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ENERGY, CLIMATE
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Biofuel Scenarios for India

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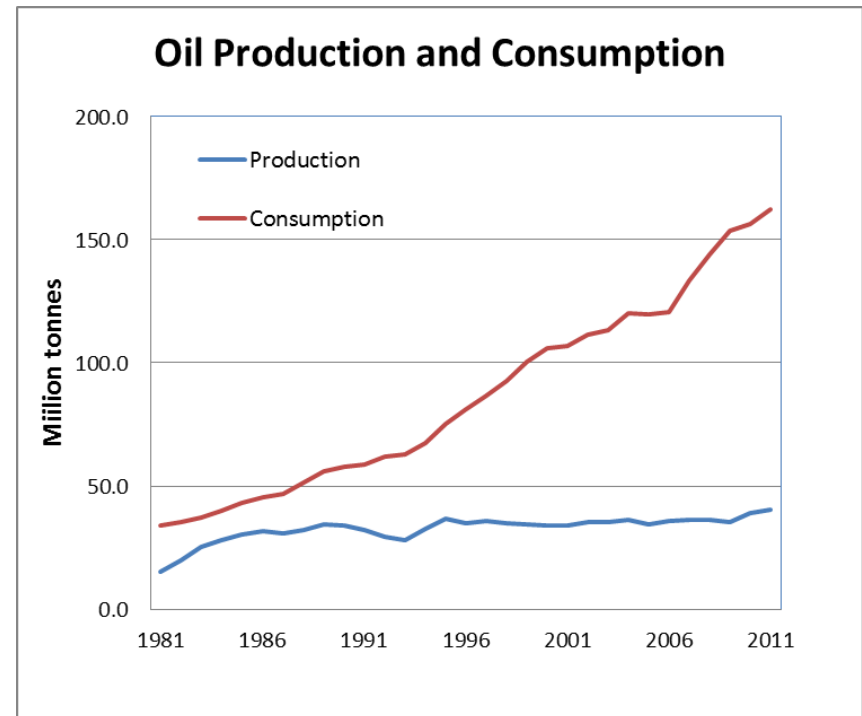
1. Context
2. Methodology
3. Biomass resources
4. Results

Biofuel Policy

- Blending Targets for Oil Companies
 - Currently 5% Blending of ethanol in petrol (20 states and 8 UT)
 - Future biofuels targets (ethanol and biodiesel)
 - 10% by 2017
 - **20% by 2020**
- Minimum Support Price
 - Rs 27 per litre of ethanol (~ 0.5 US \$)
 - Rs 26.5 per litre of biodiesel
- Achievement
 - Petrol : Around 2% ethanol blending (0.4 billion litres)
 - Diesel : No large scale blending (0.14 – 0.3 million litres by informal sector)

