Bio economy: Myth to reality

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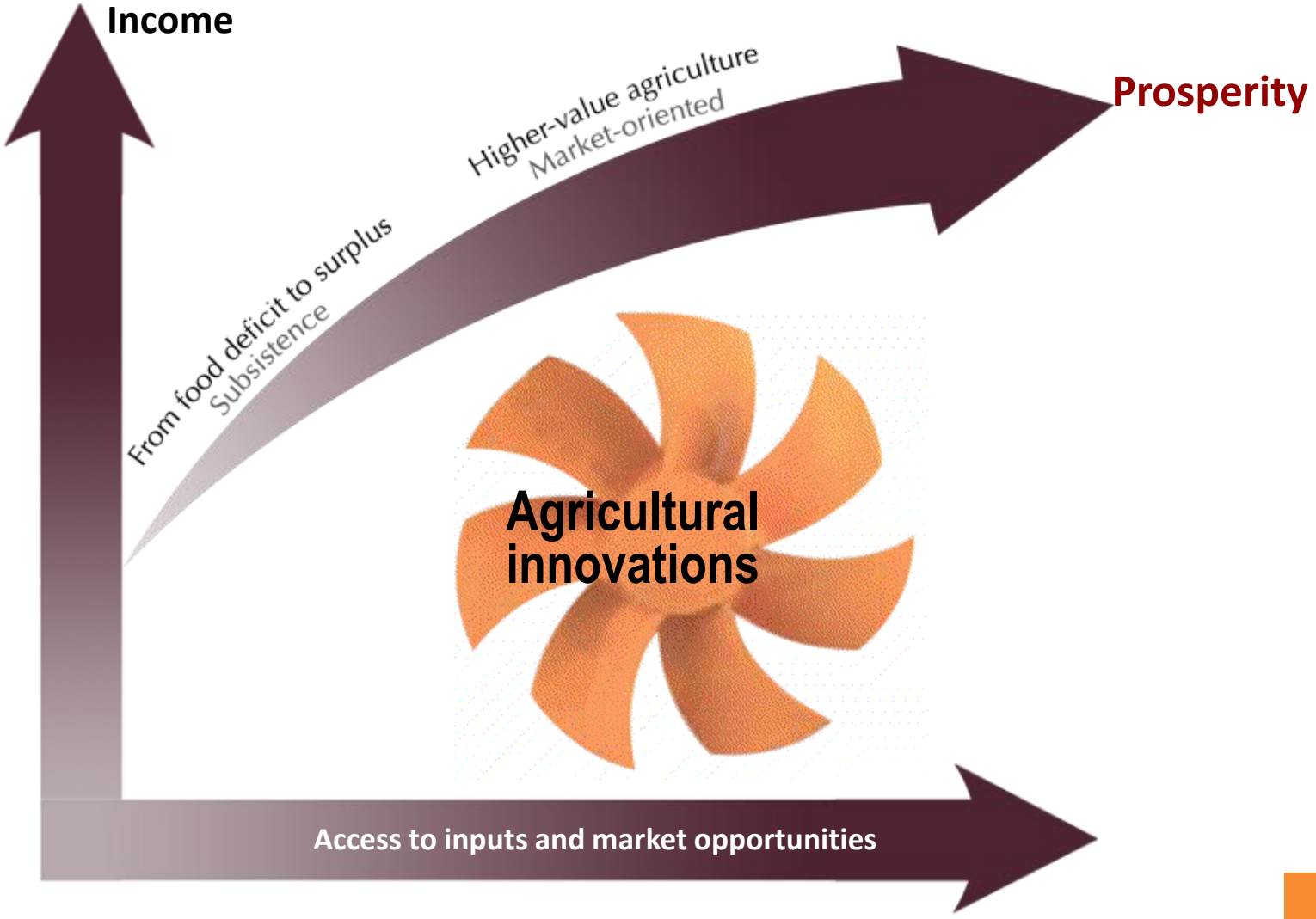
Roadmap to prosperity

