cycle comparisons. These comparisons are made on numerous assumptions. Although, scientifically reliable results can be derived, these results and the resulting

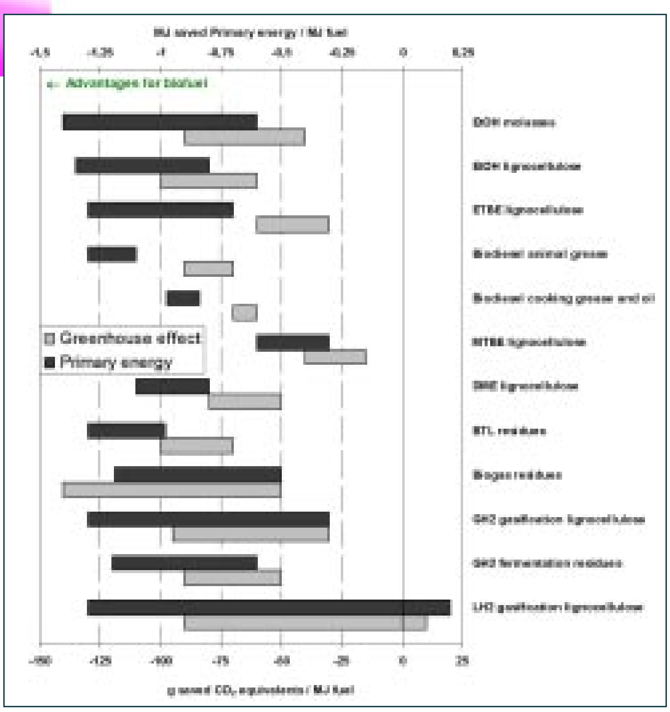

Figure 4: Greenhouse gas and primary energy savings for biofuels from residues compared to their fossil counterpart
(Source: [IFEU 2004]. [IFEU 2006])

interpretations cannot be generalized, because other assumptions, system boundaries etc. lead to different results. Therefore, the results must be explicitly discussed considering the underlying assumptions. Nevertheless, the evaluated results from LCI and LCI Analysis are reliable, because data that are not reliable at all are excluded from the final assessment and other uncertain data have been examined by sensitivity analysis.

The main result is that the energy and greenhouse gas balances of the biofuels considered are mostly favorable as compared to fossil fuels. Since most biofuels, however, have disadvantage in other environmental impact categories (see Figure for RME), an objective decision in favor of one or another fuel can only be undertaken if energy savings of fossil resources as well as greenhouse gases are given the highest ecological importance. In this case, almost all investigated biofuels compare favorably to their fossil alternatives.

The following additional conclusions can be made from the presented results:

■ High variability of the results: An examination of various studies in energy and greenhouse gas balances of biofuels shows a high level of variability in the findings. A direct comparison between the different biofuel options is not always possible. The high level of variability arises from the favorable or unfavorable assumptions taken on the external factors, e.g. those related to the cultivation, the conversion or valuation of the co-products. In order to make direct comparison among different biofuel options, the system boundaries must be determined exactly.

■ A ranking of biofuels can be undertaken for some aspects:

❍ Regarding the area-related consideration for biofuels from agriculture, ETBE shows advantages compared to all other biofuels.

❍ Bioethanol scores better or worse in depending on resources, rather than biodiesel and vegetable oil

❍ Biodiesel shows advantages compared to vegetable oil, when the same system boundaries are assumed

❍ Biodiesel from palm oil shows a huge bandwidth and can even be disadvantageous compared to fossil fuel

❍ BTL shows higher advantages – again, if looked at area related - compared to biodiesel to ethanol, if ethanol is produced with conventional technologies from wheat, maize or potato. However, ethanol shows advantageous results compared to BTL, if produced from sugar cane

■ Geographically specific advantages: The advantages of some biofuels are dependent upon geographical areas. For example, the bioethanol production from sugarcane is only limited to the tropical climatic conditions, while the cultivation of sugar-beets in the temperate regions is only found on particularly fertile soils.

