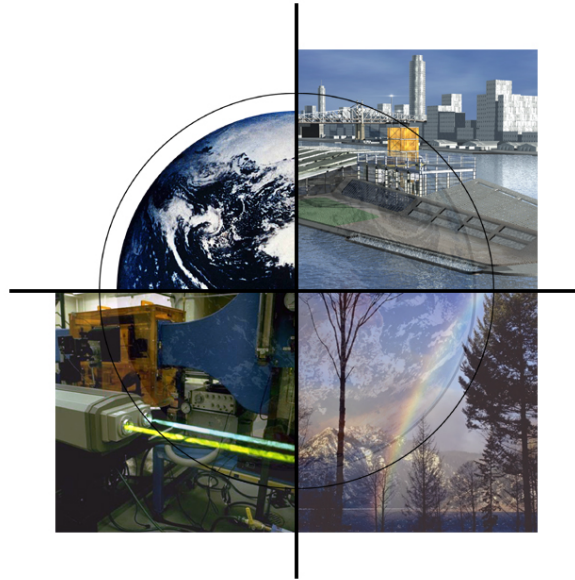


National Energy Technology Laboratory

Overview

Mineral Carbonation Workshop



August 8, 2001

Carl O. Bauer, Associate Laboratory Director



We Are:



- **One of DOE's 15 national laboratories**
- **Government owned and operated**
- **Sites in Oklahoma, Pennsylvania, and West Virginia**
- **Over 1,100 federal and support contractor employees**
- **FY01 budget of \$774 million**



Sites in Pennsylvania, West Virginia, Oklahoma



Pittsburgh, PA



Morgantown, WV

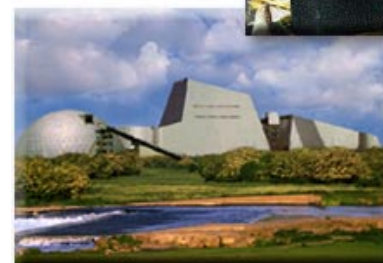


Tulsa, OK



Our Mission

- **Resolve the environmental, supply, and reliability constraints of producing and using fossil resources to provide Americans with a stronger economy, healthier environment, and more secure future**
- **Support development and deployment of environmental technologies that reduce the cost and risk of remediating DOE's weapons complex**
- **Contribute to best business practices and energy policy development**



NETL's Five RD&D Areas

**Electric Power
Using Coal**
Mining to Light Switch



**Energy
Policy Support**
*A Key Issue in Use
of Fossil Energy*



**Strategic Center
for Natural Gas**
Borehole to Burner Tip



Clean Fuels

Oil Supply
NPTO



**Fuels from
Coal and Gas**
*Supply and Delivery of Clean
Fuels for Transportation/
Other End Use
Sectors*



**Environmental
Management/Defense
Programs**
Supporting DOE



Electric Power Using Coal

Mining to Light Switch

Existing Fleet Technologies

- Emission control (NO_x, SO_x, PM_{2.5}, mercury/air toxics)
- Efficiency improvements
- Repowering & retrofiting

Mid-Term Markets

- Improved environmental technology
- Gasification & combustion
- Efficiency improvements
- Repowering & retrofiting
- Clean coal demonstrations (PPII, CCPI)

Vision 21-Future Energy Plants

- Near-zero emissions
- Technology innovation
- Advanced research
- Market flexibility and competitive economics



