

**SECOND REPORT - DISTRICT WISE ASSESSMENT OF WASTE AVAILABILITY & ENERGY GENERATION POTENTIAL FOR FIVE SELECTED SECTORS: (URBAN ORGANIC SOLID WASTE, URBAN ORGANIC LIQUID WASTE, SLAUGHTERHOUSE, DISTILLERY INDUSTRY AND PULP & PAPER INDUSTRY) ACROSS INDIA.**

Extended Mapping of the available urban and industrial organic waste in various locations in India

## PREFACE

United Nations Industrial Development Organisation (UNIDO) is implementing a GEF-supported project “Organic Waste Streams for Industrial Energy Applications in India” jointly with the Ministry of New and Renewable Energy (MNRE), Government of India. The project aims to contribute to its climate change strategic objective namely, promoting investment in renewable energy technologies by transforming the market for using organic waste for SME industrial energy applications in India; and focusses on supporting different technological and commercial innovations in the application of bio-methanation technology (Biogas or Anaerobic Digestion).

A study for extended mapping of the urban and industrial organic waste availability across India is being carried out by UNIDO to determine energy generation potential from different organic wastes. A comprehensive and integrated “Bio-Resource Map” of the organic waste from four targeted sectors and five additional sectors have been developed using GIS applications. The complete study has the following outcome reports.

|                   |   |
|-------------------|---|
| First Report      | District wise assessment of waste availability and energy generation potential (Power, Bio-CNG) in four priority industrial sectors identified (Fruit & vegetable processing, poultry, cattle, and press mud) under GEF UNIDO project across India. |
| Second Report     | District wise assessment of waste availability and energy generation potential (power and/or, bio-CNG) in the five sectors(Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry, and Pulp & Paper industry).  |
| Final Deliverable | Development of “Comprehensive Map” using GIS applications based on the detailed outcomes and analyses indicating Availability and Energy Potential for all the sectors and all the States in India.   |

The current report is on District wise assessment of waste availability and energy generation potential (power and/or, bio-CNG) in the five sectors(Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry, and Pulp & Paper industry).

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## Abbreviations

|        |   |   |
|--------|---|---|
| AIDA   | : | All India Distillers' Association   |
| APEDA  | : | The Agricultural and Processed Food Products Export Development Authority |
| ASI    | : | Annual Survey of Industries   |
| BOD    | : | Biological Oxygen Demand  |
| CNG    | : | Compressed Natural Gas  |
| COD    | : | Chemical Oxygen Demand  |
| CPCB   | : | Central Pollution Control Board   |
| CPHEEO | : | Central Public Health & Environmental Engineering Organisation            |
| CPPRI  | : | Central Pulp & Paper Research Institute                                   |
| DAHD   | : | Department of Animal Husbandry  |
| ENA    | : | Extra Neutral Alcohol   |
| ETP    | : | Effluent Treatment Plant  |
| GEF    | : | Global Environment Facility   |
| GIS    | : | Geographic Information System   |
| IPMA   | : | Indian Paper Manufacturers Association                                    |
| LPCD   | : | Litres per Capita per Day   |
| MLD    | : | Millions Litre Per Day  |
| MNRE   | : | Ministry of New & Renewable Energy  |
| MOAFW  | : | Ministry of Agriculture & Farmers Welfare                                 |
| MOUD   | : | Ministry of Urban Development   |
| MSW    | : | Municipal Solid Waste   |
| MT     | : | Metric Ton  |
| MW     | : | Megawatt  |
| NAPCC  | : | National Action Plan on Climate Change                                    |
| NCT    | : | National Capital Territory  |
| PPG    | : | Project Preparation Grant   |
| RS     | : | Rectified spirit  |
| SEA    | : | Solvent Extractors Association  |
| SBM    | : | Swachh Bharat Mission   |
| TPA    | : | Ton Per Annum   |
| TPD    | : | Ton Per Day   |
| ULB    | : | Urban Local Body  |
| UNIDO  | : | United Nations Industrial Development Organization                        |



## 1.0 ORGANIC WASTE STREAMS IN INDIA

### 1.1 Project Background

The project “Organic waste streams for industrial renewable energy applications in India” reflects the Government’s priorities to promote sustainable development as set out in the National Action Plan on Climate Change (NAPCC). To further access the potential of energy generation from industrial and urban organic wastes, a study entitled “Organic waste streams for industrial renewable energy application in India” was undertaken by GEF under the project preparation grant (PPG) and in consultation with the Ministry of New and Renewable Energy (MNRE). During the study bio, methanation (Anaerobic Digestion) was identified as the most feasible technology for organic waste to energy generation.

The platform for accelerating the implementation of bio methanation technologies in India to maximize the potential of available organic industrial waste for energy generation was built upon four important areas, which included:

- Identification of SMEs sector with highest untapped potential
- Identification of most suitable business models based on level of innovation, technology, integration capability, end applications, and acceptance by technical and financial due diligence.
- Ease of financing through innovative mechanisms and
- Mapping of actual availability of selected categories of industrial organic wastes across various locations in India.

With the above background, this assignment aims to develop a comprehensive and integrated “Bio Resource Map” of organic industrial waste using GIS application for mapping the actual availability of organic wastes in identified sectors across various locations in India. The Bio Resource Map developed for the project will facilitate the potential investor in exploring different regions and waste sectors; and installation of potential organic waste to energy projects.

Phase I of the study covered four industrial sectors identified as priority industrial sectors namely Poultry, Sugar (Press mud), Fruit and vegetables, and cattle for mapping the organic waste availability across identified potential states in India. The final report for phase I of the assessment included the following outcome. Identification of Organic Waste Streams in India.

- Estimation of waste generation quantities.
- Identification of potential states for energy generation using organic waste from the targeted industries.
- Characterization of organic waste from targeted Industries in potential states.
- A Comprehensive map (GIS) of the organic waste from targeted industries in potential states.

The Phase II of the assessment is divided into two parts. Part I include an extension of the Phase I study to cover district-wise assessment of waste availability and energy generation potential in four priority industrial sectors of Phase I (poultry industry, sugar industry, fruit & vegetable, and food processing industry, and cattle farming) to all the districts in India.

Part II includes district-wise assessment of waste availability and energy generation potential assessment of five new industrial sectors. The new five industrial sectors include Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry, and Pulp and Paper industry.

The current report provides pan India district-wise assessment of the five new industrial sectors covered in Part II (Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry, and Pulp and Paper industry) of the assignment. Data relevant to the sectors has been updated and added for all the districts in India and a detailed matrix on estimated waste generation and energy potential of urban and industrial organic waste has been developed. The report also priorities and shortlist states and key districts within the states based on the waste generation/ availability and other parameters. The outcome of the report and the Bio Resource Map developed for the sectors will serve as a guide for potential investors for identification of areas with maximum availability of waste, areas with multi/mixed feedstock and will also support the potential investor in the selection of the region having a maximum potential to set up a bio methanation plant from the five new industrial sectors.

## 1.2 Data Sources

The data sources identified for the project included secondary sources such as published Government of India reports, published articles, research papers, central and guidelines industrial data from various sources; validated based on-site visits, stakeholder consultations, discussion with industry representatives, industry associations, and other primary sources. Key data sources considered for data on urban and industrial waste generation for selected sectors assessment are listed in the following table.

**Table 1-1: Sector-wise key sources and scale of data availability**

| Sl. No. | Sector             | Key Data Source   | Data availability                |
|---------|--------------------|---|----------------------------------|
| 1       | Urban solid waste  | <ul style="list-style-type: none"> <li>Municipal Solid Waste Management Manual-2016, CPHEEO for population projection</li> <li>Per capita solid waste generation rate -</li> <li>Central Pollution Control Board (CPCB)</li> <li>Solid Waste data from State Urban development Departments – Selected States</li> <li>Census of India, 2011</li> <li>Discussion with Central Pollution Control Board (CPCB)</li> <li>Discussion with Ministry of Urban Development (MOUD) -Swachh Bharat Mission (SBM)</li> <li>Discussion with State Pollution Control Departments – selected states</li> <li>Discussion with CPHEEO officials</li> <li>Discussion with State Urban development Departments – selected states</li> </ul> | State/District/ULB Level         |
| 2       | Urban liquid waste | <ul style="list-style-type: none"> <li>Municipal Solid Waste Management Manual-2016, CPHEEO for population projection</li> <li>National Inventory of Sewage Treatment Plants, march 2021, CPCB for Per capita liquid waste generation rate</li> <li>Census of India, 2011</li> <li>Discussion with Ministry of Urban Development (MOUD)</li> <li>Discussion with Central Pollution Control Board (CPCB)</li> <li>Discussion with CPHEEO officials</li> <li>Discussion with State Urban development Departments – selected states</li> </ul>   | State / district level/ULB Level |
| 3       | Slaughterhouse     | <ul style="list-style-type: none"> <li>Nos. of a slaughtered animal (State level)-Basic Animal Husbandry Statistics - 2019, Ministry of Fisheries, Animal, Husbandry &amp; Dairying, Department of Animal Husbandry &amp; Dairying</li> <li>Animal husbandry department of respective states</li> <li>Thumb Rules for slaughterhouse waste management and design of pollution control systems/measure - Maharashtra Pollution Control Board</li> </ul>  | State / district level           |

| Sl. No. | Sector                | Key Data Source  | Data availability      |
|---------|-----------------------|--|------------------------|
|         |                       | <ul style="list-style-type: none"> <li>• Discussion with slaughterhouse operator during the site visit.</li> <li>• Discussion with Agricultural and Processed Food Products Export Development Authority (APEDA) officials.</li> </ul>   |                        |
| 4       | Distillery industry   | <ul style="list-style-type: none"> <li>• Nos. of unit &amp; installed capacity - A Directory of Indian Distilleries, 2015 -16</li> <li>• Discussion with All India Distillers' Association (AIDA)</li> <li>• Discussion with Distillery Plant operators</li> </ul>   | State / district level |
| 5       | Pulp & Paper industry | <ul style="list-style-type: none"> <li>• No. of paper mills, installed capacity &amp; raw material used - Indian Agro &amp; Recycled Paper Mills Association's "Indian Agro &amp; Recycled Paper Mills Association's "In paper Directory on Indian Paper Manufacturers and Allied Industry, 2019"</li> <li>• Capacity utilization - A report on opportunities for green chemistry initiatives: pulp and paper industry, Office of The Principal Scientific Adviser To The Gol Vigyan Bhawan Annexe, New Delhi 2014</li> <li>• Indian Paper Manufacturers Association (IPMA).</li> <li>• Discussion with expert - Central Pulp &amp; Paper Research Institute (CPPRI), Saharanpur.</li> <li>• Discussion with pulp and paper mills in selected states and consultations with the industry representatives</li> <li>• Consultation with the industry associations</li> </ul> | State / district level |

## 2.0 ASSESSMENT OF IDENTIFIED SECTORS

### 2.1 Pulp & Paper Industry

The Indian paper industry accounts for about 4% of the world's production of paper. The per capita paper consumption in India is around 14 kg, way behind the global average of 57 kg. However, India is the fastest-growing market for paper globally<sup>1</sup>.

State-wise information on the paper industry in India has been compiled from the data<sup>2</sup> published by Indian Agro & Recycled Paper Mills Association and is provided in **Table 2-1**. The data indicates that out of 779 registered Pulp & Paper Industries in India, 648 units are functional, and 130 units are non-functional. The total installed capacity of functional paper mills in India is **19.58** million TPA.

Gujarat has the maximum number of functional paper mills i.e. 126, with an installed capacity of 3.69 million TPA which is 18.87% of the total installed capacity in India. Gujarat is followed by Uttar Pradesh in functional paper mills 89 units: 2.94 million TPA capacity, Tamil Nadu (66 units; 2.57 million TPA capacity), Maharashtra (92 units; 1.58 million TPA capacity) and Telangana (34 units; 1.5 million TPA capacity).

**Table 2-1: State-wise details of functional paper mills numbers and Installed capacity**

| SN           | State             | No of Paper Mills | Installed Capacity - (million TPA) |
|--------------|-------------------|-------------------|------------------------------------|
| 1            | Andhra Pradesh    | 33                | 0.99                               |
| 2            | Assam             | 5                 | 0.43                               |
| 3            | Chandigarh        | 4                 | 0.05                               |
| 4            | Chhattisgarh      | 12                | 0.12                               |
| 5            | Delhi             | 1                 | 0.01                               |
| 6            | Gujarat           | 126               | 3.69                               |
| 7            | Haryana           | 12                | 0.21                               |
| 8            | Himanchal Pradesh | 4                 | 0.15                               |
| 9            | J&K               | 3                 | 0.09                               |
| 10           | Jharkhand         | 1                 | 0.0009                             |
| 11           | Karnataka         | 21                | 0.81                               |
| 12           | Kerala            | 13                | 0.41                               |
| 13           | Madhya Pradesh    | 10                | 0.38                               |
| 14           | Maharashtra       | 92                | 1.58                               |
| 15           | Nagaland          | 1                 | 0.03                               |
| 16           | Odisha            | 5                 | 0.37                               |
| 17           | Puducherry        | 6                 | 0.08                               |
| 18           | Punjab            | 45                | 1.32                               |
| 19           | Rajasthan         | 8                 | 0.06                               |
| 20           | Tamil Nadu        | 66                | 2.57                               |
| 21           | Telangana         | 34                | 1.50                               |
| 22           | Uttar Pradesh     | 89                | 2.94                               |
| 23           | Uttarakhand       | 24                | 1.03                               |
| 24           | West Bengal       | 33                | 0.74                               |
| <b>Total</b> |                   | <b>648</b>        | <b>19.58</b>                       |

<sup>1</sup> Indian Paper Manufacturers Association (IPMA). <http://ipmaindia.org/overview/>

<sup>2</sup> Paper directory - Indian Paper Manufactures and Allied Industry-2019

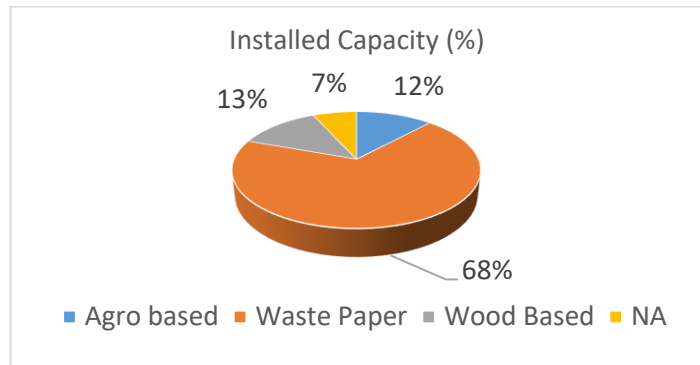
Source: Indian Agro & Recycled Paper Mills Association's "In paper Directory on Indian Paper Manufacturers and Allied Industry, 2019

### 2.1.1 Pulp & Paper Industry in India

Waste generated from the paper & pulp industry depends on the process and raw material used.

The Indian paper mills use the following type of raw materials: wood/forest-based products (bamboo, wood), agro-residue (bagasse, wheat & rice straw, jute sticks), and wastepaper for manufacturing paper. The raw material-wise breakup of the installed capacity of pulp & paper mills is provided in Figure 2-1.

**Figure 2-1: Installed Capacity of Pulp & Paper Mills Based on Raw Materials**

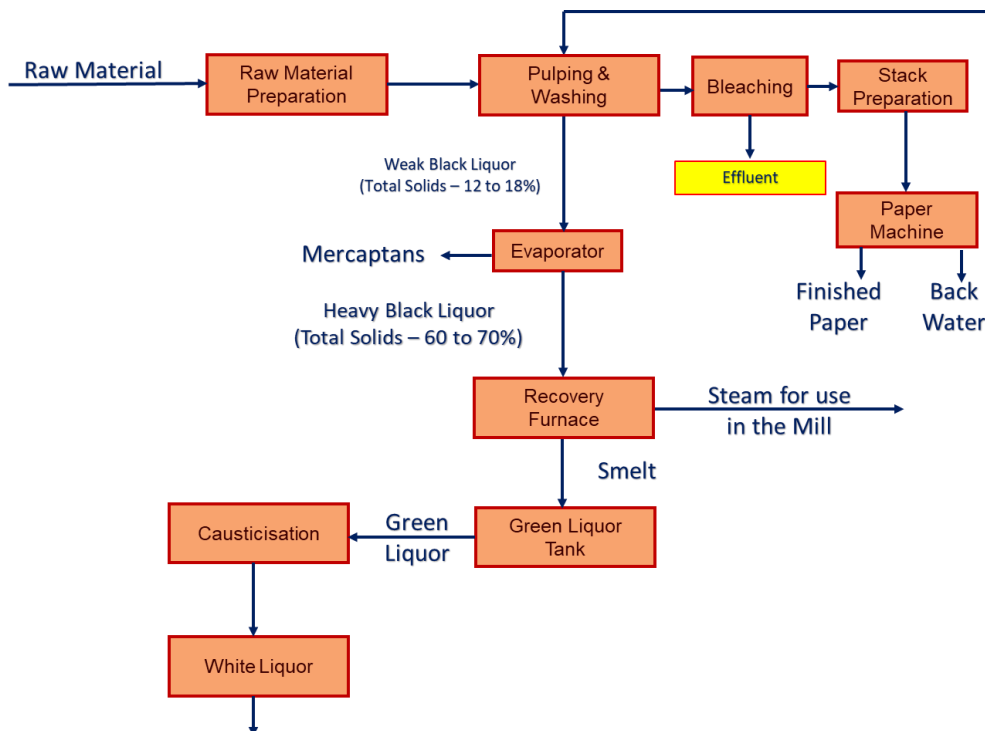


Source: Indian Agro & Recycled Paper Mills Association's "In paper Directory on Indian Paper Manufacturers and Allied Industry, 2019

Approximately 68% of the installed capacity for pulp & Paper mills is for wastepaper-based units, followed by wood-based (13%) and agro-based (12%). The percentage of the wood / forest-based paper industry is declining due to environmental regulations, non-availability, and the rising cost of raw materials. The majority of the pulp & paper industries are shifting to non-wood-based or wastepaper-based raw materials. Waste generated from wastepaper-based units is less in comparison to wood-based or agro residue-based units.

Pulp & paper manufacturing is divided into five major processes i.e., Raw material preparation, Pulping, Bleaching Chemical Recovery, and Papermaking. The flow diagram in Figure 2-2 depicts the typical process in the paper industry and effluent generation process.

**Figure 2-2: Manufacturing Process of Paper Industry**



**Raw Material Preparation:** Raw materials are prepared as per processing norms before the pulping process. Major processing involves debarking and cutting of wood in case of wood-based units, processing of agro and wastepaper raw material suitable for pulping. While the wastepaper is sorted out in the storage yard as per the quality of wastepaper and final product in case of wastepaper-based units.

**Pulping Process:** The pulping process involves extracting fibrous materials from raw materials by the chemical or mechanical or chemical-mechanical process. Fibrous raw materials, chemicals, additives, water, and energy are utilised during the process. The raw materials are cooked and mechanically or chemically treated to get the pulp for paper making. This process is one of the major sources of effluents during the manufacturing process.

**Bleaching Process:** The bleaching process is carried out to improve the brightness of the pulp. The type of pulp involved, and the destined end-use are important factors in the actual process. Some of the bleaching agents used are chlorine, chlorine dioxide, hydrogen peroxide, caustic, oxygen, ozone, hypochlorite, sodium bisulphite.

**Chemical Recovery:** Spent chemicals is regenerating from chemical recovery which was used in pulping. Chemical pulping produces a waste stream of inorganic chemicals and wood residues known as black liquor. The black liquor is concentrated in evaporators and then incinerated in recovery furnaces, many of which are connected to steam turbine cogeneration systems. Sodium sulphite is also recovered.

**Papermaking:** Papermaking consists of pressing and drying which is the most important and final process. The water is removed by pressing and the paper is left to dry. In one of the most common papermaking processes, the paper is pressed, drained, and dried in a continuous process. In another, a pulp matt is formed in layers with water removal and treating occurring between deposits.

## 2.1.2 Waste Streams from Pulp & Paper Industry

### Solid Waste

The total solid waste generated is 1%-2% of the total waste generated from the pulp & paper industry. Sludge from the ETP and plastic waste is the major solid waste generated during the raw material processing<sup>3</sup>; the quantity of solid waste generated depends upon the following:

- raw material consumed,
- internal & external control measures,
- housekeeping,
- waste utilisation and
- collection and recycling practices.

Apart from the above source, solid waste is also generated during stock preparation, process water clarification, and wastewater treatment. During the field investigation and stakeholder consultations, it was revealed that quantum of wastewater generated from the wastepaper-based paper industry is 50% less compared to the non-wastepaper-based paper industry.

Most of the solid waste generated from the pulp & paper manufacturing unit is reused and recycled within the plant. Plastic waste collected from pulp slurry is considered as hazardous waste and it is sent to a cement factory for co-processing. **Table 2-2** presents the type of raw material and waste generated for the sector.

**Table 2-2: Raw Material and Waste Streams for Paper & Pulp industry**

| Sector                | Database to estimate the waste quantity  | Raw material                     | Waste stream – solid              | Waste stream – liquid |
|-----------------------|--|----------------------------------|-----------------------------------|-----------------------|
| Pulp & Paper Industry | State-wise number of industries and plant capacity<br><br>90% of the capacity utilisation is considered* | Wood, bagasse, grass, wastepaper | Non-Organic Waste -Not Considered | Black liquor          |

\* A Report on Opportunities for Green Chemistry Initiatives: Pulp and Paper Industry, Office of The Principal Scientific Adviser to The GOI Vigyan Bhawan Annexe, New Delhi, 2014, Prepared by NEERI, Nagpur

<sup>3</sup> <https://www.environmentalpollution.in/waste-management/solid-waste-management-in-pulp-and-paper-industry-in-india/2869>

## Liquid Waste

Globally, average raw water consumption by large-scale Pulp and Paper mills is 28.66 m<sup>3</sup>/ton of paper while in India it is about 80-150 m<sup>3</sup>/ ton (Naidu, 2012). The pulp and paper industry raw water consumption depends upon the type of raw material being used. Consumption of raw water and wastewater generation is higher in wood & agro-based mills compared to wastepaper-based mills.

A large number of chemicals such as sodium hydroxide, sodium carbonates, sodium sulphide, bi-sulphites, elemental chlorine or chlorine dioxide, calcium oxide, hydrochloric acid, etc. are used in the manufacturing of paper. It results in the generation of larger quantities of effluents containing organic and inorganic salts and toxic pollutants, which are let out. Fugitive fibres, starch, hemicellulose, and organic acids are the main cause of organic pollution in effluents. This results in a COD discharge in the range of 25-125 kg/t of pulp. High BOD/COD concentration results in depletion of oxygen available to fauna and flora downstream of effluent discharge. Many toxins such as resin and fatty acids and heavy metals present in the paper mill effluents are absorbed by the organic solids.

Large volumes of wastewater (up to 70% of raw water consumption<sup>4</sup>) are generated for each metric ton of paper produced, depending on the nature of raw material, the type of finished product and the extent of water use. The wastewater from the production processes of this industry includes high concentrations of chemicals such as sodium hydroxide, sodium carbonate, sodium sulphide, bisulphites, elemental chlorine or chlorine dioxide, calcium oxide, hydrochloric acid, etc. The raw wastewater from paper mills has high COD levels i.e., 11,000mg/l and BOD levels 4,000mg/l. The wastewater has a high potential for generation of bioenergy.

The various sources of liquid and solid waste generated from pulp & paper industry are provided in **Table 2-3**; the table provides information on raw material used, water consumption, waste generation & its characteristics.

### **Case Study on Biomethanation of Effluent from Pulp & Paper unit**

*Sainsons Paper Industries Ltd, Bakhil Kurukshetra district in Haryana state is generating energy from bio methanation of liquid effluent generated from the unit. The installed capacity of the unit is 60,000 TPA. Pulp/Wheat Straw/ Rice Straw/Bagasse/Wastepaper is used as a raw material for manufacturing of Paper. The plant has a biomethanation and a cogeneration unit.*

- *Co-generation plant of 4 MW capacity with Rice /wheat straw and husk as a fuel.*
- *Bio methanation plant is also installed at the unit. The liquid waste generated from the industry is used for bio methanation. The gas generated from the bio methanation is used for the heating process and the company is planning to convert it to CNG in the future.*

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<sup>4</sup> Wastewater Treatment and Reclamation: A Review of Pulp and Paper Industry Practices and Opportunities.

Martin A. Hubbe,\*<sup>a</sup> Jeremy R. Metts,<sup>a,b</sup> Daphne Hermosilla,<sup>c</sup> M. Angeles Blanco,<sup>d</sup> Laleh Yerushalmi,<sup>e</sup> Fariborz Haghghat,<sup>e</sup> Petra Lindholm-Lehto,<sup>f</sup> Zahra Khodaparast,<sup>g</sup> Mohammadreza Kamali,<sup>h</sup> and Allan Elliot.

**Table 2-3: Liquid & Solid Waste from Pulp & Paper**

| Mill Code                                     | Product                      | Capacity (TPA) | Raw Material Used | Pulping (Soda/Kraft/Hydra-pulping & bleach Sequence) | Water (m <sup>3</sup> /t) | Major Source of Waste Generation                | Liquid Waste and its Characteristics |                          | Solid Waste (Kg. per tonne) |
|---|------------------------------|----------------|-------------------|--|---------------------------|---|--------------------------------------|--------------------------|-----------------------------|
|   |                              |                |                   |  |                           |   | In-effluent                          | Effluent                 |                             |
| <b>Secondary Fibre-based Paper Industries</b> |                              |                |                   |  |                           |   |                                      |                          |                             |
| A   | Duplex Board and Kraft Paper | 10,800         | WP-10,947         | Hydra - pulping                                      | 95                        | 1. Centri-screens                               | Q-100 m <sup>3</sup> /t              | Q - 65 m <sup>3</sup> /t | Plastic-5.7                 |
|   |                              |                | PP-1,219          |  |                           | 2. Centi-cleaners                               | pH-4.9                               | PH-6.7                   | Sludge-140                  |
|   |                              |                | SC-1,021          |  |                           | 3. Deckers                                      | SS-2058                              | SS-37                    | Boiler ash-240              |
|   |                              |                | CS-27             |  |                           | 4. Moulds of paper machines                     | COD-1952<br>BOD788                   | COD-68                   |                             |
|   |                              |                |                   |  |                           |   |                                      | BOD-27                   |                             |
| B   | Duplex Board                 | 9,900          | WP-9,000          | Hydra - pulping                                      | 120                       | 1. Centricleaners                               | Q-100 m <sup>3</sup> /t              | Q-50 m <sup>3</sup> /t   | Plastic-70                  |
|   |                              |                | PP-1,500          |  |                           | 2. Deckers                                      | SS-1,200                             | SS-200                   | Sludge-50                   |
|   |                              |                | Roshin - 60       |  |                           | 3. Paper machine moulds Pulp mill               | COD-600                              | COD - 200                | Boiler Ash-242              |
|   |                              |                | Alum - 350        |  |                           |   | BOD-300                              | BOD-30                   |                             |
|   |                              |                | Tale - 250        |  |                           |   |                                      |                          |                             |
| <b>Agro-based Paper Industries</b>            |                              |                |                   |  |                           |   |                                      |                          |                             |
| C   | Quality Bleached Paper       | 11,454         | Bagasse – 11,306  | Soda pulping, CEH-bleaching                          | 135                       | 1. Brown stock washing                          | Q-100 m <sup>3</sup> /t              | Q-100 m <sup>3</sup> /t  | Bagasse pith 300            |
|   |                              |                | WS – 7,385        |  |                           | 2. Screening                                    | SS-800                               | SS-80                    | ETP sludge-75               |
|   |                              |                | RS – 1,809        |  |                           | 3. Decker                                       | BOD-350                              | BOD-NA                   | Coal ash-160                |
|   |                              |                | Jute - 202        |  |                           | 4. Filters in bleaching                         | DS-850                               | DS-800                   |                             |
|   |                              |                | WP – 2,078        |  |                           | 5. Screening (Wastepaper stream)                | COD-1,800                            | COD-NA                   |                             |
|   |                              |                | PP- 3,481         |  |                           | 6. Paper machine filtrate from wire             |                                      |                          |                             |
|   |                              |                | CS – 2,100        |  |                           | 7. Boiler blowdown                              |                                      |                          |                             |
|   |                              |                | Filter – 1,900    |  |                           | 8. Leakage of B/1 from pump glands in pulp mill |                                      |                          |                             |
|   |                              |                | Rosin - 75        |  |                           |   |                                      |                          |                             |



District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| Mill Code | Product                  | Capacity (TPA) | Raw Material Used | Pulping (Soda/Kraft/Hydra-pulping & bleach Sequence) | Water (m <sup>3</sup> /t) | Major Source of Waste Generation                | Liquid Waste and its Characteristics |                        | Solid Waste (Kg. per tonne)         |
|-----------|--------------------------|----------------|-------------------|--|---------------------------|---|--------------------------------------|------------------------|-------------------------------------|
|           |                          |                |                   |  |                           |   | In-effluent                          | Effluent               |                                     |
|           |                          |                | Chlorine - 75     |  |                           |   |                                      |                        |                                     |
| D         | Writing & Printing Paper | 8,000          | Bagasse - 14000   | Soda pulping, CEH-bleaching                          | 110                       | 1. Brown stock washer                           | Q-100 m <sup>3</sup> /t              | Q-95 m <sup>3</sup> /t | Raw Material Preparation-80         |
|           | Duplex Board             | 18,000         | RS – 22,000       |  |                           | 2. Cleaning sys.                                | SS-1750                              | SS-80                  | Plastic or other - Material in WP25 |
|           | Art & Chromo Paper       | 4,500          | WP – 14,000       |  |                           | 3. Decker (Unbleached)                          | BOD-800                              | BOD-70                 | Screening Plant 5                   |
|           |                          |                | PP – 35,000       |  |                           | 4. Bleach filters                               | DS-1,850                             | DS-39                  | Boiler ash-200                      |
|           |                          |                | CS – 3,100        |  |                           | 5. Cleaning sys. (Wastepaper stream)            | COD-2,850                            | COD-500 to 800         |                                     |
|           |                          |                | Chlorine - 850    |  |                           | 6. Paper machine (Wet end)                      |                                      |                        |                                     |
|           |                          |                | Filter – 2,400    |  |                           | 7. Leakage of B/1 from Pump glands in pulp mill |                                      |                        |                                     |
|           |                          |                | SC - 250          |  |                           | 8. Boiler blowdown                              |                                      |                        |                                     |

Source: Parivesh, A Newsletter from ENVIS Centre - CPCB

Abbreviations: PP-Purchased Pulp; WP-Waste Paper; RS-Rice Straw, WS-Wheat Straw; CS-Caustic Soda; SC-Sizing Chemical, Q-Flow; CEH-Chlorination, alkali-extraction, hypochlorite

### 2.1.3 Energy generation potential from Pulp & Paper industry

Liquid waste generated from Pulp & Paper Industry has been considered for assessment of energy generation potential. The total energy potential for the selected sectors is 1507 MW. State-wise waste generation and energy potential is provided in **Table 2-4**.

**Table 2-4: State-wise functional paper mill - waste generation & energy potential.**

| SN           | State             | Total No of Paper Mills | Total Installed Capacity – (In '000) TPA | 90% <sup>5</sup> Capacity Utilisation - (In '000) TPA | Water consumption in million m <sup>3</sup> per annum <sup>6</sup> | Wastewater in million m <sup>3</sup> per annum | Energy potential MW <sup>7</sup> | Bio CNG(T) (1MW = 4.8 TPD Bio CNG) |
|--------------|-------------------|-------------------------|--|---|--|--|----------------------------------|------------------------------------|
| 1            | Andhra Pradesh    | 33                      | 992                                      | 893   | 89   | 63   | 76.36                            | 366.54                             |
| 2            | Assam             | 5                       | 430                                      | 387   | 39   | 27   | 33.11                            | 158.93                             |
| 3            | Chandigarh        | 4                       | 49                                       | 44  | 4  | 3  | 3.77                             | 18.10                              |
| 4            | Chhattisgarh      | 12                      | 122                                      | 110   | 11   | 8  | 9.41                             | 45.17                              |
| 5            | Delhi             | 1                       | 6  | 5   | 1  | 0.38   | 0.46                             | 2.22                               |
| 6            | Gujarat           | 126                     | 3,694                                    | 3,325   | 332  | 233  | 284.28                           | 1364.56                            |
| 7            | Haryana           | 12                      | 207                                      | 186   | 19   | 13   | 15.91                            | 76.37                              |
| 8            | Himanchal Pradesh | 4                       | 154                                      | 139   | 14   | 10   | 11.85                            | 56.88                              |
| 9            | J&K               | 3                       | 93                                       | 83  | 8  | 6  | 7.13                             | 34.24                              |
| 10           | Jharkhand         | 1                       | 0.90                                     | 0.81  | 0.08   | 0.06   | 0.07                             | 0.33                               |
| 11           | Karnataka         | 21                      | 809                                      | 728   | 73   | 51   | 62.28                            | 298.97                             |
| 12           | Kerala            | 13                      | 415                                      | 373   | 37   | 26   | 31.90                            | 153.14                             |
| 13           | Madhya Pradesh    | 10                      | 376                                      | 338   | 34   | 24   | 28.90                            | 138.72                             |
| 14           | Maharashtra       | 92                      | 1,580                                    | 1,422   | 142  | 100  | 121.62                           | 583.77                             |
| 15           | Nagaland          | 1                       | 33                                       | 30  | 3  | 2  | 2.54                             | 12.19                              |
| 16           | Odisha            | 5                       | 369                                      | 332   | 33   | 23   | 28.36                            | 136.11                             |
| 17           | Puducherry        | 6                       | 79                                       | 71  | 7  | 5  | 6.09                             | 29.26                              |
| 18           | Punjab            | 45                      | 1,324                                    | 1,191   | 119  | 83   | 101.85                           | 488.87                             |
| 19           | Rajasthan         | 8                       | 64                                       | 58  | 6  | 4  | 4.92                             | 23.63                              |
| 20           | Tamil Nadu        | 66                      | 2,570                                    | 2,313   | 231  | 162  | 197.75                           | 949.19                             |
| 21           | Telangana         | 34                      | 1,503                                    | 1,352   | 135  | 95   | 115.63                           | 555.03                             |
| 22           | Uttar Pradesh     | 89                      | 2,945                                    | 2,650   | 265  | 186  | 226.60                           | 1087.68                            |
| 23           | Uttarakhand       | 24                      | 1,026                                    | 924   | 92   | 65   | 78.97                            | 379.08                             |
| 24           | West Bengal       | 33                      | 739                                      | 665   | 66   | 47   | 56.84                            | 272.86                             |
| <b>Total</b> |                   | <b>648</b>              | <b>19,579</b>                            | <b>17,621</b>   | <b>1762</b>  | <b>1233</b>                                    | <b>1506.63</b>                   | <b>7231.84</b>                     |

Source: Data on number of paper mills and Installed capacity - Indian Agro & Recycled Paper Mills Association's "In paper Directory on Indian Paper Manufacturers and Allied Industry, 2019

<sup>5</sup> Paper industry is operating at a capacity utilization level of around 90%, A Report on Opportunities for Green Chemistry Initiatives: Pulp And Paper Industry, Office of The Principal Scientific Adviser to The GOI Vigyan Bhawan Annexe, New Delhi, 2014, Prepared by NEERI, Nagpur.

<sup>6</sup> Jung, H. & Pauly, D.. (2011). Water in the Pulp and Paper Industry. 10.1016/B978-0-444-53199-5.00100-7. Water consumption in Indian plants is between 80-150 m<sup>3</sup>/ton (Naidu, 2012). Water consumption of 100 m<sup>3</sup> per ton has been considered for calculations in the report.

<sup>7</sup> Factor for energy potential estimation - 1 m<sup>3</sup> of wastewater generates 5 m<sup>3</sup> of biogas

**Formula for power potential estimation from biogas**

**Power Potential =  $\frac{\text{Biogas generated in a year} \times 2.14}{(365 \times 24 \times 1000)}$**

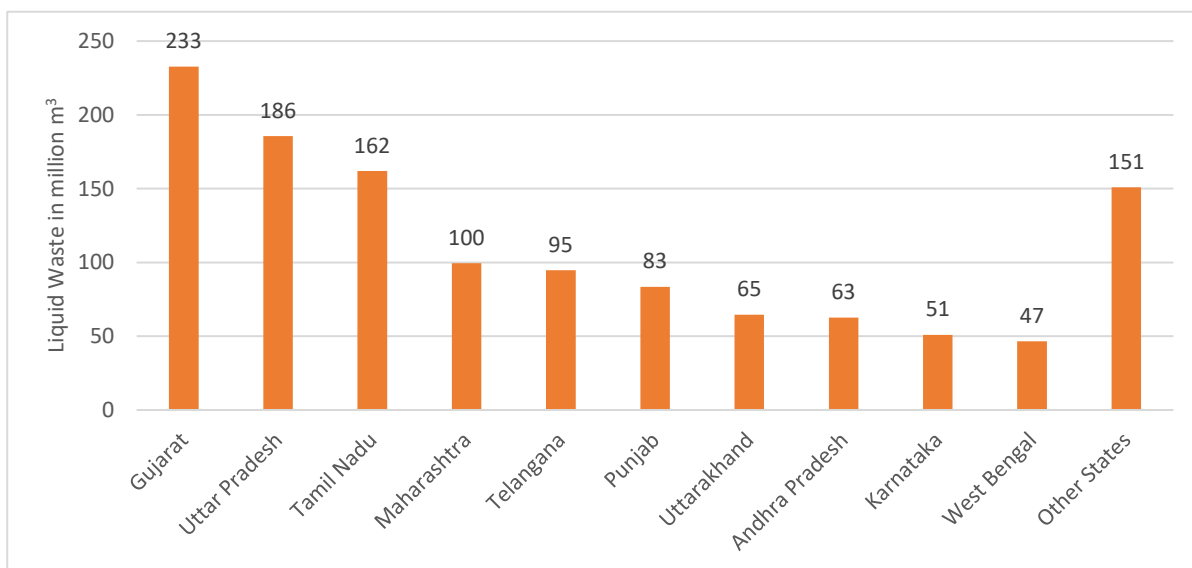
*Thermal value of Biogas – 22 MJ m<sup>3</sup>*

3.6 MJ = 1KWh, 1m<sup>3</sup> biogas = (22/3.6) kWh = 6.1 kWh, Electrical conversion efficiency = 35%, Therefore, 1m<sup>3</sup> biogas = 2.14 kWh (elec)

Note: Above formula has been considered to estimate energy potential from waste streams of Pulp & Paper Liquid Waste

States having a maximum share in liquid effluent from pulp and paper are Gujarat, Uttar Pradesh, Tamil Nadu, Maharashtra, Telangana, Punjab, Uttarakhand & Andhra Pradesh which contributes approximately 75% of the total pulp & Paper effluent in India. State-wise generation of effluent from the paper industry is provided in **Figure 2-3**.

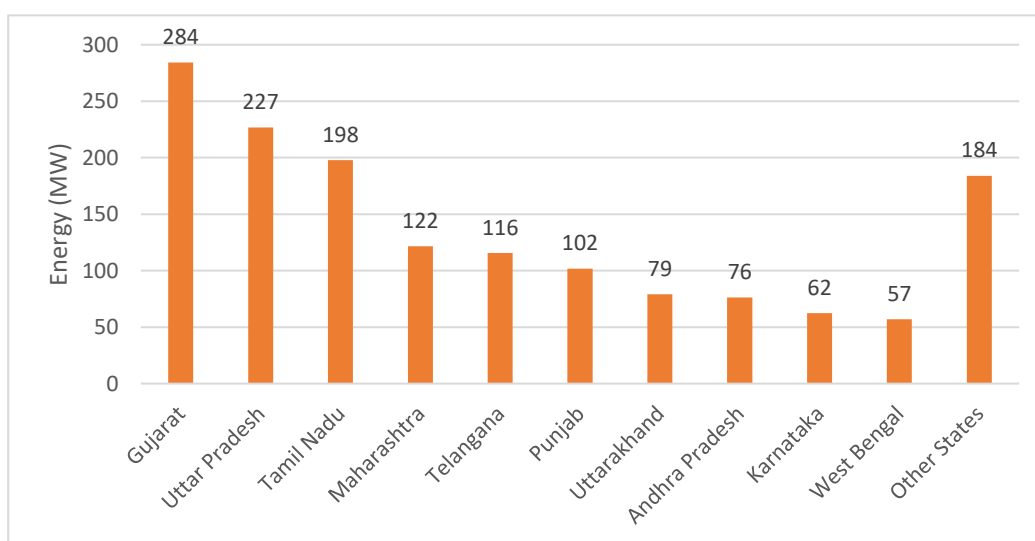
**Figure 2-3: State-wise generation of effluent in the paper industry**



Source: Based on the data from Indian Agro & Recycled Paper Mills Association's "In paper Directory on Indian Paper Manufacturers and Allied Industry, 2019

State-wise energy potential in the paper industry is provided in **Figure 2-4**.

**Figure 2-4: State-wise generating paper industry maximum energy potential**



Source: Indian Agro & Recycled Paper Mills Association's "In paper Directory on Indian Paper Manufacturers and Allied Industry,

Figure 2-5: the Key States from Pulp & Paper Industry

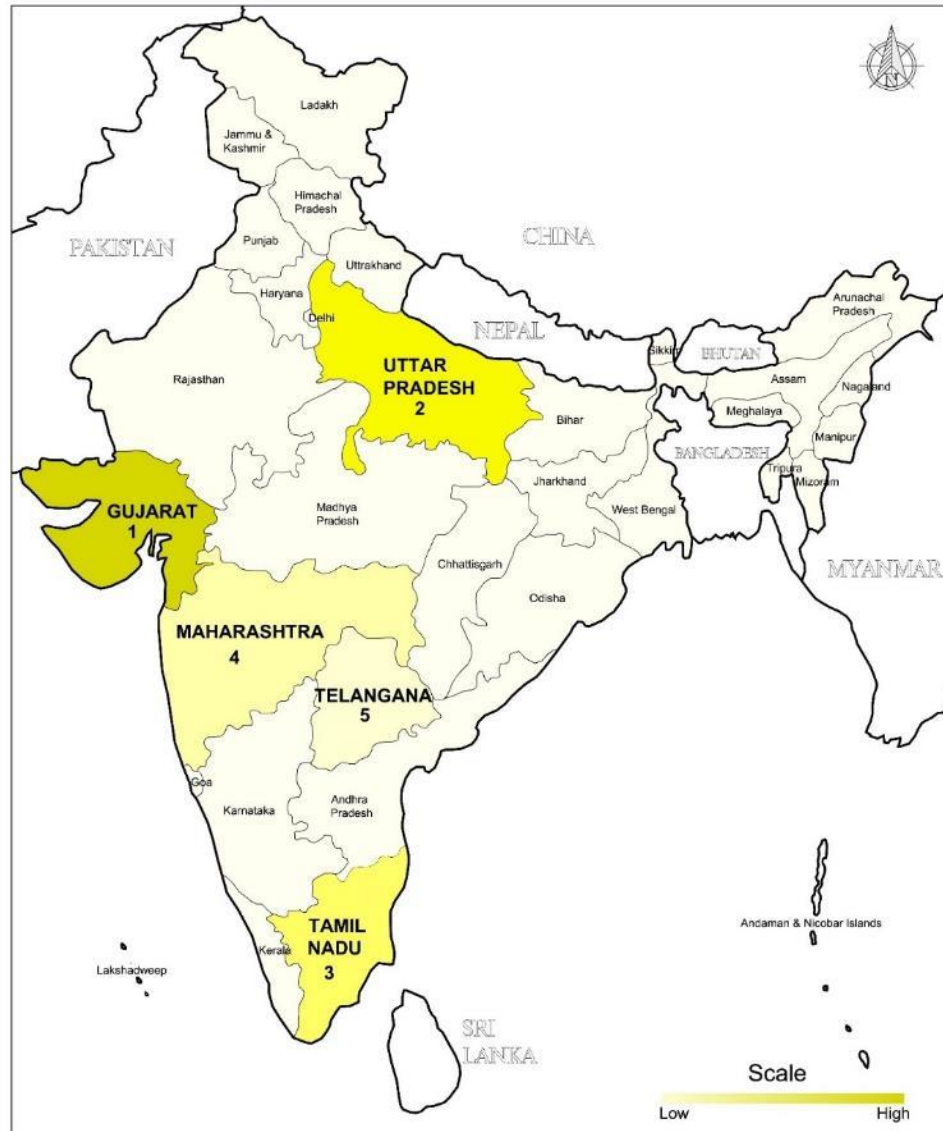
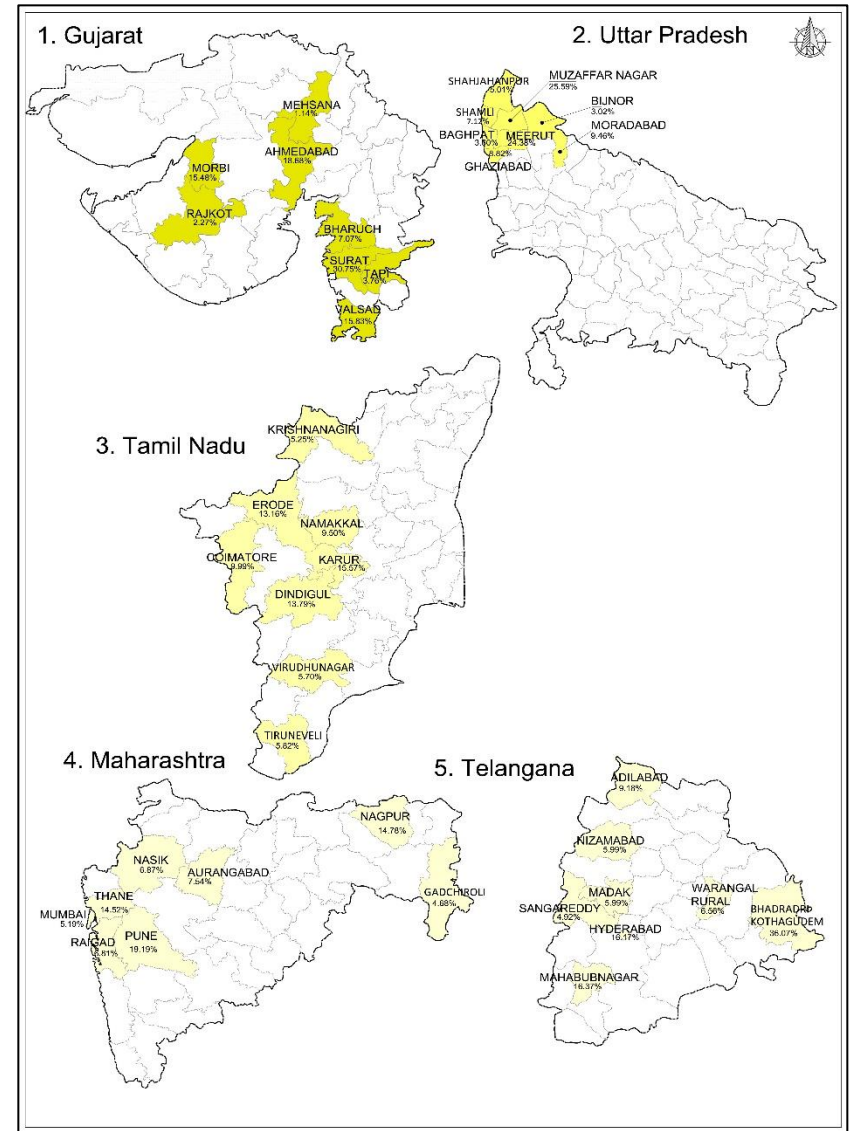


Figure 2-6: Energy Potential District in Potential States

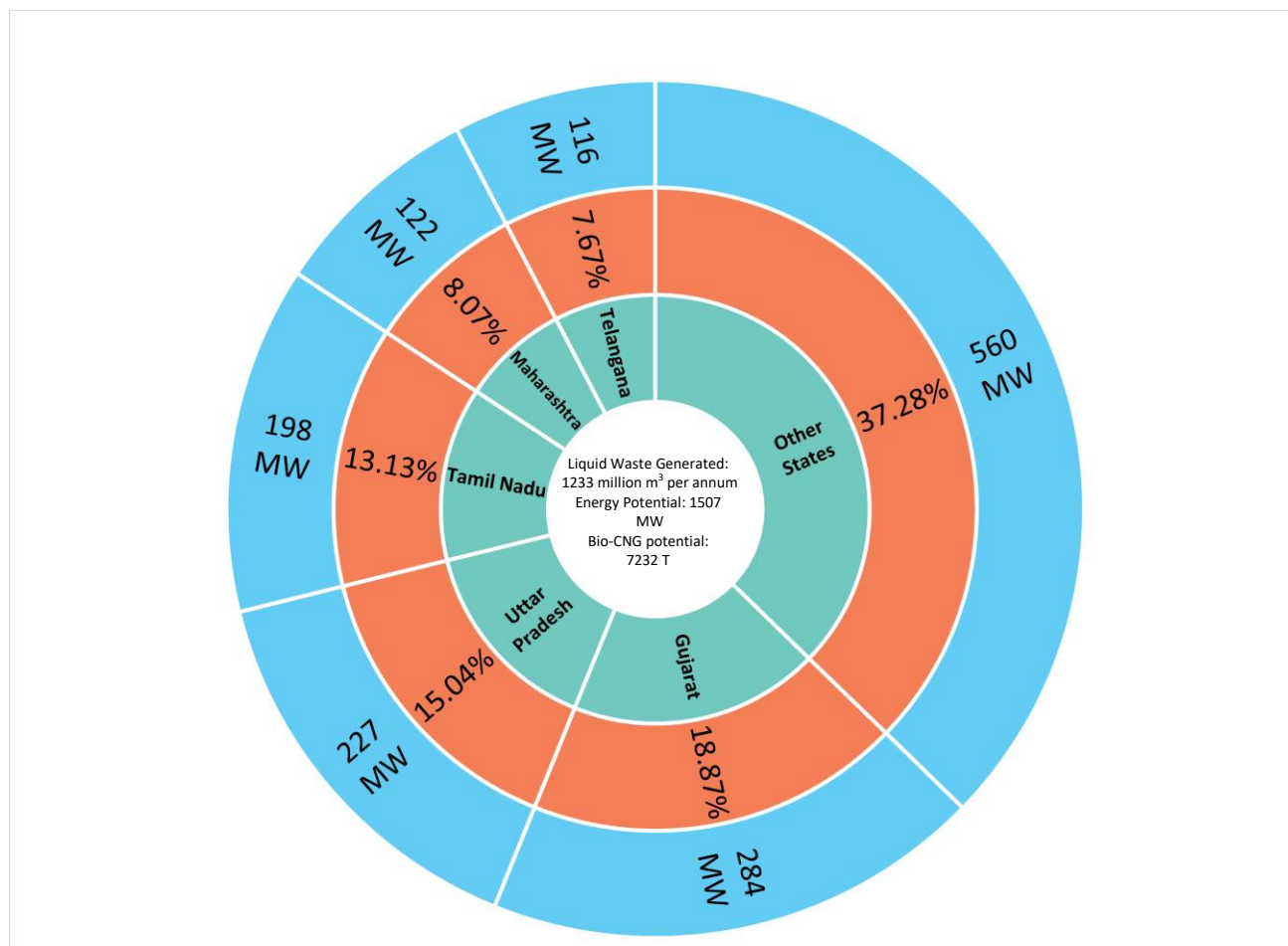


The top 10 districts having high energy potential from the liquid waste of the Pulp & Paper Industry is provided in **Table 2-5**. State and District wise data provided in **Annexure 2**

**Table 2-5: Energy Potential in Top 10 Districts**

| SN           | District            | State          | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) |
|--------------|---------------------|----------------|-----------------------------------|-----------------------|
| 1            | Surat               | Gujarat        | 35,78,40,000                      | 87.42                 |
| 2            | Muzzaffar Nagar     | Uttar Pradesh  | 24,08,23,800                      | 58.83                 |
| 3            | Meerut              | Uttar Pradesh  | 22,61,07,000                      | 55.24                 |
| 4            | Ahmadabad           | Gujarat        | 21,73,81,500                      | 53.10                 |
| 5            | Valsad              | Gujarat        | 18,53,05,050                      | 45.27                 |
| 6            | Morbi               | Gujarat        | 18,08,88,750                      | 44.19                 |
| 7            | Bhadradi Kothagudem | Telangana      | 17,07,30,000                      | 41.71                 |
| 8            | Udham Singh Nagar   | Uttarakhand    | 15,94,26,225                      | 38.95                 |
| 9            | East Godavari       | Andhra Pradesh | 15,33,73,500                      | 37.47                 |
| 10           | Nainital            | Uttarakhand    | 14,02,15,950                      | 34.25                 |
| <b>Total</b> |                     |                | <b>2,03,20,91,775</b>             | <b>496</b>            |

**Figure 2-7: Top 5 States - Liquid waste- Pulp & Paper and Energy Potential**



Gujarat, Uttar Pradesh, Tamil Nadu, and Maharashtra have been identified as key potential states for energy generation from Pulp and Paper effluent; major districts in the shortlisted states have also been identified. District-wise energy potentials is provided in **Annexure – I**. Details of shortlisted states and districts are provided in **Table 2-6**.

