

CHALLENGES IN BIODIESEL FEEDSTOCK & WAY FORWARD

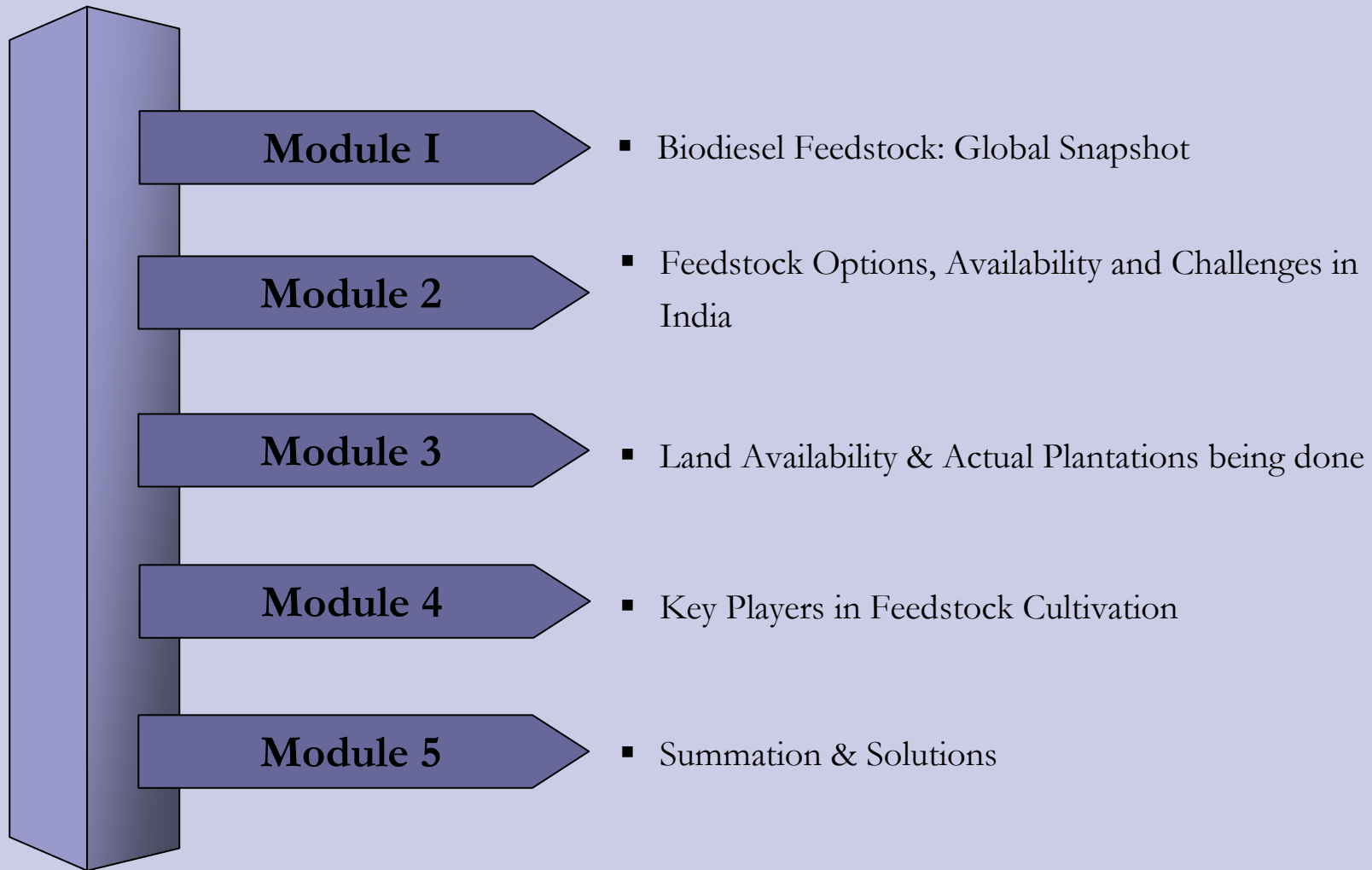
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FROST & SULLIVAN

