

Agricultural Residues



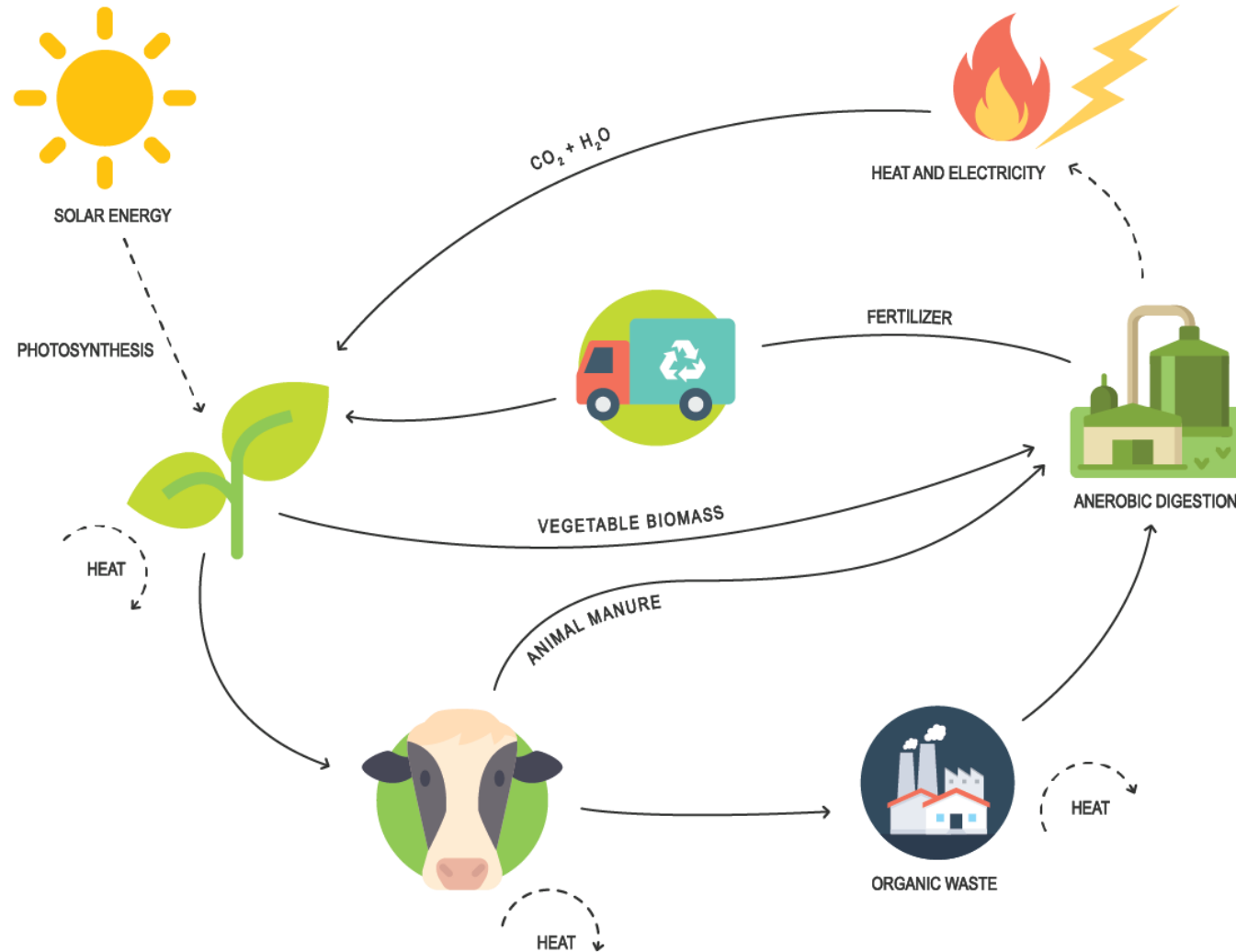
Bioenergy as an all-rounder

Waste Treatment Benefits

- Natural waste treatment process
- Requires less land than aerobic composting
- Reduces disposed waste volume to landfill