■ Future development: In the future, the advantages of currently used biofuels from cultivated biomass (as compared to conventional fuels) will be enhanced. This is based on an increase in biomass yields, lower primary energy demand for agricultural resources, higher biofuel yields as well as a lower level of energy consumption as a result of the conversion.

The technical potential of biofuels is generally very high when all possibilities of biofuel production and currently unavailable technologies in the production of biofuels are considered. Whether and when these technologies will be available is not yet predictable with our present knowledge. A leading automobile manufacturer claims that the technology for the production of BTL should be available in the medium-term, and that technology for the production of hydrogen should be available in the long run.

Contrary to the high biofuel potentials, the biofuel usage in 2004, in Germany was about 1.7 % and about 0.6 % in the EU25 [DG TREN 2006]. Before the production technologies for new biofuels are available, the potential of biofuels depend mainly on the political conditions, the competing land use, and biomass usages. These factors are also not foreseeable for the future.

Competing land use: The potential of biofuels from cultivated biomass depends foremost on the land area availablity, while the potential from organic residues do not depend on land area. The land area for the production of biofuels can compete with the area for foodstuff production and the area for natural conservation. EEA 2006 shows that for Germany, the technical potentials for biofuels are reduced considerably due to the observance of natural conservation aspects (including surface water and soil conservation).

Competing biomass usages: DLR et al. 2004 has shown that competing biomass usages affect the potential of biofuels greatly. The potential of biofuels in Germany would be reduced to one quarter by 2050, if one assumes that the biomass potentials are more used in stationary sectors than in transport sector. There are no detailed potential estimates of biofuels that consider the competing usages of biomass available for the remaining reference areas (EU and the world). In many studies, it is assumed that the total available biomass is to be used in the fuel sector.

Overall, there is a considerable need for further research on biofuels for transportation. There is still a paucity of publications about the energy and greenhouse gas balances of many biofuels such as biodiesel from jatropha. With respect to DME and methanol, studies cover only a few conversion paths. The knowledge gap is even larger in the area of LCAs. For instance, there is a lack of studies on detailed examinations on emissions of biofuels like BTL in the modern motor concepts. Also, other environmental impacts except greenhouse gases are missing in many important individual studies.

Nevertheless, there is a great potential for biofuels for transportation, which should be developed in accordance with the use of biomass for electricity and heat generation.

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Courtesy: G.A. Reinhardt, H. Helms*

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This paper was presented by G.A. Reinhardt at the 4th International Biofuels Conference

State to Encourage Jatropha Cultivation: Buddhadeb

Wednesday, April 25, 2007

HALDIA, India: The Communist Party of India-Marxist (CPI-M)-led West Bengal government is now set to encourage “agriculture-based industry” by utilising the wastelands for cultivation of feedstocks like jatropha.

“The State Government will shortly come up with a clear policy earmarking all the wastelands in West Bengal. Three departments - panchayats, agriculture, and land reforms - are together working on this policy,” West Bengal Chief Minister Buddhadeb Bhattacharya said on Tuesday while laying the foundation stone of a biodiesel plant at Haldia in East Midnapore.

The Emami group is setting up the biodiesel project at Haldia, the first in eastern India, investing Rs.1.5 billion with an initial capacity of 100,000 tonnes per annum. The plant is expected to commence by 2007-end. It will come up in technical collaboration with an Italian-Belgian joint venture company, said R S Goenka, Emami Group’s Joint Chairman.

Bhattacharya said after identifying these areas, the State Government will directly involve the local farmers for cultivation of jatropha on the wastelands.

“It’s high time we switch over from conventional resources to alternative energy resources procuring biodiesel or biogas. If we can encourage farmers to cultivate jatropha, it would help a lot to generate biofuel in West Bengal,” he said.

