
Reliance Biodiesel Initiative



12th March, 2007

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- ❖ Biofuels – Global Perspective
- ❖ Reliance Perspective
- ❖ Fundamentals
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Biofuels



Positives

- ❖ Large market opportunity
- ❖ Alternative energy resource
- ❖ Integrated farming operations (plant tissue culture, produce for retail, energy)
- ❖ Reduces dependence on Middle East to some extent
- ❖ Puts income in the hands of farmers
- ❖ Helps reduce gaseous emissions
- ❖ Potential to revolutionise value of marginal lands/water resource usage

Concerns

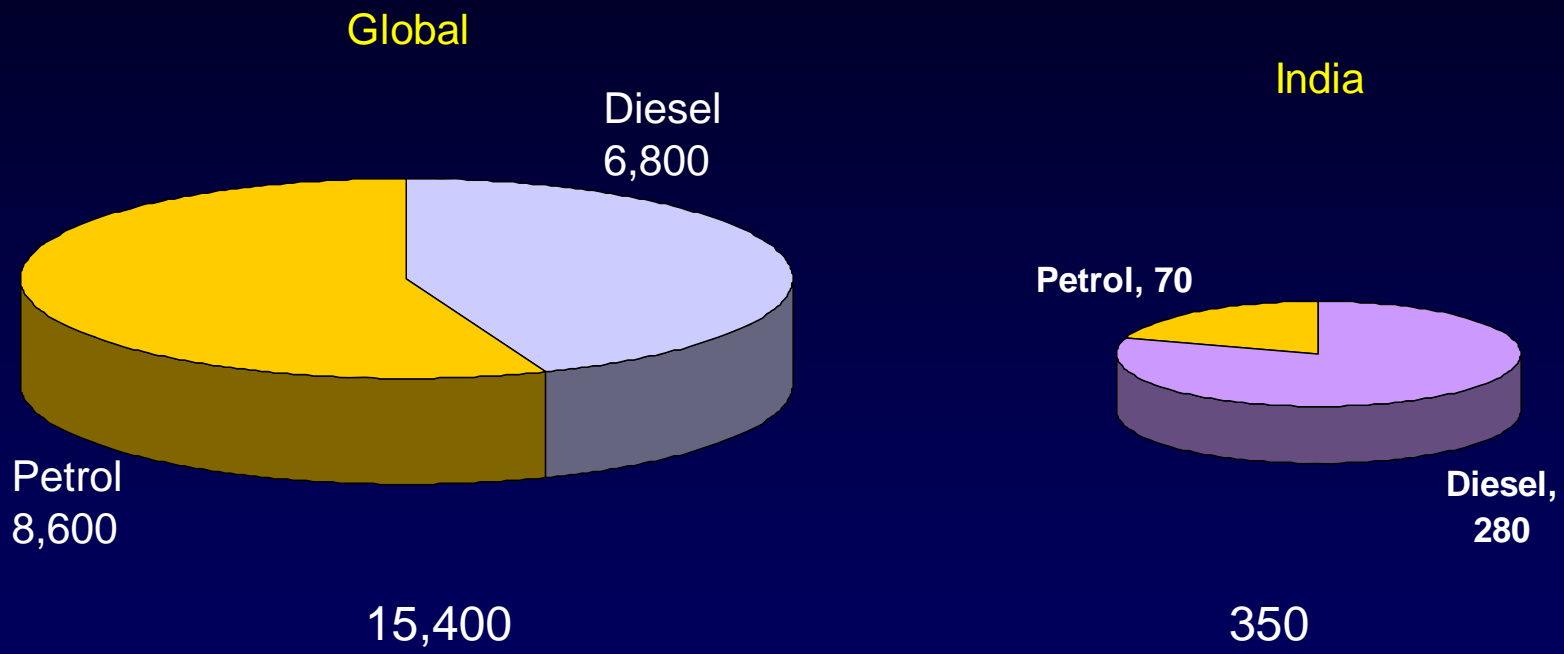
- ❖ Supply logistics from scattered farms
- ❖ Requires vast tracts of land
- ❖ Deprives alternate use for feedstock
- ❖ Needs Government fiscal support
- ❖ Needs change in engine design (petrol)
- ❖ Subject to large agricultural market price swings
- ❖ Socio-political issues

*High crude oil prices, dependence on middle east and creation of wealth for farmers are key considerations for the biofuels initiative.*⁴

Global Fuel Market Opportunity



Transportation Fuels Consumption (2003)
(Million barrels/year)



Global market for automobile fuels estimated at USD 600 billion.