Energy Benefits

- Net energy-producing process
- Generates high quality renewable fuel
- Numerous end-use applications



Environmental Benefits

- Significantly reduces greenhouse gas emissions
- Eliminates odours
- Produces nutrient-rich organic fertilizer
- Maximizes recycling

Social Benefits

- Inclusive economical growth
- Employment opportunities
- Empowerment of women

Feedstock

ANIMAL BY- PRODUCTS

Liquid and solid manure, slaughterhouse waste (like blood and feathers), whey, fat separator contents and flotation tailings

VEGETABLE BY- PRODUCTS

Organic residues from Restaurants, vegetable market yard

ENERGY CROPS

Grass, maize, corn, potatoes, fodder beet, mustard, silage



INDUSTRIAL AND COMMERCIAL WASTES

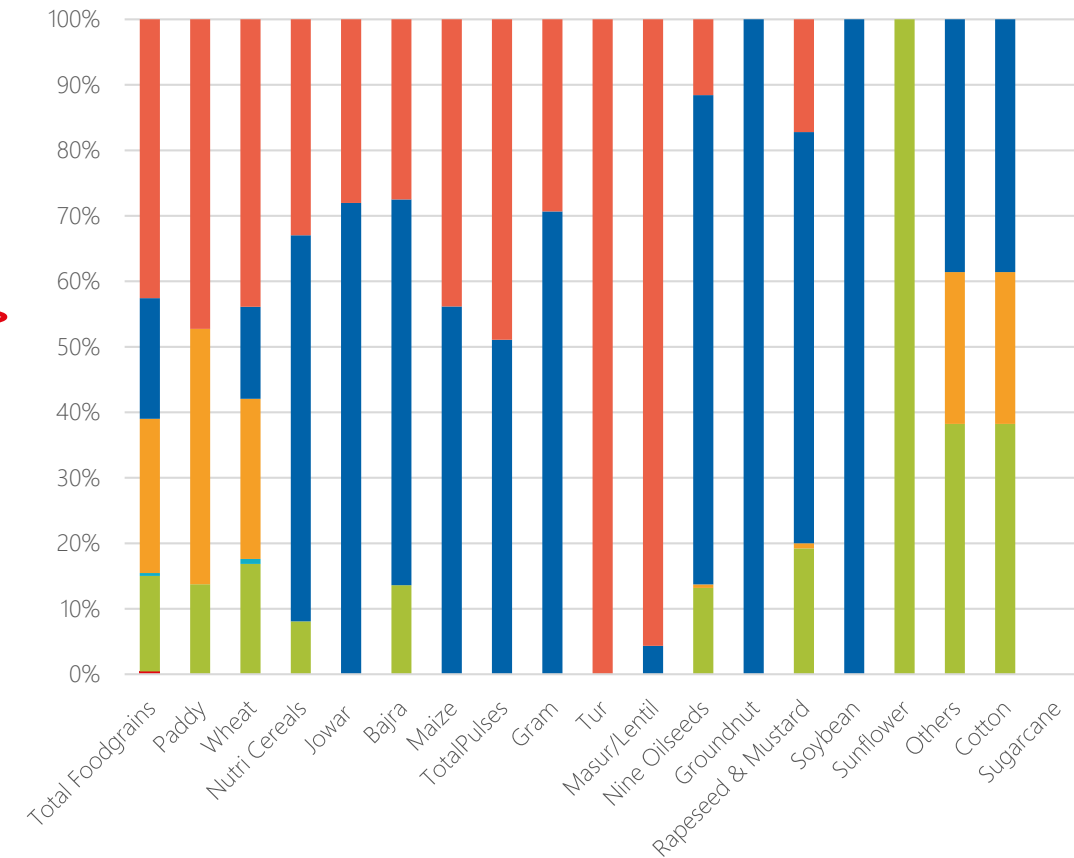
Organic residues from food, beverage or feed production, including catering waste and expired food

