



Bio-Mobility®: Towards Sustainable Decarbonization of Transportation

Energy is the driving force for industrial and economic growth of any developing nation. Transportation is among second largest energy consumer and GHG emitter after industry. In a world threatened by climate change, there is a dire need of sustainable decarbonization of transportation sector. Embracing Biofuels by consuming Low Carbon Biofuels is the most promising solution to combat the evils of climate change.

Future of Mobility Together Towards Sustainable Mobility

Witness the future of mobility with innovative solutions from Praj industries, world's leading industrial biotechnology company. Make Praj your partner in energy transition for sustainable decarbonization of transportation sector across all modes of mobility.

Reimagining Transportation with Bio-Mobility[®]:

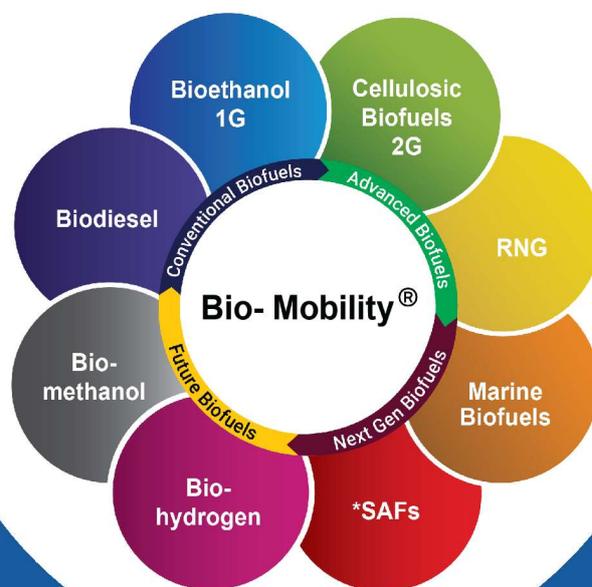
Bio-Mobility[®] platform of technologies envisages utilization of Agri residues and organic waste to produce low carbon transportation fuels (in liquid and gaseous state) across all modes of mobility i.e. Surface, Air and Marine.

Praj Offers End To End Innovative Technology Solutions:

We create value for our customers with our distinct TEMPO (Technology, Engineering, Manufacturing, Project management and Operations) business model.

- Exploration of new bio-based feedstocks
- Cutting-edge technologies for Converting sustainable feedstocks into low carbon Biofuels
- Concept – Realization - Life Cycle Management of biofuels plants
- Catering to exponentially growing energy needs of energy transition

At Praj, we firmly believe that Circular Bioeconomy is the promising pathway for a cleaner & greener environment for better future. Bioeconomy is knowledge-based production facilitating use of biological resources to provide products, processes, services & energy. Bio-Mobility[®], one of the important pillars of Bioeconomy facilitates energy transition.



Praj's Bio-Mobility® Platform Facilitates The Following Sustainable Development Goals:

Sustainable Feedstocks: Ensuring surplus availability

- Sugary Feedstocks: Sugarcane juice, molasses B & C, BIOSYRUP®
- Starchy Feedstocks: Surplus Or Damaged Grains, Tubers
- Lignocellulosic Feedstocks: Rice Straw, Wheat Straw, Bamboo

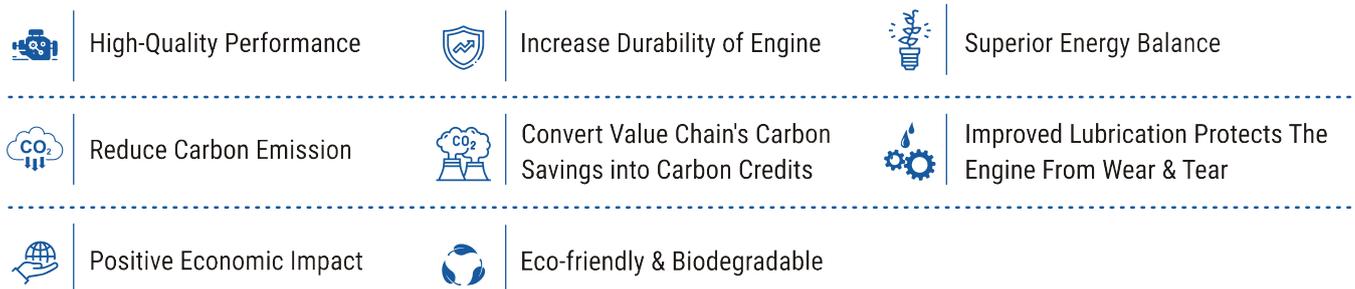
Sustainable Operations: Enabling Low Emissions

- Low Energy Footprint
- Low Carbon Footprint
- Low Water Footprint

Sustainable Market & Ecosystem: Holistic Environment

- Ensuring Sustainable Off Take
- Promoting Biofuels
- New Application Development