Carbon Sequestration: An Important Option to Address Climate Change

- Low-cost separation/capture
- Long-term storage

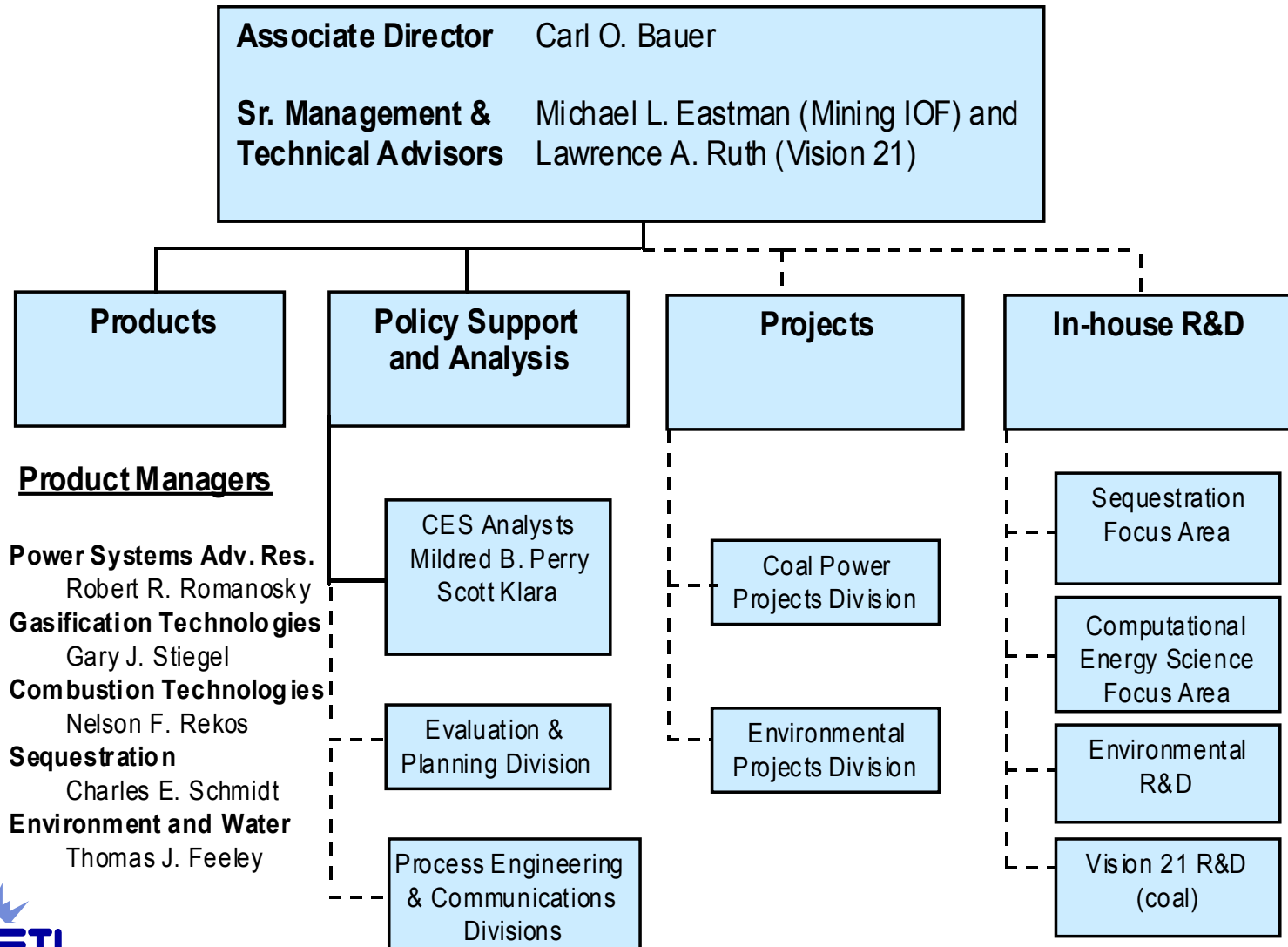
Mining/Water: Addressing Energy Supply Issues

- Mining “Industry of Future”
- Watershed management



Coal and Environmental Systems Program

“A Strategic Center for Coal”