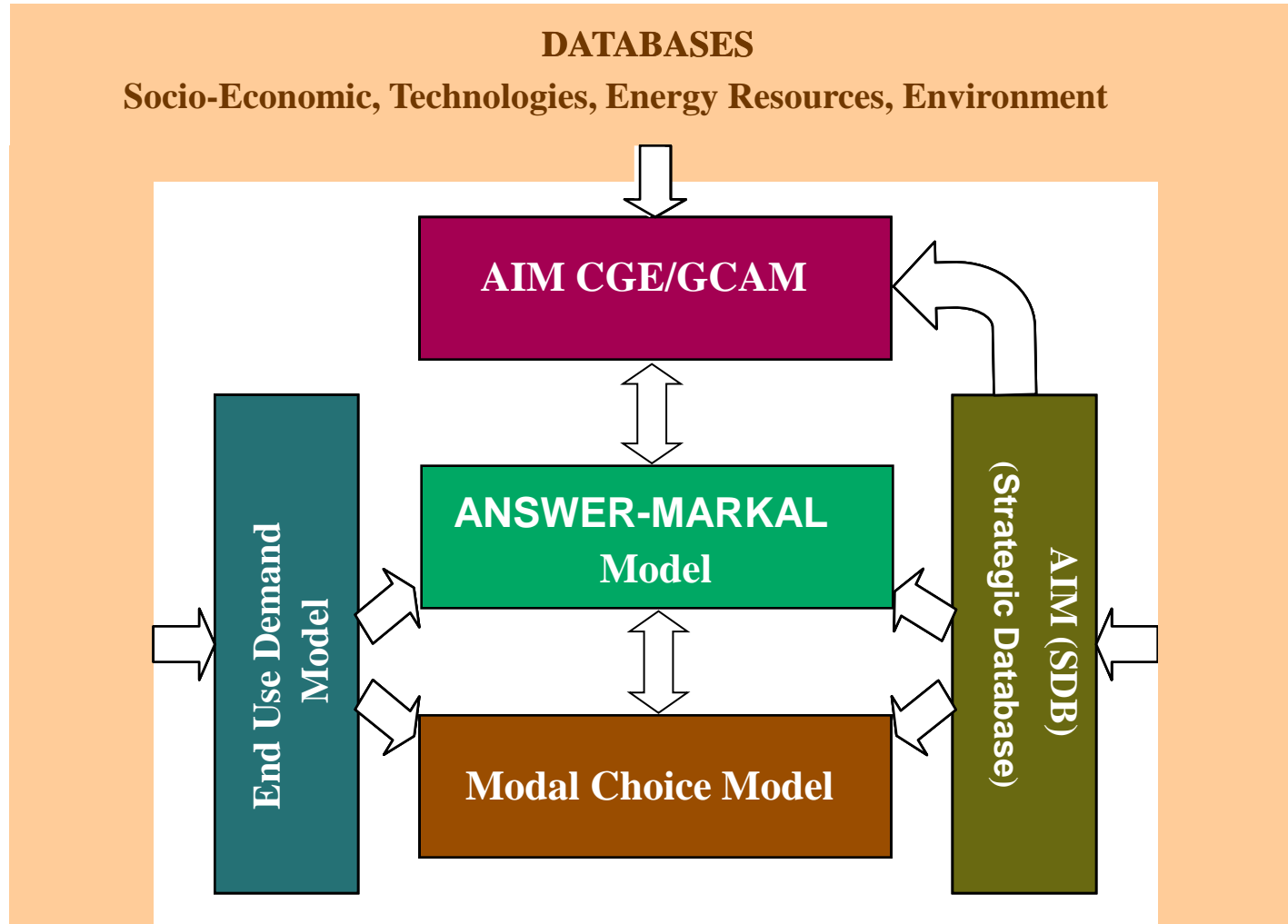
Drivers

- Push
 - Balance of Payments
 - Rising share of Oil in Imports
- Pull
 - Rural development and job stimulation
 - Identified as a priority for mitigation (NAPCC)

