



# **Biomass Strategies for Aligning Sustainable Development and Climate Goals**

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# MDG, India's National Targets, Biomass and Climate Change

MDG and global targets	India's National plan targets	Interface with Climate Change
<p><b>Goal 1: Eradicate extreme poverty and hunger</b></p> <p>Targets: Halve, between 1990 and 2015, the proportion of people with income below \$1 a day and those who suffer from hunger</p>	<p>Double the per capita income by 2012</p> <p>Reduce poverty ratio by 15% by 2012</p> <p>Contain population growth to 16.2% between 2001-2011</p>	<p>Bio-energy can enhance rural income, substitute oil imports and enhance mitigative &amp; adaptive capacity</p> <p>Lower population reduces pressure on land, water and energy consumption</p>
<p><b>Goal 7: Ensure environmental sustainability</b></p> <p>Targets: Integrate SD principles in country policies/ programs to reverse loss of environmental resources</p> <p>Target: Halve by 2015 the proportion of people without sustainable access to safe drinking water</p>	<p>Increase in forest cover to 25% by 2007 and 33% by 2012 (from 23% in 2001)</p> <p>Sustained access to potable drinking water to all villages by 2007</p> <p>Electrify 80,000 additional villages by 2012 via decentralized sources</p> <p>Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012</p>	<p>Enhanced sink capacity; energy security due to substitution of fossil imports; reduced pressure on land, resources and ecosystems</p> <p>Better quality of life and adaptive capacity due to access to electricity, enhanced supply of clean water, health &amp; education in rural areas</p>





## Modern Biomass Fuels and Technologies

### Comparative Advantages of Commercial Biomass

- *Decentralized Applications (e.g. remote areas)*
- *Local Employment*
- *Environment*