Biofuels: A Boon for Decarbonizing Automobile Industry

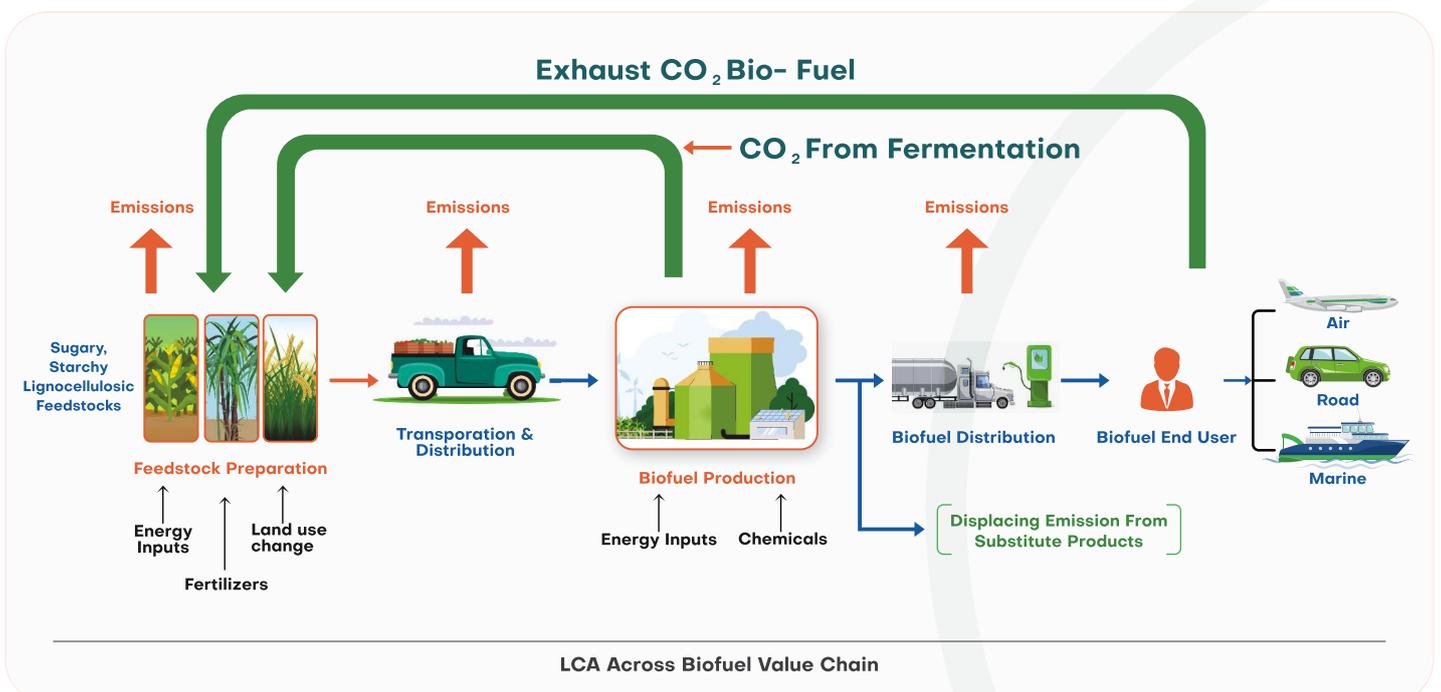


Environmental Sustainability – Carbon Intensity Reduction

As a part of 'Accelerating the Energy Transition,' Praj has the capabilities of carbon intensity measurement & evaluation. Praj uses Life Cycle Analysis (LCA) process to estimate the carbon intensity by accounting for carbon emissions throughout the lifecycle of a product. Decarbonization is about reducing CO₂ emissions resulting from transportation activities, with an eventual goal of eliminating them.

Carbon Intensity Measurement Involves Calculating Carbon Emissions With The Following Considerations:

- Feedstock preparation
- Transportation considerations (distance of travel)
- Displaced emissions in case of co-product being used as a substitute



Bio-Mobility® Offerings:



1st Gen Bioethanol Plant at Jaywant Sugars, Satara, Maharashtra
Typical GHG Savings over Fossil Fuels up to 60%

First Generation Bioethanol Technology (1st Gen)

Praj has over four decades of expertise and experience on processes to transform first-generation agricultural feedstocks, viz. Sugary Feedstocks: Sugarcane Juice, B & C molasses, BIOSYRUP and Starchy Feedstocks: Grains and tubers into Bioethanol.

Among many credits, Praj has 10,000+ global feedstock-bank & around 300+ patented technologies coupled with world-class engineering & manufacturing capabilities with a focus on a customer-centric approach at its heart.

Praj facilities product flexibility with Fuel-Grade Bioethanol as per country specifications & Industrial-Grade Bioethanol for perfumery, pharma, solvent, and rectified spirit sector.