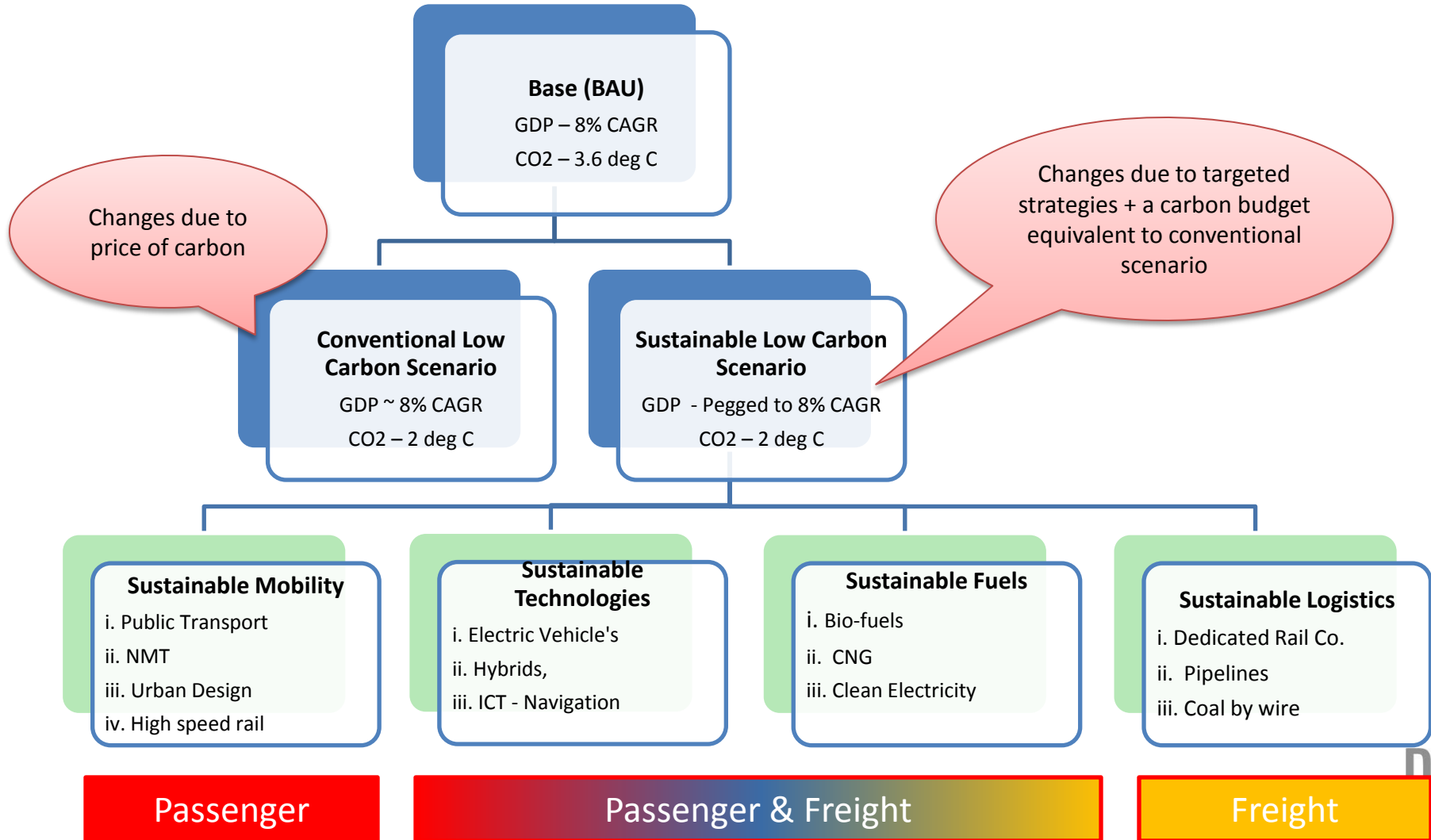


Research Questions

- What are the biomass resources available for biofuels in India?
- What is the economic potential of biofuels in BAU scenario?
- What is the economic potential of biofuels in a Low Carbon Scenario?



Architecture for Transport Scenarios



Bio fuel Storylines

- BAU

- Support prices for ethanol and biodiesel are not beyond ex refinery price for petrol and diesel
- No land from food and forests diverted for bio crops
- Institutional weakness in taking over marginal lands for bio crops

- Low Carbon Scenario

- Support pricing framework same as BAU
- Overall sustainable transitions
 - demographic, consumptions, dematerializations reduce demand for transport
- A global price corresponding to 2 deg C target
- Better success in taking marginal lands for bio crops

Bioethanol from Molasses

- Concerns
 - Sugarcane production **concentrated** in 4 states
 - **Competing demand** for industrial and other uses for ethanol

Technical Potential

	2010	2020	2030
Sugarcane Production (Mt)	342.4	370.9	418.8
Molasses (Mt)	11.6	12.5	14.1
Ethanol (BL)	2.7	2.9	3.3
Ethanol Blending (BL)	1.1	1.2	1.3
(Mtoe)	0.55	0.59	0.67

Source : Adapted from Purohit & Fisher, 2013

Biodiesel from Jatropha

- Concerns
 - **Limited experience** - only 0.5 Mha cropped and blending not started
 - **Low yields** - Actual yield of oil is a low 0.11 – 0.23 mt