Biofuels can be a USD 60 billion opportunity, based on 10% substitution.

Global Biofuels Market



Figures in Billion Gallons

Region	2006	2020	CAGR
North America	4.3	30	15%
Europe	1.1	20	25%
South/Central America	4.2	7	5%
Asia	1.7	30	25%
Total	11.3	87	

Source : Goldman Sachs

Current market penetration very is low. Asia Pacific (India and Australia) are expected to show highest growth rate for biofuels.

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Milestones



- ❖ Product must meet fuel quality standards
- ❖ Ensure cost competitiveness with conventional fuels
- ❖ Focus on socially non-disruptive biomass raw material - non-food, non-cattle fodder, less-compostable biomass
- ❖ Sustainability considering water and land availability

Quality, Sustainability and Cost Competitiveness must be the drivers

Biodiesel Raw Material Options



- ❖ Food-based
 - ❖ Sunflower
 - ❖ Rapeseed
 - ❖ Mustard
 - ❖ Palm
 - ❖ Others (Tallow, Soy)
- ❖ Non-food based
 - ❖ Jatropha
 - ❖ Karanja
 - ❖ Waste grease and oils

Non-food raw material options more relevant in Indian context

Biodiesel Feedstock Comparison



Raw Material	Iodine Number	Cold Flow Pour Point Deg C
EU Standard	Max 120	-12 *
Rapeseed Oil	107	-15
Jatropha Oil	102	-5
Sunflower Oil	133	-8
Soya Oil	141	-3
Coconut Oil	10	0
Palm Oil	53	11
Beef Tallow	47	16

Source : Morgan Stanley
 * CFPP not fixed

Properties	Unit	Diesel	Biodiesel
Density	Kg/L	0.845	0.880
Heating value	MJ/Kg	44.2	39.9
Cetane Number		48	55
Viscosity	Sq. mm/sec	2.7	4.3
Flash Point	Deg c	80	147
Solidification Point	Deg C	-14	-3

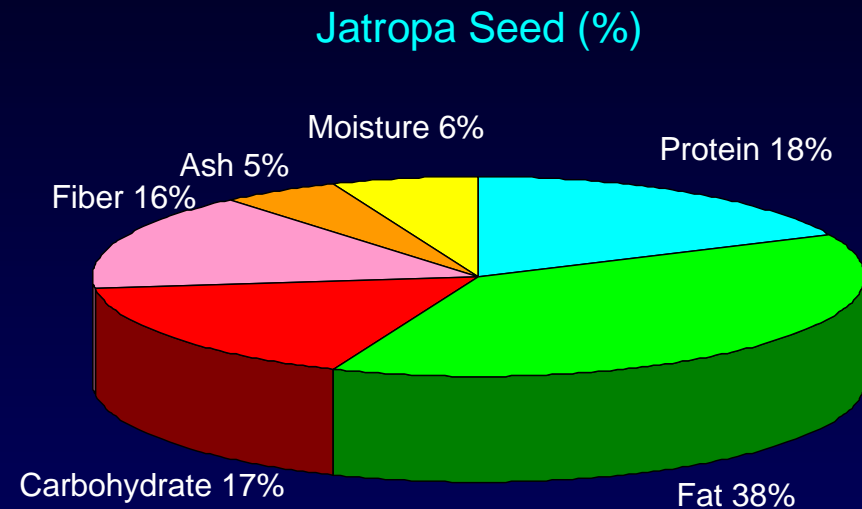
Source : Schrimppf 2002

From a product quality standpoint, after rapeseed oil, Jatropha oil is best suited for making Biodiesel

Jatropha – the best fit



- ❖ Usable biomass 33% of seed
- ❖ Fermentable sugars yield 22% of seed
- ❖ Bioethanol yield 11% of seed
- ❖ Biobutanol 7% of seed



Jatropha is an excellent raw material for Biodiesel

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First Principles



- ❖ **Ecologically sustainable**
- ❖ **Not taxing the food chain**
- ❖ **Partnership with Producers**
- ❖ **Revegetate Marginal Lands**
- ❖ **Optimise biomass production and utilisation**
- ❖ **Utilise all byproducts**

Bio Diesel not at cost of food, but for more value from land

Vision



Evolve a unique end to end business model for biodiesel that will ensure constant, adequate and best quality supply at optimal costs on one hand and maximize returns for producers on the other

Business Model of Seed to Seed Oil will ensure best realisation at all levels of value chain

Mission



By 2015 the entire value chain from seed production to oil extraction and transesterification process will be in place to produce 1 million tonnes of biodiesel.

