Organic Solid waste to Biofuels

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PRAJ INDUSTRIES LTD

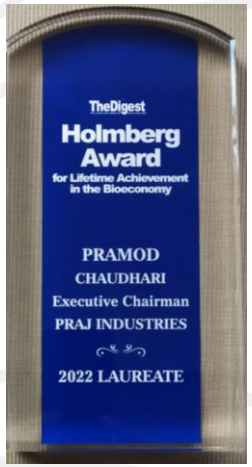
In Focus …

RenGas praj Innovate • Integrate • Deliver

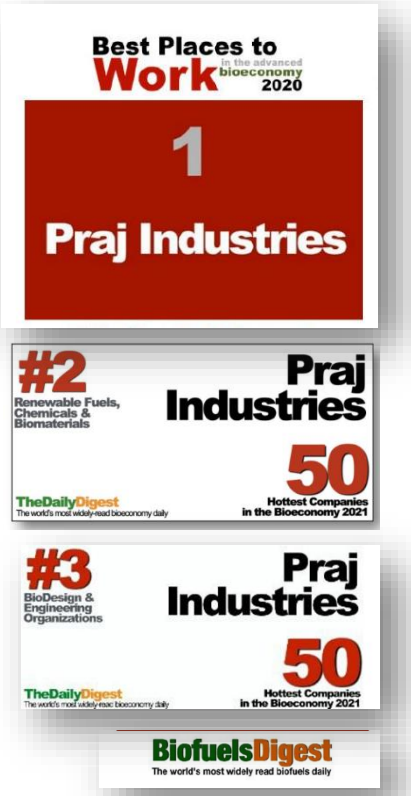
- About Praj
- India Energy and Bio fuel Facts
- Praj's Biorefinery Approach
- Solid waste to CBG (Biofuel)
- Filter mud to CBG Project
- Reference Project in India

