

# Biofuels Potential in India: Technology and Policy Issues

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# Research engagement in CTARA, IITB

- Production of biofuels and nutraceuticals from horticultural processing waste
- Impact of biofuels production on water resource availability in India
- Exploration of value added products from agricultural residues (Example: areca nut husk)
- Food Security in India: Impact of post harvest losses
- Study of impact of biomass based rural energy projects on local contexts

# Energy Issues

- Increased world demand for limited oil supply
- Growing need to identify sustainable source of domestically produced energy supply
- Energy is connected to economic development, livelihood, environmental health and safety

# Consumption of petroleum products in India

- Transport (Petrol, Diesel, CNG, Aviation Fuel) : 51%
- Industry (Petrol, Diesel, Fuel Oil, Naphtha, Natural Gas): 14%
- Domestic (LPG and Kerosene): 18%
- Agriculture (Diesel): 4%
- Others: 13%

# Biorefinery: Multiple Products



## Biomass Feedstock

- Grasses
- Agricultural Crops
- Agricultural Residues
- Animal Wastes
- Municipal Solid Waste

## Conversion Processes

- Enzymatic Fermentation
- Acid Hydrolysis/Fermentation
- Gasification
- Combustion

## Products

### Fuels:

- Ethanol
- Biodiesel
- Hydrogen

### Power:

- Electricity
- Heat

### Nutrient recovery

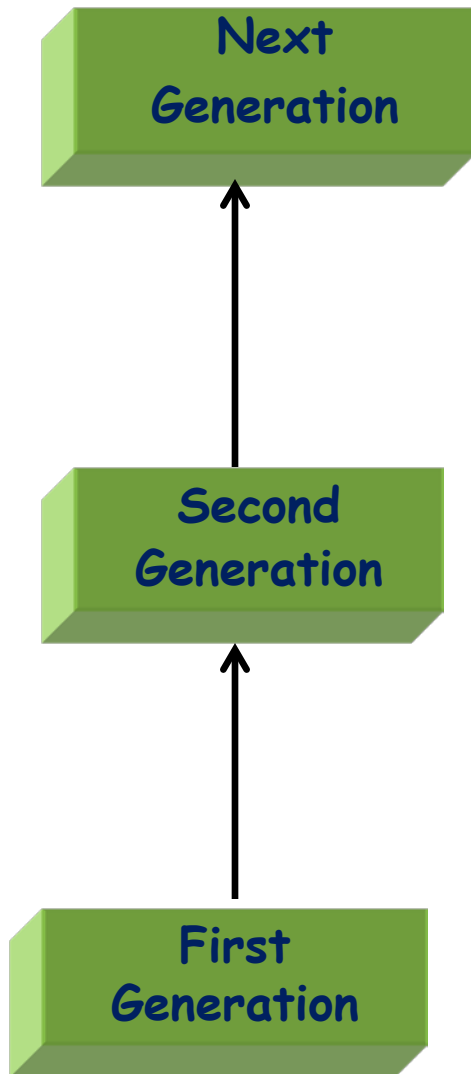
- Amino acids
- Proteins
- Nutraceuticals
- Cell mass

### Chemicals

- Plastics
- Solvents
- Adhesives
- Furfural
- Fatty acids
- Acetic Acid
- Lactic acid