**Table 2-6: Identified potential districts**

| State     | Gujarat   | Uttar Pradesh | Tamil Nadu | Maharashtra | Telangana    |
|-----------|-----------|---------------|------------|-------------|--------------|
| Districts | Surat     | Muzaffarnagar | Karur      | Pune        | Bhadrachalam |
|           | Ahmedabad | Meerut        | Dindigul   | Nagpur      | Mahabubnagar |
|           | Valsad    | Moradabad     | Erode      | Thane       | Hyderabad    |
|           | Morbi     | Ghaziabad     | Coimbatore | Aurangabad  | Adilabad     |

## 2.2 Distillery Industry

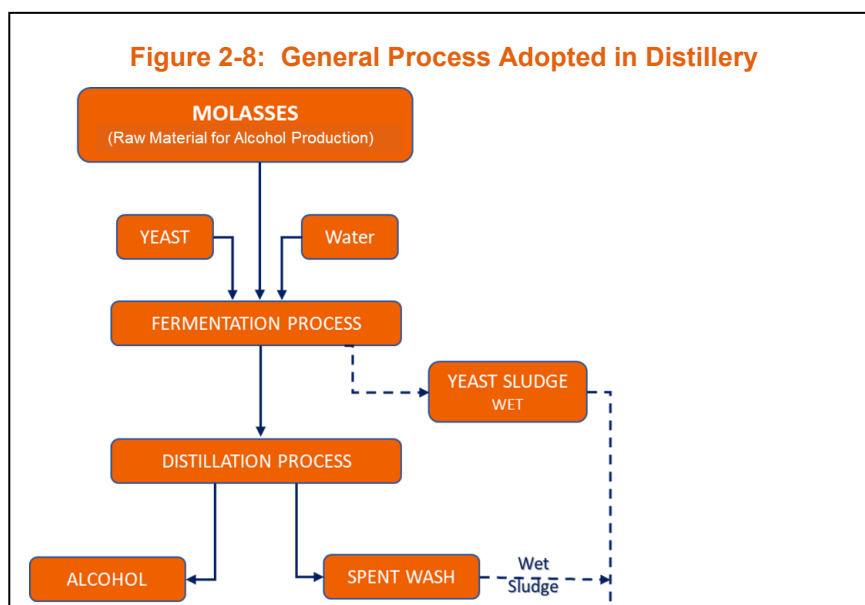
The distillery industry is one of the fastest-growing industries in India and currently India is the third-largest liquor market in the world<sup>8</sup>. The Indian distillery industry comprises Indian Made Foreign Liquor (IMFL), foreign liquor Bottled In India (BII), foreign liquor Bottled In Origin (BIO), country liquor, wine, and beer segment. The first distillery in the country was set up at Kanpur in the year 1805 by Carew & Co. Ltd., for the manufacturing of Rum.

A distilled beverage, liquor, or spirit is a potable liquid containing ethanol produced by the distillation of fermented grain, fruit, or vegetables.

The Indian distillery units use sugarcane molasses as a preferred raw material because of its large-scale availability. Therefore, the Indian fermentation industry is categorized into Maltry, Brewery, and Distillery based on either molasses or grain.

### 2.2.1 Waste streams

The production of alcohol in the distillery industry is classified into the Rectified spirit (RS), Extra neutral alcohol (ENA), and Anhydrous fuel alcohol. Liquid waste generated from Distillery Industry has been estimated based on the plant capacity of the distillery and capacity utilisation factor of 65% derived based on the discussion with the distillery association. **Table 2-77** presents a brief of the type of raw material and waste generated for the sector.



**Table 2-7: Sector-wise type of data used to assess the waste, raw material, and waste streams.**

| Sector              | Database to estimate the waste quantity   | Raw material     | Waste stream – solid | Waste stream – liquid |
|---------------------|---|------------------|----------------------|-----------------------|
| Distillery industry | District-wise number of industries and plant capacity 65% of the capacity utilisation is considered | Molasses, grains | NA                   | Spent wash            |

<sup>8</sup> Eduved Global Management Research Alcoholic Beverages Industry in India: A Exploratory study,2014. [https://www.researchgate.net/publication/343219639\\_Eduved\\_Global\\_Management\\_Research\\_ALCOHOLIC\\_BEVERAGES\\_INDUSTRIY\\_IN\\_INDIA\\_AN\\_EXPLORATORY\\_STUDY](https://www.researchgate.net/publication/343219639_Eduved_Global_Management_Research_ALCOHOLIC_BEVERAGES_INDUSTRIY_IN_INDIA_AN_EXPLORATORY_STUDY)

## Wastewater from Molasses Based Distilleries in India

A large quantity of wastewater is generated from the process of distillation which causes contamination of soil and water. The effluent generated from the distillery contains organic and inorganic substances. Spent wash is identified as a major source of wastewater from molasses-based distilleries from the analyser column. Other wastewaters generated are fermented sludge, spent lees from the rectifier, cooling water, Waste wash water, Water treatment plant wastewater, Boiler blowdown, and Bottling plant wash wastewater. The typical characteristics of wastewater generated from the distillery industry is provided in **Table 2-8**

**Table 2-8: Typical characteristics of different wastewater streams**

| S.N | Parameter           | Spent wash      | Fermenter cooling | Fermenter cleaning | Condenser cooling | Fermenter wash | Bottling plant |
|-----|---------------------|-----------------|-------------------|--------------------|-------------------|----------------|----------------|
| 1   | Colour              | Dark brown      | Colourless        | Colourless         | Colourless        | Faint          | Colourless     |
| 2   | pH                  | 4–4.5           | 6.26              | 5.0–5.5            | 6.8–7.8           | 6              | 7.45           |
| 3   | Alkalinity (mg/L)   | 3500            | 300               | Nil                | -                 | 40             | 80             |
| 4   | Total solids (mg/L) | 100,000         | 1000–1300         | 1000–1500          | 700–900           | 550            | 400            |
| 5   | Suspended solids    | 10,000          | 220               | 400–600            | 180–200           | 300            | 100            |
| 6   | BOD (mg/L)          | 45,000–60,000   | 100–110           | 500–600            | 70–80             | 15             | 5              |
| 7   | COD (mg/L)          | 80,000– 120,000 | 500–1000          | 1200–1600          | 200–300           | 25             | 15             |

(Source: Dr. Piyush M. Maurya, Dr. Suhas V. Patil" A Review on Treatment of Distillery Wastewater by Physicochemical Approaches" ,International Journal of Research Studies in Science, Engineering and Technology, vol. 5, no. 9, pp. 36-44, 2018.)

The spent wash generated from the distillery industry has a high calorific value after concentration by evaporation. It is burnt as fuel in the incinerator boiler to produce high-pressure steam. Using Spent Wash as raw material will help to achieve Zero Discharge from the distillery industry.

### Spent Wash

The characteristics of spent wash vary with the ethanol production process. Spent wash is acidic (pH 3.7 - 4.5) in nature, dark brown with BOD (45000–70000 mg/L) and COD (80000–160000 mg/L) emitting obnoxious odour. The characteristics of spent wash from various types of manufacturing processes are provided in **Table 2-9**.

**Table 2-9: Characteristics of Spent Wash from Various Type of Manufacturing Process**

| Sr. No | Parameter           | Batch Process     | Continuous Process  | Bio – Still Process |
|--------|---------------------|-------------------|---------------------|---------------------|
| 1      | Volume, L/L alcohol | 14-15             | 10-12               | 7-9                 |
| 2      | Colour              | Dark brown        | Dark brown          | Dark brown          |
| 3      | pH                  | 3.7 – 4.5         | 4.0 – 4.3           | 4.0 – 4.2           |
| 4      | COD                 | 80,000-1,00,000   | 1,10,000 – 1,30,000 | 1,40,000 – 1,60,000 |
| 5      | BOD                 | 45,000 – 5,0000   | 55,000 – 65,000     | 60,000 – 70,000     |
| 6      | Solids              |                   |                     |                     |
| a      | Total               | 90,000 – 1,20,000 | 1,30,000 – 1,60,000 | 1,60,000 – 2,10,000 |
| b      | Total Volatile      | 60,000 – 70,000   | 60,000 – 75,000     | 80,000 – 90,000     |
| c      | Inorganic dissolved | 30,000 – 40,000   | 35,000 – 45000      | 60,000 – 90,000     |
| 7      | Chlorides           | 5,000- 6,000      | 6,000 – 7,500       | 10,000 – 12,000     |
| 8      | Sulphates           | 4,000 – 8,000     | 4,500 – 8,500       | 8,000 – 10,000      |
| 9      | Total Nitrogen      | 1,000 – 1,200     | 1,000 – 1,400       | 2,000 – 2,500       |
| 10     | Potassium           | 8,000 – 12,000    | 10,000 – 14,000     | 20,000 – 22,000     |
| 11     | Phosphorous         | 200 – 300         | 300 – 500           | 1,600 – 2,000       |
| 12     | Sodium              | 400 – 600         | 1,400 – 1,500       | 1,200 – 1,500       |
| 13     | Calcium             | 2,000 – 3,500     | 4,500 – 6,000       | 5,000 – 6,500       |

(Source: Draft report prepared on "Development of Methodology for Environmental auditing" by Dr. B. Subba Rao of EPRF, Sangli, for CPCB)

Note: All values from SN 4 to SN 13 are in mg/L

Spent wash generated from the distillery units is currently treated by the following three methods (a) Concentration followed by incineration, (b) Anaerobic digestion with biogas recovery followed by aerobic polishing, and (c) Direct wet oxidation of stillage by air at high temperature with the generation of steam followed by aerobic polishing.

## 2.2.2 Distillery Industry in India & Energy Potential

There are 394 distillery units<sup>9</sup> in India, of which 356 units are molasses-based, 21 are grain-based units and 17 units are hybrid i.e., molasses and grain-based. The installed capacity of total distillery units is around 1,29,68,842 KL. Most of the distillery industries are concentrated in Uttar Pradesh, Maharashtra, Karnataka, and Tamil Nadu. These four states contribute to more than 90% of the total alcohol production in the country. Uttar Pradesh has a maximum share of 57.78% followed by Maharashtra (15.9%), Karnataka (8.8%), and Tamil Nadu (4%). State-wise Number of distilleries, the capacity of the plants is provided in **Table 2-10**.

**Table 2-10: State-wise Distillery Industry details along with the installed capacity**

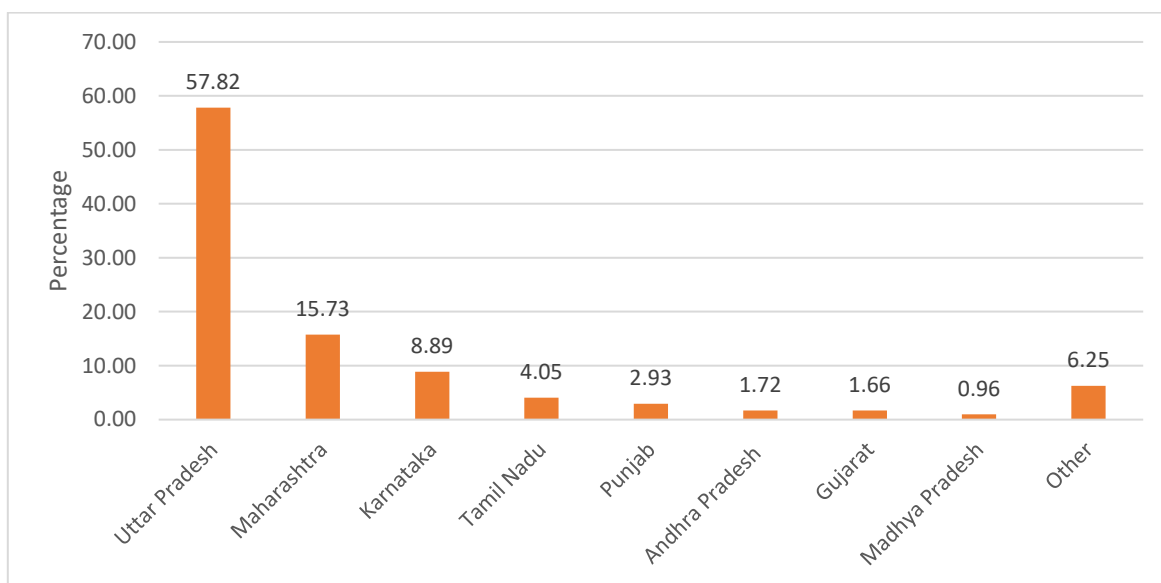
| S.N          | State            | Total Number of Industries | Molasses Based Units | Grain Based Units | Molasses & Grain Bases Units | Capacity ('000 KL/annum) |
|--------------|------------------|----------------------------|----------------------|-------------------|------------------------------|--------------------------|
| 1            | Andhra Pradesh   | 18                         | 14                   | 2                 | 2                            | 223                      |
| 2            | Bihar            | 7                          | 6                    |                   | 1                            | 115                      |
| 3            | Chandigarh       | 2                          | 1                    |                   | 1                            | 36                       |
| 4            | Chhattisgarh     | 2                          | 2                    |                   |                              | 44                       |
| 5            | Daman            | 5                          | 5                    |                   |                              | 33                       |
| 6            | Goa              | 5                          | 5                    |                   |                              | 5                        |
| 7            | Gujarat          | 15                         | 15                   |                   |                              | 216                      |
| 8            | Himachal Pradesh | 3                          | 3                    |                   |                              | 14                       |
| 9            | Haryana          | 12                         | 5                    | 6                 | 1                            | 99                       |
| 10           | Jammu & Kashmir  | 6                          | 6                    |                   |                              | 103                      |
| 11           | Karnataka        | 41                         | 41                   |                   |                              | 1,152                    |
| 12           | Kerala           | 11                         | 11                   |                   |                              | 33                       |
| 13           | Madhya Pradesh   | 14                         | 5                    | 4                 | 5                            | 124                      |
| 14           | Maharashtra      | 113                        | 110                  | 3                 |                              | 2,038                    |
| 15           | Nagaland         | 1                          | 1                    |                   |                              | 1                        |
| 16           | Odisha           | 10                         | 10                   |                   |                              | 40                       |
| 17           | Puducherry       | 5                          | 5                    |                   |                              | 12                       |
| 18           | Punjab           | 13                         | 7                    | 1                 | 5                            | 379                      |
| 19           | Rajasthan        | 9                          | 4                    | 5                 |                              | 20                       |
| 20           | Sikkim           | 2                          | 2                    |                   |                              | 4                        |
| 21           | Tamil Nadu       | 27                         | 27                   | 0                 | 0                            | 524                      |
| 22           | Telangana        | 7                          | 5                    | 0                 | 2                            | 93                       |
| 23           | Uttar Pradesh    | 58                         | 58                   |                   |                              | 7,494                    |
| 24           | Uttarakhand      | 4                          | 4                    |                   |                              | 102                      |
| 25           | West Bengal      | 4                          | 4                    |                   |                              | 55                       |
| <b>Total</b> |                  | <b>394</b>                 | <b>356</b>           | <b>21</b>         | <b>17</b>                    | <b>1,29,60</b>           |

Source: All India Distiller's Association, Directory of Indian Distilleries, 2018 -19

<sup>9</sup> All India Distiller's Association, Directory of Indian Distilleries, 2018 -19



**Figure 2-9: Top states in spent wash generation**



Data Source: All India Distiller's Association, Directory of Indian Distilleries, 2018 -19

About, 12–15 litres of spent wash is generated for one litre of alcohol produced. The total energy potential for the selected sectors is 619 MW. State-wise waste generation and energy potential is provided in **Table 2-11**.

**Table 2-11: State-wise Distillery Industry details along with waste generation and energy Potential**

| SN | State & UT       | Annual Capacity in ('000 KL) | Annual Capacity Utilisation @65% <sup>10</sup> in ('000 KL) | Annual Spent wash generated (In '000 KL) <sup>11*</sup> | Energy Potential - Annual (MW)** | Bio CNG (T) |
|----|------------------|------------------------------|---|---|----------------------------------|-------------|
| 1  | Andhra Pradesh   | 223                          | 145   | 1,736   | 10.60                            | 50.89       |
| 2  | Bihar            | 115                          | 75  | 897   | 5.48                             | 26.29       |
| 3  | Chandigarh       | 36                           | 23  | 281   | 1.71                             | 8.23        |
| 4  | Chhattisgarh     | 44                           | 29  | 344   | 2.10                             | 10.08       |
| 5  | Daman            | 33                           | 21  | 254   | 1.55                             | 7.44        |
| 6  | Goa              | 5                            | 3   | 41  | 0.25                             | 1.21        |
| 7  | Gujarat          | 216                          | 140   | 1,681   | 10.27                            | 49.28       |
| 8  | Himachal Pradesh | 14                           | 9   | 106   | 0.65                             | 3.11        |
| 9  | Haryana          | 99                           | 65  | 775   | 4.74                             | 22.73       |
| 10 | Jammu & Kashmir  | 103                          | 67  | 801   | 4.89                             | 23.49       |
| 11 | Karnataka        | 1,152                        | 748   | 8,982   | 54.85                            | 263.30      |
| 12 | Kerala           | 33                           | 22  | 260   | 1.59                             | 7.62        |
| 13 | Madhya Pradesh   | 124                          | 81  | 971   | 5.93                             | 28.47       |
| 14 | Maharashtra      | 2,038                        | 1,325   | 15,900  | 97.10                            | 466.10      |
| 15 | Nagaland         | 1                            | 1   | 11  | 0.06                             | 0.31        |
| 16 | Odisha           | 40                           | 26  | 313   | 1.91                             | 9.19        |
| 17 | Puducherry       | 12                           | 8   | 91  | 0.56                             | 2.68        |

<sup>10</sup> All India Distiller's Association indicated that the capacity utilisation factor for Indian distillery industry is only 65% of the installed capacity.

<sup>11</sup> 12 litre of spent wash per litre of alcohol produced is considered for the study after discussion with Distillery Associations.

| SN           | State & UT    | Annual Capacity in ('000 KL) | Annual Capacity Utilisation @65% <sup>10</sup> in ('000 KL) | Annual Spent wash generated (In '000 KL) <sup>11*</sup> | Energy Potential - Annual (MW)** | Bio CNG (T)     |
|--------------|---------------|------------------------------|---|---|----------------------------------|-----------------|
| 18           | Punjab        | 379                          | 247   | 2,959   | 18.07                            | 86.75           |
| 19           | Rajasthan     | 20                           | 13  | 158   | 0.97                             | 4.63            |
| 20           | Sikkim        | 4                            | 2   | 27  | 0.17                             | 0.80            |
| 21           | Tamil Nadu    | 524                          | 341   | 4,091   | 24.98                            | 119.92          |
| 22           | Telangana     | 93                           | 61  | 728   | 4.45                             | 21.35           |
| 23           | Uttar Pradesh | 7,494                        | 4,871   | 58,449  | 356.97                           | 1,713.45        |
| 24           | Uttarakhand   | 102                          | 66  | 797   | 4.87                             | 23.37           |
| 25           | West Bengal   | 55                           | 36  | 431   | 2.63                             | 12.64           |
| <b>Total</b> |               | <b>12,960</b>                | <b>8,424</b>  | <b>1,01,086</b>   | <b>617.36</b>                    | <b>2,963.34</b> |

Source: All India Distiller's Association, Directory of Indian Distilleries, 2018 -19

\* Cleaner Production Opportunities in Distillery Sector - Production Centre- ENVIS Centre

\*\* 25 Nm<sup>3</sup>/KL of spent wash is considered for estimating the energy potential

([http://www.ckinetics.com/publications/Waste\\_to\\_Wealth\\_Knowledge\\_Paper\\_Optimized.pdf](http://www.ckinetics.com/publications/Waste_to_Wealth_Knowledge_Paper_Optimized.pdf))

### Formula for power potential estimation from biogas

$$\text{Power Potential} = \frac{\text{Biogas generated in a year} \times 2.14}{(365 \times 24 \times 1000)}$$

Thermal value of Biogas – 22 MJ m<sup>3</sup>

3.6 MJ = 1KWh

1m<sup>3</sup> biogas = (22/3.6) kWh = 6.1 kWh

Electrical conversion efficiency = 35%

Therefore, 1m<sup>3</sup> biogas = 2.14 kWh (elec)

Note: Above formula has been considered to estimate energy potential from waste streams of Distillery

**Table 2-12: Energy Potential from Distillery Effluent - Top 10 Districts**

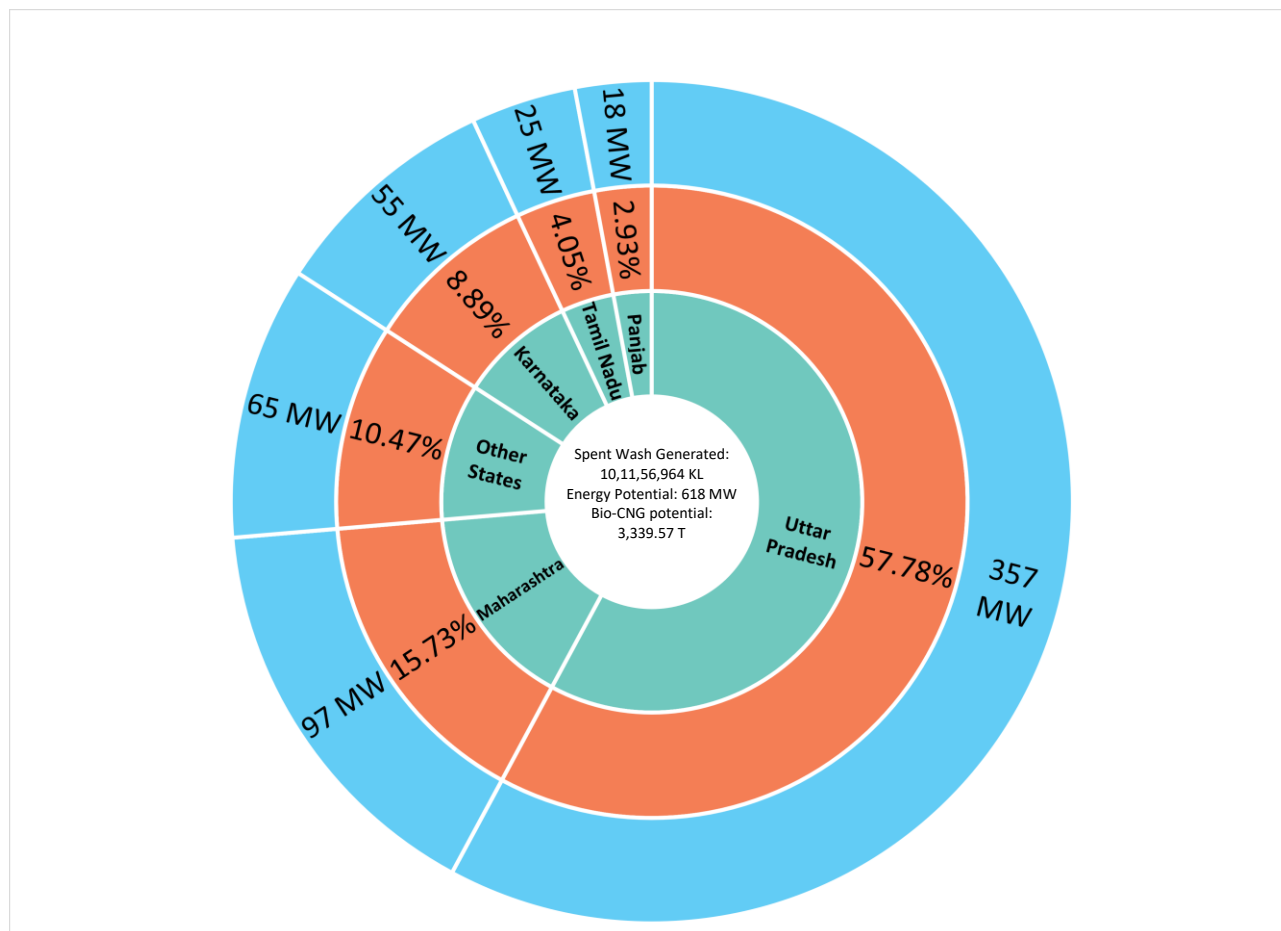
| SN           | District        | State         | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) |
|--------------|-----------------|---------------|-----------------------------------|-----------------------|
| 1            | Moradabad       | Uttar Pradesh | 1,14,07,50,000                    | 278.68                |
| 2            | Pune            | Maharashtra   | 13,79,43,000                      | 33.70                 |
| 3            | Bengaluru Rural | Karnataka     | 8,00,67,000                       | 19.56                 |
| 4            | Ahmednagar      | Maharashtra   | 6,98,19,750                       | 17.06                 |
| 5            | Belgaum         | Karnataka     | 5,05,18,455                       | 12.34                 |
| 6            | Bijnor          | Uttar Pradesh | 3,94,29,000                       | 9.63                  |
| 7            | Kolhapur        | Maharashtra   | 3,81,61,500                       | 9.32                  |
| 8            | Lakhimpur       | Uttar Pradesh | 3,51,00,000                       | 8.57                  |
| 9            | Hardoi          | Uttar Pradesh | 3,02,44,500                       | 7.39                  |
| 10           | Patiala         | Punjab        | 2,98,35,000                       | 7.29                  |
| <b>Total</b> |                 |               | <b>1,65,18,68,205</b>             | <b>403.54</b>         |

Source: Calculated by Arcadis for the distillery installed capacity data from All India Distiller's Association, Directory of Indian Distilleries, 2018-19

\*25 Nm<sup>3</sup>/KL of spent wash is considered for estimating the energy potential

([http://www.ckinetics.com/publications/Waste\\_to\\_Wealth\\_Knowledge\\_Paper\\_Optimized.pdf](http://www.ckinetics.com/publications/Waste_to_Wealth_Knowledge_Paper_Optimized.pdf))

**Figure 2-10: Top 5 States – Spent wash- Distillery and Energy Potential**

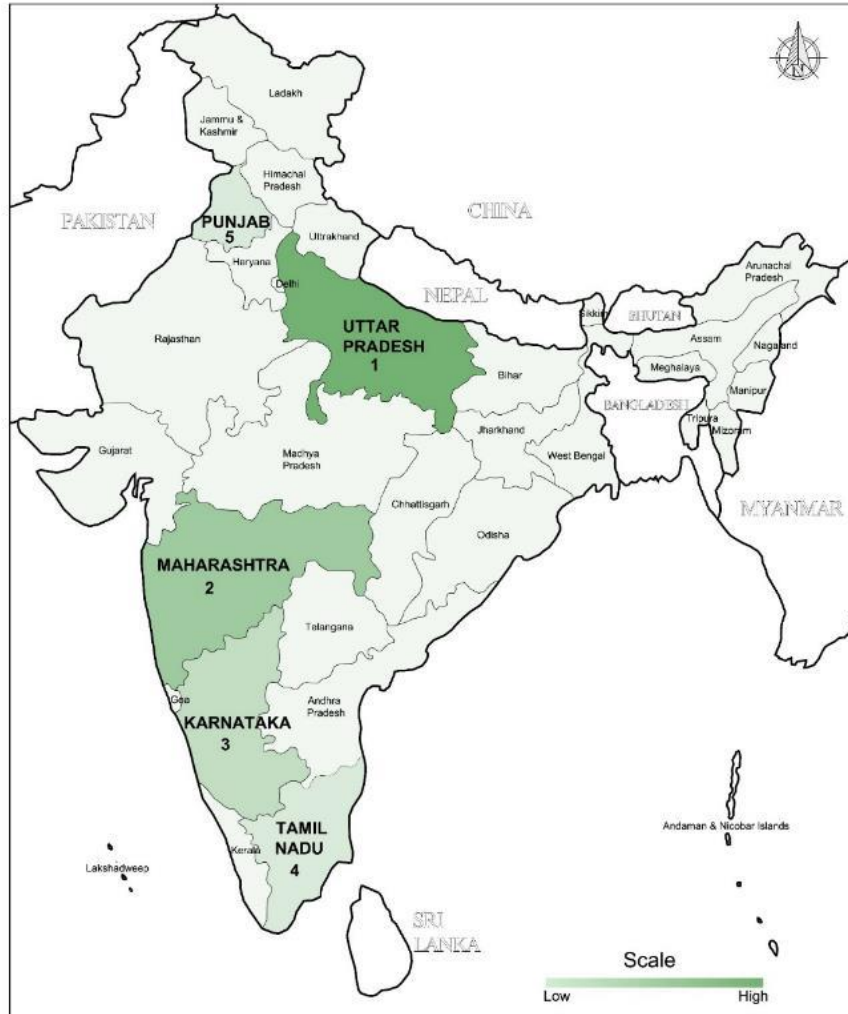


Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, and Punjab have been identified as the potential states with maximum energy potential from spent wash from the distillery industry; major districts in the shortlisted states have also been identified. District-wise energy potentials is provided in Annexures. Details of shortlisted states and districts are provided in **Table 2-13**.

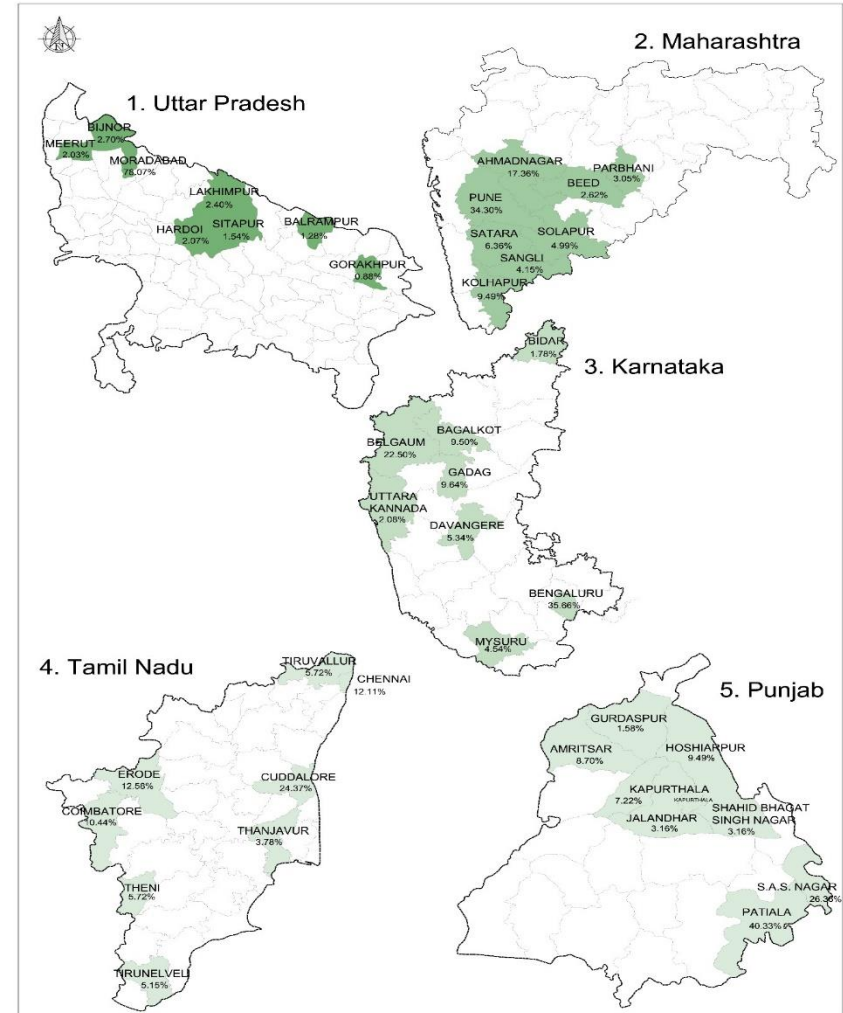
**Table 2-13: Identified Potential Districts**

| State     | Uttar Pradesh | Maharashtra | Karnataka       | Tamil Nadu | Punjab     |
|-----------|---------------|-------------|-----------------|------------|------------|
| Districts | Moradabad     | Pune        | Bengaluru Rural | Cuddalore  | Patiala    |
|           | Bijnor        | Ahmednagar  | Belgaum         | Erode      | SAS Nagar  |
|           | Lakhimpur     | Kolhapur    | Gadag           | Chennai    | Hoshiarpur |
|           | Hardoi        | Satara      | Bagalkot        | Coimbatore | Amritsar   |

**Figure 2-11: States with Maximum Energy Potential from Distillery Industry**



**Figure 2-12: Districts with maximum energy potential from distillery waste in top 5 states**



## 2.3 Urban Organic Liquid Waste

Urban organic liquid waste or sewage is domestic wastewater generated from the water discharged from residential units, commercial complexes, hotels, and educational institutions. Class I cities and Class II towns have been considered for the current assessment as Class I cities and Class II towns register maximum coverage in terms of individual households connected with sewage network; Class III, Class IV, Class V, and Class VI are not considered as these towns do not have established sewage network in place. Estimation on urban liquid waste or sewage generation has been made based on the estimates considered by CPCB<sup>12</sup> for Class I Cities and Class II towns, i.e., water supply @185 litres per capita per day (LPCD) and 80% of water supply as sewage generation<sup>13</sup>.

**Table 2-14** presents the data on urban organic liquid waste generation in India. The estimated liquid waste generation is 49,450 MLD which is based on the projected population data for 2021.

**Table 2-14: Urban Liquid Waste Generation in States**

| SN | State                | Avg. projected population for 2021 (In 000) | Water Supply @ 185 LPCD (In 0,00,000 litre) | Sewage Generation (MLD) | State wise % |
|----|----------------------|---|---|-------------------------|--------------|
| 1  | Assam                | 2,626                                       | 486   | 389                     | 0.79         |
| 2  | Andhra Pradesh       | 14,939                                      | 2,764                                       | 2,211                   | 4.47         |
| 3  | Arunachal Pradesh    | 91  | 17  | 13                      | 0.03         |
| 4  | Andaman & Nicobar    | 135   | 25  | 20                      | 0.04         |
| 5  | Bihar                | 10,641                                      | 1,969                                       | 1,575                   | 3.18         |
| 6  | Chandigarh           | 1,230                                       | 227   | 182                     | 0.37         |
| 7  | Chhattisgarh         | 4,736                                       | 876   | 701                     | 1.42         |
| 8  | Dadra & Nagar Haveli | 170   | 31  | 25                      | 0.05         |
| 9  | Daman & Diu          | 74  | 14  | 11                      | 0.02         |
| 10 | Delhi                | 20,905                                      | 3,502                                       | 3,330                   | 6.73         |
| 11 | Goa                  | 277   | 51  | 41                      | 0.08         |
| 12 | Gujarat              | 26,798                                      | 4,958                                       | 3,966                   | 8.02         |
| 13 | Haryana              | 9,041                                       | 1,673                                       | 1,338                   | 2.71         |
| 14 | Himanchal Pradesh    | 208   | 39  | 31                      | 0.06         |
| 15 | Jammu & Kashmir      | 1,735                                       | 321   | 257                     | 0.52         |
| 16 | Jharkhand            | 6,853                                       | 1,268                                       | 1,014                   | 2.05         |
| 17 | Karnataka            | 23,756                                      | 4,395                                       | 3,516                   | 7.11         |
| 18 | Kerala               | 5,497                                       | 1,017                                       | 814                     | 1.65         |
| 19 | Madhya Pradesh       | 24,753                                      | 3,060                                       | 2,448                   | 4.95         |
| 20 | Maharashtra          | 54,262                                      | 10,038                                      | 8,031                   | 16.24        |
| 21 | Manipur              | 321   | 59  | 47                      | 0.10         |
| 22 | Meghalaya            | 324   | 60  | 48                      | 0.10         |
| 23 | Mizoram              | 488   | 90  | 72                      | 0.15         |
| 24 | Nagaland             | 302   | 56  | 45                      | 0.09         |
| 25 | Odisha               | 5,410                                       | 1,001                                       | 801                     | 1.62         |
| 26 | Puducherry           | 908   | 168   | 134                     | 0.27         |

<sup>12</sup> National Inventory of Sewage Treatment Plants, March 2021 Central Pollution Control Board Parivesh Bhawan East Arjun Nagar, Delhi

<sup>13</sup> Sewage generation for NCT of Delhi is estimated based on their 80 % of water supply of 925 MGD.

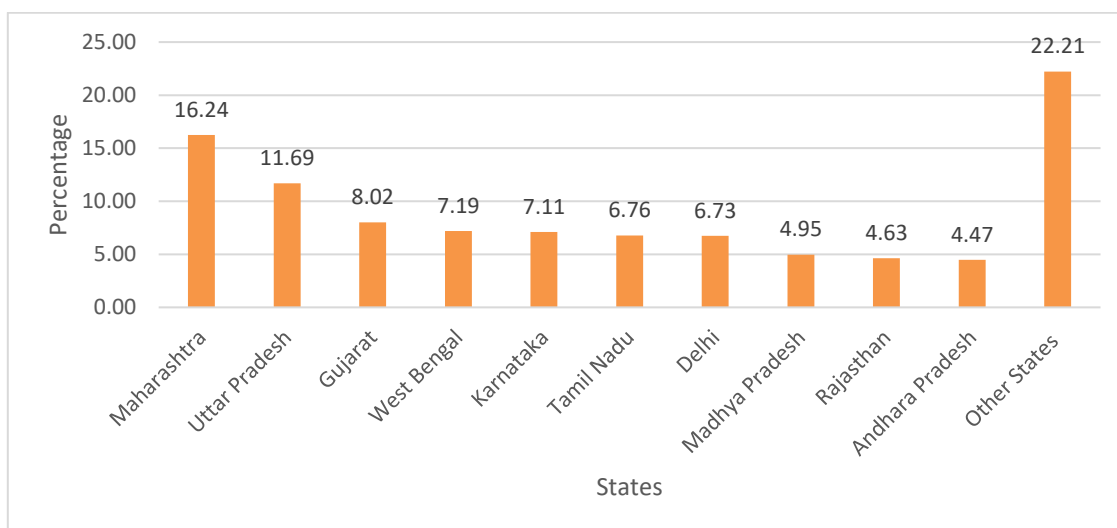
| SN | State         | Avg. projected population for 2021 (In 000) | Water Supply @ 185 LPCD (In 0,00,000 litre) | Sewage Generation (MLD) | State wise % |
|----|---------------|---|---|-------------------------|--------------|
| 27 | Punjab        | 9,467                                       | 1,751                                       | 1,401                   | 2.83         |
| 28 | Rajasthan     | 15,471                                      | 2,862                                       | 2,290                   | 4.63         |
| 29 | Sikkim        | 143   | 26  | 21                      | 0.04         |
| 30 | Tamil Nadu    | 22,590                                      | 4,179                                       | 3,343                   | 6.76         |
| 31 | Telangana     | 10,806                                      | 1,999                                       | 1,599                   | 3.23         |
| 32 | Tripura       | 554   | 103   | 82                      | 0.17         |
| 33 | Uttar Pradesh | 39,045                                      | 7,223                                       | 5,779                   | 11.69        |
| 34 | Uttarakhand   | 2,158                                       | 399   | 319                     | 0.65         |
| 35 | West Bengal   | 24,025                                      | 4,445                                       | 3,556                   | 7.19         |
|    | <b>Total</b>  | <b>3,40,737</b>                             | <b>61,151</b>                               | <b>49,450</b>           | <b>100</b>   |

\*Ladakh & Lakshadweep - No town falls in Class I & II category.

Source: Census data (1971-2011) and Population projections by Arcadis for class I & Class II (average of standard population projection methodologies i.e., Arithmetic Progression, Geometric Progression, and Incremental Increase).

Maharashtra generates approximately 16.24% of the total urban liquid waste followed by Uttar Pradesh, Gujarat, West Bengal, Karnataka, Tamil Nadu & Delhi with contributions of 11.69%, 8.02%, 7.19%, 7.11%, 6.76%, 6.73%, 4.95%, 4.63%, 4.47% and 22.21% respectively. State wise liquid waste generated in major states is provided in **Figure 2-13**.

**Figure 2-13: Percentage of Urban Liquid Waste Generation by the Major States**



The total energy potential in liquid waste in India is 485 MW. The top 10 states have the potential to generate 77.7 percent of total energy potential in the sector of the country. States having major energy potential are Maharashtra (79 MW), Uttar Pradesh (57 MW), Gujarat (39 MW), West Bengal (35 MW), Karnataka (34 MW), Tamil Nadu (33 MW), Delhi (33 MW), Madhya Pradesh (24 MW), Rajasthan (22 MW) and Andhra Pradesh (22 MW). Energy potential is provided in **Table 2-15**.

**Table 2-15: Energy Generation Potential from Urban Liquid Waste**

| SN | State & UT           | Sewage Generation (MLD) | Biogas per Day (In 000 m <sup>3</sup> ) | Energy Potential (MW) <sup>14</sup> | Bio-CNG (T)    |
|----|----------------------|-------------------------|---|-------------------------------------|----------------|
| 1  | Assam                | 389                     | 43                                      | 3.81                                | 18.30          |
| 2  | Andhra Pradesh       | 2,211                   | 243                                     | 21.69                               | 104.09         |
| 3  | Arunachal Pradesh    | 13                      | 1.5                                     | 0.13                                | 0.63           |
| 4  | Andaman & Nicobar    | 20                      | 2.2                                     | 0.20                                | 0.94           |
| 5  | Bihar                | 1,575                   | 173                                     | 15.45                               | 74.14          |
| 6  | Chandigarh           | 182                     | 20                                      | 1.79                                | 8.57           |
| 7  | Chhattisgarh         | 701                     | 77                                      | 6.88                                | 33.00          |
| 8  | Dadra & Nagar Haveli | 25                      | 2.8                                     | 0.25                                | 1.18           |
| 9  | Daman & Diu          | 11                      | 1.2                                     | 0.11                                | 0.52           |
| 10 | Delhi                | 3,330                   | 366                                     | 32.66                               | 156.78         |
| 11 | Goa                  | 41                      | 4.5                                     | 0.40                                | 1.93           |
| 12 | Gujarat              | 3,966                   | 436                                     | 38.90                               | 186.73         |
| 13 | Haryana              | 1,338                   | 147                                     | 13.12                               | 62.99          |
| 14 | Himanchal Pradesh    | 31                      | 3.4                                     | 0.30                                | 1.45           |
| 15 | Jammu & Kashmir      | 257                     | 28                                      | 2.52                                | 12.09          |
| 16 | Jharkhand            | 1,014                   | 112                                     | 9.95                                | 47.75          |
| 17 | Karnataka            | 3,516                   | 387                                     | 34.49                               | 165.53         |
| 18 | Kerala               | 814                     | 89                                      | 7.98                                | 38.30          |
| 19 | Madhya Pradesh       | 2,448                   | 269                                     | 24.01                               | 115.24         |
| 20 | Maharashtra          | 8,031                   | 883                                     | 78.77                               | 378.09         |
| 21 | Manipur              | 47                      | 5.2                                     | 0.47                                | 2.23           |
| 22 | Meghalaya            | 48                      | 5.3                                     | 0.47                                | 2.26           |
| 23 | Mizoram              | 72                      | 7.9                                     | 0.71                                | 3.40           |
| 24 | Nagaland             | 45                      | 4.9                                     | 0.44                                | 2.10           |
| 25 | Odisha               | 801                     | 88                                      | 7.85                                | 37.69          |
| 26 | Puducherry           | 134                     | 15                                      | 1.32                                | 6.32           |
| 27 | Punjab               | 1,401                   | 154                                     | 13.74                               | 65.96          |
| 28 | Rajasthan            | 2,290                   | 252                                     | 22.46                               | 107.80         |
| 29 | Sikkim               | 21                      | 2.3                                     | 0.21                                | 1.00           |
| 30 | Tamil Nadu           | 3,343                   | 368                                     | 32.79                               | 157.40         |
| 31 | Telangana            | 1,599                   | 176                                     | 15.69                               | 75.30          |
| 32 | Tripura              | 82                      | 9.0                                     | 0.80                                | 3.86           |
| 33 | Uttar Pradesh        | 5,779                   | 636                                     | 56.68                               | 272.06         |
| 34 | Uttarakhand          | 319                     | 35                                      | 3.13                                | 15.04          |
| 35 | West Bengal          | 3,556                   | 391                                     | 34.87                               | 167.40         |
|    | <b>Total</b>         | <b>49,450</b>           | <b>5,439</b>                            | <b>485.02</b>                       | <b>2328.09</b> |

Source: Arcadis Calculation based on CPCB guideline.

<sup>14</sup>Biogas potential has been assumed considering 110 m<sup>3</sup> of biogas / MLD of sewage

Please note that the above potential is only for class I and class II towns only, not the total energy potential from urban liquid waste in India.

**Formula for power potential estimation from biogas**

$$\text{Power Potential} = \frac{\text{Biogas generated in a year} \times 2.14}{(365 \times 24 \times 1000)}$$

Thermal value of Biogas – 22 MJ m<sup>3</sup>, 3.6 MJ = 1KWh, 1m<sup>3</sup> biogas = (22/3.6) kWh = 6.1 kWh, Electrical conversion efficiency = 35%  
Therefore, 1m<sup>3</sup> biogas = 2.14 kWh (elec)

Note: Above formula has been considered to estimate energy potential from waste streams of Urban Organic liquid Waste

District-level energy potential from the urban liquid waste sector has also been analysed as a part of the study. State and District wise data provided in **Annexure 4**. The top 10 districts having high energy potential from urban liquid waste is provided in **Table 2-16**.

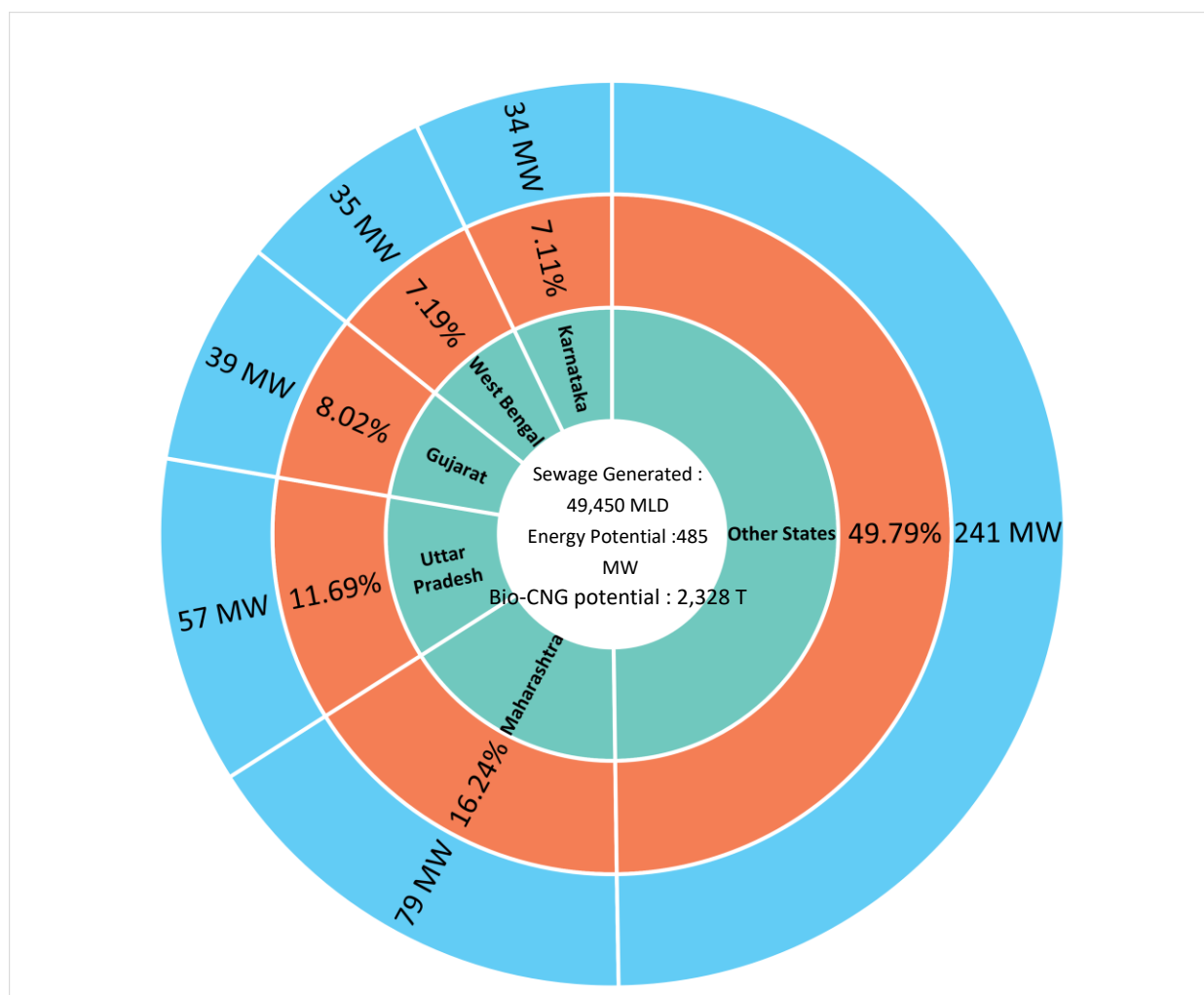
**Table 2-16:: Energy Potential from urban liquid waste - Top 10 Districts**

| SN           | District Name     | State Name  | Biogas per Day<br>(In '000 m <sup>3</sup> ) | Energy Potential<br>(MW) |
|--------------|-------------------|-------------|---|--------------------------|
| 1            | Delhi             | Delhi       | 3,66,300                                    | 32.66                    |
| 2            | Mumbai Suburban   | Maharashtra | 234240                                      | 20.89                    |
| 3            | Thane             | Maharashtra | 189572                                      | 16.90                    |
| 4            | Bangalore         | Karnataka   | 188038                                      | 16.77                    |
| 5            | Ahmadabad         | Gujarat     | 118425                                      | 10.56                    |
| 6            | Pune              | Maharashtra | 113847                                      | 10.15                    |
| 7            | Surat             | Gujarat     | 104976                                      | 9.36                     |
| 8            | North 24 Parganas | West Bengal | 95808                                       | 8.54                     |
| 9            | Hyderabad         | Telangana   | 87905                                       | 7.84                     |
| 10           | Chennai           | Tamil Nadu  | 84573                                       | 7.54                     |
| <b>Total</b> |                   |             | <b>15,83,684</b>                            | <b>141.21</b>            |

Source: Arcadis Calculation based on CPCB guideline.



**Figure 2-14: Percentage of Urban Liquid Waste Generation by the Major States**



The top five states Maharashtra, Uttar Pradesh, Gujarat, West Bengal and Karnataka, generate 52% of the Urban liquid waste of the country. Major districts in the shortlisted states are identified. Details of shortlisted states and districts are provided in **Table 2-17**.

**Table 2-17: Identified potential districts**

| State     | Maharashtra | Uttar Pradesh | Gujarat   | West Bengal       | Karnataka       |
|-----------|-------------|---------------|-----------|-------------------|-----------------|
| Districts | Mumbai      | Ghaziabad     | Ahmadabad | North 24 Parganas | Bangalore Urban |
|           | Thane       | Lucknow       | Surat     | Kolkata           | Mysore          |
|           | Pune        | Kanpur        | Rajkot    | Paschim Bardhaman | Dharwad         |
|           | Nagpur      | Agra          | Vadodara  | Howrah            | Bellary         |
|           | Nasik       | Meerut        | Bhavnagar | Hugli             | Belgaum         |

Figure 2-15: The potential States for Urban Liquid Waste

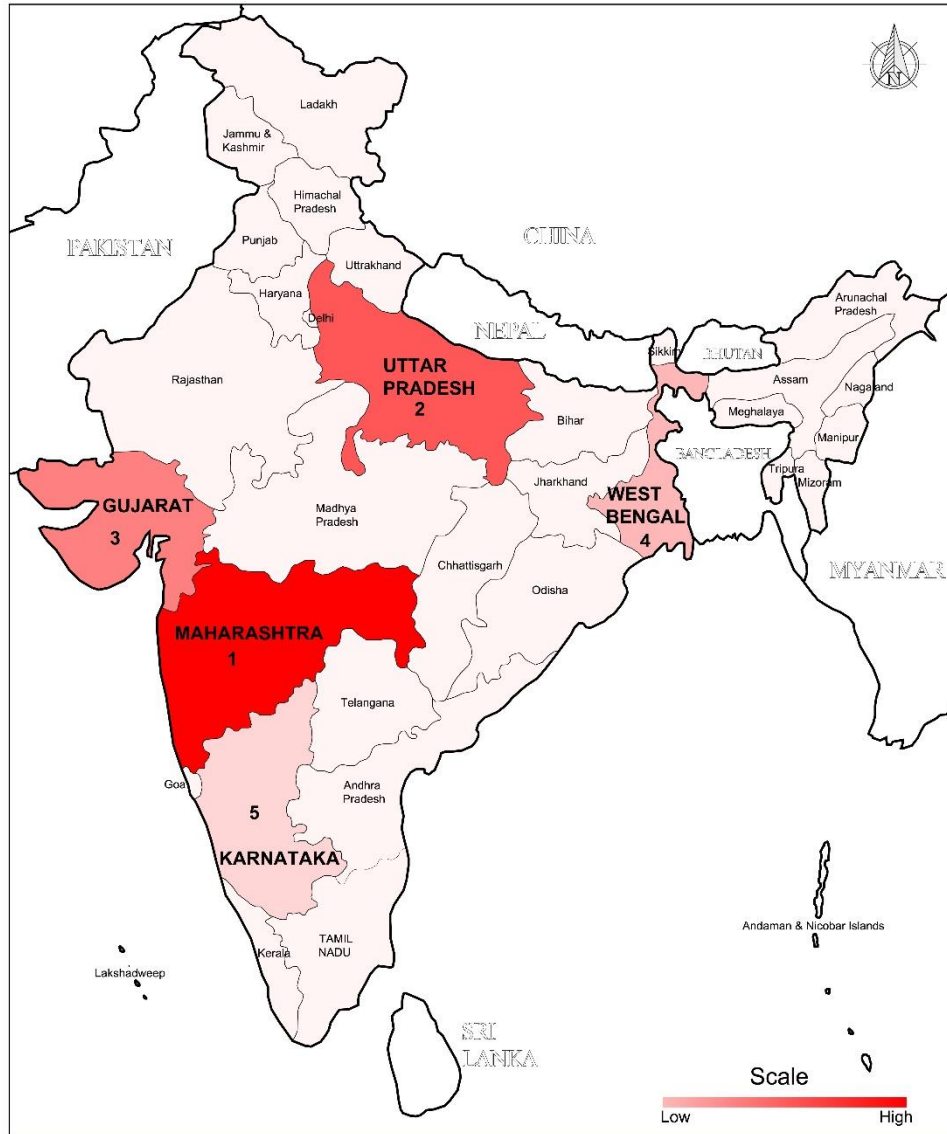
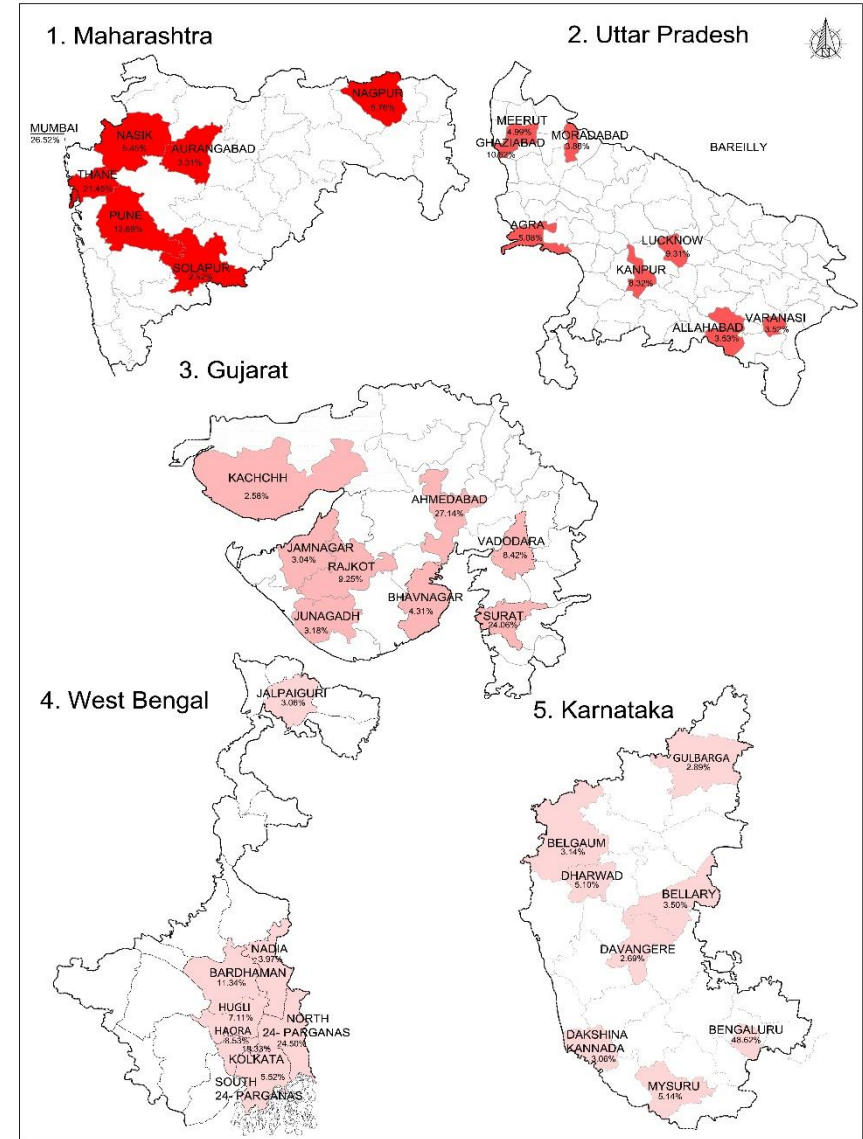


Figure 2-16: Potential Districts for Urban Liquid Waste



## 2.4 Urban Organic Solid Waste

The total solid waste generated in urban India is approximately 164,217 MT per day; with maximum generation of 11.9% from Uttar Pradesh followed by 10.60% from West Bengal, 9.89% from Maharashtra, 7.91% from Tamil Nadu, 7.46% from Gujarat and 6.91% from Karnataka.

