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(57) Abstract :

The invention discloses an algae-based bioreactor comprising a CO₂ inlet (201), a photobioreactor chamber (202), and algae culture (203) for carbon capture and bioenergy generation. Integrated biomass harvesting unit (204) and energy conversion unit (205) produce biofuels, biogas, and hydrogen. A monitoring system (206) optimizes growth, while modular scalability (105) ensures adaptability. The hybrid energy recovery unit (106) generates electricity and recycles surplus heat. The invention provides an eco-friendly, dual-function system addressing both climate change and renewable energy needs efficiently.

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