Advanced Research - Power Systems

Ingenuity, innovation and implementation

Mission

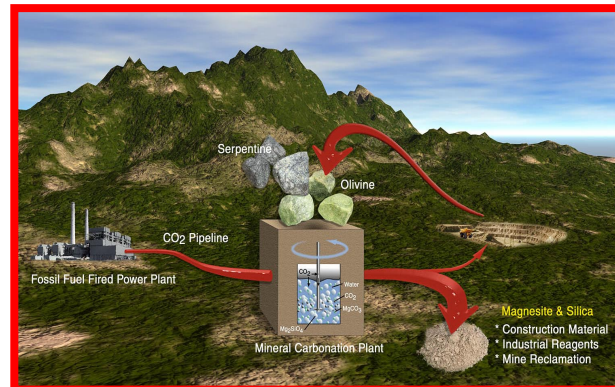
- Extend state of knowledge in fossil energy technology by developing and deploying innovative systems capable of improving efficiency and environmental performance while reducing costs



Advanced materials consortium for ultra- supercritical power plants - NETL/ORNL/EPRI/CURC

Scope

- Create basic information and knowledge to bridge gaps between fundamental science and advanced engineering to overcome technical barriers encountered by Vision 21 and other line R&D programs
- Stimulate advanced research in new directions--explore innovative concepts to enhance pace of fossil energy technology development



Mineral carbonation- Albany Research Center/LANL/NETL/ASU

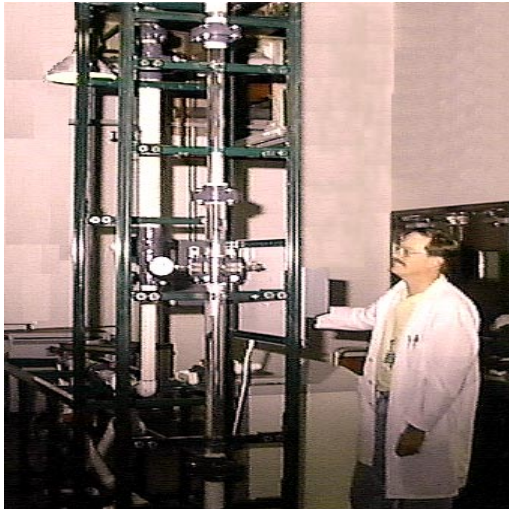


Carbon Sequestration

Technology solutions for a carbon constrained world

Mission

- Continue to use fossil fuels for energy production and address stabilization of atmospheric levels of carbon dioxide



Scope

- Conduct a multifaceted R&D program to develop a robust portfolio of carbon sequestration technologies
- Ensure that sequestering carbon in ocean or geological locations will not result in adverse environmental legacies
- Define role of carbon sequestration in addressing stabilization of atmospheric CO₂

*NETL Low-Pressure Water
Tunnel--ocean sequestration
R&D*



DOE's Sequestration Program

Office of Fossil Energy

- Separation and capture
- Terrestrial ecosystems
- Geologic sequestration
- Ocean sequestration
- Conversion and reuse
- Modeling and assessments

Research coordination

Office of Science

- Geologic sequestration
- Enhanced carbon sequestration in terrestrial ecosystems (CSiTE)
- Ocean carbon sequestration (DOCS)
- Sequencing genomes of microorganisms
- Advanced chemical and biological processes