Pointing out the importance of alternative energy resources, the Chief Minister said the State Government has already started a pilot project for cultivating jatropha in Bankura district. He said there is huge scope to cultivate the feedstock in Purulia, West Midnapore (Jhargram sub-division) and Bankura districts. To strengthen the State’s economic prosperity, the government will go in for jatropha cultivation in a big way and will motivate the farmers through the district administration, zilla parishads and panchayats. The process is expected to start in the next few months.

“This biodiesel plant will be the first such agriculture-based industrial unit in West Bengal where farmers will be directly benefited,” said Laksman Seth, Chairman, Haldia Development Authority.

For feeding the biodiesel plants adequately, jatropha cultivation over an area of 100,000 acres is essential, Bhattacharya said, adding this will create employment opportunities to 200,000 people at the rate of two persons per acre of cultivation. Currently, India produces only 22 percent of its total diesel requirement and 78 percent is imported draining off huge amounts of foreign currency reserves every year, Seth said.

Source: http://www.keralanext.com/India/read.asp?id=1001833

Policy Guidelines for Intensive Cultivation of Oil Seed Bearing Trees and Biodiesel Production – Science & Technology Department, Govt of Orissa

Resolution

Biodiesel produced from vegetable resources is fast emerging as a viable alternative to petro-diesel, particularly in the face of its diminishing supply and the resulting steep increase in price.

Production of Biodiesel also supplements the general economic growth by way of waste land utilization, employment generation, entrepreneurship development, augmentation of additional source of power, increasing share of organic manure in agriculture etc.

Potential of Biodiesel Production

The current biodiesel production potential of the State has been estimated at approximately 1000 KL per annum. With further utilization of about 30% wasteland of the State, the production is likely to increase up to 14000 KL per annum. At B20, this oil can be blended with 70000Kl of diesel and at B5, the same can be blended with 280000Kl of diesel.

Quantification of Benefits of Biodiesel Production

- Total expected production : 14000 KL per annum
- Utilization of wasteland : 0.6 Million Hectares
- Employment generation : 100 million man days
- Additional organic manure : 42,000 tons

With the above consideration in view, Government is pleased to decide the following guidelines for implementation and promotion of biodiesel in the State.

Objectives and Strategies

The main objective of the policy is to enhance economic growth through maximization of production of biodiesel in the State. Other objectives are:

- To put at least 30% wasteland of the State into effective use through cultivation of oil seed bearing trees;
- To enable the poor and disadvantaged people of the society to take up cultivation of oil seed bearing trees;
- To fix up the minimum support price of oil seeds;

- To enable interested and eligible entrepreneurs to set up biodiesel production plants;
- To provide suitable market linkage to biodiesel producers to sell their product, and
- To set up quality control facilities to guide entrepreneurs to produce Bureau of Indian Standards (BIS) standard biodiesel.

Operative Period

The scheme for promotional and fiscal incentives for intensive cultivation of tree borne oil seeds and establishment of biodiesel production units will come into operation with immediate effect and will remain in force for a period of 10 years.

Cultivation of Oil Seed Bearing Trees

Propagation of oil seeds

Although, several oil bearing trees like Karanj, Mahua, Polang, Kusum, Neem, Simarauba, Sal, Linseed, Castor, Baigaba etc. are native to Orissa, systematic propagation and processing of these seeds is very important in view of large scale commercial production of biofuels. However, the proposed magnitude of the campaign calls for well laid out actions and well defined roles and responsibilities of different stakeholders.

Selection of Oil bearing Trees

Except Polang which grows well in regions closer to the sea coast all other species can be grown all over the State even on marginal and degraded lands.

Oil seed bearing trees can be chosen depending upon the local agro-climatic conditions and economic feasibility for large scale biodiesel production. Jatropha Curcas, however, is a generally accepted biodiesel species because of its adaptability to all types of harsh conditions.

