



Department
for International
Development

 UK Government



SCGJ

SKILL COUNCIL FOR
GREEN JOBS

Future Job Roles in Operations and Maintenance of Bio-CNG Plants

Study conducted for Skill Council for Green Jobs (SCGJ)

June 30, 2020

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1

Study Overview

Study Overview

Objective of the study

To identify new and emerging Job Roles in the Bio-CNG sector for development of National Occupational Standards

Outputs of the study

- Identification of new and emerging job roles in Bio-CNG plants
- Study Report and dissemination of the findings of the report to all the concerned stakeholders.

Outcomes of the study

- Creation of Qualification Packs/Training standards post identification of Job roles
- Conducting ToT/ToA in the new age job roles

Approach

Secondary Research

- Desk research to identify the emerging areas in the field of Bio-CNG along with the type of jobs in demand in next 3 - 5 years.
- Study of global best practices (including UK) to identify areas of potential growth in future.
- Identify various government initiatives for adoption and also include industry best practices in India and globally.

Primary Research

- Preparation of a study questionnaire for stakeholder consultations.
- Interactions with a few select industry partners (private industries, Industry associations, SCGJ) to understand the future estimated skilled workforce requirement, changing nature of jobs, technological advancements and potential areas of upcoming job roles in next 5-10 years.

2

Overview of Bio-CNG

Biomass Sector: An Overview

Biomass

India produces approx. 450-500 million tonnes of biomass per year which amounts to 32% of all the primary energy use in the country at present. EAI (Energy Alternatives India) estimates that the potential in the short term for power from biomass in India varies from about 18,000 MW, when the scope of biomass is as traditionally defined, to a high of about 50,000 MW, if one were to expand the scope of definition of biomass.

Opportunities

Biomass has the highest potential for small scale business development and mass employment. Opportunities are diverse, and are present in such different sectors as, R&D, agriculture (biomass cultivation and processing), transport services, bioenergy production, manufacturing and servicing of core equipment and EPC.

Types of Conversion Process to generate Biomass Energy

Direct Combustion

Burning of Biomass in presence of Oxygen to convert into heat/electricity with the help of steam cycle (Stoves Boilers, power plants). These processes are applied on a small scale for domestic heating

Biochemical Process

This entails the transformation of biomass into gaseous or liquid fuels such as biogas or bioethanol through

- a. **Anaerobic Digestion**
- b. Alcoholic fermentation

Thermochemical Process

This entails the application of heat and chemical processes into the production such as

- a. Pyrolysis: Temp. range of 300-800 degree Celsius and produces liquid fuel
- b. Gasification: Temp. range of 700-1400 degree Celsius used to produce synthetic gas

Biomass: Bio-CNG

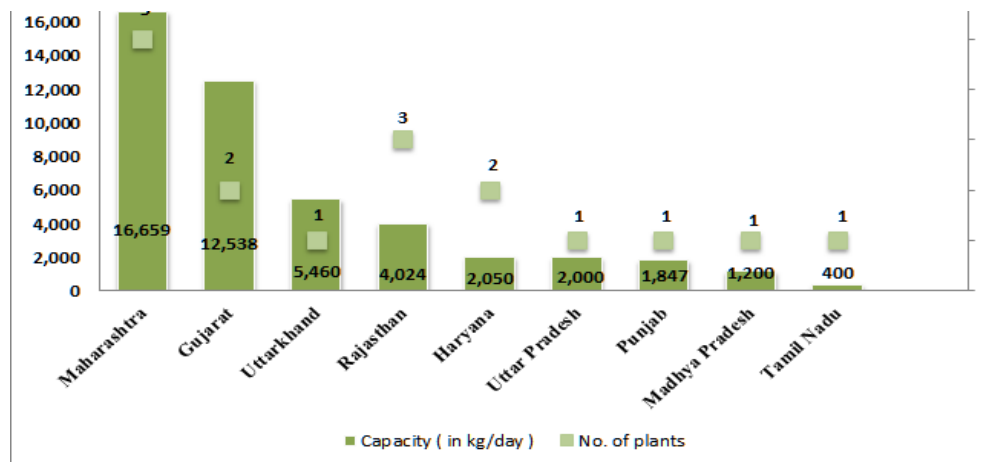
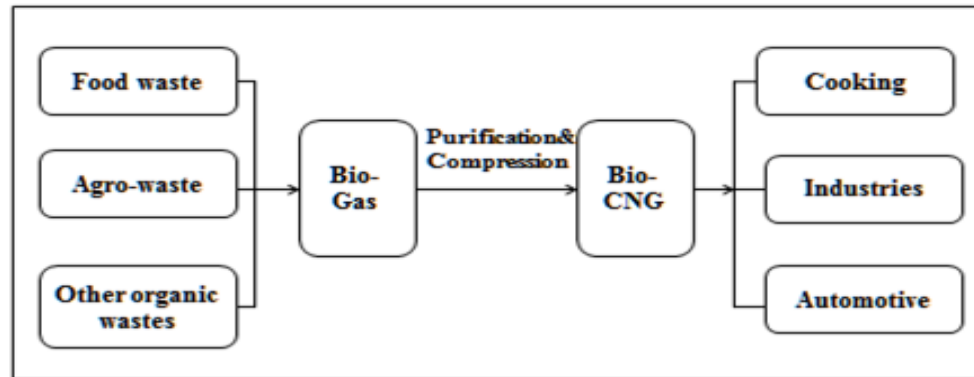
Background

