Survey Manual for Biomass Potential Assessment

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Sardar Patel Renewable Energy Research Institute, Anand, Gujarat

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Survey Manual for
Biomass Potential Assessment

Prepared
by

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1. Introduction

This manual provides a standardized procedure for the planning, execution, data collection, analysis, and reporting of biomass potential assessment studies across the study area. The goal is to ensure the collection of consistent, accurate, and quality data for evaluating block- wise and ultimately region-level biomass potential assessment. For the assessment of biomass potential in the study region, a total of three categories of biomass have been defined, such as village-level biomass (crop residues and animal manure), agro-industrial biomass, and forestry biomass. A separate questionnaire for each category has been defined, and a proforma is mentioned in the manual. In the category of village-level assessment, targeting the commercial stables or gaushalas or poultry farms, a separate set of questions for livestock owners has been prepared.

1.1 Scope of the Manual

- Sample size identification depending on the population in each category, i.e., number of villages, number of agro-industries, forest ranges, etc.
- Process flow chart for creating touch base points in the field for different categories
- Proforma of questionnaires for the village-level, agro-industrial and forest-level biomass assessment to design the survey tool
- Sample collection methodologies
- Stakeholder Engagement and Field Surveys
- Quantification of surplus biomass and its potential
- Data curation, compilation and report preparation

2. Crop Residues Potential

2.1. Biomass resource data collection and analysis

- The information about no. of villages present in district and their taluka-wise distribution should be collected from the state government website of district
- Villages should be selected randomly at taluka-level. Total number of selected villages should be at least 15% of total villages of the particular taluka
- Selected villages should be surveyed for biomass production potential, utilization pattern and surplus availability

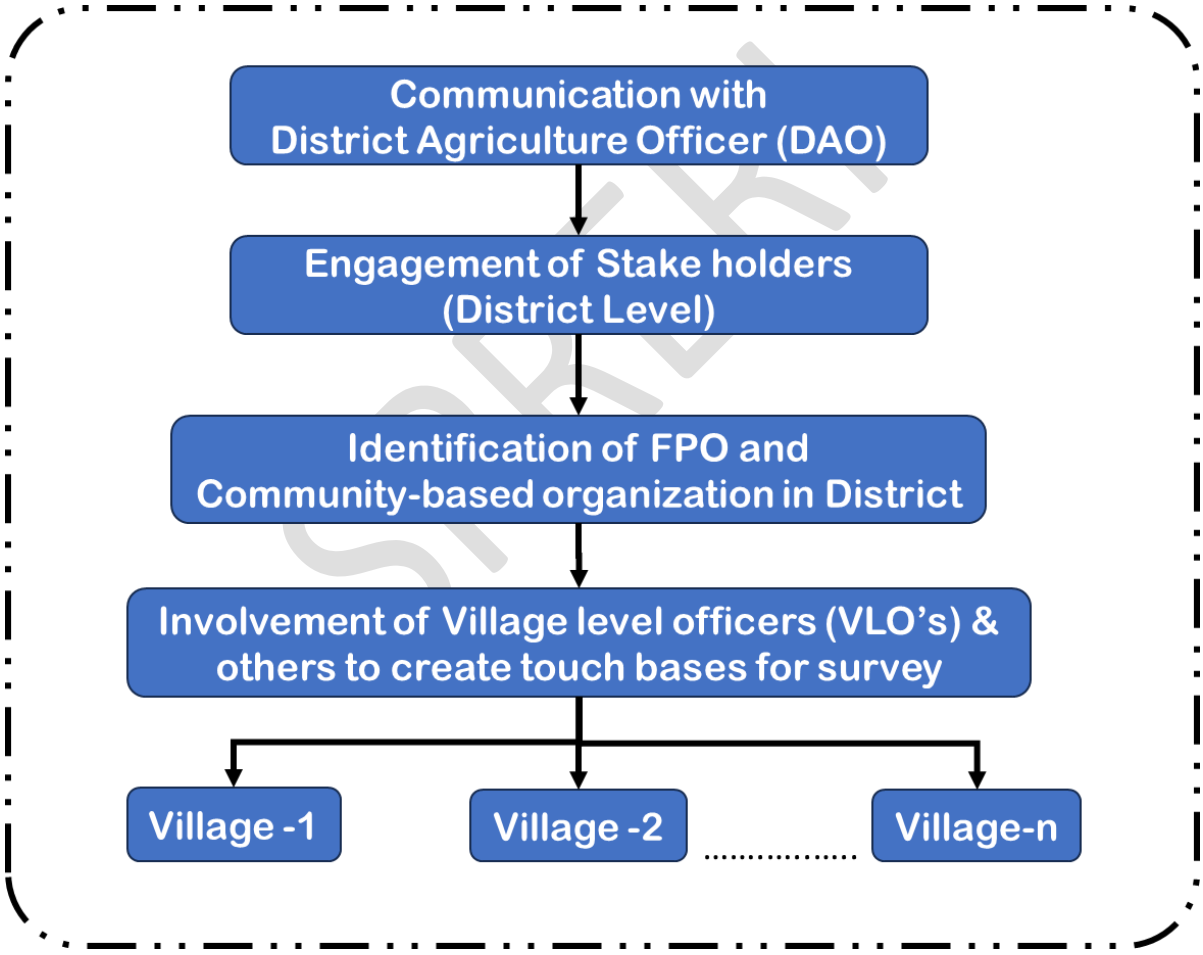


Fig. 1. Biomass Assessments at Village-level

2.1.1. Proforma for questionnaires for village details

Proforma-1: Village details

Sr. No.	Question	Response/Options
1.	Village name	
2.	Taluka name	
3.	District name	
4.	Pin-code	
5.	Location (Geotag)	
6.	Agriculture zone	☐ Zone 1 ☐ Zone 2 ☐ Zone 3 ☐ Zone 4 ☐ Zone 5 ☐ Zone 6 ☐ Zone 7 ☐ Zone 8
7.	Population of the village	
8.	Total cultivable land in the village (Bigha)	
9.	Type of Bigha	_____ha
10.	Number of farmers in the village	
11.	Categories of farmers in the village	• Marginal: _____ha • Small: _____ha • Medium: _____ha • Semi-medium: _____ha • Large: _____ha
12.	Season-wise crops cultivated in the village	• Kharif: _____ _____ _____ _____ • Rabi: _____ _____ _____ _____ • Zaid: _____ _____ _____ • Annual crop: _____ _____

