

International Network on Biofixation of CO₂ and Greenhouse Gas Abatement with Microalgae

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Biofixation of CO₂ with microalgae represents an advanced, climate friendly biological process that enables the direct utilization of fossil CO₂ streams from concentrated sources, such as power plants. Mitigation of greenhouse gas (GHG) emissions would result from the conversion of the harvested algal biomass to renewable biofuels (methane, ethanol, biodiesel and hydrogen) and fossil fuel-sparing products (such as fertilizers, biopolymers and lubricants). Microalgae mass cultures can also be combined with additional environmental services, specifically wastewater treatment and nutrient recycling, to reduce pollution (in particular phosphorous and nitrogen nutrients) and produce reclaimed water. As a result, the use of fossil fuel is further mitigated and CO₂ and other GHG emissions are reduced.

To advance the development and applications of microalgae biofixation processes for renewable energy production and GHG abatement, the U.S. Department of Energy National Energy Technology Laboratory (DoE-NETL) and EniTecnologie, the R&D arm of the Italian oil & gas company Eni, organized the "International Network on Biofixation of CO₂ and GHG Abatement with Microalgae". This initiative operates under the auspices of the IEA GHG R&D Programme and includes as members major energy companies, government agencies and other organizations with an interest in supporting R&D activities in this field. The purpose of the Network is to provide a forum for participants to share information and expertise, enhance understanding of R&D issues, identify and develop practical microalgae-based processes for GHG abatement through internal and external activities (technical meetings, publications, conference presentations and web-based information). The strategic objective of the Network is to demonstrate within five years the technical and economic feasibility of microalgae CO₂ biofixation technologies for GHG abatement and to achieve practical applications within the decade. This is to be pursued through research coordination, project development and review, technical assistance, techno-economic analyses and resource assessments.

As a tool for guiding future R&D activities integrating in its broad vision the projects carried out by the Network members, a Technology Roadmap has been completed. The Technology Roadmap identified four multipurpose microalgae biofixation processes with potential for practical development and significant global impact in GHG mitigation. It also detailed the key scientific and technological issues whose resolution could achieve the strategic objective within the ten year time-frame of the Network. The common R&D issues identified were the need to develop techniques allowing the mass culture of selected microalgae species in large open, unlined ponds, the low-cost harvesting of the algal biomass and the achievement of high productivities (> 100 metric tons/hectare/year). Such high productivities are required to reduce land area requirements (the footprint of the process), reduce costs and increase the global mitigation potential of such technologies.

Currently, eight R&D projects are ongoing under the umbrella of the Network, focusing on genetic and culture techniques to increase productivity in outdoor ponds and demonstrate the effectiveness of algal cultures for nutrient removal and energy production. A systems and global analysis of the potential of microalgae mass cultures for renewable energy production and GHG abatement is underway. The initial results of these R&D projects and systems analyses will be presented.

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