Waste has been projected for the year 2021 using the population obtained through population projection for 2021, base data available from ULBs or District level environmental plan and considering an annual increment of 1.30%<sup>15</sup> on the per capita waste generation rate. CPHEEO manual<sup>16</sup> has been referred for towns and cities wherever base data was not available for solid waste.

CPHEEO Manual and CPCB report indicated that the per capita solid waste production rate lies between

- 200-300 gm/capita/day - Population < 200,000
- 300–350 gm/capita/day - Population between 200,000 – 500,000
- 350–400 gm/capita/day - Population between 500,000 – 1,000,000
- 400–600 gm/capita/day - Population > 1 million

The population projection for cities and towns has been done considering the average population derived from standard projection methods i.e., Arithmetic Progression, Geometric Progression, and Incremental Increase Method. The state-wise urban solid waste generation is provided in **Table 2-18**.

**Table 2-18: State-wise urban solid waste generation**

| SN | State & UT           | MSW Generation (TPD) | Contribution |
|----|----------------------|----------------------|--------------|
| 1  | Assam                | 1800                 | 1.10%        |
| 2  | Andhra Pradesh       | 7094                 | 4.32%        |
| 3  | Arunachal Pradesh    | 283                  | 0.17%        |
| 4  | Andaman & Nicobar    | 158                  | 0.10%        |
| 5  | Bihar                | 5073                 | 3.09%        |
| 6  | Chandigarh           | 516                  | 0.31%        |
| 7  | Chhattisgarh         | 2452                 | 1.49%        |
| 8  | Dadra & Nagar Haveli | 94                   | 0.06%        |
| 9  | Daman & Diu          | 93                   | 0.06%        |
| 10 | Delhi                | 9590                 | 5.84%        |
| 11 | Goa                  | 270                  | 0.16%        |
| 12 | Gujarat              | 12255                | 7.46%        |
| 13 | Haryana              | 4065                 | 2.48%        |
| 14 | Himachal Pradesh     | 374                  | 0.23%        |
| 15 | Jammu & Kashmir      | 1608                 | 0.98%        |
| 16 | Jharkhand            | 3610                 | 2.20%        |
| 17 | Karnataka            | 11348                | 6.91%        |
| 18 | Kerala               | 6726                 | 4.10%        |
| 19 | Madhya Pradesh       | 8006                 | 4.88%        |
| 20 | Maharashtra          | 16242                | 9.89%        |
| 21 | Manipur              | 417                  | 0.25%        |
| 22 | Meghalaya            | 187                  | 0.11%        |

<sup>15</sup> <https://mohua.gov.in/upload/uploadfiles/files/93.pdf>

<sup>16</sup> CPCB 2016; CPHEEO 2016a; MNRE 2016

| SN | State & UT    | MSW Generation (TPD) | Contribution  |
|----|---------------|----------------------|---------------|
| 23 | Mizoram       | 196                  | 0.12%         |
| 24 | Nagaland      | 195                  | 0.12%         |
| 25 | Odisha        | 2708                 | 1.65%         |
| 26 | Puducherry    | 344                  | 0.21%         |
| 27 | Punjab        | 4424                 | 2.69%         |
| 28 | Rajasthan     | 7399                 | 4.51%         |
| 29 | Sikkim        | 55                   | 0.03%         |
| 30 | Tamil Nadu    | 12987                | 7.91%         |
| 31 | Telangana     | 4986                 | 3.04%         |
| 32 | Tripura       | 512                  | 0.31%         |
| 33 | Uttar Pradesh | 19549                | 11.90%        |
| 34 | Uttarakhand   | 1170                 | 0.71%         |
| 35 | West Bengal   | 17400                | 10.60%        |
| 36 | Ladakh        | 15                   | 0.01%         |
| 37 | Lakshadweep   | 15                   | 0.01%         |
|    | <b>Total</b>  | <b>1,64,217</b>      | <b>100.00</b> |

Source: ULB Level data/District Environmental Plan and Waste Projection

The total energy potential from urban organic solid waste in India is **904 MW**. The top 10 states have the potential to generate 74.20 % of the total energy potential from this sector in the country. States having major energy potential are Uttar Pradesh (108 MW) West Bengal (96 MW), Maharashtra (89 MW). Tamil Nadu (71 MW), Gujarat (67 MW), Karnataka (62 MW), Delhi (53 MW) Madhya Pradesh (44 MW), Rajasthan (41 MW), and Andhra Pradesh (39 MW). Energy potential is provided in **Table 2-19**.

**Table 2-19: Energy Potential from Urban Organic Solid Waste**

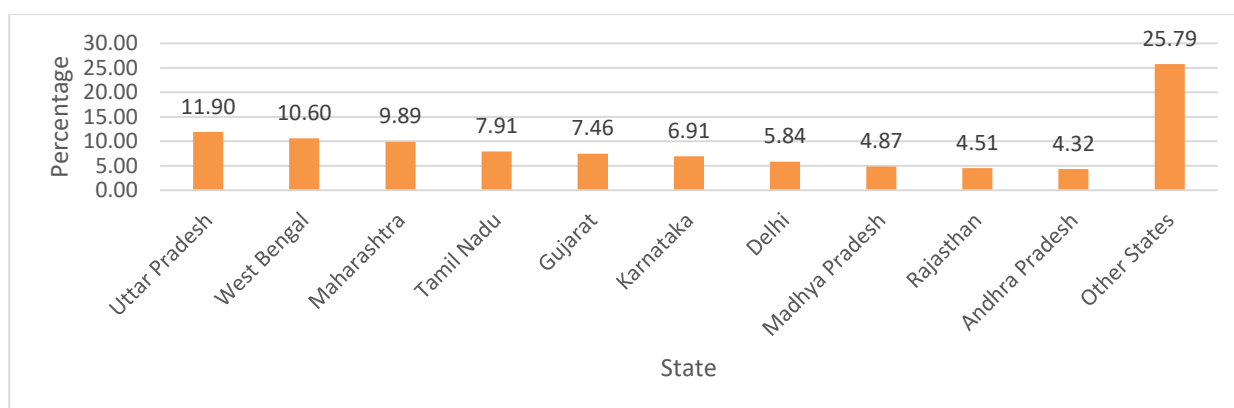
| SN | State                | MSW Generation (TPD) | Urban Organic Solid Waste 51.44%*(TPD) | Biogas Generation (In '000 m <sup>3</sup> ) <sup>17</sup> per annum | Energy Potential (MW) | Bio CNG (T) |
|----|----------------------|----------------------|--|---|-----------------------|-------------|
| 1  | Assam                | 1,800                | 926                                    | 40,553  | 9.91                  | 47.55       |
| 2  | Andhra Pradesh       | 7,094                | 3,649                                  | 1,59,835  | 39.05                 | 187.42      |
| 3  | Arunachal Pradesh    | 283                  | 145                                    | 6,372   | 1.56                  | 7.47        |
| 4  | Andaman & Nicobar    | 158                  | 82                                     | 3,585   | 0.88                  | 4.20        |
| 5  | Bihar                | 5,073                | 2,610                                  | 1,14,303  | 27.92                 | 134.03      |
| 6  | Chandigarh           | 516                  | 265                                    | 11,625  | 2.84                  | 13.63       |
| 7  | Chhattisgarh         | 2,452                | 1,261                                  | 55,250  | 13.50                 | 64.79       |
| 8  | Dadra & Nagar Haveli | 94                   | 48                                     | 2,115   | 0.52                  | 2.48        |
| 9  | Daman & Diu          | 93                   | 48                                     | 2,089   | 0.51                  | 2.45        |
| 10 | Delhi                | 9,590                | 4,933                                  | 2,16,075  | 52.79                 | 253.37      |
| 11 | Goa                  | 270                  | 139                                    | 6,082   | 1.49                  | 7.13        |
| 12 | Gujarat              | 12,255               | 6,304                                  | 2,76,110  | 67.45                 | 323.77      |
| 13 | Haryana              | 4,065                | 2,091                                  | 91,584  | 22.37                 | 107.39      |
| 14 | Himachal Pradesh     | 374                  | 192                                    | 8,423   | 2.06                  | 9.88        |
| 15 | Jammu & Kashmir      | 1,608                | 827                                    | 36,219  | 8.85                  | 42.47       |

<sup>17</sup>Biogas potential has been assumed considering 120 m<sup>3</sup> of biogas / TPD of Organic Solid Waste

| SN | State          | MSW Generation (TPD) | Urban Organic Solid Waste 51.44%*(TPD) | Biogas Generation (In '000 m <sup>3</sup> ) <sup>17</sup> per annum | Energy Potential (MW) | Bio CNG (T)    |
|----|----------------|----------------------|--|---|-----------------------|----------------|
| 16 | Jharkhand      | 3,610                | 1,857                                  | 81,327  | 19.87                 | 95.36          |
| 17 | Karnataka      | 11,348               | 5,837                                  | 2,55,681  | 62.46                 | 299.81         |
| 18 | Kerala         | 6,726                | 3,460                                  | 1,51,542  | 37.02                 | 177.70         |
| 19 | Ladakh         | 15                   | 8                                      | 343   | 0.08                  | 0.40           |
| 20 | Lakshadweep    | 15                   | 8                                      | 349   | 0.09                  | 0.41           |
| 21 | Madhya Pradesh | 8,006                | 4,118                                  | 1,80,372  | 44.06                 | 211.50         |
| 22 | Maharashtra    | 16,242               | 8,355                                  | 3,65,943  | 89.40                 | 429.11         |
| 23 | Manipur        | 417                  | 215                                    | 9,402   | 2.30                  | 11.03          |
| 24 | Meghalaya      | 187                  | 96                                     | 4,212   | 1.03                  | 4.94           |
| 25 | Mizoram        | 196                  | 101                                    | 4,406   | 1.08                  | 5.17           |
| 26 | Nagaland       | 195                  | 100                                    | 4,387   | 1.07                  | 5.14           |
| 27 | Odisha         | 2,708                | 1,393                                  | 61,018  | 14.91                 | 71.55          |
| 28 | Puducherry     | 344                  | 177                                    | 7,740   | 1.89                  | 9.08           |
| 29 | Punjab         | 4,424                | 2,276                                  | 99,684  | 24.35                 | 116.89         |
| 30 | Rajasthan      | 7,399                | 3,806                                  | 1,66,714  | 40.73                 | 195.49         |
| 31 | Sikkim         | 55                   | 28                                     | 1,245   | 0.30                  | 1.46           |
| 32 | Tamil Nadu     | 12,987               | 6,680                                  | 2,92,602  | 71.48                 | 343.11         |
| 33 | Telangana      | 4,986                | 2,565                                  | 1,12,335  | 27.44                 | 131.72         |
| 34 | Tripura        | 512                  | 263                                    | 11,538  | 2.82                  | 13.53          |
| 35 | Uttar Pradesh  | 19,549               | 10,056                                 | 4,40,444  | 107.60                | 516.47         |
| 36 | Uttarakhand    | 1,169                | 601                                    | 26,328  | 6.43                  | 30.87          |
| 37 | West Bengal    | 17,403               | 8,952                                  | 3,92,105  | 95.79                 | 459.78         |
|    | <b>Total</b>   | <b>1,64,217</b>      | <b>84,473</b>                          | <b>36,99,936</b>  | <b>903.87</b>         | <b>4338.55</b> |

Source: [https://cpcb.nic.in/uploads/MSW/Waste\\_generation\\_Composition.pdf](https://cpcb.nic.in/uploads/MSW/Waste_generation_Composition.pdf). 51.44% is the average organic content in waste composition across 59 cities in India conducted by CPCB and NEERI 2004-05

**Figure 2-17: State-wise percentage of Energy Potential from Urban Organic solid waste**



**Formula for power potential estimation from biogas**

$$\text{Power Potential} = \frac{(\text{Biogas generated in a year} \times 2.14)}{(365 \times 24 \times 1000)}$$

Thermal value of Biogas – 22 MJ m<sup>3</sup>

3.6 MJ = 1KWh

1m<sup>3</sup> biogas = (22/3.6) kWh = 6.1 kWh

Electrical conversion efficiency = 35%

Therefore, 1m<sup>3</sup> biogas = 2.14 kWh (elec)

Note: Above formula has been considered to estimate energy potential from waste streams of Urban Organic Solid Waste

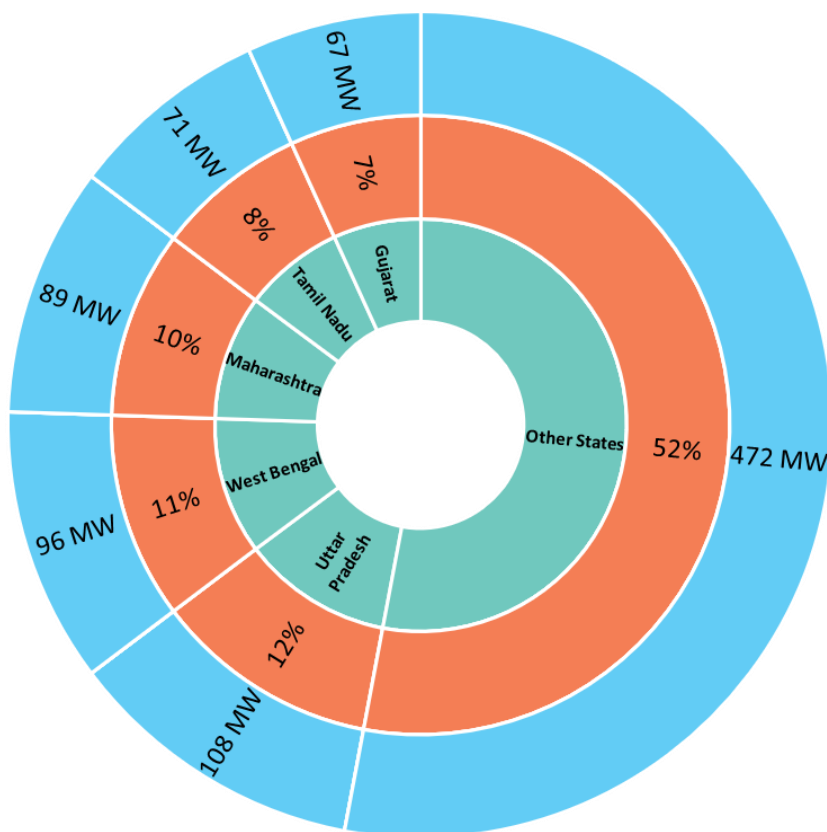
District-level energy potential from the urban organic solid waste sector has also been analysed as a part of the study. State and District wise data provided in **Annexure 5**. The top 10 districts having high energy potential from urban organic solid waste is provided in **Table 2-20**.

**Table 2-20:: Energy Potential from urban organic solid waste - Top 10 Districts**

| SN           | District Name     | State & UT  | Biogas (In '000 m <sup>3</sup> ) | Energy Potential (MW) |
|--------------|-------------------|-------------|----------------------------------|-----------------------|
| 1            | Delhi             | Delhi       | 21,6,07,50,325                   | 52.79                 |
| 2            | Bengaluru (U)     | Karnataka   | 13,20,99,764                     | 32.27                 |
| 3            | Ahmadabad         | Gujarat     | 10,65,53,692                     | 26.03                 |
| 4            | Kolkata           | West Bengal | 10,44,69,521                     | 25.52                 |
| 5            | Mumbai            | Maharashtra | 8,18,75,368                      | 20                    |
| 6            | North 24 Parganas | West Bengal | 7,45,47,103                      | 18.21                 |
| 7            | Hyderabad         | Telangana   | 5,98,65,807                      | 14.62                 |
| 8            | Chennai           | Tamil Nadu  | 5,85,22,207                      | 14.30                 |
| 9            | Thane             | Maharashtra | 57913313                         | 14.15                 |
| 10           | Surat             | Gujarat     | 5,16,21,979                      | 12.61                 |
| <b>Total</b> |                   |             | <b>72,74,68,754.00</b>           | <b>230.50</b>         |

Source: [https://cpcb.nic.in/uploads/MSW/Waste\\_generation\\_Composition.pdf](https://cpcb.nic.in/uploads/MSW/Waste_generation_Composition.pdf). 51.44% is the average organic content in waste composition across 59 cities in India conducted by CPCB and NEERI 2004-05.

**Figure 2-18: Percentage of Urban Organic Solid Waste Generation by the Major States**

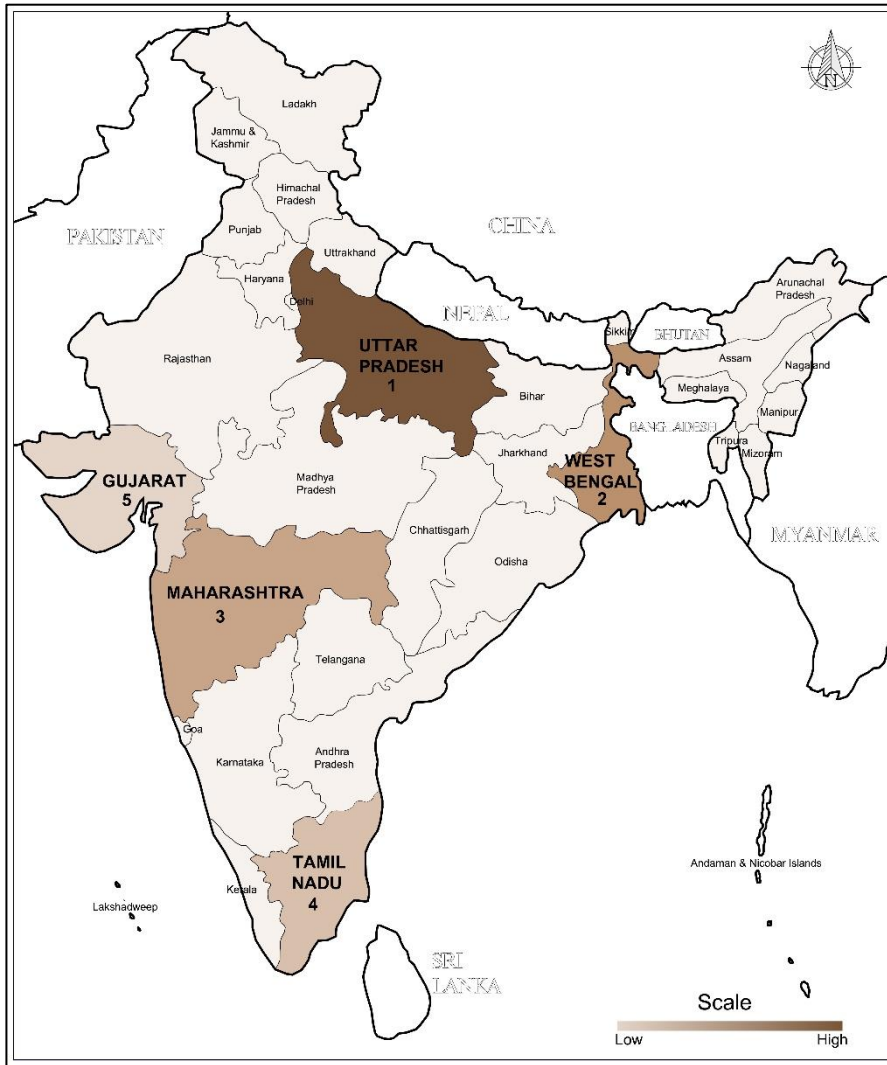


Identification of high energy potential districts has been done for the top five shortlisted states. Details of shortlisted states and districts are provided in **Table 2-21**.

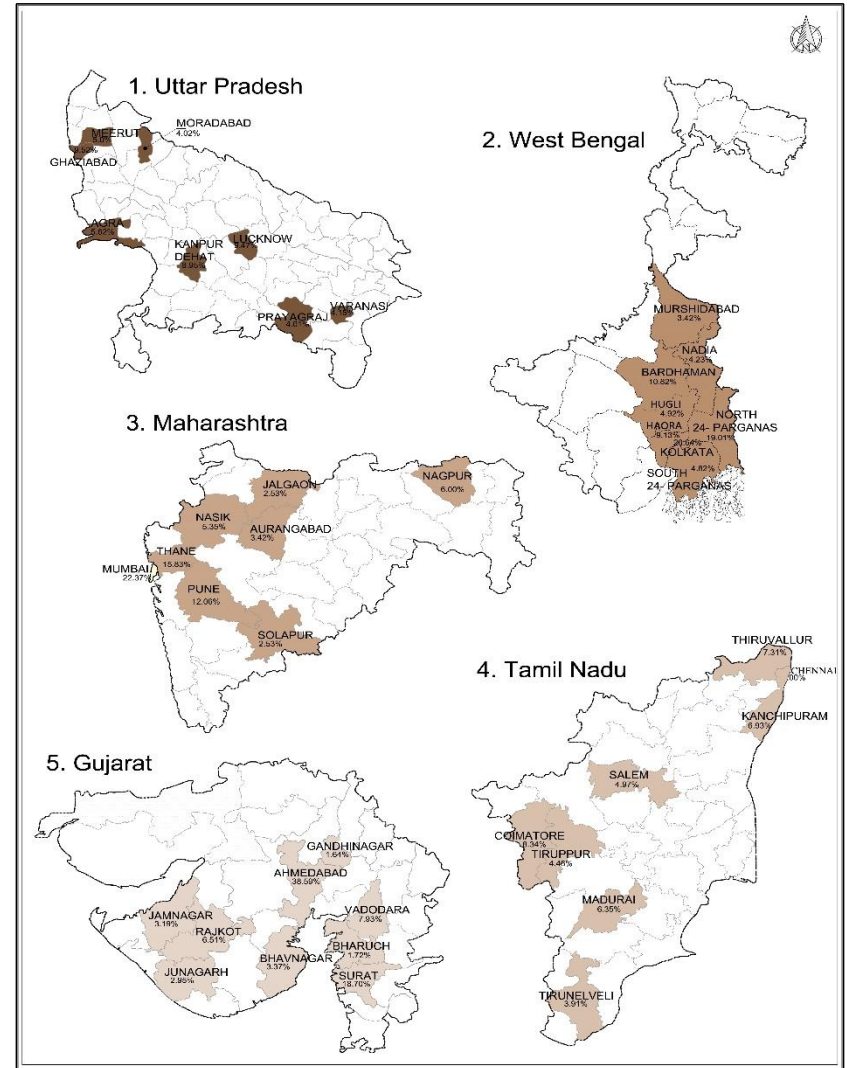
**Table 2-21: Identified potential districts**

| State     | Uttar Pradesh | West Bengal        | Maharashtra              | Tamil Nadu   | Gujarat   |
|-----------|---------------|--------------------|--------------------------|--------------|-----------|
| Districts | Lucknow       | Kolkata            | Mumbai & Mumbai Suburban | Chennai      | Ahmadabad |
|           | Ghaziabad     | North 24 Parganas  | Thane                    | Coimbatore   | Surat     |
|           | Kanpur Dehat  | Hawrah             | Pune                     | Thiruvallur  | Vadodara  |
|           | Agra          | Paschim Barddhaman | Nagpur                   | Kancheepuram | Rajkot    |
|           | Meerut        | Hugli              | Nasik                    | Madurai      | Jamnagar  |

**Figure 2-19: The potential States in India for Urban Organic Solid Waste**



**Figure 2-20: Potential Districts in the Key States for Urban Organic Solid Waste**





## 2.5 Slaughterhouse

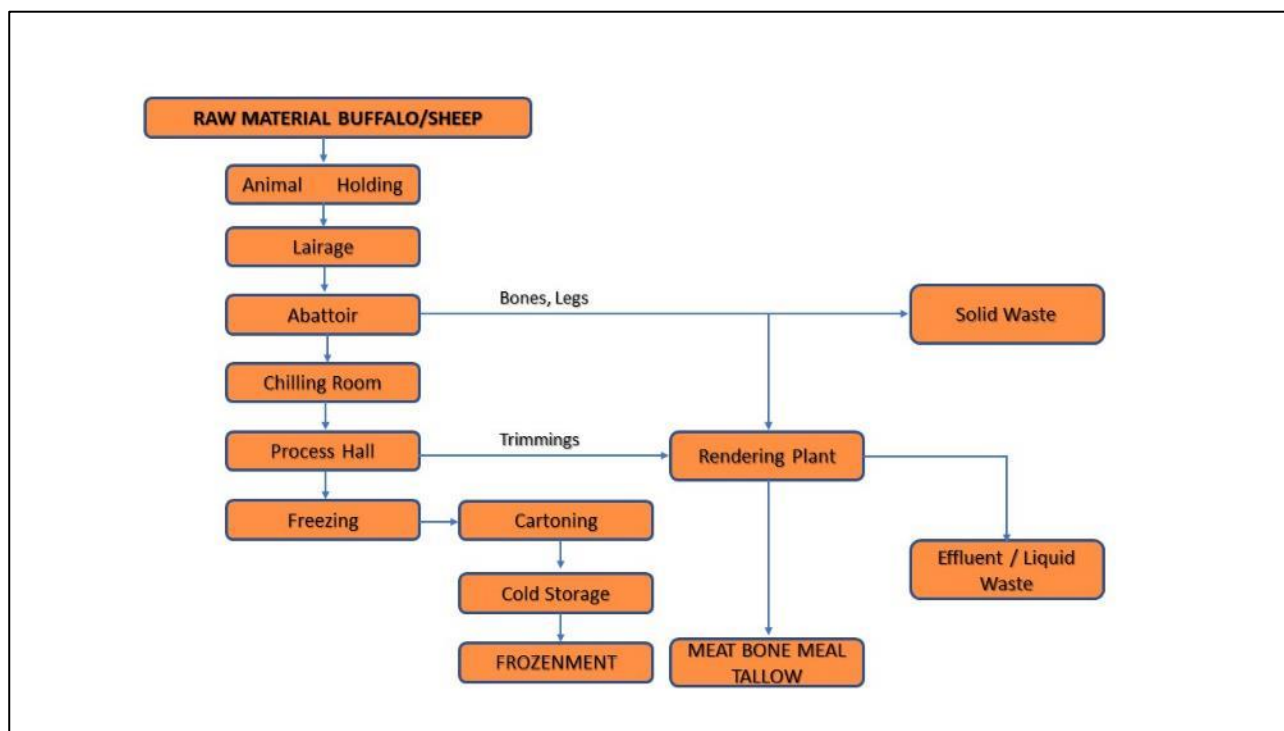
Slaughterhouses in India slaughter farm animal and process it into meat products for local consumption as well as for export purposes. The contribution in the meat production by cattle, sheep, goats and poultry is 30%, 5%, 10%, and 11.5% respectively.

Most of the animals slaughtered are small (goat & sheep) and are sold in the local market. Hence, the export of sheep and goat meat in terms of quantity is very small. Though India is the second largest exporter of meat products, and the export is growing at a rate of 25-30% per annum, the export is primarily restricted to countries in the Middle East, with a large ethnic Indian population. In India, domestic market consumption is also growing with an increase in several fast-food outlets. Despite the growth and large business opportunities involved, the meat sector is largely an unorganized sector in India.

### Slaughterhouse Process Flow

The key process and steps followed in slaughterhouses include Animal holding, Lairage, Abattoir/Slaughterhouse, Chilling, Processing, freezing, Cold Storage, and Rendering. The process flow chart is provided below.

Figure 2-21: Process flow diagram for slaughtering process in India



### 2.5.1 Effluent and Solid Waste Generation from Slaughterhouse:

Both Solid and liquid waste is generated from the slaughterhouses. Major waste types are meat scrap (non-edible offal like lungs, large intestines, various glands, animal tissues, organs), blood, dung (cattle are detained for 24 hours before slaughtering), effluent after washing (carcass, machine, slaughterhouse), sludge from Effluent Treatment Plant (ETP) and animal carcass. Normally blood does not form part of the waste from the slaughterhouse as it is required to be collected separately for pharmaceutical and other usage as per the Central Pollution Control Board (CPCB) 'Guidelines for Sanitation in Slaughterhouses'.

The rendering process is a major source of effluent and contributes considerable organic load to the plant effluent. In the rendering process, the waste meat and inedible portions of the animal bodies like cartilage, bones, fat, etc. are put into the rendering process, where they are crushed, and steam cooked to separate fat and then decanted. It helps rupture connective tissues of individual fat and muscle cells so that raw fat and other materials bound within are free. The fat is sold as inedible tallow, which is used for manufacturing soaps. The waste (glue) water is generated and separated from fats. The glue water contains about 75 percent of the total protein content of rendering input and therefore is a major source of BOD. It has been estimated that the

average BOD of the glue water stream is 32,000 mg/L. The grease is another component of glue water that is usually separated from water in grease traps. This separated fat can be disposed of on land after composting<sup>18</sup>.

A high amount of fresh water is required for washing carcasses, machines in a slaughterhouse. More water is required for mechanised slaughterhouses rather than manual slaughtering. The water consumption also varies depending on the size of the slaughterhouse; per animal water consumption is lesser for large slaughterhouses than small ones.

**Table 2-22: Sources of liquid and solid waste generation from Slaughterhouse.**

| SN | Source                   | Liquid Waste                   | Solid Waste         |
|----|--------------------------|--------------------------------|---------------------|
| 1  | Animal Holding           | Floor washing & Urine          | Fodder Waste /Dungs |
| 2  | Abattoir                 | Blood, Floor & machine washing | Blood Clots         |
| 3  | Hide Removal             |                                | Hair & Dirt         |
| 4  | Cleaning Internal Organs | Wash Liquor                    | Paunch Content      |
| 5  | Rendering                | Glue Water                     |                     |
| 6  | Carcass Dressing         | Blood, Floor machine washing   | Flash, Grease       |
| 7  | By-Products Plant        | Floor machine washing          | Grease and offal    |

Source: Revised Comprehensive Industry document on slaughterhouses, CPCB, 2017

Wastewater discharged from slaughterhouse contains high BOD, COD, and TSS concentrations indicating high biogas generation potential. The effluent from the slaughterhouse requires appropriate treatment before disposal into the sewer system, as per the CPCB Guidelines for sanitation in Slaughterhouses.

**Table 2-23: Characteristics of Slaughterhouse wastewater**

| SN | Parameter                              | Raw Effluent  |
|----|--|---------------|
| 1  | pH                                     | 7.6           |
| 2  | Total Suspended solids (mg/L)          | 1,500 -4,500  |
| 3  | Biochemical Oxygen Demand (BOD) (mg/L) | 1,200 – 4,000 |
| 4  | Chemical Oxygen Demand (COD) (mg/L)    | 3,000 – 7,000 |

Source: Revised Comprehensive Industry document on slaughterhouses, CPCB, 2017

**Table 2-24: Characteristics of Slaughterhouse Solid Waste**

| SN | Parameter             | Value      |
|----|-----------------------|------------|
| 1  | Moisture Content      | 60 – 85%   |
| 2  | Total Solid           | 15 – 40%   |
| 3  | Total Volatile Solids | 70 – 92%   |
| 4  | Organic Carbon        | 22 – 28%   |
| 5  | Total Nitrogen        | 2.5 – 4.2% |
| 6  | Phosphorous           | 0.2 – 0.4% |
| 7  | Potassium             | 0.3 – 0.4% |

Source: Revised Comprehensive Industry document on slaughterhouses, CPCB, 2017

Most of the waste obtained from the slaughtering process has available market/ commercial value after processing. Most of the solid and liquid waste is utilised locally.

- Non-edible offal wastes are disposed of by a process called rendering. The rendering process dries the material and separates the fat from the bone and protein. The dried materials have nutrients, so it is normally packed and sold as poultry feed.
- Fats obtained are collected in the tallow chambers and supplied to soap manufacturers.

<sup>18</sup> Source: Revised Comprehensive Industry document on slaughterhouses, CPCB, 2017

<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwishZaKINHyAhWTxDgGHeAVDulQFnoECAIQAAQ&url=https%3A%2F%2Fcpcb.nic.in%2Fopenpdf.php%3Fid%3DTGF0ZXN0RmlsZS8xNzVfMTUxMTI2NDE0MV9tZWRpYXBob3RvODkzOS5wZGY%3D&usg=AOvVaw1ax8D1b3oADZivptTziqfJ>

- Blood from the slaughtering process is added to the processed meat.
- Cattle dung is sold to farmers of nearby villages.
- Wastewater is normally diverted for irrigation to the farmland after primary treatment.

Most of the solid wastes generated from slaughterhouse have utilisation potential so they may not be available for energy generation.

## 2.5.2 Practices on Slaughterhouse waste treatment in India

Most of the slaughterhouses in India are operated and managed by municipalities/local bodies. There is no treatment facility for waste generated from slaughterhouses except for selected facilities in large urban local bodies. Generally, the liquid waste is stored in a settling tank for some time and drained into the sewer line without treatment. The wastewater generated from the slaughter. The settled solids are removed and disposed of along with the municipal solid waste.

Some of the recent or upgraded slaughterhouses operations are more mechanised and organised. The slaughterhouses are equipped with the Effluent Treatment Plant (ETP) which includes a screen, equalization tank, and single-stage biological treatment system. The treated wastewater from the effluent treatment plant is disposed of into sewer/on land. Some slaughterhouses also use anaerobic reactors to reduce the organic load to the extent of 50 -70 % to the subsequent aerobic biological treatment process. The biogas produced from the biological treatment is used as fuel within the plant.

### Slaughterhouse & Animals Slaughtered

The Department of Animal Husbandry (DAHD) in their annual report of Basics of Animal Husbandry Statistics, 2019 has published that there are 1302 registered slaughterhouses across the country. However, different secondary sources present different statistics on the number of slaughterhouses in India. As per CPCB<sup>19</sup>, India has more than 1176 slaughterhouses and 75 modern abattoirs. In addition, a considerable number of animals are slaughtered in the unorganised sector as well. Most slaughterhouses in India are service-oriented and perform only the killing and dressing of animals without an onsite rendering process. During the slaughtering process, both solid and liquid waste is generated. State-wise data on the number of slaughterhouses and animals slaughtered is provided in Table 2-25

**Table 2-25: State-wise details on slaughterhouse**

| SN | State                      | No. of Slaughterhouse |
|----|----------------------------|-----------------------|
| 1  | Andhra Pradesh & Telangana | 224                   |
| 2  | A&N Islands                | 1                     |
| 3  | Arunachal Pradesh          | 1                     |
| 4  | Assam                      | 1                     |
| 5  | Bihar                      | 42                    |
| 6  | Chhattisgarh               | 26                    |
| 7  | Chandigarh                 | 1                     |
| 8  | D.& N. Haveli              | 1                     |
| 9  | Daman & Diu                | 2                     |
| 10 | Delhi                      | 1                     |
| 11 | Goa                        | 1                     |
| 12 | Gujarat                    | 38                    |
| 13 | Haryana                    | 37                    |
| 14 | Himachal Pradesh           | 37                    |
| 15 | Jammu & Kashmir            | 2                     |
| 16 | Jharkhand                  | 1                     |

<sup>19</sup> Revised Comprehensive Industry Document on Slaughterhouses, CPCB, 2017

| SN           | State          | No. of Slaughterhouse |
|--------------|----------------|-----------------------|
| 17           | Karnataka      | 86                    |
| 18           | Kerala         | 47                    |
| 19           | Lakshadweep    | 1                     |
| 20           | Madhya Pradesh | 25                    |
| 21           | Maharashtra    | 106                   |
| 22           | Meghalaya      | 4                     |
| 23           | Mizoram        | 2                     |
| 24           | Odisha         | 65                    |
| 25           | Puducherry     | 1                     |
| 26           | Punjab         | 43                    |
| 27           | Rajasthan      | 8                     |
| 28           | Sikkim         | 4                     |
| 29           | Tamil Nadu     | 135                   |
| 30           | Tripura        | 0                     |
| 31           | Uttar Pradesh  | 179                   |
| 32           | Uttarakhand    | 25                    |
| 33           | West Bengal    | 29                    |
| <b>Total</b> |                | <b>1176</b>           |

Source: Revised Comprehensive Industry Document on Slaughterhouses, CPCB, 2017

Andhra Pradesh has the maximum number of slaughterhouses followed by Uttar Pradesh, Tamil Nadu, and Maharashtra. Quality and quantity of wastewater and solid waste generation from slaughterhouses vary depending upon the category of the animal slaughtered i.e., cattle and buffalo, sheep & goat, pig and poultry. Around 89% of animals are slaughtered in ten states Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Maharashtra, Karnataka, Odisha, Kerala, Punjab, Bihar, and Gujarat.

District-wise details for animal slaughtered in twelve states was collected from the Animal husbandry department of respective states. The data collated include details of the total number of animals slaughtered in the district, type of animal slaughtered, etc. which was further analysed. For the rest of the states, consolidated data published by the Animal Husbandry Department, Govt. of India (Basic Animal Husbandry Statistic – 2019, GoI) is referred. The summary of the data is provided in the table below.

**Table 2-26: State-wise number of animals slaughtered (in '000 nos.)**

| SN | State             | Cattle | Buffalo | Sheep | Goat | Pig  |
|----|-------------------|--------|---------|-------|------|------|
| 1  | Andhra Pradesh    | 0      | 1111    | 13199 | 3835 | 48   |
| 2  | A & N Islands     | 1      | 0       | 0     | 10   | 10   |
| 3  | Arunachal Pradesh | 101    | 12      | 17    | 238  | 96   |
| 4  | Assam             | 54     | 2       | 251   | 2139 | 612  |
| 5  | Bihar             | 460    | 1110    | 213   | 9441 | 3129 |
| 6  | Chandigarh        | 0      | 0       | 27    | 37   | 5    |
| 7  | Chhattisgarh      | 0      | 0       | 138   | 1208 | 101  |
| 8  | Daman & Diu       | 0      | 0       | 0     | 16   | 0    |
| 9  | Goa               | 3      | 0       | 0     | 246  | 47   |
| 10 | Gujarat           | 0      | 10      | 54    | 79   | 4    |
| 11 | Haryana           | 0      | 52      | 875   | 375  | 127  |
| 12 | Himachal Pradesh  | 0      | 0       | 49    | 124  | 3    |
| 13 | Jammu & Kashmir   | 0      | 31      | 1432  | 778  | 0    |

| SN | State          | Cattle      | Buffalo      | Sheep        | Goat         | Pig         |
|----|----------------|-------------|--------------|--------------|--------------|-------------|
| 14 | Jharkhand      | 0           | 2            | 142          | 2363         | 571         |
| 15 | Karnataka      | 136         | 84           | 3015         | 2165         | 115         |
| 16 | Kerala         | 1255        | 856          | 0            | 1692         | 98          |
| 17 | Lakshadweep    | 1           | 0            | 0            | 10           | 0           |
| 18 | Madhya Pradesh | 0           | 253          | 81           | 1826         | 69          |
| 19 | Maharashtra    | 0           | 879          | 342          | 644          | 43          |
| 20 | Manipur        | 87          | 49           | 11           | 41           | 143         |
| 21 | Meghalaya      | 265         | 6            | 0            | 129          | 336         |
| 22 | Mizoram        | 44          | 2            | 0            | 19           | 92          |
| 23 | Nagaland       | 78          | 27           | 0            | 42           | 199         |
| 24 | Odisha         | 0           | 0            | 1519         | 6207         | 250         |
| 25 | Puducherry     | 14          | 1            | 101          | 621          | 1           |
| 26 | Punjab         | 0           | 816          | 254          | 580          | 21          |
| 27 | Rajasthan      | 0           | 838          | 3910         | 6003         | 242         |
| 28 | Sikkim         | 15          | 2            | 0            | 6            | 14          |
| 29 | Tamil Nadu     | 397         | 22           | 5012         | 5757         | 94          |
| 30 | Telangana      | 0           | 1076         | 20640        | 5571         | 150         |
| 31 | Tripura        | 0           | 0            | 0            | 404          | 247         |
| 33 | Uttar Pradesh  | 0           | 4550         | 1124         | 4549         | 1439        |
| 35 | Uttarakhand    | 0           | 34           | 149          | 692          | 68          |
| 36 | West Bengal    | 131         | 108          | 2229         | 30343        | 1096        |
|    | <b>Total</b>   | <b>3041</b> | <b>11934</b> | <b>54784</b> | <b>88187</b> | <b>9471</b> |

Source: Basic Animal Husbandry Statistic – 2019, GoI & Animal Husbandry Department of respective state

Quality and quantity of wastewater and solid waste generation from slaughterhouses vary depending upon the category of the animal slaughtered i.e., cattle and buffalo, sheep & goat, pig and poultry. Around 85% of animals are slaughtered in ten states West Bengal, Telangana, Andhra Pradesh, Bihar, Uttar Pradesh, Tamil Nadu, Rajasthan, Odisha, Karnataka, Kerala, and Maharashtra.

**Table 2-27: State-wise Energy Potential from Waste Generated from the slaughterhouse**

| SN | State & UT        | The total solid waste generated (In tonne) per annum | Biogas Generation (In '000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid waste generated (Million litres) per annum | Biogas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio CNG (T) |
|----|-------------------|--|---|-----------------------|---|--|-----------------------|--|-------------|
| 1  | Andhra Pradesh    | 51,336   | 6,160   | 1.50                  | 787   | 38,540   | 9.41                  | 10.92  | 52.42       |
| 2  | A&N Islands       | 35   | 4   | 0.001                 | 1   | 40   | 0.01                  | 0.01   | 0.05        |
| 3  | Arunachal Pradesh | 2,146  | 258   | 0.06                  | 36  | 1,747  | 0.43                  | 0.49   | 2.35        |
| 4  | Assam             | 5,988  | 719   | 0.18                  | 108   | 5,301  | 1.30                  | 1.47   | 7.06        |
| 5  | Bihar             | 43,202   | 5,184   | 1.27                  | 748   | 36,668   | 8.96                  | 10.22  | 49.08       |
| 6  | Chandigarh        | 135  | 16  | 0.004                 | 2   | 108  | 0.03                  | 0.03   | 0.15        |
| 7  | Chhattisgarh      | 2,857  | 343   | 0.08                  | 46  | 2,269  | 0.6                   | 0.64   | 3.06        |
| 8  | Daman & Diu       | 33   | 4   | 0.001                 | 1   | 25   | 0.01                  | 0.01   | 0.03        |
| 9  | Goa               | 568  | 68  | 0.02                  | 10  | 488  | 0.12                  | 0.14   | 0.65        |
| 10 | Gujarat           | 426  | 51  | 0.01                  | 7   | 325  | 0.08                  | 0.09   | 0.44        |
| 11 | Haryana           | 3,389  | 407   | 0.10                  | 55  | 2,708  | 0.66                  | 0.76   | 3.65        |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| SN | State & UT       | The total solid waste generated (In tonne) per annum | Biogas Generation (In '000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid waste generated (Million litres) per annum | Biogas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio CNG (T)   |
|----|------------------|--|---|-----------------------|---|--|-----------------------|--|---------------|
| 12 | Himachal Pradesh | 364  | 44  | 0.01                  | 6   | 276  | 0.07                  | 0.08   | 0.38          |
| 13 | Jammu & Kashmir  | 5,069  | 608   | 0.15                  | 77  | 3,789  | 0.93                  | 1.07   | 5.16          |
| 14 | Jharkhand        | 5,460  | 655   | 0.16                  | 99  | 4,844  | 1.18                  | 1.34   | 6.45          |
| 15 | Karnataka        | 13,995   | 1,679   | 0.41                  | 217   | 10,633   | 2.60                  | 3.01   | 14.44         |
| 16 | Kerala           | 33,134   | 3,976   | 0.97                  | 513   | 25,148   | 6.14                  | 7.11   | 34.15         |
| 17 | Lakshadweep      | 30   | 4   | 0.001                 | 0.45  | 22   | 0.01                  | 0.01   | 0.03          |
| 18 | Madhya Pradesh   | 7,572  | 909   | 0.22                  | 118   | 5,779  | 1.41                  | 1.63   | 7.84          |
| 19 | Maharashtra      | 14,389   | 1,727   | 0.42                  | 223   | 10,916   | 2.67                  | 3.09   | 14.83         |
| 20 | Manipur          | 2,047  | 246   | 0.06                  | 35  | 1,738  | 0.42                  | 0.48   | 2.33          |
| 21 | Meghalaya        | 4,158  | 499   | 0.12                  | 73  | 3,592  | 0.88                  | 1.00   | 4.80          |
| 22 | Mizoram          | 702  | 84  | 0.02                  | 13  | 654  | 0.16                  | 0.18   | 0.87          |
| 23 | Nagaland         | 1,618  | 194   | 0.05                  | 30  | 1,490  | 0.36                  | 0.41   | 1.98          |
| 24 | Odisha           | 16,299   | 1,956   | 0.48                  | 255   | 12,505   | 3.05                  | 3.53   | 16.96         |
| 25 | Puducherry       | 1,732  | 208   | 0.051                 | 26  | 1,296  | 0.32                  | 0.37   | 1.76          |
| 26 | Punjab           | 13,182   | 1,582   | 0.39                  | 204   | 9,977  | 2.44                  | 2.82   | 13.55         |
| 27 | Rajasthan        | 32,625   | 3,915   | 0.96                  | 506   | 24,794   | 6.06                  | 7.01   | 33.66         |
| 28 | Sikkim           | 253  | 30  | 0.01                  | 4   | 211  | 0.05                  | 0.06   | 0.28          |
| 29 | Tamil Nadu       | 28,502   | 3,420   | 0.84                  | 438   | 21,463   | 5.24                  | 6.08   | 29.18         |
| 30 | Telangana        | 70,154   | 8,418   | 2.06                  | 1076  | 52,724   | 12.88                 | 14.94  | 71.70         |
| 31 | Tripura          | 923  | 111   | 0.03                  | 21  | 1,021  | 0.25                  | 0.28   | 1.33          |
| 32 | Uttar Pradesh    | 76,051   | 9,126   | 2.23                  | 1210  | 59,313   | 14.49                 | 16.72  | 80.25         |
| 33 | Uttarakhand      | 2,266  | 272   | 0.07                  | 36  | 1,788  | 0.44                  | 0.50   | 2.42          |
| 34 | West Bengal      | 72,087   | 8,650   | 2.11                  | 1129  | 55,329   | 13.52                 | 15.63  | 75.02         |
|    | <b>Total</b>     | <b>5,12,727</b>                                      | <b>61,527.25</b>                                      | <b>15.03</b>          | <b>8,113</b>  | <b>3,97,522.42</b>                                   | <b>97.11</b>          | <b>112.14</b>  | <b>538.28</b> |

Source:

- 1) Waste generation from Slaughterhouse calculated by Arcadis based on the standards prescribed by Maharashtra Pollution Control Board (Maharashtra Pollution Control Board circular on slaughterhouse waste management and design of pollution control systems/measures). MPCB numbers have been validated by the team during field investigations. Standards used for waste calculation are provided below for reference

**Solid waste:** 4% of average weight for cattle and Buffalo (Average weight of Cattle & Buffalo is 350 kg); 7% of the average weight for goat and sheep (Average weight of sheep & Goat is 30 kg); 1% of the average weight of Pig (30 kg)

**Liquid waste:** 80% of total water consumption is generated as liquid waste. Water consumption for cattle and Buffalo - 270 litres/ Cattle & Buffalo ; Water consumption- 40 litres/Sheep, goat & Pig.

- 2) \*Biogas generation estimation from solid and liquid waste was done:
  - 120-160 m<sup>3</sup> biogas is generated from per ton of slaughterhouse solid wastes (source: <http://www.bioenergyconsult.com/biogas-from-slaughterhouse-wastes>)
  - 3000 litres of wastewater from slaughterhouse generates an average of 147.67 m<sup>3</sup> of biogas/day( source: <http://www.omicsonline.org/biogas-from-slaughterhouse-waste-towards-anenergy-self-sufficient-industry-with-economical-analysis-in-india-1948-5948.S12-001.php?aid=8071>)

### Formula for power potential estimation from biogas

$$\text{Power Potential} = \frac{\text{Biogas generated in a year} \times 2.14}{(365 \times 24 \times 1000)}$$

Thermal value of Biogas – 22 MJ m<sup>3</sup>

3.6 MJ = 1KWh

1m<sup>3</sup> biogas = (22/3.6) kWh = 6.1 kWh

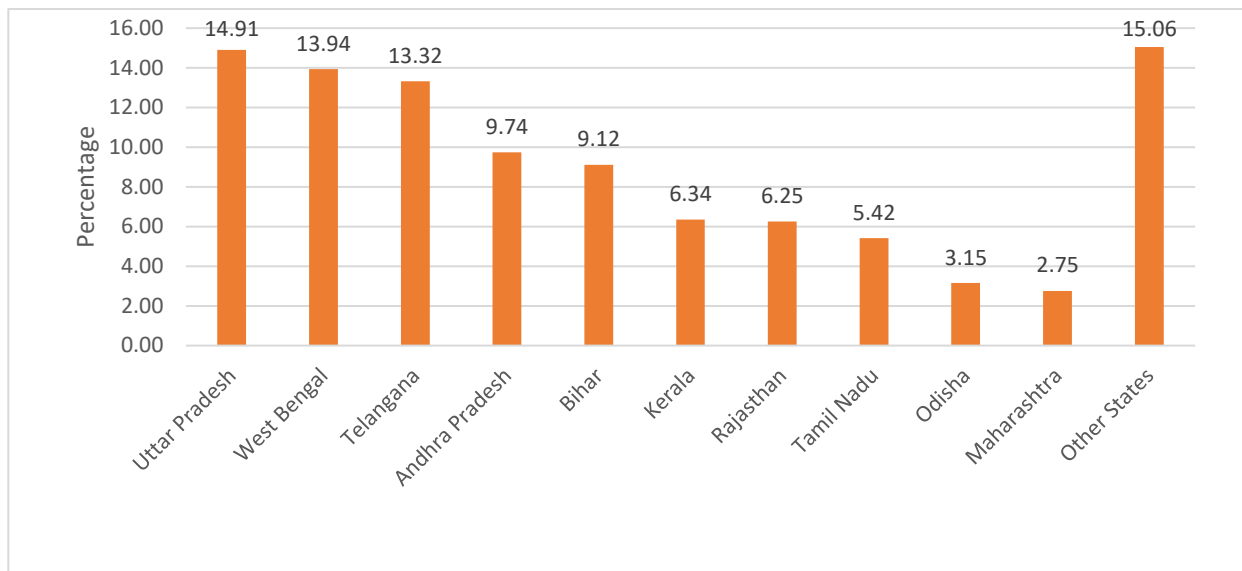
Electrical conversion efficiency = 35%

Therefore, 1m<sup>3</sup> biogas = 2.14 kWh (elec)

Note: Above formula has been considered to estimate energy potential from waste streams of Slaughterhouse

The total energy potential from animal slaughtering in India is 112 MW. The top 10 states have approximately 85 percent energy generation potential from slaughterhouse waste. States having major energy potential are Uttar Pradesh (14.91%), West Bengal (13.94%), Telangana (13.32%), Andhra Pradesh (9.74%), Bihar (9.12%), Kerala (6.34%), Rajasthan (6.25%), Tamil Nadu (5.42%), Odisha (3.15%) & Maharashtra (2.75%).