Facts at a glance

George Washington Carver Award 2020 *Presented to* **Dr. Pramod Chaudhari**

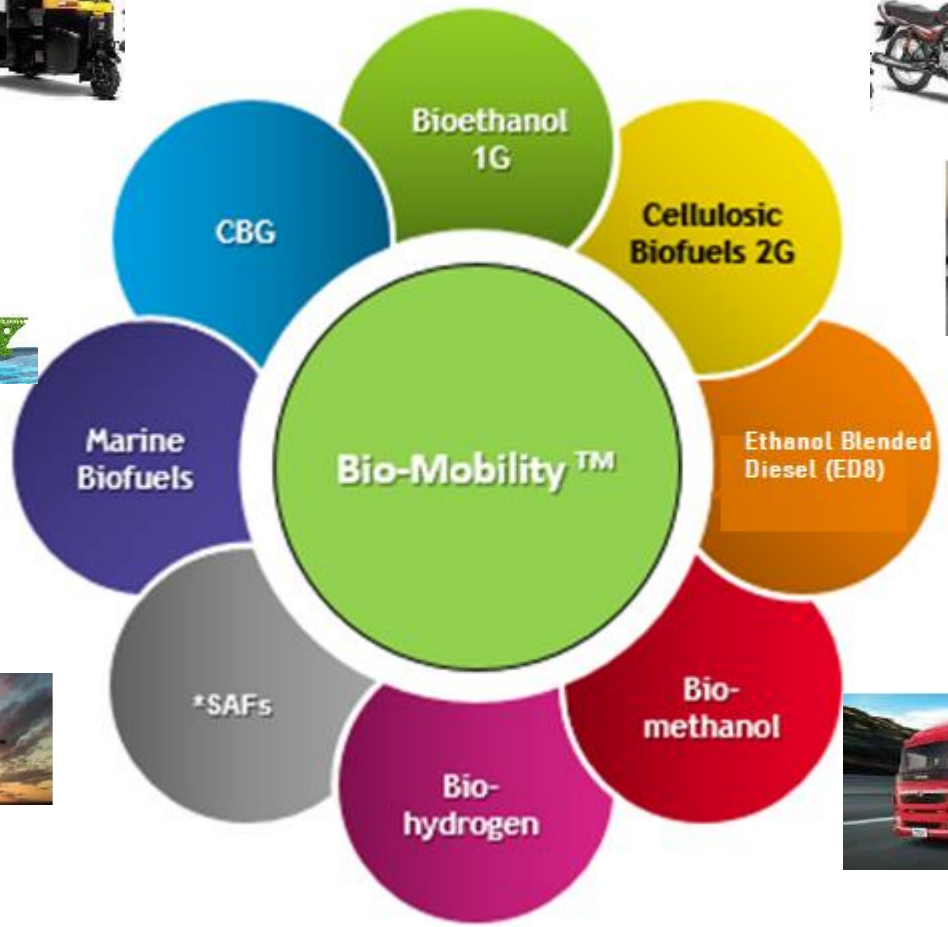


William C. Holmberg Award 2022



*excluding China

Praj's Bio-MobilityTM Platform: Reconfiguring transportation fuel mix



*SAF: Sustainable Aviation Fuels

- **Demand** for transportation fuel is **ever rising**
- Transportation sector the **major contributor** to rising **GHG** emission
- Both, major cause for **environmental Pollution** and major **health hazard**
- **Bio-Mobility™** based transportation helps minimize **carbon footprint**