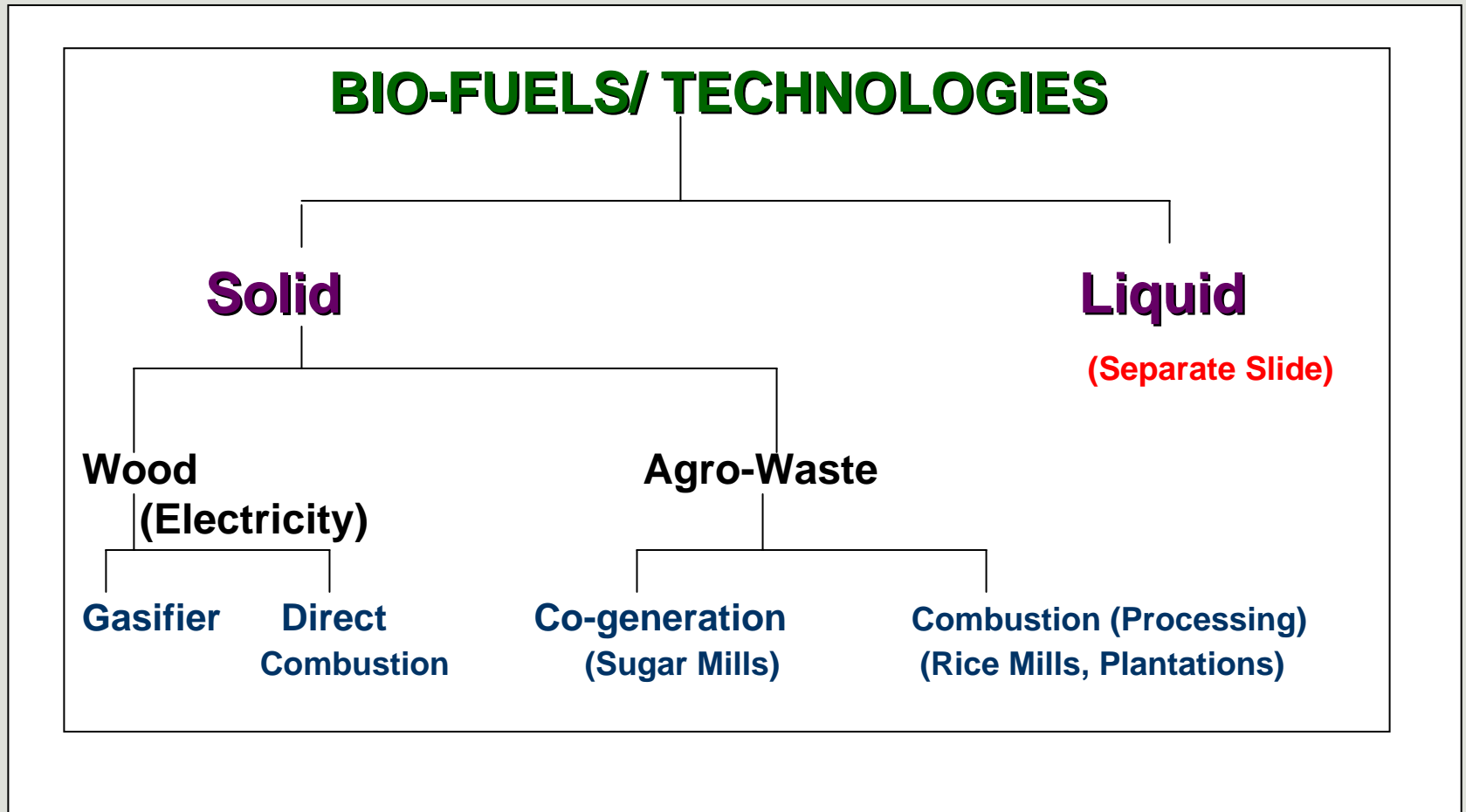
### Factor Supply and Productivity

- *Land Supply (?)*
- *Labor (+)*
- *Technology developments*
  - ✓ *Gasifiers*
  - ✓ *Liquids (e.g. Ethanol)*
  - ✓ *Increasing scale in direct combustion*
  - ✓ *Co-generation*



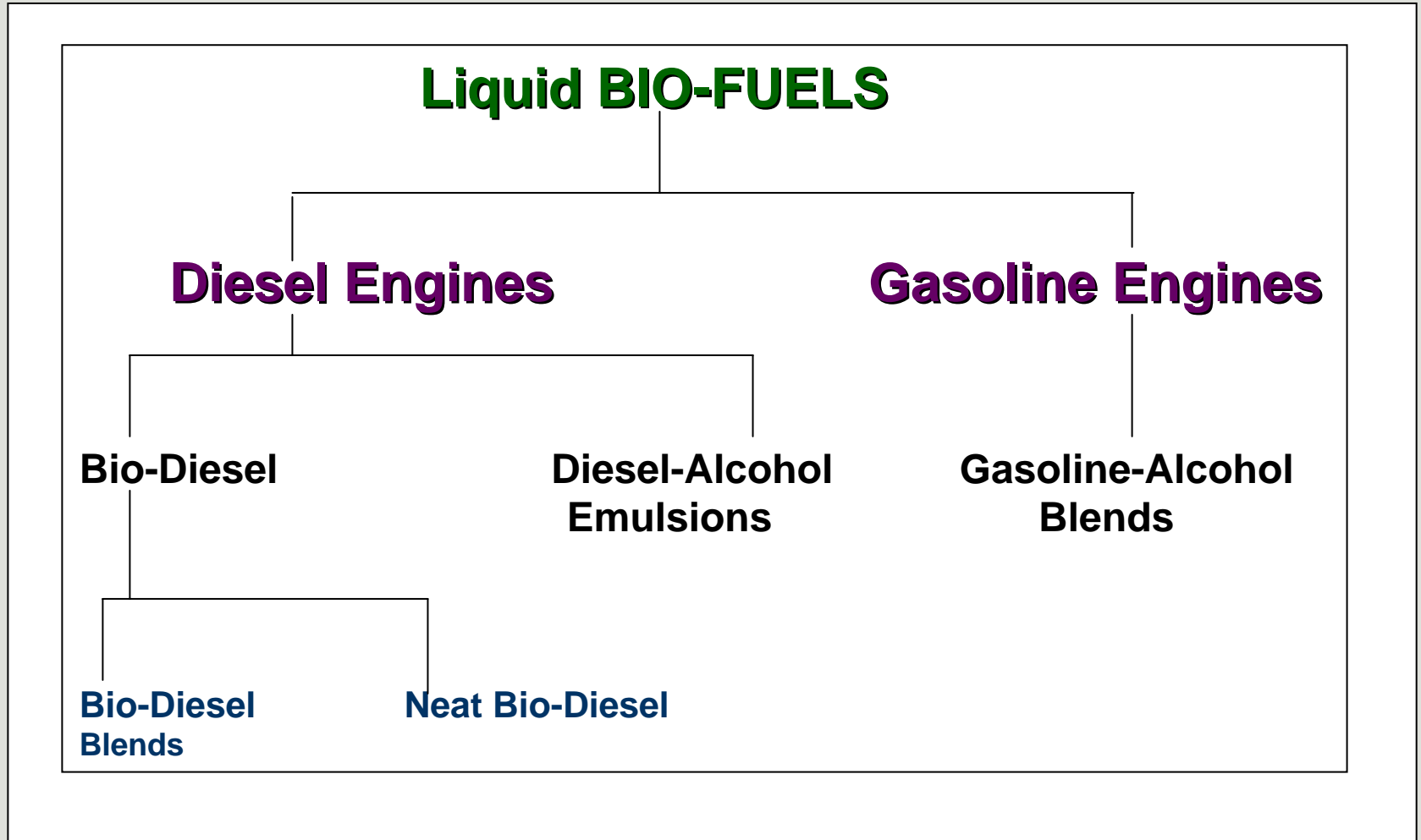


# Modern Biomass Fuels and Technologies





# Modern Biomass Fuels and Technologies





## Biomass Gasifier

- **Niche & Decentralized Applications**
- **MW Size Equipments**
- **Technology R&D and Manufacturing in India**
- **Economics and supply-chain not yet favorable**

### Gosaba Island, Sunderbans

- **500 kW, 5 x 100 kW AG series Gasifiers**
- **Supplying 800 households**
- **Managed by Rural Energy Co-operative**
- **No Disruption till date**