**Figure 2-22: State-wise percentage of Energy Potential**

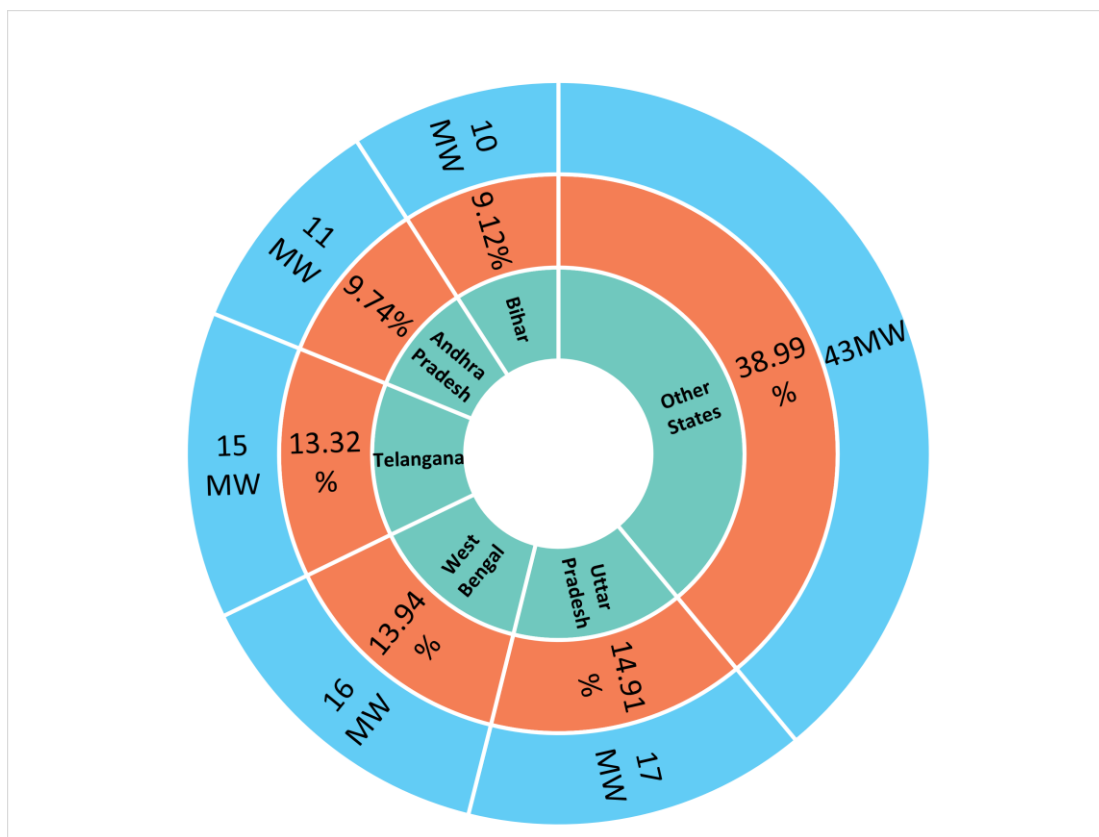


District-level energy potential from the slaughterhouse has also been analysed as a part of the study. State and District wise data provided in **Annexure 5**. The top 10 districts having high energy potential from urban organic solid waste is provided in **Table 2-28**.

**Table 2-28: Energy Potential from Slaughterhouse Solid & Liquid Waste- Top 10 Districts**

| SN           | District      | State          | Annual Biogas yield in Nm <sup>3</sup> | Energy Potential (MW) |
|--------------|---------------|----------------|--|-----------------------|
| 1            | Aligarh       | Uttar Pradesh  | 1,84,93,399                            | 4.52                  |
| 2            | Unnao         | Uttar Pradesh  | 1,75,54,522                            | 4.29                  |
| 3            | SAS Nagar     | Punjab         | 1,00,80,521                            | 2.46                  |
| 4            | Kurnool       | Andhra Pradesh | 77,25,290                              | 1.89                  |
| 5            | Anantapur     | Andhra Pradesh | 72,54,068                              | 1.77                  |
| 6            | Sangareddy    | Telangana      | 70,45,301                              | 1.72                  |
| 7            | Prakasam      | Andhra Pradesh | 61,03,401                              | 1.49                  |
| 8            | Bareilly      | Uttar Pradesh  | 49,08,130                              | 1.20                  |
| 9            | Bengaluru (U) | Karnataka      | 47,25,703                              | 1.15                  |
| 10           | Barabanki     | Uttar Pradesh  | 33,58,014                              | 0.82                  |
| <b>Total</b> |               |                | <b>8,72,48,349</b>                     | <b>21.31</b>          |

**Figure 2-23: States with high energy potential from Slaughterhouse waste**



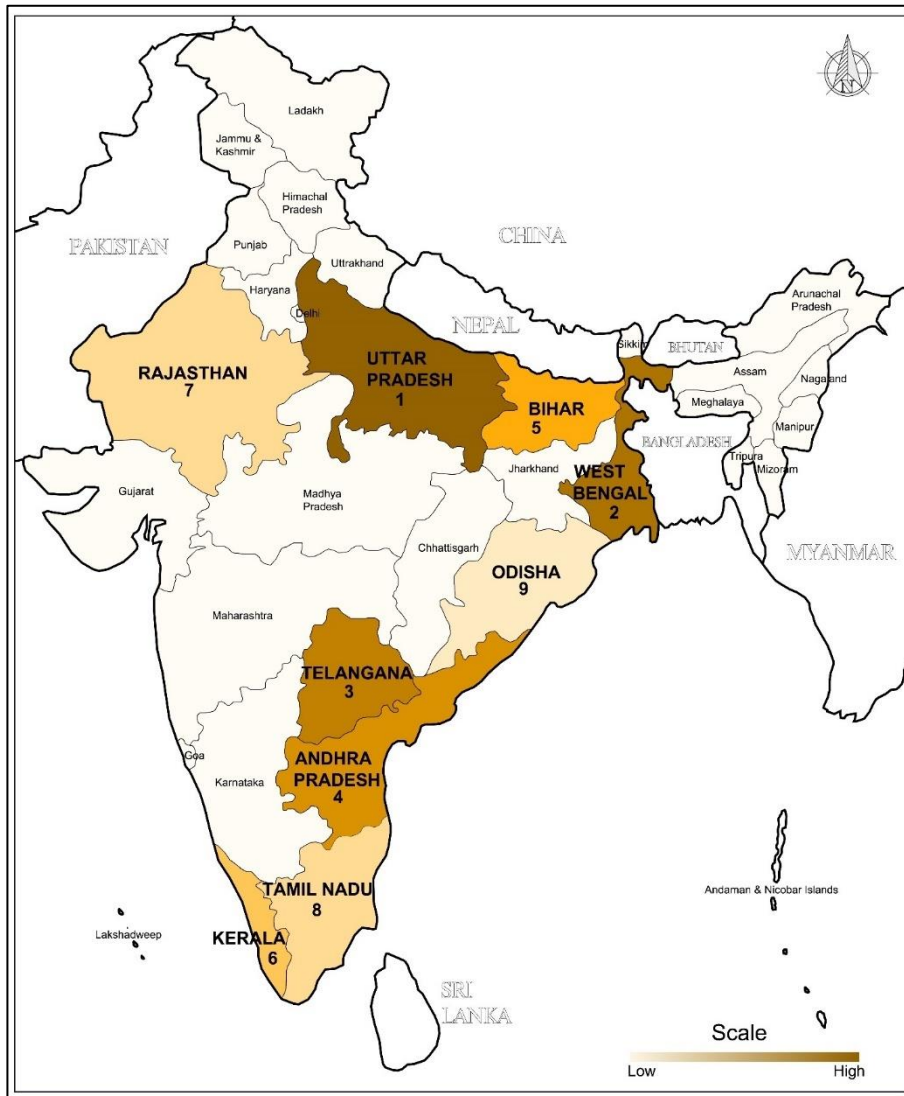
Identification of districts with high energy potential from slaughterhouse waste has been done for twelve states as district-wise data as *district wise data was not available for other states*. Five districts of each from shortlisted states are identified. Details of shortlisted states and districts are provided in **Table 2-29**. State and District wise data provided in **Annexure 6**.

**Table 2-29: Key Districts in selected states with maximum Energy Potential**

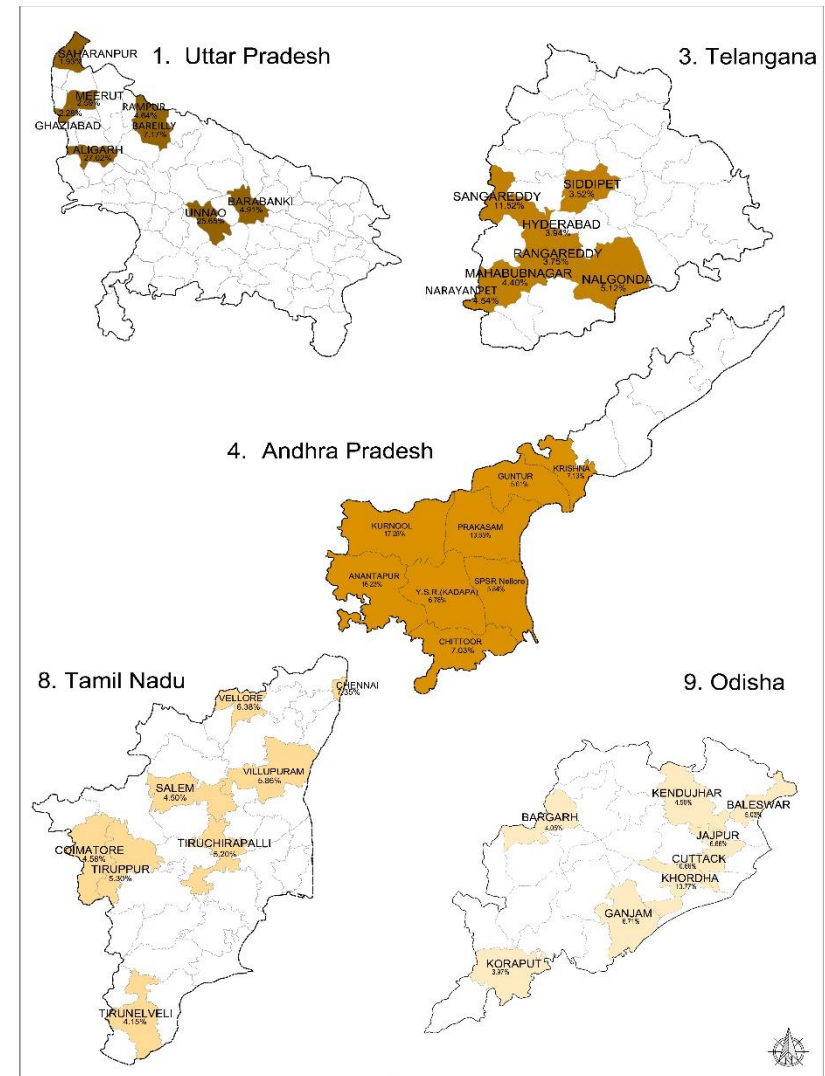
| State     | Uttar Pradesh | Telangana   | Andhra Pradesh | Tamil Nadu     | Odisha   |
|-----------|---------------|-------------|----------------|----------------|----------|
| Districts | Aligarh       | Sangareddy  | Kurnool        | Chennai        | Khordha  |
|           | Unnao         | Nalgonda    | Anantapur      | Vellore        | Cuttack  |
|           | Bareilly      | Narayanpet  | Prakasam       | Villupuram     | Ganjam   |
|           | Barabanki     | Mahbubnagar | Krishna        | Tiruchirapalli | Jajpur   |
|           | Rampur        | Hydrabad    | Chittoor       | Tiruppur       | Balasore |



**Figure 2-24: States with high energy potential from Slaughterhouse waste**



**Figure 2-25: Districts with maximum energy potential from Slaughterhouse Industry in key states**



## 2.6 Energy Potential for Selected Five Sectors

The project has identified five priority sectors, where despite large waste generation and energy potential are available. Five key identified sectors share **Urban organic solid waste, Urban organic liquid waste, Distillery industry, Slaughterhouse, and Pulp & Paper industry.**

Energy potential for identified sectors in different states has been estimated based on various factors such as biogas yield, methane yield, total solids, volatile solids, calorific value, etc. referred from various secondary and primary sources. Sector-wise share in energy potential including potential from solid and liquid waste is shown in **Table 2-30.**

**Table 2-30: Matrix on state and sector-wise energy potential for five selected sectors– in MW**

| S. No | States/ UTs          | Pulp and Paper industry | Distillery industry | Urban organic liquid waste | Urban organic solid waste | Slaughterhouse | Total  | State share in total |
|-------|----------------------|-------------------------|---------------------|----------------------------|---------------------------|----------------|--------|----------------------|
| 1     | Andhra Pradesh       | 76.36                   | 10.60               | 21.69                      | 39.05                     | 10.92          | 157.47 | 4.34                 |
| 2     | Arunachal Pradesh    |                         |                     | 0.13                       | 1.56                      | 0.49           | 2.18   | 0.06                 |
| 3     | Assam                | 33.11                   |                     | 3.81                       | 9.91                      | 1.47           | 48.30  | 1.33                 |
| 4     | Andaman & Nicobar    |                         |                     | 0.20                       | 0.88                      | 0.01           | 1.08   | 0.03                 |
| 5     | Bihar                |                         | 5.48                | 15.45                      | 27.92                     | 10.22          | 59.07  | 1.63                 |
| 6     | Chandigarh           | 3.77                    | 1.71                | 1.79                       | 2.84                      | 0.03           | 10.14  | 0.28                 |
| 7     | Chhattisgarh         | 9.41                    | 2.10                | 6.88                       | 13.50                     | 0.64           | 32.52  | 0.90                 |
| 8     | Daman & Diu          |                         | 1.55                | 0.11                       | 0.51                      | 0.01           | 2.17   | 0.06                 |
| 9     | Dadra & Nagar Haveli |                         |                     | 0.25                       | 0.52                      |                | 0.76   | 0.02                 |
| 10    | Delhi                | 0.46                    |                     | 32.66                      | 52.79                     |                | 85.91  | 2.37                 |
| 11    | Goa                  |                         | 0.25                | 0.40                       | 1.49                      | 0.14           | 2.28   | 0.06                 |
| 12    | Gujarat              | 284.28                  | 10.27               | 38.90                      | 67.45                     | 0.09           | 400.99 | 11.06                |
| 13    | Haryana              | 15.91                   | 4.74                | 13.12                      | 22.37                     | 0.76           | 56.90  | 1.57                 |
| 14    | Himachal Pradesh     | 11.85                   | 0.65                | 0.30                       | 2.06                      | 0.08           | 14.94  | 0.41                 |
| 15    | Jammu and Kashmir    | 7.13                    | 4.89                | 2.52                       | 8.85                      | 1.07           | 24.47  | 0.67                 |
| 16    | Jharkhand            | 0.07                    |                     | 9.95                       | 19.87                     | 1.34           | 31.23  | 0.86                 |
| 17    | Karnataka            | 62.28                   | 54.85               | 34.49                      | 62.46                     | 3.01           | 217.09 | 5.99                 |
| 18    | Kerala               | 31.90                   | 1.59                | 7.98                       | 37.02                     | 7.11           | 85.60  | 2.36                 |
| 19    | Ladakh               |                         |                     |                            | 0.08                      |                | 0.08   | 0.00                 |
| 20    | Lakshadweep          |                         |                     |                            | 0.09                      | 0.01           | 0.09   | 0.00                 |
| 21    | Madhya Pradesh       | 28.90                   | 5.93                | 24.01                      | 44.06                     | 1.63           | 104.54 | 2.88                 |
| 22    | Maharashtra          | 121.62                  | 97.10               | 78.77                      | 89.40                     | 3.09           | 391.12 | 10.79                |
| 23    | Manipur              |                         |                     | 0.47                       | 2.30                      | 0.48           | 3.25   | 0.09                 |
| 24    | Meghalaya            |                         |                     | 0.47                       | 1.03                      | 1.00           | 2.50   | 0.07                 |
| 25    | Mizoram              |                         |                     | 0.71                       | 1.08                      | 0.18           | 1.97   | 0.05                 |
| 26    | Nagaland             | 2.54                    | 0.06                | 0.44                       | 1.07                      | 0.41           | 4.53   | 0.12                 |
| 27    | Odisha               | 28.36                   | 1.91                | 7.85                       | 14.91                     | 3.53           | 56.57  | 1.56                 |
| 28    | Puducherry           | 6.09                    | 0.56                | 1.32                       | 1.89                      | 0.37           | 10.22  | 0.28                 |
| 29    | Punjab               | 101.85                  | 18.07               | 13.74                      | 24.35                     | 2.82           | 160.84 | 4.44                 |
| 30    | Rajasthan            | 4.92                    | 0.97                | 22.46                      | 40.73                     | 7.01           | 76.08  | 2.10                 |
| 31    | Sikkim               |                         | 0.17                | 0.21                       | 0.30                      | 0.06           | 0.74   | 0.02                 |
| 32    | Tamil Nadu           | 197.75                  | 24.98               | 32.79                      | 71.48                     | 6.08           | 333.08 | 9.19                 |
| 33    | Telangana            | 115.63                  | 4.45                | 15.69                      | 27.44                     | 14.94          | 178.14 | 4.91                 |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| S. No        | States/ UTs   | Pulp and Paper industry | Distillery industry | Urban organic liquid waste | Urban organic solid waste | Slaughterhouse | Total       | State share in total |
|--------------|---------------|-------------------------|---------------------|----------------------------|---------------------------|----------------|-------------|----------------------|
| 34           | Tripura       |                         |                     | 0.80                       | 2.82                      | 0.28           | 3.90        | 0.11                 |
| 35           | Uttar Pradesh | 226.60                  | 356.97              | 56.68                      | 107.60                    | 16.72          | 764.56      | 21.09                |
| 36           | Uttarakhand   | 78.97                   | 4.87                | 3.13                       | 6.43                      | 0.50           | 93.91       | 2.59                 |
| 37           | West Bengal   | 56.84                   | 2.63                | 34.87                      | 95.79                     | 15.63          | 205.77      | 5.68                 |
| <b>Total</b> |               | <b>1506.63</b>          | <b>617.36</b>       | <b>485.02</b>              | <b>903.87</b>             | <b>112.14</b>  | <b>3625</b> | <b>100.00</b>        |

### Annexure 1: Stakeholder Consultations

| Sector   | Pulp & Paper Industry   |
|--|---|
| Name of Paper Industry   | Siddheshawri Industry Pvt. Limited,<br>Muzaffarnagar, Uttar Pradesh |
| Date of Consultation   | 16.06.2021  |
| Siddheshawri Industry Pvt. Limited Representative  | Mr. Shishir Sahgal, Manager   |
| Arcadis Representative   | Mr. Rajnish Kumar, Senior Consultant                                |
| <p>The key areas of discussion are highlighted in the following section:</p> <ul style="list-style-type: none"> <li>○ Raw Materials used in the industry for paper manufacturing: Wastepaper, particularly Kraft paper</li> <li>○ Water consumption: 10 m<sup>3</sup> per ton</li> <li>○ Wastewater: 6-7 m<sup>3</sup> per ton</li> <li>○ Solid waste: Plastic (&lt;1%) &amp; metals (very less). Since the raw material for the unit was waste paper limited solid waste was generated from the process. Plastic waste from the unit is collected and transported to the cement factory in Chittorgarh, Rajasthan.</li> <li>○ Wastewater is reused in the process after recycling from ETP; Some of the wastewater was observed to be drained.</li> </ul> <p><i>Key issues identified</i></p> <ul style="list-style-type: none"> <li>○ Discussion with the plant operator indicated that the paper industry in Muzaffarnagar is not concentrated in one place and is spread over different locations. Hence, the collection of wastewater from each industrial units will be a big challenge as there is no one drainage system to collect wastewater in one place.</li> <li>○ There is limited space for storage of wastewater within each industrial premises and the industrial units do not keep it for long due to a bad odour coming from wastewater.</li> <li>○ The centralised drainage system is required for the collection of waste water at a lower cost. It is advised to concentrate on planned industrial areas having centralised drainage systems to fetch wastewater for WTE purposes.</li> </ul> |   |



Storage of Wastepaper



Pulping process for paper manufacturing



Pulping



Stock Preparation



Cleaning of Pulp



Paper Making

| Sector  | Pulp & Paper Industry                          |
|---|--|
| Name of Paper Industry  | Bindal Duplex,<br>Muzaffarnagar, Uttar Pradesh |
| Date of Consultation  | 16.06.2021                                     |
| Bindal Duplex   | Mr. Akshay Tyagi, Chief Engineer               |
| Arcadis Representative  | Mr. Rajnish Kumar                              |
| <p>The issues discussed during the meeting is as below:</p> <p>Raw Materials used for paper manufacturing:</p> <ul style="list-style-type: none"> <li>○ Wastepaper, particularly Kraft paper. Earlier the unit used wheat straw &amp; bagasse as raw material but due to cheaper rate of wastepaper now not using wheat straw &amp; bagasse.</li> <li>○ Wastepaper is imported from other country. Now import is stopped due to Covid impact and wastepaper price is increased to double. The management is again thinking to use wheat straw &amp; bagasse as a raw material.</li> <li>○ Water consumption: 22-25 M<sup>3</sup> per ton for waste paper</li> <li>○ Wastewater: 80% of water consumed per ton</li> <li>○ Solid waste: Plastic (&lt;1%) &amp; metals (very less). Plastic waste from the unit is categorised as hazardous waste and is sent to Bharat Oil for processing Hazardous waste operator).</li> <li>○ Some wastewater is reused after recycling from ETP and the balance is drained out of site.</li> <li>○ The paper industry in Muzaffarnagar is not concentrated in one place and it is spread over different locations.</li> <li>○ Collection of wastewater will be a big challenge as there is no one drainage system to collect wastewater in one place.</li> </ul> |  |



Pulping Making



Paper Making

| Sector                          | Paper and Pulp Industry  |
|---------------------------------|--|
| Name of Paper and Pulp Industry | Saisons Paper Industries Ltd.<br>2 Plot no. 5, Bakhli village, Pehowa, Kurukshetra – 136128. |
| Date of Consultation            | 25.06.2021   |

|  |       |   |
|--|-------|---|
| Sainsons Industries Ltd.   | Paper | Mr. Jagannath Shah, Vice president-works - 9254039100 |
| Arcadis Representative   |       | Mr. Sourabh Gupta, Associate Consultant               |
| <p>The summary of the key points discussed are as below:</p> <ul style="list-style-type: none"> <li>○ Year of Establishment: 1993</li> <li>○ Total Installed capacity: 300 MT per day paper production.</li> <li>○ Total Operational capacity: 300 MT per day paper production.</li> <li>○ The raw material used in the industry: Wheat stalk, recycle waste-paper etc.</li> <li>○ Quantum of waste generated:<br/>Solid waste - Boiler ash - 30 tons per day.<br/>Effluent - processed water - 1500 KL per day</li> <li>○ characteristics of organic waste generated:<br/>Inlet water (approximate.) – BOD - 1000 and BOD - 5000.<br/>Outlet water (approximate) – BOD - 20 and COD - 200.</li> <li>○ The current method of disposal of waste:</li> <li>○ Ash is collected by a contractor who dumps it into a low landfill.</li> <li>○ Process water is treated in ETP. ETP sludge is used in boards manufacturing and Boiler.</li> <li>○ Mode of transportation of organic waste: Waste is carried in vehicles like trucks, trolleys etc. which are provided by the contractor.</li> <li>○ Applied for CBG plant of 2.5ton capacity under SATAT scheme.</li> <li>○ Granted subsidy for Biomass generation under Central Government scheme.</li> </ul> |       |   |

Raw material storage compound



Discussion with Vice president- works



| Sector   | Distillery  |
|--|---|
| Name of Institution  | All India Distillers Association (AIDA)   |
| Date of Consultation   | 18.06.2021  |
| All India Distillers Association   | Mr. Rajneesh Agarwal, Secretary General, U.P Distillery Association,<br>Ph.D. House, New Delhi. |
| Arcadis Representative   | Mr. Rajnish Kumar, Senior Consultant  |
| <p>The issues discussed during meeting is as below:</p> <ul style="list-style-type: none"> <li>○ UP Distillers Association represents the distillery units established in the state of Uttar Pradesh.</li> </ul> |   |

- The prime objective of the Association is to look after the interests of members who are dealing in Alcohol, Industrial Alcohol, Gasohol, IMFL and Country Liquor.
- The association organises Seminars & Training workshops on Distillery/Liquor industry related issues.
- Environmental clearance is very important apart from other clearances.
- Challenges faced by Distillery Industry in India –
  - i. Environmental &
  - ii. Wastewater Management
- Spent wash is the main source of pollution from the distillery industry.
- Distillery industry is currently practicing Bio composting & Incineration for disposal of spent wash.
- Incineration is limited as it creates air pollution. Though there are norms of CPCB & MoEF & CC and the distillery industry adhere by it. So, associations do not promote incineration because of air pollution.
- Bio composting is relatively better method for disposal of spent wash.
- Distillery industry is working on a Zero liquid discharge principle.
- The directory published by All India Distillers Association (AIDA) covers all distillery units in India, Nepal & Bhutan.
- Utilisation of distillery plants is around 65%. (Please check with Distillery units).
- There is no commercial value of spent wash generated for the industry.
- There is no knowledge of the WTE plant using spent wash as a raw material or feed stock.
- Not many innovations are happening in the distillery industry which can have an impact on the WTE facility.
- AIDA requests to share data of technology providers for WTE from the spent wash.

| Sector                            | Distillery   |
|-----------------------------------|--|
| Name of Paper Industry            | Radico Khaitan Ltd<br>Rampur, Uttar Pradesh  |
| Date of Consultation              | 22.06.2021   |
| Radico Khaitan Ltd Representative | Mr. KM Singh, Director<br>Mr. Devendra Singh, Manager<br>Mr. Vishal Saxena,<br>Mr. Amrit Raj Tomar, Engineer Environment |
| Arcadis Representative            | Mr. Rajnish Kumar, Senior Consultant   |

Radico Khaitan Limited (RKL) is one of the oldest and the largest manufacturers of Indian Made Foreign Liquor (IMFL) in India. Formerly known as Rampur Distillery, RKL commenced its operations in 1943 and over the years, emerged as a major bulk spirits supplier.

Product: 8 PM Whisky, Magic Moments Vodka, Contessa XXX Rum, and Old Admiral Brandy.

The key areas of discussion are highlighted in the following section:

- Radico Khaitan is making distillery only while most of the distillery plant is in sugar mills. It is purchasing molasses from sugar industries.
- The capacity of the distillery plant is 60,000 KL per annum.
- Total operational days are 350 days in a year.
- Plant utilisation is 70 to 75% utilisation.
- There are three types of raw materials used in the distillery and per day capacity is as follow:
  - i. Molasse – 200 kl per day
  - ii. Grain (Rice, Maize, Millet & Sorghum) – 100 km per day
  - iii. Malt (Barley) – 8 kl per day
- Spent wash is generated from molasses only.
- No spent wash is generated from Grain or Malt.
- 1 M<sup>3</sup> of spent wash generates 90 M<sup>3</sup> of Biogas.
- 9 litre of spent wash generates for making 1 litre of alcohol before evaporation.



- 6 litre of spent wash generates for making 1 litre of alcohol after evaporation.
- The spent wash is used in three types:
  - i. Bio composting by mixing with press mud.
  - ii. Incineration
  - iii. Bio methanation
- Spent wash is used for Bio composting and Bio methanation in Radico Khaitan, Rampur.
- One Biogas Generator (BGG) is installed in the plant and 2 MW is generated from the biogas.
- The installed capacity of BGG is 26 Ton and operational capacity is 17 Ton.
- Wastewater is reused in the process after recycling from ETP.

*Key issues identified.*

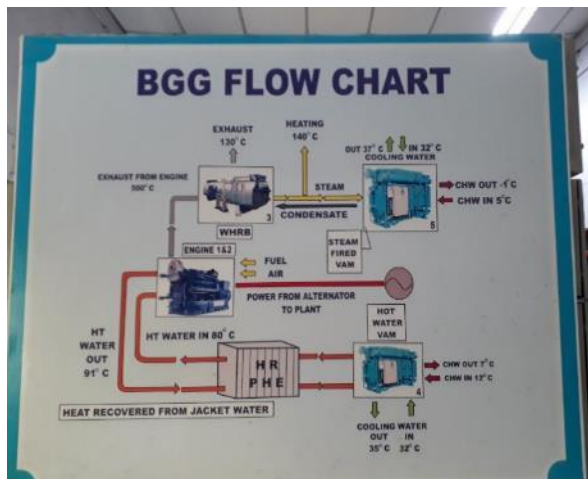
- Benefits of **Bio methanation**
  - Biogas generation process has lower operation costs.
  - The energy generated from the biogas is used in distillery plants.
- Achieve Zero Liquid Discharge (ZLD) is very difficult for the distillery industry.
- Bio composting is also manufactured by using spent wash.



Distillery Plant



Boiler Room



BGG Flow Chart displayed in Plant



Bio Composting

| Sector  | Distillery  |
|---|---|
| Name of Paper Industry  | National Industrial Corporation Ltd. (NICOL) Moradabad, Uttar Pradesh |
| Date of Consultation  | 22.06.2021  |
| NICOL Representative  | Mr. Ved Gupta, Manager  |
| Arcadis Representative  | Mr. Rajnish Kumar, Senior Consultant                                  |
| <p>National Industrial Corporation Ltd (NICOL) is one of the country's oldest Spirit &amp; Liquor manufacture in India. Earlier it was known as Ajudhia Distillery.</p> <p>The key areas of disc are highlighted in the following section:</p> <ul style="list-style-type: none"> <li>○ Molasses is used as a raw material for manufacturing distillery.</li> <li>○ Capacity of distillery plant is 60 KL per day.</li> <li>○ Total operational days are 270 days in a year.</li> <li>○ Plant capacity is 80%. (As per government guideline the approved capacity of the distillery has to manufacture 80% of potable and 20% of industrial distillery).</li> <li>○ Spent wash generated from molasses is used for manufacturing bio composting.</li> <li>○ 3.5 kg of molasses is generated from 100 kg of sugarcane</li> <li>○ 1 Quintal of Molasses generates 21 Litre of Alcohol.</li> <li>○ 8 to 9 litres of spent wash is generated for making 1 litre of alcohol.</li> <li>○ Wastewater is reused in the process after recycling from ETP.</li> <li>○ Sludge generated from ETP (which is dead yeast) is used in Bio Composting.</li> <li>○ Distillery industries must consume spent wash either by manufacturing Bio compost or installing incineration.</li> <li>○ Spent wash cannot be used for Agri irrigation while it is allowed in Maharashtra &amp; Karnataka.</li> </ul> <p><i>Key issues identified.</i></p> <ul style="list-style-type: none"> <li>○ Govt. of India is promoting incineration technology in distillery industry.</li> <li>○ Govt. of India is approving increase in plant capacity for plants using spent wash for incineration not for bio compost.</li> <li>○ Installing incineration plant requires high investment &amp; maintenance cost.</li> <li>○ Also, the self-life of incineration plant is less due to the chemical characteristics of spent wash.</li> <li>○ The compost manufacturing area does not have a shed so compost manufacturing is stopped during the monsoon season in July, August, and September.</li> <li>○ There is no commercial value of bio compost as farmers are not interested to use it.</li> </ul> |   |



Distillery Plant



Distillery Plant



Spent Wash Lagoon



Bio Composting

| Sector   | Slaughterhouse  |
|--|---|
| Name of Slaughter Industry   | Meem Agro Foods Private Limited, Kairana, District-Shamli, Uttar Pradesh  |
| Date of Consultation   | 16.06.2021  |
| Meem Agro Foods Private Limited & Others   | Dr. Yashwant Singh, Chief Veterinary Officer (Govt. of Uttar Pradesh), District-Shamli<br>Dr. Pushpendra Singh, Veterinary Officer (Govt. of Uttar Pradesh), Block-Shamli<br>Md. Tanveer, Meem Agro Foods Private Limited |
| Arcadis Representative   | Mr. Rajnish Kumar, Senior Consultant  |
| <p>The summary of the key points discussed during the meeting is as below:</p> <ul style="list-style-type: none"> <li>○ Total capacity: 300 buffaloes per day (no cow/pig/goat/sheep slaughtered in the unit).</li> <li>○ Production: boneless meat, tallow, bone-meat meal, and blood meat</li> <li>○ Water Source: Ground Water after approval from Central Ground Water Authority.</li> <li>○ Water Consumption: 350 to 400 litre per animal.</li> <li>○ Plant Components <ul style="list-style-type: none"> <li>○ Slaughtering units</li> <li>○ Meat processing halls</li> <li>○ Cold storage unit</li> <li>○ Rendering unit</li> <li>○ Animal holding units</li> <li>○ ETP with no power generation units</li> </ul> </li> <li>○ The slaughtering of animals generates the following types of wastes: <ul style="list-style-type: none"> <li>○ non-edible offal like lungs, large intestines, various glands, animal tissues, organs, various body parts, etc. stomach/intestinal contents</li> <li>○ dung (Since cattle is detained for 24 hours before slaughtering)</li> <li>○ sludge from Effluent Treatment Plant (ETP)</li> <li>○ bones obtained after slaughtering etc.</li> </ul> </li> <li>○ Most of the waste obtained from the slaughtering process has a ready market/ commercial value after processing, so practically all the waste is utilised. Following are the end-use of waste from the slaughtering process. <ul style="list-style-type: none"> <li>○ Non-edible offal wastes are disposed of by a process called rendering. The rendering process dries the material and separates the fat from the bone and protein. The dried materials have nutrients, so it is normally packed and sold as poultry feed.</li> <li>○ Fats obtained are collected in the tallow chambers and supplied to soap manufacturers.</li> <li>○ Blood is added to the processed meat.</li> <li>○ Cattle Dung: direct sale to farmers of nearby villages.</li> <li>○ Recycling of wastewater from ETP. Wastewater is used for irrigation on the farmland.</li> </ul> </li> </ul> |   |



Rendering Hall



Non-edible offal obtained after slaughtering



Tallow Chamber used for storage of fats



Packing of animal products after rendering for supply as poultry feed

| Sector   | Slaughterhouse  |
|--|---|
| Name of Slaughter Industry   | Fair Exports India Pvt. Ltd,<br>Village Ahmad Nagar Pahari, Tehsil Sadar,, District Rampur,<br>Uttar Pradesh, Postal Code - 244901                      |
| Date of Consultation   | 22.06.2021  |
| Fair Exports India Pvt. Ltd & Others   | Dr. Yogendra Singh, Veterinary Officer (Govt. of Uttar Pradesh),<br>Block-Rampur<br>Mr. Mohammed Abdul Haq, General Manager, Fair Exports India Pvt Ltd |
| Arcadis Representative   | Mr. Rajnish Kumar, Senior Consultant  |
| <p>The summary of the key points discussed during the meeting is as below:</p> <ul style="list-style-type: none"> <li>○ Total capacity: 1100 buffalos per day &amp; 1000 sheep per day (no cow/pig/goat slaughtered in the unit).</li> <li>○ The catchment area of the slaughterhouse for animals is around a 100 km radius from Rampur city.</li> <li>○ Production: boneless meat, tallow, bone-meat meal, and blood meat</li> <li>○ The average weight of buffalo is around 400 kg.</li> <li>○ Water Source: Ground Water after approval from Central Ground Water Authority.</li> <li>○ Water Consumption: 400 litres per large animal and 350 litres for a small animals.</li> <li>○ Plant Components <ul style="list-style-type: none"> <li>○ Slaughtering units</li> <li>○ Meat processing unit</li> <li>○ Cold storage unit</li> <li>○ Rendering unit</li> <li>○ Animal holding units</li> <li>○ Boiler for power generation</li> <li>○ ETP</li> </ul> </li> <li>○ Useable parts of animals after slaughtering are as follows: <ul style="list-style-type: none"> <li>○ Boneless – 35%</li> <li>○ Head – 2%</li> <li>○ Horn – 0.38%</li> <li>○ Hooves – 0.13%</li> <li>○ Hide – 8.75%</li> <li>○ Legs – 2%</li> <li>○ Blood – 3%</li> </ul> </li> <li>○ The slaughtering of animals generates the following types of wastes: <ul style="list-style-type: none"> <li>○ Offal – 17.50%</li> <li>○ Rendering Waste – 31.25%</li> <li>○ Undigested materials</li> <li>○ dung (Since cattle is detained for 24 hours before slaughtering)</li> <li>○ sludge from Effluent Treatment Plant (ETP) is used in the boiler.</li> </ul> </li> <li>○ Due to new technology, all wastes generated within the slaughterhouse are processed and sold to market. <ul style="list-style-type: none"> <li>○ Non-edible offal and other wastes are disposed of by the process called rendering.</li> <li>○ The rendering process dries the material and separates the fat from the <b>bone</b> and <b>protein</b> and manufactures Meat and bone meal (MBM).</li> <li>○ MBM is packed and sold as poultry feed in the market.</li> <li>○ Fats obtained are collected in the tallow chambers and supplied to soap manufacturers and poultry farms.</li> <li>○ Blood is added to meat during processing.</li> <li>○ Cattle Dung is mixed with undigested materials &amp; wood. It is used as fuel in the boiler. The boiler generates energy that is used in the plant.</li> </ul> </li> <li>○ Used water is categorised into three categories: <ol style="list-style-type: none"> <li>i. Red Water: water mixed with blood.</li> <li>ii. Green Water: water mixed with cattle dung.</li> <li>iii. White water: water mixed with fat content.</li> </ol> </li> </ul> |   |

- The three categories of water are treated through ETP, Wet land and Dissolved air flotation (DAF) technology in the plant.
- No waste is available from the slaughterhouse.



Mixing and blending of cattle dung with undigested food



Tallow Chamber used for storage of fats



Rendering Hall



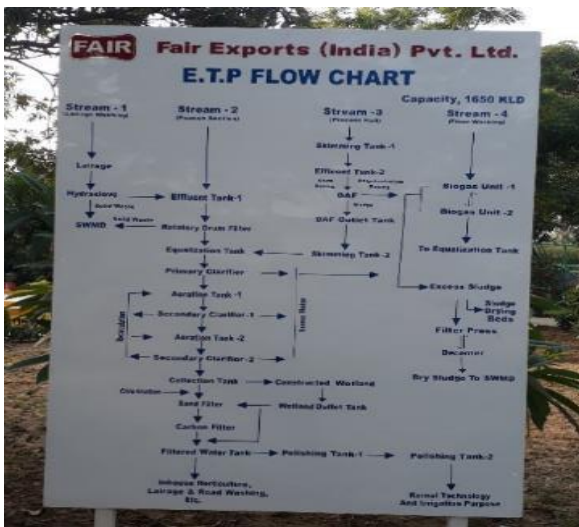
Bones stored for rendering



Animal Fat and MBM



DAF



ETP Flow chart displayed



ETP



Wetland treatment of water in the plant



## Annexure - B

### Pulp & Paper sector- State and district wise energy production

#### Assumptions:

- Water consumption considered 100 m<sup>3</sup>/ ton
- 70% of wastewater (of raw water consumption) are generated for each metric ton of paper produced
- Factor for energy potential estimation - 1 m<sup>3</sup> of wastewater generates 5 m<sup>3</sup> of biogas

#### State – Andhra Pradesh

| District      | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|---------------|---|-----------------------------------|-----------------------|---------------|
| Anantpur      | 1.89  | 94,50,000                         | 2.31                  | 11.08         |
| Chittoor      | 0.82  | 40,95,000                         | 1.00                  | 4.80          |
| East Godavari | 30.67   | 15,33,73,500                      | 37.47                 | 179.85        |
| Guntur        | 0.68  | 34,02,000                         | 0.83                  | 3.99          |
| Krishna       | 0.95  | 47,25,000                         | 1.15                  | 5.54          |
| Nellore       | 0.95  | 47,25,000                         | 1.15                  | 5.54          |
| Srikakulam    | 6.62  | 3,30,75,000                       | 8.08                  | 38.78         |
| Vizianagaram  | 0.003   | 12,600                            | 0.003                 | 0.01          |
| West Godavari | 19.95   | 9,97,29,000                       | 24.36                 | 116.94        |
| <b>Total</b>  | <b>62.52</b>  | <b>31,25,87,100</b>               | <b>76.36</b>          | <b>366.54</b> |

#### State – Assam

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Hailakandi   | 20.98   | 104,895,000                       | 25.63                 | 123.00        |
| Kamrup       | 5.18  | 25,908,750                        | 6.33                  | 30.38         |
| Sonitpur     | 0.95  | 4,734,450                         | 1.16                  | 5.55          |
| <b>Total</b> | <b>27.11</b>  | <b>13,55,38,200</b>               | <b>33.11</b>          | <b>158.93</b> |

#### Union Territory – Chandigarh

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Chandigarh   | 3.09  | 1,54,35,000                       | 3.77                  | 18.10         |
| <b>Total</b> | <b>3.09</b>   | <b>1,54,35,000</b>                | <b>3.77</b>           | <b>18.10</b>  |

#### State – Chhattisgarh

| District       | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|----------------|---|-----------------------------------|-----------------------|---------------|
| Bilaspur       | 2.11  | 1,05,52,500                       | 2.58                  | 12.37         |
| Durg           | 1.54  | 77,17,500                         | 1.89                  | 9.05          |
| Janjgir Champa | 1.04  | 51,97,500                         | 1.27                  | 6.09          |
| Raigarh        | 0.47  | 23,62,500                         | 0.58                  | 2.77          |
| Raipur         | 1.40  | 70,24,500                         | 1.72                  | 8.24          |

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Rajnangaon   | 1.13  | 56,70,000                         | 1.39                  | 6.65          |
| <b>Total</b> | <b>7.70</b>   | <b>3,85,24,500</b>                | <b>9.41</b>           | <b>45.17</b>  |

#### Union Territory – Delhi

| District         | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|------------------|---|-----------------------------------|-----------------------|---------------|
| South East Delhi | 0.38  | 18,90,000                         | 0.46                  | 2.22          |
| <b>Total</b>     | <b>0.38</b>   | <b>18,90,000</b>                  | <b>0.46</b>           | <b>2.22</b>   |

#### State – Gujarat

| District       | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD)  |
|----------------|---|-----------------------------------|-----------------------|----------------|
| Ahmedabad      | 43.48   | 21,73,81,500                      | 53.10                 | 254.90         |
| Anand          | 1.32  | 66,15,000                         | 1.62                  | 7.76           |
| Aravalli       | 2.52  | 1,26,00,000                       | 3.08                  | 14.77          |
| Banas Kantha   | 0.18  | 8,77,275                          | 0.21                  | 1.03           |
| Bharuch        | 16.45   | 8,22,46,500                       | 20.09                 | 96.44          |
| Dahod          | 0.02  | 94,500                            | 0.02                  | 0.11           |
| Gandhinagar    | 0.24  | 12,12,750                         | 0.30                  | 1.42           |
| Kheda          | 0.38  | 18,90,000                         | 0.46                  | 2.22           |
| Kutch          | 2.08  | 1,03,95,000                       | 2.54                  | 12.19          |
| Mehsana        | 2.65  | 1,32,30,000                       | 3.23                  | 15.51          |
| Morbi          | 36.18   | 18,08,88,750                      | 44.19                 | 212.11         |
| Navsari        | 0.81  | 40,57,200                         | 0.99                  | 4.76           |
| Panchmahal     | 1.10  | 54,81,000                         | 1.34                  | 6.43           |
| Patan          | 1.36  | 68,04,000                         | 1.66                  | 7.98           |
| Rajkot         | 5.27  | 2,63,71,800                       | 6.44                  | 30.92          |
| Sabarkantha    | 0.95  | 47,25,000                         | 1.15                  | 5.54           |
| Surat          | 71.57   | 35,78,40,000                      | 87.42                 | 419.60         |
| Surendra Nagar | 0.38  | 19,05,750                         | 0.47                  | 2.23           |
| Tapi           | 8.76  | 4,37,85,000                       | 10.70                 | 51.34          |
| Valsad         | 37.06   | 18,53,05,050                      | 45.27                 | 217.29         |
| <b>Total</b>   | <b>232.74</b>   | <b>1,16,37,06,075</b>             | <b>284.28</b>         | <b>1364.56</b> |

#### State – Haryana

| District    | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|-------------|---|-----------------------------------|-----------------------|---------------|
| Faridabad   | 0.10  | 5,19,750                          | 0.13                  | 0.61          |
| Karnal      | 2.29  | 1,14,34,500                       | 2.79                  | 13.41         |
| Kurukshetra | 3.78  | 1,89,00,000                       | 4.62                  | 22.16         |
| Panchkula   | 0.45  | 22,68,000                         | 0.55                  | 2.66          |
| Rewari      | 0.68  | 34,02,000                         | 0.83                  | 3.99          |

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Sirsa        | 1.00  | 49,77,000                         | 1.22                  | 5.84          |
| Yamunanagar  | 4.73  | 2,36,25,000                       | 5.77                  | 27.70         |
| <b>Total</b> | <b>13.03</b>  | <b>6,51,26,250</b>                | <b>15.91</b>          | <b>76.37</b>  |

#### State – Himanchal Pradesh

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Sirmaur      | 5.41  | 2,70,27,000                       | 6.60                  | 31.69         |
| Solan        | 4.30  | 2,14,83,000                       | 5.25                  | 25.19         |
| <b>Total</b> | <b>9.71</b>   | <b>4,85,10,000</b>                | <b>11.85</b>          | <b>56.88</b>  |

#### Union Territory – Jammu & Kashmir

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Jammu        | 4.57  | 63,31,500                         | 1.55                  | 7.42          |
| Kathua       | 1.27  | 2,28,69,000                       | 5.59                  | 26.82         |
| <b>Total</b> | <b>5.84</b>   | <b>2,92,00,500</b>                | <b>7.13</b>           | <b>34.24</b>  |

#### State – Jharkhand

| District       | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|----------------|---|-----------------------------------|-----------------------|---------------|
| East Singhbhum | 0.06  | 2,83,500                          | 0.07                  | 0.33          |
| <b>Total</b>   | <b>0.06</b>   | <b>2,83,500</b>                   | <b>0.07</b>           | <b>0.33</b>   |

#### State – Karnataka

| District         | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|------------------|---|-----------------------------------|-----------------------|---------------|
| Bengaluru Rural  | 13.82   | 6,90,79,500                       | 16.88                 | 81.00         |
| Bidar            | 1.98  | 99,22,500                         | 2.42                  | 11.64         |
| Dakshina Kannada | 0.38  | 18,90,000                         | 0.46                  | 2.22          |
| Haveri           | 5.14  | 2,57,04,000                       | 6.28                  | 30.14         |
| Mysore           | 4.10  | 2,04,75,000                       | 5.00                  | 24.01         |
| Mysuru           | 6.05  | 3,02,40,000                       | 7.39                  | 35.46         |
| Shivamoga        | 6.30  | 3,15,00,000                       | 7.70                  | 36.94         |
| Uttar Kannada    | 13.23   | 6,61,50,000                       | 16.16                 | 77.57         |
| <b>Total</b>     | <b>50.99</b>  | <b>25,49,61,000</b>               | <b>62.28</b>          | <b>298.97</b> |

#### State – Kerala

| District           | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------------|---|-----------------------------------|-----------------------|---------------|
| Kottayam           | 7.62  | 3,81,15,000                       | 9.31                  | 44.69         |
| Kollam             | 7.25  | 3,62,25,000                       | 8.85                  | 42.48         |
| Thrissur           | 5.20  | 2,59,87,500                       | 6.35                  | 30.47         |
| Ernakulam          | 4.38  | 2,19,24,000                       | 5.36                  | 25.71         |
| Palakkad           | 0.63  | 31,50,000                         | 0.77                  | 3.69          |
| Thiruvananthapuram | 0.57  | 28,35,000                         | 0.69                  | 3.32          |
| Alappuzha          | 0.47  | 23,62,500                         | 0.58                  | 2.77          |
| <b>Total</b>       | <b>26.12</b>  | <b>13,05,99,000</b>               | <b>31.90</b>          | <b>153.14</b> |

#### State – Madhya Pradesh

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Bhopal       | 0.95  | 47,25,000                         | 1.15                  | 5.54          |
| Burhanpur    | 6.30  | 3,15,00,000                       | 7.70                  | 36.94         |
| Dewas        | 0.57  | 28,35,000                         | 0.69                  | 3.32          |
| Ratlam       | 0.28  | 14,17,500                         | 0.35                  | 1.66          |
| Satna        | 0.45  | 22,68,000                         | 0.55                  | 2.66          |
| Shahdol      | 14.49   | 7,24,50,000                       | 17.70                 | 84.96         |
| Vidisha      | 0.62  | 31,02,750                         | 0.76                  | 3.64          |
| <b>Total</b> | <b>23.66</b>  | <b>11,82,98,250</b>               | <b>28.90</b>          | <b>138.72</b> |

#### State – Maharashtra

| District        | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|-----------------|---|-----------------------------------|-----------------------|---------------|
| Ahmadnagar      | 3.40  | 1,69,78,185                       | 4.15                  | 19.91         |
| Aurangabad      | 10.78   | 5,38,77,600                       | 13.16                 | 63.18         |
| Bhandara        | 0.68  | 34,02,000                         | 0.83                  | 3.99          |
| Buldhana        | 0.53  | 26,27,100                         | 0.64                  | 3.08          |
| Gadchiroli      | 4.66  | 2,33,10,000                       | 5.69                  | 27.33         |
| Gondia          | 0.76  | 37,80,000                         | 0.92                  | 4.43          |
| Jalgaon         | 1.17  | 58,59,000                         | 1.43                  | 6.87          |
| Kolhapur        | 1.71  | 85,68,000                         | 2.09                  | 10.05         |
| Latur           | 0.15  | 7,68,600                          | 0.19                  | 0.90          |
| Mumbai          | 5.36  | 2,68,12,800                       | 6.55                  | 31.44         |
| Mumbai Suburban | 1.48  | 74,08,800                         | 1.81                  | 8.69          |
| Nagpur          | 14.71   | 7,35,65,100                       | 17.97                 | 86.26         |
| Nanded          | 0.57  | 28,35,000                         | 0.69                  | 3.32          |
| Nandurban       | 1.26  | 63,00,000                         | 1.54                  | 7.39          |
| Nasik           | 6.84  | 3,41,77,500                       | 8.35                  | 40.08         |
| Pune            | 19.11   | 9,55,58,400                       | 23.34                 | 112.05        |
| Raigad          | 6.78  | 3,38,94,000                       | 8.28                  | 39.74         |
| Ratnagiri       | 2.84  | 1,41,75,000                       | 3.46                  | 16.62         |
| Sangli          | 0.91  | 45,36,000                         | 1.11                  | 5.32          |

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Satara       | 1.32  | 66,15,000                         | 1.62                  | 7.76          |
| Thane        | 14.45   | 7,22,73,600                       | 17.66                 | 84.75         |
| Yavatmal     | 0.10  | 5,19,750                          | 0.13                  | 0.61          |
| <b>Total</b> | <b>99.57</b>  | <b>49,78,41,435</b>               | <b>121.62</b>         | <b>583.77</b> |

#### State – Nagaland

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Mokokchung   | 2.08  | 1,03,95,000.00                    | 2.54                  | 12.19         |
| <b>Total</b> | <b>2.08</b>   | <b>1,03,95,000.00</b>             | <b>2.54</b>           | <b>12.19</b>  |

#### State – Odisha

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Balasure     | 9.45  | 4,72,50,000                       | 11.54                 | 55.41         |
| Bolangir     | 0.38  | 18,90,000                         | 0.46                  | 2.22          |
| Cuttak       | 0.28  | 14,17,500                         | 0.35                  | 1.66          |
| Koratur      | 4.54  | 2,26,80,000                       | 5.54                  | 26.59         |
| Rayagada     | 8.57  | 4,28,40,000                       | 10.47                 | 50.23         |
| <b>Total</b> | <b>23.22</b>  | <b>11,60,77,500</b>               | <b>28.36</b>          | <b>136.11</b> |

#### Union Territory – Puducherry

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Puducherry   | 4.99  | 2,49,48,945                       | 6.09                  | 29.26         |
| <b>Total</b> | <b>4.99</b>   | <b>2,49,48,945</b>                | <b>6.09</b>           | <b>29.26</b>  |

#### State – Punjab

| District  | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|-----------|---|-----------------------------------|-----------------------|---------------|
| Amritsar  | 24.12   | 12,05,97,750                      | 29.46                 | 141.41        |
| Barnala   | 0.08  | 3,78,000                          | 0.09                  | 0.44          |
| Bhatinda  | 0.42  | 20,79,000                         | 0.51                  | 2.44          |
| Gurdaspur | 1.02  | 51,03,000                         | 1.25                  | 5.98          |
| Hosiarpur | 6.30  | 3,15,00,000                       | 7.70                  | 36.94         |
| Jalandhar | 0.28  | 13,86,000                         | 0.34                  | 1.63          |
| Ludhiana  | 7.26  | 3,63,13,200                       | 8.87                  | 42.58         |
| Mohali    | 10.14   | 5,07,15,000                       | 12.39                 | 59.47         |

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Muksar       | 6.84  | 3,42,09,000                       | 8.36                  | 40.11         |
| Patiala      | 3.74  | 1,87,11,000                       | 4.57                  | 21.94         |
| Sangrur      | 23.18   | 11,59,20,000                      | 28.32                 | 135.93        |
| <b>Total</b> | <b>83.38</b>  | <b>41,69,11,950</b>               | <b>101.85</b>         | <b>488.87</b> |

#### State – Rajasthan

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Ajmer        | 0.07  | 3,40,200                          | 0.08                  | 0.40          |
| Alwar        | 1.01  | 50,40,000                         | 1.23                  | 5.91          |
| Jaipur       | 2.92  | 1,45,84,500                       | 3.56                  | 17.10         |
| Jhunjhunu    | 0.04  | 1,89,000                          | 0.05                  | 0.22          |
| <b>Total</b> | <b>4.03</b>   | <b>2,01,53,700</b>                | <b>4.92</b>           | <b>23.63</b>  |

#### State – Tamil Nadu

| District     | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------|---------------|
| Chengalpattu | 2.08  | 1,03,95,000                       | 2.54                  | 12.19         |
| Chennai      | 4.79  | 2,39,40,000                       | 5.85                  | 28.07         |
| Coimbatore   | 16.18   | 8,08,76,250                       | 19.76                 | 94.84         |
| Dindigul     | 22.32   | 11,16,20,250                      | 27.27                 | 130.89        |
| Erode        | 21.31   | 10,65,64,500                      | 26.03                 | 124.96        |
| Kancheepuram | 2.84  | 1,41,75,000                       | 3.46                  | 16.62         |
| Karur        | 25.20   | 12,60,00,000                      | 30.78                 | 147.75        |
| Krishnagiri  | 8.51  | 4,25,25,000                       | 10.39                 | 49.86         |
| Madurai      | 0.69  | 34,65,000                         | 0.85                  | 4.06          |
| Namakkal     | 15.94   | 7,96,95,000                       | 19.47                 | 93.45         |
| Pudukkottai  | 2.04  | 1,02,06,000                       | 2.49                  | 11.97         |
| Thiruvallur  | 8.51  | 4,25,25,000                       | 10.39                 | 49.86         |
| Thoothukudi  | 0.06  | 3,15,000                          | 0.08                  | 0.37          |
| Tirunelveli  | 9.42  | 4,71,08,250                       | 11.51                 | 55.24         |
| Tirupur      | 7.56  | 3,78,00,000                       | 9.23                  | 44.32         |
| Virudhunagar | 14.45   | 7,22,61,000                       | 17.65                 | 84.73         |
| <b>Total</b> | <b>161.89</b>   | <b>80,94,71,250</b>               | <b>197.75</b>         | <b>949.19</b> |

#### State – Telangana

| District            | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|---------------------|---|-----------------------------------|-----------------------|---------------|
| Adilabad            | 8.69  | 4,34,70,000                       | 10.62                 | 50.97         |
| Bhadradi Kothagudem | 28.48   | 14,23,80,000                      | 34.78                 | 166.96        |

| District            | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|---------------------|---|-----------------------------------|-----------------------|---------------|
| Hyderabad           | 15.31   | 7,65,45,000                       | 18.70                 | 89.76         |
| Kothagudem          | 5.67  | 2,83,50,000                       | 6.93                  | 33.24         |
| Madak               | 5.67  | 2,83,50,000                       | 6.93                  | 33.24         |
| Mahbubnagar         | 15.50   | 7,74,90,000                       | 18.93                 | 90.86         |
| Nalgonda            | 1.32  | 66,15,000                         | 1.62                  | 7.76          |
| Nizamabad           | 1.70  | 85,05,000                         | 2.08                  | 9.97          |
| Ranga Reddy         | 0.66  | 33,16,950                         | 0.81                  | 3.89          |
| Sangareddy          | 4.66  | 2,33,10,000                       | 5.69                  | 27.33         |
| Warangal Rural      | 6.21  | 3,10,27,500                       | 7.58                  | 36.38         |
| Yadadri Bhuvanagiri | 0.79  | 39,69,000                         | 0.97                  | 4.65          |
| <b>Total</b>        | <b>94.67</b>  | <b>47,33,28,450</b>               | <b>115.63</b>         | <b>555.03</b> |

#### State – Uttar Pradesh

| District           | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD)  |
|--------------------|---|-----------------------------------|-----------------------|----------------|
| Allahabad          | 1.51  | 75,60,000                         | 1.85                  | 8.86           |
| Amruha             | 2.34  | 1,17,18,000                       | 2.86                  | 13.74          |
| Ayodhya            | 0.25  | 12,60,000                         | 0.31                  | 1.48           |
| Baghpat            | 6.67  | 3,33,58,500                       | 8.15                  | 39.12          |
| Bareilly           | 0.59  | 29,61,000                         | 0.72                  | 3.47           |
| Basti              | 0.66  | 32,76,000                         | 0.80                  | 3.84           |
| Bijnor             | 5.80  | 2,89,95,750                       | 7.08                  | 34.00          |
| Bulandshahr        | 1.36  | 68,04,000                         | 1.66                  | 7.98           |
| Chandauli          | 4.84  | 2,41,92,000                       | 5.91                  | 28.37          |
| Deoria             | 2.27  | 1,13,40,000                       | 2.77                  | 13.30          |
| Firozabad          | 0.67  | 33,39,000                         | 0.82                  | 3.92           |
| Gautam Budha Nagar | 0.98  | 49,14,000                         | 1.20                  | 5.76           |
| Ghaziabad          | 16.37   | 8,18,37,000                       | 19.99                 | 95.96          |
| Hapur              | 1.98  | 99,22,500                         | 2.42                  | 11.64          |
| Kanpur Nagar       | 0.91  | 45,36,000                         | 1.11                  | 5.32           |
| Lucknow            | 0.94  | 46,77,750                         | 1.14                  | 5.49           |
| Meerut             | 45.22   | 22,61,07,000                      | 55.24                 | 265.13         |
| Moradabad          | 17.55   | 8,77,27,500                       | 21.43                 | 102.87         |
| Muzaffarnagar      | 48.16   | 24,08,23,800                      | 58.83                 | 282.39         |
| Pilibhit           | 0.19  | 9,45,000                          | 0.23                  | 1.11           |
| Rampur             | 0.76  | 37,80,000                         | 0.92                  | 4.43           |
| Saharanpur         | 1.01  | 50,66,145                         | 1.24                  | 5.94           |
| Sant Kabir Nagar   | 0.32  | 15,75,000                         | 0.38                  | 1.85           |
| Shahjahanpur       | 9.30  | 4,64,94,000                       | 11.36                 | 54.52          |
| Shamli             | 13.21   | 6,60,55,500                       | 16.14                 | 77.46          |
| Sitapur            | 1.66  | 83,16,000                         | 2.03                  | 9.75           |
| <b>Total</b>       | <b>185.52</b>   | <b>92,75,81,445</b>               | <b>226.60</b>         | <b>1087.68</b> |

#### State – Uttarakhand

| District          | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|-------------------|---|-----------------------------------|-----------------------|---------------|
| Nainital          | 28.04   | 14,02,15,950                      | 34.25                 | 164.42        |
| Udham Singh Nagar | 31.89   | 15,94,26,225                      | 38.95                 | 186.94        |
| Haridwar          | 4.73  | 2,36,34,450                       | 5.77                  | 27.71         |
| <b>Total</b>      | <b>64.66</b>  | <b>32,32,76,625</b>               | <b>78.97</b>          | <b>379.08</b> |

**State – West Bengal**

| District         | Liquid waste generation in million m <sup>3</sup> per annum | Biogas in m <sup>3</sup> - Annual | Energy Potential (MW) | Bio CNG (TPD) |
|------------------|---|-----------------------------------|-----------------------|---------------|
| Purba Burdwan    | 13.87   | 6,93,70,875                       | 16.95                 | 81.34         |
| Hoogly           | 2.30  | 1,14,97,500                       | 2.81                  | 13.48         |
| Howrah           | 3.31  | 1,65,59,550                       | 4.05                  | 19.42         |
| Kolkata          | 10.15   | 5,07,27,600                       | 12.39                 | 59.48         |
| Malda            | 0.47  | 23,62,500                         | 0.58                  | 2.77          |
| East Mednipur    | 2.51  | 1,25,37,000                       | 3.06                  | 14.70         |
| Nadiad           | 0.95  | 47,25,000                         | 1.15                  | 5.54          |
| North 24 Pargana | 6.59  | 3,29,26,950                       | 8.04                  | 38.61         |
| South 24 Pargana | 2.52  | 1,26,00,000                       | 3.08                  | 14.77         |
| West Mednipur    | 3.88  | 1,93,85,100                       | 4.74                  | 22.73         |
| <b>Total</b>     | <b>46.54</b>  | <b>23,26,92,075</b>               | <b>56.84</b>          | <b>272.86</b> |



### Distillery sector- State and district wise energy production

#### Assumptions:

- Distillery Industry is operating at a capacity utilization level of around 65%.
- 12 litres of spent wash is generated for one litre of alcohol produced
- 25 Nm<sup>3</sup>/KL of spent wash is considered for estimating the energy potential.