Facilitates sustainable decarburization through circular bio-economy

INDIA ENERGY AND BIOFUEL SOME FACTS

3rd Largest Consumer of Primary Energy

3RD

High Import dependency

85%

High Import Bill

$122

Bln

Self Sufficiency in Petroleum Products

15%

India's CO_2 Emission

2.3

Billion Ton

Contribution of Transport Sector to GHG Emissions

11-13%

Reduction in Emission Intensity by 2030

45%

Revised Nationally Determined Contribution

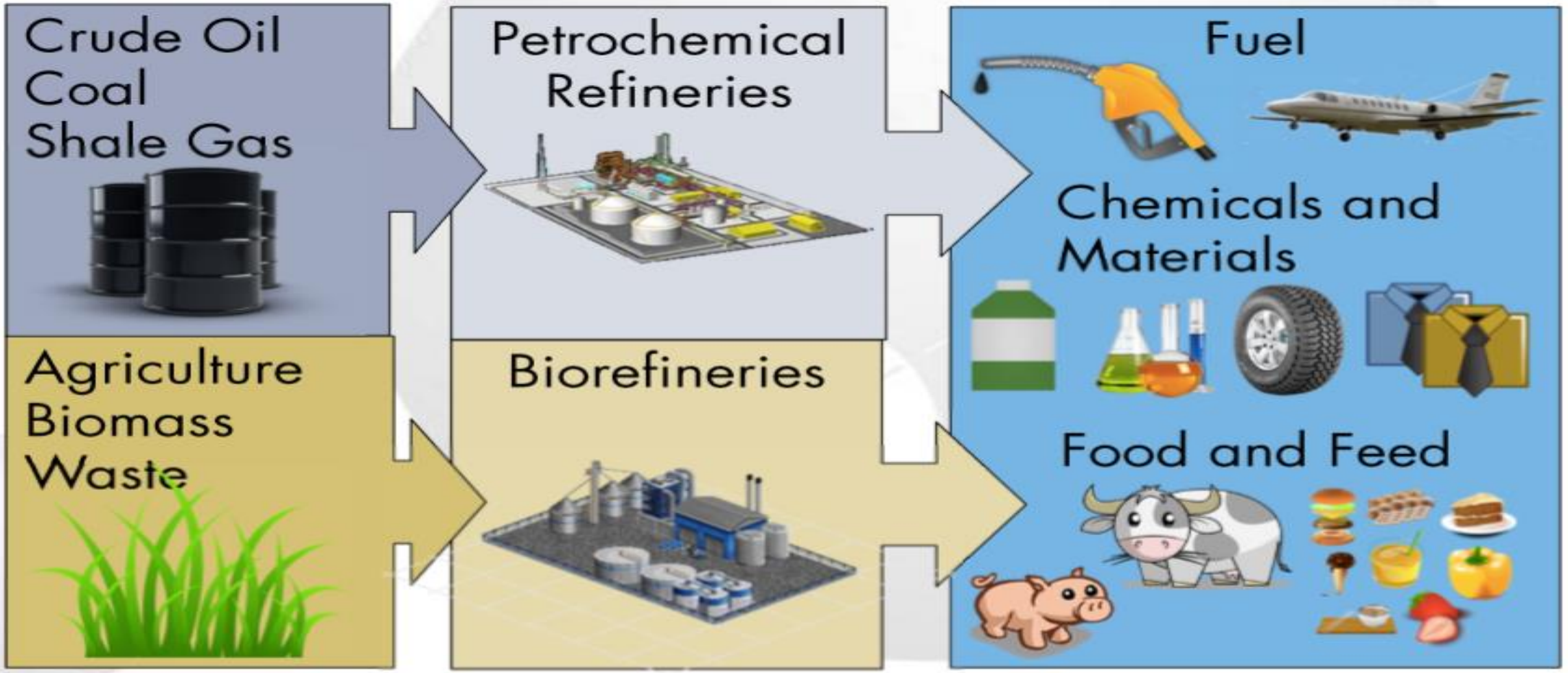
Ethanol Blending Achieved in 2021-22

~10 %

Sustainable Biofuels for Transportation is Need of the hour

BEYOND FOSSIL

BIOECONOMY: THE INDUSTRIAL VALUE CHAIN CONCEPT



BIO-REFINERY CONCEPT

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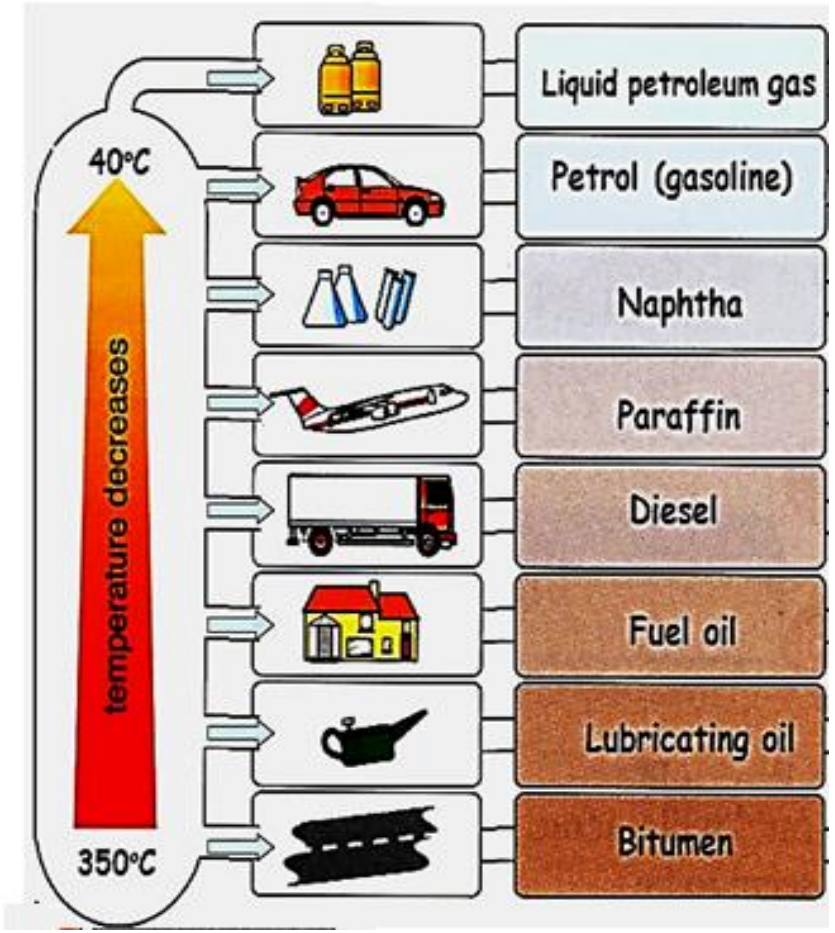
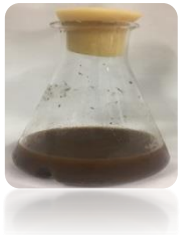
Crude Oil Refinery