13.	Number of livestock in the village	• Milching animals (With Infants (I)) ○ Cow (I): _____ ○ Buffalo (I): _____ ○ Goat (I): _____ ○ Sheep (I): _____ ○ Others (I): _____ • Non-milching animals: ○ Bullock (I): _____ ○ Calf (I): _____ ○ He-goat (I): _____ ○ Others (I): _____
14.	Infrastructure available in the village Panchayat Bhavan ☐ Yes ☐ No Primary School/s ☐ Yes ☐ No Secondary School/s ☐ Yes ☐ No Higher Secondary School/s ☐ Yes ☐ No Primary Health Centre ☐ Yes ☐ No Higher Educational/ Training Facility ☐ Yes ☐ No Dairy or BMC facilities ☐ Yes ☐ No Other Government/ CSR funded facilities or Infrastructure/s (Please specify) _____ ☐ Yes ☐ No	
15.	Any Societies/ SHGs/ FPOs being Operational in Village	• SHG: _____ _____ _____ • FPO: _____ _____ • Others: _____ _____
16.	Respondent name	
17.	Respondent designation	
18.	Respondent address	
19.	Respondent contact detail	
20.	The information entered are as per details provided by the respondent	(Acknowledgement type)
21.	Surveyor name	
22.	Image/s or video clips	
23.	Date and time	

2.2. Selection of respondents in the village for crop-residue assessment

- Numbers of farmers/ respondent selected in a village should be 15 nos. (3 nos. of each category of farmers i.e., marginal, small, medium, semi-medium, and large). If all categories of farmers are not available in the village, then at least three farmers of each category should be surveyed in the particular village

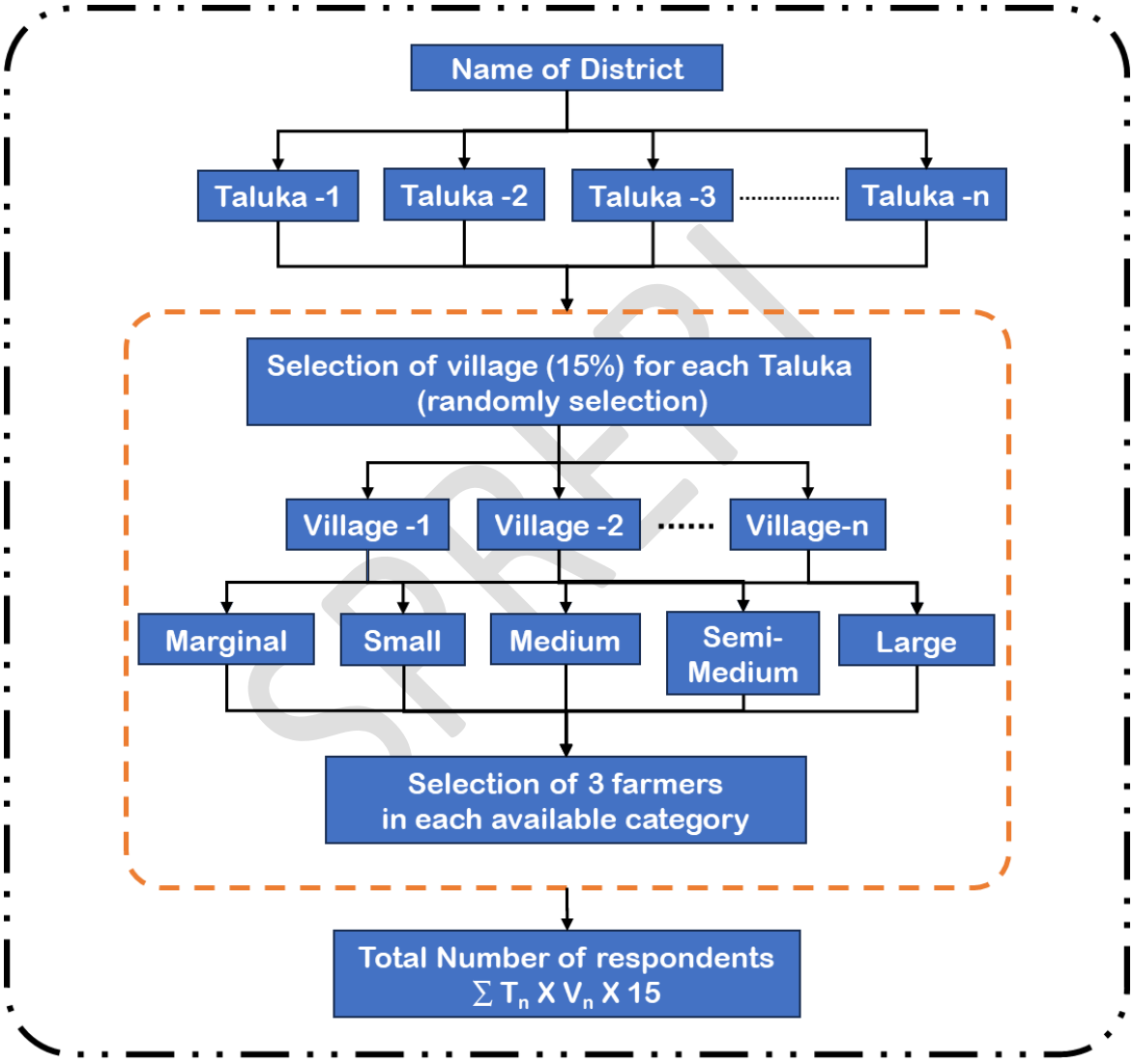


Fig. 2. Selection of respondents in the village for crop-residue assessment

2.2.1. Proforma for questionnaires for crop residue assessment in the village

Proforma-2: Details of farmer for crop residues production potential and surplus availability

General Information of the farmer		
1.	Farmer's Name	
2.	Age	_____Years
3.	Gender	☐ Male ☐ Female
4.	Village name and address	
5.	Location	
6.	Contact detail	
7.	Educational qualification	
8.	Land holding the village (bigha)	
9.	Type of bigha	_____ha
10.	Land-size category	☐ Marginal ☐ Small ☐ Semi-medium ☐ Medium ☐ Large
11.	Number of livestock and manure production	

Type of animal	Numbers	Feed (kg/day)	Manure (kg/day)
Cow			
Buffalo			
Goat			
Sheep			
Bullock			
Calf			
Horse			
Chicken			
Others-1			
Others-2			
Others-3			

Crop cultivation details

12. Crops cultivated by a farmer in FY 2024-25

Season	Name of crop	Area cultivated	Source of irrigation	Production	Crop yield	Harvesting mechanism	Name of residues	Residues produced	Residue yield	Fallow land
Kharif										
Rabi										
Zaid										
Annual crop										