BIOWASTES FROM HOUSEHOLDS

Organic fraction of household waste (ideally separated collected), garden and park waste

Supply side assessment at National & State level

S.No.	Crop	Biomass Generation					
		India	Haryana	Himachal Pradesh	Punjab	Rajasthan	Uttar Pradesh
		Generation (MnT)	Generation (MnT)	Generation (MnT)	Generation (MnT)	Generation (MnT)	Generation (MnT)
1	Total Foodgrains	483.74	33.81	1.03	54.63	42.71	98.68
2	Paddy	197.91	7.68	0.00	21.79	0.00	26.42
3	Wheat	183.94	22.63	1.03	32.83	18.88	58.95
4	Nutri Cereals	53.69	1.21	0.00	0.00	8.83	4.94
5	Jowar	4.70	0.00	0.00	0.00	0.59	0.23
6	Bajra	22.39	2.29	0.00	0.00	9.91	4.63
7	Maize	21.11	0.00	0.00	0.00	4.51	3.52
8	TotalPulses	27.99	0.00	0.00	0.00	2.85	2.73
9	Gram	16.21	0.00	0.00	0.00	2.82	1.17
10	Tur	8.98	0.00	0.00	0.00	0.00	0.68
11	Masur/Lentil	2.81	0.00	0.00	0.00	0.04	0.88
12	Nine Oilseeds	53.55	2.04	0.00	0.08	11.55	1.79
13	Groundnut	14.72	0.00	0.00	0.00	3.04	0.00
14	Rapeseed & Mustard	14.94	2.00	0.00	0.08	6.53	1.79
15	Soybean	23.44	0.00	0.00	0.00	1.99	0.00
16	Sunflower	0.44	0.04	0.00	0.00	0.00	0.00
17	Others	71.78	5.03	0.00	3.05	5.08	0.00
18	Cotton	71.78	5.03	0.00	3.05	5.08	0.00
	Total	637.05	40.88	1.03	57.76	62.19	103.19



Paddy straw data on million tonne basis

S.N.	States	Residue generation	Residue surplus	Residue burned
1	Andhra Pradesh	43.89	6.96	2.73
2	Bihar	25.29	5.08	3.19
3	Chhattisgarh	11.25	2.12	0.83
4	Gujarat	28.73	8.90	3.81
5	Haryana	27.83	11.22	9.08
6	Karnataka	33.94	8.98	5.66
7	Madhya Pradesh	33.18	10.22	6.91
8	Maharashtra	46.45	14.67	7.42
9	Orissa	20.07	3.68	1.34
10	Punjab	50.75	24.83	19.65
11	Rajasthan	29.32	8.52	1.78
12	Tamil Nadu	19.93	7.05	4.08
13	Uttar Pradesh	59.97	13.53	11.92
14	West Bengal	35.93	4.29	4.96

Properties

Table 1. Rice straw properties.

HHT MJ kg ⁻¹	Proximate analysis			Ultimate analysis (% weight - dry fuel)						Sources
	Fix C	Volatile	Ash	C	H	N	S	Cl	Ash	
15.09	15.86	65.47	18.67	38.2	5.2		0.87	0.12	20.26	Jenkins et al 1998
14.57				35.94		1.18			22.00	Munder 2013
14.08				33.7	4.0	1.71	0.16	0.32	29.1	Guillemot et al 2014