Inclusive Market-Oriented Development (IMOD)



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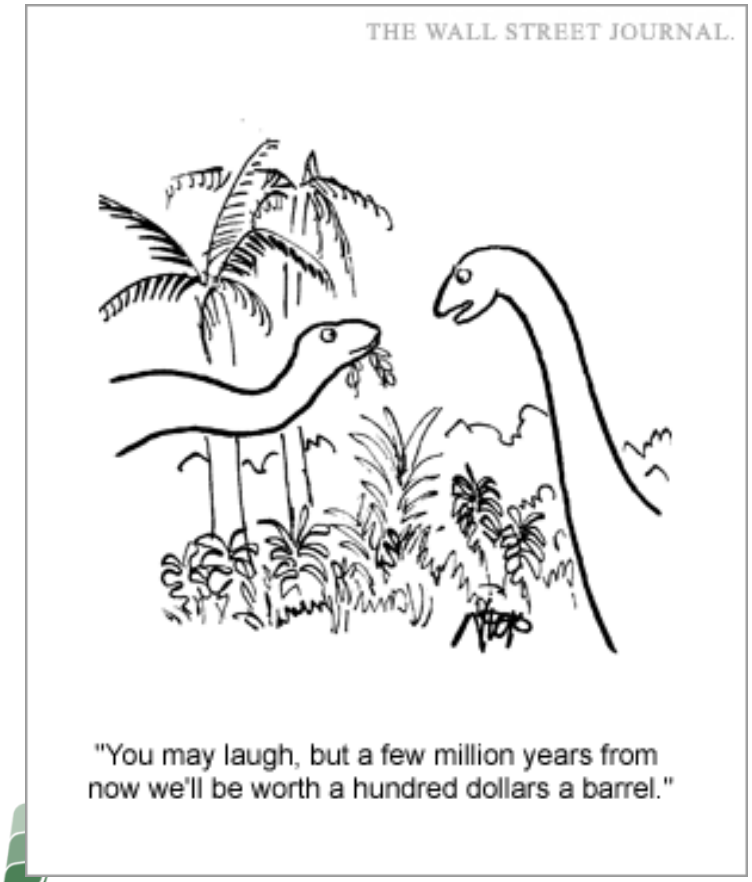
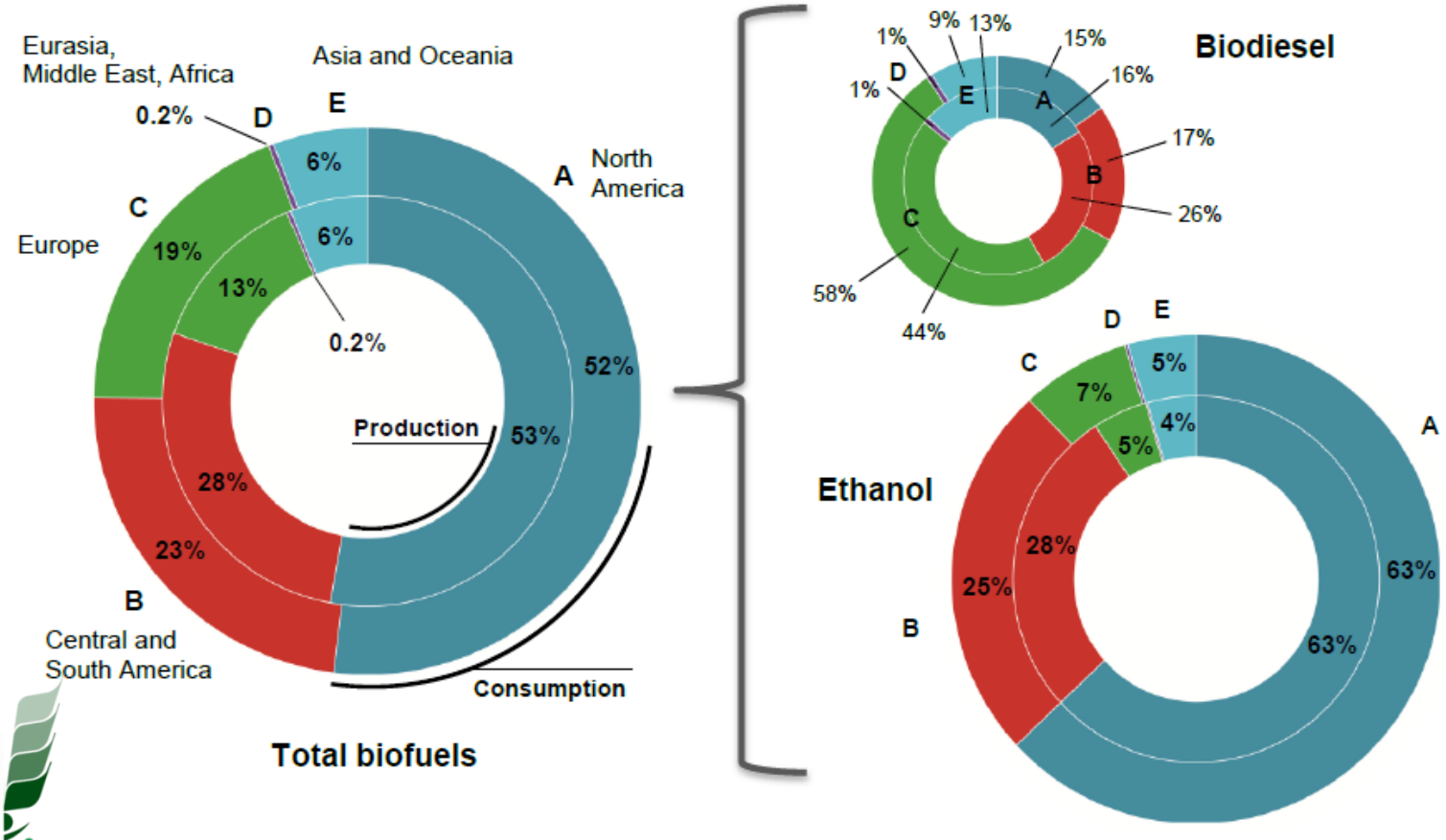
IMOD: Innovate. Grow. Prosper.