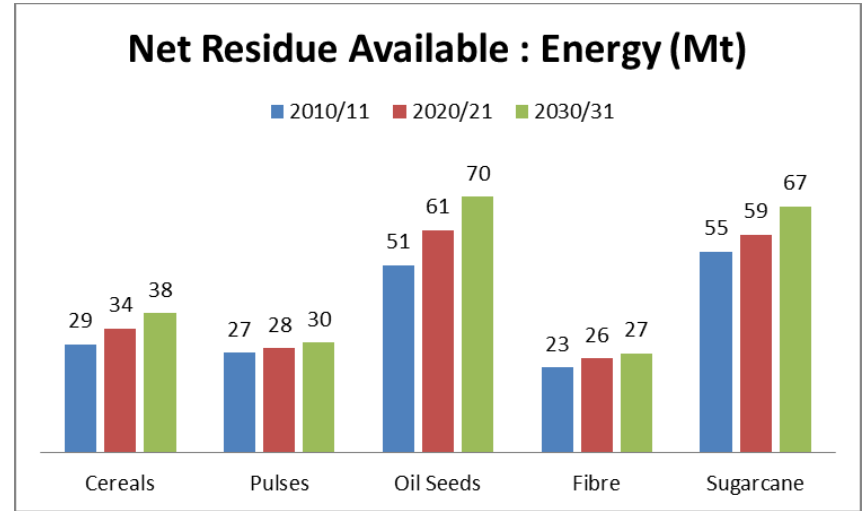
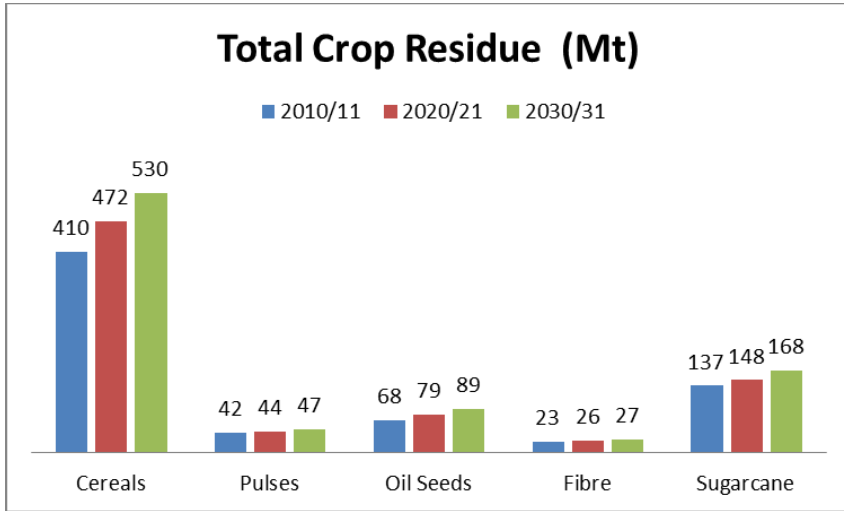
Technical Potential

	Total Area (Mha)	Found Suitable (*) (Mha)	Total yield oil (Mt)
Culturable waste land	12.9	2.0	3.4
Culturable waste land plus pastures, barren and unculturable land, etc.	79.4	11.1	16.4