In India, traditionally biomass had been utilized through direct combustion or anaerobic digestion. Further processing of this mixture, purification and compression is called Bio compressed Natural Gas (Bio-CNG).

Bio- CNG is estimated to replace two- thirds of India's Natural gas imports, which is currently at 429 billion cubic feet. Currently 17 bio-Gas plants are operational in India which are spread in nine states, with Maharashtra leading in the terms of the largest capacity.

Why Bio-Gas to Bio-CNG

- 167% higher Calorific Value than Biogas
- Exactly similar to commercially available natural gas in its composition and energy potential
- Biogas contains trace components like water vapor, hydrogen sulfide, carbon monoxide making it corrosive and unsuitable to be used as fuel
- 62 million tonnes per annum production potential helps bringing down crude oil imports
- Bio-CNG can replace 2/3rd of India's Natural Gas imports
- Enriched organic manure produced in Bio-CNG process can be used as a fertilizer

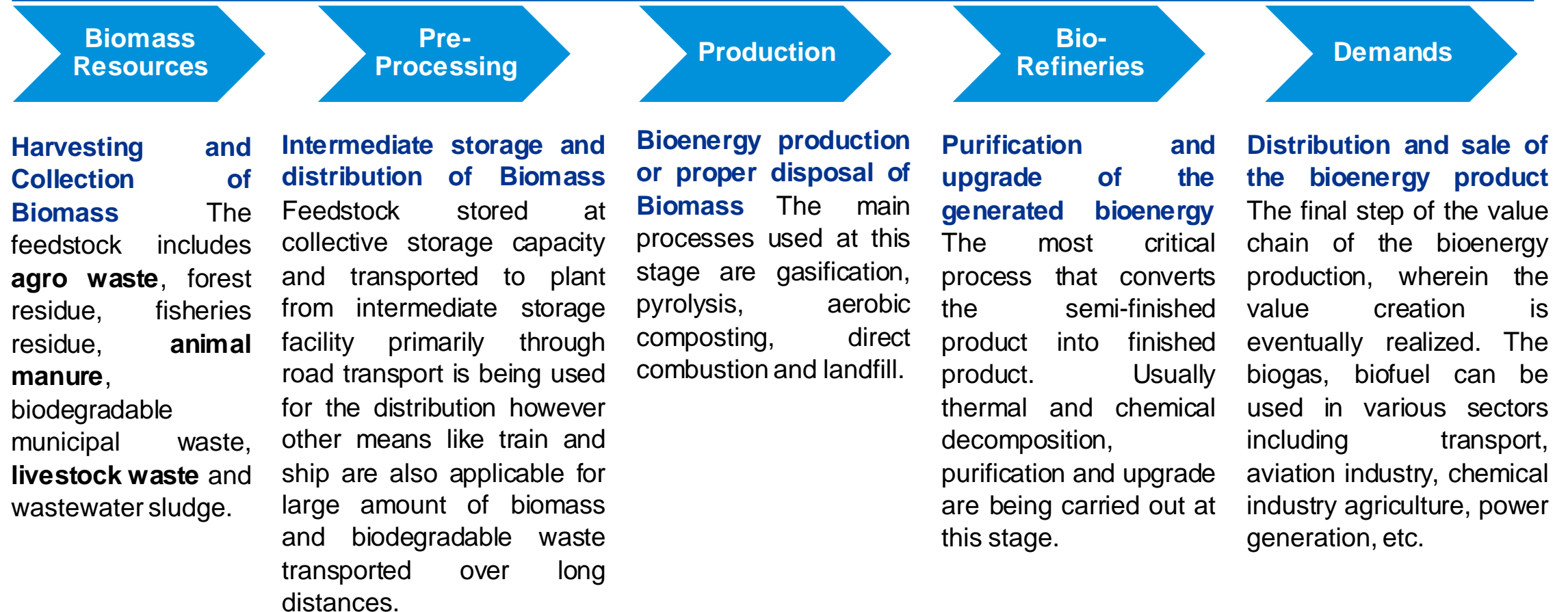


Key Challenges faced in adoption of Bio-CNG

- Relatively new technology in India
- Capital cost of installation of Bio-CNG plants along with segregation and processing costs of waste is expensive
- Lack of skilled technicians
- No specific standards existing in India for installation, operation and maintenance of these plants
- Installation near waste generation abundant hence challenging to ensure consistent supply of waste sources for production