*Adapted from NREL*

# The Biofuel Generations



- Algae based biofuels
- Biobutanol
- Bio-hydrogen
- Bio-dimethyl ether

*Cutting edge technologies - require R&D intervention*

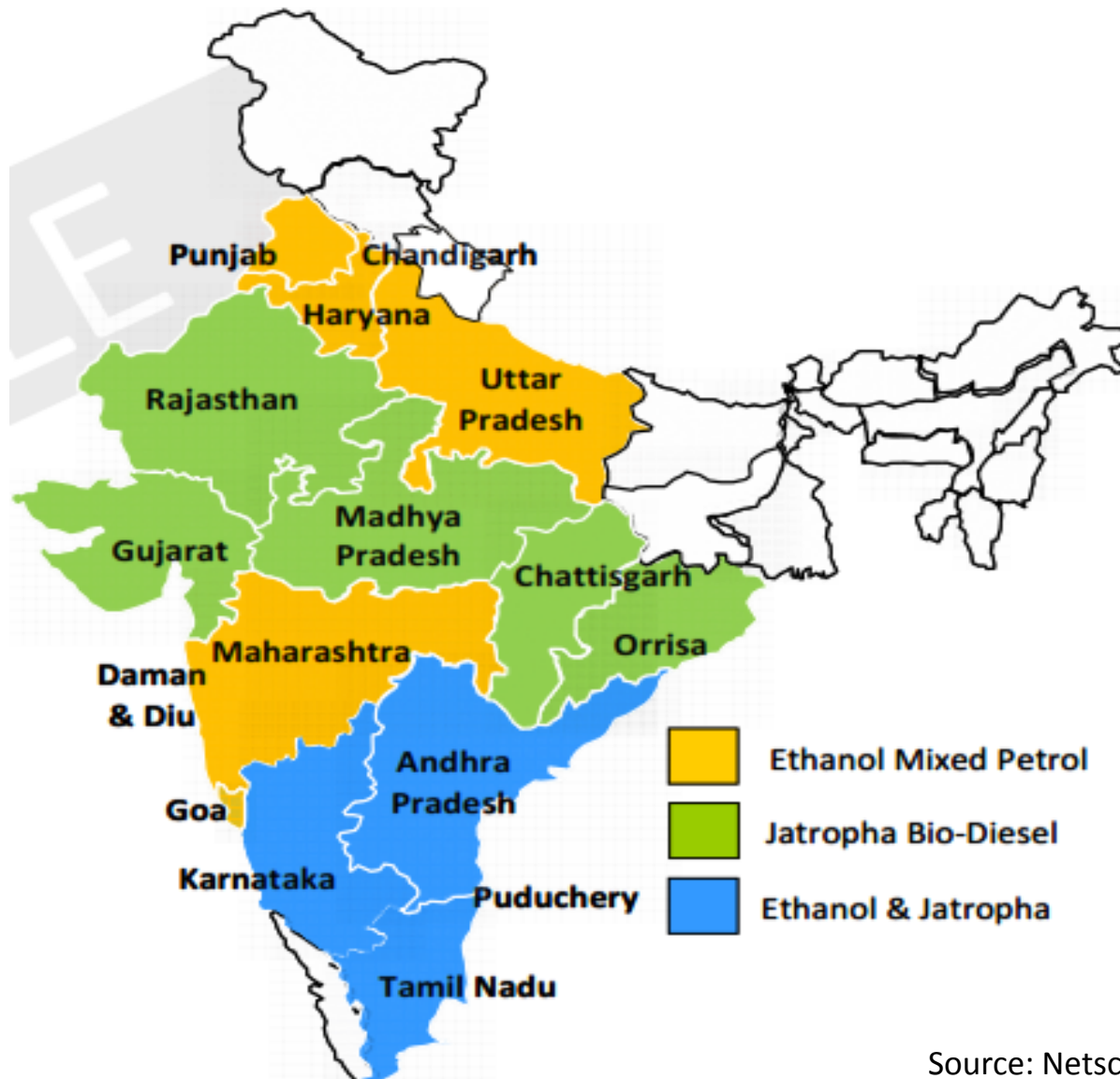
- Lignocellulosic feedstocks to ethanol

*Many at Pilot plant or demonstration stage*




- Biodiesel from Jatropha
- Bioethanol from sugar and starchy crops




*Established technology, already commercialized* 6

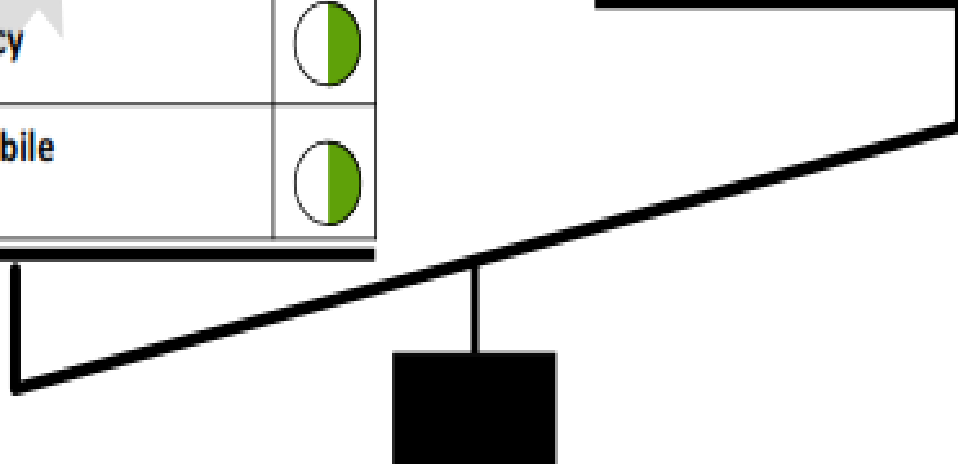
# Production Distribution of Biofuels



# Drivers and Challenges

<i>Drivers</i>	
Increasing energy demand and rising oil prices	
National Bio-fuel policy	
Support from automobile manufacturers	

<i>Challenges</i>	
Raw material supply constraints	
Food vs. Fuel	
Lack of Cost Competitiveness	