1 million tonnes of biodiesel by 2015

Objectives



- ❖ To respond to the global biofuels requirements by creating viable business model
- ❖ Create a niche by developing unique end to end solutions optimizing time and resources
- ❖ Holistic approach for including multiple biofuels like bio-diesel, Bio ethanol, Bio Butanol, etc.
- ❖ Develop superior varieties through metabolic engineering
- ❖ Establish coalition with farmers for production

Establish workability of all streams of biodiesel

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Farm Operations



- ❖ Development of Hybrids & High Yielding Varieties (HYV) to maximize the per hectare oil yields.
- ❖ Large scale multiplication of elite plant material for distribution to growers.
- ❖ Development of R&D plantations for Agronomic practices, Development of Nutrient & Pest management regimes and Development of inter-crop combinations to maximize revenue per unit area.
- ❖ Development of commercial plantations both own and with HNFs with high investment, high input and high yield regime to de-risk the raw material supply to the processing units.
- ❖ Develop models for seed / seed oil procurement based on qualitative procurement parameters

Reliance is committed to holistic management of Jatropha as a commercially viable crop

Farm Advocacy - Design



- ❖ Engage with Marginal Farmers to adopt Jatropha on Marginal Lands
- ❖ Create local stake holding
- ❖ NGO Collaboration
- ❖ Bring in potential financing
- ❖ Human Resource