February 1, 2008

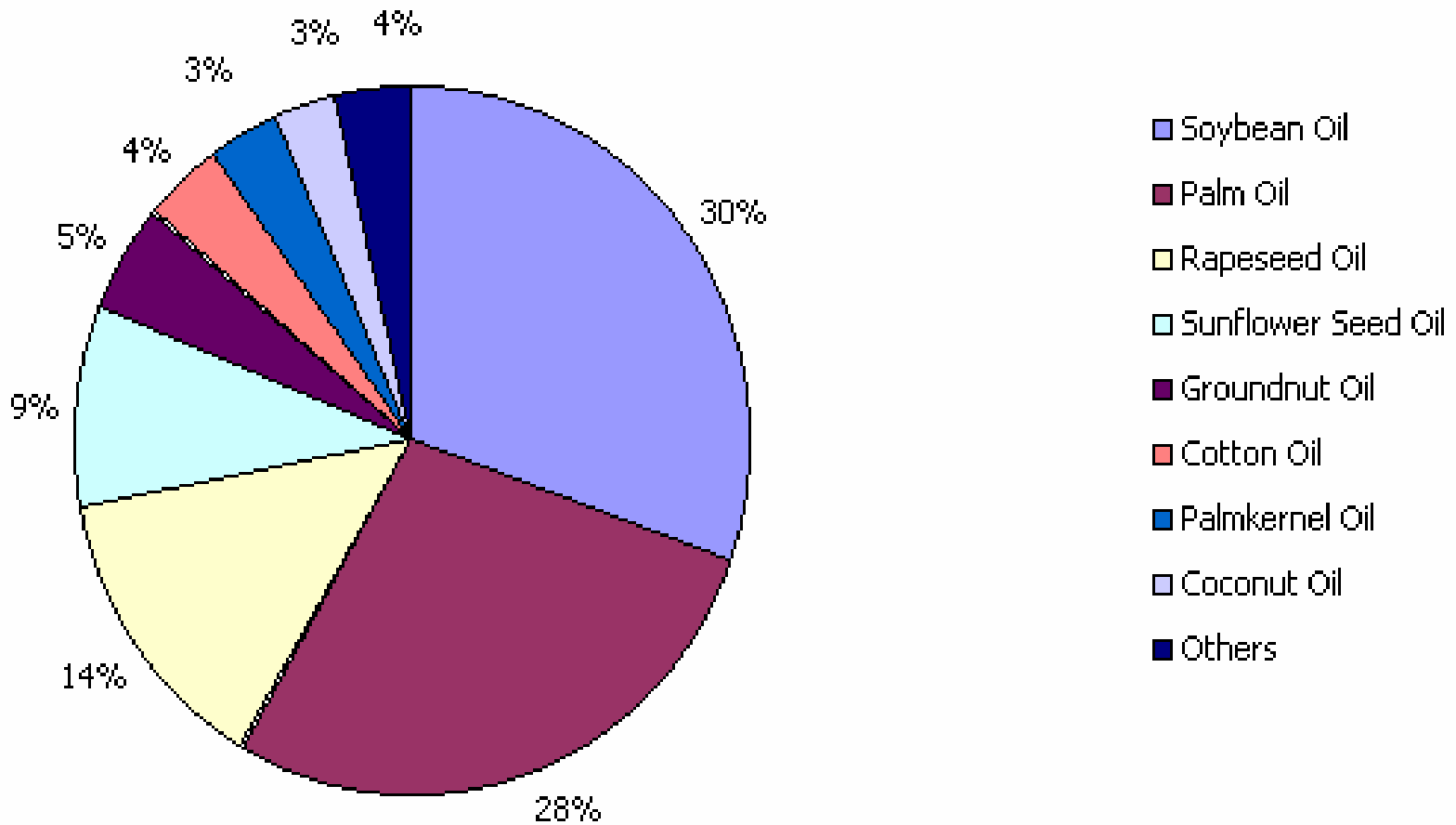


PRESENTATION FLOW



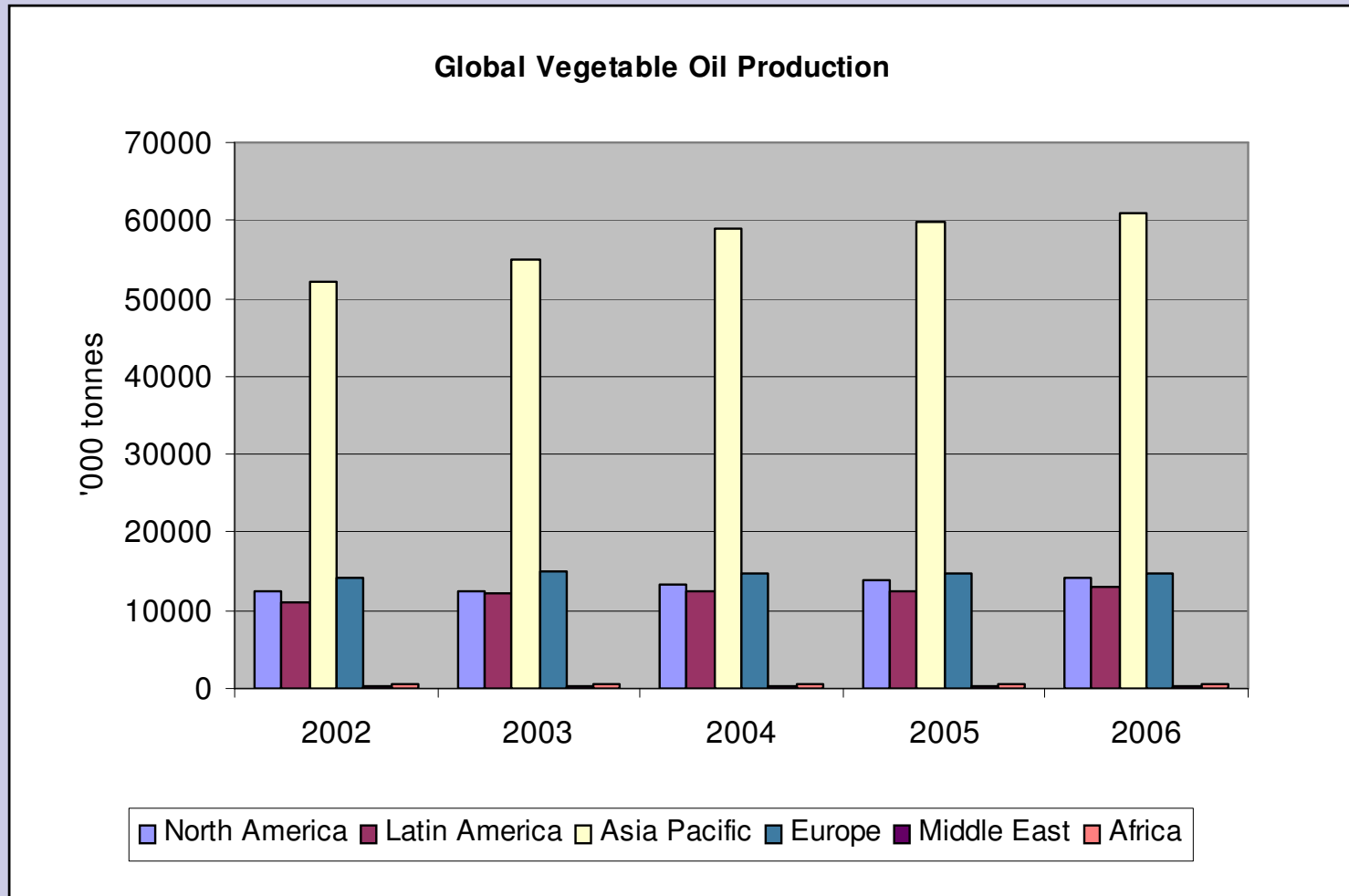


Biodiesel Feedstock – Quick Global Snapshot



102 million tonnes of vegetable oil available Globally – not much!

