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Biofuels for Energy Security: Driving India's Sustainable Future

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In the face of climate change and the growing challenges of global energy demand, India is adopting innovative solutions to secure its energy future while minimizing environmental impact. A cornerstone of this transition is the adoption of biofuels, which offer a clean, renewable alternative to fossil fuels. By reducing dependence on imports, cutting carbon emissions, and fostering energy security, biofuels are playing a pivotal role in India's sustainable development.

Biofuels and Mission LiFE: A Synergistic Approach

India's commitment to sustainable living is embodied in Mission LiFE (Lifestyle for Environment), a national initiative advocating for sustainable practices at individual, community, and corporate levels. This movement emphasizes reducing ecological footprints through conscious choices in consumption, waste management, and energy use. Biofuels align seamlessly with Mission LiFE, offering practical, scalable solutions to some of the most pressing environmental and energy challenges.

India's renewable energy landscape has seen remarkable growth, with installed capacity crossing 200 GW this year, accounting for 46% of its energy mix. This includes 92 GW from solar, 48 GW from wind, 52 GW from hydro-electric power and 11 GW's contribution from bioenergy. Biofuels, particularly ethanol and compressed biogas (CBG), are promising fuels to bridging the gap between India's renewable energy goals and its energy security needs.

Strengthening Energy Independence through Biofuels

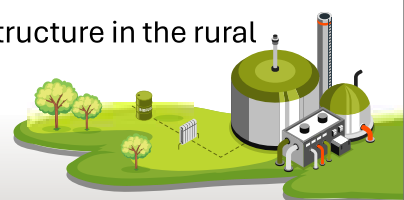
BiofuelCircle, a leading digital platform for the bioenergy supply chain, was established to address two critical challenges: the effective management of agricultural waste and the growing demand for clean energy solutions. Recognizing the vast potential of bioenergy, the company set out to resolve the inefficiencies caused by a fragmented biomass and biofuel supply chain. Farmers faced difficulties monetizing agricultural waste, while industries struggled to secure consistent and cost-effective biomass supplies.

To bridge this gap, BiofuelCircle developed a digital marketplace designed to connect biomass producers, primarily farmers, with buyers such as bioenergy companies and industrial users. This platform simplifies the procurement process by introducing transparency, traceability, and efficiency in transactions. It enables farmers to generate additional revenue streams while providing buyers with seamless access to sustainable energy resources.

BiofuelCircle's digital ecosystem brings together key stakeholders, including farmers, biomass processors, biofuel consumers, transporters, and warehousing partners. This integrated approach reduces inefficiencies and promotes biofuels as a scalable and practical alternative to fossil fuels. Guided by this vision, the company is building a robust bioenergy ecosystem that supports environmental sustainability and economic development.

Revolutionizing Biofuel Adoption

The company's two primary areas of focus are creating incentives and infrastructure in the rural



segment to enable industrial-scale biomass supply; bridging the gap between the relatively unorganized rural supply side and sophisticated industrial buyers demanding reliability, quality, and predictability. To address these, the company has set up biomass banks and created an e-commerce marketplace.

The Biomass Bank™ model is at the heart of its mission to provide a steady and reliable supply of biomass. These biomass banks are a local ecosystem run by rural enterprises and enabled by the BiofuelCircle digital platform. The ecosystem with local participation is responsible for biomass collection, transport, and storage. By doing this closer to the source, logistics costs are minimized and biomass is readily available to meet the needs of bio-energy plants and other industries.

Coordination of the operations of the Biomass Banks™ are through the cloud-based platform, which gives real-time visibility into inventory levels, logistics, and delivery schedules. This model not only creates a consistent supply chain but also generates livelihoods for local tractor owners, equipment operators, laborers, and others, enhancing the value of agricultural residues for farmers and integrating them into the biofuel value chain.

Expanding Reach, Empowering Rural India

To build sustainable biomass aggregation infrastructure, BiofuelCircle is expanding its reach into rural India. The company plans to take its rural warehouses to 35 at the end of Mar'25, across key agricultural states including Uttar Pradesh, Haryana, Maharashtra, Gujarat, and Andhra Pradesh. The company's mobile platform deploys GPS and telematics-based app to promote rural biomass businesses.