13. Total seasonal residue generation

Sr. No.	Season	Residues produced
1	Kharif	
2	Rabi	
3	Zaid	
4	Annual crop	
5	Total annual production	

14. Machinery used for harvesting

- Reapers
- Sickle
- Digger
- Combine harvester
- Others _

15. Crops cultivated by a farmer in the FY 2023-24

Season	Name of crop	Area cultivated	Source of irrigation	Production	Crop yield	Harvesting mechanism	Name of residues	Residues produced	Residue yield	Fallow land
Kharif										
Rabi										
Zaid										
Annual crop										

16. Total seasonal residue generation

Sr. No.	Season	Residues produced
1	Kharif	
2	Rabi	
3	Zaid	
4	Annual crop	
5	Annual production	

17. Machinery used for harvesting

- Reapers
- Sickle
- Digger
- Combine harvester
- Others _

Crop residues utilization pattern and surplus availability

For FY 2024-25

18. Utilization categories (For each selected crop)

Name of residues generated	Total quantities of Residues produced	Storage method	Storage duration	Availability period	Type of application	Quantity used	Surplus availability
Residue-1					Animal fodder		
					Domestic fuel		
					Compost		
					Mulching		
					Sale for fodder		
					Sale for biogas		
					Sale as fuel		
					Field burning		
Residue-2					Animal fodder		
					Domestic fuel		
					Compost		
					Mulching		
					Sale for fodder		
					Sale for biogas		
					Sale as fuel		
					Field burning		
Residue-n					Animal fodder		
					Domestic fuel		
					Compost		
					Mulching		
					Sale for fodder		
					Sale for biogas		
					Sale as fuel		
					Field burning		
						Total surplus residues available	

19. Details of the field burning of crop residues

Name of residues	Area of burning	Month/date of burning	Reason for burning
Residue-1			
Residue-2			
…			
Residue-n			

For FY 2023-24

20. Utilization categories (For each selected crop)

Name of residues generated	Total quantities of Residues produced	Storage method	Storage duration	Availability period	Type of application	Quantity used	Surplus availability
Residue-1					Animal fodder		
					Domestic fuel		
					Compost		
					Mulching		
					Sale for fodder		
					Sale for biogas		
					Sale as fuel		
					Field burning		
Residue-2					Animal fodder		
					Domestic fuel		
					Compost		
					Mulching		
					Sale for fodder		
					Sale for biogas		
					Sale as fuel		
					Field burning		
Residue-n					Animal fodder		
					Domestic fuel		
					Compost		
					Mulching		

						Sale for fodder		
						Sale for biogas		
						Sale as fuel		
						Field burning		
						Total surplus residues available		

21. Details of burning of crop residues

Name of residues	Area of burning	Month/date of burning	Reason for burning
Residue-1			
Residue-2			
…			
Residue-n			

Crop Residue Management Details		
22.	Value-added products being produced (with quantity)	☐ Biochar _____ ☐ Biogas _____ ☐ Briquettes _____ ☐ Compost _____ ☐ Dung cake _____ ☐ Others (Please specify) _____ ☐ Not being carried out
23.	Constraints in crop residue management	☐ Labor shortage for biomass collection and handling ☐ Logistics and machinery for collection, transportation and storage ☐ Lack of market demand ☐ High transportation costs ☐ Lack of storage space ☐ Risk of fire hazards ☐ Time constraint for next cropping season ☐ Lack of technology for processing into useful products (e.g., bioenergy, compost) ☐ Lack of awareness ☐ Environmental regulations or restrictions on burning ☐ Other (Please specify)
24.	Technical support is required for utilization of crop residues	☐ Technology for conversion in a value-added product ☐ Market Linkages ☐ Financial / banking support ☐ Research ☐ Other Resources
25.	Any Other Suggestion	

Acknowledgement and Other Details		
26.	Interested for the supply of suitable raw/value- added crop residues for suitable applications	☐ Yes ☐ No
27.	Desirable rates of raw crop residues (Rs./kg)	
28.	Sample quantity	
29.	Sample number	
30.	Respondent name	
31.	Relation with farmer	
32.	The information entered is as per the details provided by the respondent	(Acknowledgement type)
33.	Surveyor name	
34.	Images	
35.	Videos	
36.	Date & Time	

2.3. Analysis of the collected data

Proforma-3: Survey Data Compilation Format

Summary of Crop Residue Potential in a Taluka					
Sr. No.	Crop residue name	Area Covered (hectare)	Residue Produced (kT/Year)	Surplus Residue Available (kT/Year)	Residue Energy Potential (MJ/Year)
1.	Cotton stalk				
2.	Rice straw				
3.	Wheat straw				
….					
n.	Biomass-n				

Summary of Crop Residue Potential in the district					
Sr. No.	Crop residue name	Area Covered (hectare)	Residue Produced (kT/Year)	Surplus Residue Available (kT/Year)	Residue Energy Potential (MJ/Year)
1.	Cotton stalk				
2.	Rice straw				
3.	Wheat straw				
….					
n.	Biomass-n				

Crop residue Potential in the District (taluka-wise)				
Sr. No.	Taluka	Biomass Produced (kT/Year)	Surplus Biomass Available (kT/Year)	Biomass Energy Potential (MJ/Year)
1.	Taluka-1			
2.	Taluka-2			
….				
n.	Taluka-n			

Taluka-wise summary of potential crop residues in a district							
Sr. No.	Taluka	Cotton stalk (kT/Year)	Rice straw (kT/Year)	Wheat straw (kT/Year)	…	Residue-n (kT/Year)	Total residue
1.	Taluka-1						
2.	Taluka-2						
….							
n.	Taluka-n						
Total (kT)							

3. Biomass Availability in Dairy Farms and Gaushalas

3.1. Selection of respondent

- Information related to organized & unorganized dairy farm and goshala should be collected from different government sources like district agricultural officer, district animal health office, NDDB & others
- The collected information should be categorized at taluka level
- Each taluka level dairy farm at 5 % should be selected for the survey. Similarly, the goshala should be also selected at 5 % level for physical survey
- The selection of dairy farm and goshala should be done on Random basis.