Supply of Seedlings

Government and private nurseries shall be encouraged to prepare seedlings of biofuel trees and supply the same to interested farmers, co-operatives, Self Help Groups (SHGs) etc. at moderate prices. Financial incentives should be provided to women SHGs, grass root level Non Government Organizations (NGOs) / Community Based Organizations and individuals in tribal sub-plan areas for raising nurseries so as to build up a strong and continuous seedling supply chain.

Availability of land for cultivation of oilseed bearing trees

About 2 million hectares of land is available under the categories of barren and uncultivated land and fallow lands. A major portion of this land can be utilized for cultivation of oil seed bearing trees. Besides, huge areas of degraded forest are also available in the State where such cultivation can be taken up. Cultivation of oil seed bearing trees can also be taken up on field boundaries, tank bunds, fences etc.

Distribution of Land

Identification of land

While farmers have to be encouraged to cultivate biofuel plants along the fencing and the bunds of cultivated lands, the very success of the programme depends on raising such plantations on marginal and degraded lands. Such areas coming under common land, wasteland, canal and tank bunds, degraded forests, along the railway tracks, highways have to be identified by designated Government Departments and given on long term lease to interested Van Sanrakshan Samittees (VSSs), Pani Panchayats, co-operatives, SHGs,Tree Growers' Societies etc. for plantation purpose.

Eligibility

Under these policy guidelines, all families living below poverty line are eligible for government incentives for cultivating oil seed bearing trees.

SHGs, other farmers groups, associations, consortia etc. with more than 50% members belonging to the BPL category will be preferred.

Individual farmers belonging to BPL categories	2.5 hectare per beneficiary
SHGs/ VSS/Bhumi Panchayats/ Other recognised farmers groups etc.	25 hectares per group

Allocation of wasteland

Waste land in suitable agro-climatic zones will be identified by concerned Government functionaries and allotted for the purpose of cultivation of oil seed bearing trees to different categories of beneficiaries as under:

- Allocation of land will be made as per prevailing Acts of the Revenue Department under OLR/OPLE/ OGLE.
- VSSs with due permission of the forest department may also raise oil seed bearing tree plantations in forest and degraded forest lands. In such cases, the quantity of land to be allocated per VSS may be decided by the forest department.

The above arrangement, however, does not prevent others to grow plantation on their own land.

Financial Incentives

Support price of oil seeds

In order to facilitate farmers to sell their oil seeds, State Government shall fix up remunerative support prices for purchase of different oil seeds suitable for production of biofuels.

Incentives for raising commercial plantations

For raising commercial plantations, different categories of cultivators can avail financial assistance under back ended credit linked subsidy programme of National Oilseed and Vegetable Development (NOVOD) Board under the Ministry of Agriculture, Government of India. (Annex-I)

For cultivation of oil seed bearing trees at present subsidy @ 30% subject to the benchmark cost of Rs 30,000/- per hectare is available under the NOVOD guidelines. The pattern of assistance is 30% subsidy, 50% bank loan and 20% beneficiary share.

Establishment of Seed Collection Centres and Buy- Back Arrangements

Government /private /NGO managed seed collection centres with adequate infrastructural facilities shall be established at well connected locations for collection and preservation of seeds. Such collection centres shall have facility to determine the oil content of seeds, grade and certify the seeds on the basis of their oil content and purchase the same from the farmers at support prices determined by Government.

Establishment of Biodiesel Production Centres

Biodiesel production can be low tech, and is not capital intensive. Biodiesel production does not require economy of scale. There is no minimum size for a biodiesel facility and small decentralized biodiesel facilities do not require dedicated technical staff support; they can be operated by locally trained non-technical staff.

Eligible entrepreneurs shall be entitled to subsidy as per the special package offered under Self Employment Programme implemented by the Industries Department. Such special package allows 15% capital subsidy and 3% interest subsidy.

