



Municipal Solid Waste Management: Waste-to-Energy Technologies, Recycling & Refurbishment

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About GPS Renewables



Technology Stack

Arguably India's only [full stack biogas technology company](#) with,


- Special microbes (**anaerobic fungi**)
- Own **biohealth monitoring softwares** (being used by RIL)
- **Strong process know** (experienced India team + **recently acquired [Proweps](#)**, a leading German biogas design & engg firm)
- [ISO 45001, 14001 & 9001 certified manufacturing unit for proprietary biogas upgradation unit + heat exchangers](#)

EPC experience

- Amongst the top 3 EPC players in biogas space
- Currently [executing CBG projects worth 1,000+ Cr](#), including MoU for additional 600 Cr with RIL
- TEPC partner for the [Indore CBG project](#)
- Just [soft commissioned \(start of feeding\) RIL's Barabanki paddy straw based project on 15th Aug, '23 in just over 8 months](#)
- On track to commission **all RIL projects (6 nos) within 9 months**

Project development experience

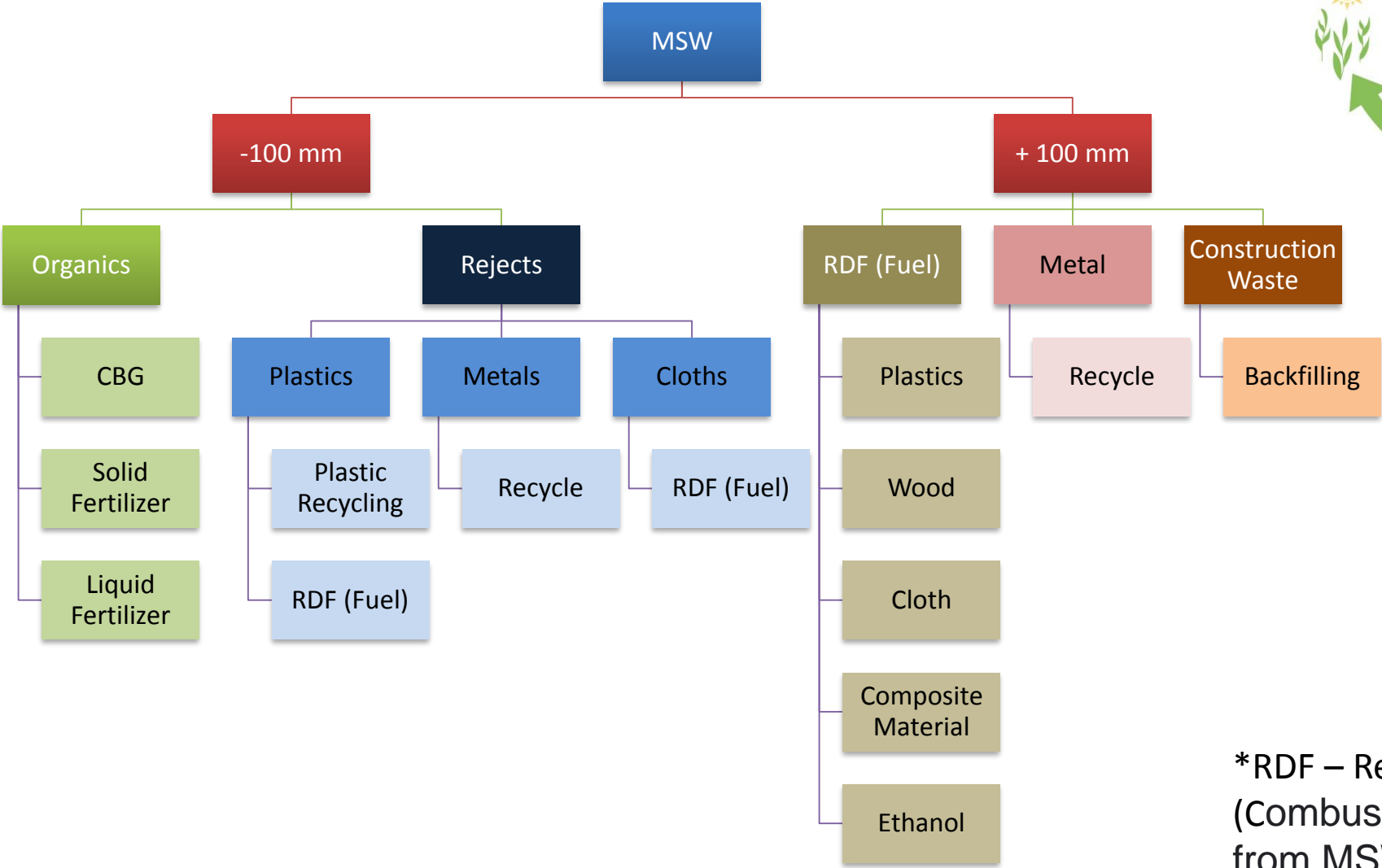
- GPSR has a 100% owned subsidiary called ARYA – a CBG platform arm
- **Already sold Panipat Biogas Pvt Ltd to RIL**. On track to be commissioned in Nov '23
- [22 CBG projects under incubation](#). 11 projects are shovel ready
- [Appointed EY Parthenon for Commercial DD](#) for its projects
- Currently co-developing projects with **IFC, Mitsui & Osaka Gas**

An aerial photograph of a municipal solid waste management facility. The facility features a large, long building with a grey roof and green and white striped walls. The roof is covered with solar panels. To the left of the building, there is a large pile of brown organic waste. In the background, there are more buildings and a dirt road. The surrounding area is dry and hilly with sparse vegetation. The text "Municipal Solid Waste Value Chain & Process Technology" is overlaid on the left side of the image.

Municipal Solid Waste Value Chain & Process Technology

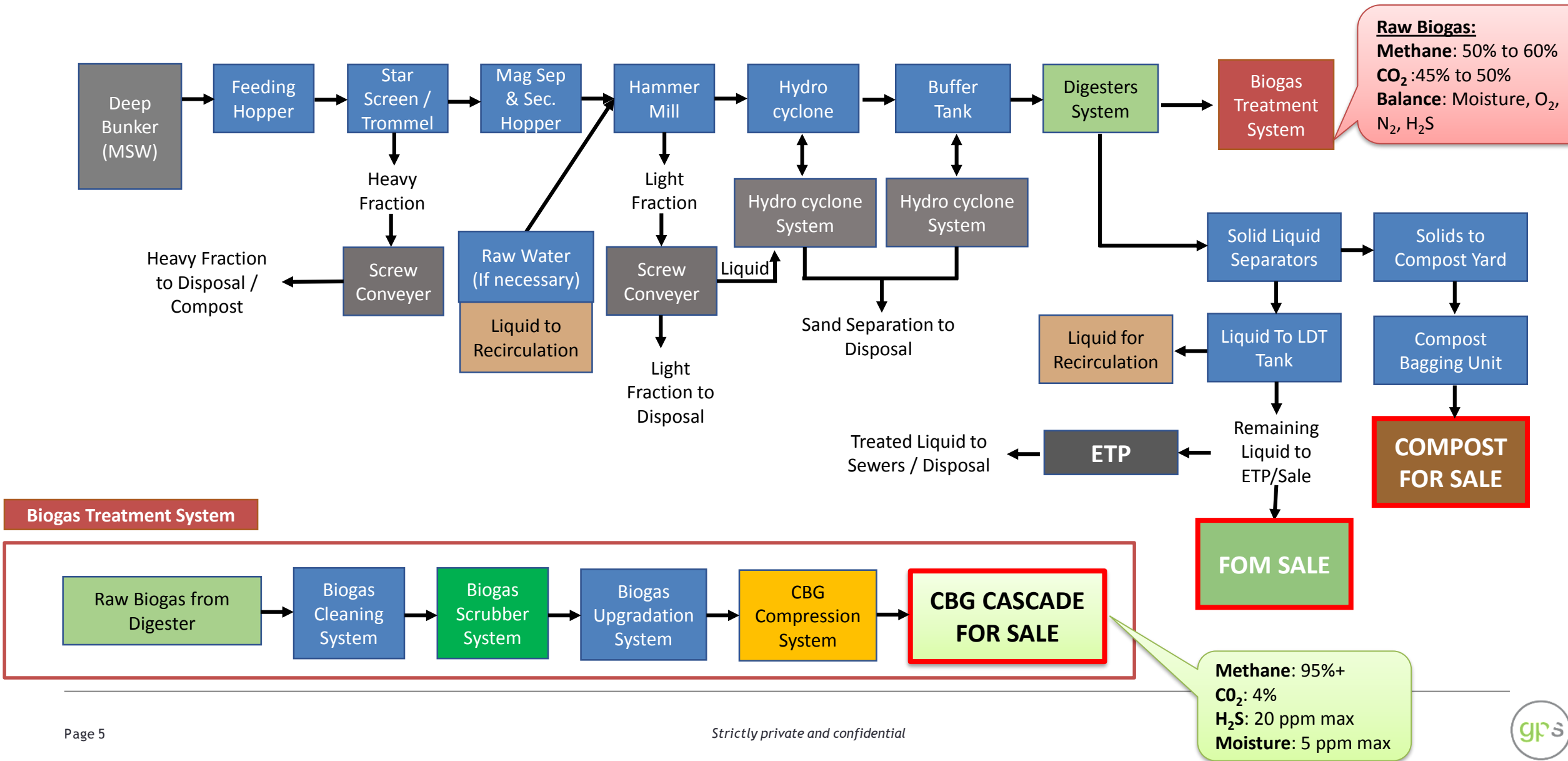
Municipal Solid Waste (MSW) - Value Chain