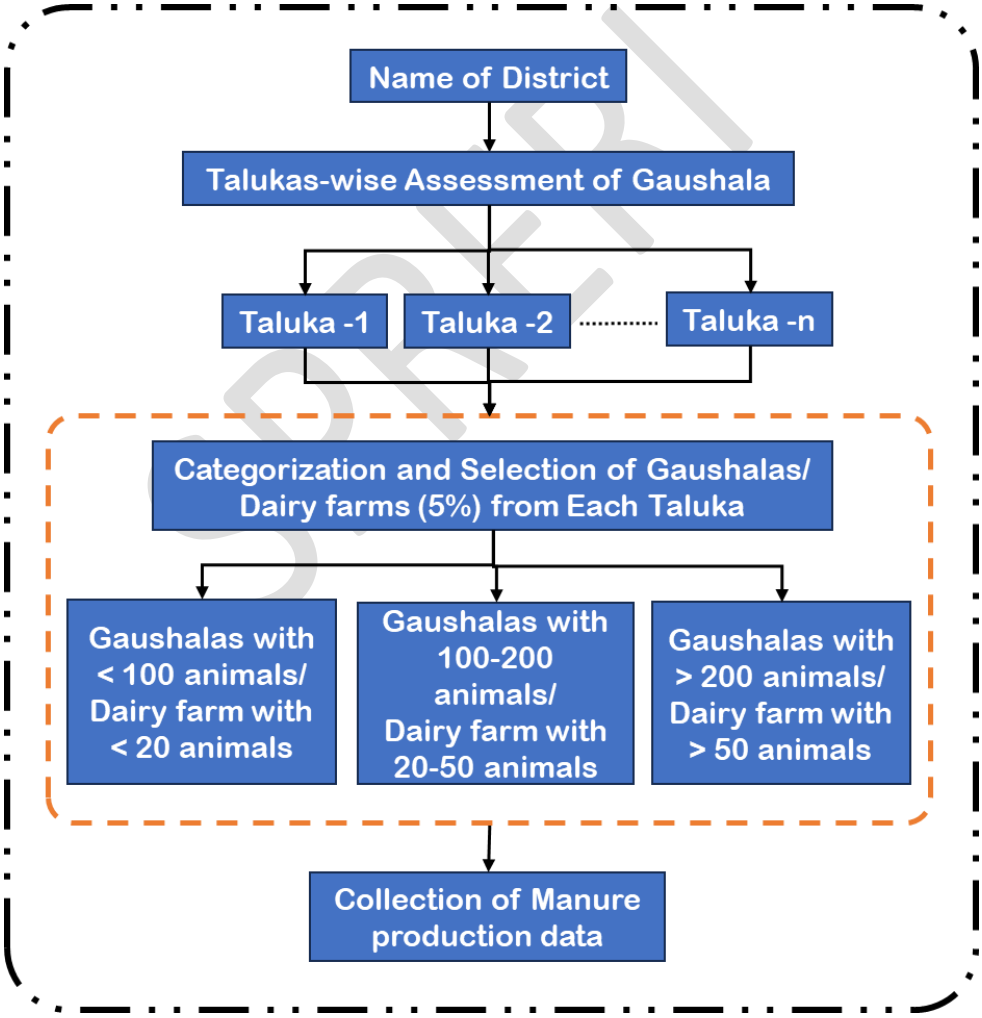


Fig. 3. Selection of respondents for dairy farms and gaushalas

3.2. Information of the dairy farms/ gaushalas

Proforma-4: Questionnaire for Livestock owner/ dairy farm/ gaushala

<table>
<tr><td colspan="3">General Information of dairy farms/ gaushalas</td></tr>
<tr><td>1.</td><td>Name of owner</td><td></td></tr>
<tr><td>2.</td><td>Age</td><td>_____Years</td></tr>
<tr><td>3.</td><td>Gender</td><td>☐ Male ☐ Female</td></tr>
<tr><td>4.</td><td>Village</td><td></td></tr>
<tr><td>5.</td><td>Taluka</td><td></td></tr>
<tr><td>6.</td><td>District</td><td></td></tr>
<tr><td>7.</td><td>Pin code</td><td></td></tr>
<tr><td>8.</td><td>Location</td><td>(Geotag)</td></tr>
<tr><td>9.</td><td>Contact details</td><td></td></tr>
<tr><td>10.</td><td>Educational Qualification</td><td></td></tr>
<tr><td>11.</td><td>Training obtained for dairy management</td><td>☐ Yes ☐ No</td></tr>
<tr><td>12.</td><td colspan="2">Number of Milking Animals and Manure Production Details
<table>
<tr><th>Name</th><th>No. of animal</th><th>Milk production</th><th>Manure production</th><th>Collection method</th><th>Storage method</th><th>Storage duration</th></tr>
<tr><td>Cow</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Buffalo</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sheep</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Goat</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Others</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>13.</td><td colspan="2">Male Animals Available and Manure Production Details
<table>
<tr><th>Name</th><th>No. of animal</th><th>Purpose</th><th>Manure production</th><th>Collection method</th><th>Storage method</th><th>Storage duration</th></tr>
<tr><td>Bull</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Buffalo</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sheep</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Goat</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Others</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
</table>

14. Utilization of generated manure

Name of residues	Total quantity produced	Availability period	Type of application	Quantity used	Surplus availability
Residue-1			Fertilizer		
			Biogas		
			Sale		
			Other uses		
Residue-2			Fertilizer		
			Biogas		
			Sale		
			Other uses		
Residue-n			Fertilizer		
			Biogas		
			Sale		
			Other uses		
Total surplus residues available					

15. Requirement of animal feed

Name of fodder	**Average requirement**		**Self-produced (Tons/annum)**	**Purchased (Tons/annum)**
	Tons/day	**Tons/annum**		

16.	Surplus availability of fodder/ residual fodder	
17.	Available fodder-residues for energy conversion	

Animal Manure Management Details

18.	Value-added products being produced (with quantity)	☐ Biogas _____ ☐ Compost _____ ☐ Dung cake _____ ☐ Dung log _____ ☐ Others (Please specify_____) ☐ Not being carried out
19.	Machinery used for collection, transportation and storage	☐ Dung scrapper ☐ Slurry scrapper ☐ Tractor and trolley ☐ Dung briquetting machine ☐ Dung de-watering machine ☐ Others (Please specify_____)
20.	Constraints in dung Management	☐ Lack of storage space ☐ Labor shortage for collection and handling