Biomass to Bio-CNG: Understanding the Supply Chain

Biomass Potential: As per MNRE's estimates, the current availability of biomass in India (2018-19)* is estimated at about 500 million metric tonnes per year. Moreover, surplus biomass availability to the tune of 120-150 million metric tonnes per annum covering agro and forest residues corresponds to a potential of 18000 MW



*https://mnre.gov.in/file-manager/UserFiles/MNRE_HRD_Report.pdf

Biomass: Occupational Map and Policy Support

Feedstock Production-Sources

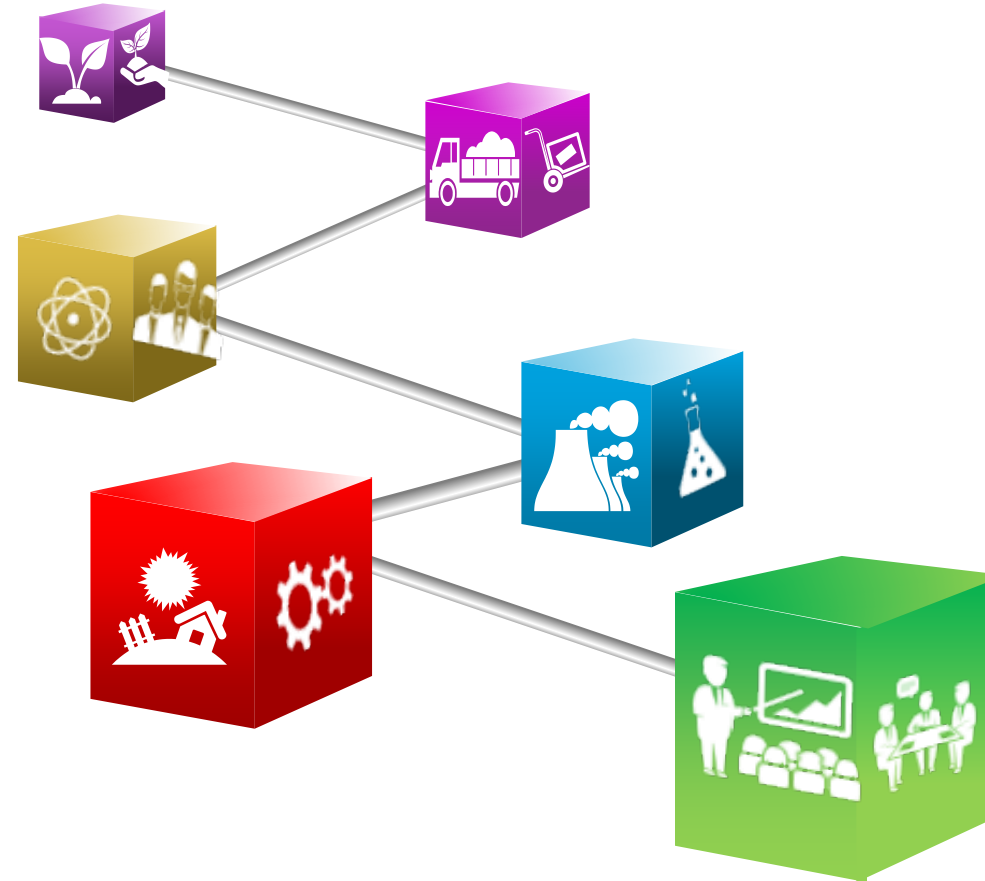
- Field and plantation biomass (Ex: Crop residue, perennial grass)
- Industrial biomass (Ex: Bagasse, Husk)
- Forest biomass (Ex: Wood)
- Urban waste biomass (Ex: Solid waste, Food waste)
- Aquatic biomass (Ex: Algae)

Conversion

- Biochemical Conversion
- Thermochemical Conversion
- Chemical

Policy Support

- SATAT, Gobardhan, NNBOMP
- National Policy on Biofuels
- Central Financial Assistance (CFA) of MNRE
- Dedicated Organization has been created to cater to the Skill requirements in the sector