Circular Economy



*RDF – Refuse Derived Fuel
(Combustible components
from MSW)

Municipal Solid Waste to CBG/Bio-CNG Plant - Process Technology



Municipal Solid Waste - Recycling

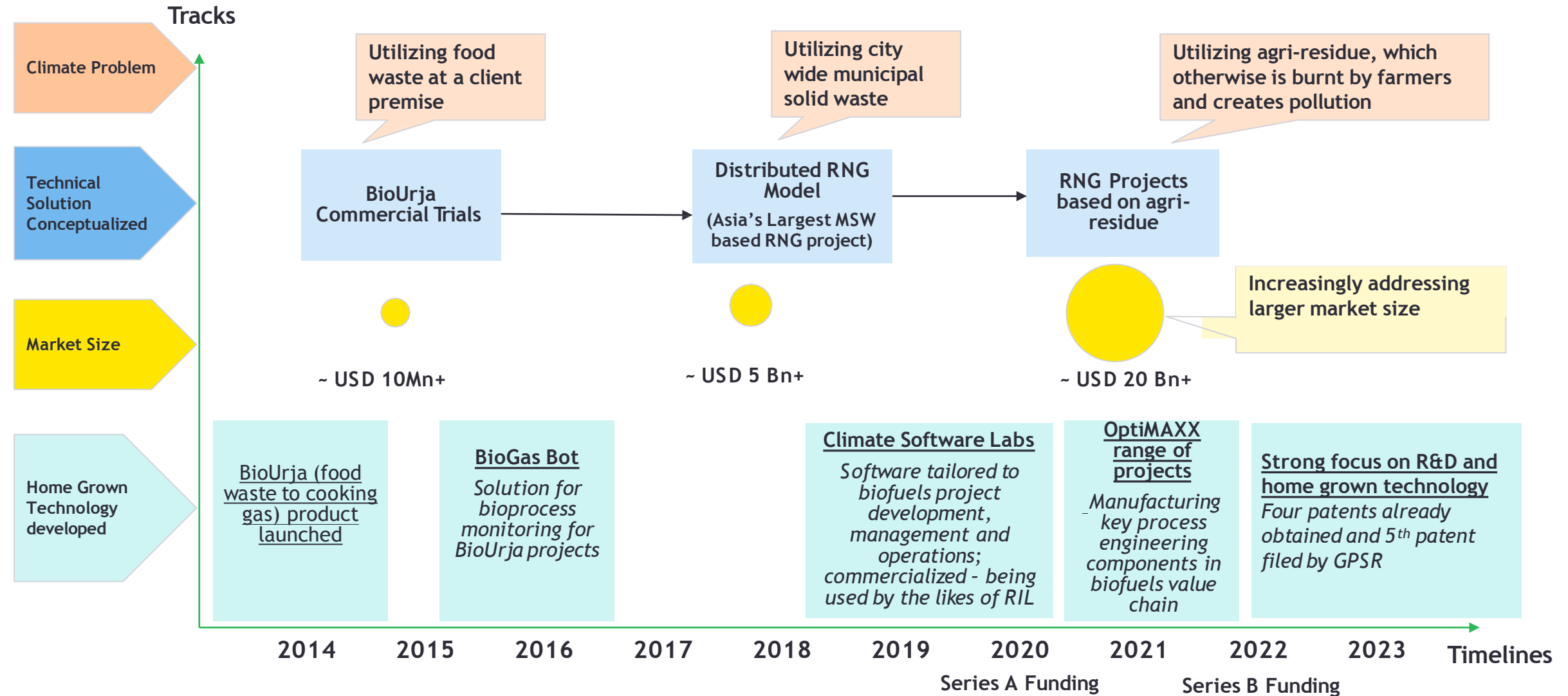
Circular Economy



Technology Journey GPS Renewables

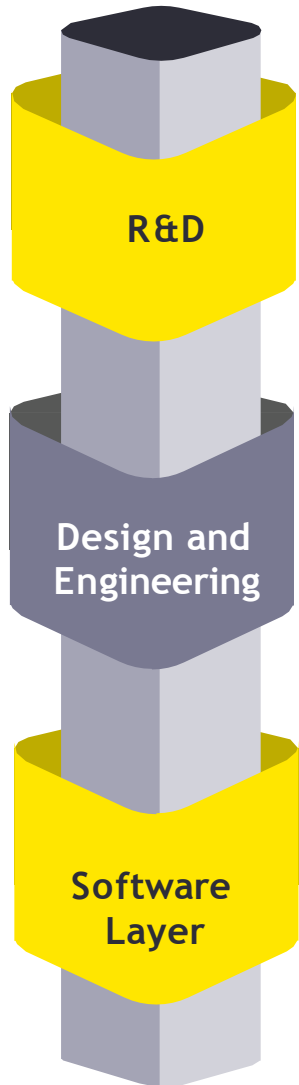


Technology Journey: Always focussed on technology development with large scale positive climate impact at its core