(*) Through Agroecological zone assesment

Source : Adapted from Purohit & Fisher, 2013

Agricultural Residues for Biofuels



Source : Adapted from Purohit & Fisher, 2013

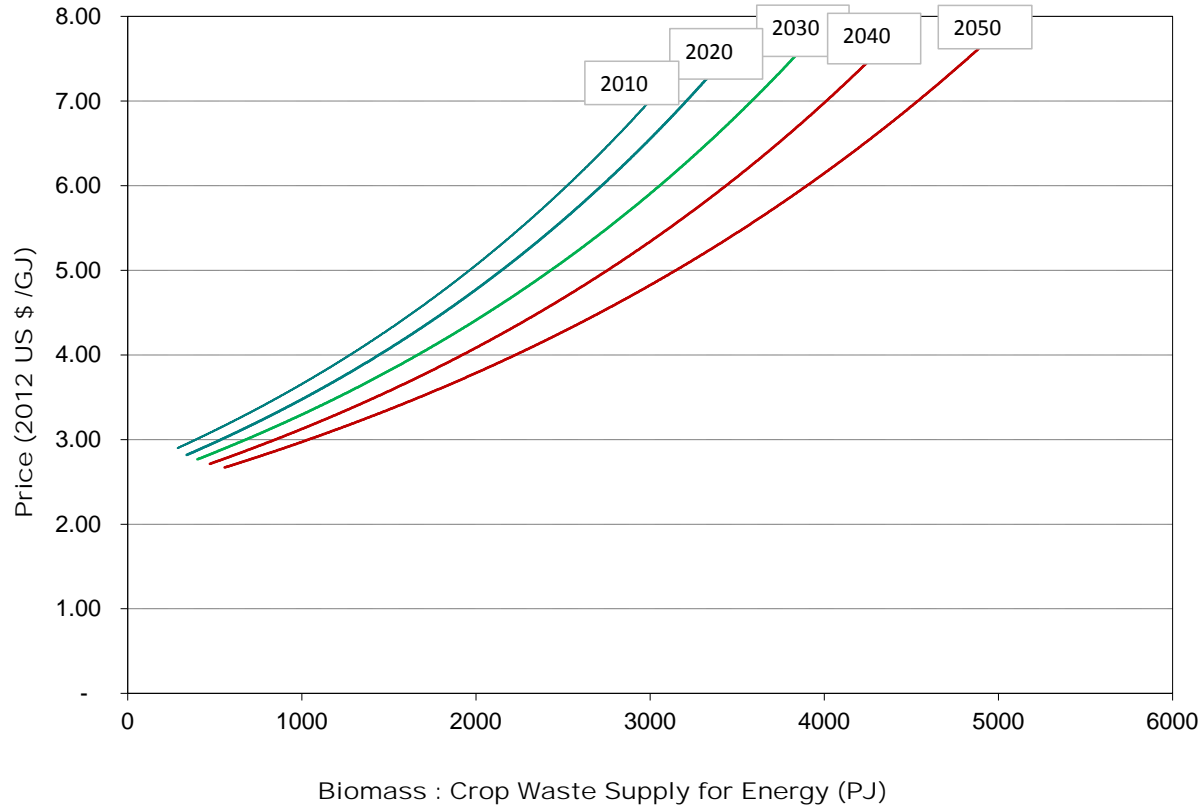
Net Residue Availability

2010 – 72.3 Mtoe

2020 – 80.3 Mtoe

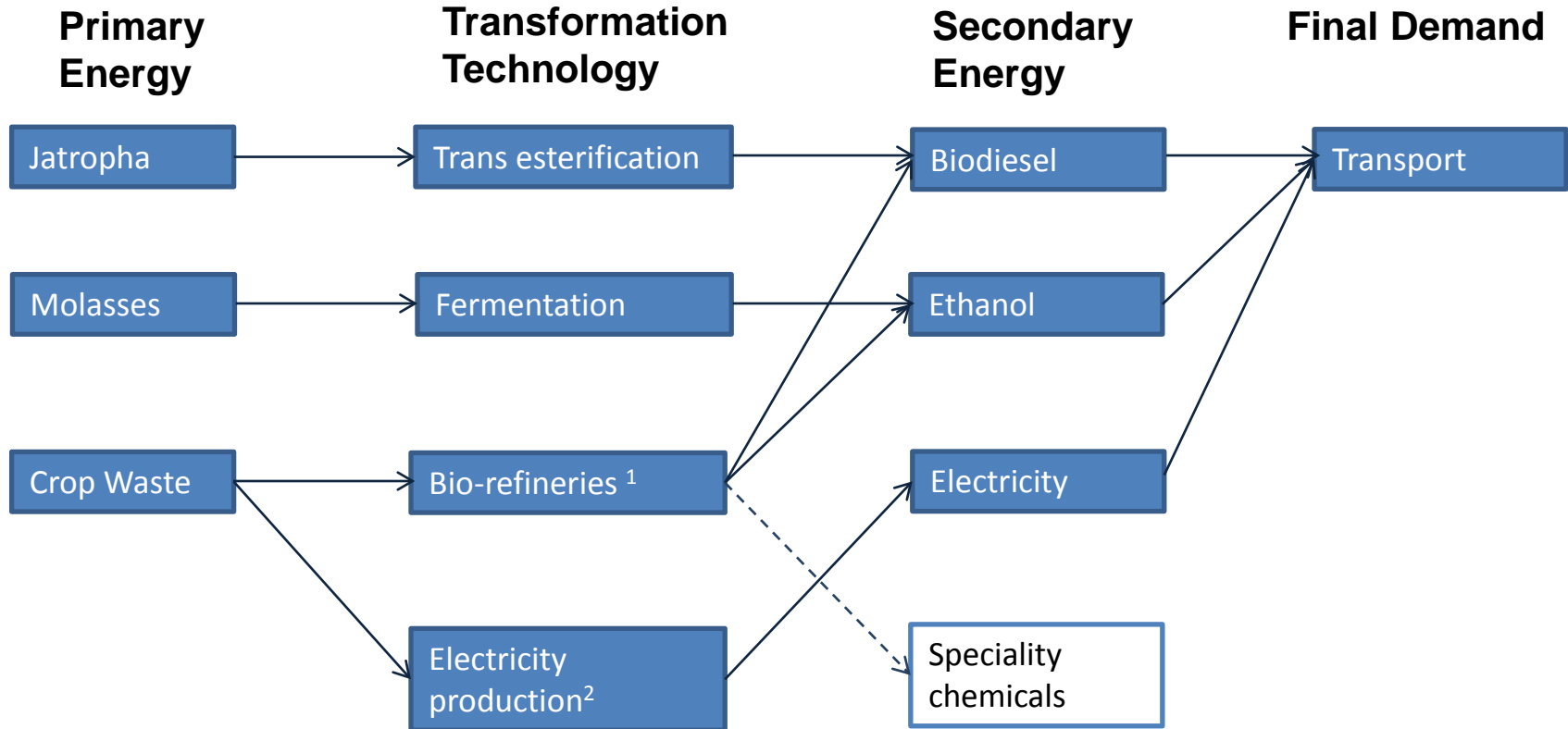
2030 – 89.3 Mtoe

Cost Curves for Crop Waste



- Underlying data based on detailed estimates for individual crops
- However uncertainties with respect to demand for biomass from other sectors considered

Partial RES for Bio-fuels



1. Bio refineries include Cellulosic technology for Ethanol, hydrogenation and FTP technology for biodiesel
2. Both Co-firing of biomass & dedicated biomass gasifier.