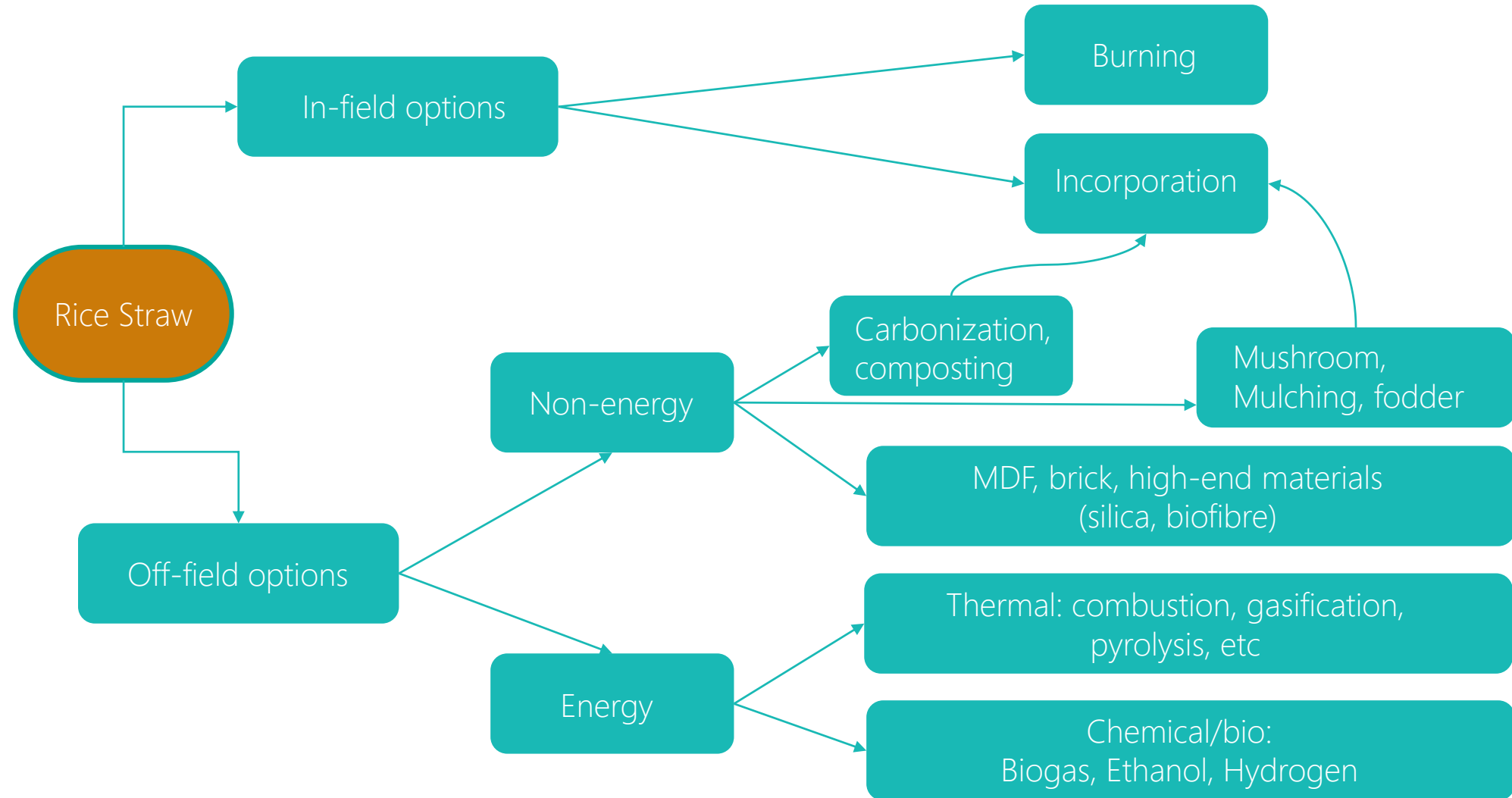
Table 2. Properties of ash from rice straw.