GPSR is the leading full stack biofuels technology player

Tech stack provides the competitive advantage, that can be leveraged globally



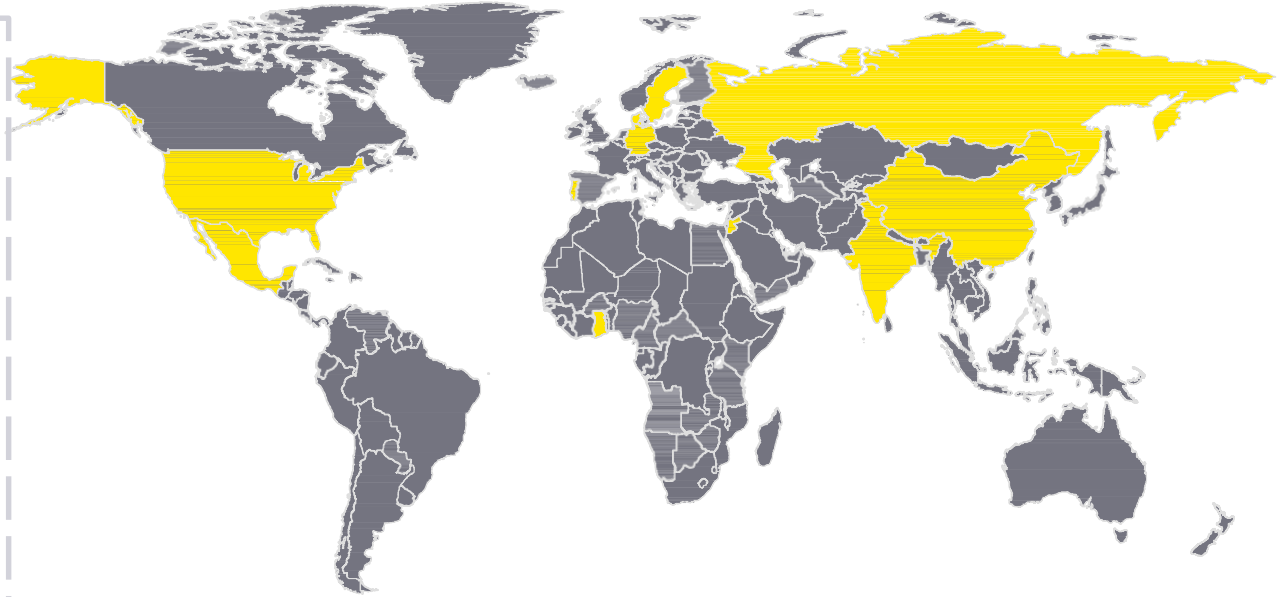
- ▶ Strong IP backed differentiation; 4 patents obtained, 5th patent filed
- ▶ Own R&D arm, GPSR Avishkar, with a well defined roadmap for developing own technology and harnessing technology partnerships
- ▶ On path to create a universal pre-digester for conversion of any feedstock to variety of biofuels
- ▶ Platform guided by industry stalwarts, each with 3+ decades of experience
- ▶ Partnerships with Snow Leopard Projects, LanzaTech , Praj and HyGear

- ▶ With 500+ years experience GPSR engineering team is alumni of leading organizations, providing GPSR an edge in design and engineering
- ▶ Capabilities for full range of services from conception to execution
- ▶ Acquired Proweps, a Germany-based leading design and engineering firm with experience of 150+ turkey biofuel projects globally

- ▶ GPSR's **Climate Software Lab (CSL)** has been building its own biofuel software suite focussed on biofuel project execution and operation
- ▶ CSL's tools are already being used by the likes of RIL
- ▶ Developed an AI powered tool for Carbon Integrity, GPSR's application integrating blockchain, SCADA and IoT to ensure high data transparency

...Strengthened by acquisition of Proweps Envirotech, one of Europe's leading biogas design and engineering firms

- ▶ An internationally active biofuel engineering company operating in **more than 11 countries**
- ▶ Provides design and technical solutions around the recycling of municipal, industrial and agricultural organic waste and biomass
- ▶ Design, engineering and technology partner for 'Asia's largest Compressed Biogas plant at Indore, India
- ▶ **Execution experience:** Anaerobic digestion plants based on variety of feedstock (MSW, agri-residue, energy crops, manure, etc.); Biogas upgradation plants (production of biomethane); Pre-treatment plants for organic waste, etc.



2015

Proweps launched its operations in Germany

25

Waste Treatment Plants

12

12 biogas upgrading plants with capacity of 1.4 Nm³/h Biogas

150+

Large scale turnkey projects

Select Customers

DIEFFENBACHER

(Germany)

ION EXCHANGE
Refreshing the Planet

(India)

TAHAL
GROUP

(Israel)

VafabMiljö
(Sweden)

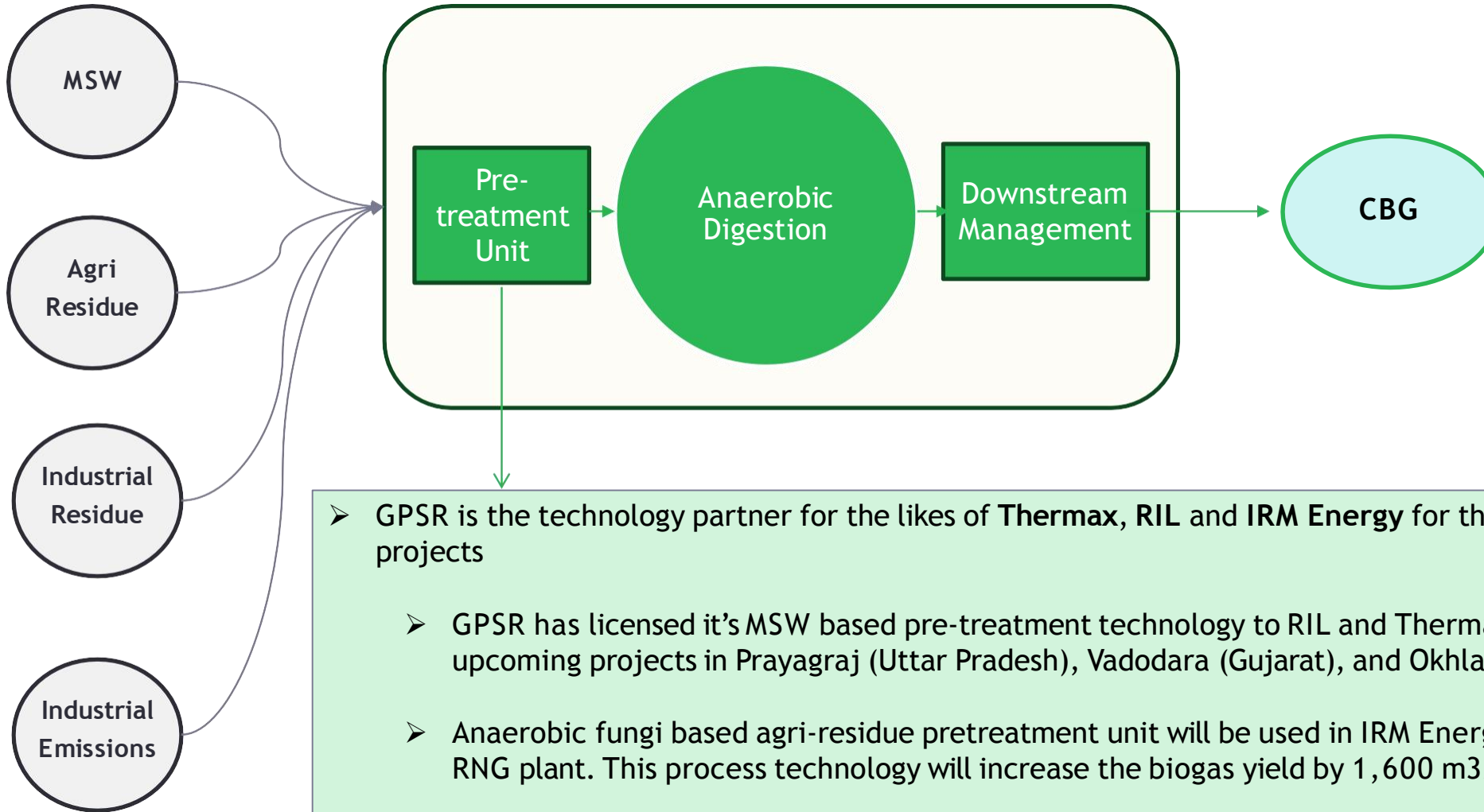
Algar
Valorizamos o ambiente
(Portugal)

StormFisher
BIOGAS
(Canada)

Skövde Biogas
Probably the world's best vehicle fuel
(Sweden)