Applied R&D

Basic Science



Approaches to Sequester Carbon

Capture and Storage



Unmineable
Coal Seams



Deep Ocean
Injection



Depleted Oil /
Gas Wells,
Saline Reservoirs

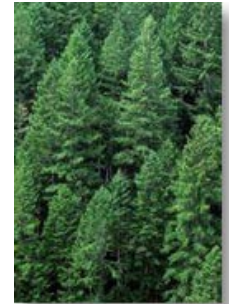


Mineral
Carbonation

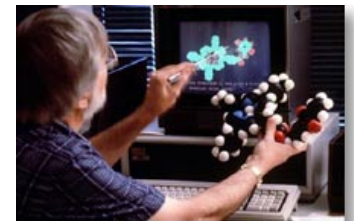


Iron or Nitrogen
Fertilization of
Ocean

Enhance Natural Processes



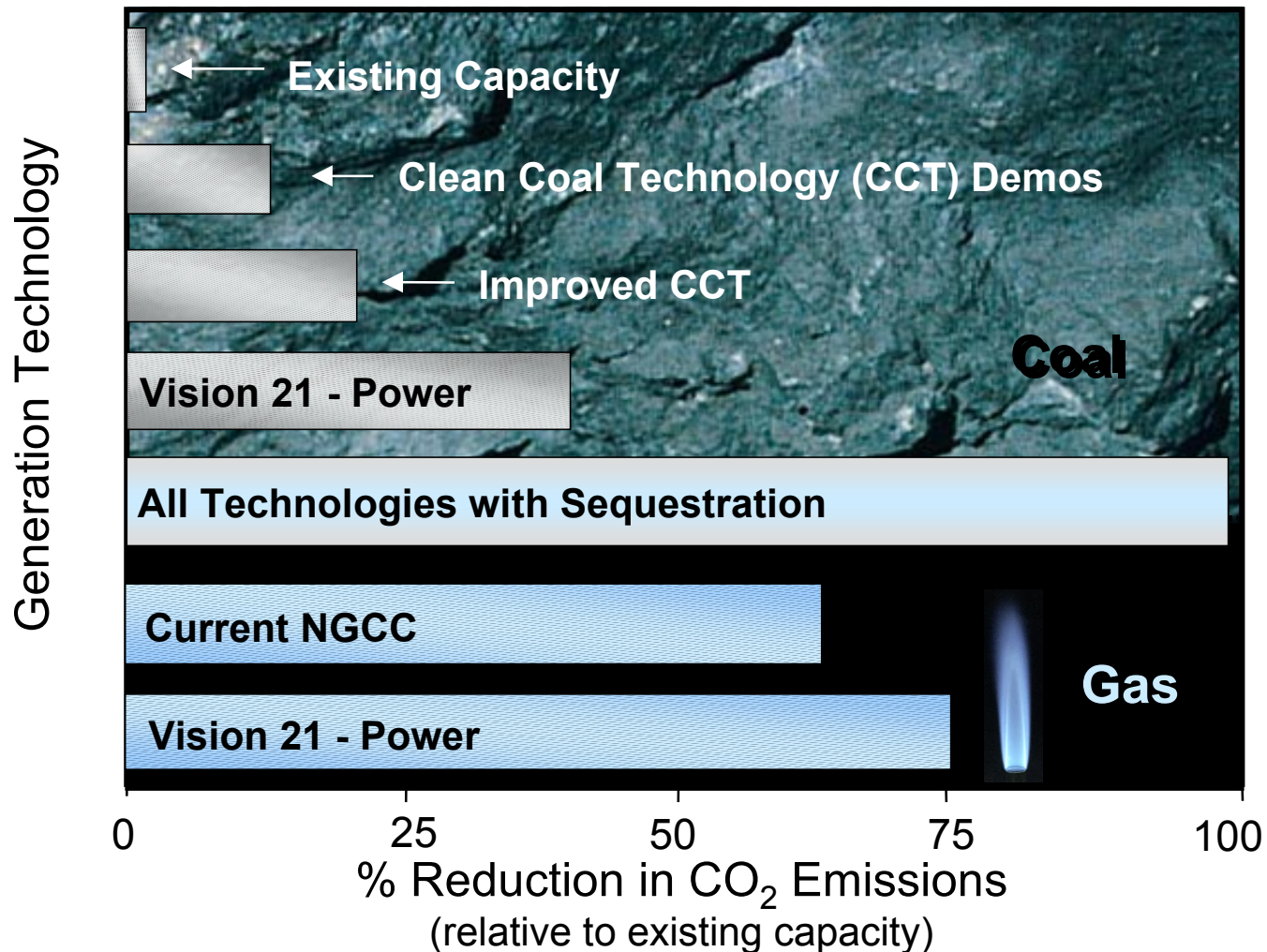
Forestation



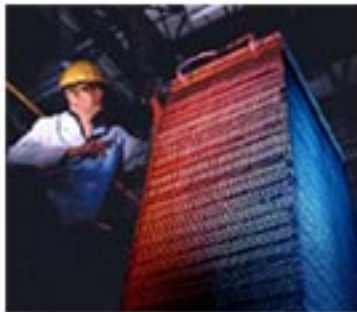