Feedstock Logistics

- Harvesting and Collection
- Storage
- Pre-processing
- Transportation

Distribution

- Transportation
- Storage
- Dispensing

End Use

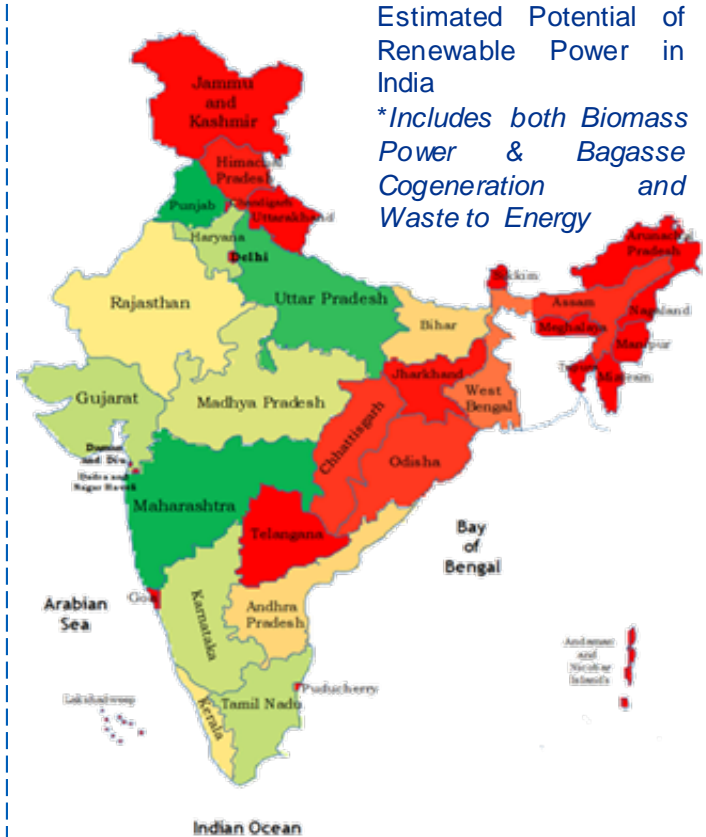
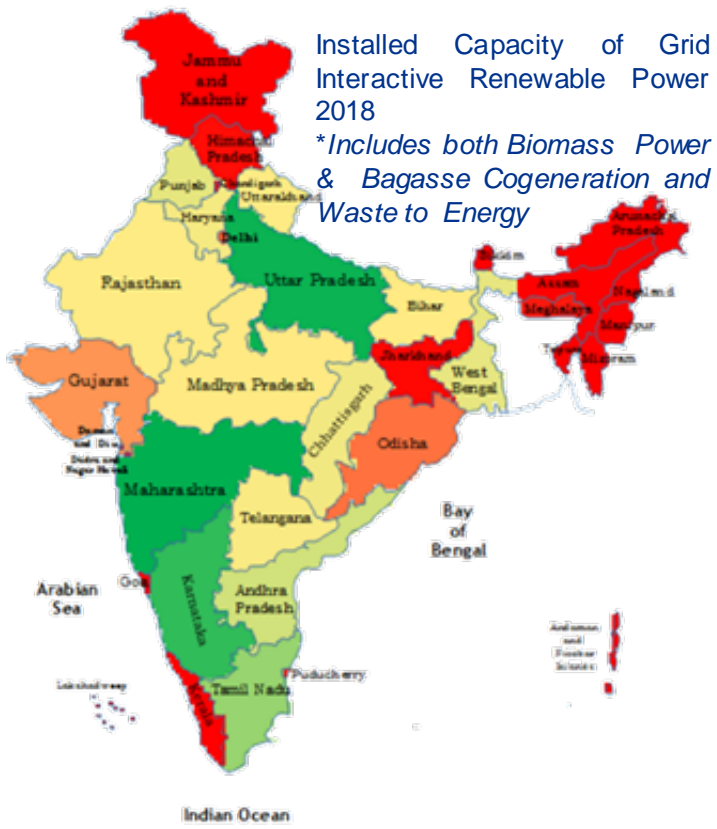
- Grid Based Power to be used in electricity for households
- Industrial
- Light and heavy duty vehicles such as locomotives etc.
- Airplanes
- Electricity for Households
- Shipping etc

Currently, about 32% of total primary energy used in India is derived from Biomass. More than 70% of the country's population depends upon biomass for its energy needs. India has ~5+ GW capacity biomass powered plants: 83% are grid connected while the remaining 17% are off-grid plants.

3

Industry Scenario - India

Biomass: Potential in India



Colour Gradient of Maps- Lowest (Red) to Highest (Green)

The leading states for biomass power projects are **Maharashtra, Uttar Pradesh and Karnataka** with each one having more than 1 GW of Grid interacted biomass power. Other states with favorable policy and opportunities in Biomass are **Punjab, Andhra Pradesh and Bihar**.