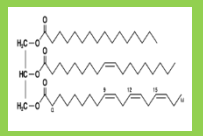


Bio-refinery

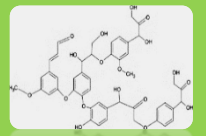


Bio crude

Sugar (C5 & C6)

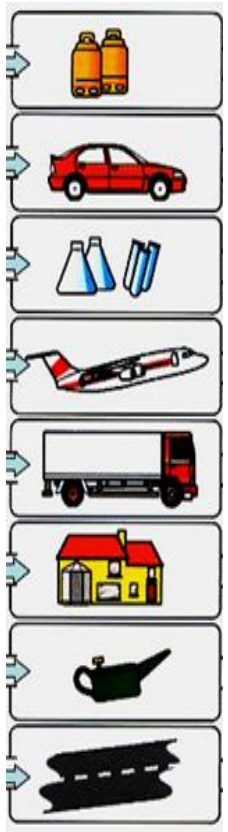


Triglycerides



Lignin

Extractives & Ash



Bio-CNG

Bio-ethanol
Bio-butanol

Bio-chemicals

Bio-Jet

Renewable Diesel

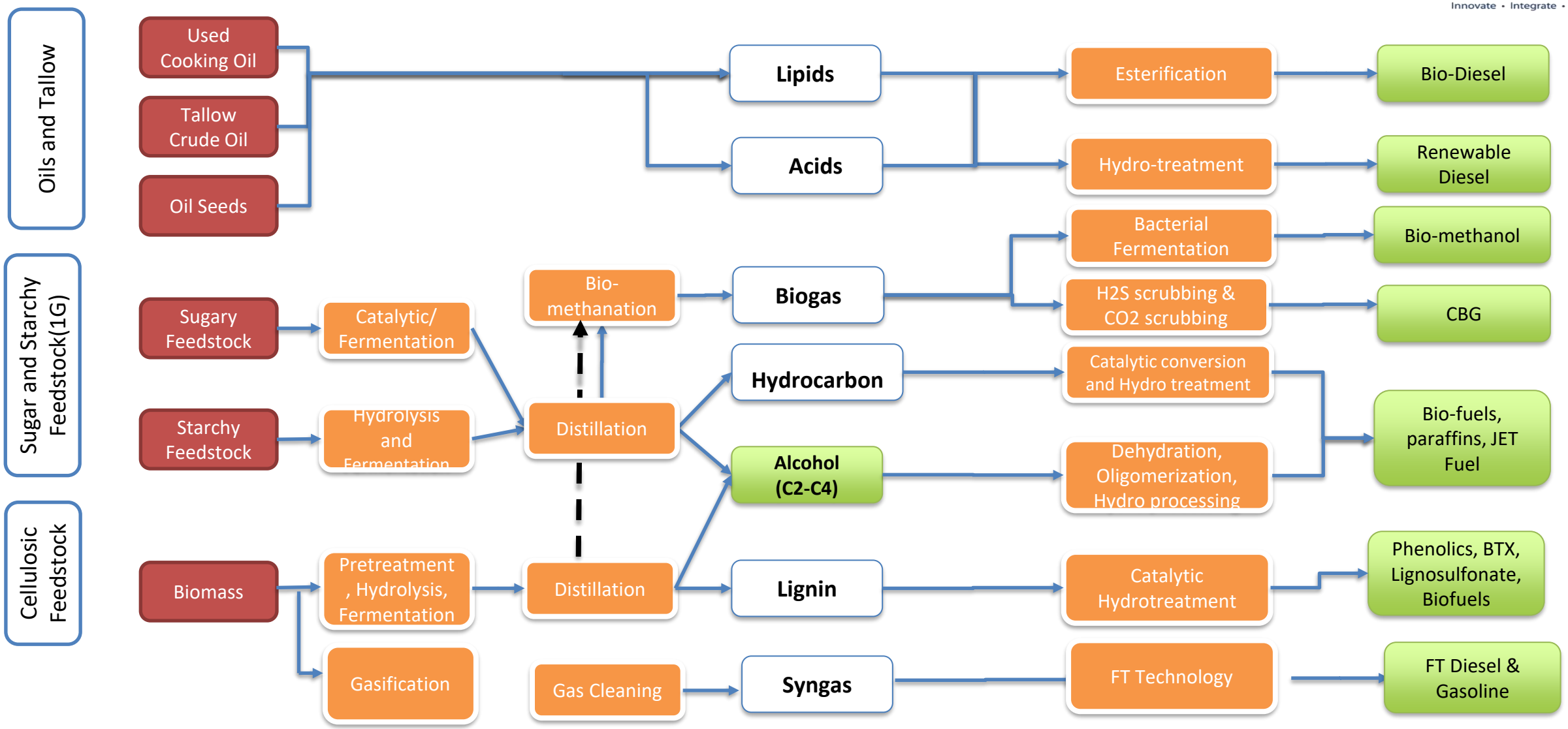
Bio-oil

Bio-fertilizer

Ligno-sulfonate
Bitumen

Shift for Economical, Societal and Ecological progress

BIO-REFINERY PATHWAY