Financial assistance and other incentives for setting up complete biodiesel production units shall be given to individual entrepreneurs as well as groups as per relevant provisions of IPR, PMRY, and KVIC/ KVIB.

All such incentives shall be in consonance with the Self Employment Policy of the State Government.

Selection of Entrepreneur

Entrepreneurs for setting up biodiesel plants shall be selected as per selection procedure in vogue of the District Industries Centres (DIC).

Preparation of Detailed Project Reports (DPRs)

Standard priced DPRs for different capacities of biodiesel plants shall be made available to the selected entrepreneur by Orissa Renewable Energy Development Agency (OREDA). Location specific amendments to the DPR, if any, shall be incorporated by OREDA subject to verification of details and on payment of costs of such verification etc.

Establishment of Quality Control Centres

BIS has specified standards for quality of biodiesel for blending with petro-diesel in India. Indian Oil Corporation has also set up certain quality standards and norms for procurement of biodiesel by them.

The entrepreneurs in order to sell their biodiesel must adhere to the above standards and norms and such adherence should be monitored by suitable Quality Control Facilities created under the State Nodal Department / Agency. Such facilities shall also duly certify the biodiesel following which sale to indenting buyers or consumption for one self can be affected by the respective biodiesel unit.

IEC Activities

As of now, there is very little mass awareness about organized plantations of oil seed bearing trees in the State. The opportunities and potential to various beneficiaries like farmers, traders, industry and consumers have to be properly articulated. Booklets, brochures, manuals etc. have to be prepared in Oriya detailing the package of practices in plantation of biofuel trees, collection and preservation of seeds, buy back arrangements, economics, financial incentives, loans etc. and widely circulated among farmers. Government Departments like Agriculture, Forest, OUAT, Krishi Vigyan Kendras, PRIs, NGOs and other grass root level extension functionaries, electronic media, etc. should be adequately geared up to take up the task of awareness and education. Suitable budgetary provisions should be made by the State Government for such extensive awareness and education campaigns.

Role of OREDA

OREDA will act as the Nodal Agency for the entire programme and function as the single window for promotion and facilitation of all projects prepared under these guidelines.

Source: http://orissagov.nic.in/panchayat/biodieselpolicy.pdf

Finnish Oil Major Eyes Indian Jatropha

By IANS – Thursday April 19, 2007

Helsinki, April 19 (IANS) Jatropha, a wonder plant grown in India, might soon fuel cars in Europe with Finnish oil and refining major Neste Oil considering importing it for its upcoming biodiesel plants.

'We are continuously looking for ways to expand our raw material base for NExBTL (the second generation biodiesel developed by Neste), and in this search, the non-edible jatropha is very interesting,' said Neste Oil president and CEO Risto Rinne here.

'Currently, Neste Oil has no ongoing projects in India but with its vast population and proactive biofuel targets, India is an attractive future market opportunity for Neste Oil's NexBTL renewable diesel,' he told visiting Indian journalists.

Neste Oil, the third largest company in Finland with a 50.1 percent government stake, is coming up with its first biodiesel plant in May this year and aims to emerge as the world's leading biodiesel company besides running its traditional oil refining business.

'India is a rather new thing for us but we can buy Jatropha Curcas from India to begin with,' said Osmo Kammonen, Senior Vice-President, Communications, Neste Oil.

Jatropha Curcas is the wonder plant that produces seeds with an oil content of 37 percent. The oil can be combusted as fuel without being refined. It burns with a clear smoke-free flame and has been tested successfully as a fuel for the simple diesel engine.

'More than 50 percent of new European Union (EU) cars are diesel cars and so we want to gear up to produce more diesel,' said Kammonen.

'India has potential to be a market and for sourcing our raw material. I am sure that our people are looking at the Indian market. We need to find a good supplier. New diesel vehicles are better than gasoline ones. For producing biodiesel we use animal fat and vegetable oil as feedstock and jatropha is a good option,' he said.

