

# **SecurEarth: A Crosscutting Initiative for the Geo- and Environmental Sciences**

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## **SECUREarth: A CROSSCUTTING INITIATIVE FOR THE GEO- AND ENVIRONMENTAL SCIENCES**

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***“...addressing critical energy and environmental problems will probably have a larger societal impact than curing cancer. Now we just have to convince Congress of that.”*** - Steven Chu, Nobel Laureate and Director of the Lawrence Berkeley National Laboratory, in a 2005 presentation at the LBNL

***“...a new national energy program is essential and must be initiated with the intensity and commitment of the Manhattan Project, and sustained until this problem is solved”... “Considering the urgency of the energy problem, the magnitude of the needed scientific breakthroughs, and the historic rate of scientific discovery, current efforts will likely be too little, too late.”*** - 2003, Basic Energy Science Advisory Committee recommendation

Over the next several decades, the U.S. will be facing critical decisions regarding extraction and utilization of the Earth's resources and stewardship of the Earth. Demands for energy (e.g., fossil, geothermal) and useable water supplies, as well as for places and methods to deal with waste products (e.g., carbon dioxide, radioactive waste), are increasing rapidly. Moreover, the demands are usually interdependent and conflicting. Postponing decisions will become increasingly difficult and unpopular. Complex policy decisions (examples?) with long-range consequences that must be made in the near future will depend on several types of information: social, economic, political and scientific. To balance the urgency with which social, economic, and political information will be used, pertinent scientific information must also be readily available, practical, and possessed with high degree of certainty. Therefore, there is a vital need for timely and relevant scientific information related to energy, resource and environmental issues that will enable decision makers to make better decisions related to public policy.

SECUREarth was launched several years ago as a proposition by scientists from DOE national laboratories, universities and industry who recognized two fundamental issues related to the role of the earth sciences, particularly subsurface science, in addressing resource and environmental issues. The first is that we are still struggling to make connections between pore-, molecular- and cellular-scale information and the complex, large-scale systems where we most need predictive capabilities. To take advantage of the growing wealth of scientific information about physical, chemical and biological processes we need to facilitate research leading to an understanding of how individual processes are coupled, how whole-systems behave and can be modeled, and how the response of large-scale systems to natural or engineered changes can be reasonably predicted. It will also be important to assess both the level of uncertainty associated with predictions and the potential consequences of that uncertainty, as well as to develop strategies for minimizing that uncertainty. The second issue for SECUREarth is that the rate at which the science related to the earth's environment is progressing will not produce some of the most critically needed information by the time policy decisions must be made. Therefore, SECUREarth is concerned both with opening new frontiers for the earth sciences, and also with increasing the rate at which the science becomes useful and available to inform decision makers.

The vision for SECUREarth is to facilitate the direction of funding from government and industry sources in order to advance scientific and engineering research on topics that are common to, and will have the greatest impact on, the most urgent problems that relate to the earth's subsurface, such as predicting and controlling fluid movement. Ideally, SECUREarth can make solutions to problems possible rather than solving the problems themselves. The real solutions will result from the work of many individuals in the scientific and non-scientific communities using new principles derived from SECUREarth research. At this time, a major emphasis is given to a number of topics leading to a better understanding and ability to control fluid flow in complex subsurface environments. However, SECUREarth is also in a period of evaluation, critique and definition that will benefit from input from many sources.

A SECUREarth Workshop in 2005, together with the National Research Council board meeting and other meetings in 2004, have initiated the identification of crosscutting themes in subsurface processes related to energy and the environment. The 2005 SECUREarth workshop analyzed six major problem areas in order to identify or confirm the underlying scientific gaps that, if addressed, would make possible and accelerate research that can provide the scientific basis for policy decisions. While the gaps may be well recognized, progress leading to practical applications and use in other research areas needs to be accelerated, and will require coordinated interdisciplinary efforts. The problem areas included: Groundwater quality and quantity; Contaminant remediation; Fossil fuel recovery; Carbon sequestration; Geothermal energy, and Nuclear waste storage. The underlying cross-cutting themes, which would become interdisciplinary research campaigns supported by SECUREarth were: Techniques for flow delineation, methods for manipulation of flow, understanding flow in fractured media, computational techniques required for advanced modeling and predictions, understanding and simulating process coupling, and control of subsurface microbiological processes.