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THE COMPLEX PATH TO BIOFUEL SUSTAINABILITY

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‘A historic moment for India, demonstrating its commitment to climate action with global cooperation’ | Photo Credit: AP

Until a few years ago, working on biofuels called for constant justification in the face of electric vehicles (EVs) taking over the world. Today, while there is no doubt that EV adoption has amplified over the years, there is growing awareness of the fact that no decarbonisation strategy is trade-off-free. For instance, for a transition to EVs, existing internal combustion engine (ICE) vehicles and the supporting infrastructure need to be replaced entirely, which is capital intensive. Further, the required batteries and critical minerals used in them need to be imported, adding to environmental concerns on how these minerals are mined, among other issues. Biofuels, on the other hand, can be used in existing ICE engines and infrastructure with little to no modifications (depending on the blending rates) and offer import independence.

However, ‘biofuel’ is a blanket term that includes both sustainable and unsustainable fuels, and an understanding of their difference will be essential to drive effective decarbonisation action.

In India, biofuel is synonymous with first-generation (1G) ethanol, which is primarily sourced from food crops. The policy target in India of achieving 20% ethanol blending with petrol (E20) by 2025-26 is expected to be met almost entirely by 1G ethanol made from sugar cane and foodgrains. Second-generation (2G) ethanol, which is made from crop wastes and residues, is unlikely to contribute much to achieving this target due to several challenges related to feedstock supply chain and scaling up.

The groundwater depletion implications of growing sugar cane are well known, but the food security implications of groundwater depletion and of using foodgrains for ethanol production are harder to imagine because India is currently a surplus food producer. But there are several reasons why diverting the surplus produce towards energy or specifically growing a crop for energy may not be a sustainable strategy.

First, India’s crop yields have already stagnated, and global warming is expected to reduce yields, which means that the same area under cultivation (arable land) will produce less with time but will need to suffice for a growing population. So, our strategy to meet blending targets cannot depend on surplus crop production.

Second, a recent study led by the University of Michigan projected that the rates of groundwater depletion could triple during 2040-81 compared with the current rate. This is again attributable to

temperature rise and the resultant increase in crop water requirements. With such limited resources, be it groundwater or arable land, food production should be prioritised over fuel.

Third, the agriculture sector is one of the hardest-to-abate in terms of direct greenhouse gas (GHG) emissions. So, increasing GHG emissions from this sector for motor fuel production in order to decrease GHG emissions from the transport sector is an unnecessary balancing loop that would achieve little net benefit.

In India, the ethanol blending policy has been a good strategy to deal with the surplus sugar production. Another good strategy to deal with the surplus sugar production would be to reduce surplus sugar cane cultivation. Increasing farmer income is often waved as a white flag in response to this argument, but sugar cane being a remunerative crop has more to do with government intervention than anything else. This means that any unassuming crop could be made as remunerative as sugar cane if so desired.

‘Sustainable’ biofuels are produced from crop residues and other wastes, with low water and GHG footprint. The Global Biofuels Alliance that was formed at the G-20 Summit in New Delhi last week is expected to strengthen the development of sustainable biofuels, in addition to promoting ethanol uptake. It is, therefore, a historic moment for India, demonstrating its commitment to climate action with global cooperation.

The Energy Transitions Commission, in its report on ‘Bioresources within a Net-Zero Emissions Economy’, recommended that biomass should be prioritised for use in sectors where there are limited low-carbon alternatives. Long-haul aviation and road freight segments, wherein complete electrification might take longer to achieve, could make the cut, whereas petrol vehicles (for which ethanol blending is currently being targeted) would probably not.

According to the International Energy Agency, to achieve net-zero emissions by 2050 globally, sustainable biofuel production needs to triple by 2030 to fuel modes that have few other mitigation options. Although 1G ethanol is unlikely to fit the bill, 2G ethanol could be counted as a sustainable fuel, especially if the production is decentralised, i.e., crop residues do not have to be transported large distances to a central manufacturing plant. But this might affect achieving economies of scale for the 2G plant.

Balancing economies of scale with the energy needs (and costs) of biomass collection and transport across large distances is a major challenge. The Global Biofuels Alliance could help drive innovation and technology development in establishing an efficient biomass supply chain and smaller-scale decentralised biofuel production units.

Achieving true sustainability is complex, especially with respect to biofuels. Therefore, any strategy should be carefully examined in the context of the larger ecosystem to avoid unintended negative consequences.

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