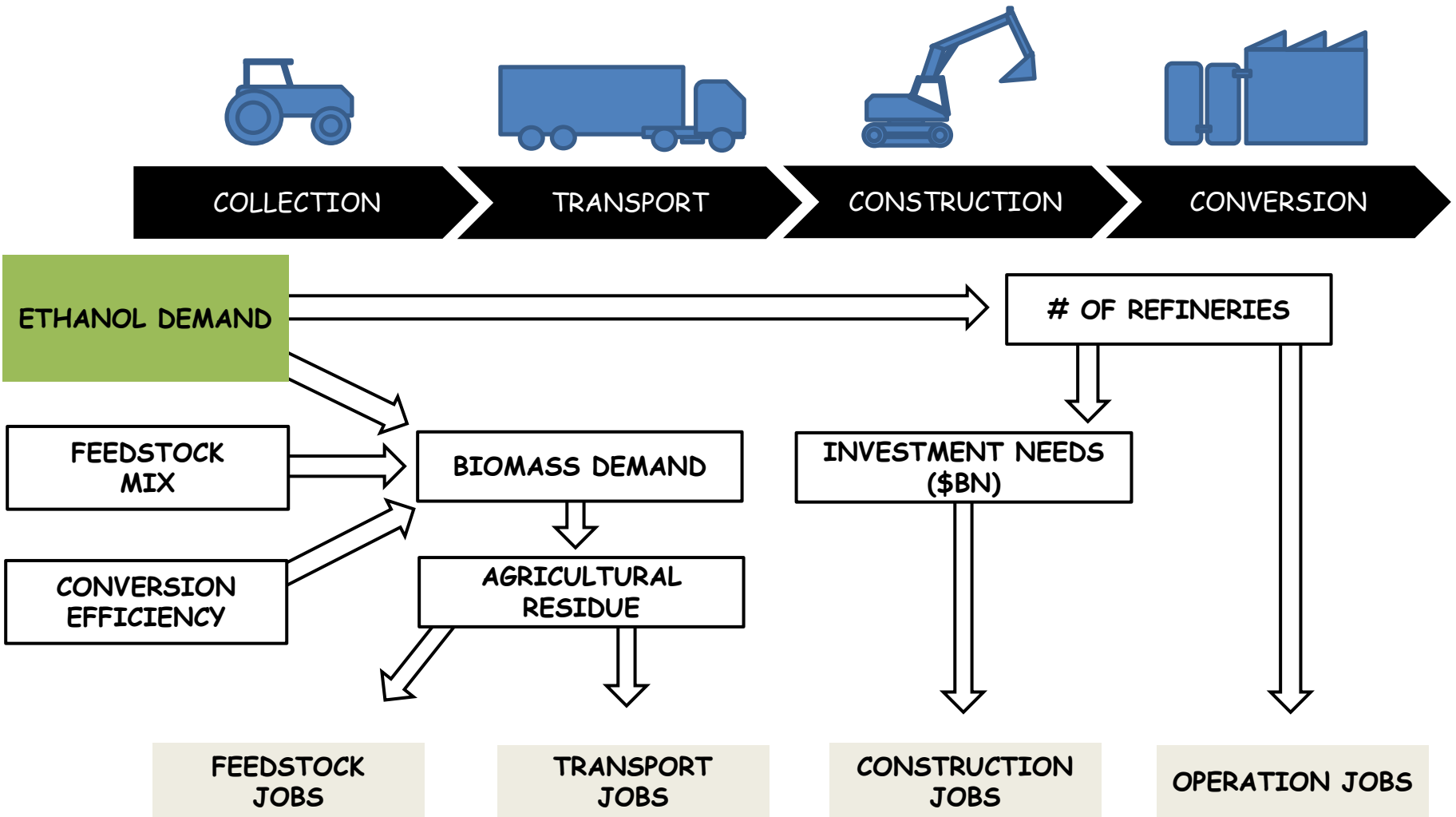




# National Biofuels Policy (NBP)

- Target: 20% blending of biodiesel and bio-ethanol by 2017.
- Effort to stimulate rural development and create employment opportunities
- Environment protection
- Derive bio-fuel from non-food sources