SiO ₂	Al ₂ O ₃	TiO ₂	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O ₃	SO ₃	P ₂ O ₅	Sources
74.67	1.04	0.09	0.85	3.01	1.75	0.96	12.3	1.24	1.41	Jeng et al 2012
82.6	1.1		1.0	3.3	1.7	0.3	6.3	0.9	1.7	

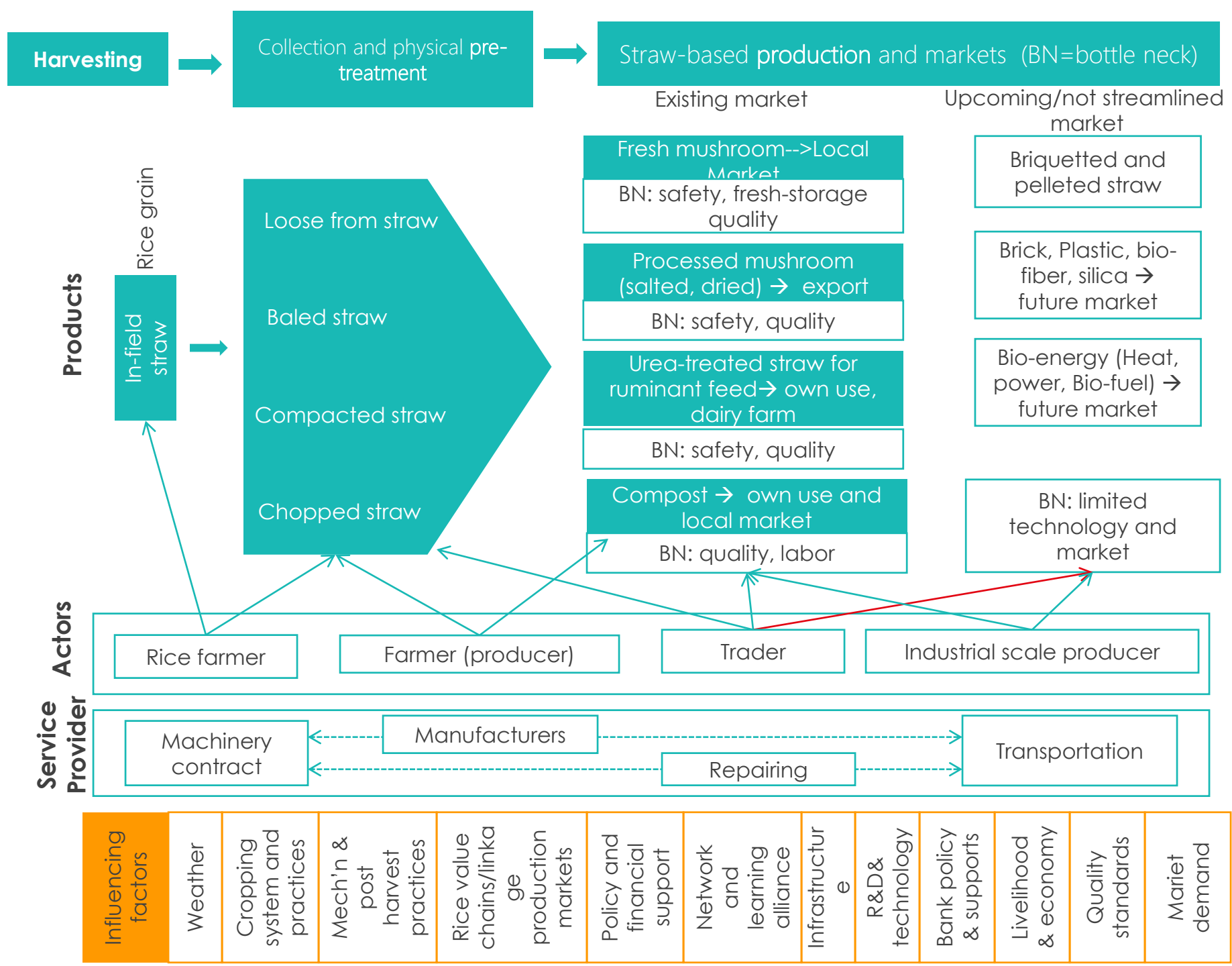
Challenges

- Huge volume of crop residue;
- Collection & Storage;
- Time window between harvesting and sowing of next crops;
- Awareness, Dissemination of Technology, Capacity Building of Technical Manpower and those of farmers;
- Cost-effective mechanization, availability of appropriate machinery;
- Utilization of crop residue;
- Technology up-gradation.