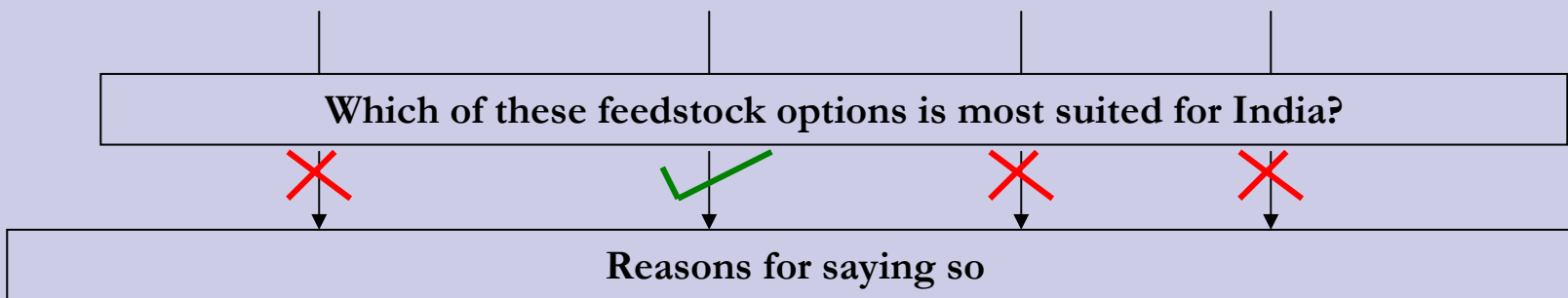
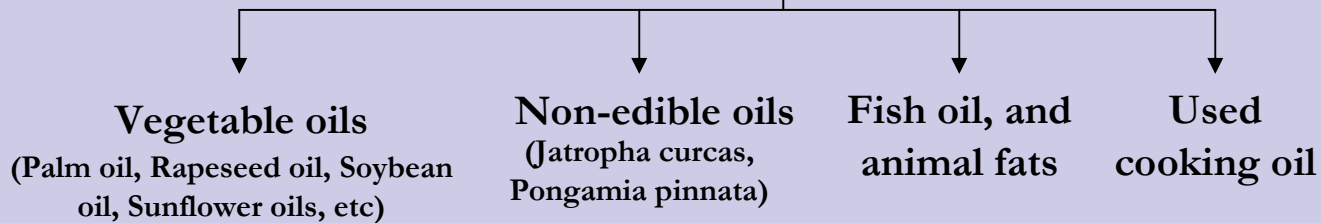
Global Biodiesel Feedstock Growth is Slow and Finite



102 million tonnes of vegetable oil – 102 million tonnes of biodiesel

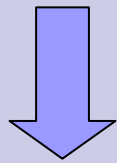
Feedstock Options for Biodiesel in India

Common feedstock options for biodiesel



India has always been a net importer of vegetable oils. (40-50% of requirement is met through imports). It's therefore not advisable for India's biodiesel program to depend on vegetable oils

Jatropha: Best suited for Indian scenario



Why Jatropha?

Although these 2 options are currently being used in India, supply chain and availability will be a serious question once large quantities of biodiesel are required. Moreover, these require additional purification, which adds to the cost. Currently, only temporary arrangements have been made for smaller quantities of biodiesel production

But why *Jatropha* specifically for India?

- The oil yield per hectare and yield per seed of *Jatropha* is among the highest for tree-borne oil seeds
- It can be grown in areas of low rainfall (200 mm per year), on low fertility, marginal, degraded, fallow and waste lands. Canals, roads railway tracks, borders of farmers' fields as a boundary fence/hedge in arid areas and even alkaline soils are appropriate for the crop.
This type of land is abundant in India
- *Jatropha* is easily established in nurseries, grows relatively quickly and is hardy
- *Jatropha* seeds are easy to collect as they are ready to be plucked before the rainy season and as the plants are not very tall
- *Jatropha* is not browsed by animals
- Being rich in nitrogen, the seed cake is an excellent source of plant nutrients.

Source: United Nation's assessment of the Biofuels industry in India, Oct 2006

Pongamia pinnata is also increasingly being considered as a viable feedstock option for India. Currently, Pongamia plantations are focused in the state of Andhra Pradesh

Feedstock Comparison

| | Jatropha | Pongamia |
|----------------------------|--|------------------------------|
| Maturity/fruiting | 2-3 years | 5 years |
| Plants/hectare | 2500 | 156-200 |
| Seed/plant | 2 Kg Avg (1-4 kg) | 15 Kg Avg (5-30 Kg per tree) |
| Seed yield/hectare | 5,000 Kg | 3,500 Kg |
| Oil yield/hectare | 1,750 Kg (30-40%) | 1,075 Kg (25-30%) |
| Tree height | 2 meters | 10 meters |
| Manufacturing costs | For both Jatropha and Pongamia: large scale (over 100 MT/day) is Rs 5/liter, and small scale (less than 10 MT/day) is Rs 10/liter, on an average | |