		☐ Lack of market demand ☐ High transportation costs ☐ Lack of technology for conversion to bio- energy ☐ Environmental regulations or restrictions ☐ Other (Please specify_____)
21.	Technical support is required for utilization of surplus manure/ fodder residues	☐ Technology for conversion in a value- added product ☐ Market Linkages ☐ Financial / banking support ☐ Research ☐ Other Resources
22.	Any Other Suggestion	
Acknowledgement and Other Details		
23.	Interested for Supply of Animal dung for energy	☐ Yes ☐ No
24.	Price of sale for cow dung (with quantity)	_____kg/day @ _____Rs./kg
25.	Price of sale for manure (with quantity)	_____kg/day @ _____Rs./kg
26.	Price of sale for surplus fodder (with quantity)	_____kg/day @ _____Rs./kg
27.	Price of sale for residue fodder (with quantity)	_____kg/day @ _____Rs./kg
28.	Respondent name	
29.	Designation of respondent	
30.	Contact details of respondent	
31.	The Information Entered are as per Details Provided by the Respondent	(Acknowledgement type)
32.	Surveyor Name	
33.	Images	
34.	Videos, GPS tracted	
35.	Date & Time	

*A dedicated Toolbox equipped with Geo-tagging should be utilized to authenticate the survey data

3.3. Analysis of the collected data for Gaushalas

Proforma-5: Survey Data Compilation Format

Summary of Manure Potential in the Particular Taluka					
Sr. No.	Category	No. of Gaushalas/ Dairy farms	Manure production	Existing utilization	Residue Energy Potential (MJ/Year)
1.	< 100 Animals				
2.	100-200 Animals				
3.	> 200 Animals				

Taluka-wise summary of potential crop residues in the Particular Taluka										
Sr. No.	Taluka	Manure details for < 100 Animals			Manure details for 100-200 Animals			Manure details for > 200 Animals		
		Prod.	Utilization	Residue Energy Potential	Prod.	Utilization	Residue Energy Potential	Prod.	Utilization	Residue Energy Potential
1.	Taluka-1									
2.	Taluka-2									
3.	Taluka-3									
….										
n.	Taluka-n									

Summary of Manure Potential in the District					
Sr. No.	Category	No. of Gaushalas/ Dairy farms	Manure production	Existing utilization	Residue Energy Potential (MJ/Year)
1.	< 100 Animals				
2.	100-200 Animals				
3.	> 200 Animals				

3.4. Analysis of the collected data for Dairy farms

Proforma-6: Survey Data Compilation Format

Summary of Manure Potential in the Particular Taluka					
Sr. No.	Category	No. of Dairy farms	Manure production	Existing utilization	Residue Energy Potential (MJ/Year)
1.	< 20 Animals				
2.	20-50 Animals				
3.	> 50 Animals				

Summary of Manure Potential in the District					
Sr. No.	Category	No. of Dairy farms	Manure production	Existing utilization	Residue Energy Potential (MJ/Year)
1.	< 20 Animals				
2.	20-50 Animals				
3.	> 50 Animals				

Taluka-wise summary of potential crop residues in the Particular Taluka										
Sr. No.	Taluka	Manure details for < 20Animals			Manure details for 20-50 Animals			Manure details for > 50 Animals		
		Prod.	Utilization	Residue Energy Potential	Prod.	Utilization	Residue Energy Potential	Prod.	Utilization	Residue Energy Potential
1.	Taluka-1									
2.	Taluka-2									
3.	Taluka-3									
….										
n.	Taluka-n									

4. Biomass assessment of biomass in Agro-industries & Saw mills

4.1. Selection of respondent

- The information related to different types of industries and saw mills should be collected from district authority and other sector like MSME etc. at the district level.
- These industries should be categorized based on their capacities i.e. small, medium enterprises Industries should be categorized at taluka level
- 5% of different category of industries should be selected randomly for data collection at taluka level agro industries should be surveyed for biomass generation and utilization patterns