Neste Oil's NExBTL renewable diesel is a second generation biodiesel which is pure hydrocarbon and according to its properties and quality, is similar to fossil diesel.

Wider feedstock - raw materials like jatropha - base can be utilised in the production process for Neste Oil. The higher the NExBTL content, the lesser the emissions. The first NExBTL production at a Neste Oil unit will be on-stream in Porvoo, Finland, this year.

Neste Oil, the third largest company in Finland with a 50.1 percent government stake, is coming up with its first biodiesel plant in May this year and aims to emerge as the world's leading biodiesel company besides running its traditional oil refining business

Neste Oil's Porvoo and Naantali refineries have a combined refining capacity of about 14 million tonnes a year. 'Neste Oil is involved in developing third generation biodiesel technology. Though it does not significantly differ from NExBTL, the technology enables one to exploit the whole plant (biomass) and thereby widens the feedstock base since Finland is the most extensively forested country in Europe with 86 percent of its land area falling under forests,' said a Neste Oil official.

In 2006, the company supplied 8.1 million tonnes of petroleum products to Finland and exported 6 million tonnes. It imports crude oil mainly from Russia (48 percent in 2006).

Neste Oil has some 900 Neste service stations, diesel fuel outlets and other sales points in Finland, and some 240 Neste stations and outlets and diesel fuel outlets in the Baltic states, Russia and Poland.

Jatropha is a valuable multi-purpose crop to alleviate soil degradation, desertification and deforestation and can be used for bio-energy to replace petro-diesel, besides, for soap production and climatic protection.

According to Abhishek Maharishi, CEO, Centre for Jatropha Promotion and Biodiesel, Rajasthan, if the Indian government implements its policy on jatropha cultivation in right earnest the country could be a leading exporter.

'Since 2003, the policy has been adopted to promote the cultivation, yet there are hurdles. A biodiesel board formed in Rajasthan is yet to function. We think that if at least 10 percent of the 33 million hectares of wastelands in India is made available for jatropha, it could turn the fortunes of the rural poor and work wonders,' Maharishi told IANS.

Source: http://in.news.yahoo.com/070419/43/6eqra.html

Biofuel from Algae – A Substitute for Petroleum Diesel – Indian Efforts

Introduction

In recent times, it has been realized that biodiesel production is possible on a large-scale to replace the entire fossil fuel for transportation needs.

Microalgae are the primitive form of plants. The mechanism of photosynthesis in microalgae is similar to that of higher plants but they are more efficient converters of solar energy because of their simple cellular structure. Microalgae are capable of producing 30 times the amount of oil per unit area of land compared to terrestrial oilseed crops.

"Microalgae are remarkable and efficient biological factories capable of consuming waste form of CO_2 and converting it into a high density liquid form of energy (Natural Oil)". Large-scale production of energy is usually referred to in terms of a unit called "QUAD" which represents 10^{15} units. This perspective can be realized from the concept of large algae farms.