#### State – Andhra Pradesh

| District      | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|---------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Chittor       | 42,074  | 3,28,177                          | 82,04,430                         | 2.00                         | 9.62          |
| East Godawari | 33,240  | 2,59,272                          | 64,81,800                         | 1.58                         | 7.60          |
| Prakasam      | 12,000  | 93,600                            | 23,40,000                         | 0.57                         | 2.74          |
| Visakhapatnam | 6,545   | 51,051                            | 12,76,275                         | 0.31                         | 1.50          |
| Krishna       | 45,000  | 3,51,000                          | 87,75,000                         | 2.14                         | 10.29         |
| Sri Kakulam   | 24,000  | 1,87,200                          | 46,80,000                         | 1.14                         | 5.49          |
| West Godawari | 59,700  | 4,65,660                          | 1,16,41,500                       | 2.84                         | 13.65         |
| <b>Total</b>  | <b>2,22,559</b>                               | <b>17,35,960</b>                  | <b>1735.9602</b>                  | <b>10.60</b>                 | <b>51</b>     |

#### State – Bihar

| District       | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|----------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Bhagalpur      | 6,600   | 51,480                            | 12,87,000                         | 0.31                         | 1.51          |
| Gopalgani      | 7,500   | 58,500                            | 14,62,500                         | 0.36                         | 1.71          |
| Nalanda        | 18,000  | 1,40,400                          | 35,10,000                         | 0.86                         | 4.12          |
| Patna          | 4,860   | 37,908                            | 9,47,700                          | 0.23                         | 1.11          |
| Sitamarhi      | 28,500  | 2,22,300                          | 55,57,500                         | 1.36                         | 6.52          |
| West Champaran | 49,500  | 3,86,100                          | 96,52,500                         | 2.36                         | 11.32         |
| <b>Total</b>   | <b>1,14,960</b>                               | <b>8,96,688</b>                   | <b>2,24,17,200</b>                | <b>5.48</b>                  | <b>26.29</b>  |

#### Union Territory – Chandigarh

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Chandigarh   | 36,000  | 2,80,800                          | 70,20,000                         | 1.71                         | 8.23          |
| <b>Total</b> | <b>36,000</b>                                 | <b>2,80,800</b>                   | <b>70,20,000</b>                  | <b>1.71</b>                  | <b>8.23</b>   |

#### State – Chhattisgarh

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Bilaspur     | 37500   | 292500                            | 73,12,500                         | 1.79                         | 8.57          |
| Mungeli      | 6600  | 51480                             | 12,87,000                         | 0.31                         | 1.51          |
| <b>Total</b> | <b>44,100</b>                                 | <b>3,43,980</b>                   | <b>343.98</b>                     | <b>2.10</b>                  | <b>10.08</b>  |

#### Union Territory – Daman and Diu

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Daman        | 32,520  | 2,53,656                          | 253.656                           | 1.55                         | 7.44          |
| <b>Total</b> | <b>32,520</b>                                 | <b>2,53,656</b>                   | <b>253.656</b>                    | <b>1.55</b>                  | <b>7.44</b>   |

**State – Goa**

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| North Goa    | 3,600   | 28,080                            | 7,02,000                          | 0.17                         | 0.82          |
| South Goa    | 1,706   | 13,307                            | 3,32,670                          | 0.08                         | 0.39          |
| <b>Total</b> | <b>5,306</b>                                  | <b>41,387</b>                     | <b>10,34,670</b>                  | <b>0.25</b>                  | <b>1.21</b>   |

**State – Gujarat**

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Bharuch      | 58,850  | 4,59,030                          | 1,14,75,750                       | 2.80                         | 13.46         |
| Bhavnagar    | 15,000  | 1,17,000                          | 29,25,000                         | 0.71                         | 3.43          |
| Junaghrh     | 6,600   | 51,480                            | 12,87,000                         | 0.31                         | 1.51          |
| Navasari     | 25,500  | 1,98,900                          | 49,72,500                         | 1.21                         | 5.83          |
| Surat        | 84,563  | 6,59,591                          | 1,64,89,785                       | 4.03                         | 19.34         |
| Valsad       | 25,000  | 1,95,000                          | 48,75,000                         | 1.19                         | 5.72          |
| <b>Total</b> | <b>2,15,513</b>                               | <b>16,81,001</b>                  | <b>4,20,25,035</b>                | <b>10.27</b>                 | <b>49.28</b>  |

**State – Haryana**

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Amabala      | 28,900  | 2,25,420                          | 56,35,500                         | 1.38                         | 6.61          |
| Faridabad    | 13,500  | 1,05,300                          | 26,32,500                         | 0.64                         | 3.09          |
| Gurgaon      | 7,500   | 58,500                            | 14,62,500                         | 0.36                         | 1.71          |
| Panchkula    | 49,500  | 3,86,100                          | 96,52,500                         | 2.36                         | 11.32         |
| <b>Total</b> | <b>99,400</b>                                 | <b>7,75,320</b>                   | <b>1,93,83,000</b>                | <b>4.74</b>                  | <b>22.73</b>  |

**State – Himanchal Pradesh**

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Solan        | 1,500   | 11,700                            | 2,92,500                          | 0.07                         | 0.34          |
| Una          | 12,100  | 94,380                            | 23,59,500                         | 0.58                         | 2.77          |
| <b>Total</b> | <b>13,600</b>                                 | <b>1,06,080</b>                   | <b>26,52,000</b>                  | <b>0.65</b>                  | <b>3.11</b>   |

**Union Territory – Jammu & Kashmir**

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Jammu        | 1,02,749                                      | 8,01,442                          | 2,00,36,055                       | 4.89                         | 23.49         |
| <b>Total</b> | <b>1,02,749</b>                               | <b>8,01,442</b>                   | <b>2,00,36,055</b>                | <b>4.89</b>                  | <b>23.49</b>  |

**State – Karnataka**

| District | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|----------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Bagalkot | 1,09,400                                      | 8,53,320                          | 2,13,33,000                       | 5.21                         | 25.02         |

| District        | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|-----------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Belgaum         | 2,59,069                                      | 20,20,738                         | 5,05,18,455                       | 12.34                        | 59.24         |
| Bengaluru Rural | 4,10,600                                      | 32,02,680                         | 8,00,67,000                       | 19.56                        | 93.89         |
| Bidar           | 20,475  | 1,59,705                          | 39,92,625                         | 0.98                         | 4.68          |
| Chickballapur   | 13,500  | 1,05,300                          | 26,32,500                         | 0.64                         | 3.09          |
| Chitradurga     | 5,400   | 42,120                            | 10,53,000                         | 0.26                         | 1.23          |
| Davangere       | 61,500  | 4,79,700                          | 1,19,92,500                       | 2.93                         | 14.06         |
| Dharwad         | 21,175  | 1,65,165                          | 41,29,125                         | 1.01                         | 4.84          |
| Gadag           | 1,11,000                                      | 8,65,800                          | 2,16,45,000                       | 5.29                         | 25.38         |
| Mandya          | 32,000  | 2,49,600                          | 62,40,000                         | 1.52                         | 7.32          |
| Mysore          | 69,895  | 5,45,181                          | 1,36,29,525                       | 3.33                         | 15.98         |
| Uttara Kannada  | 37,500  | 2,92,500                          | 73,12,500                         | 1.79                         | 8.57          |
| <b>Total</b>    | <b>11,51,514</b>                              | <b>89,81,809</b>                  | <b>22,45,45,230</b>               | <b>54.85</b>                 | <b>263.30</b> |

#### State – Kerala

| District       | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|----------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Alappuzha      | 7,200   | 56,160                            | 14,04,000                         | 0.34                         | 1.65          |
| Kannur         | 3,000   | 23,400                            | 5,85,000                          | 0.14                         | 0.69          |
| Kasaragod      | 300   | 2,340                             | 58,500                            | 0.01                         | 0.07          |
| Palakkad       | 3,060   | 23,868                            | 5,96,700                          | 0.15                         | 0.70          |
| Pathanamthitta | 2,820   | 21,996                            | 5,49,900                          | 0.13                         | 0.64          |
| Trissur        | 16,950  | 1,32,210                          | 33,05,250                         | 0.81                         | 3.88          |
| <b>Total</b>   | <b>33,330</b>                                 | <b>2,59,974</b>                   | <b>64,99,350</b>                  | <b>1.59</b>                  | <b>7.62</b>   |

#### State – Madhya Pradesh

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Chhatarpur   | 3,000   | 23,400                            | 5,85,000                          | 0.14                         | 0.69          |
| Gwalior      | 27,598  | 2,15,264                          | 53,81,610                         | 1.31                         | 6.31          |
| Jabalpur     | 4,500   | 35,100                            | 8,77,500                          | 0.21                         | 1.03          |
| Khargone     | 56,400  | 4,39,920                          | 1,09,98,000                       | 2.69                         | 12.90         |
| Raisen       | 33,000  | 2,57,400                          | 64,35,000                         | 1.57                         | 7.55          |
| <b>Total</b> | <b>1,24,498</b>                               | <b>9,71,084</b>                   | <b>2,42,77,110</b>                | <b>5.93</b>                  | <b>28.47</b>  |

#### State – Maharashtra

| District   | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Ahmednagar | 3,58,050                                      | 27,92,790                         | 6,98,19,750                       | 17.06                        | 81.87         |
| Akola      | 9,000   | 70,200                            | 17,55,000                         | 0.43                         | 2.06          |
| Aurangabad | 31,437  | 2,45,209                          | 61,30,215                         | 1.50                         | 7.19          |
| Beed       | 54,000  | 4,21,200                          | 1,05,30,000                       | 2.57                         | 12.35         |
| Hingoli    | 15,000  | 1,17,000                          | 29,25,000                         | 0.71                         | 3.43          |

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Jalgaon      | 24,000  | 1,87,200                          | 46,80,000                         | 1.14                         | 5.49          |
| Jalna        | 18,000  | 1,40,400                          | 35,10,000                         | 0.86                         | 4.12          |
| Kolhapur     | 1,95,700                                      | 15,26,460                         | 3,81,61,500                       | 9.32                         | 44.75         |
| Latur        | 51,000  | 3,97,800                          | 99,45,000                         | 2.43                         | 11.66         |
| Mumbai       | 43,500  | 3,39,300                          | 84,82,500                         | 2.07                         | 9.95          |
| Nagpur       | 27,000  | 2,10,600                          | 52,65,000                         | 1.29                         | 6.17          |
| Nandurbar    | 33,000  | 2,57,400                          | 64,35,000                         | 1.57                         | 7.55          |
| Nashik       | 46,150  | 3,59,970                          | 89,99,250                         | 2.20                         | 10.55         |
| Osmanabad    | 31,500  | 2,45,700                          | 61,42,500                         | 1.50                         | 7.20          |
| Parbhani     | 63,000  | 4,91,400                          | 1,22,85,000                       | 3.00                         | 14.41         |
| Pune         | 7,07,400                                      | 55,17,720                         | 13,79,43,000                      | 33.70                        | 161.75        |
| Ratnagiri    | 7,000   | 54,600                            | 13,65,000                         | 0.33                         | 1.60          |
| Sangli       | 85,500  | 6,66,900                          | 1,66,72,500                       | 4.07                         | 19.55         |
| Satara       | 1,31,100                                      | 10,22,580                         | 2,55,64,500                       | 6.25                         | 29.98         |
| Solapur      | 1,03,000                                      | 8,03,400                          | 2,00,85,000                       | 4.91                         | 23.55         |
| Thane        | 4,100   | 31,980                            | 7,99,500                          | 0.20                         | 0.94          |
| <b>Total</b> | <b>20,38,437</b>                              | <b>1,58,99,809</b>                | <b>15899.8086</b>                 | <b>97.10</b>                 | <b>466.10</b> |

#### State – Nagaland

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Dimapur      | 1,350   | 10,530                            | 2,63,250                          | 0.06                         | 0.31          |
| <b>TOTAL</b> | <b>1,350</b>                                  | <b>10,530</b>                     | <b>2,63,250</b>                   | <b>0.06</b>                  | <b>0.31</b>   |

#### State – Odisha

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Dhenjanal    | 9,000   | 70,200                            | 17,55,000                         | 0.43                         | 2.06          |
| Ganjam       | 3,000   | 23,400                            | 5,85,000                          | 0.14                         | 0.69          |
| Khorda       | 21,015  | 1,63,917                          | 40,97,925                         | 1.00                         | 4.81          |
| Koraput      | 5,100   | 39,780                            | 9,94,500                          | 0.24                         | 1.17          |
| Mayurbhanj   | 1,350   | 10,530                            | 2,63,250                          | 0.06                         | 0.31          |
| Rayagada     | 720   | 5,616                             | 1,40,400                          | 0.03                         | 0.16          |
| <b>Total</b> | <b>40,185</b>                                 | <b>3,13,443</b>                   | <b>7836075</b>                    | <b>1.91</b>                  | <b>9.19</b>   |

#### Union Territory – Puducherry

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Puducherry   | 11,700  | 91,260                            | 22,81,500                         | 0.56                         | 2.68          |
| <b>Total</b> | <b>11,700</b>                                 | <b>91,260</b>                     | <b>22,81,500</b>                  | <b>0.56</b>                  | <b>2.68</b>   |

**State – Punjab**

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Amritsar     | 33,000  | 2,57,400                          | 64,35,000                         | 1.57                         | 7.55          |
| Gurdaspur    | 6,000   | 46,800                            | 11,70,000                         | 0.29                         | 1.37          |
| Hoshiyarpur  | 36,000  | 2,80,800                          | 70,20,000                         | 1.71                         | 8.23          |
| Jalandar     | 12,000  | 93,600                            | 23,40,000                         | 0.57                         | 2.74          |
| Kapurtala    | 27,372  | 2,13,502                          | 53,37,540                         | 1.30                         | 6.26          |
| Mohali       | 1,00,000                                      | 7,80,000                          | 1,95,00,000                       | 4.76                         | 22.87         |
| Nawanshar    | 12,000  | 93,600                            | 23,40,000                         | 0.57                         | 2.74          |
| Patiala      | 1,53,000                                      | 11,93,400                         | 2,98,35,000                       | 7.29                         | 34.98         |
| <b>Total</b> | <b>3,79,372</b>                               | <b>29,59,102</b>                  | <b>7,39,77,540</b>                | <b>18.07</b>                 | <b>86.75</b>  |

**State – Rajasthan**

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Alwar        | 7,500   | 58,500                            | 14,62,500                         | 0.36                         | 1.71          |
| Chitorgarh   | 5,000   | 39,000                            | 9,75,000                          | 0.24                         | 1.14          |
| Jaipur       | 6,400   | 49,920                            | 12,48,000                         | 0.30                         | 1.46          |
| Udaipur      | 1,365   | 10,647                            | 2,66,175                          | 0.07                         | 0.31          |
| <b>Total</b> | <b>20,265</b>                                 | <b>1,58,067</b>                   | <b>3951675</b>                    | <b>0.97</b>                  | <b>4.63</b>   |

**State – Sikkim**

| District           | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| East Sikkim Rangpo | 3504  | 27331                             | 6,83,280                          | 0.17                         | 0.80          |
| <b>Total</b>       | <b>3504</b>                                   | <b>27331</b>                      | <b>6,83,280</b>                   | <b>0.17</b>                  | <b>0.80</b>   |

**State – Tamil Nadu**

| District      | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|---------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Chengalpattu  | 6,750   | 52,650                            | 13,16,250                         | 0.32                         | 1.54          |
| Chennai       | 63,500  | 4,95,300                          | 1,23,82,500                       | 3.02                         | 14.52         |
| Coimbatore    | 54,750  | 4,27,050                          | 1,06,76,250                       | 2.61                         | 12.52         |
| Cuddalore     | 1,27,800                                      | 9,96,840                          | 2,49,21,000                       | 6.09                         | 29.22         |
| Dharmapuri    | 14,850  | 1,15,830                          | 28,95,750                         | 0.71                         | 3.40          |
| Dindigul Anna | 10,500  | 81,900                            | 20,47,500                         | 0.50                         | 2.40          |
| Erode         | 66,000  | 5,14,800                          | 1,28,70,000                       | 3.14                         | 15.09         |
| Namakkal      | 19,500  | 1,52,100                          | 38,02,500                         | 0.93                         | 4.46          |
| Tanjore       | 19,800  | 1,54,440                          | 38,61,000                         | 0.94                         | 4.53          |
| Theni         | 30,000  | 2,34,000                          | 58,50,000                         | 1.43                         | 6.86          |
| Tiruchiapalli | 27,000  | 2,10,600                          | 52,65,000                         | 1.29                         | 6.17          |
| Tirunelveli   | 27,000  | 2,10,600                          | 52,65,000                         | 1.29                         | 6.17          |
| Tiruvallur    | 30,000  | 2,34,000                          | 58,50,000                         | 1.43                         | 6.86          |
| Vellore       | 9,000   | 70,200                            | 17,55,000                         | 0.43                         | 2.06          |
| Viluppuram    | 18,000  | 1,40,400                          | 35,10,000                         | 0.86                         | 4.12          |

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| <b>Total</b> | <b>5,24,450</b>                               | <b>40,90,710</b>                  | <b>10,22,67,750</b>               | <b>24.98</b>                 | <b>119.92</b> |

#### State – Telangana

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Hyderabad    | 9,840   | 76,752                            | 19,18,800                         | 0.47                         | 2.25          |
| Mahabubnagar | 47,100  | 3,67,380                          | 91,84,500                         | 2.24                         | 10.77         |
| Medak        | 9,450   | 73,710                            | 18,42,750                         | 0.45                         | 2.16          |
| Nizamabad    | 27,000  | 2,10,600                          | 52,65,000                         | 1.29                         | 6.17          |
| <b>Total</b> | <b>93,390</b>                                 | <b>7,28,442</b>                   | <b>1,82,11,050</b>                | <b>4.45</b>                  | <b>21.35</b>  |

#### State – Uttar Pradesh

| District             | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|----------------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Aligarh              | 18,000  | 1,40,400                          | 35,10,000                         | 0.86                         | 4.12          |
| Ayodhya              | 13,500  | 1,05,300                          | 26,32,500                         | 0.64                         | 3.09          |
| Bahraich             | 9,000   | 70,200                            | 17,55,000                         | 0.43                         | 2.06          |
| Balrampur            | 96,000  | 7,48,800                          | 1,87,20,000                       | 4.57                         | 21.95         |
| Bareilly             | 52,365  | 4,08,447                          | 1,02,11,175                       | 2.49                         | 11.97         |
| Basti                | 48,000  | 3,74,400                          | 93,60,000                         | 2.29                         | 10.98         |
| Bijnor               | 2,02,200                                      | 15,77,160                         | 3,94,29,000                       | 9.63                         | 46.23         |
| Bulandshar           | 9,000   | 70,200                            | 17,55,000                         | 0.43                         | 2.06          |
| Farrukhbad           | 18,000  | 1,40,400                          | 35,10,000                         | 0.86                         | 4.12          |
| Jyotiba Phuley Nagar | 1,643   | 12,815                            | 3,20,385                          | 0.08                         | 0.38          |
| Gazipur              | 24,100  | 1,87,980                          | 46,99,500                         | 1.15                         | 5.51          |
| Ghaziabad            | 10,593  | 82,622                            | 20,65,538                         | 0.50                         | 2.42          |
| Ghonda               | 52,700  | 4,11,060                          | 1,02,76,500                       | 2.51                         | 12.05         |
| Gorakhpur            | 66,000  | 5,14,800                          | 1,28,70,000                       | 3.14                         | 15.09         |
| Hapur                | 63,000  | 4,91,400                          | 1,22,85,000                       | 3.00                         | 14.41         |
| Hardoi               | 1,55,100                                      | 12,09,780                         | 3,02,44,500                       | 7.39                         | 35.46         |
| Khushinagar          | 30,000  | 2,34,000                          | 58,50,000                         | 1.43                         | 6.86          |
| Lakhimpur Kheri      | 1,80,000                                      | 14,04,000                         | 3,51,00,000                       | 8.57                         | 41.16         |
| Lucknow              | 5,000   | 39,000                            | 9,75,000                          | 0.24                         | 1.14          |
| Mau                  | 12,000  | 93,600                            | 23,40,000                         | 0.57                         | 2.74          |
| Meerut               | 1,51,900                                      | 11,84,820                         | 2,96,20,500                       | 7.24                         | 34.73         |
| Moradabad            | 58,50,000                                     | 4,56,30,000                       | 1,14,07,50,000                    | 278.68                       | 1,337.65      |
| Muzafarnagar         | 82,500  | 6,43,500                          | 1,60,87,500                       | 3.93                         | 18.86         |
| Pilibhit             | 9,000   | 70,200                            | 17,55,000                         | 0.43                         | 2.06          |
| Rampur               | 60,460  | 4,71,588                          | 1,17,89,700                       | 2.88                         | 13.82         |
| Saharanpur           | 96,600  | 7,53,480                          | 1,88,37,000                       | 4.60                         | 22.09         |
| Shahjahanpur         | 45,000  | 3,51,000                          | 87,75,000                         | 2.14                         | 10.29         |
| Shamli               | 11,864  | 92,539                            | 23,13,480                         | 0.57                         | 2.71          |
| Sitapur              | 1,15,500                                      | 9,00,900                          | 2,25,22,500                       | 5.50                         | 26.41         |

| District     | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD)  |
|--------------|---|-----------------------------------|-----------------------------------|------------------------------|----------------|
| Unnao        | 4,500   | 35,100                            | 8,77,500                          | 0.21                         | 1.03           |
| <b>Total</b> | <b>74,93,525</b>                              | <b>5,84,49,491</b>                | <b>1,46,12,37,278</b>             | <b>356.97</b>                | <b>1713.45</b> |

#### State – Uttarakhand

| District          | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|-------------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Dehradun          | 6,800   | 53,040                            | 13,26,000                         | 0.32                         | 1.55          |
| Uttam Singh Nagar | 95,390  | 7,44,042                          | 1,86,01,050                       | 4.54                         | 21.81         |
| <b>Total</b>      | <b>1,02,190</b>                               | <b>7,97,082</b>                   | <b>1,99,27,050</b>                | <b>4.87</b>                  | <b>23.37</b>  |

#### State – West Bengal

| District          | Licensed & Installed Capacity in KL per Annum | Spent wash generated KL per Annum | Biogas in m <sup>3</sup> - Annual | Annual Energy Potential (MW) | Bio CNG (TPD) |
|-------------------|---|-----------------------------------|-----------------------------------|------------------------------|---------------|
| Darjeeling        | 13,500  | 1,05,300                          | 26,32,500                         | 0.64                         | 3.09          |
| Hoogly            | 1,800   | 14,040                            | 3,51,000                          | 0.09                         | 0.41          |
| North 24 Parganas | 40,000  | 3,12,000                          | 78,00,000                         | 1.91                         | 9.15          |
| <b>Total</b>      | <b>55,300</b>                                 | <b>4,31,340</b>                   | <b>1,07,83,500</b>                | <b>2.63</b>                  | <b>12.64</b>  |

Urban Liquid Waste sector- State and district wise energy production

**Assumptions:**

- Estimation on urban liquid waste or sewage generation has been made based on the estimates considered by CPCB for Class I Cities and Class II towns,
- Water supply @185 litres per capita per day (LPCD) and 80% of water supply as sewage generation
- Sewage generation for NCT of Delhi is estimated based on their 80 % of water supply of 925 MGD.

**State – Assam**

| District Name       | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------------|-------------------------|-------------------------------|-----------------------|---------------|
| BONGAIGAON          | 12.82                   | 1,410.24                      | 0.13                  | 0.60          |
| CACHAR              | 32.76                   | 3,603.36                      | 0.32                  | 1.54          |
| DHUBRI              | 10.30                   | 1,133.29                      | 0.10                  | 0.49          |
| DIBRUGARH           | 25.05                   | 2,755.23                      | 0.25                  | 1.18          |
| EAST KARBI ANGLONG  | 11.72                   | 1,288.92                      | 0.11                  | 0.55          |
| GOALPARA            | 9.39                    | 1,033.09                      | 0.09                  | 0.44          |
| JORHAT              | 22.25                   | 2,447.40                      | 0.22                  | 1.05          |
| KAMRUP METROPOLITAN | 179.53                  | 19,747.80                     | 1.76                  | 8.45          |
| KARIMGANJ           | 9.88                    | 1,087.33                      | 0.10                  | 0.47          |
| LAKHIMPUR           | 10.80                   | 1,188.41                      | 0.11                  | 0.51          |
| NAGAON              | 21.36                   | 2,350.05                      | 0.21                  | 1.01          |
| SIBSAGAR            | 8.80                    | 968.35                        | 0.09                  | 0.41          |
| SONITPUR            | 12.85                   | 1,413.52                      | 0.13                  | 0.60          |
| TINSUKIA            | 21.11                   | 2,321.85                      | 0.21                  | 0.99          |
| <b>TOTAL</b>        | <b>388.63</b>           | <b>42748.85</b>               | <b>3.81</b>           | <b>18.30</b>  |

**State – Andhra Pradesh**

| District Name               | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------------------|-------------------------|-------------------------------|-----------------------|---------------|
| ANANTAPUR                   | 166.83                  | 18,351.39                     | 1.64                  | 7.85          |
| CHITTOOR                    | 177.01                  | 19,470.96                     | 1.74                  | 8.33          |
| EAST GODAVARI               | 176.62                  | 19,427.82                     | 1.73                  | 8.32          |
| GUNTUR                      | 289.29                  | 31,822.02                     | 2.84                  | 13.62         |
| KADAPA                      | 150.51                  | 16,556.05                     | 1.48                  | 7.09          |
| KRISHNA                     | 276.19                  | 30,380.70                     | 2.71                  | 13.00         |
| KURNOOL                     | 184.83                  | 20,331.30                     | 1.81                  | 8.70          |
| PRAKASAM                    | 76.98                   | 8,467.81                      | 0.76                  | 3.62          |
| SRI POTTI SRIRAMULU NELLORE | 141.82                  | 15,600.01                     | 1.39                  | 6.68          |
| SRIKAKULAM                  | 35.37                   | 3,890.50                      | 0.35                  | 1.67          |
| VISAKHAPATNAM               | 361.31                  | 39,744.03                     | 3.54                  | 17.01         |
| VIZIANAGARAM                | 59.35                   | 6,527.97                      | 0.58                  | 2.79          |
| WEST GODAVARI               | 114.92                  | 12,641.08                     | 1.13                  | 5.41          |
| <b>TOTAL</b>                | <b>2,211.01</b>         | <b>243,212</b>                | <b>21.69</b>          | <b>104.09</b> |

**State – Arunachal Pradesh**

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| PAPUM PARE    | 13.45                   | 1,479.18                      | 0.13                  | 0.63          |
| <b>TOTAL</b>  | <b>13.45</b>            | <b>1,479.18</b>               | <b>0.13</b>           | <b>0.63</b>   |



**Union Territory - Andaman & Nicobar**

| District Name          | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------------------|-------------------------|-------------------------------|-----------------------|---------------|
| SOUTH ANDAMAN DISTRICT | 20.04                   | 2204.34                       | 0.24                  | 0.94          |
| <b>TOTAL</b>           | <b>20.04</b>            | <b>2204.34</b>                | <b>0.24</b>           | <b>0.94</b>   |

**State – Bihar**

| District Name      | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------|-------------------------|-------------------------------|-----------------------|---------------|
| ARARIA             | 23.48                   | 2,582.88                      | 0.23                  | 1.11          |
| ARWAL *            | 10.64                   | 1,169.87                      | 0.10                  | 0.50          |
| AURANGABAD         | 29.58                   | 3,254.34                      | 0.29                  | 1.39          |
| BEGUSARAI          | 93.99                   | 10,339.26                     | 0.92                  | 4.43          |
| BHAGALPUR          | 79.40                   | 8,734.01                      | 0.78                  | 3.74          |
| BHOJPUR            | 47.08                   | 5,178.84                      | 0.46                  | 2.22          |
| BUXAR *            | 28.19                   | 3,101.15                      | 0.28                  | 1.33          |
| DARBHANGA          | 66.32                   | 7,295.37                      | 0.65                  | 3.12          |
| GAYA               | 84.13                   | 9,254.49                      | 0.83                  | 3.96          |
| GOPALGANJ          | 12.60                   | 1,385.86                      | 0.12                  | 0.59          |
| JAMUI *            | 15.92                   | 1,751.59                      | 0.16                  | 0.75          |
| JEHANABAD          | 19.10                   | 2,101.05                      | 0.19                  | 0.90          |
| KAIMUR (BHABUA) *  | 9.33                    | 1,026.67                      | 0.09                  | 0.44          |
| KATIHAR            | 43.51                   | 4,786.10                      | 0.43                  | 2.05          |
| KISHANGANJ         | 19.02                   | 2,091.67                      | 0.19                  | 0.90          |
| LAKHISARAI *       | 18.68                   | 2,054.40                      | 0.18                  | 0.88          |
| MADHEPURA          | 10.08                   | 1,108.29                      | 0.10                  | 0.47          |
| MADHUBANI          | 13.08                   | 1,439.34                      | 0.13                  | 0.62          |
| MUNGER             | 53.69                   | 5,905.81                      | 0.53                  | 2.53          |
| MUZAFFARPUR        | 62.99                   | 6,929.06                      | 0.62                  | 2.97          |
| NALANDA            | 63.76                   | 7,013.10                      | 0.63                  | 3.00          |
| NAWADA             | 18.42                   | 2,026.34                      | 0.18                  | 0.87          |
| PATNA              | 401.10                  | 44,121.11                     | 3.93                  | 18.88         |
| PASHCHIM CHAMPARAN | 44.81                   | 4,929.12                      | 0.44                  | 2.11          |
| PURBA CHAMPARAN    | 33.84                   | 3,722.26                      | 0.33                  | 1.59          |
| PURNIA             | 55.50                   | 6,104.48                      | 0.54                  | 2.61          |
| ROHTAS             | 50.74                   | 5,581.58                      | 0.50                  | 2.39          |
| SAHARSA            | 31.17                   | 3,428.90                      | 0.31                  | 1.47          |
| SAMASTIPUR         | 11.50                   | 1,265.12                      | 0.11                  | 0.54          |
| SARAN              | 35.29                   | 3,882.20                      | 0.35                  | 1.66          |
| SHEIKHPURA *       | 11.50                   | 1,265.12                      | 0.11                  | 0.54          |
| SITAMARHI          | 11.90                   | 1,309.42                      | 0.12                  | 0.56          |
| SIWAN              | 25.43                   | 2,797.04                      | 0.25                  | 1.20          |
| SUPAUL *           | 11.78                   | 1,295.78                      | 0.12                  | 0.55          |
| VAISHALI           | 27.29                   | 3,002.27                      | 0.27                  | 1.28          |
| <b>Total</b>       | <b>1574.85</b>          | <b>173233.89</b>              | <b>15.45</b>          | <b>74.14</b>  |

#### Union Territory - Chandigarh

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Chandigarh    | 181.99                  | 20,019.29                     | 1.79                  | 8.57          |
| <b>TOTAL</b>  | <b>181.99</b>           | <b>20,019.29</b>              | <b>1.79</b>           | <b>8.57</b>   |

#### State – Chhattisgarh

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Bilaspur      | 66.14                   | 7,275.28                      | 0.65                  | 3.11          |
| Durg          | 182.44                  | 20,068.40                     | 1.79                  | 8.59          |
| Jagdalpur     | 50.51                   | 5,555.58                      | 0.5                   | 2.38          |
| Korba         | 77.32                   | 8,505.17                      | 0.76                  | 3.64          |
| Koriya        | 65.79                   | 7,236.38                      | 0.65                  | 3.1           |
| Raipur        | 229.69                  | 25,265.42                     | 2.25                  | 10.81         |
| Rajnandgaon   | 29.09                   | 3,199.57                      | 0.29                  | 1.37          |
| <b>Total</b>  | <b>700.96</b>           | <b>77,105.79</b>              | <b>6.88</b>           | <b>33.00</b>  |

#### Union Territory - Dadra & Nagar Haveli

| District Name        | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Dadra & Nagar Haveli | 25.12                   | 2763.02                       | 0.25                  | 1.18          |
| <b>Total</b>         | <b>25.12</b>            | <b>2,763.02</b>               | <b>0.25</b>           | <b>1.18</b>   |

#### Union Territory - Delhi

| District Name        | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Delhi (All District) | 3,330                   | 366,300                       | 32.66                 | 156.78        |
| <b>TOTAL</b>         | <b>3,330</b>            | <b>366,300</b>                | <b>32.66</b>          | <b>156.78</b> |

#### Union Territory - Daman & Diu

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Daman         | 11.01                   | 1,210.89                      | 0.11                  | 0.52          |
| <b>Total</b>  | <b>11.01</b>            | <b>1,210.89</b>               | <b>0.11</b>           | <b>0.52</b>   |

#### State – Goa

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| North Goa     | 10.69                   | 1,175.83                      | 0.10                  | 0.50          |
| South Goa     | 30.24                   | 3,326.50                      | 0.30                  | 1.42          |
| <b>Total</b>  | <b>40.93</b>            | <b>4,502.34</b>               | <b>0.40</b>           | <b>1.93</b>   |

#### State – Gujarat

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Ahmadabad     | 1076.59                 | 118,425.42                    | 10.56                 | 50.69         |
| Amreli        | 34.57                   | 3,802.60                      | 0.34                  | 1.63          |
| Anand         | 74.96                   | 8,245.90                      | 0.74                  | 3.53          |
| Banas kantha  | 47.05                   | 5,175.37                      | 0.46                  | 2.22          |
| Bharuch       | 44.02                   | 4,841.73                      | 0.43                  | 2.07          |
| Bhavnagar     | 170.9                   | 18,799.28                     | 1.68                  | 8.05          |

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Dohad         | 20.78                   | 2,286.34                      | 0.2                   | 0.98          |
| Gandhinagar   | 87.59                   | 9,634.52                      | 0.86                  | 4.12          |
| Jamnagar      | 120.43                  | 13,247.28                     | 1.18                  | 5.67          |
| Junagadh      | 126.08                  | 13,868.58                     | 1.24                  | 5.94          |
| Kachchh       | 102.16                  | 11,238.07                     | 1                     | 4.81          |
| Kheda         | 38.39                   | 4,222.40                      | 0.38                  | 1.81          |
| Mahesana      | 74.23                   | 8,165.46                      | 0.73                  | 3.49          |
| Navsari       | 52.93                   | 5,822.30                      | 0.52                  | 2.49          |
| Panch mahals  | 37.18                   | 4,090.31                      | 0.36                  | 1.75          |
| Patan         | 32.79                   | 3,607.27                      | 0.32                  | 1.54          |
| Porbandar     | 24.5                    | 2,694.74                      | 0.24                  | 1.15          |
| Rajkot        | 366.77                  | 40,345.23                     | 3.6                   | 17.27         |
| Sabar kantha  | 27.26                   | 2,998.41                      | 0.27                  | 1.28          |
| Surat         | 954.33                  | 104,976.28                    | 9.36                  | 44.93         |
| Surendranagar | 57.28                   | 6,300.29                      | 0.56                  | 2.7           |
| Vadodara      | 334.1                   | 36,750.53                     | 3.28                  | 15.73         |
| Valsad        | 61.23                   | 6,735.13                      | 0.6                   | 2.88          |
| <b>Total</b>  | <b>3966.12</b>          | <b>436,273.46</b>             | <b>38.90</b>          | <b>186.73</b> |

#### State – Haryana

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Ambala        | 59.31                   | 6,524                         | 0.58                  | 2.79          |
| Bhiwani       | 44.88                   | 4,937                         | 0.44                  | 2.11          |
| Faridabad*    | 302.75                  | 33,302                        | 2.97                  | 14.25         |
| Fatehabad     | 24.75                   | 2,722                         | 0.24                  | 1.17          |
| Gurugram      | 206.43                  | 22,707                        | 2.02                  | 9.72          |
| Hisar         | 71.1                    | 7,821                         | 0.7                   | 3.35          |
| Jhajjar       | 34.41                   | 3,786                         | 0.34                  | 1.62          |
| Jind*         | 43.11                   | 4,743                         | 0.42                  | 2.03          |
| Kaithal       | 26.57                   | 2,923                         | 0.26                  | 1.25          |
| Karnal        | 55.68                   | 6,125                         | 0.55                  | 2.62          |
| Kurukshetra   | 30.22                   | 3,324                         | 0.3                   | 1.42          |
| Mahendragarh  | 13.01                   | 1,431                         | 0.13                  | 0.61          |
| Palwal*       | 34.06                   | 3,746                         | 0.33                  | 1.6           |
| Panchkula     | 55.31                   | 6,084                         | 0.54                  | 2.6           |
| Panipat*      | 69.16                   | 7,608                         | 0.68                  | 3.26          |
| Rewari        | 26.61                   | 2,927                         | 0.26                  | 1.25          |
| Rohtak        | 68.01                   | 7,481                         | 0.67                  | 3.2           |
| Sirsa*        | 42.7                    | 4,697                         | 0.42                  | 2.01          |
| Sonipat*      | 67.77                   | 7,455                         | 0.66                  | 3.19          |
| Yamunanagar*  | 62.18                   | 6,840                         | 0.61                  | 2.93          |
| <b>Total</b>  | <b>1338.02</b>          | <b>147,182.64</b>             | <b>13.12</b>          | <b>62.99</b>  |

**State – Himachal Pradesh**

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Shimla        | 30.81                   | 3389.45                       | 0.30                  | 1.45          |
| <b>Total</b>  | <b>30.81</b>            | <b>3389.45</b>                | <b>0.30</b>           | <b>1.45</b>   |

**Union Territory – Jammu & Kashmir**

| District Name           | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Anantnag (m cl + og)    | 18.9                    | 2,078.48                      | 0.19                  | 0.89          |
| Baramula                | 16.38                   | 1,801.26                      | 0.16                  | 0.77          |
| Kathua                  | 7.06                    | 776.8                         | 0.07                  | 0.33          |
| Srinagar (m corp. + og) | 137.16                  | 15,087.31                     | 1.35                  | 6.46          |
| Udhampur                | 77.28                   | 8,500.26                      | 0.76                  | 3.64          |
| <b>Total</b>            | <b>256.76</b>           | <b>28,244.10</b>              | <b>2.52</b>           | <b>12.09</b>  |

**State – Jharkhand**

| District Name        | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Bokaro               | 123.04                  | 13,534.53                     | 1.21                  | 5.79          |
| Deoghar*             | 50.26                   | 5,528.76                      | 0.49                  | 2.37          |
| Dhanbad              | 270.94                  | 29,803.29                     | 2.66                  | 12.76         |
| Giridih              | 20.32                   | 2,234.78                      | 0.2                   | 0.96          |
| Gumla                | 9.46                    | 1,040.64                      | 0.09                  | 0.45          |
| Hazaribagh           | 24.98                   | 2,748.34                      | 0.25                  | 1.18          |
| Kodarma              | 15.98                   | 1,757.56                      | 0.16                  | 0.75          |
| Lohardaga*           | 10.58                   | 1,163.36                      | 0.1                   | 0.5           |
| Palamu               | 13.49                   | 1,484.34                      | 0.13                  | 0.64          |
| Pashchimi singhbhum* | 20.82                   | 2,289.97                      | 0.2                   | 0.98          |
| Purbi singhbhum*     | 171.89                  | 18,907.44                     | 1.69                  | 8.09          |
| Ramgarh              | 30.23                   | 3,324.81                      | 0.3                   | 1.42          |
| Ranchi               | 201.89                  | 22,207.78                     | 1.98                  | 9.5           |
| Sahibganj*           | 15.44                   | 1,698.67                      | 0.15                  | 0.73          |
| Saraikela-kharswana  | 34.87                   | 3,835.47                      | 0.34                  | 1.64          |
| <b>Total</b>         | <b>1014.18</b>          | <b>111,559.74</b>             | <b>9.95</b>           | <b>47.75</b>  |

**State – Karnataka**

| District Name   | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------|-------------------------|-------------------------------|-----------------------|---------------|
| Belgaum         | 110.32                  | 12,135.64                     | 1.08                  | 5.19          |
| Bagalkot        | 64.37                   | 7,080.75                      | 0.63                  | 3.03          |
| Bangalore       | 1709.44                 | 188,038.02                    | 16.77                 | 80.48         |
| Bangalore rural | 27.79                   | 3,057.38                      | 0.27                  | 1.31          |
| Bellary         | 122.88                  | 13,517.03                     | 1.21                  | 5.79          |
| Bidar           | 53.53                   | 5,888.06                      | 0.53                  | 2.52          |
| Bijapur         | 60.01                   | 6,601.64                      | 0.59                  | 2.83          |
| Chamarajanagar  | 22.16                   | 2,437.23                      | 0.22                  | 1.04          |
| Chikkaballapura | 33.93                   | 3,731.92                      | 0.33                  | 1.6           |
| Chikmagalur     | 21.22                   | 2,334.59                      | 0.21                  | 1             |
| Chitradurga     | 46.54                   | 5,118.90                      | 0.46                  | 2.19          |

| District Name    | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Dakshina kannada | 107.75                  | 11,852.07                     | 1.06                  | 5.07          |
| Davanagere       | 94.72                   | 10,418.95                     | 0.93                  | 4.46          |
| Dharwad          | 179.33                  | 19,725.83                     | 1.76                  | 8.44          |
| Gadag            | 28.83                   | 3,171.36                      | 0.28                  | 1.36          |
| Gulbarga         | 101.57                  | 11,172.36                     | 1                     | 4.78          |
| Hassan           | 37.52                   | 4,127.36                      | 0.37                  | 1.77          |
| Haveri           | 30.67                   | 3,373.18                      | 0.3                   | 1.44          |
| Kolar            | 65.91                   | 7,250.49                      | 0.65                  | 3.1           |
| Koppal           | 33.45                   | 3,679.04                      | 0.33                  | 1.57          |
| Mandya           | 22.88                   | 2,516.94                      | 0.22                  | 1.08          |
| Mysore           | 180.82                  | 19,890.45                     | 1.77                  | 8.51          |
| Raichur          | 56.68                   | 6,235.32                      | 0.56                  | 2.67          |
| Ramanagara       | 39.14                   | 4,304.94                      | 0.38                  | 1.84          |
| Shimoga          | 91.73                   | 10,090.44                     | 0.9                   | 4.32          |
| Tumkur           | 78.38                   | 8,622.06                      | 0.77                  | 3.69          |
| Udupi            | 28.07                   | 3,087.24                      | 0.28                  | 1.32          |
| Uttara kannada   | 34.11                   | 3,751.58                      | 0.33                  | 1.61          |
| Yadgir           | 32.16                   | 3,537.54                      | 0.32                  | 1.51          |
| <b>Total</b>     | <b>3515.89</b>          | <b>386,748.29</b>             | <b>34.49</b>          | <b>165.53</b> |

#### State – Kerala

| District Name      | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Alapuzhha          | 49.42                   | 5436.09                       | 0.48                  | 2.33          |
| Ernakulam          | 111.31                  | 12243.96                      | 1.09                  | 5.24          |
| Idukki             | 8.99                    | 988.47                        | 0.09                  | 0.42          |
| Kannur             | 45.09                   | 4960.03                       | 0.44                  | 2.12          |
| Kasaragod          | 24.01                   | 2641.52                       | 0.24                  | 1.13          |
| Kollam             | 61.86                   | 6804.2                        | 0.61                  | 2.91          |
| Kottayam           | 6.77                    | 744.33                        | 0.07                  | 0.32          |
| Kozhikode          | 135.31                  | 14884.09                      | 1.33                  | 6.37          |
| Malappuram         | 94.84                   | 10432.44                      | 0.93                  | 4.47          |
| Palakkad           | 28.7                    | 3157.23                       | 0.28                  | 1.35          |
| Pathanamthitta     | 8.86                    | 975.06                        | 0.09                  | 0.42          |
| Thiruvananthapuram | 158.19                  | 17400.58                      | 1.55                  | 7.45          |
| Thrissur           | 80.2                    | 8822.16                       | 0.79                  | 3.78          |
| <b>Total</b>       | <b>813.55</b>           | <b>89490.16</b>               | <b>7.99</b>           | <b>38.31</b>  |

#### State – Madhya Pradesh

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Ashoknagar *  | 15.62                   | 1718.4                        | 0.15                  | 0.74          |
| Balaghat      | 14.63                   | 1608.84                       | 0.14                  | 0.69          |
| Barwani       | 20.02                   | 2202.03                       | 0.2                   | 0.94          |
| Betul         | 33.9                    | 3729.3                        | 0.33                  | 1.6           |
| Bhind         | 48.73                   | 5360.28                       | 0.48                  | 2.29          |
| Bhopal        | 361.34                  | 39747.67                      | 3.54                  | 17.01         |
| Burhanpur     | 35.49                   | 3903.5                        | 0.35                  | 1.67          |
| Chhatarpur    | 27.11                   | 2982.45                       | 0.27                  | 1.28          |

| District Name         | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Chhindwara            | 31.89                   | 3507.89                       | 0.31                  | 1.5           |
| Damoh                 | 24.15                   | 2656.94                       | 0.24                  | 1.14          |
| Datia                 | 17.87                   | 1965.3                        | 0.18                  | 0.84          |
| Dewas                 | 56.85                   | 6253.76                       | 0.56                  | 2.68          |
| Dhar                  | 53.72                   | 5908.71                       | 0.53                  | 2.53          |
| Guna                  | 47.3                    | 5203.2                        | 0.46                  | 2.23          |
| Gwalior               | 198.46                  | 21830.34                      | 1.95                  | 9.34          |
| Harda                 | 13.12                   | 1443.41                       | 0.13                  | 0.62          |
| Hoshangabad           | 38.98                   | 4287.45                       | 0.38                  | 1.84          |
| Indore                | 396.18                  | 43579.42                      | 3.89                  | 18.65         |
| Jabalpur              | 199.42                  | 21935.69                      | 1.96                  | 9.39          |
| Katni                 | 39.06                   | 4296.71                       | 0.38                  | 1.84          |
| Khandwa (east nimar)  | 34.9                    | 3839.15                       | 0.34                  | 1.64          |
| Khargone (west nimar) | 20.75                   | 2282.67                       | 0.2                   | 0.98          |
| Mandla                | 9.22                    | 1013.81                       | 0.09                  | 0.43          |
| Mandsaur              | 24.9                    | 2739.08                       | 0.24                  | 1.17          |
| Morena                | 38.45                   | 4229.33                       | 0.38                  | 1.81          |
| Narsimhapur           | 10.35                   | 1138.19                       | 0.1                   | 0.49          |
| Neemuch               | 22.78                   | 2505.28                       | 0.22                  | 1.07          |
| Panna                 | 10.29                   | 1131.7                        | 0.1                   | 0.48          |
| Raisen                | 12.72                   | 1399.17                       | 0.12                  | 0.6           |
| Ratlam                | 59.25                   | 6517.6                        | 0.58                  | 2.79          |
| Rewa                  | 43.5                    | 4784.77                       | 0.43                  | 2.05          |
| Sagar                 | 67.04                   | 7373.89                       | 0.66                  | 3.16          |
| Satna                 | 54.09                   | 5949.49                       | 0.53                  | 2.55          |
| Sehore                | 29.66                   | 3262.88                       | 0.29                  | 1.4           |
| Seoni                 | 18.08                   | 1988.64                       | 0.18                  | 0.85          |
| Shahdol               | 15.51                   | 1706.34                       | 0.15                  | 0.73          |
| Shajapur              | 21.51                   | 2365.89                       | 0.21                  | 1.01          |
| Sheopur               | 13.44                   | 1478.76                       | 0.13                  | 0.63          |
| Shivpuri              | 33.26                   | 3658.46                       | 0.33                  | 1.57          |
| Sidhi                 | 10.61                   | 1167.23                       | 0.1                   | 0.5           |
| Singrauli *           | 48.76                   | 5363.67                       | 0.48                  | 2.3           |
| Tikamgarh             | 14.07                   | 1547.97                       | 0.14                  | 0.66          |
| Ujjain                | 108.18                  | 11899.99                      | 1.06                  | 5.09          |
| Vidisha               | 52.71                   | 5798.01                       | 0.52                  | 2.48          |
| <b>Total</b>          | <b>2,447.85</b>         | <b>2,69,263.23</b>            | <b>24.01</b>          | <b>115.24</b> |