The key benefits include:

- Product Maximization & Co-product Valorisation
- Multi-feed, Multi-Product Systems
- Facilitates Carbon Intensity Life Cycle Assessment
- Achieving Environmental Norms
- Low Carbon Intensity Biofuels
- Reduction in Energy & Water Footprints

Second Generation Biomass to Bioethanol Technology (2nd Gen)

Praj offers design, engineering, installation, commissioning of a bio-refineries based on its proprietary technology enfinity® – 2nd Gen Biomass to Bioethanol technology. A bio-refinery produces Bioethanol, renewable chemicals and materials by processing a wide range of agricultural residues like rice straw, wheat straw, bagasse, corn stover and corn cobs and forest residues such as soft wood, bamboo, wood chips & Empty Fruit Bunches (EFB). Apart from Bioethanol, a wide range of value-added co-products like Bio-bitumen, Bio-fertilizer and Ligno-sulphates are also produced in a Biorefinery.

enfinity® technology is a 2nd Gen Bioethanol technology that converts lignocellulosic feedstocks from agricultural residues into Bioethanol & co-products. This technology is currently being deployed at three commercial scale Bio-refineries in India.

Celluniti™ technology is a 2nd Gen Bioethanol technology in collaboration with Sekab that converts lignocellulosic feedstocks from forestry residues into Bioethanol & co-products.

The key benefits include:

- Alternative to Stubble Burning
- Waste to Energy
- Reduce Air And Soil Pollution
- Additional Revenue For Farmers & Boosts Rural Economy
- Low Carbon Biofuels & Value-added Co-products
- Reduce Carbon & Energy Footprint



2nd Gen Bioethanol Biorefinery at IOCL, Panipat, Haryana
Typical GHG Savings over Fossil Fuels: Up to 95%



CBG Plant at Shreenath Mhaskoba, Daund, Pune, Maharashtra
Typical GHG Savings over Fossil Fuels: Up to 100%

Compressed Biogas (CBG) Technology

Praj has developed its proprietary Compressed Biogas (CBG) technology, RenGas® and commissioned over 45 plants in India. The Compressed Biogas plant processes a wide range of agricultural residues like Sugarcane bagasse, Wheat Straw, Corn Stover, Rice Straw, Soyabean Straw and Corn Cobs, and farm and industrial waste like Chicken litter, Sugarcane press mud, Cow dung, Napier grass, corn biomass and empty fruit bunches of palms. Apart from vehicle grade CBG, organic manure in solid & liquid form is obtained as a value-added coproducts.

The key benefits include:

- Low Carbon Intensity Plant with Highest yield
- Unique Microbial Cultures Reducing Operating Cost
- Plug Flow Reactor (PFR) Digester Designed In Collaboration With DVO Inc.
- Zero Moving Parts In The Reactor Resulting Low Maintenance
- High Energy Efficiency & Maximum Uptime
- Digestate Processing Into Value Added Manure With Organic Certificates





Sustainable Aviation Fuel Technology

Praj is ready to offer end to end solutions to produce Sustainable Aviation Fuel (SAF) based on ASTM- approved Alcohol-To-Jet (ATJ) pathway, in collaboration with Gevo Inc., USA. Praj-Gevo's innovative process uses Isobutanol produced from sugars as feedstock to produce SAF. Iso-octane is another high value co-product used as fuel for high performance driving.

Typical GHG Savings over Fossil Fuels: Up to 55%

Praj Integrated Advanced Biorefinery

Praj is uniquely positioned to offer an integrated advanced biorefinery that is capable of processing multi feedstocks (Sugary, Starchy & Lignocellulosic) to produce multiple products (various grades of Bioethanol, Compressed Biogas, Sustainable Aviation Fuel, Renewable chemicals and materials).

Feedstocks are processed to produce mixed sugar streams & lignin-rich cakes. Mixed sugars streams undergo fermentation to produce Bioethanol or Renewable Chemicals and Materials or both. Bioethanol produced can be further processed into Sustainable Aviation Fuel (SAF). Further processing of lignin rich cakes can yield variety of value-added products like Bio-bitumen, Lignosulfonates, Marine Biofuels.



Bio-Mobility[®] Helps Strike A Fine Balance Between People - Plant - Profit

Praj's Bio-Mobility[®] platform of technologies is powered by indigenous energy solutions to make India an energy self-reliant nation. These technologies will help save important FOREX currency and provides rural empowerment through job creation along with boosting entrepreneurship. It also provides additional income to farmers further strengthening the rural economy. Embracing Bio-Mobility technology solutions provide easy integration with existing system & provide solutions to standalone distilleries.

1000++ References
In
100+ Countries
Across
6 Continents



**ACCELERATING ENERGY TRANSITION
TOWARDS A SUSTAINABLE TOMORROW!**



Innovate • Integrate • Deliver

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