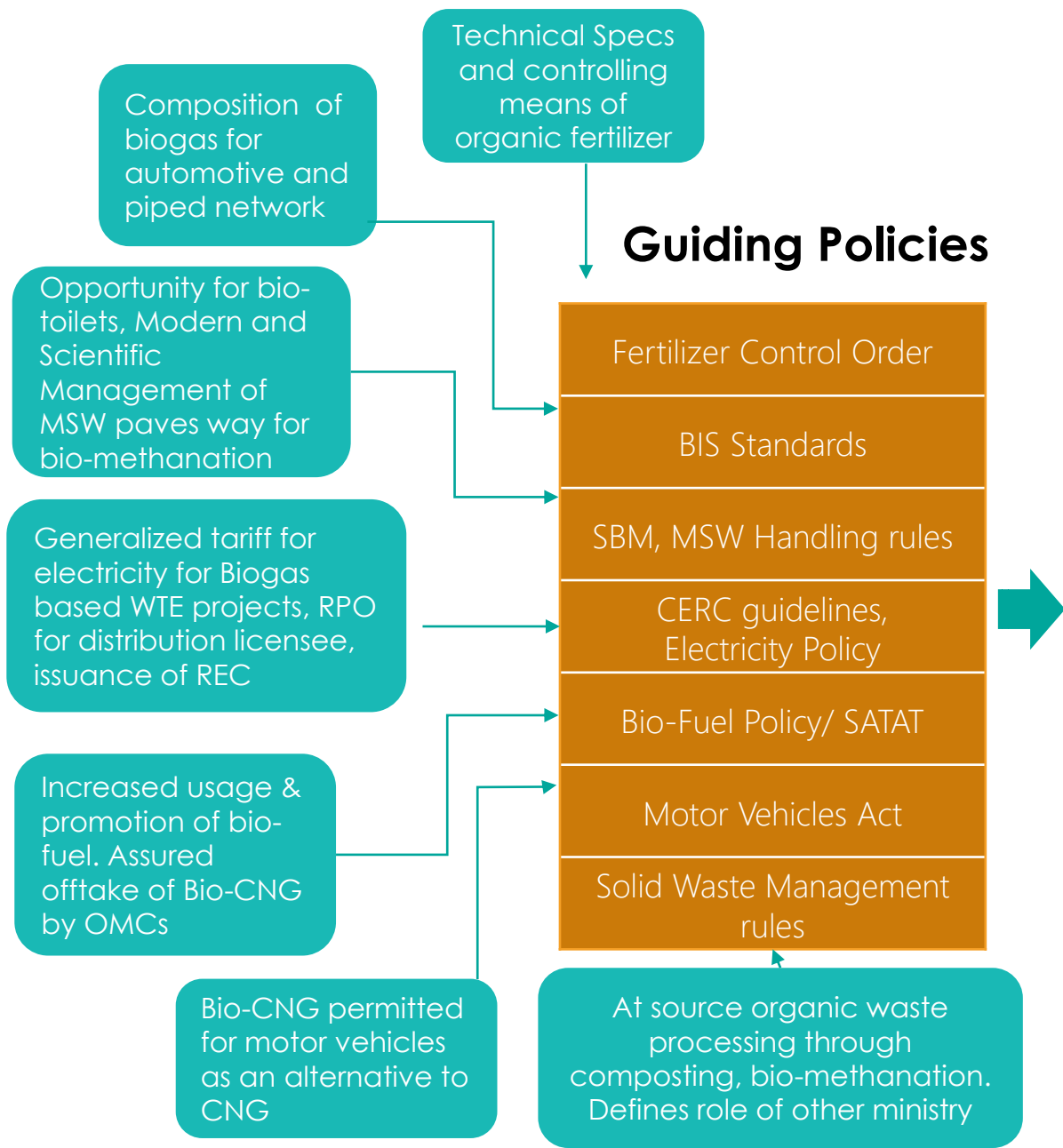
Rice straw management



Traditionally, in South and Southeast Asian countries, rice straw and husk are considered as wastes, either dumped into rivers or burned in the field, causing GHG emissions, contamination, and pollution. With the development of recent technologies, rice residues can be processed and managed using better practices. Management options for rice residues can be classified as in-field and off-field management