Growth Areas

- ❑ Global employment in RE is expected to increase nine-fold reaching 20 million jobs by 2030, with biomass leading the growth
- ❑ India has a potential of generating 18 GW of energy from Biomass
- ❑ Shift towards a decarbonized power sector in India, with coal-sector-based employment expected to decline by about 52 % between 2020 and 2050
- ❑ Indian Oil, HPCL, BPCL to **invest INR 10,000 crore** for **Bio-CNG plants** thereby **operating 400 plants by 2022**

Major Challenges

- ❑ Fragmented farm lands makes waste collection difficult. The ambiguity on government policy and dissemination of information regarding purchase notification, schedules, price adds to farmers confusion
- ❑ Major technical upliftment of the processing units including both bio as well as thermo plants
- ❑ Road blocks such as raw material cost, weather, storage resource constraint etc. in increasing competing usage of biomass resources, leads to high opportunity costs
- ❑ Lack of motivation among rural entrepreneurs to take up the responsibility of supplying biomass to processing facilities.
- ❑ Lack of skilled workers in the sector combined with unpaid family work, places a disproportionate burden on women

Bio-CNG: Initiatives by Government

*Hon'ble Prime Minister has given the following four pillars of our vision of India's energy future – **Energy Access, Energy Efficiency, Energy Sustainability and Energy Security***

Gobar-Dhan

GOBAR-DHAN (Galvanising Organic Bio-Agro Resources) was launched in 2018 to convert cattle dung and solid waste in farms to CBG and compost. Scheme envisages to set-up **700 biogas plants** by SHGs, Gram Panchayat, Bulk Waste generators and Entrepreneurs.

NNBOMP

New National Biogas and Organic Manure Programme (NNBOMP) was launched to promote family type biogas plants of size ranging from 1 cubic mtr to 25 cubic mtr. Primary objective of this initiative is to provide clean cooking fuel in rural areas by setting-up **2.55 lakh** biogas plants.

SATAT

Sustainable Alternative Towards Affordable Transportation (SATAT), was launched in 2018 to promote Compressed Bio Gas (CBG) as an alternative and green transport fuel. The government is keen to set up **5000 CBG** plants by 2025 under this scheme.

National Policy of Biofuels

It was relaunched in 2018 to increase usage of Biofuels in energy and transportation sector; to utilize, develop and promote domestic feedstock and conversion of surplus quantities of food grains to ethanol; to increase blending percentage to **20% in petrol and 5% in diesel by 2030**.

BPGTP

Biogas Power Generation (Off-grid) and Thermal energy application Programme (BPGTP) was launched to promote community scale biogas plants in the size of 30m³-2500m³ and power generation capacity of 3kW-250kW. Scheme accomplished about 9MWeq of installed capacity.

Waste to Energy Programme

The objective of this program is to promote setting up of projects for recovery of energy in the form of Biogas / Bio-CNG / Enriched Biogas / Syngas / Power from urban, industrial and agricultural wastes. The scheme aims to setup a total **500+MW** of installed capacity.

India plans to start 6,000 compressed biogas (Bio-CNG) plants by 2020, creating potential employment for over 90,000 people

Case Study 1: Punjab, Lambra Village, Hoshiarpur District

This village installed community owned biogas plant with a capacity to process 2500 kg of cow dung daily and pays the families Rs 8 per quintal for the agro waste acquired

Technical Assistance by : Punjab Pollution Control Board (PPCB) & Punjab Agriculture University (PAU)

Financial Assistance by : Union Ministry of New and Renewable Energy (Rs 2 lakhs)

Piped Gobar Gas available to all the families of the village from 4 am to 10 pm



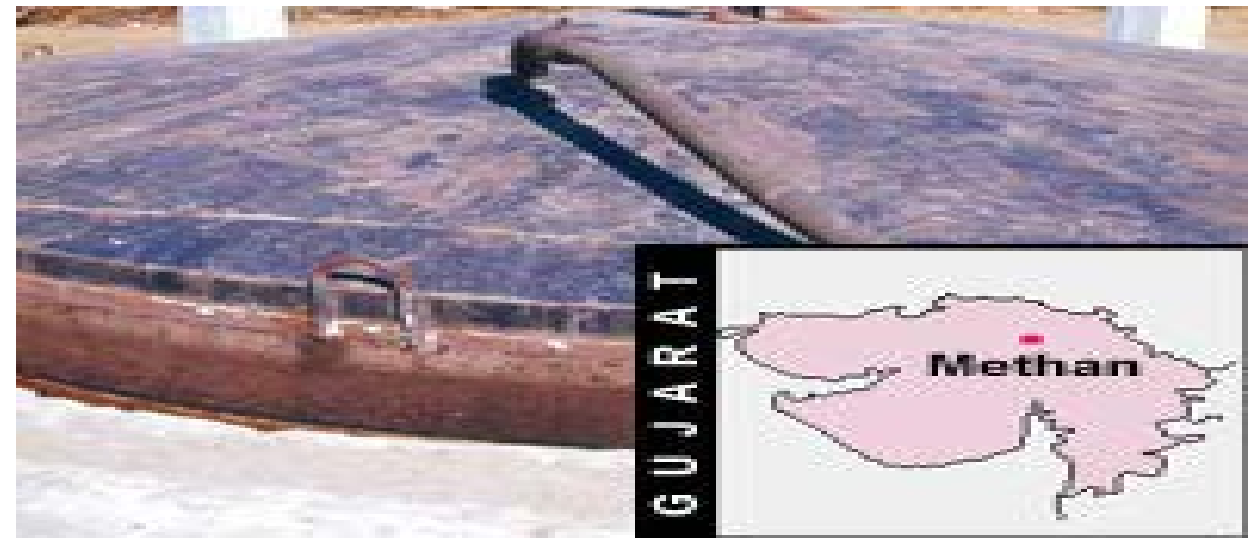
Case Study 2: Gujarat, Methan Village, Patan District