Sugarcane Bio-refinery

stalk

juice

syrup

molasses

Bagasse

Pressmud/Trash

1G

1G

1G

2G

CBG

Ethanol (1G/2G)

RNG / BioCNG

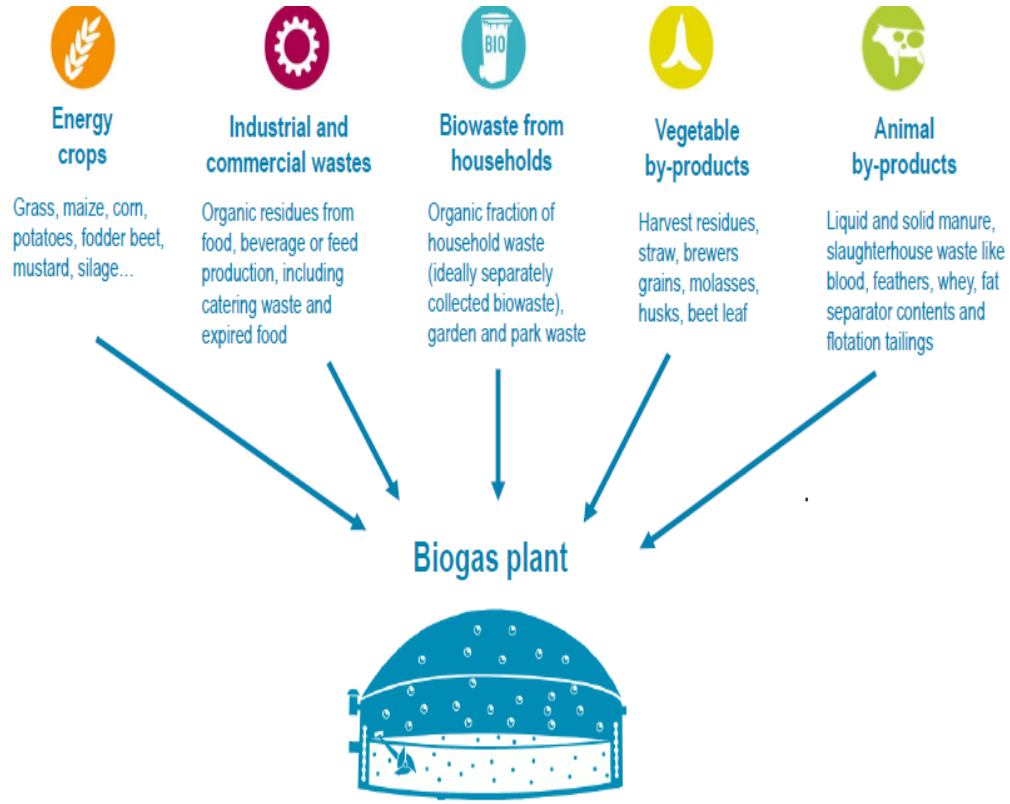
High Value Lignin

CCS: CO_2 Capture & Storage

Potential Organic waste Source of Biogas

Biogas potential from Industrial waste

- Sugar factories, Distilleries, Starch
- Agro Residue
- Food waste from MSW
- STP (Sludge)
- Food-Agro Processing units (starch, palm, food etc.)
- Animal droppings
- Dairy