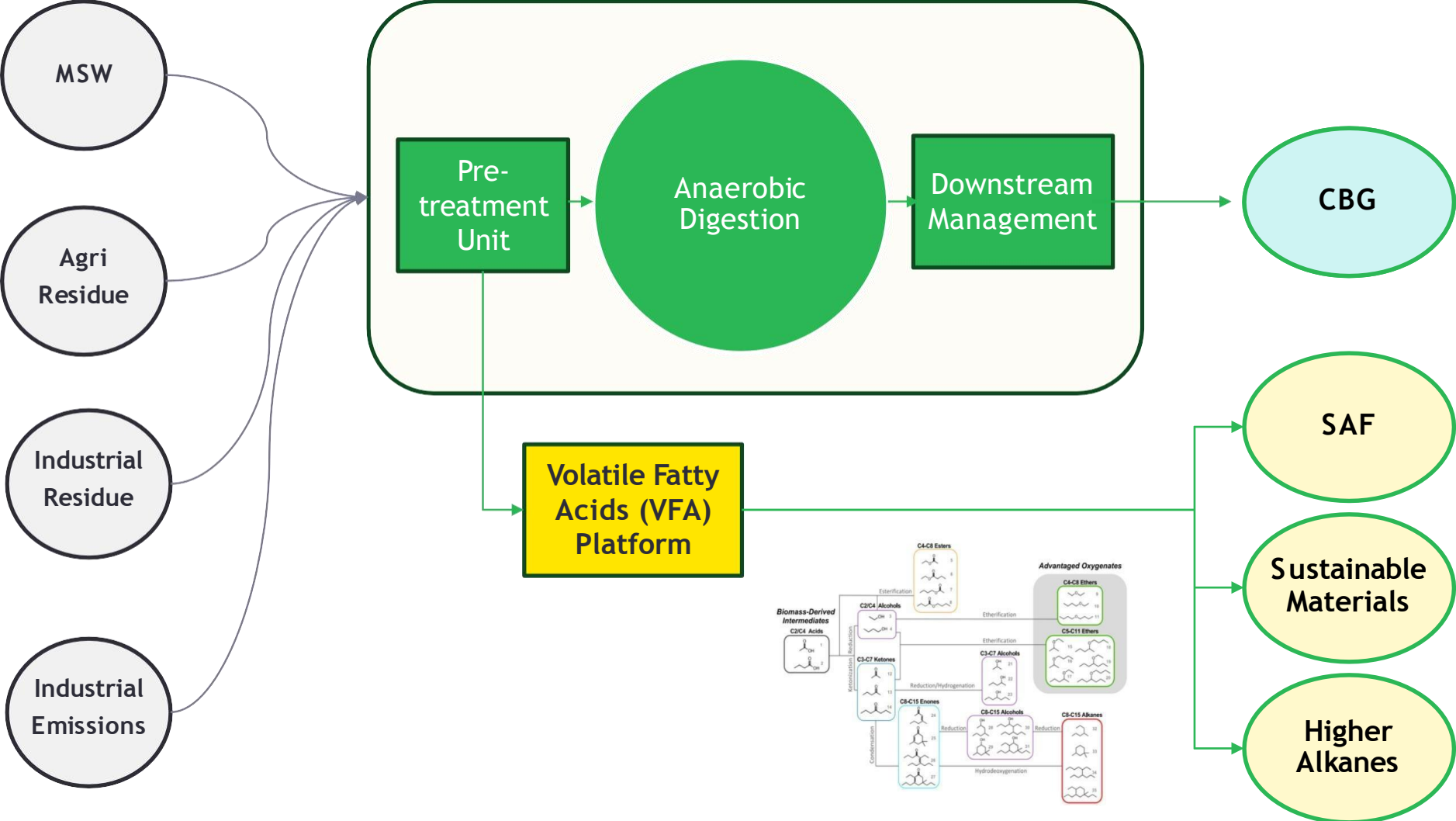
Technology Licensing - Capabilities Today

GPSR has demonstrated capabilities in the pre-treatment unit of anaerobic digestion

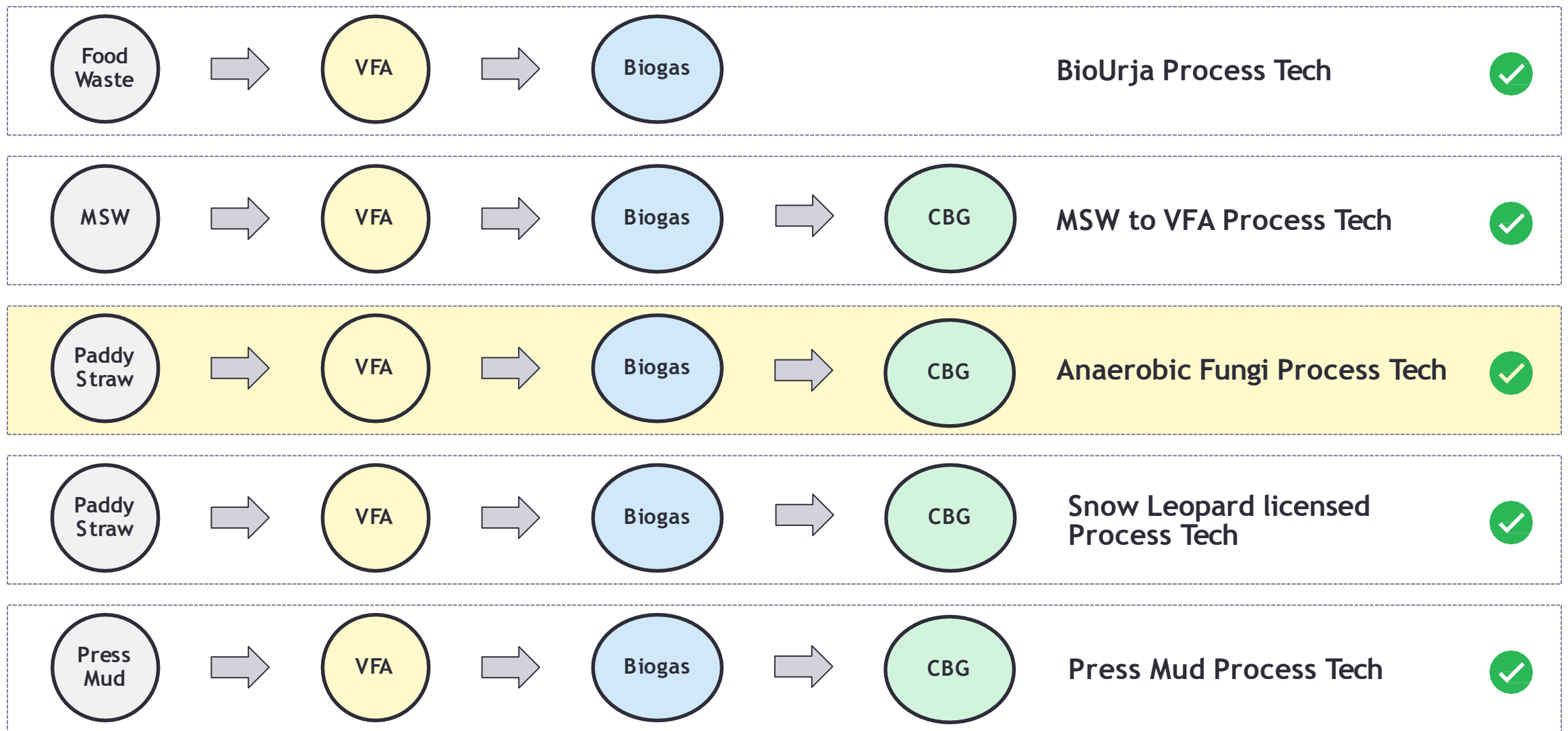


Technology Licensing - Future Plans - VFA Platform

GPSR is working on a VFA Platform that basis multi-inputs can produce a variety of outputs