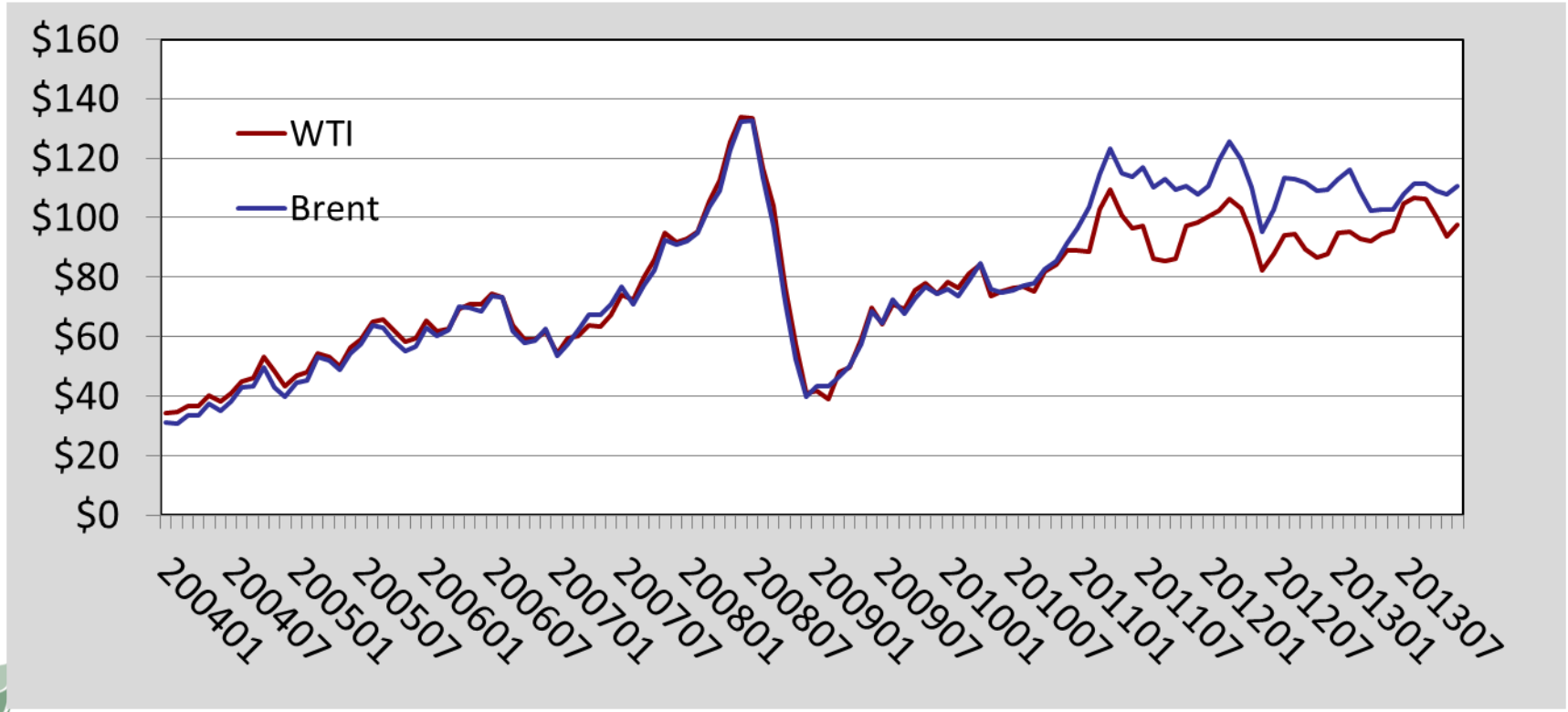
Relevance of Biofuels