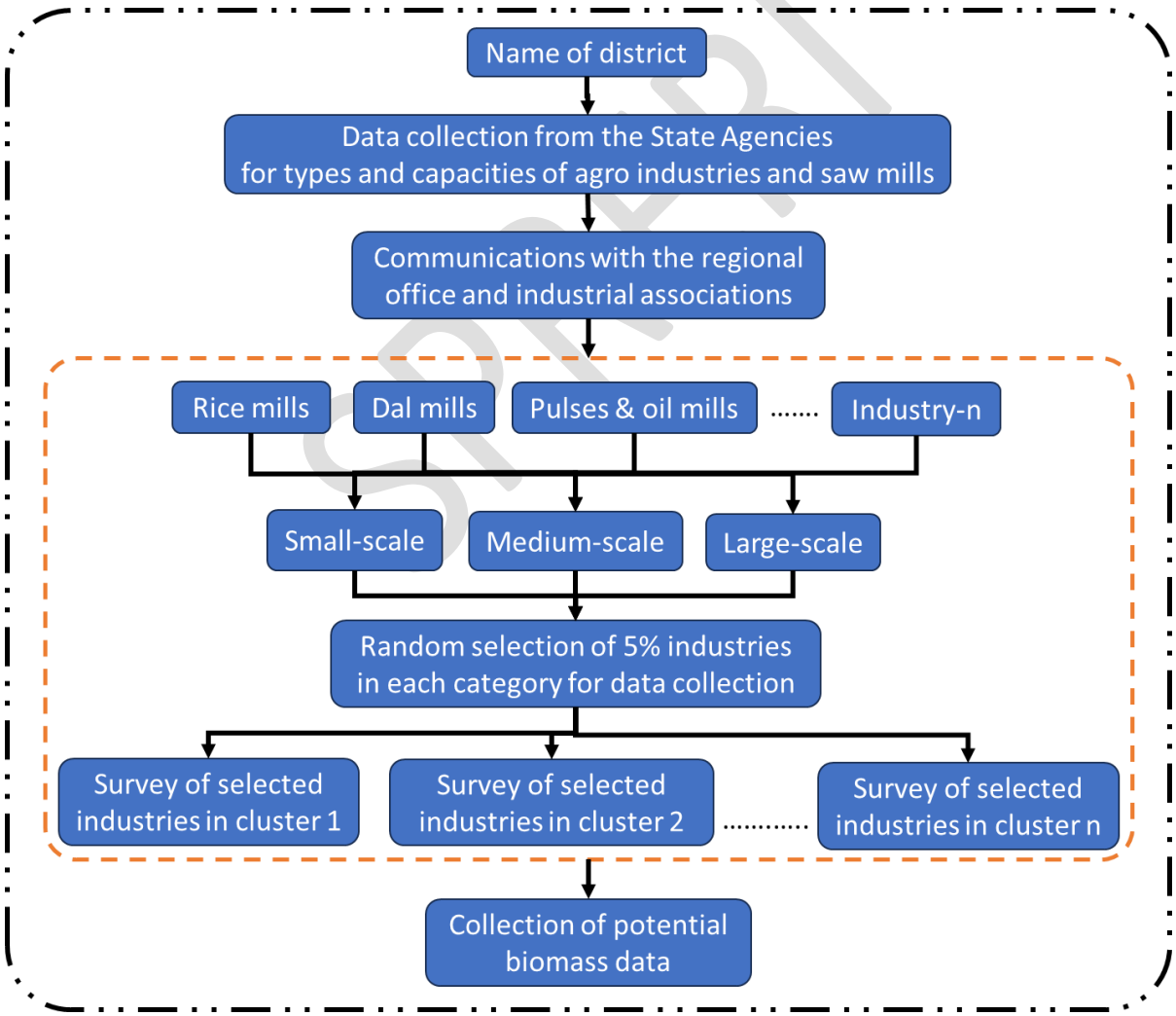


Fig. 4. Biomass Assessment from Agro-industries and sawmills

4.2. Proforma of questionnaires for agro-industries and sawmills

Prforma-7: Questionnaire for of agro-industrial biomass

Sr. No.	Question	Response/Options
4.	Industry name	
5.	Address	
6.	Contact details	
7.	Location	**(Geotag)**
8.	Name of Respondent	
9.	Designation	
10.	Contact details of respondent	
11.	Type of industry	☐ Rice Milling ☐ Sugar Industry ☐ Dal mill ☐ Wheat mill ☐ Flour mill ☐ Oil & pulses ☐ Other (Please specify)
12.	Category of industry	☐ Small ☐ Medium ☐ Large
13.	Primary product produced by the Industry	
14.	Production capacity (per day)	
15.	Agro-industrial biomass being generated	
16.	Product to residue ratio	
17.	Operating days per annum	
18.	Agro-industrial byproducts industry generates	

Name of Biomass	Production (per day)	Separation/Collection method	Storage method	Storage duration	Availability period
Biomass-1					
Biomass-2					
….					
Biomass-n					

19.	Utilization pattern of byproducts/waste							
	Name of residues generated	Total quantities of Residues produced	Storage method	Storage duration	Availability period	Usage	Qty. used	Surplus
	Biomass-1					Thermal/ power usage		
						Packing media		
						Biogas production		
						Biochar production		
						Fertilizer production		
						Sale in pulp production		
						Disposed of as waste		
						Others		
	Biomass-2					Thermal/ power usage		
						Packing media		
						Biogas production		
						Biochar production		
						Fertilizer production		
						Sale in pulp production		
						Disposed of as waste		
						Others		
	Biomass-n					Thermal/ power usage		
						Packing media		
						Biogas production		
						Biochar production		
						Fertilizer production		
						Sale in pulp production		
						Disposed of as waste		
						Others		
	Total surplus biomass produced							

20.	Challenge in use of management of waste	☐ Lack of infrastructure (e.g., processing equipment, storage) ☐ High cost of processing ☐ Lack of demand for waste ☐ Environmental regulations and restrictions ☐ Lack of awareness or technical knowledge ☐ Poor quality of byproducts (e.g., contamination, inconsistent size) ☐ Transport challenges ☐ Other (Please specify)
Techno-Economic & Supply Chain Analysis		
21.	Average distance biomass is transported for use/sale	_____km
22.	Mode of transportation	(Vehicle type and capacity)
23.	Cost of transportation (per ton)	_____
24.	Challenges in supply chain logistics	
Acknowledgement and Other Details		
25.	Interested for Supply of surplus biomass for energy generation	☐ Yes ☐ No
26.	Price of sale for biomass (with quantity)	_____kg/day @ _____Rs./kg
27.	The Information Entered are as per Details Provided by the Respondent	(Acknowledgement type)
28.	Surveyor Name	
29.	Images	
30.	Videos, GPS tracked	
31.	Date & Time	

*A dedicated Toolbox equipped with Geo-tagging should be utilized to authenticate the survey data

4.3. Analysis of the collected data

Proforma-8: Survey Data Compilation Format

Summary of Biomass Potential in the Taluka (Taluka Name)										
Sr. No.	Industry type	Number of mills			Surplus biomass production			Energy potential		
		Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
1.	Rice mill									
2.	Sawmill									
….										
n.	Industry-n									
Total										

Summary of Biomass Potential in the District										
Sr. No.	Industry type	Number of mills			Surplus biomass production			Energy potential		
		Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
1.	Rice mill									
2.	Sawmill									
….										
n.	Industry-n									
Total										

Summary of Taluka-wise Agro-industrial Biomass Potential in the District						
Sr. No.	Category	Rice husk	Groundnut shell	Sawdust	Residue-n	Residue Energy Potential (MJ/Year)
1.	Taluka-1					
2.	Taluka-2					
..	…					
n.	Taluka-n					
Total						

5. Forest Biomass Assessment

5.1. Identification of respondents

Range-wise information of forest areas at the district level should be collected and 10% of forest rangers should be assessed for the biomass potential