Inter Ministerial Policies



MNRE-Central Coordinating Ministry

Involved Ministry	Usage of Bioenergy and by products			
	Thermal	Electric	Transport	Organic Manure
MoAFW/ MoCF				✓
MoCA			✓	?
MoUD	✓	✓	✓	✓
MoP		✓	✓	
MoPNG	✓		✓	✓
MoRTH	✓	✓		
MoEF	✓	✓	✓	✓

MoRD, MoCI (PESO), MSME(KVIC), MoF (IREDA, NCEF, NABARD)

Other Supporting Ministries and bodies

Policy Support for Biogas sector

Scale of Biogas plant

1-25 m³

Region	1 m ³ (Subsidy in INR)	2-6 m ³ (Subsidy in INR)
NE States	17000	22000
General	7500	12000
Toilet linked Biogas Plants	1600 (Additional subsidy)	
Turn-Key Fee (5 year warranty)	2500 per plant (1-10 m ³) 4500 per plant (15-25 m ³)	

New National Biogas and Organic Manure Program (NNBOMP)

3-250 kW

Capacity	Subsidy (max up to 40% of total cost)
3-20 kW _{el}	40,000/kW**
20-100 kW _{el}	35,000/kW**
100-250 kW _{el}	30,000/kW**

Biogas Power(Off- grid) Programme (BPP)

For BPP, Thermal Subsidy is 50 % of above rates

***>250 kW

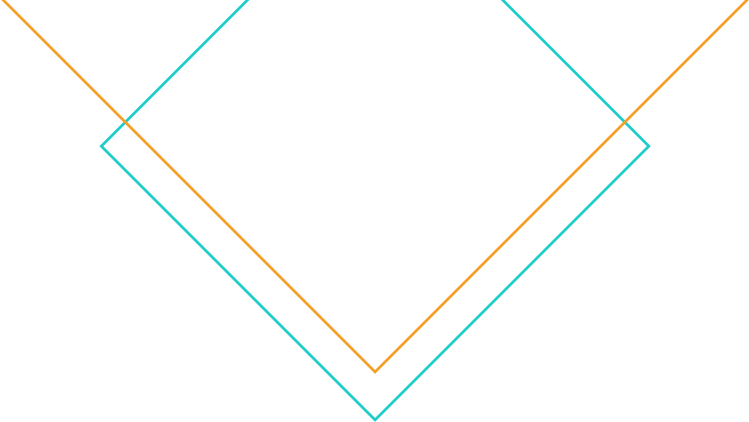
Waste/ Process/ Technology	Subsidy (in INR)
bio-CNG generation from biogas produced from Urban waste/ Agro waste/ Ind. Waste or mix of these	4 crore/MWeq (max. 10 crore/ project)
Power generation based on biogas produced from Urban/ Agro Waste or, production of bio-CNG	3 crore/MWeq (max 10 crore/ project)
Only Biogas generation from Urban, Industrial and Agricultural waste/ residue	1 crore/ MWeq (max. 10 crore/ project)

Programme on Energy from Urban, Industrial and Agricultural Wastes/Residues

*Presently the subsidy amount is 4 cr/ MW_{el}. Prospectively its on cards to increase it to 5 cr/ MW_{el}

**Rates defined are for SC/SCT and NER states; for general states specific cost is 5000/ kW lesser across all scale

*** For only cattle dung based projects, limit of > 250 KW holds good



Thanks

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