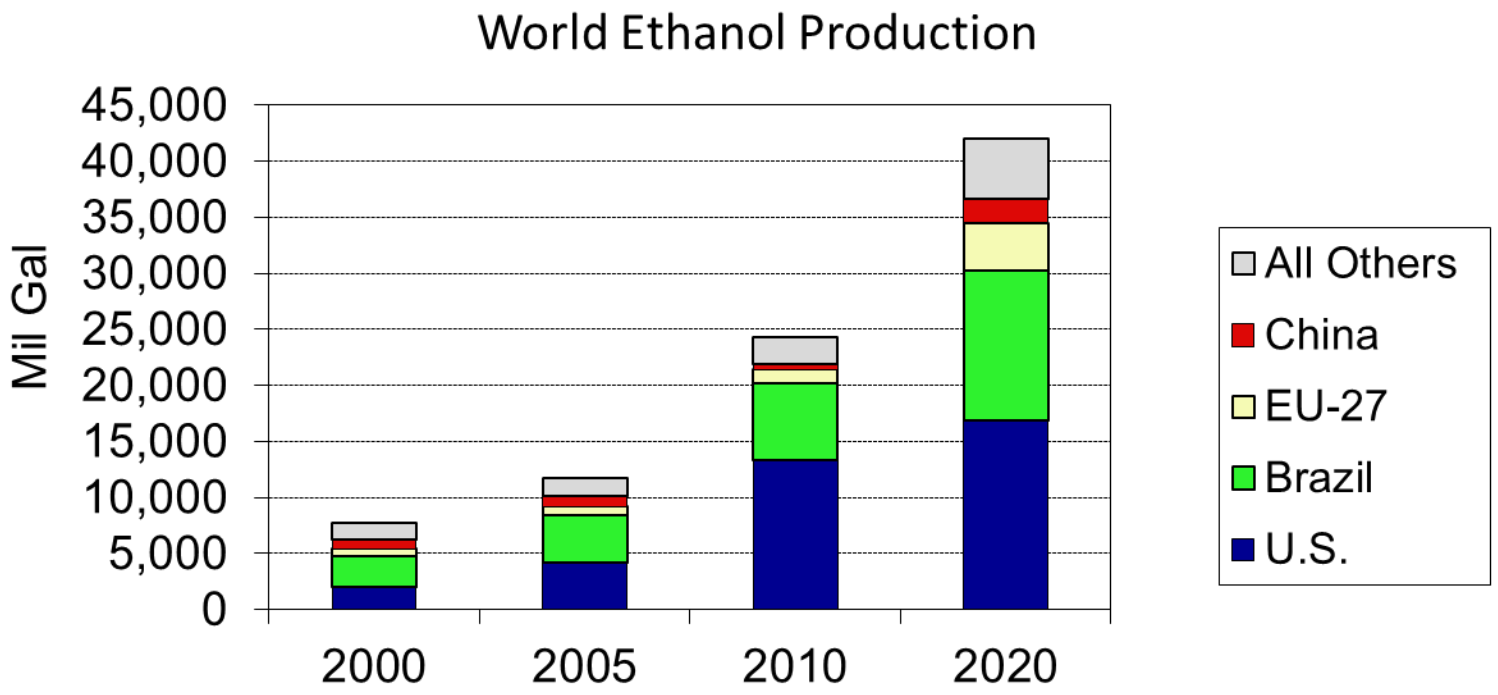
Biofuels production and consumption pattern