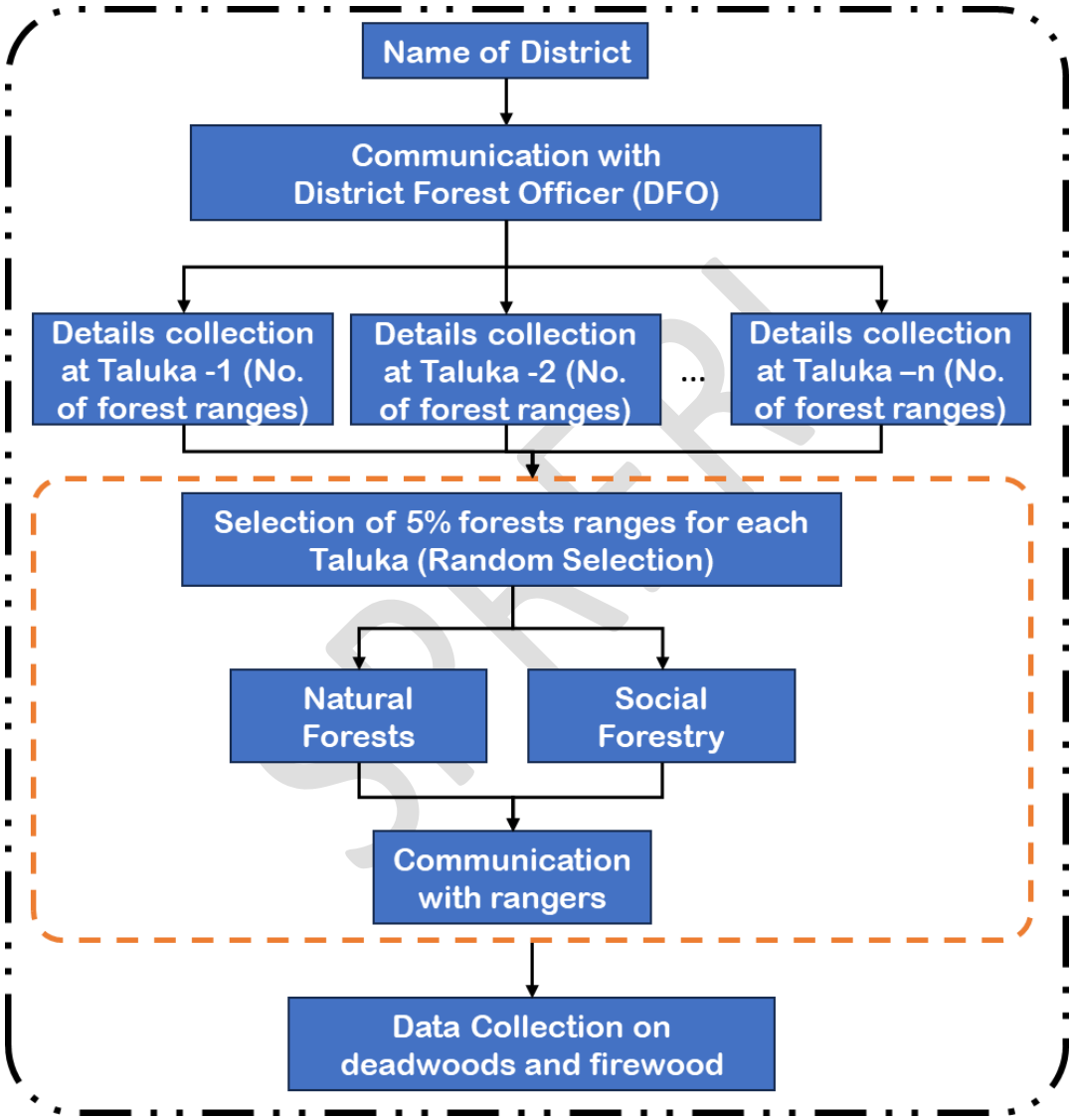


Fig. 5. Selection of respondents for biomass assessments in forest regions

Prforma-8: Questionnaire for of forestry biomass

S. No.	Question	Response/Options
1.	Name of Respondent:	
2.	Designation/ Organization:	
3.	Contact Information	
4.	District name	
5.	Location (Forest Division):	(Geotag)
6.	Total size of the forest area (in Hectare)	
7.	Type of forest • Natural forest • Man-made forest	
8.	Types of forest biomass are present in the area • Natural • Manmade	
9.	Availability of deadwoods	
10.	Total quantity of deadwood available annually (in tons or cubic meters)	
11.	Total quantity of fallen branches and twigs available annually (in tons or cubic meters)	
12.	Any seasonal fluctuations in the availability of forest biomass (e.g., deadwood, branches, leaves) (If yes, peak time)	
13.	Practices for forest biomass (deadwood, branches, leaves) typically managed or used in the area For example • Used for composting • Used as firewood/fuel • Sold in the market • Used for construction purposes • Used for making charcoal • Other (Please specify):	
14.	Market for selling of forest biomass (e.g., deadwood, branches) • Local households • Industrial buyers (e.g., paper mills, brick kilns) • Charcoal producers • Biomass energy producers • Other (Please specify)	
15.	If yes, to above question, how much is the sell annually (in tons or cubic meters)	

16.	Challenges in utilizing of forest biomass • Market demand • Lack of infrastructure (e.g., transport, storage) • Difficulty in collection or harvesting • Government regulations or restrictions • Lack of technical knowledge or expertise • Other (Please specify):	

*A dedicated Toolbox equipped with Geo-tagging should be utilized to authenticate the survey data

5.2. Analysis of the collected data

Proforma-9: Survey Data Compilation Format

Summary of Range-wise Residue in a Taluka (Number of ranges)							
Sr. No.	Forest residue name	Residue Produced (kT/Year)		Surplus Residue Available (kT/Year)		Residue Energy Potential (MJ/Year)	
		Natural Forest	Social forestry	Natural Forest	Social forestry	Natural Forest	Social forestry
1.	Deadwood						
2.	Branches/ Prunings						
…	……						
n.	Others						
	Total						

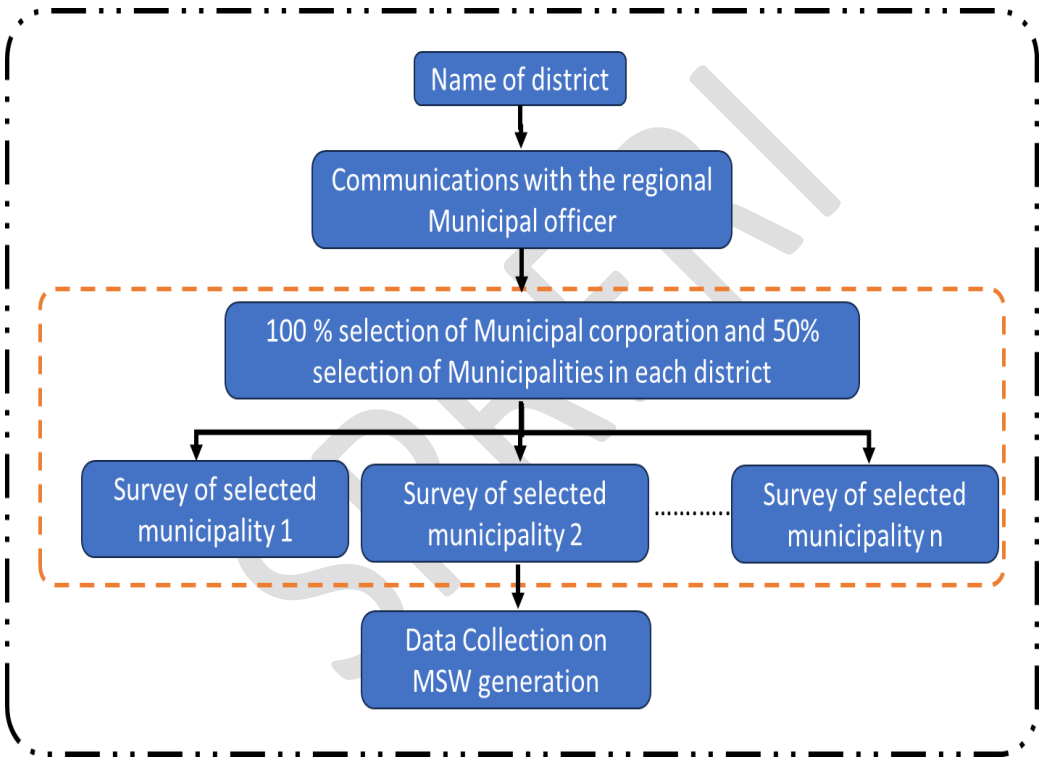
Summary of Range-wise Residue in District (Number of ranges)							
Sr. No.	Forest residue name	Residue Produced (kT/Year)		Surplus Residue Available (kT/Year)		Residue Energy Potential (MJ/Year)	
		Natural Forest	Social forestry	Natural Forest	Social forestry	Natural Forest	Social forestry
1.	Deadwood						
2.	Branches/ Prunings						
…	……						
n.	Others						
	Total						