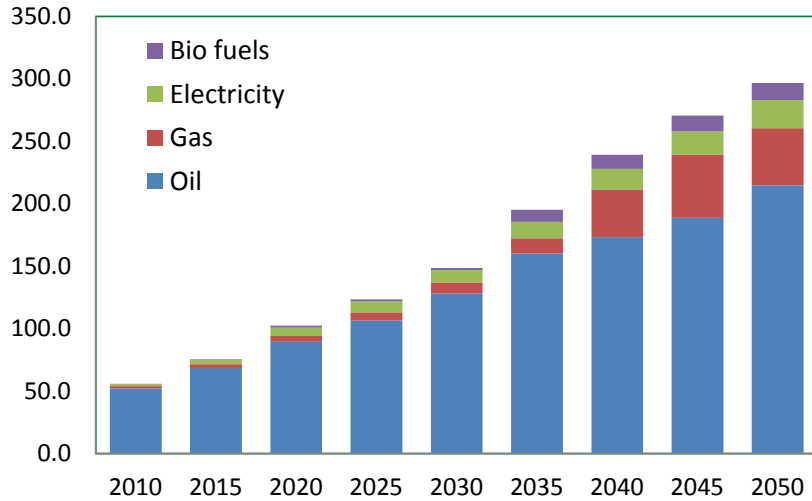


Results



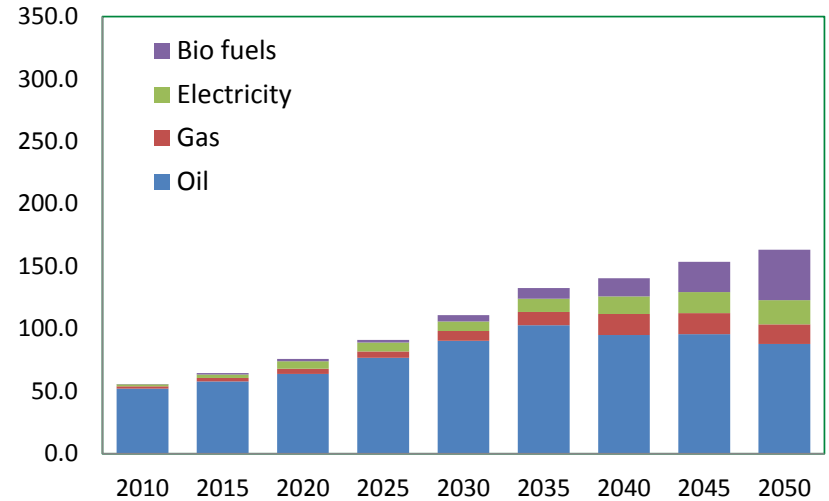
Fuel Mix for Transport

**Energy Demand - BAU
(Mtoe)**



0.3% 1.6% 1.1% 4.7% 4.6%

**Energy Demand - Sustainable LCS
(Mtoe)**



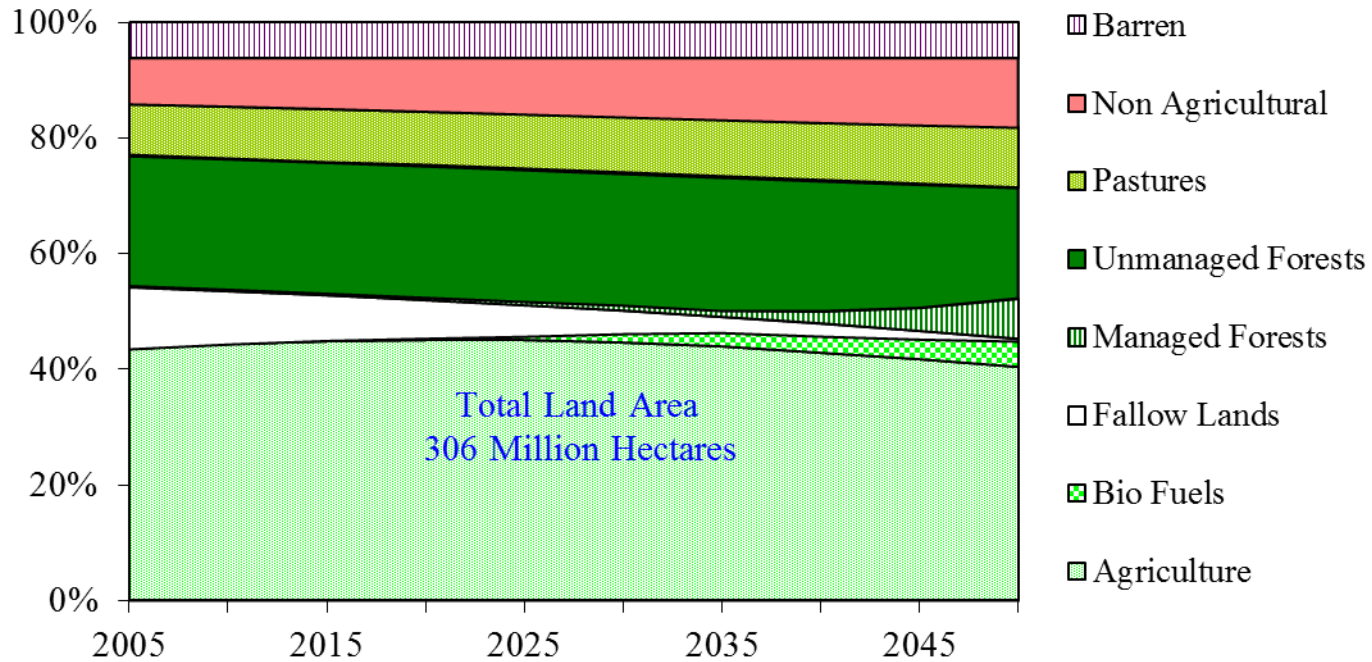
0.3% 2.3% 4.6% 10.3% 24.7%

Share of biofuels

LCS:

- Bio crops (Jatropha, Sweet Sorghum)
- Crop waste
- Imports of bio fuels

Land Use : Low Carbon Scenario



Source : Shukla, Dhar & Fujino, 2011

Conclusions

- Bioethanol from molasses can play a very minor role in long term biofuel transitions
- Jatropha technical potential high however risks (diversion of land & lack of experiences) and absence of good experiences
- Long term future of biofuels would depend on second generation pathway using crop wastes (but would require R&D and global partnerships)



Thank You

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Project Website :

www.unep.org/transport/lowcarbon