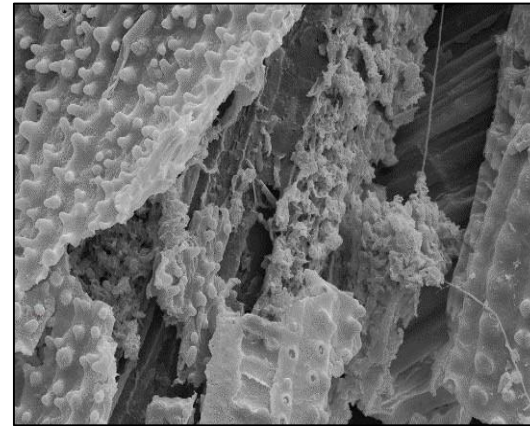
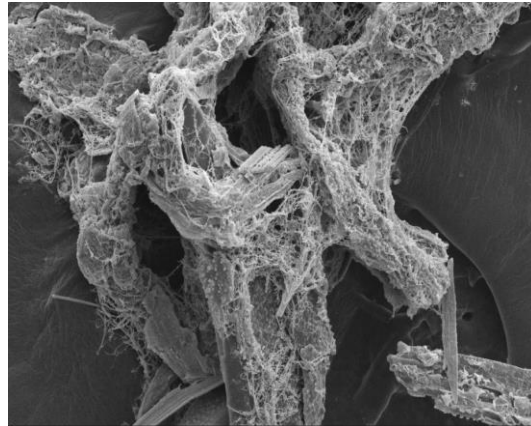
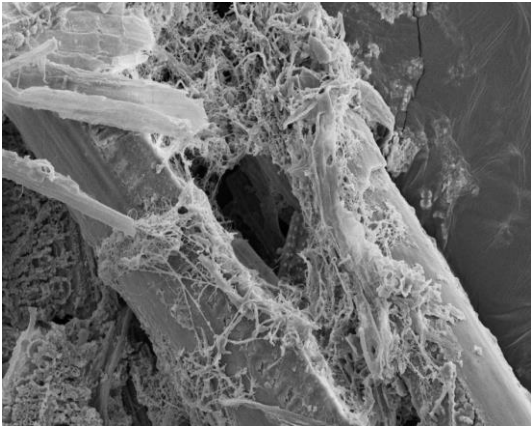
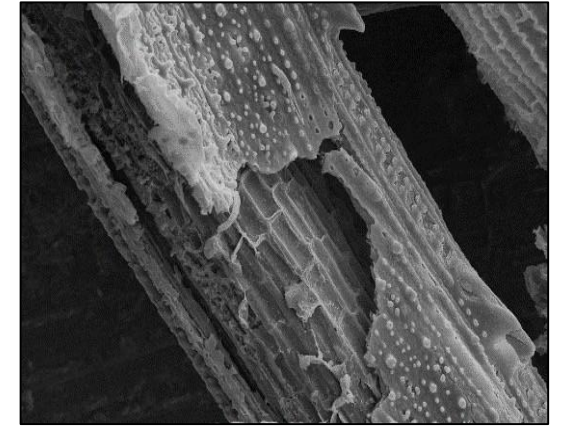
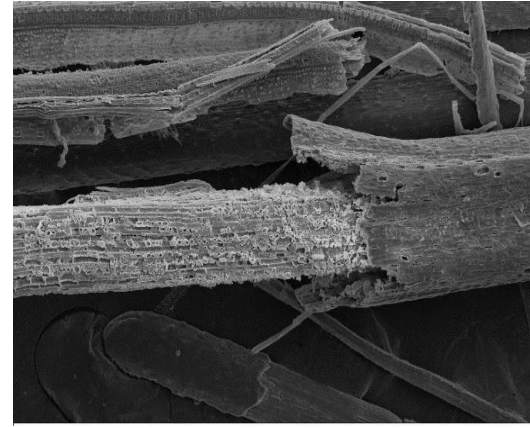
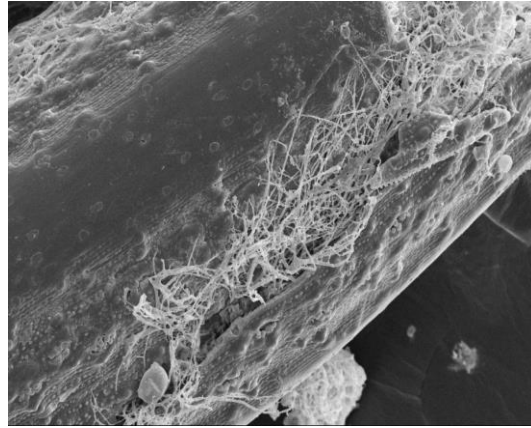
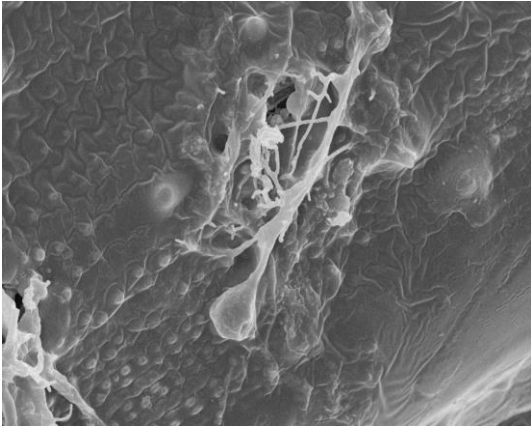
Universal Pre-Digester - Process Technology for Multiple Feeds



Snapshot of R&D work

R&D work with Agharkar Research Institute

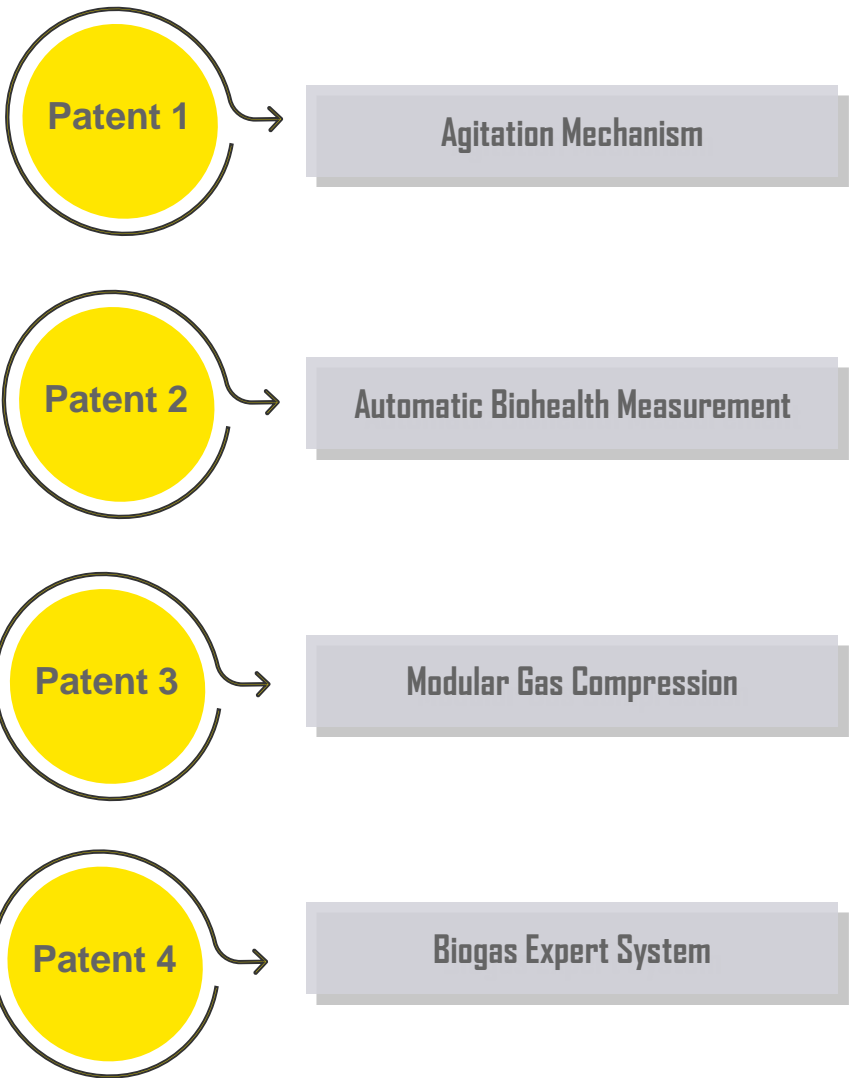
GPSR R&D team in association with Agharkar Research Institute are driving innovation in developing biofuel production technologies to convert Paddy Straw to CBG using Anaerobic Fungi, in by far the most resource efficient manner