# NBP and Job Creation Scenario

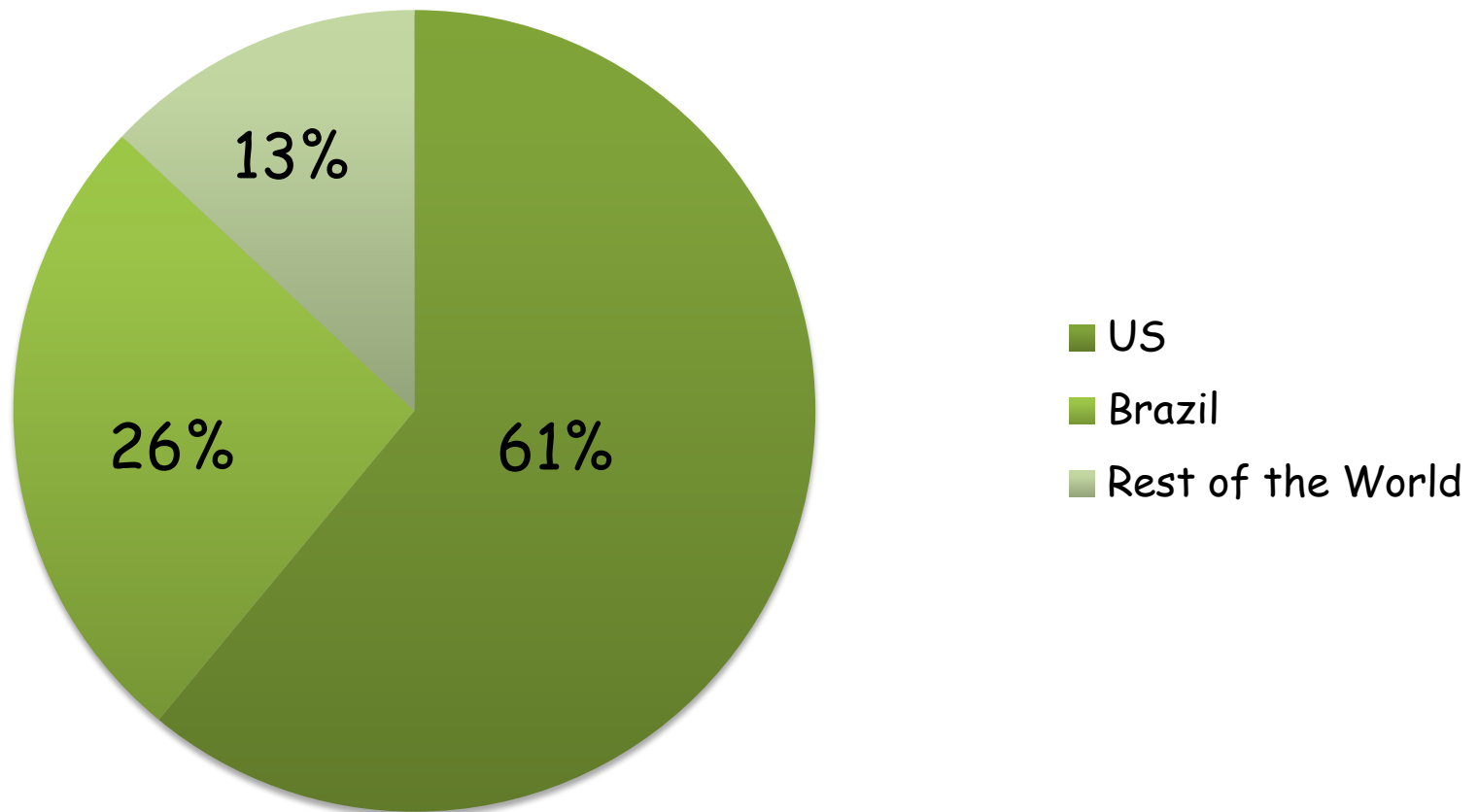


# NBP-A Reality Check

- 20 per cent blending for both bioethanol and biodiesel has been proposed, to be achieved by 2017
- A 10 percent ethanol blending for motor gasoline is supposed to be mandatory from October 2008
- Till date, biodiesel blending is not mandatory in India
- Deriving biofuels from non-food sources

# Bioethanol Production

Global fuel ethanol production in 2012 : 83 billion liters



# Challenges in Bioethanol Production

- Feedstock Availability
- Land Availability (Food Vs Fuel ?)
- Supply Chain issue
- Availability of labor
- Water
- Costs

# Biodiesel Production

# Biodiesel Potential

## Strengths

- Alternate fuel source
- Energy security of the country
- Less GHG emissions, environment friendly
- Higher Cetane number and better lubricating effect for biodiesel

## Opportunities

- National Biodiesel policy
- Keen interest of private players
- R&D across the sector
- Less dependency on depleting fossil fuels

## Weaknesses

- Wasteland requirements
- Need for engine modifications in higher blends
- Market still in nascent stage
- Still in field trial stage in India

## Threats

- The discovery of huge gas reserves in India may push biofuels on the backfoot
- Food vs. fuel debate
- Cost effectiveness of Biofuels
- Raw material

<b>Wastelands in India</b>		<b>Million hectares</b>
1	Gullied and/or Ravenous land*	1.90
2	Land with or without scrub*	18.79
3	Waterlogged and Marshy land	0.97