**State – Maharashtra**

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Ahmadnagar    | 101.36                  | 11150.09                      | 0.99                  | 4.77          |
| Akola         | 90.48                   | 9952.8                        | 0.89                  | 4.26          |
| Amravati      | 146.64                  | 16130.24                      | 1.44                  | 6.9           |
| Aurangabad    | 265.27                  | 29180.23                      | 2.6                   | 12.49         |
| Bhandara      | 15.79                   | 1737.11                       | 0.15                  | 0.74          |
| Bid           | 66.21                   | 7282.94                       | 0.65                  | 3.12          |
| Buldana       | 59.68                   | 6565.21                       | 0.59                  | 2.81          |
| Chandrapur    | 88.53                   | 9738.2                        | 0.87                  | 4.17          |
| Dhule         | 80.09                   | 8809.45                       | 0.79                  | 3.77          |
| Gadchiroli    | 10.49                   | 1153.58                       | 0.1                   | 0.49          |

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Gondiya*      | 21.77                   | 2394.71                       | 0.21                  | 1.02          |
| Hingoli       | 27.75                   | 3052.79                       | 0.27                  | 1.31          |
| Jalgaon       | 174.92                  | 19240.79                      | 1.72                  | 8.24          |
| Jalna         | 52.03                   | 5723.27                       | 0.51                  | 2.45          |
| Kolhapur      | 145.73                  | 16030.7                       | 1.43                  | 6.86          |
| Latur         | 93.88                   | 10327.02                      | 0.92                  | 4.42          |
| Mumbai        | 2129.46                 | 234240.14                     | 20.89                 | 100.25        |
| Nagpur        | 462.82                  | 50910.12                      | 4.54                  | 21.79         |
| Nanded        | 114.48                  | 12592.75                      | 1.12                  | 5.39          |
| Nandurbar     | 30.3                    | 3333.29                       | 0.3                   | 1.43          |
| Nashik        | 437.61                  | 48137.07                      | 4.29                  | 20.6          |
| Osmanabad     | 21.3                    | 2342.47                       | 0.21                  | 1             |
| Parbhani      | 59.05                   | 6495.12                       | 0.58                  | 2.78          |
| Pune          | 1034.98                 | 113847.35                     | 10.15                 | 48.73         |
| Raigarh       | 112.75                  | 12402.84                      | 1.11                  | 5.31          |
| Ratnagiri     | 22.7                    | 2496.69                       | 0.22                  | 1.07          |
| Sangli        | 100.67                  | 11073.7                       | 0.99                  | 4.74          |
| Satara        | 36.89                   | 4057.53                       | 0.36                  | 1.74          |
| Solapur       | 201.86                  | 22204.69                      | 1.98                  | 9.5           |
| Thane         | 1723.38                 | 189571.68                     | 16.9                  | 81.14         |
| Wardha        | 34.44                   | 3788.71                       | 0.34                  | 1.62          |
| Washim        | 25.5                    | 2804.46                       | 0.25                  | 1.2           |
| Yavatmal      | 42                      | 4619.86                       | 0.41                  | 1.98          |
| <b>Total</b>  | <b>8030.80</b>          | <b>883387.60</b>              | <b>78.77</b>          | <b>378.09</b> |

#### State – Manipur

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Imphal West   | 32.67                   | 3593.257                      | 0.320                 | 1.538         |
| Imphal East   | 14.77                   | 1624.633                      | 0.145                 | 0.695         |
| <b>Total</b>  | <b>47.44</b>            | <b>5217.890</b>               | <b>0.465</b>          | <b>2.233</b>  |

#### State – Meghalaya

| District Name    | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------------|-------------------------|-------------------------------|-----------------------|---------------|
| West Garo hills  | 14.28                   | 1570.698                      | 0.140                 | 0.672         |
| East Khasi hills | 33.72                   | 3709.323                      | 0.331                 | 1.588         |
| <b>Total</b>     | <b>48.00</b>            | <b>5280.021</b>               | <b>0.471</b>          | <b>2.260</b>  |

#### State – Mizoram

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Aizawl        | 61.09                   | 6719.88                       | 0.60                  | 2.88          |
| Lunglei       | 11.12                   | 1222.71                       | 0.11                  | 0.52          |
| <b>Total</b>  | <b>72.21</b>            | <b>7942.59</b>                | <b>0.71</b>           | <b>3.40</b>   |

#### State – Nagaland

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Dimapur*      | 25.70                   | 2826.628                      | 0.252                 | 1.210         |
| Kohima        | 18.99                   | 2089.047                      | 0.186                 | 0.894         |
| <b>Total</b>  | <b>44.69</b>            | <b>4915.675</b>               | <b>0.438</b>          | <b>2.104</b>  |

#### State – Odisha

| District Name  | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------|-------------------------|-------------------------------|-----------------------|---------------|
| Bargarh        | 14.96                   | 1645.72                       | 0.15                  | 0.7           |
| Balangir       | 17.38                   | 1911.31                       | 0.17                  | 0.82          |
| Baleshwar      | 26.44                   | 2908.7                        | 0.26                  | 1.24          |
| Bhadrak        | 21.99                   | 2418.69                       | 0.22                  | 1.04          |
| Cuttack        | 115.1                   | 12660.48                      | 1.13                  | 5.42          |
| Dhenkanal      | 13.49                   | 1483.35                       | 0.13                  | 0.63          |
| Ganjam         | 62.91                   | 6919.68                       | 0.62                  | 2.96          |
| Jagatsinghapur | 13.95                   | 1534.1                        | 0.14                  | 0.66          |
| Jajapur        | 10.89                   | 1197.36                       | 0.11                  | 0.51          |
| Jharsuguda     | 31.99                   | 3518.85                       | 0.31                  | 1.51          |
| Kalahandi      | 12.31                   | 1354.46                       | 0.12                  | 0.58          |
| Kendujhar      | 22.89                   | 2517.71                       | 0.22                  | 1.08          |
| Khordha        | 197.54                  | 21729.29                      | 1.94                  | 9.3           |
| Koratput       | 27.05                   | 2975.42                       | 0.27                  | 1.27          |
| Mayurbhanj     | 21.86                   | 2404.57                       | 0.21                  | 1.03          |
| Puri           | 35.81                   | 3939.32                       | 0.35                  | 1.69          |
| Rayagada       | 12.77                   | 1404.7                        | 0.13                  | 0.6           |
| Sambalpur      | 33.28                   | 3661.09                       | 0.33                  | 1.57          |
| Sundargarh     | 108.05                  | 11885.01                      | 1.06                  | 5.09          |
| <b>Total</b>   | <b>800.63</b>           | <b>88069.80</b>               | <b>7.85</b>           | <b>37.69</b>  |

#### Union Territory – Puducherry

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Karaikal*     | 15.78                   | 1735.64                       | 0.15                  | 0.74          |
| Puducherry*   | 107.12                  | 11783.11                      | 1.05                  | 5.04          |
| Yanam*        | 11.42                   | 1256                          | 0.11                  | 0.54          |
| <b>Total</b>  | <b>134.32</b>           | <b>14774.75</b>               | <b>1.32</b>           | <b>6.32</b>   |

#### State – Punjab

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Amritsar      | 198.45                  | 21829.76                      | 1.95                  | 9.34          |
| Barnala*      | 26.52                   | 2917.56                       | 0.26                  | 1.25          |
| Bathinda      | 66.08                   | 7268.78                       | 0.65                  | 3.11          |
| Faridkot*     | 31.6                    | 3475.95                       | 0.31                  | 1.49          |
| Fatehgarh     | 25.35                   | 2789.03                       | 0.25                  | 1.19          |
| Firozpur      | 65.49                   | 7204.39                       | 0.64                  | 3.08          |
| Gurdaspur     | 68.48                   | 7532.65                       | 0.67                  | 3.22          |
| Hoshiarpur    | 30.12                   | 3312.8                        | 0.3                   | 1.42          |
| Jalandhar     | 155.48                  | 17103.04                      | 1.53                  | 7.32          |
| Kapurthala    | 37.76                   | 4153.17                       | 0.37                  | 1.78          |



| District Name              | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Ludhiana                   | 338.15                  | 37196.23                      | 3.32                  | 15.92         |
| Mansa                      | 14.65                   | 1611.76                       | 0.14                  | 0.69          |
| Moga                       | 26.41                   | 2904.98                       | 0.26                  | 1.24          |
| Muktsar*                   | 35.97                   | 3957.18                       | 0.35                  | 1.69          |
| Patiala*                   | 109.22                  | 12013.71                      | 1.07                  | 5.14          |
| Rupnagar                   | 10.23                   | 1125.71                       | 0.1                   | 0.48          |
| Sahibzada ajit singh nagar | 87.37                   | 9610.92                       | 0.86                  | 4.11          |
| Sangrur                    | 61.83                   | 6801.71                       | 0.61                  | 2.91          |
| Tarn taran*                | 11.88                   | 1306.66                       | 0.12                  | 0.56          |
| <b>Total</b>               | <b>1401.05</b>          | <b>154115.98</b>              | <b>13.74</b>          | <b>65.96</b>  |

#### State – Rajasthan

| District Name  | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------|-------------------------|-------------------------------|-----------------------|---------------|
| Ajmer*         | 155.51                  | 17106.47                      | 1.53                  | 7.32          |
| Alwar          | 86.49                   | 9513.81                       | 0.85                  | 4.07          |
| Banswara       | 18.58                   | 2044.33                       | 0.18                  | 0.87          |
| Baran          | 22.47                   | 2472.18                       | 0.22                  | 1.06          |
| Barmer*        | 30.88                   | 3396.44                       | 0.3                   | 1.45          |
| Bharatput      | 46.87                   | 5155.32                       | 0.46                  | 2.21          |
| Bhilwara       | 68.6                    | 7546.54                       | 0.67                  | 3.23          |
| Bikaner*       | 138.64                  | 15250                         | 1.36                  | 6.53          |
| Bundi          | 18.97                   | 2086.44                       | 0.19                  | 0.89          |
| Chittaurgarh   | 33.55                   | 3690.46                       | 0.33                  | 1.58          |
| Churu          | 78.3                    | 8613.15                       | 0.77                  | 3.69          |
| Dausa          | 16.59                   | 1825                          | 0.16                  | 0.78          |
| Dhaulpur       | 36.87                   | 4056.02                       | 0.36                  | 1.74          |
| Ganganagar     | 54.94                   | 6043.04                       | 0.54                  | 2.59          |
| Hanumangarh    | 28.66                   | 3152.68                       | 0.28                  | 1.35          |
| Jaipur*        | 602.48                  | 66272.51                      | 5.91                  | 28.36         |
| Jaisalmer*     | 12.27                   | 1349.2                        | 0.12                  | 0.58          |
| Jalor          | 9.95                    | 1094.25                       | 0.1                   | 0.47          |
| Jhalawar       | 12.38                   | 1361.97                       | 0.12                  | 0.58          |
| Jhunjhunun     | 33.06                   | 3637.11                       | 0.32                  | 1.56          |
| Jodhpur        | 192.94                  | 21222.97                      | 1.89                  | 9.08          |
| Karauli        | 34.7                    | 3817.29                       | 0.34                  | 1.63          |
| Kota           | 193.76                  | 21313.57                      | 1.9                   | 9.12          |
| Nagaur*        | 68.81                   | 7568.89                       | 0.67                  | 3.24          |
| Pali           | 43.81                   | 4819.57                       | 0.43                  | 2.06          |
| Rajsamand      | 12.94                   | 1423.3                        | 0.13                  | 0.61          |
| Sawai madhopur | 46.06                   | 5066.99                       | 0.45                  | 2.17          |
| Sikar          | 70.94                   | 7803.29                       | 0.7                   | 3.34          |
| Sirohi         | 9.6                     | 1056.45                       | 0.09                  | 0.45          |
| Tonk           | 29.83                   | 3281.63                       | 0.29                  | 1.4           |
| Udaipur        | 80.29                   | 8831.65                       | 0.79                  | 3.78          |
| <b>Total</b>   | <b>2289.75</b>          | <b>251872.52</b>              | <b>22.46</b>          | <b>107.80</b> |

**State – Sikkim**

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| East district | 21.19                   | 2331.23                       | 0.21                  | 1.00          |
| <b>Total</b>  | <b>21.19</b>            | <b>2331.23</b>                | <b>0.21</b>           | <b>1.00</b>   |

**State – Tamil Nadu**

| District Name   | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------|-------------------------|-------------------------------|-----------------------|---------------|
| Chennai*        | 768.84                  | 84572.67                      | 7.54                  | 36.2          |
| Coimbatore      | 269.27                  | 29619.21                      | 2.64                  | 12.68         |
| Cuddalore       | 77.82                   | 8559.79                       | 0.76                  | 3.66          |
| Dharmapuri      | 11.23                   | 1235.52                       | 0.11                  | 0.53          |
| Dindigul        | 44.59                   | 4905.28                       | 0.44                  | 2.1           |
| Erode           | 75.33                   | 8286.59                       | 0.74                  | 3.55          |
| Kancheepuram    | 219.1                   | 24100.98                      | 2.15                  | 10.32         |
| Kanyakumari     | 36.48                   | 4012.95                       | 0.36                  | 1.72          |
| Karur           | 35.21                   | 3872.86                       | 0.35                  | 1.66          |
| Krishnagiri*    | 35.77                   | 3934.89                       | 0.35                  | 1.68          |
| Madurai         | 213.45                  | 23479.32                      | 2.09                  | 10.05         |
| Mayiladuthurai  | 30.15                   | 3316.26                       | 0.3                   | 1.42          |
| Namakkal        | 46.45                   | 5109.46                       | 0.46                  | 2.19          |
| Pudukkottai     | 19.35                   | 2128.66                       | 0.19                  | 0.91          |
| Ramanathapuram  | 26.12                   | 2873.59                       | 0.26                  | 1.23          |
| Salem           | 169.27                  | 18619.36                      | 1.66                  | 7.97          |
| Sivaganga       | 26.86                   | 2954.11                       | 0.26                  | 1.26          |
| Thanjavur       | 69.54                   | 7649.44                       | 0.68                  | 3.27          |
| The nilgiris    | 13.75                   | 1512.76                       | 0.13                  | 0.65          |
| Theni           | 39.84                   | 4381.96                       | 0.39                  | 1.88          |
| Thiruvallur*    | 314.37                  | 34580.65                      | 3.08                  | 14.8          |
| Thiruvarur      | 20.31                   | 2233.87                       | 0.2                   | 0.96          |
| Thoothukkudi*   | 54.24                   | 5966.79                       | 0.53                  | 2.55          |
| Tiruchirappalli | 142.26                  | 15648.75                      | 1.4                   | 6.7           |
| Tirunelveli     | 127.03                  | 13973.47                      | 1.25                  | 5.98          |
| Tiruppur        | 165.15                  | 18166.98                      | 1.62                  | 7.78          |
| Tiruvannamalai  | 35.41                   | 3894.82                       | 0.35                  | 1.67          |
| Vellore*        | 140.19                  | 15420.73                      | 1.38                  | 6.6           |
| Viluppuram      | 36.67                   | 4033.62                       | 0.36                  | 1.73          |
| Virudhunagar*   | 79.26                   | 8718.33                       | 0.78                  | 3.73          |
| <b>Total</b>    | <b>3343.31</b>          | <b>367763.65</b>              | <b>32.79</b>          | <b>157.40</b> |

**State – Telangana**

| District Name         | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------------|-------------------------|-------------------------------|-----------------------|---------------|
| ADILABAD DISTRICT     | 21.56                   | 2371.90                       | 0.21                  | 1.02          |
| BHADRADRI KOTHAGUDEM* | 36.08                   | 3968.96                       | 0.35                  | 1.70          |
| HYDERABAD             | 799.14                  | 87904.95                      | 7.84                  | 37.62         |

| District Name                | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------------------------|-------------------------|-------------------------------|-----------------------|---------------|
| JAGTIAL*                     | 41.71                   | 4587.72                       | 0.41                  | 1.96          |
| JANGAON*                     | 9.48                    | 1042.92                       | 0.09                  | 0.45          |
| JOGULAMBA GADWAL*            | 11.33                   | 1246.02                       | 0.11                  | 0.53          |
| KAMAREDDY*                   | 15.25                   | 1677.94                       | 0.15                  | 0.72          |
| KARIMNAGAR DISTRICT          | 57.42                   | 6316.64                       | 0.56                  | 2.70          |
| KHAMMAM DISTRICT             | 35.30                   | 3883.19                       | 0.35                  | 1.66          |
| KUMURAM BHEEM ASIFABAD*      | 8.91                    | 979.81                        | 0.09                  | 0.42          |
| MAHBUBNAGAR DISTRICT         | 35.47                   | 3901.86                       | 0.35                  | 1.67          |
| MANCHERIAL*                  | 34.66                   | 3812.99                       | 0.34                  | 1.63          |
| MEDCHAL-MALKAJGIRI DISTRICT* | 28.29                   | 3111.69                       | 0.28                  | 1.33          |
| NALGONDA*                    | 49.85                   | 5483.38                       | 0.49                  | 2.35          |
| NIRMAL*                      | 26.95                   | 2964.16                       | 0.26                  | 1.27          |
| NIZAMABAD*                   | 80.69                   | 8875.87                       | 0.79                  | 3.80          |
| PEDDAPALLI*                  | 48.54                   | 5339.03                       | 0.48                  | 2.29          |
| RAJANNA SIRCILLA*            | 15.45                   | 1699.99                       | 0.15                  | 0.73          |
| SANGAREDDY*                  | 27.15                   | 2986.15                       | 0.27                  | 1.28          |
| SIDDIPET*                    | 11.55                   | 1270.86                       | 0.11                  | 0.54          |
| SURYAPET*                    | 33.50                   | 3684.91                       | 0.33                  | 1.58          |
| VIKARABAD*                   | 21.66                   | 2382.61                       | 0.21                  | 1.02          |
| WANAPARTHY*                  | 11.22                   | 1234.32                       | 0.11                  | 0.53          |
| WARANGAL*                    | 128.95                  | 14184.70                      | 1.26                  | 6.07          |
| YADADRI BHUVANAGIRI*         | 9.24                    | 1016.06                       | 0.09                  | 0.43          |
| <b>Total</b>                 | <b>1599.35</b>          | <b>175928.70</b>              | <b>15.69</b>          | <b>75.30</b>  |

**State – Tripura**

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|--------------------------|-----------------------|---------------|
| West Tripura  | 82.02                   | 9022.27                  | 0.80                  | 3.86          |
| <b>Total</b>  | <b>82.02</b>            | <b>9022.27</b>           | <b>0.80</b>           | <b>3.86</b>   |

**State – Uttar Pradesh**

| District Name  | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------|-------------------------|-------------------------------|-----------------------|---------------|
| Agra           | 293.52                  | 32286.86                      | 2.88                  | 13.82         |
| Aligarh        | 171.54                  | 18869.39                      | 1.68                  | 8.08          |
| Allahabad      | 203.88                  | 22426.72                      | 2                     | 9.6           |
| Ambedkar nagar | 40.71                   | 4477.58                       | 0.4                   | 1.92          |
| Auraiya        | 16.29                   | 1792.41                       | 0.16                  | 0.77          |
| Azamgarh       | 32.52                   | 3577.38                       | 0.32                  | 1.53          |
| Baghpat        | 28.62                   | 3148.29                       | 0.28                  | 1.35          |
| Bahraich       | 32.59                   | 3584.8                        | 0.32                  | 1.53          |
| Ballia         | 17.82                   | 1959.7                        | 0.17                  | 0.84          |
| Balrampur      | 14.28                   | 1571.19                       | 0.14                  | 0.67          |
| Banda          | 29.1                    | 3201.2                        | 0.29                  | 1.37          |
| Barabanki      | 13.95                   | 1534.14                       | 0.14                  | 0.66          |
| Bareilly*      | 199.47                  | 21941.19                      | 1.96                  | 9.39          |
| Basti          | 19.68                   | 2165.17                       | 0.19                  | 0.93          |
| Bijnor         | 103.1                   | 11340.78                      | 1.01                  | 4.85          |

| District Name                | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Budaun                       | 50                      | 5499.8                        | 0.49                  | 2.35          |
| Bulandshahar*                | 98.3                    | 10812.81                      | 0.96                  | 4.63          |
| Chandauli                    | 22.18                   | 2439.27                       | 0.22                  | 1.04          |
| Chitrakoot                   | 10.42                   | 1146.04                       | 0.1                   | 0.49          |
| Deoria                       | 23.83                   | 2620.89                       | 0.23                  | 1.12          |
| Etah                         | 21.67                   | 2383.7                        | 0.21                  | 1.02          |
| Etawah                       | 46.57                   | 5122.86                       | 0.46                  | 2.19          |
| Faizabad                     | 37.37                   | 4110.86                       | 0.37                  | 1.76          |
| Farrukhabad                  | 49.14                   | 5405.85                       | 0.48                  | 2.31          |
| Fatehpur                     | 35.73                   | 3930.37                       | 0.35                  | 1.68          |
| Firozabad                    | 146.49                  | 16113.68                      | 1.44                  | 6.9           |
| Gautam buddha nagar          | 167.54                  | 18428.88                      | 1.64                  | 7.89          |
| Ghaziabad                    | 613.62                  | 67498.65                      | 6.02                  | 28.89         |
| Ghazipur                     | 21.46                   | 2360.97                       | 0.21                  | 1.01          |
| Gonda                        | 19.2                    | 2111.68                       | 0.19                  | 0.9           |
| Gorakhpur                    | 120.4                   | 13244.5                       | 1.18                  | 5.67          |
| Hamirpur                     | 11.62                   | 1277.91                       | 0.11                  | 0.55          |
| Hardoi*                      | 62.52                   | 6877.57                       | 0.61                  | 2.94          |
| Jalaun                       | 64.72                   | 7119.15                       | 0.63                  | 3.05          |
| Jaunpur                      | 31.07                   | 3417.26                       | 0.3                   | 1.46          |
| Jhansi                       | 101.58                  | 11173.31                      | 1                     | 4.78          |
| Jyotiba phule nagar          | 56.24                   | 6186.34                       | 0.55                  | 2.65          |
| Kannauj                      | 26.7                    | 2937.32                       | 0.26                  | 1.26          |
| Kanpur                       | 498.21                  | 54802.76                      | 4.89                  | 23.46         |
| Kasganj *                    | 17.31                   | 1904.63                       | 0.17                  | 0.82          |
| Lakhimpur Kheri              | 38.84                   | 4271.94                       | 0.38                  | 1.83          |
| Lalitpur                     | 24.82                   | 2730.32                       | 0.24                  | 1.17          |
| Lucknow                      | 537.97                  | 59176.39                      | 5.28                  | 25.33         |
| Mahamaya nagar               | 24.08                   | 2649.18                       | 0.24                  | 1.13          |
| Mahoba                       | 17.41                   | 1915.11                       | 0.17                  | 0.82          |
| Mainpuri                     | 24.98                   | 2748.18                       | 0.25                  | 1.18          |
| Mathura*                     | 84.29                   | 9271.66                       | 0.83                  | 3.97          |
| Mau                          | 53.39                   | 5872.6                        | 0.52                  | 2.51          |
| Meerut                       | 288.58                  | 31743.25                      | 2.83                  | 13.59         |
| Mirzapur                     | 40.63                   | 4468.87                       | 0.4                   | 1.91          |
| Moradabad                    | 224.36                  | 24679.52                      | 2.2                   | 10.56         |
| Muzaffarnagar                | 130.49                  | 14353.63                      | 1.28                  | 6.14          |
| Pilibhit                     | 34.91                   | 3839.68                       | 0.34                  | 1.64          |
| Pratapgarh                   | 13.24                   | 1456.91                       | 0.13                  | 0.62          |
| Rae bareli                   | 36.28                   | 3991.05                       | 0.36                  | 1.71          |
| Rampur                       | 55.27                   | 6080.12                       | 0.54                  | 2.6           |
| Saharanpur                   | 158.14                  | 17395.72                      | 1.55                  | 7.45          |
| Sant ravidas nagar (bhadohi) | 17.92                   | 1971.6                        | 0.18                  | 0.84          |
| Shahjahanpur                 | 67.92                   | 7471.52                       | 0.67                  | 3.2           |
| Sitapur                      | 62.17                   | 6838.56                       | 0.61                  | 2.93          |
| Sultanpur                    | 19.51                   | 2146.44                       | 0.19                  | 0.92          |

| District Name | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|-------------------------|-------------------------------|-----------------------|---------------|
| Unnao         | 49.2                    | 5412.49                       | 0.48                  | 2.32          |
| Varanasi      | 203.32                  | 22365.07                      | 1.99                  | 9.57          |
| <b>Total</b>  | <b>5778.67</b>          | <b>635653.68</b>              | <b>56.68</b>          | <b>272.06</b> |

#### State – Uttarakhand

| District Name     | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Dehradun          | 127.09                  | 13979.74                      | 1.25                  | 5.98          |
| Hardwar           | 73.55                   | 8090.97                       | 0.72                  | 3.46          |
| Nainital          | 47.7                    | 5247.43                       | 0.47                  | 2.25          |
| Pithoragarh       | 10.78                   | 1185.5                        | 0.11                  | 0.51          |
| Udham Singh Nagar | 60.23                   | 6625.35                       | 0.59                  | 2.84          |
| <b>Total</b>      | <b>319.35</b>           | <b>35128.98</b>               | <b>3.13</b>           | <b>15.04</b>  |

#### State – West Bengal

| District Name      | Sewage Generation (MLD) | Biogas (m <sup>3</sup> ) /day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------|-------------------------|-------------------------------|-----------------------|---------------|
| Bankura            | 33.88                   | 3,726.49                      | 0.33                  | 1.59          |
| Paschim Barddhaman | 403.17                  | 44,348.84                     | 3.95                  | 18.98         |
| Birbhum            | 36.04                   | 3,964.26                      | 0.35                  | 1.7           |
| Dakshin dinajpur   | 36.46                   | 4,010.72                      | 0.36                  | 1.72          |
| Darjiling          | 70.53                   | 7,758.60                      | 0.69                  | 3.32          |
| Haora              | 303.37                  | 33,370.83                     | 2.98                  | 14.28         |
| Hugli              | 252.72                  | 27,798.90                     | 2.48                  | 11.9          |
| Jalpaiguri         | 108.8                   | 11,968.05                     | 1.07                  | 5.12          |
| Koch bihar         | 12.39                   | 1,362.60                      | 0.12                  | 0.58          |
| Kolkata            | 687.48                  | 75,622.67                     | 6.74                  | 32.37         |
| Malda              | 56.32                   | 6,195.30                      | 0.55                  | 2.65          |
| Murshidabad        | 87.32                   | 9,604.89                      | 0.86                  | 4.11          |
| Nadia              | 141.15                  | 15,525.97                     | 1.38                  | 6.65          |
| North 24 parganas  | 870.98                  | 95,807.50                     | 8.54                  | 41.01         |
| Paschim Medinipur  | 97.84                   | 10,762.03                     | 0.96                  | 4.61          |
| Purba Medinipur    | 86.41                   | 9,505.13                      | 0.85                  | 4.07          |
| Puruliya           | 20.55                   | 2,260.63                      | 0.2                   | 0.97          |
| South 24 parganas  | 196.33                  | 21,596.00                     | 1.93                  | 9.24          |
| Uttar Dinajpur     | 53.93                   | 5,931.93                      | 0.53                  | 2.54          |
| <b>Total</b>       | <b>3555.65</b>          | <b>391121.37</b>              | <b>34.87</b>          | <b>167.40</b> |

Urban Solid Waste sector- State and district wise energy production

**Assumptions:**

- CPHEEO Manual and CPCB report indicated that the per capita solid waste production rate lies between
  - 200-300 gm/capita/day - Population < 200,000
  - 300–350 gm/capita/day - Population between 200,000 – 500,000
  - 350–400 gm/capita/day - Population between 500,000 – 1,000,000
  - 400–600 gm/capita/day - Population > 1 million
- Urban Organic Solid Waste 51.44% is considered of total solid waste generated
- Biogas potential has been assumed considering 120 m<sup>3</sup> of biogas / TPD of Organic Solid Waste

**State – Assam**

| District            | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Baksa               | 4.46                             | 2.30                | 1,00,594.87                  | 0.02                  | 0.12          |
| Barpeta             | 66.32                            | 34.11               | 14,94,182.63                 | 0.37                  | 1.75          |
| Bongaigaon          | 45.28                            | 23.29               | 10,20,281.96                 | 0.25                  | 1.20          |
| Cachar              | 123.59                           | 63.57               | 27,84,545.69                 | 0.68                  | 3.27          |
| Chirang             | 14.71                            | 7.57                | 3,31,441.14                  | 0.08                  | 0.39          |
| Darrang             | 24.15                            | 12.42               | 5,44,203.43                  | 0.13                  | 0.64          |
| Dhemaji             | 20.70                            | 10.65               | 4,66,277.04                  | 0.11                  | 0.55          |
| Dhubri              | 81.38                            | 41.86               | 18,33,648.27                 | 0.45                  | 2.15          |
| Dibrugarh           | 97.78                            | 50.30               | 22,03,145.40                 | 0.54                  | 2.58          |
| Dima Hasao District | 28.36                            | 14.59               | 6,38,876.08                  | 0.16                  | 0.75          |
| Goalpara            | 53.57                            | 27.56               | 12,06,998.11                 | 0.29                  | 1.42          |
| Golaghat            | 41.65                            | 21.42               | 9,38,348.16                  | 0.23                  | 1.10          |
| Hailakandi          | 21.32                            | 10.97               | 4,80,379.00                  | 0.12                  | 0.56          |
| Jorhat              | 68.16                            | 35.06               | 15,35,715.82                 | 0.38                  | 1.80          |
| Kamrup              | 49.60                            | 25.51               | 11,17,477.84                 | 0.27                  | 1.31          |
| Kamrup Metropolitan | 458.47                           | 235.83              | 1,03,29,555.78               | 2.52                  | 12.11         |
| Karbi Anglong       | 51.39                            | 26.43               | 11,57,802.70                 | 0.28                  | 1.36          |
| Karimganj           | 44.07                            | 22.67               | 9,92,974.04                  | 0.24                  | 1.16          |
| Kokrajhar           | 23.10                            | 11.88               | 5,20,370.43                  | 0.13                  | 0.61          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Lakhimpur    | 41.44                            | 21.32               | 9,33,765.18                  | 0.23                  | 1.09          |
| Marigaon     | 27.77                            | 14.28               | 6,25,602.39                  | 0.15                  | 0.73          |
| Nagaon       | 150.99                           | 77.67               | 34,01,972.36                 | 0.83                  | 3.99          |
| Nalbari      | 31.10                            | 16.00               | 7,00,724.07                  | 0.17                  | 0.82          |
| Sibsagar     | 47.03                            | 24.19               | 10,59,515.18                 | 0.26                  | 1.24          |
| Sonitpur     | 66.95                            | 34.44               | 15,08,504.76                 | 0.37                  | 1.77          |
| Tinsukia     | 100.84                           | 51.87               | 22,72,025.34                 | 0.56                  | 2.66          |
| Udalguri     | 15.74                            | 8.09                | 3,54,544.43                  | 0.09                  | 0.42          |
| <b>Total</b> | <b>1,799.92</b>                  | <b>925.88</b>       | <b>4,05,53,472.11</b>        | <b>9.91</b>           | <b>47.55</b>  |

**State – Andhra Pradesh**

| District                    | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Anantapur                   | 567.83                           | 292.09              | 12,793,547                   | 3.13                  | 15.00         |
| Chittoor                    | 717.10                           | 368.88              | 16,156,811                   | 3.95                  | 18.95         |
| East Godavari               | 578.44                           | 297.55              | 13,032,708                   | 3.18                  | 15.28         |
| Guntur                      | 800.53                           | 411.79              | 18,036,551                   | 4.41                  | 21.15         |
| Kadapa                      | 388.62                           | 199.91              | 8,755,937                    | 2.14                  | 10.27         |
| Krishna                     | 845.13                           | 434.74              | 19,041,465                   | 4.65                  | 22.33         |
| Kurnool                     | 538.03                           | 276.76              | 12,122,188                   | 2.96                  | 14.21         |
| Prakasam                    | 311.36                           | 160.16              | 7,015,079                    | 1.71                  | 8.23          |
| Sri Potti Sriramulu Nellore | 434.94                           | 223.73              | 9,799,467                    | 2.39                  | 11.49         |
| Srikakulam                  | 186.00                           | 95.68               | 4,190,674                    | 1.02                  | 4.91          |
| Visakhapatnam               | 1,097.21                         | 564.41              | 24,720,987                   | 6.04                  | 28.99         |
| Vizianagaram                | 243.89                           | 125.46              | 5,495,052                    | 1.34                  | 6.44          |
| West godavari               | 384.99                           | 198.04              | 8,674,156                    | 2.12                  | 10.17         |
| <b>Total</b>                | <b>7,094.08</b>                  | <b>3,649.19</b>     | <b>159,834,622</b>           | <b>39.05</b>          | <b>187.42</b> |

**Union Territory – Andaman & Nicobar**

| District               | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|------------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| North & Middle Andaman | 0.74                             | 0.38                | 16,582                       | 0.004                 | 0.02          |
| South Andaman          | 157.66                           | 81.10               | 3,552,195                    | 0.87                  | 4.17          |
| <b>Total</b>           | <b>158.40</b>                    | <b>81.48</b>        | <b>35,68,777</b>             | <b>0.87</b>           | <b>4.18</b>   |

**State – Arunachal Pradesh**

| District            | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Anjaw               | 0.35                             | 0.18                | 7,901                        | 0.002                 | 0.01          |
| Changlang           | 16.82                            | 8.65                | 378,969                      | 0.09                  | 0.44          |
| Dibang valley       | 6.46                             | 3.33                | 145,645                      | 0.04                  | 0.17          |
| East kameng         | 5.28                             | 2.72                | 119,005                      | 0.03                  | 0.14          |
| East siang          | 18.84                            | 9.69                | 424,537                      | 0.10                  | 0.50          |
| Kurung kumey        | 7.87                             | 4.05                | 177,234                      | 0.04                  | 0.21          |
| Lohit               | 24.28                            | 12.49               | 547,092                      | 0.13                  | 0.64          |
| Lower dibang valley | 7.73                             | 3.98                | 174,148                      | 0.04                  | 0.2           |
| Lower subansiri     | 4.22                             | 2.17                | 95,131                       | 0.02                  | 0.11          |
| Papum pare          | 99.67                            | 51.27               | 2,245,722                    | 0.55                  | 2.63          |
| Tawang              | 12.93                            | 6.65                | 291,395                      | 0.07                  | 0.34          |
| Tirap               | 37.91                            | 19.5                | 854,038                      | 0.21                  | 1.00          |
| Upper siang         | 4.35                             | 2.24                | 97,945                       | 0.02                  | 0.11          |
| Upper subansiri     | 9.39                             | 4.83                | 211,465                      | 0.05                  | 0.25          |
| West kameng         | 10.54                            | 5.42                | 237,377                      | 0.06                  | 0.28          |
| West siang          | 16.15                            | 8.31                | 363,945                      | 0.09                  | 0.43          |
| <b>Total</b>        | <b>282.79</b>                    | <b>145.47</b>       | <b>6,371,549</b>             | <b>1.56</b>           | <b>7.47</b>   |

**State – Bihar**

| District   | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Araria     | 37.42                            | 19.25               | 843,085                      | 0.21                  | 0.99          |
| Arwal      | 18.39                            | 9.46                | 414,275                      | 0.10                  | 0.49          |
| Aurangabad | 60.48                            | 31.11               | 1,362,745                    | 0.33                  | 1.60          |
| Banka      | 18.55                            | 9.54                | 417,909                      | 0.10                  | 0.49          |
| Begusarai  | 238.19                           | 122.53              | 5,366,672                    | 1.31                  | 6.29          |
| Bhagalpur  | 291.34                           | 149.86              | 6,564,071                    | 1.60                  | 7.70          |
| Bhojpur    | 160.34                           | 82.48               | 3,612,627                    | 0.88                  | 4.24          |
| Buxar      | 60.32                            | 31.03               | 1,359,111                    | 0.33                  | 1.59          |
| Darbhanga  | 182.9                            | 94.09               | 4,120,941                    | 1.01                  | 4.83          |
| Gaya       | 341.36                           | 175.6               | 7,691,188                    | 1.88                  | 9.02          |
| Gopalganj  | 43.85                            | 22.56               | 987,965                      | 0.24                  | 1.16          |
| Jahanabad  | 48.96                            | 25.19               | 1,103,213                    | 0.27                  | 1.29          |
| Jamui      | 45.81                            | 23.56               | 1,032,052                    | 0.25                  | 1.21          |



District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District          | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Kaimur(bhabua)    | 26.70                            | 13.73               | 601,498                      | 0.15                  | 0.71          |
| Katihar           | 92.97                            | 47.83               | 2,094,761                    | 0.51                  | 2.46          |
| Khagariya         | 33.37                            | 17.16               | 751,799                      | 0.18                  | 0.88          |
| Kishanganj        | 60.69                            | 31.22               | 1,367,411                    | 0.33                  | 1.60          |
| Lakhisarai        | 23.06                            | 11.86               | 519,660                      | 0.13                  | 0.61          |
| Madhepura         | 15.48                            | 7.96                | 348,863                      | 0.09                  | 0.41          |
| Madhubani         | 42.28                            | 21.75               | 952,613                      | 0.23                  | 1.12          |
| Munger            | 161.29                           | 82.97               | 3,633,987                    | 0.89                  | 4.26          |
| Muzaffarpur       | 206.77                           | 106.36              | 4,658,771                    | 1.14                  | 5.46          |
| Nalanda           | 222.28                           | 114.34              | 5,008,128                    | 1.22                  | 5.87          |
| Nawada            | 58.47                            | 30.08               | 1,317,466                    | 0.32                  | 1.54          |
| Paschim champaran | 122.19                           | 62.86               | 2,753,109                    | 0.67                  | 3.23          |
| Patna             | 1215.77                          | 625.39              | 27,392,268                   | 6.69                  | 32.12         |
| Purnia            | 56.79                            | 29.21               | 1,279,411                    | 0.31                  | 1.50          |
| Purvi champaran   | 148.8                            | 76.54               | 3,352,593                    | 0.82                  | 3.93          |
| Rohtas            | 475.8                            | 244.75              | 10,720,204                   | 2.62                  | 12.57         |
| Saharsa           | 21.81                            | 11.22               | 491,315                      | 0.12                  | 0.58          |
| Samastipur        | 61.61                            | 31.69               | 1,388,183                    | 0.34                  | 1.63          |
| Saran             | 130.96                           | 67.37               | 2,950,710                    | 0.72                  | 3.46          |
| Sheikhpura        | 63.41                            | 32.62               | 1,428,738                    | 0.35                  | 1.68          |
| Sheohar           | 9.68                             | 4.98                | 218,039                      | 0.05                  | 0.26          |
| Sitamarhi         | 44.19                            | 22.73               | 995,712                      | 0.24                  | 1.17          |
| Siwan             | 81.48                            | 41.92               | 1,835,890                    | 0.45                  | 2.15          |
| Supaul            | 22.61                            | 11.63               | 509,427                      | 0.12                  | 0.60          |
| Vaishali          | 126.81                           | 65.23               | 2,857,048                    | 0.70                  | 3.35          |
| <b>Total</b>      | <b>5073.23</b>                   | <b>2,609.67</b>     | <b>114,303,459</b>           | <b>27.92</b>          | <b>134.03</b> |

**Union Territory – Chandigarh**

| District   | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Chandigarh | 515.97                           | 265.41              | 11,625,109                   | 2.84                  | 13.63         |

**State – Chhattisgarh**

| District                 | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Balod                    | 29                               | 15.06               | 6,59,603                     | 0.16                  | 0.77          |
| Baloda Bazar             | 32                               | 16.37               | 7,16,854                     | 0.18                  | 0.84          |
| Balrampur                | 5                                | 2.65                | 1,16,237                     | 0.03                  | 0.14          |
| Bastar                   | 44                               | 22.77               | 9,97,376                     | 0.24                  | 1.17          |
| Bemetra                  | 15                               | 7.57                | 3,31,588                     | 0.08                  | 0.39          |
| Bijapur                  | 10                               | 5.2                 | 227,572                      | 0.06                  | 0.27          |
| Bilaspur                 | 228                              | 117.54              | 51,48,100                    | 1.26                  | 6.04          |
| Dakshin Bastar Dantewada | 27                               | 13.87               | 6,07,708                     | 0.15                  | 0.71          |
| Dhamtari                 | 46                               | 23.49               | 1,028,797                    | 0.25                  | 1.21          |
| Durg                     | 476                              | 244.96              | 1,07,29,330                  | 2.62                  | 12.58         |
| Janjgir - Champa         | 70                               | 35.99               | 1,576,325                    | 0.39                  | 1.85          |
| Jashpur                  | 25                               | 12.66               | 554,594                      | 0.14                  | 0.65          |
| Kabeerdham               | 29                               | 14.7                | 643,837                      | 0.16                  | 0.75          |
| Kpndagaon                | 16                               | 8.38                | 3,66,947                     | 0.09                  | 0.43          |
| Korba                    | 222                              | 114.25              | 5,004,048                    | 1.22                  | 5.87          |
| Koriya                   | 63                               | 32.22               | 1,411,252                    | 0.34                  | 1.65          |
| Mahasamund               | 37                               | 18.86               | 826,206                      | 0.20                  | 0.97          |
| Mungeli                  | 15                               | 7.89                | 3,45,584                     | 0.08                  | 0.41          |
| Narayanpur               | 8                                | 3.88                | 169,956                      | 0.04                  | 0.20          |
| Raigarh                  | 76                               | 39.06               | 1,710,782                    | 0.42                  | 2.01          |
| Raipur                   | 793                              | 407.95              | 1,78,68,095                  | 4.37                  | 20.95         |
| Rajnandgaon              | 82                               | 42.22               | 1,849,219                    | 0.45                  | 2.17          |
| Sukma                    | 5                                | 2.44                | 1,07,067                     | 0.03                  | 0.13          |
| Surajpur                 | 13                               | 6.83                | 2,99,083                     | 0.07                  | 0.35          |
| Surguja                  | 62                               | 31.69               | 13,87,990                    | 0.34                  | 1.63          |
| Uttar Bastar Kanker *    | 25                               | 12.91               | 565,369                      | 0.14                  | 0.66          |
| <b>Total</b>             | <b>2,452</b>                     | <b>1,261</b>        | <b>55,249,519</b>            | <b>13.50</b>          | <b>64.79</b>  |

#### Union Territory – Daman & Diu

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Diu          | 17                               | 8.74                | 383,022                      | 0.09                  | 0.45          |
| Daman        | 75.74                            | 38.96               | 1,706,389                    | 0.42                  | 2.00          |
| <b>Total</b> | <b>92.74</b>                     | <b>47.70</b>        | <b>2,089,411</b>             | <b>0.51</b>           | <b>2.45</b>   |

#### Union Territory – Delhi

| District           | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| DMC (u) (m corp.)* | 6,790.11                         | 3,492.83            | 152,986,099                  | 37.37                 | 179.39        |
| East               | 554.71                           | 285.35              | 12,498,112                   | 3.05                  | 14.66         |
| N.DMC. (m cl)*     | 79.77                            | 41.03               | 1,797,200                    | 0.44                  | 2.11          |
| North              | 159.03                           | 81.81               | 3,583,075                    | 0.88                  | 4.20          |
| North west         | 784.57                           | 403.58              | 17,676,987                   | 4.32                  | 20.73         |
| North-east         | 611.31                           | 314.46              | 13,773,187                   | 3.36                  | 16.15         |
| South              | 410.21                           | 211.01              | 9,242,299                    | 2.26                  | 10.84         |
| South-west         | 200.53                           | 103.15              | 4,518,074                    | 1.10                  | 5.30          |
| <b>Total</b>       | <b>9,590.24</b>                  | <b>4,933.22</b>     | <b>216,075,033</b>           | <b>52.79</b>          | <b>253.37</b> |

#### Union Territory – Dadra & Nagar Haveli

| District             | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Dadra & Nagar Haveli | 93.85                            | 48.28               | 2,114,547                    | 0.52                  | 2.48          |

#### State – Gujarat

| District  | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Ahmadabad | 4729                             | 2432.73             | 106,553,692                  | 26.03                 | 124.95        |
| Amreli    | 100                              | 51.28               | 2,246,048                    | 0.55                  | 2.63          |
| Anand     | 199                              | 102.26              | 4,479,089                    | 1.09                  | 5.25          |
| Aravalli  | 25                               | 13.33               | 5,83,965                     | 0.14                  | 0.68          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District       | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Banas Kantha   | 108                              | 55.76               | 2,442,088                    | 0.60                  | 2.86          |
| Bharuch        | 210                              | 108.24              | 4,741,121                    | 1.16                  | 5.56          |
| Bhavnagar      | 363                              | 186.78              | 81,80,955                    | 2.00                  | 9.59          |
| Botad          | 50                               | 25.92               | 11,35,256                    | 0.28                  | 1.33          |
| Chhota Udaipur | 9                                | 5.02                | 2,19,894                     | 0.05                  | 0.26          |
| Dohad          | 51                               | 26.25               | 1,149,877                    | 0.28                  | 1.35          |
| Dwarka         | 49                               | 25.30               | 11,08,351                    | 0.27                  | 1.30          |
| Gandhinagar    | 201                              | 103.34              | 4,526,148                    | 1.11                  | 5.31          |
| Gir Somnath    | 110                              | 57.06               | 24,99,112                    | 0.61                  | 2.93          |
| Jamnagar       | 390                              | 200.84              | 87,96,707                    | 2.15                  | 10.32         |
| Junagadh       | 250                              | 129.00              | 56,50,357                    | 1.38                  | 6.63          |
| Kachchh        | 159                              | 81.90               | 3,587,351                    | 0.88                  | 4.21          |
| Kheda          | 173                              | 89.00               | 3,898,086                    | 0.95                  | 4.57          |
| Mahesana       | 117                              | 60.01               | 2,628,607                    | 0.64                  | 3.08          |
| Mahisagar      | 16                               | 8.35                | 3,65,722                     | 0.09                  | 0.43          |
| Morbi          | 103                              | 53.33               | 23,35,999                    | 0.57                  | 2.74          |
| Narmada        | 20                               | 10.23               | 448,289                      | 0.11                  | 0.53          |
| Navsari        | 84                               | 43.28               | 1,895,538                    | 0.46                  | 2.22          |
| Panch Mahals   | 92                               | 47.16               | 20,65,522                    | 0.50                  | 2.42          |
| Patan          | 92                               | 47.32               | 2,072,658                    | 0.51                  | 2.43          |
| Porbandar      | 81                               | 41.71               | 1,827,093                    | 0.45                  | 2.14          |
| Rajkot         | 797                              | 410.26              | 1,79,69,346                  | 4.39                  | 21.07         |
| Sabar Kantha   | 85                               | 44.10               | 19,31,762                    | 0.47                  | 2.27          |
| Surat          | 2291                             | 1178.58             | 51,621,979                   | 12.61                 | 60.53         |
| Surendranagar  | 134                              | 69.16               | 3,029,135                    | 0.74                  | 3.55          |
| Tapi           | 20                               | 10.39               | 455,184                      | 0.11                  | 0.53          |
| The Dangs      | 8                                | 4.29                | 187,831                      | 0.05                  | 0.22          |
| Vadodara       | 972                              | 500.09              | 2,19,04,038                  | 5.35                  | 25.68         |
| Valsad         | 159                              | 81.58               | 3,573,004                    | 0.87                  | 4.19          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| <b>Total</b> | <b>12255</b>                     | <b>6303.88</b>      | <b>276,109,805</b>           | <b>67.45</b>          | <b>323.77</b> |

**State – Goa**

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| North Goa*   | 145.53                           | 74.86               | 3,278,826                    | 0.80                  | 3.84          |
| South Goa*   | 124.41                           | 64.00               | 2,803,131                    | 0.68                  | 3.29          |
| <b>Total</b> | <b>269.94</b>                    | <b>138.86</b>       | <b>6,081,957</b>             | <b>1.49</b>           | <b>7.13</b>   |

**State – Haryana**

| District       | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Ambala*        | 167                              | 85.90               | 3,762,305                    | 0.92                  | 4.41          |
| Bhiwani*       | 96                               | 49.36               | 21,61,804                    | 0.53                  | 2.53          |
| Charkhi Dadri* | 17                               | 8.82                | 3,86,377                     | 0.09                  | 0.45          |
| Faridabad*     | 1034                             | 532.10              | 23,306,149                   | 5.69                  | 27.33         |
| Fatehabad*     | 56                               | 28.90               | 1,265,662                    | 0.31                  | 1.48          |
| Gurgaon*       | 749                              | 385.1               | 16,867,384                   | 4.12                  | 19.78         |
| Hisar*         | 201                              | 103.22              | 4,521,227                    | 1.10                  | 5.30          |
| Jhajjar*       | 97                               | 49.70               | 2,176,935                    | 0.53                  | 2.55          |
| Jind*          | 112                              | 57.76               | 2,529,836                    | 0.62                  | 2.97          |
| Kaithal*       | 74                               | 38.03               | 1,665,804                    | 0.41                  | 1.95          |
| Karnal*        | 169                              | 87.04               | 3,812,211                    | 0.93                  | 4.47          |
| Kurukshetra*   | 104                              | 53.47               | 2,342,104                    | 0.57                  | 2.75          |
| Mahendragarh*  | 40                               | 20.35               | 891,455                      | 0.22                  | 1.05          |
| Mewat*         | 41                               | 21.3                | 933,018                      | 0.23                  | 1.09          |
| Palwal*        | 75.28                            | 38.72               | 1,696,011                    | 0.41                  | 1.99          |
| Panchkula*     | 125                              | 64.13               | 2,808,921                    | 0.69                  | 3.29          |
| Panipat*       | 207                              | 106.73              | 4,674,729                    | 1.14                  | 5.48          |
| Rewari*        | 76                               | 38.88               | 1,703,103                    | 0.42                  | 2.00          |
| Rohtak*        | 172                              | 88.49               | 3,876,063                    | 0.95                  | 4.55          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Sirsa*       | 112                              | 57.78               | 2,530,807                    | 0.62                  | 2.97          |
| Sonipat*     | 175                              | 89.97               | 3,940,559                    | 0.96                  | 4.62          |
| Yamunanagar* | 166                              | 85.2                | 3,731,749                    | 0.91                  | 4.38          |
| <b>Total</b> | <b>4,065</b>                     | <b>2,091</b>        | <b>91,584,211</b>            | <b>22.37</b>          | <b>107.39</b> |

**State – Himachal Pradesh**

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Bilaspur     | 8.77                             | 4.51                | 197,536                      | 0.05                  | 0.23          |
| Chamba       | 8.37                             | 4.31                | 188,582                      | 0.05                  | 0.22          |
| Hamirpur     | 9.75                             | 5.02                | 219,682                      | 0.05                  | 0.26          |
| Kangra       | 55.87                            | 28.74               | 1,258,825                    | 0.31                  | 1.48          |
| Kullu        | 45.96                            | 23.64               | 1,035,566                    | 0.25                  | 1.21          |
| Mandi        | 41.79                            | 21.5                | 941,528                      | 0.23                  | 1.1           |
| Shimla       | 108.11                           | 55.61               | 2,435,715                    | 0.6                   | 2.86          |
| Sirmaur      | 19.38                            | 9.97                | 436,692                      | 0.11                  | 0.51          |
| Solan        | 55                               | 28.1                | 1,230,890                    | 0.3                   | 1.44          |
| Una          | 21.21                            | 10.91               | 477,945                      | 0.12                  | 0.56          |
| <b>Total</b> | <b>373.84</b>                    | <b>192.31</b>       | <b>8,422,960</b>             | <b>2.06</b>           | <b>9.88</b>   |

**Union Territory – Jammu & Kashmir**

| District             | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Anantnag             | 67.01                            | 34.47               | 1,509,763                    | 0.37                  | 1.77          |
| Anantnag (m cl + og) | 68.59                            | 35.28               | 1,545,289                    | 0.38                  | 1.81          |
| Badgam               | 38.33                            | 19.72               | 863,659                      | 0.21                  | 1.01          |
| Bandipore            | 19.19                            | 9.87                | 432,338                      | 0.11                  | 0.51          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District                | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Baramula                | 77.23                            | 39.73               | 1,739,973                    | 0.43                  | 2.04          |
| Doda                    | 13.63                            | 7.01                | 307,044                      | 0.08                  | 0.36          |
| Ganderbal               | 22.96                            | 11.81               | 517,291                      | 0.13                  | 0.61          |
| Jammu                   | 517.78                           | 266.34              | 11,665,854                   | 2.85                  | 13.68         |
| Kathua                  | 45.28                            | 23.29               | 1,020,259                    | 0.25                  | 1.2           |
| Kishtwar                | 6.06                             | 3.12                | 136,646                      | 0.03                  | 0.16          |
| Kulgam                  | 40.24                            | 20.7                | 906,721                      | 0.22                  | 1.06          |
| Kupwara                 | 32.47                            | 16.7                | 731,628                      | 0.18                  | 0.86          |
| Pulwama                 | 22.02                            | 11.33               | 496,098                      | 0.12                  | 0.58          |
| Punch                   | 12.89                            | 6.63                | 290,502                      | 0.07                  | 0.34          |
| Rajauri                 | 17.72                            | 9.11                | 399,186                      | 0.1                   | 0.47          |
| Ramban                  | 5.05                             | 2.6                 | 113,706                      | 0.03                  | 0.13          |
| Reasi                   | 34.49                            | 17.74               | 776,999                      | 0.19                  | 0.91          |
| Samba                   | 35.43                            | 18.23               | 798,283                      | 0.2                   | 0.94          |
| Shupiyan                | 28.92                            | 14.88               | 651,649                      | 0.16                  | 0.76          |
| Srinagar                | 7.02                             | 3.61                | 158,264                      | 0.04                  | 0.19          |
| Srinagar (M Corp. + og) | 460.99                           | 237.13              | 10,386,448                   | 2.54                  | 12.18         |
| Udhampur                | 34.23                            | 17.61               | 771,309                      | 0.19                  | 0.9           |
| <b>Total</b>            | <b>1607.53</b>                   | <b>826.92</b>       | <b>36,218,910</b>            | <b>8.85</b>           | <b>42.47</b>  |

