Introduction

This research report describes the technical progress of the Global Climate and Energy Project (GCEP) in its four initial research efforts from December 16, 2002 through June 1, 2003. The research projects include:

Integrated Assessment of Technology Options:

This project includes the development of a comprehensive analysis system, including mathematical models, which can be used on a continuing basis for assessments and can serve as a basis for evaluating the probable significance of technological options. The system will also serve as a basis for assessments of options designed to speed up diffusion of technologies once developed.

Hydrogen Production and Utilization:

This project investigates production of hydrogen by genetically engineered photosynthetic microbes, with sunlight as the primary energy source. Additional research investigates advanced thin film fabrication methods for high performance fuel cells. The same approach will be used to develop sensors for monitoring bioconversion processes.

Advanced Combustion:

Developing much more efficient combustion systems will be an important component of limiting the total amount of CO_2 produced by energy use based on fossil fuels. Research activities include low irreversibility combustion engines, biomass combustion, advanced sensors for combustion systems, and process informatics.

Geologic CO_2 Sequestration:

This project examines sequestration of CO_2 in porous systems in the Earth's crust. The research effort will develop better methods for predicting the flow behavior of inject CO_2, methods for monitoring that flow, and for assessing the integrity of geologic seals that will contain the sequestered CO_2