India's largest biogas plant set-up in 1987, the biogas plant has eight digesters with a total capacity of 630 cubic meters with requirement of 2.5 tonnes of cow dung per day, saving 500 metric tonnes of fuelwood annually.

Technical Assistance by : Mehsana based Dush Sagar Dairy & State Government's Gujarat Energy development agency

Financial Assistance by : Ministry of Non Conventional energy sources provided an aid of Rs 19.91 lakhs

With 500 households in the village piped Gobar Gas is available to all the families for five to six hours a day



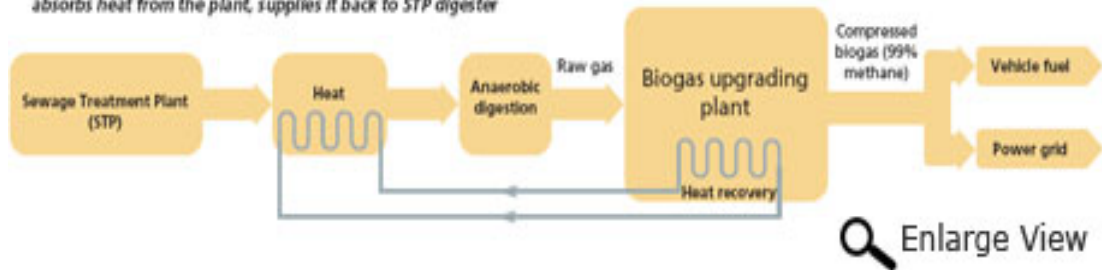
Case Study 3: West Delhi, Keshopur Sewage Treatment Plant

Chosen due to its proximity to a CNG-filling station and a CNG-fuelled power grid. DJB has a 10% stake provides raw gas and land for setting the biogas plant

Technical Assistance by : Purac puregas, Swedish company

EFFLUENTS TO ENERGY

Apart from fuelling vehicles and power grid, the technology absorbs heat from the plant, supplies it back to STP digester



Creating value from sludge to create Bio-gas for running Delhi's public transport system



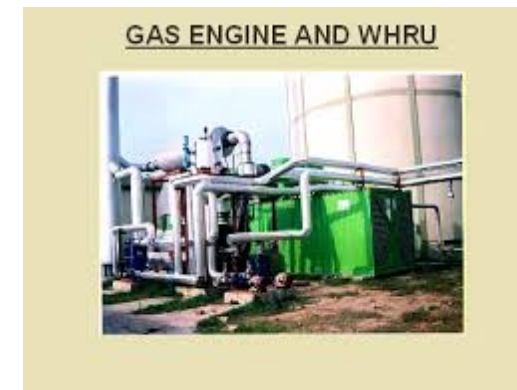
Case Study 4: Punjab, Ludhiana, Haibowal Dairy Complex

PEDA has commissioned a 1 Mega Watt (MW) high rate bio methanation cattle dung based power project

Technical Assistance by : Antac Technology, Austria

Financial Assistance by : Punjab Government and the Centre government set up the project was synchronized to the grid on September 8, 2004 at a cost of 14 crores

Capacity to produce 13-14,000 units of electricity per day. Forty seven tonnes of bio manure, used for agricultural purposes are produced daily which is sold by PEDA at Rs 25 per quintal



4


Industry Scenario -
UK : Offerings for
Indian Market

Bioenergy in UK: Industry Overview



Bio-energy including biomass, biofuel and biogas accounts for 66.3% of the UK's renewable energy across heat, transport and electricity.

In 2018, the United Kingdom significantly increased its reliance on bio-energy producing:

 Nearly 32 thousand gigawatt hours of electricity derived from biomass sources



The annual production of biofuels increased over the years, reaching 617 thousand tons of oil



Biomass accounts for about 22.9% of renewable heat generation in UK.