State – Jharkhand

| District | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Bokaro*  | 387                              | 199.01              | 8,716,704                    | 2.13                  | 10.22         |
| Chatra*  | 20                               | 10.09               | 441,979                      | 0.11                  | 0.52          |
| Deoghar* | 105                              | 54.26               | 2,376,542                    | 0.58                  | 2.79          |
| Dhanbad* | 1035                             | 532.32              | 23,315,726                   | 5.7                   | 27.34         |
| Dumka*   | 27                               | 13.98               | 612,131                      | 0.15                  | 0.72          |
| Garhwa*  | 25                               | 13.05               | 571,439                      | 0.14                  | 0.67          |
| Giridih* | 61                               | 31.42               | 1,376,114                    | 0.34                  | 1.61          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District             | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Godda*               | 21                               | 10.79               | 472,766                      | 0.12                  | 0.55          |
| Gumla*               | 21                               | 10.57               | 462,766                      | 0.11                  | 0.54          |
| Hazaribagh*          | 84                               | 43.36               | 1,899,184                    | 0.46                  | 2.23          |
| Jamtara*             | 24                               | 12.38               | 542,271                      | 0.13                  | 0.64          |
| Khunti*              | 14                               | 7.05                | 308,605                      | 0.08                  | 0.36          |
| Kodarma*             | 44                               | 22.7                | 994,074                      | 0.24                  | 1.17          |
| Latehar*             | 16                               | 8.24                | 360,713                      | 0.09                  | 0.42          |
| Lohardaga*           | 18                               | 9.19                | 402,507                      | 0.1                   | 0.47          |
| Pakaur*              | 21                               | 10.97               | 480,513                      | 0.12                  | 0.56          |
| Palamu*              | 92                               | 47.12               | 2,063,711                    | 0.5                   | 2.42          |
| Pashchimi singhbhum* | 61                               | 31.51               | 1,379,966                    | 0.34                  | 1.62          |
| Purbi singhbhum*     | 505                              | 259.62              | 11,371,454                   | 2.78                  | 13.33         |
| Ramgarh*             | 123                              | 63.28               | 2,771,516                    | 0.68                  | 3.25          |
| Ranchi*              | 738                              | 379.67              | 16,629,760                   | 4.06                  | 19.5          |
| Sahibganj*           | 48                               | 24.84               | 1,088,190                    | 0.27                  | 1.28          |
| Saraikela-kharswana* | 106                              | 54.62               | 2,392,285                    | 0.58                  | 2.81          |
| Simdega*             | 13                               | 6.77                | 296,471                      | 0.07                  | 0.35          |
| <b>Total</b>         | <b>3,610</b>                     | <b>1,857</b>        | <b>81,327,386</b>            | <b>19.87</b>          | <b>95.36</b>  |

State – Karnataka

| District        | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Bagalkot        | 176.23                           | 90.65               | 3,970,508                    | 0.97                  | 4.66          |
| Bangalore       | 5863.1                           | 3015.98             | 132,099,764                  | 32.27                 | 154.9         |
| Bangalore rural | 83.93                            | 43.17               | 1,890,991                    | 0.46                  | 2.22          |
| Belgaum         | 427.69                           | 220                 | 9,636,151                    | 2.35                  | 11.3          |
| Bellary         | 229.03                           | 117.81              | 51,60,144                    | 1.26                  | 6.05          |
| Bidar           | 153.77                           | 79.1                | 3,464,609                    | 0.85                  | 4.06          |
| Bijapur         | 184.85                           | 95.09               | 4,164,772                    | 1.02                  | 4.88          |
| Chamarajanagar  | 51.34                            | 26.41               | 1,156,666                    | 0.28                  | 1.36          |



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| District         | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Chikkaballapura  | 85.57                            | 44.02               | 1,927,881                    | 0.47                  | 2.26          |
| Chikmagalur      | 69.45                            | 35.73               | 1,564,823                    | 0.38                  | 1.83          |
| Chitradurga      | 100.53                           | 51.71               | 2,265,106                    | 0.55                  | 2.66          |
| Dakshina kannada | 377.4                            | 194.13              | 8,503,065                    | 2.08                  | 9.97          |
| Davanagere       | 261.88                           | 134.71              | 5,900,411                    | 1.44                  | 6.92          |
| Dharwad          | 636.92                           | 327.63              | 14,350,351                   | 3.51                  | 16.83         |
| Gadag            | 107.64                           | 55.37               | 2,425,155                    | 0.59                  | 2.84          |
| Gulbarga         | 345.81                           | 177.89              | 7,791,383                    | 1.90                  | 9.14          |
| Hassan           | 114.34                           | 58.82               | 2,576,199                    | 0.63                  | 3.02          |
| Haveri           | 103.6                            | 53.29               | 2,334,123                    | 0.57                  | 2.74          |
| Kodagu           | 22.99                            | 11.83               | 517,957                      | 0.13                  | 0.61          |
| Kolar            | 149.39                           | 76.84               | 3,365,802                    | 0.82                  | 3.95          |
| Koppal           | 69.38                            | 35.69               | 1,563,169                    | 0.38                  | 1.83          |
| Mandya           | 88.42                            | 45.48               | 1,992,199                    | 0.49                  | 2.34          |
| Mysore           | 570.16                           | 293.29              | 12,846,204                   | 3.14                  | 15.06         |
| Raichur          | 171.77                           | 88.36               | 3,869,996                    | 0.95                  | 4.54          |
| Ramanagara       | 80.15                            | 41.23               | 1,805,895                    | 0.44                  | 2.12          |
| Shimoga          | 211.36                           | 108.72              | 4,762,071                    | 1.16                  | 5.58          |
| Tumkur           | 214.33                           | 110.25              | 4,829,002                    | 1.18                  | 5.66          |
| Udupi            | 102.65                           | 52.8                | 2,312,839                    | 0.57                  | 2.71          |
| Uttara kannada   | 123.08                           | 63.31               | 2,773,009                    | 0.68                  | 3.25          |
| Vijaynagar       | 104.40                           | 53.70               | 23,52,181                    | 0.57                  | 2.76          |
| Yadgir           | 66.94                            | 34.44               | 1,508,257                    | 0.37                  | 1.77          |
| <b>Total</b>     | <b>11,348.09</b>                 | <b>5,837.46</b>     | <b>255,680,684</b>           | <b>62.46</b>          | <b>299.81</b> |

**State – Kerala**

| District  | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Alappuzha | 455.19                           | 234.15              | 10,255,798                   | 2.51                  | 12.03         |
| Ernakulam | 907.5                            | 466.82              | 20,446,708                   | 4.99                  | 23.98         |

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| District           | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Idukki             | 22.43                            | 11.54               | 505,334                      | 0.12                  | 0.59          |
| Kannur             | 596.48                           | 306.83              | 13,439,233                   | 3.28                  | 15.76         |
| Kasaragod          | 160.99                           | 82.81               | 3,627,272                    | 0.89                  | 4.25          |
| Kollam             | 635.5                            | 326.9               | 14,318,273                   | 3.5                   | 16.79         |
| Kottayam           | 244.32                           | 125.68              | 5,504,710                    | 1.34                  | 6.45          |
| Kozhikode          | 876.33                           | 450.79              | 19,744,411                   | 4.82                  | 23.15         |
| Malappuram         | 751.84                           | 386.75              | 16,939,563                   | 4.14                  | 19.86         |
| Palakkad           | 305.61                           | 157.21              | 6,885,719                    | 1.68                  | 8.07          |
| Pathanamthitta     | 79.41                            | 40.85               | 1,789,088                    | 0.44                  | 2.1           |
| Thiruvananthapuram | 835.68                           | 429.87              | 18,828,363                   | 4.6                   | 22.08         |
| Thrissur           | 839.18                           | 431.67              | 18,907,232                   | 4.62                  | 22.17         |
| Wayanad            | 15.54                            | 7.99                | 350,089                      | 0.09                  | 0.41          |
| <b>Total</b>       | <b>6,726.01</b>                  | <b>3,459.86</b>     | <b>151,541,793</b>           | <b>37.02</b>          | <b>177.70</b> |

State – Madhya Pradesh

| District   | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Agar Malwa | 31.65                            | 16.28               | 7,12,985                     | 0.17                  | 0.84          |
| Alirajpur  | 17.09                            | 8.79                | 385,028                      | 0.09                  | 0.45          |
| Amlai (ct) | 5.32                             | 2.73                | 119,772                      | 0.03                  | 0.14          |
| Anuppur    | 60.94                            | 31.35               | 1,373,097                    | 0.34                  | 1.61          |
| Ashoknagar | 51.29                            | 26.38               | 1,155,609                    | 0.28                  | 1.36          |
| Balaghat   | 75.88                            | 39.03               | 1,709,534                    | 0.42                  | 2.00          |
| Barwani    | 66.6                             | 34.26               | 1,500,435                    | 0.37                  | 1.76          |
| Betul      | 102.83                           | 52.9                | 2,316,832                    | 0.57                  | 2.72          |
| Bhind      | 146.92                           | 75.58               | 3,310,269                    | 0.81                  | 3.88          |
| Bhopal     | 1059.03                          | 544.77              | 23,860,791                   | 5.83                  | 27.98         |
| Burhanpur  | 86.99                            | 44.75               | 1,960,027                    | 0.48                  | 2.3           |
| Chhatarpur | 125.56                           | 64.59               | 2,829,033                    | 0.69                  | 3.32          |
| Chhindwara | 159.81                           | 82.21               | 3,600,682                    | 0.88                  | 4.22          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District              | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Damoh                 | 75.47                            | 38.82               | 1,700,425                    | 0.42                  | 1.99          |
| Datia                 | 59.68                            | 30.7                | 1,344,534                    | 0.33                  | 1.58          |
| Dewas                 | 155.56                           | 80.02               | 3,504,920                    | 0.86                  | 4.11          |
| Dhar                  | 141.57                           | 72.82               | 3,189,707                    | 0.78                  | 3.74          |
| Dindori               | 9.85                             | 5.07                | 221,903                      | 0.05                  | 0.26          |
| Guna                  | 169.62                           | 87.25               | 3,821,578                    | 0.93                  | 4.48          |
| Gwalior               | 569.52                           | 292.96              | 12,831,746                   | 3.13                  | 15.05         |
| Harda                 | 39.59                            | 20.36               | 891,893                      | 0.22                  | 1.05          |
| Hoshangabad           | 132.06                           | 67.93               | 2,975,436                    | 0.73                  | 3.49          |
| Indore                | 1215.56                          | 625.28              | 27,387,405                   | 6.69                  | 32.11         |
| Jabalpur              | 739.06                           | 380.17              | 16,651,638                   | 4.07                  | 19.53         |
| Jhabua                | 27.42                            | 14.10               | 617,753                      | 0.15                  | 0.72          |
| Katni                 | 90.52                            | 46.57               | 2,039,568                    | 0.5                   | 2.39          |
| Khandwa (east nimar)  | 88.47                            | 45.51               | 1,993,220                    | 0.49                  | 2.34          |
| Khargone (west nimar) | 95.98                            | 49.37               | 2,162,497                    | 0.53                  | 2.54          |
| Mandla                | 42.85                            | 22.04               | 965,508                      | 0.24                  | 1.13          |
| Mandsaur              | 91.58                            | 47.11               | 2,063,405                    | 0.50                  | 2.42          |
| Morena                | 166.36                           | 85.58               | 3,748,200                    | 0.92                  | 4.40          |
| Narsimhapur           | 67.39                            | 34.67               | 1,518,435                    | 0.37                  | 1.78          |
| Neemuch               | 74.56                            | 38.35               | 1,679,917                    | 0.41                  | 1.97          |
| Panna                 | 37.91                            | 19.5                | 854,046                      | 0.21                  | 1.00          |
| Raisen                | 95.81                            | 49.28               | 2,158,664                    | 0.53                  | 2.53          |
| Rajgarh               | 86.13                            | 44.30               | 1,940,530                    | 0.47                  | 2.28          |
| Ratlam                | 146.36                           | 75.29               | 3,297,679                    | 0.81                  | 3.87          |
| Rewa                  | 134.2                            | 69.03               | 3,023,723                    | 0.74                  | 3.55          |
| Sagar                 | 234.37                           | 120.56              | 5,280,453                    | 1.29                  | 6.19          |
| Satna                 | 160.39                           | 82.5                | 3,613,636                    | 0.88                  | 4.24          |
| Sehore                | 83.13                            | 42.76               | 1,872,890                    | 0.46                  | 2.2           |
| Seoni                 | 55.56                            | 28.58               | 1,251,766                    | 0.31                  | 1.47          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Shahdol      | 63.8                             | 32.82               | 1,437,418                    | 0.35                  | 1.69          |
| Shajapur     | 59.31                            | 30.51               | 13,36,261                    | 0.33                  | 1.57          |
| Sheopur      | 44.5                             | 22.89               | 1,002,545                    | 0.24                  | 1.18          |
| Shivpuri     | 99.06                            | 50.96               | 2,231,863                    | 0.55                  | 2.62          |
| Sidhi        | 32.73                            | 16.83               | 737,369                      | 0.18                  | 0.86          |
| Singrauli    | 87.79                            | 45.16               | 1,977,937                    | 0.48                  | 2.32          |
| Tikamgarh    | 76.43                            | 39.32               | 1,722,114                    | 0.42                  | 2.02          |
| Ujjain       | 313.25                           | 161.13              | 7,057,699                    | 1.72                  | 8.28          |
| Umaria       | 33.2                             | 17.08               | 747,920                      | 0.18                  | 0.88          |
| Vidisha      | 119.1                            | 61.26               | 2,683,364                    | 0.66                  | 3.15          |
| <b>Total</b> | <b>8,005.59</b>                  | <b>4,118.07</b>     | <b>180,371,658</b>           | <b>44.06</b>          | <b>211.50</b> |

**State – Maharashtra**

| District   | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Ahmadnagar | 280.25                           | 144.16              | 6,314,299                    | 1.54                  | 7.4           |
| Akola      | 215.62                           | 110.92              | 4,858,134                    | 1.19                  | 5.7           |
| Amravati   | 315.19                           | 162.13              | 7,101,411                    | 1.73                  | 8.33          |
| Aurangabad | 555.82                           | 285.92              | 12,523,084                   | 3.06                  | 14.68         |
| Bhandara   | 69.46                            | 35.73               | 1,565,034                    | 0.38                  | 1.84          |
| Bid        | 159.24                           | 81.91               | 3,587,682                    | 0.88                  | 4.21          |
| Buldana    | 163.79                           | 84.25               | 3,690,224                    | 0.9                   | 4.33          |
| Chandrapur | 245.41                           | 126.24              | 5,529,319                    | 1.35                  | 6.48          |
| Dhule      | 175.01                           | 90.03               | 3,943,192                    | 0.96                  | 4.62          |
| Gadchiroli | 38.44                            | 19.77               | 866,107                      | 0.21                  | 1.02          |
| Gondiya    | 67.14                            | 34.54               | 1,512,805                    | 0.37                  | 1.77          |
| Hingoli    | 54.69                            | 28.13               | 1,232,245                    | 0.3                   | 1.44          |
| Jalgaon    | 410.58                           | 211.2               | 9,250,762                    | 2.26                  | 10.85         |
| Jalna      | 117.78                           | 60.59               | 2,653,765                    | 0.65                  | 3.11          |
| Kolhapur   | 369.35                           | 189.99              | 8,321,777                    | 2.03                  | 9.76          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District                 | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Latur                    | 204.22                           | 105.05              | 4,601,261                    | 1.12                  | 5.4           |
| Mumbai & mumbai suburban | 3,633.94                         | 1,869.30            | 81,875,368                   | 20                    | 96.01         |
| Nagpur                   | 973.17                           | 500.6               | 21,926,272                   | 5.36                  | 25.71         |
| Nanded                   | 292.29                           | 150.35              | 6,585,399                    | 1.61                  | 7.72          |
| Nandurbar                | 83.47                            | 42.94               | 1,880,722                    | 0.46                  | 2.21          |
| Nashik                   | 868.69                           | 446.86              | 19,572,266                   | 4.78                  | 22.95         |
| Osmanabad                | 86.82                            | 44.66               | 1,956,178                    | 0.48                  | 2.29          |
| Palghar                  | 541.23                           | 278.41              | 12,194,304                   | 2.98                  | 14.30         |
| Parbhani                 | 180.18                           | 92.68               | 4,059,572                    | 0.99                  | 4.76          |
| Pune                     | 1,958.38                         | 1,007.39            | 44,123,821                   | 10.78                 | 51.74         |
| Raigarh                  | 328.98                           | 169.23              | 7,412,155                    | 1.81                  | 8.69          |
| Ratnagiri                | 80.31                            | 41.31               | 1,809,471                    | 0.44                  | 2.12          |
| Sangli                   | 215.65                           | 110.93              | 4,858,790                    | 1.19                  | 5.7           |
| Satara                   | 174.14                           | 89.58               | 3,923,531                    | 0.96                  | 4.6           |
| Sindhudurg               | 29.53                            | 15.19               | 665,271                      | 0.16                  | 0.78          |
| Solapur                  | 413.44                           | 212.67              | 9,315,154                    | 2.28                  | 10.92         |
| Thane                    | 2570.42                          | 1322.22             | 57,913,313                   | 14.15                 | 67.91         |
| Wardha                   | 124.08                           | 63.82               | 2,795,526                    | 0.68                  | 3.28          |
| Washim                   | 63.77                            | 32.81               | 1,436,864                    | 0.35                  | 1.68          |
| Yavatmal                 | 181.42                           | 93.32               | 4,087,577                    | 1.00                  | 4.79          |
| <b>Total</b>             | <b>16,241.94</b>                 | <b>8,354.86</b>     | <b>365,942,655</b>           | <b>89.40</b>          | <b>429.11</b> |

**Union Territory – Ladakh**

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Leh (ladakh) | 12                               | 6.05                | 264,813                      | 0.06                  | 0.31          |
| Kargil       | 3                                | 1.78                | 78,089                       | 0.02                  | 0.09          |
| <b>Total</b> | <b>15</b>                        | <b>7.83</b>         | <b>342,902</b>               | <b>0.08</b>           | <b>0.40</b>   |

**State – Manipur**

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District      | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Bishnupur     | 41.72                            | 21.46               | 940,027                      | 0.23                  | 1.1           |
| Chandel       | 5.17                             | 2.66                | 116,591                      | 0.03                  | 0.14          |
| Churachandpur | 6.23                             | 3.2                 | 140,375                      | 0.03                  | 0.16          |
| Imphal East   | 60.32                            | 31.03               | 1,359,002                    | 0.33                  | 1.59          |
| Imphal West   | 211.82                           | 108.96              | 4,772,404                    | 1.17                  | 5.6           |
| Senapati      | 2.54                             | 1.31                | 57,168                       | 0.01                  | 0.07          |
| Tamenglong    | 6.57                             | 3.38                | 148,067                      | 0.04                  | 0.17          |
| Thoubal       | 73.71                            | 37.92               | 1,660,714                    | 0.41                  | 1.95          |
| Ukhrul        | 9.23                             | 4.75                | 207,897                      | 0.05                  | 0.24          |
| <b>TOTAL</b>  | <b>417.31</b>                    | <b>214.66</b>       | <b>9,402,246</b>             | <b>2.30</b>           | <b>11.03</b>  |

**State – Meghalaya**

| District          | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| East garo hills   | 15                               | 7.62                | 333,839                      | 0.08                  | 0.39          |
| East khasi hills* | 111                              | 57.23               | 2,506,825                    | 0.61                  | 2.94          |
| Jaintia hills*    | 9                                | 4.48                | 196,046                      | 0.05                  | 0.23          |
| Ri bhoi*          | 8                                | 4.31                | 188,618                      | 0.05                  | 0.22          |
| South garo hills  | 4                                | 2.24                | 97,927                       | 0.02                  | 0.11          |
| West garo hills   | 24                               | 12.41               | 543,442                      | 0.13                  | 0.64          |
| West khasi hills* | 15                               | 7.88                | 345,279                      | 0.08                  | 0.4           |
| <b>Total</b>      | <b>187</b>                       | <b>96.16</b>        | <b>4,211,976</b>             | <b>1.03</b>           | <b>4.94</b>   |

**State – Mizoram**

| District   | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Aizawl*    | 31                               | 15.78               | 691,242                      | 0.17                  | 0.81          |
| Champhai*  | 30                               | 15.2                | 665,783                      | 0.16                  | 0.78          |
| Kolasib*   | 29                               | 14.69               | 643,252                      | 0.16                  | 0.75          |
| Lawngtlai* | 13                               | 6.52                | 285,690                      | 0.07                  | 0.34          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Lunglei*     | 57                               | 29.4                | 1,287,856                    | 0.31                  | 1.51          |
| Mamit*       | 9                                | 4.67                | 204,354                      | 0.05                  | 0.24          |
| Saiha*       | 8.39                             | 4.32                | 189,004                      | 0.05                  | 0.22          |
| Serchhip*    | 19                               | 10.03               | 439,124                      | 0.11                  | 0.51          |
| <b>Total</b> | <b>195.57</b>                    | <b>100.60</b>       | <b>4,406,304</b>             | <b>1.08</b>           | <b>5.17</b>   |

**State – Nagaland**

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Dimapur*     | 70                               | 36.26               | 1,588,142                    | 0.39                  | 1.86          |
| Kiphire*     | 6                                | 3.06                | 133,971                      | 0.03                  | 0.16          |
| Kohima*      | 40                               | 20.59               | 901,951                      | 0.22                  | 1.06          |
| Longleng*    | 3                                | 1.41                | 61,862                       | 0.02                  | 0.07          |
| Mokokchung*  | 18                               | 9.05                | 396,585                      | 0.1                   | 0.47          |
| Mon*         | 12                               | 6.13                | 268,560                      | 0.07                  | 0.31          |
| Peren*       | 5                                | 2.56                | 112,055                      | 0.03                  | 0.13          |
| Phek*        | 8                                | 4.26                | 186,581                      | 0.05                  | 0.22          |
| Tuensang*    | 12                               | 6.15                | 269,192                      | 0.07                  | 0.32          |
| Wokha*       | 12                               | 6.05                | 265,208                      | 0.06                  | 0.31          |
| Zunheboto*   | 9                                | 4.63                | 202,683                      | 0.05                  | 0.24          |
| <b>Total</b> | <b>194.70</b>                    | <b>100.16</b>       | <b>4,386,792</b>             | <b>1.07</b>           | <b>5.14</b>   |

**State – Odisha**

| District  | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Anugul    | 68.16                            | 35.06               | 1,535,754                    | 0.38                  | 1.8           |
| Balangir  | 99.56                            | 51.22               | 2,243,219                    | 0.55                  | 2.63          |
| Baleshwar | 77.96                            | 40.11               | 1,756,600                    | 0.43                  | 2.06          |
| Bargarh   | 47.11                            | 24.24               | 1,061,509                    | 0.26                  | 1.24          |
| Baudh     | 6.77                             | 3.48                | 152,640                      | 0.04                  | 0.18          |
| Bhadrak   | 56.05                            | 28.83               | 1,262,796                    | 0.31                  | 1.48          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District       | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Cuttack        | 214.35                           | 110.26              | 4,829,446                    | 1.18                  | 5.66          |
| Debagarh       | 6.58                             | 3.38                | 148,219                      | 0.04                  | 0.17          |
| Dhenkanal      | 39.92                            | 20.54               | 899,487                      | 0.22                  | 1.05          |
| Gajapati       | 21.11                            | 10.86               | 475,734                      | 0.12                  | 0.56          |
| Ganjam         | 269.46                           | 138.61              | 6,071,081                    | 1.48                  | 7.12          |
| Jagatsinghapur | 39.75                            | 20.45               | 895,551                      | 0.22                  | 1.05          |
| Jajapur        | 43.05                            | 22.14               | 969,875                      | 0.24                  | 1.14          |
| Jharsuguda     | 71.96                            | 37.01               | 1,621,212                    | 0.4                   | 1.9           |
| Kalahandi      | 62.42                            | 32.11               | 1,406,419                    | 0.34                  | 1.65          |
| Kandhamal      | 23.63                            | 12.15               | 532,355                      | 0.13                  | 0.62          |
| Kendrapara     | 27.93                            | 14.37               | 629,283                      | 0.15                  | 0.74          |
| Kendujhar      | 80.59                            | 41.46               | 1,815,752                    | 0.44                  | 2.13          |
| Khordha        | 694.39                           | 357.19              | 15,644,995                   | 3.82                  | 18.35         |
| Koraput        | 53.45                            | 27.5                | 1,204,326                    | 0.29                  | 1.41          |
| Malkangiri     | 25.27                            | 13                  | 569,396                      | 0.14                  | 0.67          |
| Mayurbhanj     | 59.65                            | 30.69               | 1,344,012                    | 0.33                  | 1.58          |
| Nabarangapur   | 42.5                             | 21.86               | 957,594                      | 0.23                  | 1.12          |
| Nayagarh       | 26.75                            | 13.76               | 602,682                      | 0.15                  | 0.71          |
| Nuapada        | 16.58                            | 8.53                | 373,650                      | 0.09                  | 0.44          |
| Puri           | 88.83                            | 45.7                | 2,001,465                    | 0.49                  | 2.35          |
| Rayagada       | 68.92                            | 35.45               | 1,552,823                    | 0.38                  | 1.82          |
| Sambalpur      | 109.71                           | 56.43               | 2,471,809                    | 0.6                   | 2.9           |
| Subarnapur     | 16.84                            | 8.66                | 379,366                      | 0.09                  | 0.44          |
| Sundargarh     | 248.95                           | 128.06              | 5,608,947                    | 1.37                  | 6.58          |
| <b>Total</b>   | <b>2,708.21</b>                  | <b>1,393.10</b>     | <b>61,017,997</b>            | <b>14.91</b>          | <b>71.55</b>  |

**Union Territory – Puducherry**

| District    | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Karaikal*   | 30.72                            | 15.8                | 692,160                      | 0.17                  | 0.81          |
| Mahe*       | 13.65                            | 7.02                | 307,466                      | 0.08                  | 0.36          |
| Puducherry* | 279.88                           | 143.97              | 6,305,898                    | 1.54                  | 7.39          |



District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Yanam*       | 19.29                            | 9.92                | 434,560                      | 0.11                  | 0.51          |
| <b>Total</b> | <b>343.53</b>                    | <b>176.71</b>       | <b>7,740,083</b>             | <b>1.89</b>           | <b>9.08</b>   |

**State – Punjab**

| District                    | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Amritsar*                   | 726.17                           | 373.54              | 16,361,236                   | 4                     | 19.19         |
| Barnala*                    | 66.57                            | 34.24               | 1,499,902                    | 0.37                  | 1.76          |
| Bathinda*                   | 206.59                           | 106.27              | 4,654,596                    | 1.14                  | 5.46          |
| Faridkot*                   | 63.84                            | 32.84               | 1,438,303                    | 0.35                  | 1.69          |
| Fatehgarh Sahib*            | 55.85                            | 28.73               | 1,258,443                    | 0.31                  | 1.48          |
| Fazilka*                    | 79.20                            | 40.74               | 17,84,484                    | 0.44                  | 2.09          |
| Ferozpur*                   | 84.02                            | 43.22               | 18,92,960                    | 0.46                  | 2.22          |
| Gurdaspur*                  | 140.53                           | 72.29               | 31,66,167                    | 0.77                  | 3.71          |
| Hoshiarpur*                 | 114.27                           | 58.78               | 2,574,642                    | 0.63                  | 3.02          |
| Jalandhar*                  | 610.18                           | 313.88              | 13,747,820                   | 3.36                  | 16.12         |
| Kapurthala*                 | 94.08                            | 48.39               | 2,119,607                    | 0.52                  | 2.49          |
| Ludhiana*                   | 1,169.38                         | 601.53              | 26,347,035                   | 6.44                  | 30.89         |
| Mansa*                      | 48.93                            | 25.17               | 1,102,341                    | 0.27                  | 1.29          |
| Moga*                       | 64.15                            | 33                  | 1,445,440                    | 0.35                  | 1.69          |
| Muktsar*                    | 76.72                            | 39.47               | 1,728,620                    | 0.42                  | 2.03          |
| Pathankot*                  | 55.11                            | 28.35               | 12,41,778                    | 0.30                  | 1.46          |
| Patiala*                    | 252.41                           | 129.84              | 5,686,959                    | 1.39                  | 6.67          |
| Rupnagar*                   | 50.73                            | 26.1                | 1,143,001                    | 0.28                  | 1.34          |
| Sahibzada Ajit Singh Nagar* | 232.68                           | 119.69              | 5,242,514                    | 1.28                  | 6.15          |
| Sangrur*                    | 154.15                           | 79.29               | 3,473,064                    | 0.85                  | 4.07          |
| Shahid Bhagat Singh Nagar*  | 37.57                            | 19.33               | 846,441                      | 0.21                  | 0.99          |
| Tarn Taran*                 | 41.22                            | 21.2                | 928,722                      | 0.23                  | 1.09          |
| <b>Total</b>                | <b>4,424.36</b>                  | <b>2,275.89</b>     | <b>99,684,074</b>            | <b>24.35</b>          | <b>116.89</b> |

**State – Rajasthan**

| District      | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Ajmer*        | 382.40                           | 196.71              | 8,615,751                    | 2.1                   | 10.1          |
| Alwar*        | 247.92                           | 127.53              | 5,585,917                    | 1.36                  | 6.55          |
| Banswara*     | 39.16                            | 20.15               | 882,380                      | 0.22                  | 1.03          |
| Baran*        | 80.32                            | 41.32               | 1,809,776                    | 0.44                  | 2.12          |
| Barmer*       | 55.61                            | 28.61               | 1,252,951                    | 0.31                  | 1.47          |
| Bharatpur*    | 174.95                           | 90.00               | 3,941,831                    | 0.96                  | 4.62          |
| Bhilwara*     | 195.85                           | 100.74              | 4,412,623                    | 1.08                  | 5.17          |
| Bikaner*      | 344.98                           | 177.46              | 7,772,641                    | 1.9                   | 9.11          |
| Bundi*        | 67.25                            | 34.60               | 1,515,280                    | 0.37                  | 1.78          |
| Chittaurgarh* | 88.30                            | 45.42               | 1,989,478                    | 0.49                  | 2.33          |
| Churu*        | 170.40                           | 87.66               | 3,839,306                    | 0.94                  | 4.5           |
| Dausa*        | 65.14                            | 33.51               | 1,467,751                    | 0.36                  | 1.72          |
| Dhaulpur*     | 78.06                            | 40.16               | 1,758,808                    | 0.43                  | 2.06          |
| Dungarpur*    | 25.99                            | 13.37               | 585,534                      | 0.14                  | 0.69          |
| Ganganagar*   | 181.68                           | 93.46               | 4,093,397                    | 1                     | 4.8           |
| Hanumangarh*  | 108.13                           | 55.62               | 2,436,260                    | 0.6                   | 2.86          |
| Jaipur*       | 2,129.15                         | 1,095.24            | 47,971,316                   | 11.72                 | 56.25         |
| Jaisalmer*    | 27.94                            | 14.37               | 629,423                      | 0.15                  | 0.74          |
| Jalor*        | 47.12                            | 24.24               | 1,061,559                    | 0.26                  | 1.24          |
| Jhalawar*     | 71.26                            | 36.66               | 1,605,632                    | 0.39                  | 1.88          |
| Jhunjhunun*   | 145.29                           | 74.74               | 3,273,420                    | 0.8                   | 3.84          |
| Jodhpur*      | 729.57                           | 375.29              | 16,437,814                   | 4.02                  | 19.28         |
| Karauli*      | 67.41                            | 34.68               | 1,518,864                    | 0.37                  | 1.78          |
| Kota*         | 709.23                           | 364.83              | 15,979,399                   | 3.9                   | 18.74         |
| Nagaur*       | 197.36                           | 101.52              | 4,446,708                    | 1.09                  | 5.21          |
| Pali*         | 164.53                           | 84.64               | 3,707,021                    | 0.91                  | 4.35          |
| Pratapgarh*   | 21.12                            | 10.86               | 475,771                      | 0.12                  | 0.56          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District        | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Rajsamand*      | 56.26                            | 28.94               | 1,267,657                    | 0.31                  | 1.49          |
| Sawai madhopur* | 86.07                            | 44.28               | 1,939,308                    | 0.47                  | 2.27          |
| Sikar*          | 216.03                           | 111.12              | 4,867,244                    | 1.19                  | 5.71          |
| Sirohi*         | 61.75                            | 31.76               | 1,391,185                    | 0.34                  | 1.63          |
| Tonk*           | 112.22                           | 57.72               | 2,528,295                    | 0.62                  | 2.96          |
| Udaipur*        | 250.91                           | 129.07              | 5,653,249                    | 1.38                  | 6.63          |
| <b>Total</b>    | <b>7,399.39</b>                  | <b>3,806.25</b>     | <b>166,713,547.96</b>        | <b>40.73</b>          | <b>195.49</b> |

State – Tamil Nadu

| District        | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Ariyalur*       | 24.41                            | 12.56               | 550,030                      | 0.13                  | 0.64          |
| Chennai*        | 2597.44                          | 1336.12             | 58,522,207                   | 14.3                  | 68.62         |
| Coimbatore*     | 1083.08                          | 557.14              | 24,402,517                   | 5.96                  | 28.61         |
| Cuddalore*      | 255.76                           | 131.56              | 5,762,356                    | 1.41                  | 6.76          |
| Dharmapuri*     | 78.05                            | 40.15               | 1,758,596                    | 0.43                  | 2.06          |
| Dindigul*       | 253.46                           | 130.38              | 5,710,675                    | 1.4                   | 6.7           |
| Erode*          | 346.65                           | 178.32              | 7,810,204                    | 1.91                  | 9.16          |
| Kancheepuram*   | 900.23                           | 463.08              | 20,282,801                   | 4.95                  | 23.78         |
| Kanniyakumari*  | 487.82                           | 250.93              | 10,990,830                   | 2.68                  | 12.89         |
| Karur*          | 133.25                           | 68.54               | 3,002,136                    | 0.73                  | 3.52          |
| Krishnagiri*    | 137.61                           | 70.79               | 3,100,439                    | 0.76                  | 3.64          |
| Madurai*        | 824.76                           | 424.25              | 18,582,341                   | 4.54                  | 21.79         |
| Nagapattinam*   | 100.98                           | 51.95               | 2,275,199                    | 0.56                  | 2.67          |
| Namakkal*       | 211.1                            | 108.59              | 4,756,183                    | 1.16                  | 5.58          |
| Perambalur*     | 30.2                             | 15.54               | 680,448                      | 0.17                  | 0.8           |
| Pudukkottai*    | 92.09                            | 47.37               | 2,074,922                    | 0.51                  | 2.43          |
| Ramanathapuram* | 121.3                            | 62.39               | 2,732,894                    | 0.67                  | 3.2           |
| Ranipet         | 110.28                           | 56.73               | 24,84,763                    | 0.61                  | 2.91          |
| Salem*          | 644.97                           | 331.77              | 14,531,660                   | 3.55                  | 17.04         |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District         | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Sivaganga*       | 118.69                           | 61.05               | 2,674,084                    | 0.65                  | 3.14          |
| Thanjavur*       | 259                              | 133.23              | 5,835,401                    | 1.43                  | 6.84          |
| The nilgiris*    | 119.49                           | 61.47               | 2,692,307                    | 0.66                  | 3.16          |
| Theni*           | 194.2                            | 99.9                | 4,375,511                    | 1.07                  | 5.13          |
| Thiruvallur*     | 949.91                           | 488.63              | 21,402,161                   | 5.23                  | 25.1          |
| Thiruvarur*      | 71.61                            | 36.84               | 1,613,523                    | 0.39                  | 1.89          |
| Thoothukkudi*    | 276.53                           | 142.25              | 6,230,481                    | 1.52                  | 7.31          |
| Tiruchirappalli* | 505.01                           | 259.78              | 11,378,302                   | 2.78                  | 13.34         |
| Tirunelveli*     | 507.34                           | 260.98              | 11,430,769                   | 2.79                  | 13.4          |
| Tiruppur*        | 579.03                           | 297.85              | 13,045,921                   | 3.19                  | 15.3          |
| Tiruvannamalai*  | 141.84                           | 72.96               | 3,195,833                    | 0.78                  | 3.75          |
| Vellore*         | 396.09                           | 203.75              | 89,24,184                    | 2.18                  | 10.46         |
| Viluppuram*      | 145.00                           | 74.59               | 3,266,958                    | 0.8                   | 3.83          |
| Virudhunagar*    | 287.53                           | 147.91              | 6,478,332                    | 1.58                  | 7.6           |
| <b>Total</b>     | <b>12984.71</b>                  | <b>6679.34</b>      | <b>292,554,966</b>           | <b>71.47</b>          | <b>343.05</b> |

State – Telangana

| District                 | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| ADILABAD*                | 61                               | 32                  | 13,83,206                    | 0.34                  | 1.62          |
| BHADRADRI KOTHAGUDEM*    | 81                               | 42                  | 18,19,859                    | 0.44                  | 2.13          |
| HYDERABAD*               | 2,657                            | 1,367               | 5,98,65,807                  | 14.62                 | 70.20         |
| JAGTIAL*                 | 70                               | 36                  | 15,87,297                    | 0.39                  | 1.86          |
| JANGOAN*                 | 18                               | 9                   | 4,09,506                     | 0.10                  | 0.48          |
| JAYASHANKAR BHUPALPALLY* | 15                               | 8                   | 3,30,486                     | 0.08                  | 0.39          |
| JOGULAMBA GADWAL*        | 19                               | 10                  | 4,31,110                     | 0.11                  | 0.51          |
| KAMAREDDY*               | 41                               | 21                  | 9,18,209                     | 0.22                  | 1.08          |
| KARIMNAGAR*              | 130                              | 67                  | 29,25,177                    | 0.71                  | 3.43          |
| KHAMMAM*                 | 117                              | 60                  | 26,31,544                    | 0.64                  | 3.09          |
| KUMURAM BHEEM ASIFABAD*  | 24                               | 13                  | 5,47,873                     | 0.13                  | 0.64          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District             | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| MAHABUBABAD*         | 26                               | 14                  | 5,95,494                     | 0.15                  | 0.70          |
| MAHBUBNAGAR*         | 125                              | 64                  | 28,22,403                    | 0.69                  | 3.31          |
| MANCHERIAL*          | 110                              | 57                  | 24,77,645                    | 0.61                  | 2.91          |
| MEDAK*               | 83                               | 43                  | 18,69,693                    | 0.46                  | 2.19          |
| MEDCHAL-MALKAJGIRI*  | 129                              | 66                  | 28,97,213                    | 0.71                  | 3.40          |
| NAGARKURNOOL *       | 25                               | 13                  | 5,61,903                     | 0.14                  | 0.66          |
| NALGONDA*            | 137                              | 70                  | 30,77,116                    | 0.75                  | 3.61          |
| NARAYANPET*          | 12                               | 6                   | 2,66,655                     | 0.07                  | 0.31          |
| NIRMAL*              | 61                               | 31                  | 13,72,017                    | 0.34                  | 1.61          |
| NIZAMABAD*           | 168                              | 86                  | 37,86,352                    | 0.92                  | 4.44          |
| PEDDAPALLI*          | 130                              | 67                  | 29,31,393                    | 0.72                  | 3.44          |
| RAJANNA SIRCILLA*    | 38                               | 19                  | 8,50,976                     | 0.21                  | 1.00          |
| RANGAREDDY*          | 78                               | 40                  | 17,65,499                    | 0.43                  | 2.07          |
| SANGAREDDY*          | 79                               | 41                  | 17,73,985                    | 0.43                  | 2.08          |
| SIDDIPET*            | 28                               | 14                  | 6,34,321                     | 0.15                  | 0.74          |
| SURYAPET*            | 57                               | 29                  | 12,74,935                    | 0.31                  | 1.49          |
| VIKARABAD*           | 37                               | 19                  | 8,24,356                     | 0.20                  | 0.97          |
| WANAPARTHY*          | 30                               | 15                  | 6,71,406                     | 0.16                  | 0.79          |
| WARANGAL*            | 365                              | 188                 | 82,22,092                    | 2.01                  | 9.64          |
| YADADRI BHUVANAGIRI* | 36                               | 18                  | 8,09,504                     | 0.20                  | 0.95          |
| <b>Total</b>         | <b>4,985.86</b>                  | <b>2,564.73</b>     | <b>11,23,35,030</b>          | <b>27.44</b>          | <b>131.72</b> |

State – Tripura

| District      | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|---------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Dhalai        | 21                               | 11.05               | 484,158                      | 0.12                  | 0.57          |
| North Tripura | 49                               | 24.97               | 1,093,665                    | 0.27                  | 1.28          |
| South Tripura | 62                               | 32.1                | 1,406,061                    | 0.34                  | 1.65          |
| West Tripura  | 380                              | 195.3               | 8,554,172                    | 2.09                  | 10.03         |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

|              |            |               |                   |             |              |
|--------------|------------|---------------|-------------------|-------------|--------------|
| <b>Total</b> | <b>512</b> | <b>263.43</b> | <b>11,538,056</b> | <b>2.82</b> | <b>13.53</b> |
|--------------|------------|---------------|-------------------|-------------|--------------|

**State – Sikkim**

| District       | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| East district  | 42.95                            | 22.09               | 967,717                      | 0.24                  | 1.13          |
| North district | 1.79                             | 0.92                | 40,401                       | 0.01                  | 0.05          |
| South district | 8.66                             | 4.45                | 195,023                      | 0.05                  | 0.23          |
| West district  | 1.84                             | 0.95                | 41,416                       | 0.01                  | 0.05          |
| <b>Total</b>   | <b>55.24</b>                     | <b>28.41</b>        | <b>1,244,557</b>             | <b>0.30</b>           | <b>1.46</b>   |

**Union Territory – Lakshadweep**

| District    | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Lakshadweep | 15.50                            | 7.97                | 349,115                      | 0.09                  | 0.41          |

**State – Uttar Pradesh**

| District        | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|-----------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Agra*           | 1,098.00                         | 564.81              | 24,738,669                   | 6.04                  | 29.01         |
| Aligarh*        | 657.25                           | 338.09              | 14,808,317                   | 3.62                  | 17.36         |
| Allahabad*      | 784.09                           | 403.33              | 17,666,017                   | 4.32                  | 20.72         |
| Ambedkar nagar* | 91.43                            | 47.03               | 2,059,884                    | 0.5                   | 2.42          |
| Amethi*         | 6.64                             | 3.41                | 1,49,544                     | 0.04                  | 0.18          |
| Auraiya*        | 73.14                            | 37.62               | 1,647,831                    | 0.4                   | 1.93          |
| Azamgarh*       | 121.5                            | 62.5                | 2,737,541                    | 0.67                  | 3.21          |
| Baghpat*        | 84.44                            | 43.43               | 1,902,426                    | 0.46                  | 2.23          |
| Bahraich*       | 101.72                           | 52.33               | 2,291,921                    | 0.56                  | 2.69          |
| Ballia*         | 89.92                            | 46.25               | 2,025,905                    | 0.49                  | 2.38          |
| Banda*          | 83.72                            | 43.07               | 1,886,343                    | 0.46                  | 2.21          |
| Barabanki*      | 101.27                           | 52.1                | 2,281,770                    | 0.56                  | 2.68          |
| Balrampur*      | 51.11                            | 26.29               | 1151533.13                   | 0.28                  | 1.35          |
| Bareilly*       | 754.65                           | 388.19              | 17,002,774                   | 4.15                  | 19.94         |
| Basti*          | 40.94                            | 21.06               | 922,386                      | 0.23                  | 1.08          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District             | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|----------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Bijnor*              | 277.5                            | 142.75              | 6,252,318                    | 1.53                  | 7.33          |
| Budaun*              | 193.34                           | 99.46               | 4,356,188                    | 1.06                  | 5.11          |
| Bulandshahar*        | 280.66                           | 144.37              | 6,323,577                    | 1.54                  | 7.42          |
| Chandauli*           | 78.76                            | 40.52               | 1,774,602                    | 0.43                  | 2.08          |
| Chitrakoot*          | 29.36                            | 15.1                | 661,513                      | 0.16                  | 0.78          |
| Deoria*              | 96.38                            | 49.58               | 2,171,576                    | 0.53                  | 2.55          |
| Etah*                | 81.29                            | 41.82               | 1,831,556                    | 0.45                  | 2.15          |
| Etawah               | 135.14                           | 69.51               | 3,044,742                    | 0.74                  | 3.57          |
| Faizabad*            | 99.05                            | 50.95               | 2,231,758                    | 0.55                  | 2.62          |
| Farrukhabad*         | 150.68                           | 77.51               | 3,394,818                    | 0.83                  | 3.98          |
| Fatehpur*            | 118.13                           | 60.76               | 2,661,449                    | 0.65                  | 3.12          |
| Firozabad*           | 367.36                           | 188.97              | 8,276,810                    | 2.02                  | 9.71          |
| Gautam buddha nagar* | 436.22                           | 224.39              | 9,828,409                    | 2.4                   | 11.52         |
| Ghaziabad*           | 1710.42                          | 879.84              | 38537012                     | 9.41                  | 45.19         |
| Ghazipur*            | 82.67                            | 42.52               | 1,862,576                    | 0.46                  | 2.18          |
| Gonda*               | 67.02                            | 34.48               | 1,510,023                    | 0.37                  | 1.77          |
| Gorakhpur*           | 356.59                           | 183.43              | 8,034,123                    | 1.96                  | 9.42          |
| Hapur*               | 150.06                           | 77.19               | 33,80,954                    | 0.83                  | 3.96          |
| Hamirpur*            | 63.3                             | 32.56               | 1,426,097                    | 0.35                  | 1.67          |
| Hardoi*              | 186.65                           | 96.01               | 4,205,392                    | 1.03                  | 4.93          |
| Jalaun*              | 147.89                           | 76.07               | 3,331,994                    | 0.81                  | 3.91          |
| Jaunpur*             | 118.71                           | 61.06               | 2,674,569                    | 0.65                  | 3.14          |
| Jhansi*              | 327.27                           | 168.35              | 7,373,600                    | 1.8                   | 8.65          |
| Jyotiba phule nagar* | 157.31                           | 80.92               | 3,544,222                    | 0.87                  | 4.16          |
| Kannauj*             | 86.76                            | 44.63               | 1,954,758                    | 0.48                  | 2.29          |
| Kanpur Dehat*        | 49.06                            | 25.24               | 11,05,379                    | 0.27                  | 1.30          |
| Kanpur Nagar         | 1,699.63                         | 874.29              | 3,82,93,835                  | 9.35                  | 44.90         |
| Kanshiram nagar *    | 85.23                            | 43.84               | 1,920,224                    | 0.47                  | 2.25          |
| Kaushambi*           | 38.55                            | 19.83               | 868,603                      | 0.21                  | 1.02          |

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| District                      | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Kheri*                        | 143.03                           | 73.57               | 3,222,495                    | 0.79                  | 3.78          |
| Kushinagar*                   | 51.39                            | 26.44               | 1,157,890                    | 0.28                  | 1.36          |
| Lalitpur*                     | 54.67                            | 28.12               | 1,231,686                    | 0.3                   | 1.44          |
| Lucknow*                      | 1,850.33                         | 951.81              | 41,689,330                   | 10.18                 | 48.89         |
| Mahamaya nagar*               | 91.94                            | 47.29               | 2,071,420                    | 0.51                  | 2.43          |
| Mahoba*                       | 56.23                            | 28.92               | 1,266,889                    | 0.31                  | 1.49          |
| Mahrajganj*                   | 41.61                            | 21.41               | 937,575                      | 0.23                  | 1.10          |
| Mainpuri*                     | 88.72                            | 45.64               | 1,998,923                    | 0.49                  | 2.34          |
| Mathura*                      | 263.31                           | 135.45              | 5,932,650                    | 1.45                  | 6.96          |
| Mau*                          | 186.83                           | 96.10               | 4,209,367                    | 1.03                  | 4.94          |
| Meerut*                       | 976.78                           | 502.45              | 22,007,518                   | 5.38                  | 25.81         |
| Mirzapur*                     | 124.06                           | 63.82               | 2,795,145                    | 0.68                  | 3.28          |
| Moradabad*                    | 641.05                           | 329.76              | 1,44,43,278                  | 3.53                  | 16.94         |
| Muzaffarnagar*                | 293.62                           | 151.04              | 66,15,508                    | 1.62                  | 7.76          |
| Pilibhit*                     | 104.96                           | 53.99               | 2,364,755                    | 0.58                  | 2.77          |
| Pratapgarh*                   | 53.1                             | 27.31               | 1,196,373                    | 0.29                  | 1.40          |
| Rae bareli*                   | 114.87                           | 59.09               | 2,588,029                    | 0.63                  | 3.03          |
| Rampur*                       | 202.91                           | 104.38              | 4,571,748                    | 1.12                  | 5.36          |
| Saharanpur*                   | 440.64                           | 226.66              | 9,927,890                    | 2.43                  | 11.64         |
| Sambhal*                      | 144.12                           | 74.14               | 3247115                      | 0.79                  | 3.81          |
| Sant kabir nagar*             | 39.65                            | 20.40               | 893,414                      | 0.22                  | 1.05          |
| Sant ravidas nagar (bhadohi)* | 71.98                            | 37.03               | 1,621,792                    | 0.40                  | 1.90          |
| Shahjahanpur*                 | 205.52                           | 105.72              | 4,630,428                    | 1.13                  | 5.43          |
| Shamli*                       | 107.78                           | 55.44               | 24,28,346                    | 0.59                  | 2.85          |
| Shrawasti*                    | 11.54                            | 5.94                | 2,60,062                     | 0.06                  | 0.30          |
| Siddharthnagar*               | 51.77                            | 26.63               | 1,166,524                    | 0.28                  | 1.37          |
| Sitapur*                      | 177.91                           | 91.52               | 4,008,418                    | 0.98                  | 4.70          |
| Sonbhadra*                    | 96.04                            | 49.4                | 2,163,744                    | 0.53                  | 2.54          |
| Sultanpur*                    | 55.91                            | 28.76               | 12,59,802                    | 0.31                  | 1.48          |



District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District     | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Unnao*       | 184.41                           | 94.86               | 4,154,949                    | 1.02                  | 4.87          |
| Varanasi*    | 811.13                           | 417.25              | 18,275,342                   | 4.46                  | 21.43         |
| <b>Total</b> | <b>19,548.60</b>                 | <b>10,055.80</b>    | <b>440,443,943</b>           | <b>107.60</b>         | <b>516.47</b> |

**State – Uttarakhand**

| District          | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Almora            | 24.07                            | 12.38               | 542,372.25                   | 0.13                  | 0.64          |
| Bageshwar         | 3.11                             | 1.6                 | 70,118.10                    | 0.02                  | 0.08          |
| Chamoli           | 20.61                            | 10.6                | 464,410.94                   | 0.11                  | 0.54          |
| Champawat         | 15.76                            | 8.11                | 355,091.19                   | 0.09                  | 0.42          |
| Dehradun          | 385.87                           | 198.49              | 8,693,967.06                 | 2.12                  | 10.19         |
| Garhwal           | 37.84                            | 19.46               | 852,498.35                   | 0.21                  | 1             |
| Hardwar           | 267.34                           | 137.52              | 6,023,397.73                 | 1.47                  | 7.06          |
| Nainital          | 138.74                           | 71.37               | 3,125,819.10                 | 0.76                  | 3.67          |
| Pithoragarh       | 25.13                            | 12.93               | 566,182.90                   | 0.14                  | 0.66          |
| Rudraprayag       | 3.98                             | 2.05                | 89,768.59                    | 0.02                  | 0.11          |
| Tehri Garhwal     | 31.9                             | 16.41               | 718,784.11                   | 0.18                  | 0.84          |
| Udham Singh Nagar | 205.43                           | 105.67              | 4,628,392.13                 | 1.13                  | 5.43          |
| Uttarkashi        | 8.74                             | 4.5                 | 197,015.28                   | 0.05                  | 0.23          |
| <b>TOTAL</b>      | <b>1,168.53</b>                  | <b>601.09</b>       | <b>26,327,817.73</b>         | <b>6.43</b>           | <b>30.87</b>  |

**State – West Bengal**

| District           | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> )/day | Energy Potential (MW) | Bio-CNG (TPD) |
|--------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Bankura            | 173.00                           | 89.08               | 3,901,696                    | 0.95                  | 4.58          |
| Paschim Barddhaman | 1573                             | 809.09              | 3,54,38,243                  | 8.66                  | 41.55         |
| Purba Barddhaman   | 311                              | 159.74              | 69,96,762                    | 1.71                  | 8.20          |
| Birbhum            | 378.00                           | 194.20              | 8,505,818                    | 2.08                  | 9.97          |
| Dakshin dinajpur   | 119.00                           | 61.43               | 2,690,479                    | 0.66                  | 3.15          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District          | Total Waste Generated 2021 (TPD) | Biodegradable (TPD) | Biogas (m <sup>3</sup> /day) | Energy Potential (MW) | Bio-CNG (TPD) |
|-------------------|----------------------------------|---------------------|------------------------------|-----------------------|---------------|
| Darjeeling        | 555.00                           | 285.74              | 12,515,564                   | 3.06                  | 14.68         |
| Haora             | 1,589.00                         | 817.43              | 35,803,335                   | 8.75                  | 41.98         |
| Hugli             | 856.00                           | 440.11              | 19,277,010                   | 4.71                  | 22.6          |
| Jalpaiguri        | 354.00                           | 181.90              | 7,967,070                    | 1.95                  | 9.34          |
| Jhargram          | 21                               | 10.74               | 4,70,413                     | 0.11                  | 0.55          |
| Koch bihar        | 141.00                           | 72.28               | 3,165,748                    | 0.77                  | 3.71          |
| Kolkata           | 4,637.00                         | 2,385.15            | 104,469,521                  | 25.52                 | 122.5         |
| Malda             | 318.00                           | 163.44              | 7,158,532                    | 1.75                  | 8.39          |
| Murshidabad       | 595.00                           | 305.98              | 13,401,864                   | 3.27                  | 15.72         |
| Nadia             | 736.00                           | 378.51              | 16,578,841                   | 4.05                  | 19.44         |
| North 24 Parganas | 3,309.00                         | 1,701.99            | 74,547,103                   | 18.21                 | 87.41         |
| Paschim Medinipur | 308                              | 158.52              | 69,43,181                    | 1.70                  | 8.14          |
| Purba Medinipur   | 245.00                           | 125.77              | 5,508,884                    | 1.35                  | 6.46          |
| Puruliya          | 150.00                           | 77.11               | 3,377,275                    | 0.83                  | 3.96          |
| South 24 parganas | 839.00                           | 431.48              | 18,898,769                   | 4.62                  | 22.16         |
| Uttar dinajpur    | 199.00                           | 102.48              | 4,488,550                    | 1.1                   | 5.26          |
| <b>Total</b>      | <b>17,403</b>                    | <b>8,952.16</b>     | <b>392,104,658</b>           | <b>95.79</b>          | <b>459.78</b> |

Slaughterhouse sector- State and district wise energy production

**Assumptions:**

- Solid waste: 4% of average weight for cattle and Buffalo (Average weight of Cattle & Buffalo is 350 kg); 7% of the average weight for goat and sheep (Average weight of sheep & Goat is 30 kg); 1% of the average weight of Pig (30 kg)
- Liquid waste: 80% of total water consumption is generated as liquid waste. Water consumption for cattle and Buffalo - 270 litres/ Cattle & Buffalo; Water consumption- 40 litres/Sheep, goat & Pig.
- Biogas generation estimation from solid and liquid waste was done:
- 120-160 m<sup>3</sup> biogas is generated from per ton of slaughterhouse solid wastes
- 3000 litres of wastewater from slaughterhouse generates an average of 147.67 m<sup>3</sup> of biogas/day.