Currently used feedstock in India

| | | |
|---|-------------------|---|
| 1 | Palm oil | This is used only by Export Oriented Units (EOUs) that import palm oil from SE Asia |
| 2 | Jatropha/Pongamia | Currently used only at lab/pilot plant quantities due to unavailability of feedstock in the early stages of development |
| 3 | Used cooking oil | Primarily used by <u>Southern Online Bio Technologies</u> & <u>Nova Biofuels</u> |
| 4 | Fish oil | |
| 5 | Acid oils | Used by Garware Chemicals |

Biodiesel Costs from Different Feedstock

| | Imported crude Palm oil | Jatropha oil (at a seed price of Rs.12/Kg) | Jatropha oil (at a seed price of Rs.6/Kg expected after stabilization) | Pongamia (at a seed price of Rs. 12/Kg) | Rapeseed (domestically produced) |
|--------------------------------|-------------------------|--|--|---|----------------------------------|
| Net Production Cost (in Rs/MT) | 40,040 | 42,080 | 22,080 | 39,560 | 56,640 |
| Net Production Cost (in Rs/Kg) | 40 | 42 | 22 | 39.5 | 57 |

Only when sufficient quantities are available, which is the biggest challenge today!

Different Feedstock Availability in India

| | | |
|---|-------------------------|--|
| 1 | Crude Palm oil | Imports from Malaysia and Indonesia (Import duty on tariff is 45%) |
| 2 | Jatropha oil | Not feasible at the price stated earlier, till large volumes of feedstock is available. Prices are higher than Pongamia because of quicker gestation periods |
| 3 | Pongamia oil | Not feasible at the price stated earlier, till large volumes of feedstock is available. |
| 4 | Used cooking oil | Sufficient quantities not available in India currently. Has to be imported. Whatever is available is highly unorganized and passes through agents |
| 5 | Fish oil | Prices have gone up, unviable for biodiesel manufacturing. Fish oil manufacturers work through various levels of agents, and are concentrated in Goa, Kerala |



Biodiesel Demand & Jatropha Requirement

| | 2006-2007 (MT) | 2011-2012 (MT) | 2016-2017 (MT) |
|-------------------------------------|----------------|----------------|----------------|
| Demand for Mineral Diesel | 52 Million | 67 Million | 83.6 Million |
| Case 1: 5% blending mandate | 2.6 Million | 3.35 Million | 4.18 Million |
| Case 2: 10% blending mandate | 5.2 Million | 6.7 Million | 8.36 Million |

Source: Planning Commission

Biodiesel demand based on 5% and 10% blending

Growth in mineral diesel demand as per Planning Commission estimates

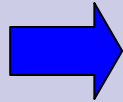
Based on estimated diesel growth rates of 5.6% in the 10th plan (2001-06), 5.0% in the 11th plan (2006-11) and 4.5% in the 12th plan (2011-16)

Land Availability & Plantation Scenario

Total Available Land: 153 Million acres (including both non-forest cultivable wastelands and degraded forestlands)

(in hectares)

To begin with, States Governments have pledged a total area of 1.72 Million hectares for Jatropha cultivation given alongside



| Sl. No. | State Area | Forest Area | Panchayat | Total |
|---------|----------------|---------------|---------------|----------------|
| 1 | Andhra Pradesh | 15000 | 160000 | 175000 |
| 2 | Assam | 25000 | - | 25000 |
| 3 | Bihar | 50000 | - | 50000 |
| 4 | Chattisgarh | 50000 | 51400 | 101400 |
| 5 | Gujarat | 49800 | - | 49800 |
| 6 | Haryana | 50000 | - | 50000 |
| 7 | Jharkhand | 6600 | 65400 | 72000 |
| 8 | Karnataka | - | 500000 | 500000 |
| 9 | Madhya Pradesh | - | 53000 | 53000 |
| 10 | Mizoram | 14000 | 12000 | 26000 |
| 11 | Rajasthan | 60000 | - | 60000 |
| 12 | Sikkim | 5000 | - | 5000 |
| 13 | Tamil Nadu | 50000 | - | 50000 |
| 14 | Uttaranchal | 500000 | - | 500000 |
| | Total | 875400 | 841800 | 1717200 |