Forestry Residue Potential in the District (Taluka-wise)								
Sr. No.	Crop residue name	No. of forest ranges	Residue Produced (kT/Year)		Surplus Residue Available (kT/Year)		Residue Energy Potential (MJ/Year)	
			Natural Forest	Social forestry	Natural Forest	Social forestry	Natural Forest	Social forestry
1.	Taluka-1							
2.	Taluka-2							
…	……							
n.	Taluka-n							
Total								

6. Municipal Solid Waste (MSW) Survey Assessment

6.1. Selection of respondent

- Information of zone engaged in MSW collection
- Identification of no. of municipal corporation, municipality and other agencies involve in collection of municipal solid waste
- Zone-wise information of municipality offices at the district level should be collected and 100% municipal corporation and 50 % municipality offices should be visited for the biomass potential assessment.



Proforma-10: Questionnaire for of MSW assessment

S. No.	Question	Response/Options
1.	Name of Municipal Corporation / municipality Office:	
2.	Contact person with designation:	
3.	Contact details	
4.	Address	
5.	Location	(Geotag)
6.	Total population	
7.	Total area	
8.	No. of Urban Local Bodies (ULBs)	
9	No. of Rural Local Bodies (if included)	
10.	Month-wise total waste generated (city-wide)-average per day (tonnes/day)	
11.	Month-wise per capita generation (g/capita/day)	
12.	Collection system type	
13.	Collection coverage	☐ Domestic _____% ☐ Commercial _____%
14.	Door to door collection	☐ Yes ☐ No ☐ Partially _____%
15.	Total number of waste collection bins located in the city	
	Frequency of emptying waste collection bins	
16.	Total number of waste transport vehicles	
17.	Composition by fraction	☐ Organic waste ☐ Paper and cardboards ☐ Plastics ☐ Cloth ☐ Metals ☐ Inert materials ☐ Hazardous ☐ Others
18.	Ongoing/planned waste-to-energy projects (Project name / capacity / status)	
19.	Annual budget for solid waste management (INR/year)	

6.1. Analysis of the collected data

Proforma-11: Survey Data Compilation Format

Summary of Range-wise Residue in a Taluka (Number of Municipalities)							
Sr. No.	MSW type	Residue Produced (kT/Year)		Surplus Residue Available (kT/Year)		Residue Energy Potential (MJ/Year)	
		Industrial	Domestic	Industrial	Domestic	Industrial	Domestic
1.	Organic						
2.	Plastic						
...	.....						
n.	Others						
	Total						

Summary of Range-wise Residue in District (Number of Municipalities)							
Sr. No.	MSW type	Residue Produced (kT/Year)		Surplus Residue Available (kT/Year)		Residue Energy Potential (MJ/Year)	
		Industrial	Domestic	Industrial	Domestic	Industrial	Domestic
1.	Organic						
2.	Plastic						
...	.....						
n.	Others						
	Total						

MSW Residue Potential in the District (Taluka-wise)								
Sr. No.	Biomass type	No. of municipality/ municipal corporation	Residue Produced (kT/Year)		Surplus Residue Available (kT/Year)		Residue Energy Potential (MJ/Year)	
			Industrial	Domestic	Industrial	Domestic	Industrial	Domestic
1.	Taluka-1							
2.	Taluka-2							
...	.....							
n.	Taluka-n							
Total								

7. Energy Potential Evaluation and Report Preparation

7.1. Biomass Surplus Quantification

7.1.1. The surplus availability of biomass should be assessed based on the crop-wise utilization pattern observed during the field survey. Considering the utilization pattern surplus availability of biomass for energy generation should be assessed

7.1.2. The biomass potential should be assessed based on the average grain-straw ratio of different crops observed during the field survey to estimate the biomass generation potential

Surplus Biomass = [Crop Yield X Grain to Straw Ratio X Area] – [Existing biomass consumption pattern for fodder, fuel, compost, etc.]

7.2. Characterization of Biomass for Energy Potential and Techno-economic feasibility

7.2.1. The samples collected of biomass from different categories and regions should be characterized

7.2.2. Based on the characterization, suitability for its conversion into energy and value added products using different technologies such as biochar, bio-methanation, gasification, solid fuels, etc.

7.2.3. Economics of biomass collection under different categories of harvesting practices should be assessed.

7.2.4. Economic feasibility for transportation of biomass in different lead distances 0-10 km, 10-50 km and 50-100 should be assessed for loose and partially processed biomass at field level (bailing, densification, etc.)

7.2.5. The logistic challenges, such as availability of manpower for collections, loading & un-loading; time constraints for next cropping field preparations; type of biomass handling machineries (especially bailing, racking, special trailers, loading & un- loading machineries, etc.)

7.3. Data Validation and Geospatial Mapping

7.3.1. The biomass generation and surplus availability should be mapped taluka-wise, crop- wise, using the resources available on ISRO-BHUVAN, Google Earth and QGIS platforms

7.3.2. The other biomass should also be assessed using the Geospatial Mapping facilities of ISRO-BHUVAN, NRSC, etc.

7.4. Block-level and final report compilation for the study region

7.4.1. Curated data of the Taluka- and District-wise for biomass generation and surplus availability (crop-wise, animal manures, agro-industrial and forest residues) should be analyzed and mapped on GIS tools

7.4.2. The report should address the variations in seasonal and regional variabilities of surplus availabilities of biomass, and existing biomass utilization patterns

7.4.3. Based on the biomass availability, potential clusters for different biomass conversion technologies should be identified/suggested

7.4.4. The report should also include the techno-economics of biomass collection, transportation at different lead distances and harvesting patterns

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