An International Network for Biofixation of CO_2 and Greenhouse Gas Abatement with Microalgae

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Microalgae can exploit solar energy for the biofixation of CO_2 into biomass that can be converted to renewable fuels (methane, biodiesel, ethanol, hydrogen) and other fossil-fuel sparing products and processes, thereby mitigating emissions of fossil CO_2 and other greenhouse gases. Microalgae mass cultures are currently used commercially in the production of high-value nutritional products, in wastewater treatment and in aquaculture. One commercial microalgae production plant in Hawaii is already using flue-gas from a small power plant as a source of the CO_2 required to grow algal biomass. Although still a relatively small industry (total commercial production is only a few thousand tons per year, world-wide), microalgae technologies have been extensively studied over the past decade in the context of greenhouse gas mitigation, particularly in Japan and the U.S.

In January of 2001, a Workshop, attended by participants from major energy companies, microalgae companies , governmental organizations, universities and others, was held in Monterotondo, near Rome Italy, to discuss the prospects of microalgae technologies in abating greenhouse gases. The Workshop was organized by EniTecnologie (the R&D arm of the Italian oil company ENI), the U.S. Department of Energy and the IEA Greenhouse Gas R&D Programme.

The consensus of the Workshop participants was that microalgae offer a variety of approaches to the goal of greenhouse gas reductions, through the production of fuels and energy sparing products (such as fertilizers and bioplastics) and applications in wastewater treatment and aquaculture. Integrated processes for wastewater treatment and aquaculture were indicated as near-term applications of microalgae technologies for greenhouse gas abatement. Such processes would also mitigate greenhouse gases through reductions in CH_4 and N_2O emissions and through reduced fossil fuel consumption, in addition to producing renewable fuels. In the longer-term, microalgae processes have potential for development of larger-scale systems specifically for power plant CO_2 capture and renewable fuels production. Significant research, development and demonstration (R,D&D) efforts will be required to achieve the economic and technical goals of high biomass productivities, long-term culture stabilities, control of biosynthetic pathways and low-cost biomass harvesting and processing.

The R&D efforts required, in terms of cost and time, to make microalgae biofixation an economically feasible option to mitigate CO_2 emissions suggest a collaboration at the international level as an effective and logical approach. An "International Network" for research coordination and collaboration, operating under the IEA Greenhouse Gas R&D Programme, is currently being organized and has a planned start date of early 2002. The membership of this Network will comprise energy companies, government organizations and funding agencies interested in developing and supporting greenhouse gas mitigation technologies. The Network will help focus R&D on practical microalgae systems that utilize concentrated sources of CO_2 and convert the microalgae biomass to substitutes for fossil fuels. R&D activities would range from field projects for waste treatment and other environmental applications to molecular biology for algal strain improvement. The principal purpose of the Network is to promote technology development and applications of microalgae biofixation through information exchange, R&D coordination, cooperative and/or collaborative research projects and by providing technical expertise for economic, engineering and scientific assessments.