GLOBAL CLIMATE AND ENERGY PROJECT

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ABSTRACT

Energy is the lifeblood of modern societies. Within 20 years, 7.5 billion humans will occupy this planet, about 25 percent more than do so now. They will want to heat and light their homes, power electrical devices, move from place to place, grow food, and drink clean water. Supplying the energy required to do all this is, by itself, a significant challenge. But that is only part of the challenge. It is now apparent that humans are interacting with the chemistry of the planet on a global scale. The concentration of CO_2 in the atmosphere has increased by a third from its pre-industrial levels. There has been an easily detectable change in the pH of the upper ocean as the CO_2 from the atmosphere dissolves. And, while there is a lively ongoing debate about the magnitude of a global warming response to the presence of greenhouse gases (GHG's) in the atmosphere, there is no question that changes are occurring on a global scale, and there is a significant possibility that the world will need an energy system that adds *much* lower GHG's to the atmosphere in the future. This project aims to make that future possible.

Imagine a global energy system that adds *very* low GHG's to the atmosphere. What would be possible primary sources of energy supply in such a system? How would energy end-users make use of that supply? What technologies and systems would be used in the developing countries in addition to North America and Europe? Would we use wind, solar, nuclear power, hydrogen, fossil fuels, and in what combinations? How would such an energy systems be created? What barriers prevent implementation of such systems today (barriers might include safety, adverse environmental effects, market acceptance, legal and social environments, and cost, for example)? What technologies will have to be developed to eliminate those barriers? How can the creative talents of the world's great universities be harnessed to invent such a future? Who will train the next generation of scientists and engineers who will make all this possible? Those questions are the reasons for this project.

With the support of visionary, international companies, Stanford University will develop and manage a portfolio of pre-commercial research to provide the basis for the low GHG-emission energy technologies of the future. It is unlikely that any one energy source will be able to meet the full range of future energy needs, and hence it is essential that the exploration of energy futures examines the technology development needed across the full spectrum of energy sources and uses. Guesses made now about which energy technologies will dominate in the future are unlikely to foresee accurately how these complex systems will evolve and how markets will respond to them, and hence investigation of a diversified portfolio of research topics is critical to project success. Research conducted as part of the project will be performed at Stanford and at other universities worldwide. Stanford will draw widely from energy expertise around the world to build the portfolio. Results of the research will be openly available, and any technology patents will be widely licensable. A key objective of this initiative is to encourage future commercial application of the technologies that flow from the research results.