Focus on creating an opportunity for Marginal Farmers and Marginal Lands

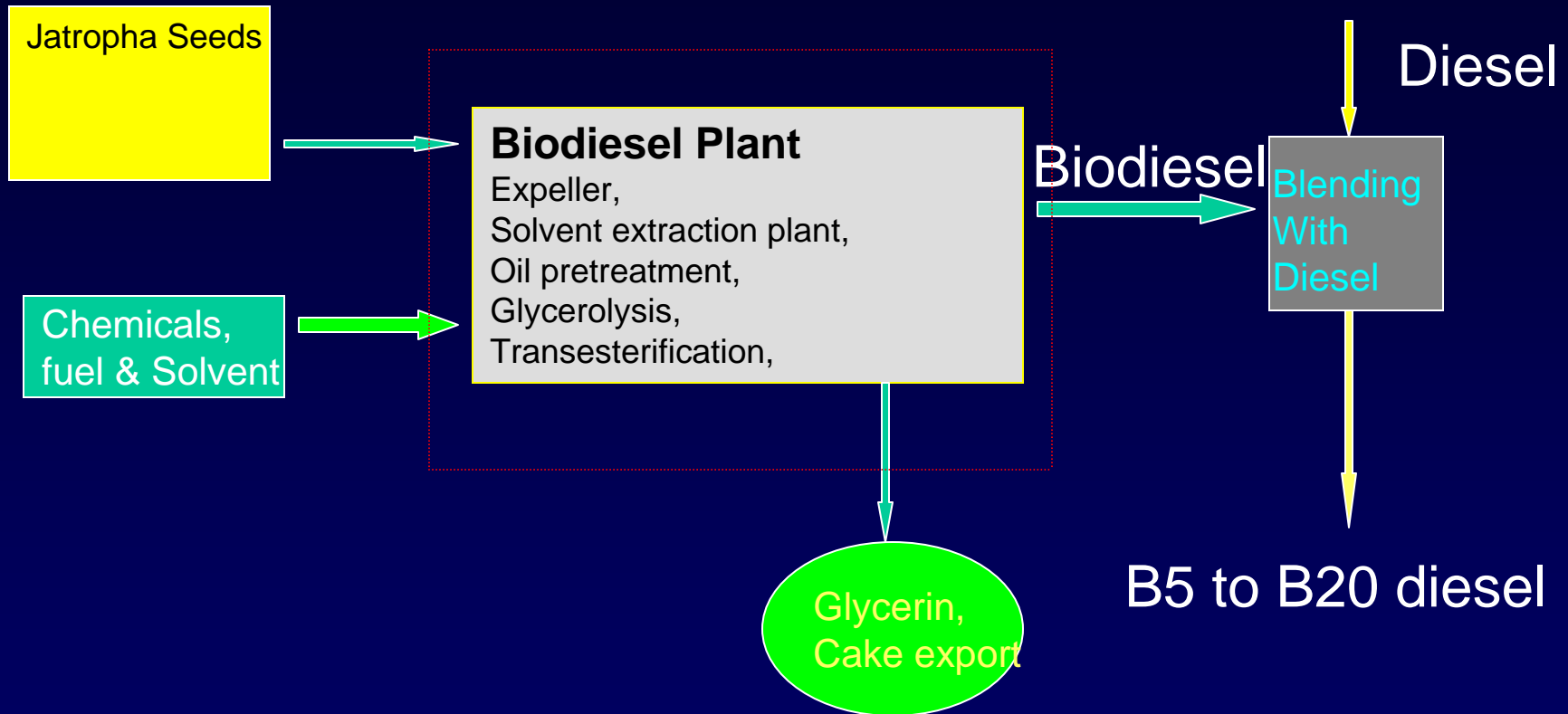
Farm Advocacy - Strategy



- ❖ Establish appropriate agronomy for marginal farmers on marginal lands
- ❖ Establish economically viable model both for Marginal Farmer and Reliance
- ❖ Establish holistic approach through links for other produce too
- ❖ Establish producer stake-holding

Establish Jatropha as a most favoured option for farming on marginal lands

Biodiesel Plant and Processing

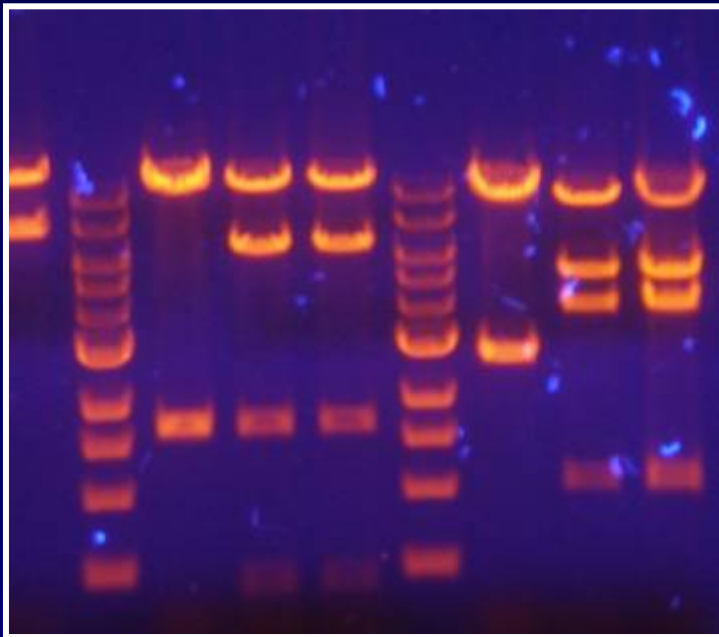


Reliance engagement in biofuels is from seed to seed oil to biodiesel for consumers

Jatropha Molecular Cloning



- ❖ Generation of genetically altered *Jatropha curcas* plants with high oil content
- ❖ Development of robust and commercially viable method for micropropagation of *Jatropha* plants in vitro.



Transgenic *Jatropha* could provide the cutting edge

Jatropha Tissue Culture



- ❖ **Direct plant regeneration is an initial step in generation of transgenics**
- ❖ **Convenient method of gene transfer is through Agro bacterium and regeneration of transgenics thru leaf disc regeneration**
- ❖ **Successful in induction of adventitious buds from leaf discs.**



1. Microbial production of Butanol

To economically produce butanol by microbial fermentation using renewable feedstock's

2. 1,3 –propanediol from glycerol, a byproduct of biodiesel plant

To effectively utilise glycerol, the byproduct of biodiesel process for production of biopolymer

Enzyme Technology



Low cost ethanol & butanol production from jatropha seed cake using enzyme technology

- ❖ **Establishment of enzyme based process for conversion of jatropha seed cake into bio-ethanol / bio-butanol.**
- ❖ **Low-cost, biomass specific, efficient cellulase and glucoamylase production.**

Focus on developing low cost Enzymes

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Challenges



- **Quality Planting Material**
- **Perfecting Jatropha Agronomy on marginal lands**
- **Integrating Jatropha into existing farming systems**
- **Mutuality between Reliance and Farmers**
- **By-products**
- **Systems and Processes to scale up and Scale out**

Perfecting “How to do” rather than “what to do”

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Forward Path



- Develop elite planting material in the short term
- Generate transgenic *Jatropha* in the mid term
- Optimise productivity in marginal lands in the long term
- Institutionalise farmer engagement and establish mutuality
- Link byproducts to best markets
- Optimise processing efficiency
- Keep cost of production competitive

Make Biodiesel a viable business model for each part and as a whole too



Thank You