High potential industries for Biogas:
Primary: Agri Residue, Sugar Mill, Distillery

Secondary: Brewery ,Pulp and paper, Milk processing, Slaughter house, and Poultry, STP , Agro trash, Animal dropping etc

Biomass: Agri-residues -Abundant Organic Source of Biofuels

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Seasonal dry biomass on harvest

Rice Straw

Wheat Straw

Corn Stover

Corn Cobs

Soybean Straw

Pigeon Pea Straw

Surplus Green biomass

Napier Grass

Green corn biomass

Biomass to Biogas - Most energy efficient way

Residues:

- Abundant Lignocellulosic Feedstock (India has about 350 Million MT)
- Available round the year
- Surplus after fodder & other needs
- Have disposal problems

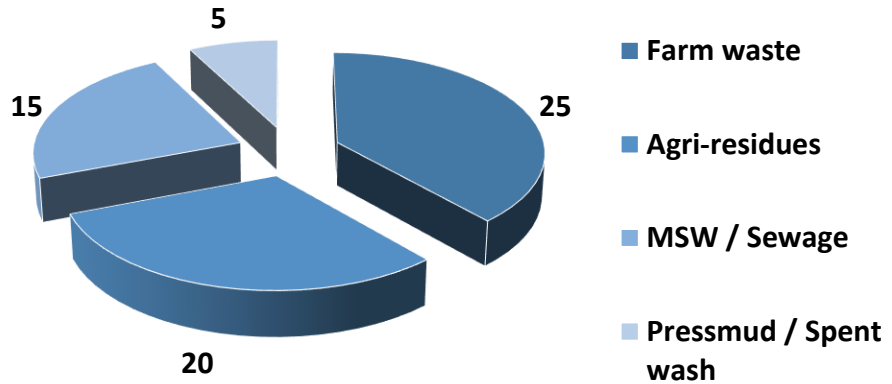
Comprise:

- Cellulosic & Hemicellulosic Sugars
- Lignin, Ash & Extractives

MoPNG SATAT plan: Replace 15 MMT CNG with CBG by 2023

150 MMT surplus residues can produce 20 Million MT CBG / Yr

Feedstock potential 60 MMT CBG in India



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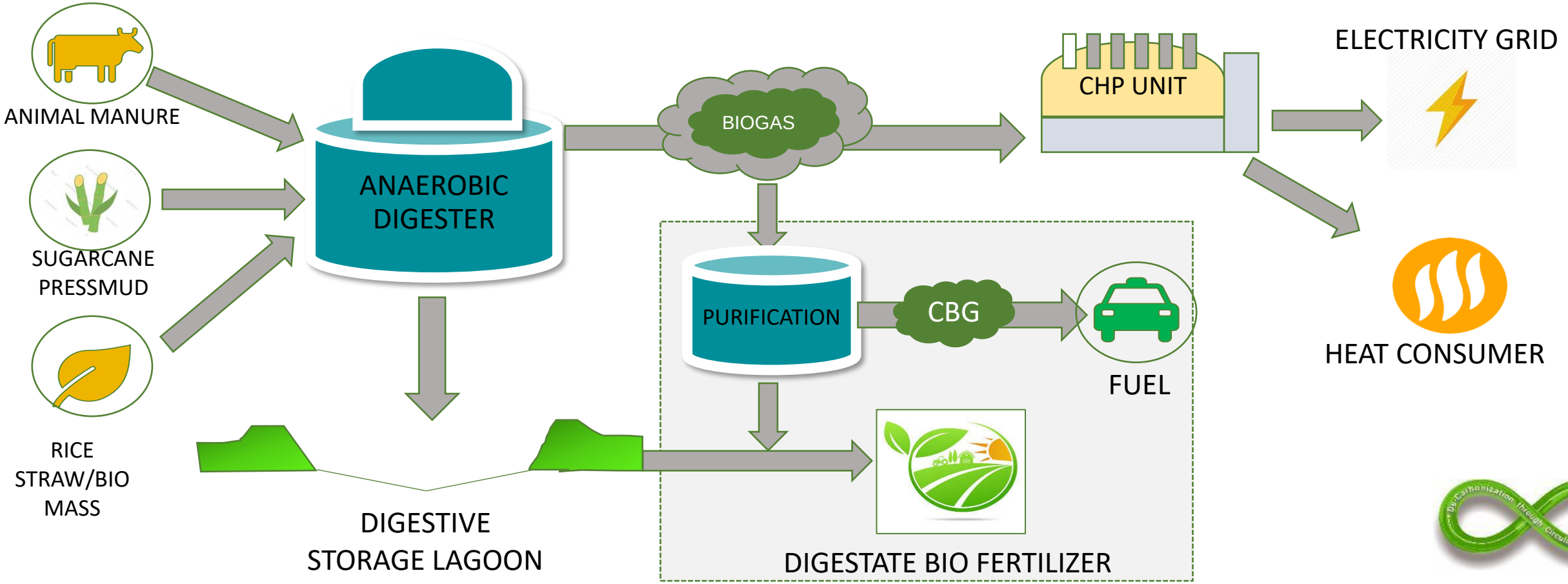
What is CBG ?

Compressed Biogas (CBG) is also known as Renewable Gas (RNG):
CBG is purified Methane (CH4) having > 96% purity and is produced from Organic waste by Biomethanation process

CBG can be used for Applications like

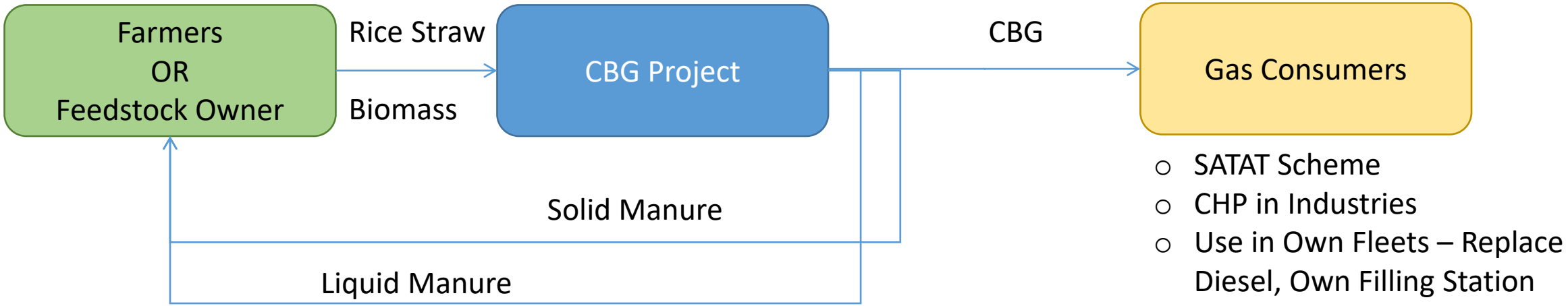
- Clean and Green Vehicle Transport Fuel
- Static & Industrial Power & Heat Generation



CBG Specifications…

Parameters	CNG Composition	CBG as per IS 16087 (2016)	Raw Biogas (From Rice Straw)
CH_4Methane min.	90%	90%	55% – 60%
Ethane	6%	-	
C3 and Higher	3%	-	
C6 & Higher	0.50%	-	
Moisture mg/m	< 5	< 5	
Total sulfur / H_2S mg/m	< 20	< 20	200 – 500
Oxygen	< 0.50%	< 0.5%	
CO_2	< 3.50%	< 4	35% – 40%
$CO_2 + N_2 + O_2$	-	< 10%	
Hydrogen	< 0.10%	-	
CO	< 0.10%	-	