Scanning Electron Microscope (SEM) images showing Rice Straw after Anaerobic Digestion at the ARI <> GPSR laboratory

Tech Company, focused on biofuels

Strong IP backed differentiation; 4 patents obtained; 5th patent filed; Strong tech integration



Technology Partnerships & Licenses



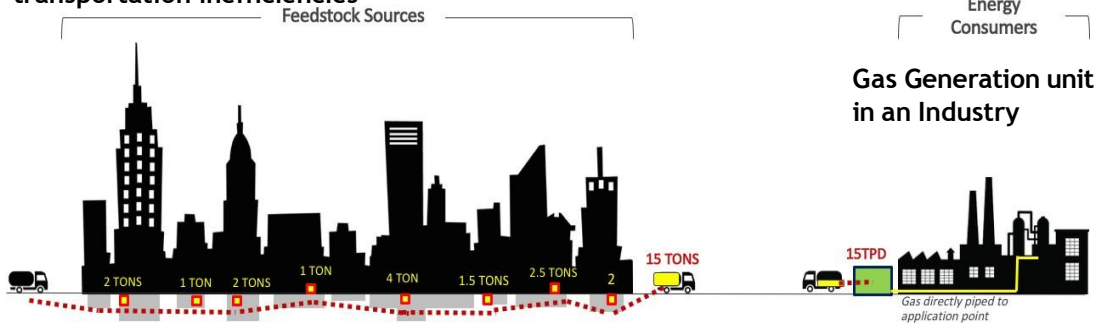
Design & Engineering Capabilities

- ▶ *Engineering team with 150+ years' experience; full range of services from conception to execution*
- ▶ *Strengthened by acquisition of Proweps Envirotech, one of Europe's leading biogas design and engineering firms*

GPSR is an Indian company with many global firsts in the biofuels space

World's first distributed RNG model (patented)

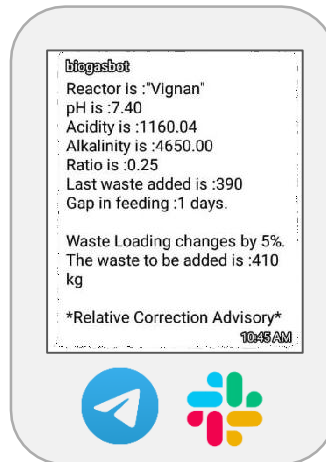
Liquid anaerobic composteur used to reduce transportation inefficiencies



Executed world's first urban waste to biofuels project on a reverse tipping model at Indore; Asia's largest RNG project (16 to 19 TPD) based on MSW (500 TPD)



World's first AI based plant biohealth monitoring system (patented) - used by RIL and EverEnviro

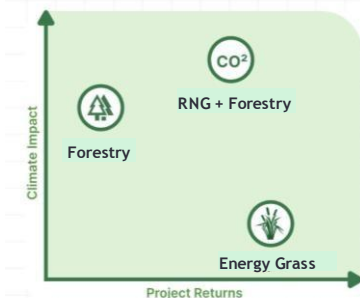


World's first biogas powered EV charging station in Haji Ali, Mumbai



1-2 TPD waste used to generate 240 m³ gas per day; can charge 8 cars a day; fast charging in 45 mins

RNG + Forestry - Innovative business model integrating forestry and biofuels



15 TPD project underway In Udaipur, Rajasthan. Land Identified, field trials being done

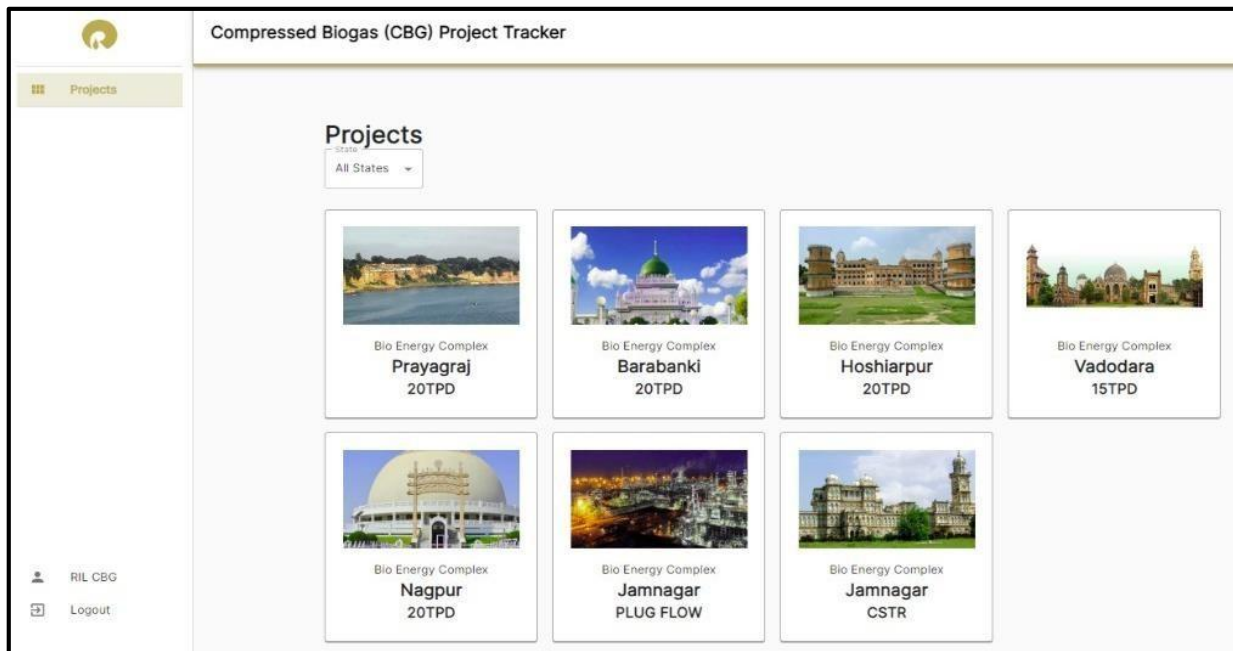
GPSR's own software layer

Climate Software Labs (CSL) - Products being used by likes of RIL

Tailored to specific needs of biofuel projects with shorter timelines and midsize budgets, the software suite enables integrated management of all aspects of EPC

- ▶ GPSR has been building its own biofuel software suite focussed on biofuel project execution and operation
- ▶ CSL's tools are already being used by the likes of RIL

CSL is headed by **Arun M**, a Computer Scientist with an M.Phil from JNU; one of the founders of the Free Software Foundation, India



Snapshot of Reliance Bioenergy's project monitoring suite powered by CSL



CSL tools

Food Waste to Cooking Gas
Bio Urja Plants

GPS Renewables



BioUrja

India's most successful industrial / corporate food waste to biogas solution with 100+ installations

GPS' captive biogas plant 'BioUrja' is a modular IOT biogas plant that digests bio-waste and produces clean biogas which can be directly used for cooking, thermal applications and for power generation



100+ BioUrja Installations



15+ States of India are under coverage

**FORTUNE
500**

Companies as the customer base



- 50-100% higher energy efficiency
- 140m³ gas/ton of waste, that's 70KGs LPG eq or 200 units electricity



- Modular and Customizable Design
- Prefabricated aesthetic components that utilize dead spaces



- Remote Monitoring Suite and Client Dashboards
- Ensures 99% uptime, minimal human intervention in operations