World oil prices remain relatively stable. Little evidence of impact of Bakken oil on U.S. market.

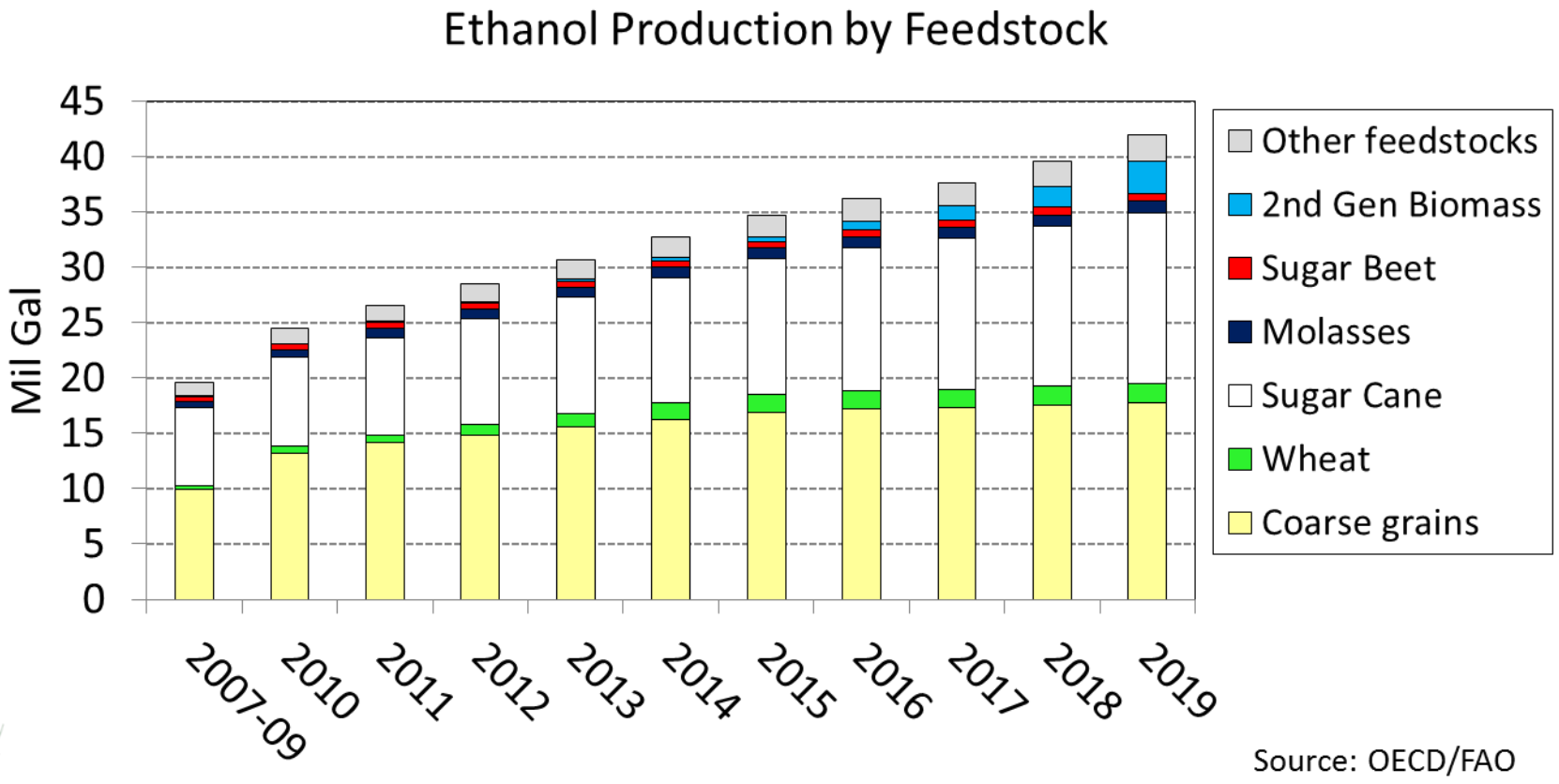


Biofuels are here to stay. Global ethanol production will again double over the next decade



Source: F.O. Licht; Projection: OECD/FAO

Coarse grains and sugarcane will remain the primary ethanol feedstocks, but new feedstocks will grow significantly.



Source: OECD/FAO

Availability and utilization of ethanol in India

Year	Highest available alcohol from molasses (billion liters)	Ethanol utilization (billion liters)		Balance (billion liters)	Ethanol required for Blending (billion liters)	Deficit/ Surplus
		Potable	Industry		@ 10%	
2010-11	2.3	0.86	0.82	0.62	1.53	-0.96
2011-12	2.3	0.89	0.84	0.57	1.64	-1.14
2012-13	2.3	0.91	0.87	0.52	1.70	-1.32
2013-14	2.3	0.94	0.90	0.46	2.02	-1.53
2014-15	2.3	0.97	0.94	0.39	2.13	-1.76
2015-16	2.3	1.00	0.97	0.33	2.23	-1.99
2016-17	2.3	1.03	1.00	0.27	2.34	-2.24
2017-18	2.3	1.06	1.04	0.2	2.46	-2.51
2018-19	2.3	1.09	1.07	0.14	2.58	-2.78
2019-20	2.3	1.12	1.11	0.07	2.71	-3.09
2020-21	2.3	1.16	1.15	-0.01	2.85	-3.42

Source: Planning Commission (2003) estimates on highest available alcohol from molasses

SSVC- Life cycle assessment

Biofuel Type	Feedstock	Net Energy Ratio	Net Energy Balance (GJ /kl)	Net Carbon Balance (tCO_2e/kl)	% Carbon emission réduction
Bioethanol	Molasses[1]	4.57	19.11	- 1.1	75%
	Sweet Sorghum[2]	7.06	21.57	-1.4	86%
	Cellulosic Biomass (Bagasse)[3]	4.39	25.41	-1.7	70%
	Cellulosic Biomass (Rice Straw)[4]	3.32	22.79	-1.6	68%
Biodiesel	Jatropha - Transesterification[5]	3.41	63.76	-4.0	30%
	Jatropha – SVO[6]	4.38	66.73	-4.5	50%