*Source: MoP, 2004*







# Bagasse Based Power Generation

- **Installed Capacity: 632 MW (March 2005)**
- **50 MW Size Projects**
- **Introduction of High Pressure Technologies in some Sugar Mills**
- **CDM Projects**



Source: MoP, 2004





## Indian Experiences with Ethanol

- India Imports 70% of oil demand - annual 120 Million ton in 2004
- Subsidized petroleum products
- Ethanol introduced as a Gasoline Mix (5-10 %) in 1980's
- Mandatory use of 5 % blend in 9 states in 2001-2
- Large number of experimental studies
- Scientific studies conducted with auto industry
- Blend increased to 10%
- Crisis of Ethanol Supply in 2004
- Price of Ethanol?
- Relaxation of blending - down to 5%







## Bio-Diesel: Energy vs. Food Security

### Energy Security

- *High oil imports contributes to balance of payment/ trade deficit*
- *Oil subsidies is a major contributor to budget deficit*
- *Rising oil demand @ 6% annual growth rate*

### Food Security:

- *2.4% of Global area; 16% of population & 17% of cattle*
- *India is amongst the largest importers of edible oil*
- *Where do we find the oil for bio-diesel?*
- *Sustainable source of vegetable oil is to be found before we can think of bio-diesel*





## Bio-Diesel: Development and Climate

### Development

- *Bio-diesel production in wasteland may help land restoration*
- *High rural employment potential in seed production and oil extraction*
- *Energy security and improved balance of payment would enhance investments due to reduced risks*

### Climate:

- *Sustainable seed production can mitigate carbon emissions in oil substitution*
- *Rural Income can enhance adaptive capacities*





## Preferred Material of Choice: JATROPHA?

**Jatropha (*Jatropha curcas*, Ratanjyot, wild castor) thrives on any type of soil**

- *Needs minimal inputs or management; Propagation is easy*
- *Has no insect, pests & not browsed by cattle or sheep*
- *Can survive long periods of drought*
- *Yield from 3rd year onwards, continues for 25-30 years*
- *25% oil from seeds by expelling, 30% by solvent extraction*
- *The meal after extraction an excellent organic manure*

**Waste or degraded land in India are estimated at 65 million hectares**





## Jatropha Plantation in India



## Jatropha plant



## Jatropha plantation on reclaimed desert using sewage waste water in Middle East





## Indian Mission on Bio-diesel

### Phase I (2003-07): Demonstration Projects

- *Plantation on 400,000 hectares of land*
- *Seed Collection*
- *Oil Extraction*
- *Transesterification*
- *Blending*
- *Marketing*

### Phase II (2007-2012)

- *Self Sustaining Expansion of Biodiesel*
- *One hectare plantation likely to produce 3.75 MT of seed, yielding 1.2 MT of oil*





## Employment & Income Estimates

- **Estimated diesel demand in 2007: 52.33 MT**
- **5% blend would require 2.62 MT Bio-diesel**
- **Plan for 2.2 million Ha area to be brought under Jatropha plantation by 2007**
- **Additional Employment opportunities for 2.4 million**
- **Employment opportunities to rise to 12 million by 11th plan (2012) for 20% bio-diesel blend**
- **Seed yield of 4 MT / Ha, gives farm income of Rs. 20,000 per Ha per year from waste lands with minimum support price of Rs. 5 per kg of seeds.**
- **Secondary employment in oil extraction plants**







# Bio-diesel vs. Diesel Emissions

**B100: Pure bio-diesel**

**B20: Mixed bio-diesel (20% bio-diesel and 80% petroleum diesel)**

Emissions	B100	B20
<b>Regulated Emissions</b>		
Total Unburned Hydrocarbons	-93%	-30%
Carbon Monoxide	-50%	-20%
Particulate Matter	-30%	-22%
NO <sub>x</sub>	+13%	+2%
<b>Non Regulated Emissions</b>		
Sulphates	-100%	-20%
Polycyclic Aromatic Hydrocarbons (PAH)	-80%	-13%
NPAH (Nitrated PAHs)	-90%	-50%
Ozone Potential of HC	-50%	-10%
<b>Life Cycle Emissions</b>		
Carbon Dioxide	-80%	
Sulphur Dioxide	-100%	



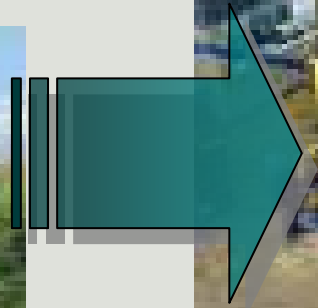


## Biotechnology

*...modern commercial biomass energy*



e.g. Switchgrass



Biorefining



**Bio  
Fuels  
Gas  
Solids**

*...bio-hydrogen*





## Biomass-Energy Crops



Hybrid Poplar



Switch Grass





# Grand Challenges for Biology, Payoffs for the Nation





# The Biomass Future

What is biomass?

- Waste products
- Farm & forest residues
- Commercial biomass crops

