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Bio-briquettes tackle India's climate, pollution and poverty challenges

Effective use of biomass can help India generate electricity, safely dispose of agricultural waste and give farmers income.

A 2022 research paper estimated that India produces a billion tonnes of crop residue per year. Most is used for purposes like cattle fodder, organic fertilisers, household fuel and roof thatching, but nearly 356.7 MT is left over. Image: CIAT International Center for Tropical Agriculture, CC BY-SA 3.0, via Flickr.

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Surjeet Kaur is a 38-year-old farmer whose family has tilled land for generations in Patiala district in the Indian state of Punjab. Each year, Kaur and her family together harvest about 90 quintals (9 tonnes) of paddy from their 3 acres of land.

The steady earning from the paddy harvest is, however, accompanied by the need to quickly dispose of straw and agricultural waste in order to plant wheat. The dominant varieties of paddy and wheat planted in north India leaves a short 10-15 day gap between harvesting paddy and planting wheat; any delay would lower the wheat harvest.

With few alternatives, and with each tonne of paddy generating 1.35 – 1.50 tonnes of rice straw, tens of thousands of farmers burn the stubble every year, despite the environmental costs, damage to biodiversity and negative impact on soil health.

"[In the past] we would harvest our crop and set fire to the straw and stubble. There was no other option for us," Surjeet tells The Third Pole. "Grey curtains of smoke would hang in the [air]... We had breathing problems and sometimes itchy skin," she adds.

Burning stubble is a crime in India. The National Green Tribunal (NGT) also specifically banned stubble burning in the states of Uttar Pradesh, Punjab, Haryana, and Rajasthan in 2015. In late 2023, the Supreme Court, too, directed these state governments to immediately stop stubble burning.

But despite these interventions, which include fines and even arrests, authorities struggle to limit stubble burning.

Incentives to curb burning

Since 2018, however, another solution emerged for farmers in the shape of government subsidies to buy crop residue for use in energy plants. In 2021, the Ministry of Power also mandated using a 5-7 per cent blend of biomass in the existing coal-fired power plants.

According to Satish Upadhyay, mission director of the National Mission on the Use of Biomass in Thermal Power Plants (SAMARTH), replacing 5 per cent coal with biomass pellets saves more than 35 million metric tonnes of coal annually. So far, 50 thermal power plants, including 15 in the state-owned electricity provider, NTPC, have co-fired 391,000 metric tonnes of biomass.

A 2022 research paper estimated that India produces a billion tonnes of crop residue per year. Most is used for purposes like cattle fodder, organic fertilisers, household fuel and roof thatching, but nearly 356.7 MT is left over. This amount of biomass, the paper suggested, could generate 53,767 megawatts of electric capacity (MWe).

While few independent audits exist of the scale of the uptake, a January 2023 report by PricewaterhouseCoopers, citing data from the Ministry of Renewable Energy, states that, "There are [now] close to 230 biomass pellet manufacturers and close to 1,030 briquette [coal dust or peat used as fuel] manufacturers spread across different states".

Monish Ahuja, chair of the Confederation of Biomass Energy Industry of India, tells The Third Pole that more than 40 companies have come up in the past two or three years to manufacture biomass pellets and briquettes, each of which has an average production capacity of 200 metric tonnes (MT) per day.

The largest of them, Punjab Renewable Energy Systems Private Limited (PRESPL), with an installed capacity of 800 MT per day, has an average daily production of 500 – 700 MT and works across 18 states in India. It uses agricultural waste such as rice straw, cane thrash, maize cobs, cotton stalk, groundnut shells and soya husk.

The road for PRESPL has been a long one. According to Pronob Roy, senior vice president (east zone), PRESPL started working with biomass collection from farmers in 2011.

The sector was small, and it was hard to attract interest or investment, so PRESPL's first major investor came from Zurich in 2013. The National Biofuel policy, released in 2018, gave a boost to the sector, and subsequent policies tapping into biomass potential have led to a rapid expansion of the sector, Roy said.

The company now engages with about 200,000 farmers and 100,000 farm workers who gather the crop residue across India. Nonetheless, the company is still largely reliant on external funding from investors such as Mitsui (Japan), NEEV fund State Bank of India (joint investment Indo–UK platform), and SHELL (Netherlands).

For farmers, such as Surjeet in Punjab, selling crop residue to PRESPL helps deal with the waste easily, and also generates additional revenue. "Announcements are made at our Gurudwara, asking us to contact the VLEs [village level entrepreneurs]." The VLEs then remove the crop residue from "our farmland within 8-10 days," she tells The Third Pole, to a specific aggregation point in each village.

The government has been happy to claim this as a success. Ashwini Kumar Choubey, the Minister of State for Environment, Forest and Climate Change, told the Indian parliament in December 2023 that there had been a 27 per cent decrease in farm fires in the states of Punjab and Haryana because of these policies.

An earlier answer of his, in February 2023, in response to concerns that farmers were not getting enough renumeration for crop residue, showed a more complicated picture.

There was a general decline of farm fires in the states of Punjab, Uttar Pradesh and Rajasthan (and a minor uptick in Delhi), but there were more crop fires in 2021 in Haryana than in the year before it, or after it. If the only important factor in farm fires was the government subsidies, the decline would have been steady – which it is not.

Nonetheless, any renumeration was a positive for Jaideep Singh, a farmer from Rampur district in Uttar Pradesh, who has been selling paddy straw and cane crush for the past two years.

He tells The Third Pole that the residue, "fetches us around INR 20,000 [USD 241] per annum or maybe more." For him, it was hard to believe that such 'waste' "can have value too". His wife, Saroj, says that the extra money is used to cover healthcare expenses for elderly parents, hiring a tutor for their children, and purchasing seeds and fertiliser.

Challenges persist

Despite the uptick, Ahuja says they face significant challenges. "We are still battling against the high cost of biomass energy production vis-a-vis lower cost of power produced from coal-fired power plants and other renewable energy sources," he says.

Santi Pada Gon Chaudhuri, one of India's pioneers in renewable energy, says, "Since the raw inputs of biomass come from unorganised sector, its price cannot be regulated by the government; this enhances the cost of generation per unit."

He tells The Third Pole, that at INR 6 (USD 0.073) per unit, energy from biomass is very expensive, compared to INR 2.20-2.30 for solar, and INR 3-5 from most coal plants. However, electricity costs from modern supercritical coal power plants are similar to the cost from biomass-based electricity, at INR 6–6.50 per unit. But, as the biomass sector grows, economies of scale are likely to lower the costs for thhe generation of electricity, Chadhari adds.

Ahuja tells The Third Pole that some costs can be lowered if the government provides incentives and subsidies for the capital cost of the plants. Additionally, tax relief to compress the crop residue, better village roads for easy transportation, as well as the availability of low-cost, nonarable land for aggregation, would make the make the sector attractive for investment.

"There is also a lack of coordination among the stakeholders," adds Sekhon of PRESPL. There are multiple ministries involved, including those of Agriculture, Environment, Renewable energy, and Power. "The need of the hour is to have a centralised agency with a single-window time-bound mechanism of clearances for faster communication and effective implementation," he says.

Meanwhile, despite the initial bottlenecks, Harjeet Singh, Global Engagement Director for the Fossil Fuel Non-Proliferation Treaty Initiative – a network of civil society actors pushing to end the use of fossil fuels – says, "This transformation towards using agri-waste as a bio-energy resource is certainly a powerful triple win."

After years of burning stubble, he says, this initiative provides climate mitigation and addresses air pollution issues, while addressing India's energy deficit and rural poverty.

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