Navigating the Agricultural Biomass Supply Chain in India

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By February 2024, India's biomass power capacity had surged to 10,845 MW as per the Ministry of New and Renewable Energy (MNRE). This surge in biomass power is crucial for India as it aims to meet 50% of its energy requirements from renewables. In this context, the efficient management of the biomass supply chain, especially the agricultural biomass supply chain as India is an agrarian economy, becomes imperative not only for energy generation but also for livelihoods and sustainable development.

Potential of Biomass in India

With an annual availability of 750 million metric tonne (MMT) and a surplus of 230 MMT as of 2021, biomass can provide huge environmental and economic benefits for India. Realising this potential, the country is operating 11,581, 21,279, and 33,196 small biogas plants in Andhra Pradesh, Karnataka, and Maharashtra as per MNRE (as of March 2023).

Cleaner energy derived from India's abundant agricultural biomass can be used for cooking and heating, which will in turn promote rural development by improving indoor air quality and reducing health risks. It will also provide economic benefits via enhanced job creation, reduced dependency on fossil-fuel imports, etc.

Further, India can benefit by converting agricultural biomass from stubble into energy to combat the issue of stubble burning. By utilising crop residues for bioenergy generation through processes such as composting, biochar production, and power generation in biogas plants, environmental and health impacts associated with stubble burning can be mitigated. This will also preserve soil fertility, mitigate climate change, and foster community development. Farmers mainly resort to stubble burning due to the short time span between harvesting and sowing the next crop. Thus, a more efficient biomass supply chain becomes crucial for the faster clearing of stubble from farmers' fields.

Agricultural Biomass Supply Chain

India's agricultural biomass supply chain begins with harvesting agricultural residues obtained from crops such as rice, wheat, and sugarcane. This is followed by collection, which involves preparing biomass for transport, and transportation. The biomass is then pre-treated for energy production suitability by using methods such as drying or pelletising. The pre-treated biomass is stored to prevent spoilage and then utilised for energy through burning, biofuel conversion, or biogas plants. Each stage presents distinct challenges and opportunities, highlighting the supply chain's complexity.

Challenges in India's Agricultural Biomass Supply Chain

The decentralisation of biomass resources—spread across regions and among small-scale farmers and industries—complicates collection and aggregation, leading to inefficiencies. Seasonal availability and limited storage infrastructure hinder reliable year-round supply. Initiatives for agricultural infrastructure and biomass collection machinery exist but face implementation challenges. To add to these, transporting biomass is complicated in India's diverse landscape, especially in rural areas where it has the added disadvantage of being costly.

Further, quality issues such as varying moisture content affect conversion efficiency, highlighting the importance of careful biomass storage practices.

Government Initiatives in Play

To foster a robust biomass ecosystem, the Ministry of Power's Biomass Co-firing Policy mandates thermal power plants to incorporate 5% agro-residue-based biomass pellets with coal, with a planned increase to 7% by 2025–26. The policy also benchmarks the prices of these pellets, aiming to reduce the reliance on fossil fuels, support farmer incomes, and establish a sustainable biomass supply chain. The government has also initiated several schemes, such as the finance assistance schemes by MNRE, to ease pellet availability and procurement challenges.

Other Fixes

Enhanced financial incentives should be provided to support farmers and entrepreneurs investing in biomass machinery, streamlining the collection, and optimising the supply chain. Investing in rural infrastructure, particularly transportation, would alleviate logistical challenges in biomass collection. Similarly, increased funding for research and development would advance biomass processing technologies, improving feedstock quality and conversion process efficiency.

Further, farmers should be educated on the environmental impacts of stubble burning and the potential of biomass energy in reducing air pollution through public awareness campaigns. Government support through incentivising farmers to refrain from burning crop residues and promoting their use in bioenergy generation would also help.

To overcome the current lack of knowledge about the biomass sector's potential among financial institutions and facilitate access to capital for biofuel projects, capacity-building programmes need to be conducted. Increased emphasis on biomass and its supply chain dynamics should be advocated on a global scale through conferences, summits, and initiatives akin to the Global Biofuel Alliance.

Quality-related issues could be addressed by establishing a comprehensive regulatory framework to monitor the biomass feedstock quality, ensuring supply chain consistency and enhancing energy production efficiency.

Conclusion

Policy interventions are pivotal for a sustainable agricultural biomass supply chain in India, as well as to address challenges and foster a transition to cleaner energy. Further, enhanced financial incentives, infrastructure development, and capacity building for improving the agricultural biomass supply chain are crucial for India's greener and more sustainable future.