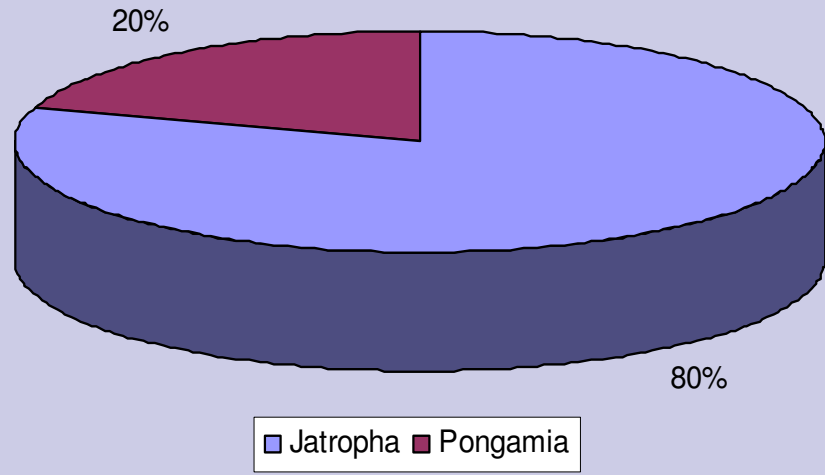
Source: Presentation made by D. Ramakrishnaiah (Director, MORD) at the Biodiesel Conference towards energy independence – focus on Jatropha (June 2006, Hyderabad)



Actual Plantations

Total area under cultivation in Acres (2007-08)

Pongamia plantations are in Andhra Pradesh



Jatropha plantations are in Madhya Pradesh, Chhattisgarh, North Eastern States, Rajasthan, Andhra Pradesh and Tamil Nadu

A Total of 1.235 Million Acres

This is just the Beginning! We have a long way to go!



Major Players in Feedstock Cultivation and Plantation in India

| Company | Feedstock cultivated |
|----------------------------|-----------------------|
| D1-BP Fuel Crops India Ltd | Jatropha |
| Mission Biofuels | Jatropha |
| Roshini Biotech Pvt Ltd | Pongamia |
| Nandan Biomatrix ltd | Jatropha and Pongamia |
| Emami Group | Jatropha |

Apart from few other players, most of the other plantations are initiatives taken by various state Governments (especially MP and Chhattisgarh which have been encouraging wasteland plantations for a few years now)

In Summation: Some Key Challenges

- Current selling price of biodiesel set by the Ministry of Petroleum & Natural Gas (MOPNG) is Rs 26.50/liter, which is low for biodiesel produced for sale to oil companies. However, once a complete National Policy on Biodiesel is issued, prices are expected to be revised upwards to accelerate the pace of substitution
- An optimum price should be such that it does not encourage a shift in cultivation pattern from food crops to energy crops on fertile land
- R&D on high yielding plant varieties and germ plasms of Jatropha are being pursued and yields vary from 0.3 MT to 1 MT per acre; this is likely to increase in near future
- As of now, less than 1% of total land available are utilized for Jatropha/Pongamia plantations. More and more companies are focusing on Jatropha plantations to sustain their feedstock availability owing to its gestation period being 2-3 years

Solutions: Focusing on Contract and Corporate Farming

Contract Farming

PROS

- Better control over returns on the investment, administration and operations
- Medium-low risk and initial investment with respect to feedstock
- Considerable investment in purchasing own land is avoided

CONS

- Considerable risk as the partner does not own the plantation
- Sufficient quantities of feedstock is expected to be available only in 2010

Corporate Farming

PROS

- Secure and assured availability of feedstock
- Complete control over all aspects of the value chain
- Can realize better margins due to lower feedstock costs

CONS

- Exit strategy will be difficult
- High level of investments, right from land purchase stage
- Administrative issues related to farming have to be taken care of by the parent company, thereby diluting the focus on manufacturing and marketing



The wasteland in India is estimated at 153 Million acres where non-edible crops like Jatropha and Pongamia can be grown. Even if plantations are grown on 10% of this land by 2016-17, Jatropha oil yield will be 11 Million MT – *adequate to cater to a 10% blending mandate of 8.36 MT as seen earlier*



THANK YOU



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