

ALGAE BIOFUEL PRODUCTION

Transportation fuel is a biofuel-relevant market that has a critical implication on the nation's economy given the huge strain placed by the crude oil import bill (6,000 billion rupees). Algae based biofuels that are of further generation from the first and second generation biofuels have been considered as they present a larger scope for use as transportation fuel.

Level 1

The microalgal technology sees slow development with commercial production starting meagerly at 10,000 tons/year in 2032. An areal productivity of 25 g/m²/day has been considered. Combined with a lipid content of 20%, this relates to a lipid productivity of 5 g/m²/day. Microalgae cultivation extends to a land area of 3,400 ha by 2047. This relates to a microalgal biofuel production of 0.05 mtoe/year by 2047. Offshore macroalgae sees only negligible development with fuel production reaching only 5,000 tonnes/year by 2047.

Level 2

The microalgal development is still slow with commercial production starting at a lowly 20,000 tons/year by 2025. An areal productivity of 55 g/m²/day has been considered. Lipid content is taken to be 27%. Microalgae cultivation extends to a land area of 64,000 ha by 2047. This relates to microalgal biofuel production of 2.6 mtoe/year by 2047. Offshore macroalgae also finds slow commercial production starting only from 2037. 50 g/m²/day productivity has been considered.

Macroalgal liquid fuel production reaches 0.11 mtoe/year by 2047.

Level 3

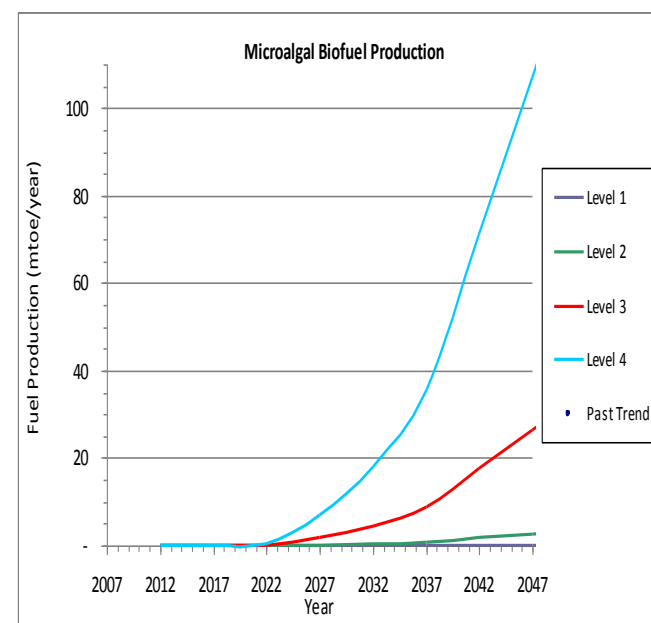
The microalgal fuel development gets better with commercial production starting from 2022 at 90,000 tons/year. An areal productivity of 85 g/m²/day has been considered. Lipid content is envisaged to be 35%. Microalgae cultivation extends to a land area of 0.3 Mha by 2047. This relates to microalgal biofuel production of 27 mtoe/year by 2047. Offshore macroalgae also picks up steam with commercial production starting from 2022. 75 g/m²/day productivity has been considered. The energy yield of fuel conversion process is projected to increase to 52% by 2047. Liquid fuel production from macroalgae reaches 1.9 mtoe/year by 2047.

Level 4

The microalgal biofuels are envisioned to become commercially viable starting from 2020. Areal productivity is 120 g/m²/day. A lipid content of 40% is achieved. Microalgae cultivation extends to an area of 0.75 Mha by 2047. Microalgal biofuel production progresses at an impressive rate reaching 107 mtoe/year by 2047 illustrating the real potential of the technology. Offshore macroalgae also becomes commercially viable by 2020. An areal productivity of 100 g/m²/day has been considered. The energy yield of fuel conversion process is projected to increase to 60% by 2047. This relates to a sizable macroalgal fuel production reaching 6 mtoe/year by 2047.

The Level 4 algal biofuel production relates to about 25% of total transportation fuel demand of India. Theoretically algal biofuels have the potential to

supply even more than the reported projection of Level 4, since unlike the other fuel technologies it is not limited by resources in the Indian context. For example, for a microalgal biofuel production of 150 mtoe/year, the land requirement would be 1 Mha. This relates to about 32% of the Rann of Kutch area i.e. 0.3% of India's total land area. So these fuels



Note: Please see detailed documentation for references