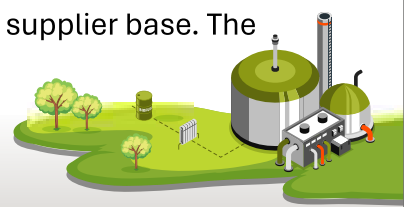
The initiative addresses India's paddy stubble burning issue and follows BiofuelCircle's 'Parali Se Ujjawal Bhavishya' campaign that was first launched in Barabanki, Uttar Pradesh this year and taken to other states. One Biomass Bank deployed over 40 advanced, digitally integrated machines to collect and process stubble, preventing approximately 30,000 MT of agricultural residue from being burned across 25,000 acres. This one Biomass Bank™ will benefit more than 5,000 farmers across 30 villages.

Addressing Industry Challenges with Tech-Driven Marketplace

Unlike conventional biofuel procurement methods that often involve cumbersome, manual processes, BiofuelCircle's fully digital, AI-powered platform streamlines procurement, enhances quality assurance and provides seamless market access for both buyers and suppliers. Supporting 90 different biomass and biofuel commodities, the platform has grown to include over 14,881 users and has facilitated trades totaling 7.6 million metric tonnes.

Powering India's Renewable Energy Revolution

At BiofuelCircle, the marketplace model is designed to address the critical challenges in the biomass supply-demand gap, particularly for India's power sector as it works to meet renewable energy targets. One of the main hurdles is the fragmented nature of biomass suppliers and tender-based procurement processes, which complicate efficient sourcing. This issue is amplified by the mandatory co-firing regulation, requiring power plants to co-fire 5% biomass with coal starting in fiscal 2024-25, rising to 7% by 2025-26. With an estimated demand of 3.5 million MT annually, the current supply chain struggles due to the dispersed supplier base. The



company's digital marketplace connects biomass suppliers and buyers directly, streamlining transactions from supplier verification to delivery scheduling, payments, and invoicing. By replacing traditional tender processes, our platform offers Online Auctions that cut procurement time and ensure a more reliable, scalable biomass supply. Additionally, the expanding Biomass Banks™ play a key role in ensuring a steady supply and mitigating any disruptions in raw material supply.

Addressing Feedstock Challenges for Bio-energy Companies

Addressing feedstock challenges is crucial for bio-energy companies to bolster India's energy transition, particularly in the automotive sector. Ethanol blending programs and compressed biogas (CBG) initiatives hinge on a consistent, high-quality biomass supply. However, seasonal variations, fragmented agricultural practices, and supply chain inefficiencies often disrupt this availability.

To overcome these hurdles, partnerships between bio-energy companies and biomass enterprises built at rural level can establish a stable feedstock supply chain. By integrating digital tools like IoT and AI-driven monitoring, companies can forecast biomass yield, track supply, and optimize logistics. Furthermore, the government needs to foster collaboration among industry stakeholders, academia, and research institutions. By establishing forums for exchanging information and collaborating on projects, we can spur innovation and address the obstacles facing the biofuel industry. Increasing public awareness of the environmental and economic advantages of biofuels can accelerate market acceptance and assist in achieving the government's sustainability objectives.

Policymakers can support this transition by making financing options available for mechanized residue collection and for establishing decentralized preprocessing hubs to streamline feedstock delivery. Thus, a combination of technological innovation, effective logistics, supportive policies, and collaboration among various stakeholders will help overcome these challenges. Developing integrated supply chains, investing in advanced pre-treatment and storage technologies, and fostering community engagement are critical steps toward ensuring a reliable and sustainable feedstock supply for CBG plants.

By resolving these feedstock challenges, the bio-energy sector can align with the automotive industry's decarbonization goals, providing sustainable fuel alternatives and significantly reducing greenhouse gas emissions in transportation.

Accelerating India's Green Transition

As India continues its journey towards energy security and sustainability, the role of biofuels will only become more central. By embracing biofuels, India is reducing its carbon emissions and ensuring a stable, reliable energy supply that enhances national security and supports long-term economic growth. BiofuelCircle's innovative approach to the biomass supply chain, combining digital platforms with physical infrastructure and rural partnerships, presents a compelling model for scaling bioenergy in India. By addressing key challenges in rural incentivization, supply reliability, and market access, the company is not only creating economic opportunities but also contributing significantly to India's renewable energy goals. As the biomass sector continues to evolve, companies like BiofuelCircle will play a crucial role in shaping a more sustainable and circular energy economy.