**State - Andhra Pradesh**

| District Name | Total Solid Waste Generation (In tonne per annum) | Bio-Gas Generation (In 000 m <sup>3</sup> per annum) | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> per annum) | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|--|-----------------------|--|--|-----------------------|--|--|---------------|
| Anantapur     | 8,354   | 1,002,485  | 0.24                  | 127.58   | 6,251,583  | 1.53                  | 7,254,068  | 1.77   | 8.51          |
| Chittoor      | 3,620   | 434,362  | 0.11                  | 55.24  | 2,706,822  | 0.66                  | 3,141,184  | 0.77   | 3.68          |
| East Godavari | 2,032   | 243,883  | 0.06                  | 31.36  | 1,536,830  | 0.38                  | 1,780,713  | 0.44   | 2.09          |
| Guntur        | 2,873   | 344,775  | 0.08                  | 44.14  | 2,162,754  | 0.53                  | 2,507,529  | 0.61   | 2.94          |
| Kadapa        | 3,487   | 418,465  | 0.10                  | 53.29  | 2,611,154  | 0.64                  | 3,029,619  | 0.74   | 3.55          |
| Krishna       | 3,648   | 437,747  | 0.11                  | 56.11  | 2,749,563  | 0.67                  | 3,187,310  | 0.78   | 3.74          |
| Kurnool       | 8,879   | 1,065,501  | 0.26                  | 135.91   | 6,659,789  | 1.63                  | 7,725,290  | 1.89   | 9.06          |
| Prakasam      | 7,006   | 840,734  | 0.21                  | 107.40   | 5,262,668  | 1.29                  | 6,103,401  | 1.49   | 7.16          |
| SPSR Nellore  | 2,997   | 359,646  | 0.09                  | 45.91  | 2,249,788  | 0.55                  | 2,609,434  | 0.64   | 3.06          |
| Srikakulam    | 1,571   | 188,570  | 0.05                  | 24.02  | 1,177,161  | 0.29                  | 1,365,731  | 0.33   | 1.60          |
| Visakhapatnam | 2,464   | 295,726  | 0.07                  | 37.88  | 1,856,229  | 0.45                  | 2,151,955  | 0.53   | 2.52          |
| Vizianagaram  | 2,038   | 244,528  | 0.06                  | 31.28  | 1,532,710  | 0.37                  | 1,777,238  | 0.43   | 2.08          |
| West Godavari | 2,366   | 283,862  | 0.07                  | 36.38  | 1,782,760  | 0.44                  | 2,066,622  | 0.50   | 2.42          |
| <b>Total</b>  | <b>51,336</b>                                     | <b>6,160,283</b>                                     | <b>1.50</b>           | <b>786.53</b>  | <b>38,539,811</b>                                    | <b>9.41</b>           | <b>44,700,094</b>  | <b>10.92</b>   | <b>52.42</b>  |

**State – Gujarat**

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Ahmedabad     | 164.15  | 19,698  | 0.005                 | 2.63   | 129,073   | 0.03                  | 148,771  | 0.04   | 0.17          |
| Rajkot        | 22.33   | 2,680   | 0.001                 | 0.34   | 16,881  | 0.004                 | 19,561   | 0.005  | 0.02          |
| Surat         | 224.45  | 26,934  | 0.007                 | 3.43   | 167,900   | 0.04                  | 194,834  | 0.05   | 0.23          |
| Surendranagar | 2.63  | 316   | 0.0001                | 0.04   | 1,990   | 0.0005                | 2,306  | 0.001  | 0.003         |
| Vadodara      | 11.89   | 1,427   | 0.0003                | 0.18   | 8,876   | 0.002                 | 10,303   | 0.003  | 0.01          |
| Valsad        | 0.92  | 110   | 0.00003               | 0.01   | 684   | 0.0002                | 794  | 0.0002   | 0.001         |
| <b>Total</b>  | <b>426.36</b>                                     | <b>51,163</b>   | <b>0.01</b>           | <b>6.64</b>  | <b>325,405</b>  | <b>0.08</b>           | <b>376568</b>  | <b>0.09</b>  | <b>0.44</b>   |

**State – Haryana**

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Ambala        | 83.87   | 10,065  | 0.002                 | 1.53   | 74,729  | 0.02                  | 84,794   | 0.02   | 0.10          |
| Bhiwani       | 74.28   | 8,914   | 0.002                 | 1.24   | 60,768  | 0.01                  | 69,682   | 0.02   | 0.08          |
| Charkhi Dadri | 32.18   | 3,862   | 0.001                 | 0.53   | 25,816  | 0.01                  | 29,677   | 0.01   | 0.03          |
| Faridabad     | 54.68   | 6,562   | 0.002                 | 0.91   | 44,440  | 0.01                  | 51,002   | 0.01   | 0.06          |
| Fatehabad     | 57.56   | 6,908   | 0.002                 | 1.03   | 50,449  | 0.01                  | 57,356   | 0.01   | 0.07          |
| Gurugram      | 64.21   | 7,705   | 0.002                 | 1.10   | 53,862  | 0.01                  | 61,567   | 0.02   | 0.07          |
| Hisar         | 69.42   | 8,331   | 0.002                 | 1.20   | 58,871  | 0.01                  | 67,201   | 0.02   | 0.08          |
| Jhajjar       | 63.42   | 7,611   | 0.002                 | 1.09   | 53,268  | 0.01                  | 60,879   | 0.01   | 0.07          |
| Jind          | 64.85   | 7,782   | 0.002                 | 1.14   | 55,797  | 0.01                  | 63,579   | 0.02   | 0.07          |
| Kaithal       | 65.62   | 7,875   | 0.002                 | 1.12   | 54,866  | 0.01                  | 62,741   | 0.02   | 0.07          |
| Karnal        | 86.29   | 10,355  | 0.003                 | 1.55   | 75,916  | 0.02                  | 86,271   | 0.02   | 0.10          |
| Kurukshetra   | 80.18   | 9,622   | 0.002                 | 1.42   | 69,716  | 0.02                  | 79,338   | 0.02   | 0.09          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Mahendragarh  | 101.27  | 12,152  | 0.003                 | 1.73   | 84,951  | 0.02                  | 97,103   | 0.02   | 0.11          |
| Mewat         | 1,934.33  | 232,120   | 0.06                  | 29.83  | 1,461,722   | 0.36                  | 1,693,841  | 0.41   | 1.99          |
| Palwal        | 62.62   | 7,515   | 0.002                 | 1.07   | 52,395  | 0.01                  | 59,909   | 0.01   | 0.07          |
| Panipat       | 48.82   | 5,859   | 0.001                 | 0.84   | 41,245  | 0.01                  | 47,103   | 0.01   | 0.06          |
| Panchkula     | 46.21   | 5,546   | 0.001                 | 0.82   | 40,285  | 0.01                  | 45,831   | 0.01   | 0.05          |
| Rewari        | 89.16   | 10,700  | 0.003                 | 1.56   | 76,402  | 0.02                  | 87,102   | 0.02   | 0.10          |
| Rohtak        | 37.43   | 4,491   | 0.001                 | 0.64   | 31,355  | 0.01                  | 35,846   | 0.01   | 0.04          |
| Sirsa         | 93.34   | 11,201  | 0.003                 | 1.57   | 76,776  | 0.02                  | 87,976   | 0.02   | 0.10          |
| Sonipat       | 68.39   | 8,207   | 0.002                 | 1.21   | 59,099  | 0.01                  | 67,306   | 0.02   | 0.08          |
| Yamunanagar   | 110.88  | 13,306  | 0.003                 | 2.14   | 104,868   | 0.03                  | 118,173  | 0.03   | 0.14          |
| <b>Total</b>  | <b>3,389.04</b>                                   | <b>406,684</b>  | <b>0.10</b>           | <b>55.26</b>   | <b>2,707,597</b>                                      | <b>0.66</b>           | <b>3,114,281</b>   | <b>0.76</b>  | <b>3.65</b>   |

**State – Karnataka**

| District Name   | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|-----------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Bagalkote       | 461.47  | 55,376  | 0.01                  | 7.03   | 344,563   | 0.08                  | 399,940  | 0.10   | 0.47          |
| Ballari         | 454.56  | 54,548  | 0.01                  | 6.95   | 340,747   | 0.08                  | 395,295  | 0.10   | 0.46          |
| Belagavi        | 429.16  | 51,499  | 0.01                  | 6.60   | 323,364   | 0.08                  | 374,863  | 0.09   | 0.44          |
| Bengaluru ( R ) | 50.25   | 6,030   | 0.001                 | 0.82   | 40,235  | 0.01                  | 46,265   | 0.01   | 0.05          |
| Bengaluru (U)   | 5,398.30  | 647,796   | 0.16                  | 83.22  | 4,077,907   | 1.00                  | 4,725,703  | 1.15   | 5.54          |
| Bidar           | 116.52  | 13,983  | 0.003                 | 1.80   | 88,224  | 0.02                  | 102,206  | 0.02   | 0.12          |
| Chamarajanagar  | 240.56  | 28,867  | 0.01                  | 3.67   | 179,759   | 0.04                  | 208,626  | 0.05   | 0.24          |
| Chikkaballapur  | 93.52   | 11,222  | 0.003                 | 1.50   | 73,645  | 0.02                  | 84,867   | 0.02   | 0.10          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District Name  | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|----------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Chikkamagaluru | 206.25  | 24,750  | 0.01                  | 3.17   | 155,550   | 0.04                  | 180,300  | 0.04   | 0.21          |
| Chitradurga    | 7.90  | 948   | 0.0002                | 0.12   | 5,900   | 0.001                 | 6,848  | 0.002  | 0.01          |
| D.Kannada      | 112.69  | 13,523  | 0.003                 | 2.04   | 99,924  | 0.02                  | 113,447  | 0.03   | 0.13          |
| Davanagere     | 104.31  | 12,517  | 0.003                 | 1.59   | 77,886  | 0.02                  | 90,403   | 0.02   | 0.11          |
| Dharwad        | 450.74  | 54,089  | 0.01                  | 6.91   | 338,739   | 0.08                  | 392,828  | 0.10   | 0.46          |
| Gadag          | 25.71   | 3,086   | 0.001                 | 0.39   | 19,200  | 0.005                 | 22,286   | 0.01   | 0.03          |
| Hassan         | 107.48  | 12,897  | 0.003                 | 1.69   | 82,695  | 0.02                  | 95,592   | 0.02   | 0.11          |
| Haveri         | 1,247.88  | 149,746   | 0.04                  | 19.17  | 939,155   | 0.23                  | 1,088,901  | 0.27   | 1.28          |
| Kalburagi      | 352.64  | 42,316  | 0.01                  | 5.38   | 263,560   | 0.06                  | 305,877  | 0.07   | 0.36          |
| Kodagu         | 111.91  | 13,429  | 0.003                 | 2.60   | 127,213   | 0.03                  | 140,642  | 0.03   | 0.16          |
| Kolar          | 402.15  | 48,258  | 0.01                  | 6.86   | 336,058   | 0.08                  | 384,317  | 0.09   | 0.45          |
| Koppal         | 400.35  | 48,042  | 0.01                  | 6.13   | 300,404   | 0.07                  | 348,446  | 0.09   | 0.41          |
| Mandya         | 774.80  | 92,976  | 0.02                  | 11.99  | 587,330   | 0.14                  | 680,307  | 0.17   | 0.80          |
| Mysuru         | 1,278.29  | 153,395   | 0.04                  | 19.48  | 954,456   | 0.23                  | 1,107,850  | 0.27   | 1.30          |
| Raichur        | 381.45  | 45,774  | 0.01                  | 5.84   | 286,319   | 0.07                  | 332,093  | 0.08   | 0.39          |
| Ramanagara     | 107.34  | 12,880  | 0.003                 | 1.65   | 80,934  | 0.02                  | 93,815   | 0.02   | 0.11          |
| Shivamogga     | 148.69  | 17,843  | 0.004                 | 2.27   | 111,021   | 0.03                  | 128,863  | 0.03   | 0.15          |
| Tumkuru        | 258.65  | 31,038  | 0.01                  | 3.98   | 195,214   | 0.05                  | 226,253  | 0.06   | 0.27          |
| Udupi          | 34.88   | 4,185   | 0.001                 | 0.53   | 26,041  | 0.01                  | 30,227   | 0.01   | 0.04          |
| Uttarakannada  | 23.27   | 2,792   | 0.001                 | 0.35   | 17,373  | 0.004                 | 20,166   | 0.005  | 0.02          |
| Vijayapura     | 68.98   | 8,277   | 0.002                 | 1.05   | 51,677  | 0.01                  | 59,954   | 0.01   | 0.07          |
| Yadagiii       | 144.12  | 17,295  | 0.004                 | 2.21   | 108,250   | 0.03                  | 125,545  | 0.03   | 0.15          |
| <b>Total</b>   | <b>13,994.82</b>                                  | <b>1,679,378</b>                                      | <b>0.41</b>           | <b>217.01</b>  | <b>10,633,345</b>                                     | <b>2.60</b>           | <b>12,312,723</b>  | <b>3.01</b>  | <b>14.44</b>  |

**State – Maharashtra**

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Ahmednagar    | 35.60   | 4,272   | 0.001                 | 0.55   | 26,915  | 0.01                  | 31,187   | 0.01   | 0.04          |
| Amravati      | 1.85  | 222   | 0.00005               | 0.03   | 1,397   | 0.0003                | 1,619  | 0.0004   | 0.002         |
| Aurangabad    | 3,152.36  | 378,283   | 0.09                  | 48.63  | 2,382,948   | 0.58                  | 2,761,231  | 0.67   | 3.24          |
| Beed          | 3.25  | 390   | 0.0001                | 0.05   | 2,455   | 0.001                 | 2,845  | 0.001  | 0.003         |
| Buldhana      | 0.24  | 29  | 0.00001               | 0.004  | 180   | 0.00004               | 208  | 0.0001   | 0.0002        |
| Chandrapur    | 0.31  | 37  | 0.00001               | 0.005  | 233   | 0.0001                | 270  | 0.0001   | 0.0003        |
| Dhule         | 157.09  | 18,851  | 0.005                 | 2.42   | 118,763   | 0.03                  | 137,614  | 0.03   | 0.16          |
| Gadchiroli    | 1.08  | 130   | 0.00003               | 0.02   | 807   | 0.0002                | 937  | 0.0002   | 0.001         |
| Hingoli       | 0.10  | 12  | 0.000003              | 0.002  | 74  | 0.00002               | 86   | 0.00002  | 0.0001        |
| Jalgaon       | 31.78   | 3,814   | 0.001                 | 0.49   | 24,026  | 0.01                  | 27,839   | 0.01   | 0.03          |
| Jalna         | 4.21  | 506   | 0.0001                | 0.07   | 3,186   | 0.0008                | 3,691  | 0.001  | 0.004         |
| Kolhapur      | 656.32  | 78,758  | 0.02                  | 10.13  | 496,178   | 0.12                  | 574,936  | 0.14   | 0.67          |
| Mumbai        | 3,015.72  | 361,886   | 0.09                  | 47.33  | 2,319,055   | 0.57                  | 2,680,941  | 0.65   | 3.14          |
| Nagpur        | 41.79   | 5,015   | 0.001                 | 0.64   | 31,593  | 0.01                  | 36,608   | 0.01   | 0.04          |
| Nanded        | 93.56   | 11,227  | 0.003                 | 1.44   | 70,733  | 0.02                  | 81,960   | 0.02   | 0.10          |
| Nashik        | 2,151.53  | 258,184   | 0.06                  | 33.20  | 1,626,560   | 0.40                  | 1,884,744  | 0.46   | 2.21          |
| Parbhani      | 140.48  | 16,857  | 0.004                 | 2.17   | 106,200   | 0.03                  | 123,057  | 0.03   | 0.14          |
| Pune          | 560.83  | 67,299  | 0.02                  | 8.65   | 423,984   | 0.10                  | 491,284  | 0.12   | 0.58          |
| Sangli        | 960.33  | 115,240   | 0.03                  | 14.82  | 726,009   | 0.18                  | 841,249  | 0.21   | 0.99          |
| Satara        | 1,107.11  | 132,853   | 0.03                  | 17.08  | 836,972   | 0.20                  | 969,825  | 0.24   | 1.14          |
| Solapur       | 1,917.27  | 230,073   | 0.06                  | 29.58  | 1,449,458   | 0.35                  | 1,679,530  | 0.41   | 1.97          |
| Thane         | 349.46  | 41,935  | 0.01                  | 5.38   | 263,483   | 0.06                  | 305,417  | 0.07   | 0.36          |
| Wardha        | 5.10  | 612   | 0.0001                | 0.08   | 3,806   | 0.001                 | 4,417  | 0.001  | 0.01          |
| Washim        | 1.18  | 141   | 0.00003               | 0.02   | 889   | 0.0002                | 1,030  | 0.0003   | 0.001         |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Yavatmal      | 0.53  | 64  | 0.00002               | 0.01   | 402   | 0.0001                | 466  | 0.0001   | 0.001         |
| <b>Total</b>  | <b>14,389.06</b>                                  | <b>1,726,687</b>                                      | <b>0.422</b>          | <b>222.78</b>  | <b>10,916,306</b>                                     | <b>2.67</b>           | <b>12,642,993</b>  | <b>3.09</b>  | <b>14.83</b>  |

**State – Meghalaya**

| District Name          | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|------------------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| East Garo Hills        | 13.93   | 1,672   | 0.0004                | 1.43   | 70,235  | 0.02                  | 71,906   | 0.02   | 0.08          |
| East Jaitia Hills      | 56.76   | 6,812   | 0.002                 | 2.74   | 134,299   | 0.03                  | 141,111  | 0.03   | 0.17          |
| East Khasi Hills       | 180.41  | 21,649.20   | 0.01                  | 35.57  | 1,742,781   | 0.43                  | 1,764,430  | 0.43   | 2.07          |
| North Garo Hills       | 2.51  | 302   | 0.0001                | 0.88   | 42,951  | 0.01                  | 43,253   | 0.01   | 0.05          |
| Ri-Bhoi                | 32.88   | 3,945   | 0.001                 | 6.63   | 324,972   | 0.08                  | 328,917  | 0.08   | 0.39          |
| South Garo Hills       | 19.78   | 2,374   | 0.001                 | 2.96   | 145,048   | 0.04                  | 147,422  | 0.04   | 0.17          |
| South West Garo Hills  | 10.03   | 1,204   | 0.0003                | 1.31   | 64,241  | 0.02                  | 65,445   | 0.02   | 0.08          |
| South West Khasi Hills | 35.65   | 4,278   | 0.001                 | 2.25   | 110,089   | 0.03                  | 114,368  | 0.03   | 0.13          |
| West Garo Hills        | 59.76   | 7,171   | 0.002                 | 6.31   | 309,410   | 0.08                  | 316,580  | 0.08   | 0.37          |
| West Jaintia Hills     | 27.19   | 3,262   | 0.001                 | 6.34   | 310,640   | 0.08                  | 313,903  | 0.08   | 0.37          |
| West Khasi Hills       | 9.95  | 1,193   | 0.0003                | 6.88   | 337,265   | 0.08                  | 338,458  | 0.08   | 0.40          |
| <b>Total</b>           | <b>448.85</b>                                     | <b>53,862</b>   | <b>0.013</b>          | <b>73.30</b>   | <b>3,591,931.28</b>                                   | <b>0.88</b>           | <b>3,645,793.04</b>  | <b>0.89</b>  | <b>4.28</b>   |

**State -Odisha**



District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Angul         | 556.86  | 66,823  | 0.02                  | 8.80   | 431,216   | 0.11                  | 498,039  | 0.12   | 0.58          |
| Balasore      | 830.14  | 99,617  | 0.02                  | 12.82  | 628,078   | 0.15                  | 727,695  | 0.18   | 0.85          |
| Baragarh      | 658.67  | 79,041  | 0.02                  | 10.33  | 506,041   | 0.12                  | 585,081  | 0.14   | 0.69          |
| Bhadrak       | 572.85  | 68,742  | 0.02                  | 8.94   | 438,146   | 0.11                  | 506,889  | 0.12   | 0.59          |
| Bolangir      | 441.75  | 53,010  | 0.01                  | 6.87   | 336,775   | 0.08                  | 389,785  | 0.10   | 0.46          |
| Boudh         | 85.67   | 10,280  | 0.003                 | 1.37   | 67,110  | 0.02                  | 77,391   | 0.02   | 0.09          |
| Cuttack       | 1,724.45  | 206,934   | 0.05                  | 27.23  | 1,334,509   | 0.33                  | 1,541,443  | 0.38   | 1.81          |
| Deogarh       | 56.74   | 6,809   | 0.002                 | 1.00   | 48,765  | 0.01                  | 55,574   | 0.01   | 0.07          |
| Dhenkanal     | 524.76  | 62,971  | 0.02                  | 8.24   | 403,995   | 0.10                  | 466,966  | 0.11   | 0.55          |
| Gajapati      | 212.72  | 25,526  | 0.01                  | 3.46   | 169,485   | 0.04                  | 195,011  | 0.05   | 0.23          |
| Ganjam        | 1,112.93  | 133,551   | 0.03                  | 17.07  | 836,403   | 0.20                  | 969,954  | 0.24   | 1.14          |
| Jagatsingpur  | 393.77  | 47,252  | 0.01                  | 6.20   | 303,863   | 0.07                  | 351,115  | 0.09   | 0.41          |
| Jajpur        | 1,100.87  | 132,105   | 0.03                  | 16.96  | 831,260   | 0.20                  | 963,364  | 0.24   | 1.13          |
| Jharsuguda    | 299.63  | 35,955  | 0.01                  | 4.69   | 229,822   | 0.06                  | 265,777  | 0.06   | 0.31          |
| Kalahandi     | 182.62  | 21,914  | 0.01                  | 3.06   | 149,713   | 0.04                  | 171,627  | 0.04   | 0.20          |
| Kandhamal     | 294.51  | 35,341  | 0.01                  | 4.68   | 229,414   | 0.06                  | 264,755  | 0.06   | 0.31          |
| Kendrapara    | 271.01  | 32,521  | 0.01                  | 4.30   | 210,473   | 0.05                  | 242,994  | 0.06   | 0.28          |
| Keonjhar      | 735.73  | 88,288  | 0.02                  | 11.46  | 561,752   | 0.14                  | 650,040  | 0.16   | 0.76          |
| Khurdha       | 2,281.32  | 273,759   | 0.07                  | 35.06  | 1,717,728   | 0.42                  | 1,991,487  | 0.49   | 2.34          |
| Koraput       | 653.57  | 78,429  | 0.02                  | 10.11  | 495,472   | 0.12                  | 573,901  | 0.14   | 0.67          |
| Malkangiri    | 276.11  | 33,133  | 0.01                  | 4.35   | 213,232   | 0.05                  | 246,366  | 0.06   | 0.29          |
| Mayurbhanj    | 511.18  | 61,341  | 0.01                  | 8.20   | 401,690   | 0.10                  | 463,031  | 0.11   | 0.54          |
| Nawarangpur   | 309.09  | 37,090  | 0.01                  | 4.84   | 237,129   | 0.06                  | 274,219  | 0.07   | 0.32          |
| Nayagarh      | 132.77  | 15,932  | 0.004                 | 2.10   | 102,720   | 0.03                  | 118,651  | 0.03   | 0.14          |
| Nuapada       | 155.32  | 18,638  | 0.005                 | 2.45   | 120,219   | 0.03                  | 138,857  | 0.03   | 0.16          |
| Puri          | 367.95  | 44,154  | 0.01                  | 5.79   | 283,604   | 0.07                  | 327,758  | 0.08   | 0.38          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Rayagada      | 356.82  | 42,818  | 0.01                  | 5.93   | 290,362   | 0.07                  | 333,181  | 0.08   | 0.39          |
| Sambalpur     | 447.35  | 53,682  | 0.01                  | 7.10   | 347,814   | 0.08                  | 401,496  | 0.10   | 0.47          |
| Subarnapur    | 131.44  | 15,773  | 0.004                 | 2.14   | 105,025   | 0.03                  | 120,798  | 0.03   | 0.14          |
| Sundargarh    | 620.56  | 74,467  | 0.02                  | 9.67   | 473,630   | 0.12                  | 548,097  | 0.13   | 0.64          |
| <b>Total</b>  | <b>16,299.14</b>                                  | <b>1,955,896</b>                                      | <b>0.48</b>           | <b>255.21</b>  | <b>12,505,443</b>                                     | <b>3.05</b>           | <b>14,461,339</b>  | <b>3.53</b>  | <b>16.96</b>  |

State – Punjab

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Amritsar      | 105.37  | 12,645  | 0.003                 | 1.654269   | 81,059  | 0.02                  | 93,704   | 0.02   | 0.11          |
| Barnala       | 68.95   | 8,274   | 0.002                 | 1.070048   | 52,432  | 0.01                  | 60,706   | 0.01   | 0.07          |
| Bathinda      | 95.66   | 11,479  | 0.003                 | 1.485849   | 72,807  | 0.02                  | 84,286   | 0.02   | 0.1           |
| Faridkot      | 85.31   | 10,237  | 0.003                 | 1.31937  | 64,649  | 0.02                  | 74,886   | 0.02   | 0.09          |
| Fazilka       | 78.31   | 9,397   | 0.002                 | 1.205848   | 59,087  | 0.01                  | 68,484   | 0.02   | 0.08          |
| FG Sahib      | 52.49   | 6,299   | 0.002                 | 0.817194   | 40,042  | 0.01                  | 46,342   | 0.01   | 0.05          |
| Firozpur      | 55.65   | 6,678   | 0.002                 | 0.864385   | 42,355  | 0.01                  | 49,033   | 0.01   | 0.06          |
| Gurdaspur     | 59.75   | 7,170   | 0.002                 | 0.939098   | 46,016  | 0.01                  | 53,185   | 0.01   | 0.06          |
| Hoshiarpur    | 93.85   | 11,262  | 0.003                 | 1.453481   | 71,221  | 0.02                  | 82,483   | 0.02   | 0.1           |
| Jalandhar     | 107.26  | 12,871  | 0.003                 | 1.66442  | 81,557  | 0.02                  | 94,428   | 0.02   | 0.11          |
| Kapurthala    | 48.5  | 5,820   | 0.001                 | 0.780747   | 38,257  | 0.01                  | 44,076   | 0.01   | 0.05          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Ludhiana      | 96.65   | 11,598  | 0.003                 | 1.504772   | 73,734  | 0.02                  | 85,332   | 0.02   | 0.1           |
| Mansa         | 90.2  | 10,823  | 0.003                 | 1.395454   | 68,377  | 0.02                  | 79,201   | 0.02   | 0.09          |
| Moga          | 73.24   | 8,789   | 0.002                 | 1.134951   | 55,613  | 0.01                  | 64,401   | 0.02   | 0.08          |
| Mohali        | 11507.17  | 1,380,861   | 0.34                  | 177.5441   | 8,699,660   | 2.13                  | 10,080,521   | 2.46   | 11.82         |
| Muktsar       | 84.16   | 10,099  | 0.002                 | 1.308071   | 64,095  | 0.02                  | 74,194   | 0.02   | 0.09          |
| Pathankot     | 57.07   | 6,849   | 0.002                 | 0.895631   | 43,886  | 0.01                  | 50,735   | 0.01   | 0.06          |
| Patiala       | 117.18  | 14,062  | 0.003                 | 1.83211  | 89,773  | 0.02                  | 103,835  | 0.03   | 0.12          |
| Ropar         | 57.91   | 6,949   | 0.002                 | 0.905275   | 44,358  | 0.01                  | 51,308   | 0.01   | 0.06          |
| S.B.S. Nagar  | 75.98   | 9,118   | 0.002                 | 1.174617   | 57,556  | 0.01                  | 66,674   | 0.02   | 0.08          |
| Sangrur       | 75.18   | 9,021   | 0.002                 | 1.165628   | 57,116  | 0.01                  | 66,137   | 0.02   | 0.08          |
| Tarn Taran    | 95.77   | 11,493  | 0.003                 | 1.487365   | 72,881  | 0.02                  | 84,374   | 0.02   | 0.1           |
| <b>Total</b>  | <b>13181.61</b>                                   | <b>1581794</b>  | <b>0.39</b>           | <b>203.6027</b>  | <b>9976531</b>  | <b>2.44</b>           | <b>11558325</b>  | <b>2.82</b>  | <b>13.56</b>  |

State – Tamil Nadu

| District Name | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Ariyalur      | 253.48  | 30,418  | 0.01                  | 4.03   | 197,382   | 0.05                  | 227,799  | 0.06   | 0.27          |
| Chennai       | 2,105.59  | 252,670   | 0.06                  | 32.16  | 1,575,768   | 0.38                  | 1,828,438  | 0.45   | 2.14          |
| Coimbatore    | 1,305.52  | 156,662   | 0.04                  | 20.07  | 983,389   | 0.24                  | 1,140,051  | 0.28   | 1.34          |
| Cuddalore     | 775.63  | 93,075  | 0.02                  | 11.96  | 585,879   | 0.14                  | 678,955  | 0.17   | 0.80          |
| Dharmapuri    | 743.78  | 89,254  | 0.02                  | 11.43  | 560,160   | 0.14                  | 649,413  | 0.16   | 0.76          |
| Dindigul      | 317.49  | 38,099  | 0.01                  | 4.84   | 237,059   | 0.06                  | 275,158  | 0.07   | 0.32          |
| Erode         | 985.15  | 118,218   | 0.03                  | 15.07  | 738,666   | 0.18                  | 856,884  | 0.21   | 1.00          |

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|-----------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Kancheepuram    | 972.16  | 116,659   | 0.03                  | 14.91  | 730,815   | 0.18                  | 847,475  | 0.21   | 0.99          |
| Kanyakumari     | 405.21  | 48,626  | 0.01                  | 6.40   | 313,473   | 0.08                  | 362,099  | 0.09   | 0.42          |
| Karur           | 471.36  | 56,563  | 0.01                  | 7.21   | 353,072   | 0.09                  | 409,635  | 0.10   | 0.48          |
| Krishnagiri     | 580.33  | 69,640  | 0.02                  | 8.84   | 433,381   | 0.11                  | 503,021  | 0.12   | 0.59          |
| Madurai         | 581.63  | 69,795  | 0.02                  | 8.88   | 435,338   | 0.11                  | 505,133  | 0.12   | 0.59          |
| Nagapattinam    | 654.55  | 78,546  | 0.02                  | 9.99   | 489,640   | 0.12                  | 568,187  | 0.14   | 0.67          |
| Namakkal        | 789.57  | 94,749  | 0.02                  | 12.15  | 595,582   | 0.15                  | 690,331  | 0.17   | 0.81          |
| Perambalur      | 287.18  | 34,461  | 0.01                  | 4.56   | 223,243   | 0.05                  | 257,704  | 0.06   | 0.30          |
| Pudukottai      | 1,178.85  | 141,462   | 0.03                  | 18.00  | 881,964   | 0.22                  | 1,023,427  | 0.25   | 1.20          |
| Ramnad          | 419.95  | 50,394  | 0.01                  | 6.40   | 313,564   | 0.08                  | 363,958  | 0.09   | 0.43          |
| Salem           | 1,269.18  | 152,301   | 0.04                  | 19.74  | 967,335   | 0.24                  | 1,119,636  | 0.27   | 1.31          |
| Sivagangai      | 835.64  | 100,277   | 0.02                  | 12.73  | 623,946   | 0.15                  | 724,223  | 0.18   | 0.85          |
| Thanjavur       | 853.42  | 102,410   | 0.03                  | 13.20  | 646,578   | 0.16                  | 748,988  | 0.18   | 0.88          |
| The Nilgiris    | 782.92  | 93,950  | 0.02                  | 12.09  | 592,611   | 0.14                  | 686,561  | 0.17   | 0.81          |
| Theni           | 501.29  | 60,155  | 0.01                  | 7.66   | 375,537   | 0.09                  | 435,691  | 0.11   | 0.51          |
| Thiruvallur     | 785.61  | 94,273  | 0.02                  | 12.03  | 589,529   | 0.14                  | 683,802  | 0.17   | 0.80          |
| Thiruvannamalai | 871.15  | 104,539   | 0.03                  | 13.57  | 664,954   | 0.16                  | 769,492  | 0.19   | 0.90          |
| Thiruvarur      | 469.68  | 56,362  | 0.01                  | 7.16   | 350,753   | 0.09                  | 407,115  | 0.10   | 0.48          |
| Thothukudi      | 1,065.75  | 127,890   | 0.03                  | 16.45  | 806,260   | 0.20                  | 934,150  | 0.23   | 1.10          |
| Tiruchirapalli  | 1,466.66  | 175,999   | 0.04                  | 22.80  | 1,117,206   | 0.27                  | 1,293,205  | 0.32   | 1.52          |
| Tirunelveli     | 1,190.09  | 142,811   | 0.03                  | 18.15  | 889,533   | 0.22                  | 1,032,344  | 0.25   | 1.21          |
| Tiruppur        | 1,519.37  | 182,324   | 0.04                  | 23.17  | 1,135,273   | 0.28                  | 1,317,597  | 0.32   | 1.55          |
| Vellore         | 1,831.45  | 219,774   | 0.05                  | 27.94  | 1,368,819   | 0.33                  | 1,588,593  | 0.39   | 1.86          |
| Villupuram      | 1,663.06  | 199,567   | 0.05                  | 25.71  | 1,259,809   | 0.31                  | 1,459,376  | 0.36   | 1.71          |
| Virudhunagar    | 569.27  | 68,313  | 0.02                  | 8.70   | 426,071   | 0.10                  | 494,383  | 0.12   | 0.58          |
| <b>Total</b>    | <b>28,501.95</b>                                  | <b>3,420,234</b>                                      | <b>0.84</b>           | <b>438.01</b>  | <b>21,462,590</b>                                     | <b>5.24</b>           | <b>24,882,824</b>  | <b>6.08</b>  | <b>29.18</b>  |

**State – Telangana**

| District Name           | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|-------------------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Adilabad                | 955.36  | 114,643   | 0.03                  | 14.68  | 719,341   | 0.18                  | 833,984  | 0.20   | 0.98          |
| Bhadradi Kothagudem     | 1,335.97  | 160,316   | 0.04                  | 20.52  | 1,005,666   | 0.25                  | 1,165,982  | 0.28   | 1.37          |
| Hyderabad               | 2,745.65  | 329,478   | 0.08                  | 42.31  | 2,073,043   | 0.51                  | 2,402,522  | 0.59   | 2.82          |
| Jagitial                | 1,747.81  | 209,737   | 0.05                  | 26.73  | 1,309,849   | 0.32                  | 1,519,586  | 0.37   | 1.78          |
| Jangoan                 | 1,834.68  | 220,162   | 0.05                  | 28.00  | 1,371,932   | 0.34                  | 1,592,094  | 0.39   | 1.87          |
| Jayashankar Bhupalpalli | 1,033.94  | 124,072   | 0.03                  | 15.79  | 773,766   | 0.19                  | 897,839  | 0.22   | 1.05          |
| Jogulamba Gadwal        | 1,587.80  | 190,537   | 0.05                  | 24.27  | 1,189,203   | 0.29                  | 1,379,740  | 0.34   | 1.62          |
| Kamareddy               | 1,903.39  | 228,407   | 0.06                  | 29.14  | 1,427,819   | 0.35                  | 1,656,226  | 0.40   | 1.94          |
| Karimnagar              | 1,872.84  | 224,741   | 0.05                  | 28.73  | 1,407,763   | 0.34                  | 1,632,504  | 0.40   | 1.91          |
| Khammam                 | 2,113.70  | 253,643   | 0.06                  | 32.33  | 1,584,343   | 0.39                  | 1,837,987  | 0.45   | 2.16          |
| Komrambheem Asifabad    | 1,126.38  | 135,166   | 0.03                  | 17.33  | 848,964   | 0.21                  | 984,130  | 0.24   | 1.15          |
| Mahabubabad             | 1,992.45  | 239,093   | 0.06                  | 30.43  | 1,490,871   | 0.36                  | 1,729,964  | 0.42   | 2.03          |
| Mahbubnagar             | 3,089.08  | 370,690   | 0.09                  | 47.28  | 2,316,644   | 0.57                  | 2,687,334  | 0.66   | 3.15          |
| Mancherial              | 1,751.16  | 210,139   | 0.05                  | 26.81  | 1,313,845   | 0.32                  | 1,523,984  | 0.37   | 1.79          |
| Medak                   | 1,923.50  | 230,820   | 0.06                  | 29.43  | 1,442,176   | 0.35                  | 1,672,996  | 0.41   | 1.96          |
| Medchal                 | 2,337.11  | 280,453   | 0.07                  | 36.04  | 1,765,919   | 0.43                  | 2,046,372  | 0.50   | 2.40          |
| Mulugu                  | 487.68  | 58,522  | 0.01                  | 7.53   | 369,172   | 0.09                  | 427,693  | 0.10   | 0.50          |
| Nagarkurnool            | 2,768.41  | 332,209   | 0.08                  | 42.34  | 2,074,542   | 0.51                  | 2,406,751  | 0.59   | 2.82          |
| Nalgonda                | 3,588.39  | 430,607   | 0.11                  | 55.07  | 2,698,222   | 0.66                  | 3,128,830  | 0.76   | 3.67          |
| Narayanpet              | 3,194.59  | 383,351   | 0.09                  | 48.85  | 2,393,826   | 0.58                  | 2,777,176  | 0.68   | 3.26          |
| Nirmal                  | 1,687.80  | 202,536   | 0.05                  | 25.95  | 1,271,529   | 0.31                  | 1,474,065  | 0.36   | 1.73          |
| Nizamabad               | 2,274.74  | 272,969   | 0.07                  | 34.94  | 1,712,242   | 0.42                  | 1,985,211  | 0.48   | 2.33          |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District Name    | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|------------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Peddapalli       | 1,527.82  | 183,339   | 0.04                  | 23.39  | 1,146,247   | 0.28                  | 1,329,586  | 0.32   | 1.56          |
| Rajanna Sircilla | 1,107.75  | 132,930   | 0.03                  | 16.96  | 830,919   | 0.20                  | 963,849  | 0.24   | 1.13          |
| Rangareddy       | 2,629.31  | 315,517   | 0.08                  | 40.35  | 1,976,983   | 0.48                  | 2,292,501  | 0.56   | 2.69          |
| Sangareddy       | 8,043.17  | 965,181   | 0.24                  | 124.08   | 6,080,120   | 1.49                  | 7,045,301  | 1.72   | 8.26          |
| Siddipet         | 2,472.78  | 296,733   | 0.07                  | 37.90  | 1,856,960   | 0.45                  | 2,153,693  | 0.53   | 2.53          |
| Suryapet         | 2,188.86  | 262,663   | 0.06                  | 33.54  | 1,643,558   | 0.40                  | 1,906,221  | 0.47   | 2.24          |
| Vikarabad        | 1,454.84  | 174,581   | 0.04                  | 22.51  | 1,103,114   | 0.27                  | 1,277,695  | 0.31   | 1.50          |
| Wanaparthy       | 2,441.07  | 292,929   | 0.07                  | 37.26  | 1,825,843   | 0.45                  | 2,118,771  | 0.52   | 2.48          |
| Warangal Rural   | 1,879.04  | 225,485   | 0.06                  | 28.72  | 1,407,176   | 0.34                  | 1,632,661  | 0.40   | 1.91          |
| Warangal Urban   | 1,175.29  | 141,035   | 0.03                  | 18.02  | 883,085   | 0.22                  | 1,024,120  | 0.25   | 1.20          |
| Yadadri Bhongir  | 1,880.66  | 225,679   | 0.06                  | 28.75  | 1,408,872   | 0.34                  | 1,634,551  | 0.40   | 1.92          |
| <b>Total</b>     | <b>70,153.02</b>                                  | <b>8,418,363</b>                                      | <b>2.06</b>           | <b>1,075.99</b>  | <b>52,723,555</b>                                     | <b>12.88</b>          | <b>61,141,918</b>  | <b>14.94</b>   | <b>71.70</b>  |

State – Uttar Pradesh

| District Name  | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|----------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Azamgarh       | 1,045.99  | 125,518   | 0.03                  | 17.44  | 854,804   | 0.21                  | 980,323  | 0.24   | 1.15          |
| Agra           | 761.50  | 91,381  | 0.02                  | 11.75  | 575,592   | 0.14                  | 666,972  | 0.16   | 0.78          |
| Aligarh        | 21,119.96   | 2,534,395   | 0.62                  | 325.69   | 15,959,004  | 3.90                  | 18,493,399   | 4.52   | 21.69         |
| Allahabad      | 1,055.09  | 126,611   | 0.03                  | 22.30  | 1,092,671   | 0.27                  | 1,219,282  | 0.30   | 1.43          |
| Ambedkar Nagar | 157.38  | 18,886  | 0.005                 | 2.40   | 117,514   | 0.03                  | 136,400  | 0.03   | 0.16          |
| Amethi         | 59.26   | 7,111   | 0.002                 | 0.90   | 44,244  | 0.01                  | 51,355   | 0.01   | 0.06          |
| Auraiya        | 1.39  | 167   | 0.00004               | 0.02   | 1,073   | 0.0003                | 1,240  | 0.0003   | 0.001         |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

| District Name   | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|-----------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Baghpat         | 24.34   | 2,920   | 0.001                 | 0.58   | 28,611  | 0.01                  | 31,532   | 0.01   | 0.04          |
| Bahraich        | 252.13  | 30,255  | 0.007                 | 3.85   | 188,472   | 0.05                  | 218,727  | 0.05   | 0.26          |
| Baliya          | 697.57  | 83,709  | 0.02                  | 12.72  | 623,488   | 0.15                  | 707,197  | 0.17   | 0.83          |
| Balrampur       | 40.19   | 4,823   | 0.001                 | 0.61   | 30,012  | 0.01                  | 34,835   | 0.01   | 0.04          |
| Barabanki       | 3,839.33  | 460,719   | 0.11                  | 59.13  | 2,897,294   | 0.71                  | 3,358,014  | 0.82   | 3.94          |
| Bareilly        | 5,603.54  | 672,425   | 0.16                  | 86.44  | 4,235,705   | 1.03                  | 4,908,130  | 1.20   | 5.76          |
| Basti           | 480.91  | 57,710  | 0.01                  | 8.43   | 412,866   | 0.10                  | 470,575  | 0.11   | 0.55          |
| Bulandshahr     | 1,173.77  | 140,852   | 0.03                  | 18.25  | 894,449   | 0.22                  | 1,035,301  | 0.25   | 1.21          |
| Chandoli        | 34.49   | 4,139   | 0.001                 | 0.53   | 25,754  | 0.01                  | 29,894   | 0.01   | 0.04          |
| Devaria         | 782.66  | 93,919  | 0.02                  | 14.36  | 703,490   | 0.17                  | 797,410  | 0.19   | 0.94          |
| Eta             | 7.13  | 855   | 0.0002                | 0.11   | 5,322   | 0.001                 | 6,177  | 0.002  | 0.01          |
| Faizabad        | 178.34  | 21,401  | 0.01                  | 2.72   | 133,162   | 0.03                  | 154,564  | 0.04   | 0.18          |
| Farukhabad      | 1.32  | 158   | 0.00004               | 0.02   | 1,021   | 0.0002                | 1,179  | 0.0003   | 0.001         |
| Fatehpur        | 901.69  | 108,203   | 0.03                  | 19.15  | 938,239   | 0.23                  | 1,046,442  | 0.26   | 1.23          |
| Firozabad       | 6.05  | 726   | 0.0002                | 0.09   | 4,514   | 0.001                 | 5,240  | 0.001  | 0.01          |
| Gautambudhnagar | 396.29  | 47,555  | 0.01                  | 6.04   | 295,899   | 0.07                  | 343,454  | 0.08   | 0.40          |
| Gazipur         | 57.51   | 6,902   | 0.002                 | 0.88   | 42,943  | 0.01                  | 49,844   | 0.01   | 0.06          |
| Ghaziabad       | 1,776.90  | 213,228   | 0.05                  | 27.43  | 1,344,100   | 0.33                  | 1,557,327  | 0.38   | 1.83          |
| Gonda           | 88.91   | 10,669  | 0.003                 | 1.35   | 66,384  | 0.02                  | 77,053   | 0.02   | 0.09          |
| Gorakhpur       | 1,161.05  | 139,326   | 0.03                  | 19.97  | 978,329   | 0.24                  | 1,117,655  | 0.27   | 1.31          |
| Hapur           | 2.51  | 301   | 0.0001                | 0.04   | 1,872   | 0.0005                | 2,173  | 0.001  | 0.003         |
| Hardoi          | 15.98   | 1,917   | 0.0005                | 0.36   | 17,607  | 0.004                 | 19,524   | 0.005  | 0.02          |
| Itawa           | 1.29  | 154   | 0.00004               | 0.02   | 986   | 0.0002                | 1,141  | 0.0003   | 0.001         |
| Jaunpur         | 59.01   | 7,081   | 0.002                 | 0.90   | 44,062  | 0.01                  | 51,144   | 0.01   | 0.06          |
| Kannauj         | 1.29  | 155   | 0.00004               | 0.02   | 1,000   | 0.0002                | 1,156  | 0.0003   | 0.001         |
| Kanpur dehat    | 1.37  | 165   | 0.00004               | 0.02   | 1,049   | 0.0003                | 1,214  | 0.0003   | 0.001         |

District wise assessment of waste availability & energy generation in Urban organic solid waste, Urban organic liquid waste, Slaughterhouse, Distillery industry and Pulp & Paper Industry – Second Report

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|------------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Kanpur shahr     | 1.58  | 190   | 0.00005               | 0.02   | 1,204   | 0.0003                | 1,394  | 0.0003   | 0.002         |
| Kasganj          | 8.33  | 999   | 0.0002                | 0.13   | 6,219   | 0.002                 | 7,218  | 0.002  | 0.01          |
| Kaushambi        | 850.16  | 102,019   | 0.02                  | 16.42  | 804,421   | 0.20                  | 906,440  | 0.22   | 1.06          |
| Kheeri           | 6.24  | 749   | 0.0002                | 0.14   | 6,954   | 0.002                 | 7,703  | 0.002  | 0.01          |
| Kushinagar       | 757.19  | 90,863  | 0.02                  | 13.23  | 648,047   | 0.16                  | 738,909  | 0.18   | 0.87          |
| Lucknow          | 3.68  | 442   | 0.0001                | 0.08   | 3,837   | 0.001                 | 4,279  | 0.001  | 0.01          |
| Mahamaya Nagar   | 7.40  | 888   | 0.0002                | 0.11   | 5,522   | 0.001                 | 6,410  | 0.002  | 0.01          |
| Maharajganj      | 765.65  | 91,878  | 0.02                  | 14.69  | 719,971   | 0.18                  | 811,849  | 0.20   | 0.95          |
| Mainpuri         | 8.03  | 963   | 0.0002                | 0.12   | 5,993   | 0.001                 | 6,956  | 0.002  | 0.01          |
| Mathura          | 6.02  | 722   | 0.0002                | 0.09   | 4,495   | 0.001                 | 5,218  | 0.001  | 0.01          |
| Mau              | 721.40  | 86,568  | 0.02                  | 12.19  | 597,286   | 0.15                  | 683,854  | 0.17   | 0.80          |
| Meerut           | 2,020.86  | 242,504   | 0.06                  | 31.24  | 1,530,583   | 0.37                  | 1,773,086  | 0.43   | 2.08          |
| Mirzapur         | 47.48   | 5,697   | 0.001                 | 0.83   | 40,663  | 0.01                  | 46,360   | 0.01   | 0.05          |
| Muzaffarnagar    | 1,498.44  | 179,813   | 0.04                  | 23.20  | 1,137,018   | 0.28                  | 1,316,831  | 0.32   | 1.54          |
| Pratapgarh       | 956.94  | 114,832   | 0.03                  | 19.91  | 975,817   | 0.24                  | 1,090,649  | 0.27   | 1.28          |
| Raibareilly      | 12.48   | 1,498   | 0.0004                | 0.29   | 13,979  | 0.003                 | 15,477   | 0.004  | 0.02          |
| Rampur           | 3,621.51  | 434,581   | 0.11                  | 55.87  | 2,737,859   | 0.67                  | 3,172,439  | 0.78   | 3.72          |
| Saharanpur       | 1,502.19  | 180,263   | 0.04                  | 23.25  | 1,139,131   | 0.28                  | 1,319,394  | 0.32   | 1.55          |
| Santakbir nagar  | 391.62  | 46,994  | 0.01                  | 6.91   | 338,550   | 0.08                  | 385,544  | 0.09   | 0.45          |
| Santravidasnagar | 18.41   | 2,209   | 0.001                 | 0.28   | 13,744  | 0.003                 | 15,952   | 0.004  | 0.02          |
| Shamli           | 3.98  | 478   | 0.0001                | 0.11   | 5,402   | 0.001                 | 5,880  | 0.001  | 0.01          |
| Sharavasti       | 88.86   | 10,663  | 0.003                 | 1.35   | 66,350  | 0.02                  | 77,013   | 0.02   | 0.09          |
| Sidharth nagar   | 669.75  | 80,370  | 0.02                  | 11.90  | 583,281   | 0.14                  | 663,651  | 0.16   | 0.78          |
| Sitapur          | 7.70  | 924   | 0.0002                | 0.12   | 5,750   | 0.001                 | 6,674  | 0.002  | 0.01          |
| Sonbhadr         | 21.65   | 2,598   | 0.001                 | 0.33   | 16,168  | 0.004                 | 18,766   | 0.005  | 0.02          |
| Sultanpur        | 124.59  | 14,951  | 0.004                 | 1.90   | 93,029  | 0.02                  | 107,981  | 0.03   | 0.13          |



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|---------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Unnao         | 20,034.37   | 2,404,125   | 0.59                  | 309.19   | 15,150,398  | 3.70                  | 17,554,522   | 4.29   | 20.58         |
| Varanasi      | 108.02  | 12,962  | 0.003                 | 2.03   | 99,378  | 0.02                  | 112,340  | 0.03   | 0.13          |
| <b>Total</b>  | <b>76,050.66</b>                                  | <b>9,126,080</b>                                      | <b>2.229</b>          | <b>1,210.46</b>  | <b>59,312,582</b>                                     | <b>14.49</b>          | <b>68,438,661</b>  | <b>16.72</b>   | <b>80.25</b>  |

**State – Uttarakhand**

| District Name     | Total Solid Waste Generation (In tonne) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Total Liquid Waste Generation (Million litres) per annum | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum | Energy Potential (MW) | Bio-Gas Generation (In 000 m <sup>3</sup> ) per annum (Solid & Liquid Waste) | Total Energy Potential - Solid Waste & Liquid Waste (MW) | Bio-CNG (TPD) |
|-------------------|---|---|-----------------------|--|---|-----------------------|--|--|---------------|
| Almora            | 146.18  | 17,542  | 0.004                 | 2.29   | 112,439   | 0.03                  | 129,980  | 0.03   | 0.15          |
| Bageshwar         | 49.86   | 5,983   | 0.001                 | 0.76   | 37,453  | 0.01                  | 43,436   | 0.01   | 0.05          |
| Chamoli           | 61.12   | 7,335   | 0.002                 | 0.94   | 46,220  | 0.01                  | 53,555   | 0.01   | 0.06          |
| Champawat         | 39.92   | 4,790   | 0.001                 | 0.62   | 30,160  | 0.01                  | 34,951   | 0.01   | 0.04          |
| Dehradun          | 259.04  | 31,084  | 0.01                  | 4.34   | 212,470   | 0.05                  | 243,555  | 0.06   | 0.29          |
| Haridwar          | 508.15  | 60,978  | 0.01                  | 8.41   | 412,066   | 0.10                  | 473,045  | 0.12   | 0.55          |
| Nainital          | 201.24  | 24,149  | 0.01                  | 3.23   | 158,286   | 0.04                  | 182,435  | 0.04   | 0.21          |
| Pauri             | 293.24  | 35,189  | 0.01                  | 4.48   | 219,741   | 0.05                  | 254,930  | 0.06   | 0.30          |
| Pithoragarh       | 109.79  | 13,175  | 0.003                 | 1.72   | 84,456  | 0.02                  | 97,630   | 0.02   | 0.11          |
| Rudraprayag       | 55.96   | 6,716   | 0.002                 | 0.86   | 42,162  | 0.01                  | 48,878   | 0.01   | 0.06          |
| Tehri             | 150.56  | 18,067  | 0.004                 | 2.33   | 114,097   | 0.03                  | 132,164  | 0.03   | 0.15          |
| Udham Singh Nagar | 273.89  | 32,867  | 0.01                  | 4.71   | 231,013   | 0.06                  | 263,880  | 0.06   | 0.31          |
| Uttarkashi        | 117.07  | 14,048  | 0.003                 | 1.79   | 87,537  | 0.02                  | 101,585  | 0.02   | 0.12          |
| <b>Total</b>      | <b>2,266.01</b>                                   | <b>271,921</b>  | <b>0.07</b>           | <b>36.49</b>   | <b>1,788,101</b>                                      | <b>0.44</b>           | <b>2,060,022</b>   | <b>0.50</b>  | <b>2.42</b>   |





UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION

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