CBG Projects Conceptualization



- SATAT Scheme
- CHP in Industries
- Use in Own Fleets – Replace Diesel, Own Filling Station
- City Buses – Tie up with City

- Increase farmers Annual Income
- Farmer uses organic manure instead of Chemical fertilizer

- Contribution to COP 26
- Atmanirbar Bharat
- Generate local Employment
- Green Project
- Generate profit & tax income to statae

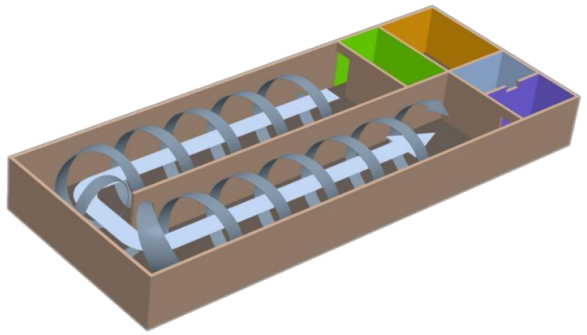
- Clean burning fuel
- Reduces pollution
- Renewable fuel
- Higher economy

PRAJ Technologies for CBG

Pre Treatment

- Proprietary Microbial Consortium for Pretreatment
- Rumen Microbes for faster AD Process

Bio Methanation



- Dual Plug flow Biomethane Digester design
- > 75 % Degradation efficacy – No agitators, Low operating power, Zero Maintenance – No down time

Gas Purification

- High efficiency Biogas upgradation to CBG
- Simple Operation without comprising performance and quality

Organic Manure

- High Quality Bio-manure formulation
- NOCA Certification for all feedstocks

Patented PressMud Stabilization Technology

Highest Yield in the Industry

PRAJ Track Record

No. of Biogas Plants supplied: ~50

37 No in India / 13 No in South East Asia & Africa

- Cane Molasses Spent Wash: 33
- Grain based Thin Slop: 15
- Cane Syrup based Spent Wash: 1
- Other Effluents: 1

Largest on Molasses Distillery Vinasse: 115,000 Nm^3/day in Thailand & India

Largest on Grain Distillery Vinasse : 24000 Nm^3/day @ India.

Additional Projects Under SATAT

- **IPL(India Potash Limited), UP – 200 TPD Press mud to CBG Plant**
- **Leafiniti, Karnataka – 200 TPD Press mud to CBG Plant**
- **HPCL – 100 TPD Rice Straw to CBG, UP - Under Installation**
- **SMSKL- 24000Nm3/day Biogas to CBG, MH – Under commissioning**
- **Reliance CBG Pilot Plant - Under Installation**


INDIA'S FIRST PRESS MUD BASED
200 TPD CBG PLANT
IPL
Indian Potash Limited

IPL Product and co-products evacuation

IOCL Pump with CBG Cascades

There is Taxi Q for CBG filling

IOCL brands CBG as **INDIGREEN**

IPL Manure Brochure Prepared jointly with PRAJ Matrix & Agri-teams

PRAJ - Straw / Bagasse CBG Plants

PRAJ Rice straw / Bagasse Demo Plant (Pune)

HPCL Rice straw to CBG Commercial Plant

- PRAJ is now constructing 100 TPD Rice straw CBG plant for Hindustan Petroleum at Badaun (UP)
- Incorporates BM Solve Microbial hydrolysis and Plug Flow Biomethanation
- NOCA certified solid and liquid Manure production technology as per FCO specifications

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Summary : PRAJ Provides High Value & Robust Technology for Biogas Solution

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- Complex feedstock handling experience
- **Press Mud, Rice & Wheat Straws, Corn Stover, Bagasse, etc.**

- **Over 50 biogas reference (PRAJ) & 120+ for DVO(Our Partner)**
- **One Stop Solution : TEPC**

- **Best-in-class**
- Low processing costs

- **Proprietary pre-treatment**
- **High Efficiency for Biomass**
- **Low Maintenance : High Digester Uptime (10-15Years)**

Towards Net-Zero &
Climate Resilient Solution

Thank you