Estimation of Energy and Carbon balance for Biofuels in India CII-DBT 2010

Potential land for biomass production in India

Data source	Area (M ha)
Planning commission	
Degraded forest	36
Degraded non-forest (total)	94
Degraded non-forest cultivated land	13
Strips and boundaries	2
Uncultivated land	33
Hand book (Min Agril)	
Forests	68.75
Non-agricultural uses land	22.45
Barren land	19.09
Permanent pasture land	11.04
Tree crops and grooves	3.57
Culturable waste land	13.94
Old fallow land	9.89
New fallow land	13.33

Feedstocks-Sustainability

Grain-sweet-energy sorghum

STATE-WISE LIST OF COMMISSINED BIOMASS POWER/COGENERATION PROJECTS

S.No.	State	MW
1	Andhra Pradesh	363.25
2	Bihar	9.50
3	Chattisgarh	231.90
4	Gujarat	0.50
5	Haryana	35.80
6	Karnataka	365.18
7	Madhya Pradesh	1.00
8	Maharashtra	403.00
9	Punjab	74.50
10	Rajasthan	73.30
11	Tamil Nadu	488.20
12	Uttarakhand	10.00
13	Uttar Pradesh	592.50
14	West Bengal	16.00
	Total	2664.63

MNRE, Govt of India

Production of different crops and their respective residue availability in India.

S.N.	Name of the crop	Annual production, thousand M T	Type of residue	Crop to residue ratio, Residue/kg of crop	Total available residue, Thousand M T
1	Sugarcane	276,250	Bagasse Top and leaves	0.33 0.05	91,162.5 13,812.5
2	Rice	145,050	Husks Stlks Straw	0.2 1.5 1.5	29,010 217,575 217,575
3	Wheat	78,000	Pods Stalks	0.3 1.5	23,000 117,000
4	Maize	18,500	Cobs Stalks	0.3 2	5,500 37,000
5	Bajra	7,690	Cobs Husks Stalks	0.33 0.3 2	12,537.7 0.3 2307 2 15,380
6	Millets	12,410	Stalks	1.2	14,892

Lignocellulosic ethanol conversion

❖Process involve extraction of polysaccharides from lignin, which are then converted into simple sugars and fermented into fuel.

Advantages:

✓A desirable supplement to transesterification and fermentation.

✓Expected cost reductions

✓Can increase the fossil fuel saved per unit of energy produced.

✓Able to use agricultural wastes and non food crops that can be grown on marginal lands

✓Research is underway to develop enzymes that would reduce lignocellulosic fuel production costs.

Characteristics of new types of biorefineries

Concept	Type of feedstock	Predominant technology	Phase of development
Green biorefineries	Wet Biomass: green grasses and green crops	Pre-treatment, pressing,fractionation, separation	Pilot plant
Whole crop biorefineries	Whole crop cereals such as rye, wheat and maize	Dry or wet milling, biochemical conversion	Pilot Plant
Lignocellulosic feedstock biorefineries	Lignocellulosic-rich biomass	Pre-treatment, chemical &enzymatic hydrolysis, fermentation, separation	R&D/Pilot plant (EC),demonstration plant, Commercial plant?
Two platform concept biorefineries	All types of biomass	Combination of sugar platform and syngas platform	Pilot plant
Thermo chemical biorefineries	All types of biomass	Thermochemical conversion: torrefaction, pyrolysis, gasification, HTU, product separation, catalytic synthesis	Pilot plant and demonstration plant