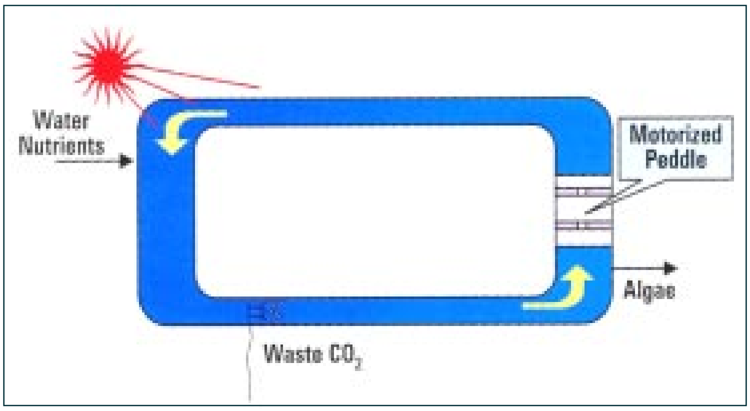

Figure 1

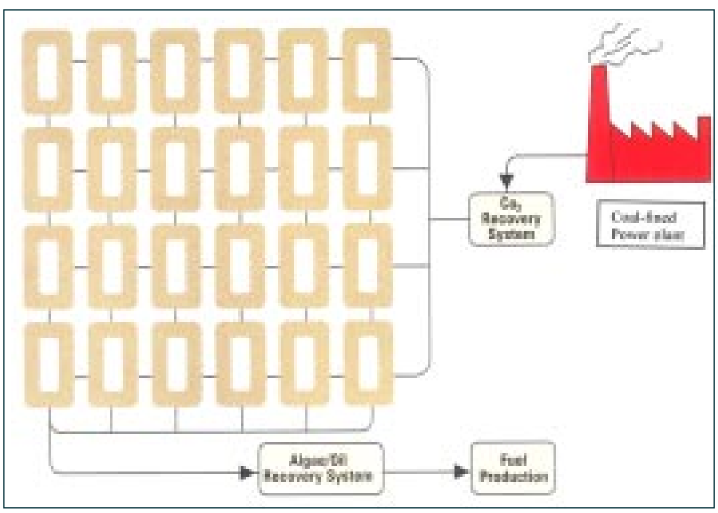

Figure 2

Such algae farms could be developed from the use of open, shallow ponds in which a convenient source of waste CO_2 could be effectively bubbled into the ponds and captured by the algae. Each pond has a "race track" design (as shown in Figure 1) in which the algae, water and nutrients are circulated around the track by means of a paddle.

The algae are kept suspended in water. The ponds are shallow so that there is sufficient insolation of sunlight. The ponds are continuously operated – water and nutrients are constantly fed into water at one end, while water containing algae is removed at the other end, where a harvesting system is provided to recover the algae from this water. For a large scale production, an "algae farm" can be designed as shown in Figure 2.

The size of these ponds is a critical factor indicated in terms of surface area which is effective in capturing the sunlight.

There are a number of waste CO_2 sources such as fossil fuel-fired power plants, distilleries or breweries. A typical coal-fired power plant emits flue gas from its stack with about 15% CO_2 concentration. This can be fed into the ponds. This concept of coupling the coal - fired power plant with an algae farm is an elegant approach to recycle CO_2 and convert it into usable biofuel.

The algae farms would not need to be built in the same location. It would be preferable to spread them around throughout the country. They can be constructed to use waste water (industrial or animal waste water). The algae farms also yield recoverable methane called "biomethane" as it comes from biomass. This methane could then be converted into methanol which could be used for converting algae oil into biodiesel (or) fuel oil.

One of the important concerns about large-scale production of biodiesel is whether it would displace currently used food crops. This conception is untenable because algae can grow in waste lands such as desert regions. Another advantage of algae cultivation is that it needs less water than traditional oil seed crops and that algae grows well with salt water too. Algae farms can also be built near seashore.

Researchers have concluded that 200,000 hectares of algae ponds would be capable of producing 3.8 million liters of oil. Single production reported over the course of one year were as high as 50 gms of algae per square meter per day in a test project of 1000m^2 pond. Careful control of pH and other physical conditions for introducing CO_2 into the ponds (through proper bubbling) have increased productivities. Climatic conditions such as providing enough sun light insolation would enhance the productivity, which is obtainable in countries like India and are most suitable. The analysis points to the need for highly productive organisms which convert most efficiently sunlight into biomass. Even with aggressive assumptions regarding biological productivity, the costs for biodiesel production can work at best to one third the cost per liter of petroleum diesel. A recent estimate reported by Bio-king Inc. is that it is possible to produce one liter of biodiesel at a cost of 40 cents in a test farm which is about Rs. 18/-.