The utilized agricultural area (UAA) in England increased by 0.6% between 2016 and 2017 and now stands at almost 9.1 million hectares making the potential for agricultural waste quite lucrative

Policy Support for Bio-Energy

Govt. schemes have been mandated to support the growth of the bio-energy sector, namely:

- Waste Strategy 2000
- A New Direction for Agriculture
- Rural Development Plan
- Animal By-Products (Enforcement) (England) Regulations 2011
- Setting up of The Renewable Transport Fuels Obligation (RTFO) and the Renewable Heat Incentive (RHI)
- Extending the fuel duty differential between bio-methane and diesel from 2024 to 2032.



Translating intent to capacity

Installed Capacity

- Number of biomass plants in the UK has more than tripled in four years, from 135 in 2014 to 429 in 2018
- Four bio-fuel plants to be funded under £45 million under Future Fuels for Flight and Freight Competition and Advanced Biofuels Demonstration Competition
- Currently there are 486 operational agri- waste plants in the UK, and a further 343 in development






Source: <https://publications.parliament.uk/pa/cm201617/cmselect/cmenergy/173/17307.html>; <https://uk-air.defra.gov.uk/library/assets/documents/reports/aeqg/road-transport-biofuels.pdf>

<https://www.statista.com/topics/4956/bioenergy-industry-in-the-united-kingdom-uk/>; <https://bioenergyinternational.com/storage-logistics/cng-fuels-to-open-five-new-biomethane-refuelling-stations>

Bioenergy in UK: Workforce Requirements and Job Roles


The no. of green collar jobs soar to approximately 400,000, with clean growth driving the UK government's modern industrial strategy. This figure could more than quadruple to 2 million by 2030.


Need for Skilled Workforce

-  Feedstock Production & Supply
-  Plant design and construction
-  Plant operation

Over the next decade the UK advanced fuels industry is expected to be worth over £400 million and create 9,800 jobs alone.

Key Industries in Bio-Energy

 Bio-fuels-bio diesel, Ethanol

 Bio gas- Bio-CNG

 Agri-waste sustainable management

Key Job roles


 Boiler house construction & maintenance

 Feedstock haulage & processing

 Process Plant Manager

 CHP Technician

 Biomass Plant Technician

 Site assessment (spatial and logistics)

Companies in UK (potential collaborations)



Engas UK is building a robust, direct compressor of raw-wet, dirty biogas and landfill gas into high purity, dry, biomethane without using any pre-compressor thus saving cost, improving efficiency and reliability.



Future Biogas is at the forefront of the anaerobic digestion industry. They develop and operate AD plants and provide development, construction, operations, ongoing compliance and asset management services.



They specialize in large scale biomass and biogas boilers, biogas plants, CHP and heat networks. In partnership, they have installed over 250 biogas worldwide and own and manage 18 of their own AD plants.



5

Industry
Consultations

Industry Consultations

As part of the primary consultations, Interview questionnaire was designed to capture different industry related information including technologies, workforce and their skill requirements, training needs, growth prospects, etc.

Key Focus Areas

Prospective areas of growth and potential, regulations

Technology interface used

Job-roles and skilled workforce requirement

Skilling requirements and training needs

Interview Questionnaire for Study on Future job roles in the TVET ecosystem in the name of DfED India is collaborating with the Entrepreneurship, Govt. to promote Skill India Mission through the 'Sk Renewable Energy is one of the priority sectors in the scale up phase of it questionnaire, we intend to identify the key areas of growth in the sector requirement of skilled workforce in new and emerging job roles.

Name of the Respondent _____
Organization _____
Designation _____
Contact No. _____
Contact Email ID _____
Areas of specialization in Firm _____

Key Research Areas:

- Key business areas
- Key technology interface
- Regulatory and Policy
- Current and Project

Q. No.

1. When was the member (y)?
 a) 0-1 year
 b) More 1
 c) More 1

2. Which part of
 a) Feeds
 b) Sludge
 c) Cowie
 d) Tank
 e) Biogas

3. Which raw mat
 a. Food I
 b. Agro V
 c. Other

4. What percent
 a. More 1

5. b. 50 - 25%
 c. Less than 25%
 a. Yes
 b. No
 If yes, please highlight

6. How would you assess dependence (Cases)
 a. High
 b. Low
 c. Other (Please s
 What are the specific di
 maintenance of these d

7. Do you use any technol
 a. Yes
 b. No
 If yes, please highlight

8. Do you envision any ne
 a. Yes
 b. No
 If Yes, please elaborate

9. What are some of the d
 used or will be used?
 Name of d

10. What is the proportion of technical strength vs low skilled manual labour?
 a) 50:50
 b) More towards the technical strength
 c) More towards the low skilled labor

11. What is the current employee strength?
 a. Less than 10
 b. Between 10-30
 c. Between 30-100
 d. Above 100

12. Do you face any skill shortage in the market?
 a) Yes
 b) No
 If yes, at which level?
 a. Entry level
 b. Mid Management level
 c. Senior Management level