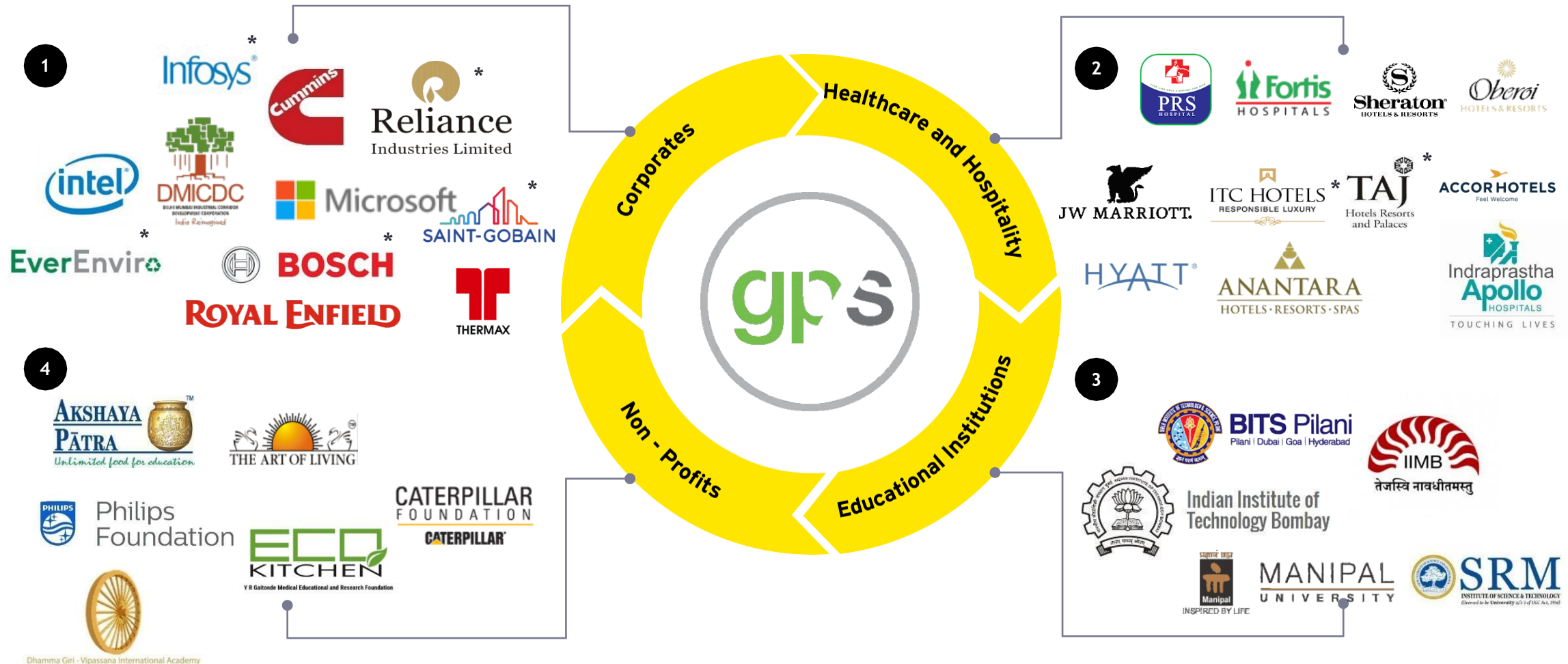


- 30-50% Lesser Space Requirement
- 1 ton waste per day processing plant occupies only 49m²



- Lowest Water Usage
- 100 liters versus 1000 liters/ton of waste in other biogas plants

Marquee customers present significant prospect of repeat business for decarbonization



* Indicates repeat business.



Asia's Largest SSO
(Organic MSW)
to
CBG/Bio-CNG plant
Indore

GPS Renewables



Case Study - Successful Execution of Asia's largest SSO based CBG Project (1/3)

Project Summary

Land & Feedstock	By Indore Municipal Corporation
Plant Capacity	16-19 TPD RNG
Feedstock	500 TPD SSO (MSW)
Project Type	Build Operate Transfer
Location	Indore, MP
Project Developer	EverEnviro

GPSR Scope of Services: End to End project delivery

Detailed Engineering and Design	✓
Site Establishment and Land Preparation	✓
Feedstock storage and handling	✓
Pre-Treatment equipment installation	✓
Upgradation system installation	✓
Commissioning and Integration	✓



Case Study - Successful Execution of Asia's largest SSO based CBG Project (2/3)

World's
First SSO

India's and one of the world's largest source separated organics (SSO) based RNG plant

0
incidents

Commissioned without any HSE incidents

100
NM³/TPD

Generated over 100 NM³/TPD of raw biogas from SSO at this scale



The Indore BioCNG project was inaugurated by Hon'ble Prime Minister of India, Shri Narendra Modi on 19th Feb, 2022



Successful Execution of Asia's largest SSO based CBG Project (3/3): Picture Gallery



EOT Grab Cranes



Pre-treatment System



Separation Hammer Mill



Digester System



ETP



Automated Control Rooms



VPSA System



Compressors



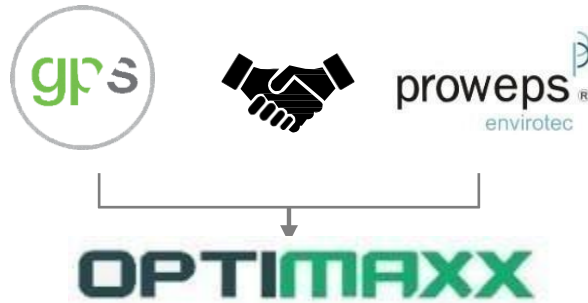
Cascade Storage Area

Proprietary Equipment
Biogas Upgradation Systems

GPS Renewables



OptiMAXX - Specialized core equipment for Biofuel Industry



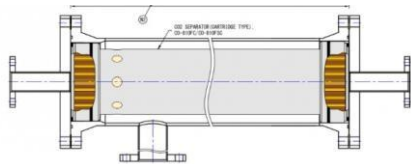
- ▶ OptiMAXX is GPSR's line of technology products for the biofuels industry
- ▶ This has been built upon ~ 10 years experience in manufacturing of BioUrjas for marquee customers
- ▶ Proweps is the developing partner with GPS to design OptiMAXX
- ▶ GPSR has a 15,000 SF ISO certified manufacturing facility in Bangalore for the specialized products



OptiMAXX - Product Snapshots

Products based on research of over 10 years

Membrane Based biogas upgradation system



Digestate heat exchanger



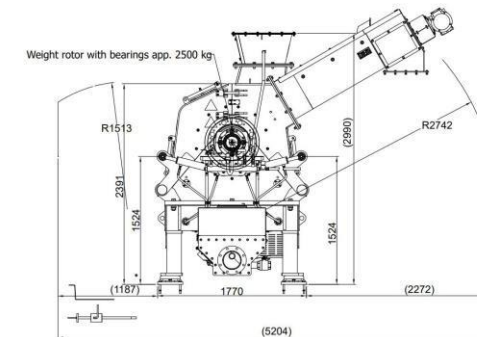
H₂S & moisture scrubbers (Under development)



VPsA Based biogas upgradation system



Hammer Mill (Under development)



Snapshot of GPSR's International Recognition



2018-2020



2016-2018



2014-2016



"THE COMPANIES ON THE 2019 APAC 25 LIST ARE VIEWED BY CLEAN TECHNOLOGY EXPERTS IN THE REGION AND THE WIDER MARKET AS INNOVATORS WITH THE POTENTIAL TO MAKE GREAT IMPACT. CONGRATULATIONS TO YOU ALL."
RICHARD YOUNGMAN,
CEO, CLEANTECH GROUP