4	Land affected by Salinity/Alkalinity	1.20
5	Shifting cultivation*	1.88
6	Under-utilised/Degraded Notified Forest land*	12.66
7	Degraded pastures/grazing land*	1.93
8	Degraded land under plantation crops*	0.21
9	Sands (riverine/coastal/desert)	3.40
10	Mining and Industrial Wasteland	0.20
11	Barren rocky area	5.77
12	Steep sloping areas	0.91
13	Snow covered and/or Glacial area	5.43
<b>Total wastelands</b>		<b>55.27</b>
<b>Wastelands suitable for jatropha cultivation</b>		<b>37.38*</b>

Notes: The categories with asterisk sign above are suitable for jatropha cultivation in India.

Source: Department of Land Resources, 2005; GOI, 2005 and TERI, 2005 cited in Biswas, Pohit and Kumar (2010)



# Process Water Requirement for 20% biofuel blend

## Biomass to Ethanol

6-10 L H<sub>2</sub>O/L EtOH

2.2 billion liters Ethanol

~13-22 billion liters H<sub>2</sub>O

## Biodiesel from Jatropha Oil

0.8-2.0 L H<sub>2</sub>O/L Biodiesel

13.6 billion liters Biodiesel

~11-27 billion liters H<sub>2</sub>O

# To Conclude...

- Massive mobilization of resources is essential for meeting NPB 2017 target
- Commercialization will require long term commitments and government support
- Extensive R&D is needed for yield improvement, new feedstocks, new processing technologies with minimum water footprint
- With govt. support and coordination with all players in R&D, agriculture, forest, processing and marketing, biofuels could help achieve NPB goals to a great extent in coming years