13. How are the training needs currently being met?
 a. On the job training
 b. Internal training by in-house experts
 c. Training by external experts
 d. Certification courses

14. What are some of the key channels of hiring?
 a. Lateral hiring
 b. Contract recruitment
 c. Hiring from IITs
 d. Hiring from employment exchanges
 e. Others (please specify)

15. What are the roles in which you hire?

Name of Job Role	Level

16. Are regulatory changes in the country and world impacting your company and the RE sector in general? If yes, how?

17. Are you partnering with any country in the Biogas/Bio-CNG space? If yes, which areas do you see as strong emerging areas in RE in the said partner countries.

18. What are the areas of growth in the next 3-5 years for your organization?

Industries that participated in consultations

Bio-CNG Companies

- Atmos Power
- CBS Technologies
- Organic Recycling Systems Pvt. Ltd.
- Grow Diesel
- 21st Century Enviro Engineers Pvt. Ltd.
- Quantum Green
- Green Connect
- SLPP Renew

- Reached out to 36 industries working in the field of Bio-CNG along with the industry association (Biogas India).
- Received responses from 8 industries.
- Due to COVID-19, many of the company offices were closed for operations, people have asked for more time or the response is still awaited.

Snapshot of responses

The proposed job roles were well received and were cited as the need of the hour

Company Name/ Whether the job role will be in demand (YES or NO)?	Plant Manager (Bio- CNG Plant) NSQF Level 6	Feedstock Manager (Procurement & Composition) NSQF Level 5	Plant Construction & Maintenance supervisor NSQF Level 5	Plant Construction & Maintenance technician (Digester) NSQF Level 4
Atmos Power		✓		✓
CBS Technologies	✓	✓	✓	✓
Quantum Green				
Organic Recycling Systems Pvt Ltd	✓			✓
Green Connect	✓		✓	✓
SLPP Renew	✓	✓	✓	✓
Grow diesel	✓	✓		
21st Century Enviro Engineers Pvt. Ltd.	✓	✓		✓

Almost all the firms interviewed had five year plus operation history

Total Responses Received	8
Skilled Workforce Requirement	High
Skilling shortage faced	Yes
Current Training Needs	On the Job Internal Training by In- house experts
%age of Operation Cost incurred to process waste	High (30% – 50%)
Prospective areas of growth	Co-Digestion, Economies of scale with standardization of process
Potential Regulations	Regulatory changes along with industry status
Technology Used	According to Process used with some respondents using their own processes

6


Recommendations

Study Recommendations

Based on the secondary research and industry consultations, the following Job roles are being recommended for Operations and Maintenance of Bio-CNG Plants

 Plant Manager (Bio-CNG Plant)
NSQF Level 6

 Feedstock Manager
(Procurement & Composition)
NSQF Level 5

 Plant Construction & Maintenance Supervisor
(Provides pre & post installation services)
NSQF Level 5

 Plant Construction & Maintenance technicians (Digesters)
NSQF Level 4

 Maintenance Engineer
NSQF Level 6

 Biomass Procurement Supervisor
NSQF Level 5


 Plant Operator
NSQF Level 4



Average Worker Profile*

- 12th pass, Diploma or Degree
- Diploma or certificate course in bio-gas / bio-plant operations
- Age: 18+

**KPMG Analysis*

 **Findings through secondary research and validated by industries**

 **Suggestions based on industry consultations**

Minimum Workforce Requirement



Plant Manager (Bio-CNG plant)
NSQF Level 6

6000



Feedstock Manager (Procurement & Composition)
NSQF Level 5

6000



Plant Construction & Maintenance
technicians (Digesters)
NSQF Level 4

6000



Plant Construction & Maintenance Supervisor (Provide
pre & post installation services)
NSQF Level 5

1260

Methodology Used

- Primary Discussion on manpower requirement envisaged by the Bio-CNG Industry
- Investment Promised by Govt/Industry in the sector

Key Findings*

- Three Govt of India schemes namely SATAT, Gobardhan & Waste to energy focusses on creation of 6000 commercial Bio-CNG plants by 2025 equivalent to 9,000 MW
- On an average each Bio-CNG plant to create 12-15 jobs**
- Expected total employment around 72,000
- As per our analysis each operating plant would require a minimum of
 - 1 Plant Manager
 - 1 Feedstock Manager
 - 1 Plant Construction & Maintenance Technicians
- Accordingly minimum workforce required in each of the above job roles is at least 6,000
- It is estimated that for MWeq, 0.14 FTE of Plant Construction & Maintenance supervisor are required
- Total turn-key technicians required is 1260

*KPMG Research and Analysis

** Industry consultations

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Thank you