2012-2014

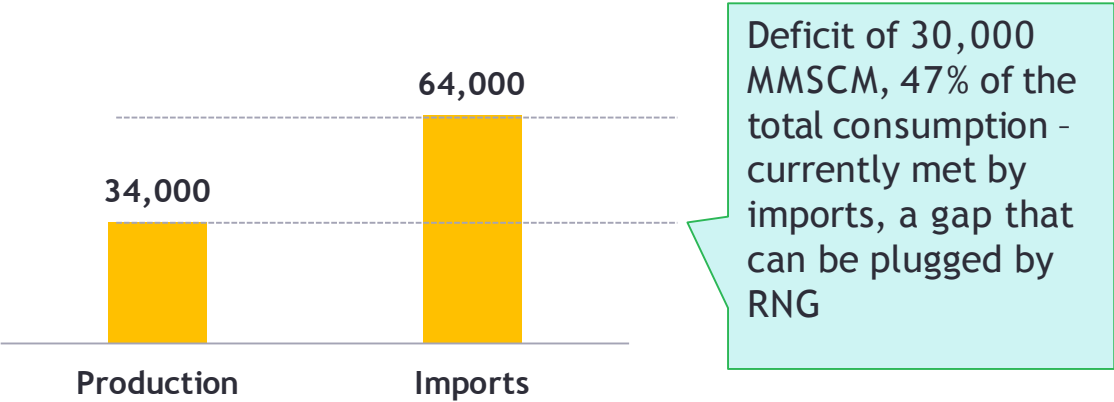


Market Potential CBG



CBG/RNG - India Market

India's natural gas production and demand (MMSCM)



CBG sources in India and potential (in MMT)

Cattle dung and chicken litter	18
Forest residue	8
Agricultural residue	12
Pres mud, spent wash and bagasse	8
Municipal solid waste	2
Energy crops in barren, waste and single crop land	12
Total CBG Potential	60 MMT

Government initiative - SATAT⁽¹⁾ scheme

5,000

RNG Projects

15 MMT

RNG Production

50 MMT

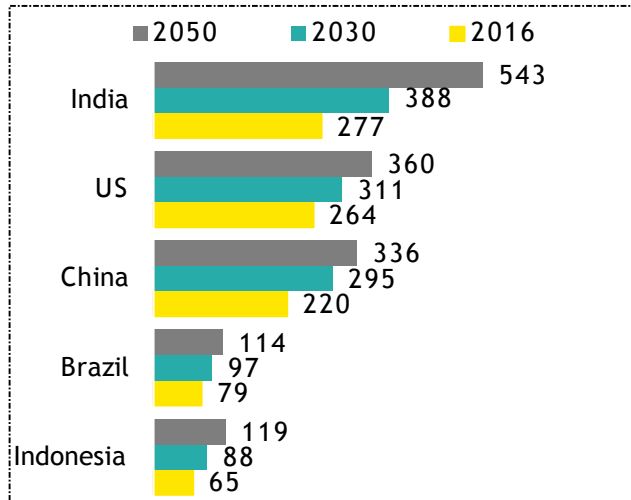
Bio-Manure

- ▶ Under the scheme, 46 RNG projects have been commissioned in India as of Mar-23, and 4,090 letters of intent have been issued to various stakeholders
- ▶ The government has also set a goal to increase the proportion of gas in the energy mix to 15% by 2030 from the current 6.5%

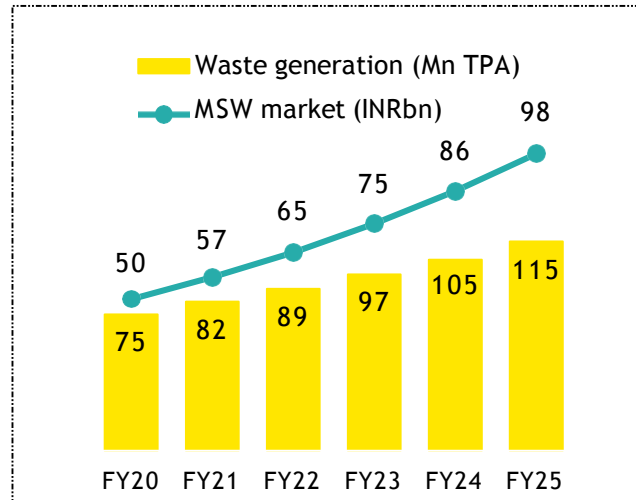
(1) Sustainable Alternative Towards Affordable Transportation scheme.

India offers an attractive value proposition for high potential biogas

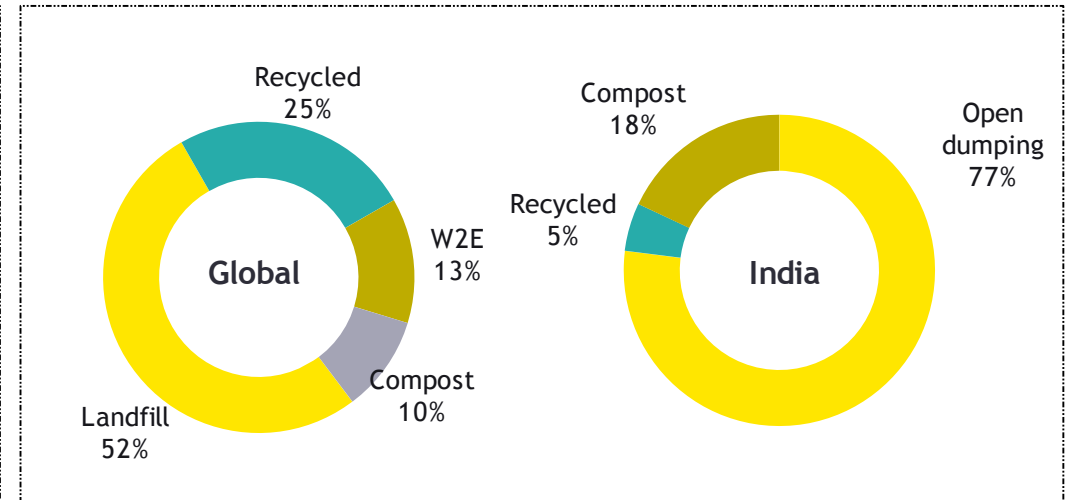
Top 5 MSW generators annually (MMT)



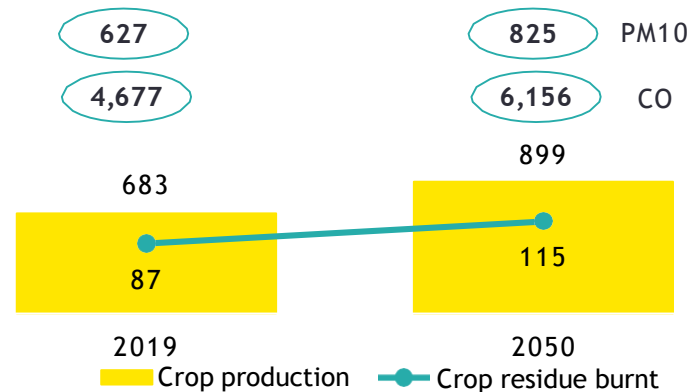
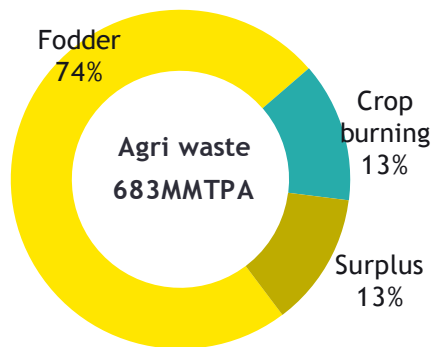
MSWM industry to become 2x in 5 years



India practices much higher level of MSW open dumping vs global avg.



Waste crop residue has potential to meet 10% of India's current energy demand



During the peak crop burning season Delhi air pollution is 20x of threshold for safe air (WHO)

- Heat from crop burning penetrates 1cm into the soil, elevating the temp. to 33.8 to 42.2 degree C
- Kills bacterial and fungal populations critical for a fertile soil

Thank you