Source: Ree and Annevelink, 2007

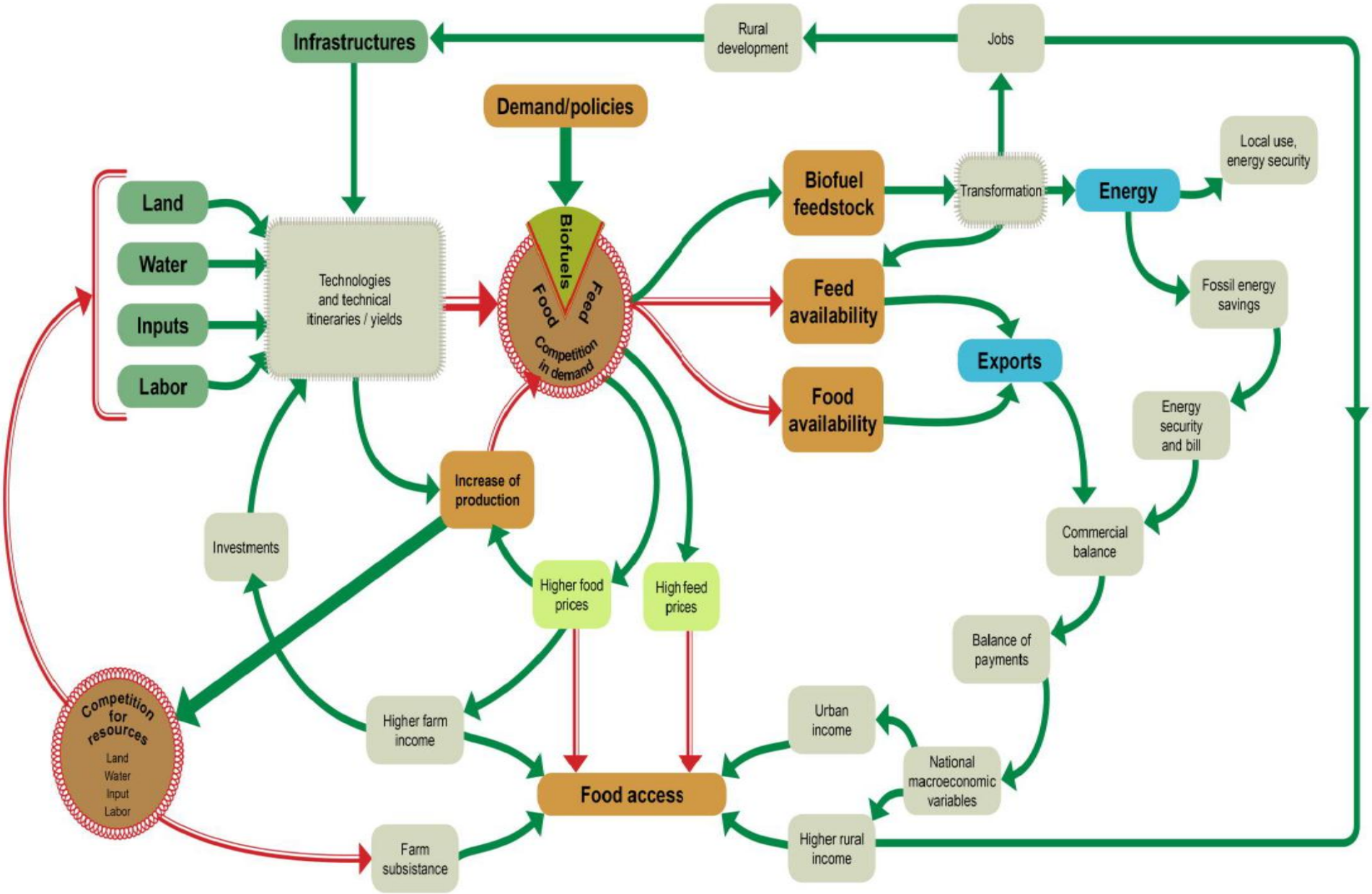
Opportunities

- Marginal/degraded lands
- Impact on small farmer holdings
- Policy support on biomass to power
- Existing infrastructure in sugar mills
- R4D in dedicated energy crops
- Biomass to bioproducts/industrial products
- Agro residues

Challenges

- Fragmented land holding
- Poor mechanisation
- Lack of infrastructure
- Collection and pre-processing
- Transportation hurdles
- Lack of coordination
- Lack of policy support (subsidies/incentives/ CDM)
- R4D

Biofuels impacts on food, Agriculture



Announcement!!

March 3-4 2014, ICRISAT, India

CGIAR

ICRISAT is a member of the CGIAR Consortium

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SEVENTH FRAMEWORK
PROGRAMME

सत्यमेव जयते

IUSSTF
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