Introduction:
GCEP’s Need for Breakthrough Research
Lynn Orr

GCEP Workshop on Breakthrough Research

Monterey, CA
November 11-12, 2005
Outline

• Global Challenge
• GCEP Response
  ➢ Project Description
  ➢ Breakthrough Strategy
• Workshop Objectives
The Grand Challenge

Needs
- Growth in world population to 9 billion from 6 billion, of which 2 billion people currently have no access to modern energy systems
- Improved standard of living in growing economies of developing world
- Increased demands for energy, food, land, and materials.

Component Challenges
- Water supply
- Agricultural systems (strongly linked to water supply)
- Energy (with possible limits on CO₂ emission)

Protection, Restoration, and Improvement of the Planetary Biogeochemical Systems
Global Geochemical History

- Concentrations of GHGs have risen significantly over the preindustrial levels.

Source: IPCC Third Assessment Report, 2001
Atmospheric CO$_2$ Concentration
- Last Glacial Maximum to Present

Adapted from: http://www.climate.unibe.ch/gallery_co2.html
The oceans have taken up ~400 Gt of fossil fuel CO₂. Global surface oceans now remove 20-25 Mt CO₂/day.

Decline in pH (0.1 since industrial revolution) affects bicarbonate, carbonate ion concentrations, rates of fixation of CaCO₃ by assorted critters in the trophic chain, potential for feedbacks with temperature change.  Source: Oceanography Vol.17, No.3, Sept. 2004
The Need for Technology

Assumed Advances In:
- Fossil Fuels
- Energy intensity
- Nuclear
- Renewables

Gap Technologies:
- Carbon capture & disposal
  - Adv. fossil
- H₂ and Adv. Transportation
- Biotechnologies
  - Soils, Bioenergy, Adv. Biological Energy

Source: J. Edmonds, PNNL
The Global Climate and Energy Project (GCEP) was established to conduct pre-commercial research necessary to develop the technology options needed to address a low greenhouse gas future.

GCEP is a 10-year, $225M commitment to developing groundbreaking technologies that may have a significant impact on a global scale.
GCEP Strategy

- Focus on potential energy technologies that may be game-changing with respect to greenhouse gas emissions
- Encourage high risk/high reward research
- Seek opportunities across a portfolio of technical areas
- Address questions appropriate to pre-commercial research that may have an impact in the 10-50 year timeframe
- Use the best research talent available
- Make all data, results, and other information generated from the project open and available to all
- Involve institutions from countries with potential high levels of future greenhouse gas emissions
Our goal for this meeting is to discuss how to populate this quadrant.
Workshop Objectives

- Explore the best approaches for encouraging breakthrough research in an academic setting
- Develop options to consider in attracting proposals and stimulating research that may lead to breakthroughs in energy technologies.
Workshop Sessions

Day 1:
- Industrial experience in breakthrough research processes
- Experiences of government programs in encouraging breakthrough research in academia

Day 2:
- Experiences of a diverse selection of university programs in breakthrough research processes
- Group sessions to develop suggestions on how to encourage researchers to propose ideas that are step-out yet aligned with a technical objective
Workshop Questions

• What are the best ways to generate breakthrough research at academic institutions around the world?
• What can we learn from industry and government experience in successfully encouraging "out-of-the-box" thinking in academia?
• What are the processes university programs use to facilitate step-out research?
Thank You!

GCEP Sponsors
- for making GCEP and this workshop possible

Andy Kaldor
- for leading the organization of this meeting

Presenters, Panel Members, and Audience
- for sharing your time, expertise, and opinions with us

GCEP Administrative Staff
- for all the logistics
  - Kersti Miller
  - Nancy Sandoval