The bulk of the natural oil derived from oil seeds or algae is in the form of triacyl glycerols (TAGs). TAGs consist of three long chains of fatty acids attached to a glycerol backbone. Rudolph Diesel first used peanut oil (which has TAGs) at the turn of last century in his diesel engine. Rapid introduction of then cheap petroleum made it the preferred source of diesel fuel. The natural oil does not operate well in diesel engines because of its high viscosity. A chemical modification of natural oil reduces the viscosity to operable range. By reacting the TAGs with simple alcohols (by a process known as "transesterification"), we can get an alkyl ester (biodiesel) which has properties very close to petroleum diesel fuel. (see Figure 3).

Biodiesel performs well like petroleum diesel or even better reducing emissions of particulate matter, CO, hydrocarbons and SO_x. Biodiesel virtually leaves no black soot in diesel engines. Other environmental benefits of biodiesel include the fact that it is highly bio-degradable and reduces many toxic and carcinogenic emissions.

Future algae farms and cultivation will look like this:

The analysis points to the need for highly productive organisms which convert most efficiently sunlight into biomass. Even with aggressive assumptions regarding biological productivity, the costs for biodiesel, production can work at best to one third the cost per liter of petroleum diesel

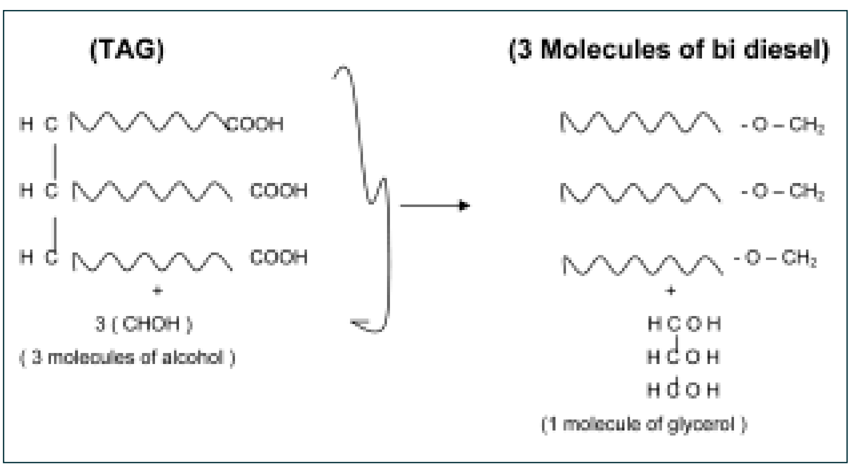

Figure 3

Bioethanol and biodiesel derived from terrestrial energy crops and from algae oils can offer a future alternative to gasoline and petroleum diesel needs of transportation and commerce, thus ensuring energy security.

Courtesy: Dr. R.Gopalakrishnan, Professor, EIE Dept., R.M.K Engineering College, Kavaraipettai-601 206

Clean Development Mechanism
A Reference Tool

Contents

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The subject of CDM is generating lots of interest amongst project developers. At the same time, the level of awareness and understanding is limited, resulting in wrong investment decisions in many cases, as also over reliance on consultants.

Keeping in mind the need for a practical guidebook on the subject of CDM, Winrock International India has come out with this 92 page comprehensive publication — CDM - A Reference Tool that would:

- Introduce project developers to the subject of CDM, and help them in undertaking an initial screening and evaluation of their projects from the CDM viewpoint
- Help the project developers to prepare Project Concept Note (PCN)
- Help the project developers to make investment decision, by analyzing as to whether there is sufficient merit in the project to take it further through the entire CDM cycle
- Help monetize CDM benefits by providing a comprehensive list of various service providers in the field of CDM

The publication is priced at Rs. 5000/- (Rupees Five Thousand only). You can either send in your request with payment via DD payable at New Delhi in favor of 'Winrock International India' or you can pay through credit cards.

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