Enhanced
Photosynthesis



Technology Can Reduce CO₂ Emissions From Fossil Energy Power Plants



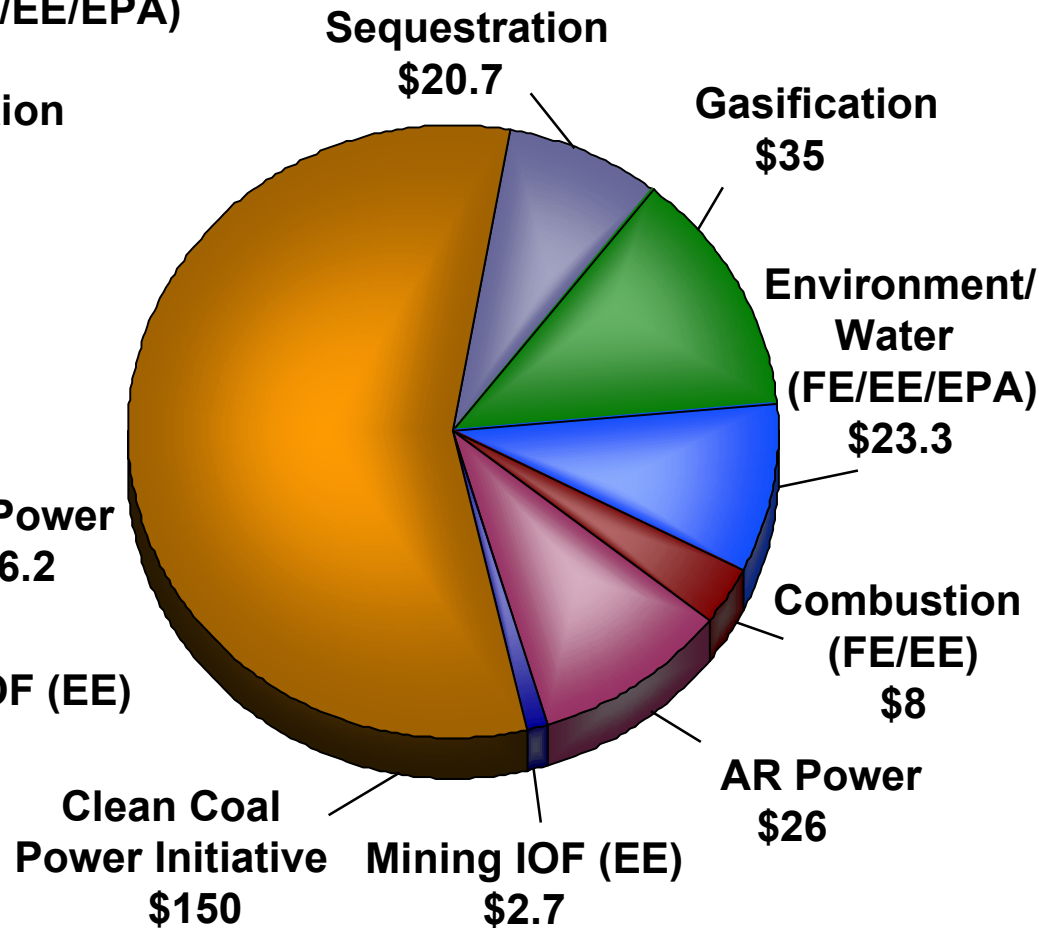
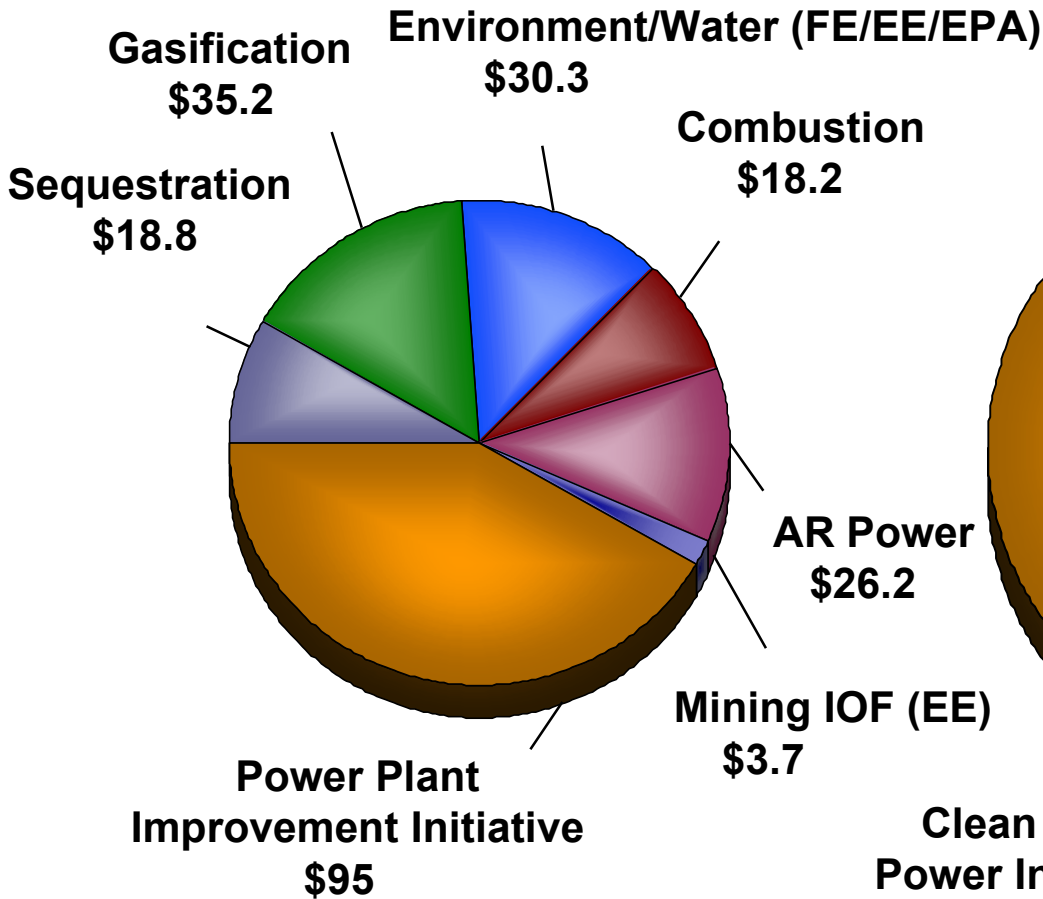
Advanced Technologies Will Play a Crucial Role in Addressing Environmental, Supply, and Reliability Constraints of Producing and Using Fossil Energy



Coal and Environmental Systems* FY 2001/FY 2002 Budget Comparisons

FY 2001 \$227.4M (all sponsors)

FY 2002 \$273M (DOE request)



*excluding CCT

Fossil Energy Mineral Carbonation Program

- **Advanced Power Research Product Manager-
Bob Romanosky, NETL**
- **Sequestration Product Manager-
Chuck Schmidt, NETL**
- **Project Manager- Phil Goldberg, NETL**



Mineral Carbonation Research

Research effort seeks to refine and validate a promising potential CO₂ sequestration technology option, mineral carbonation also known as mineral sequestration



Current Partnerships

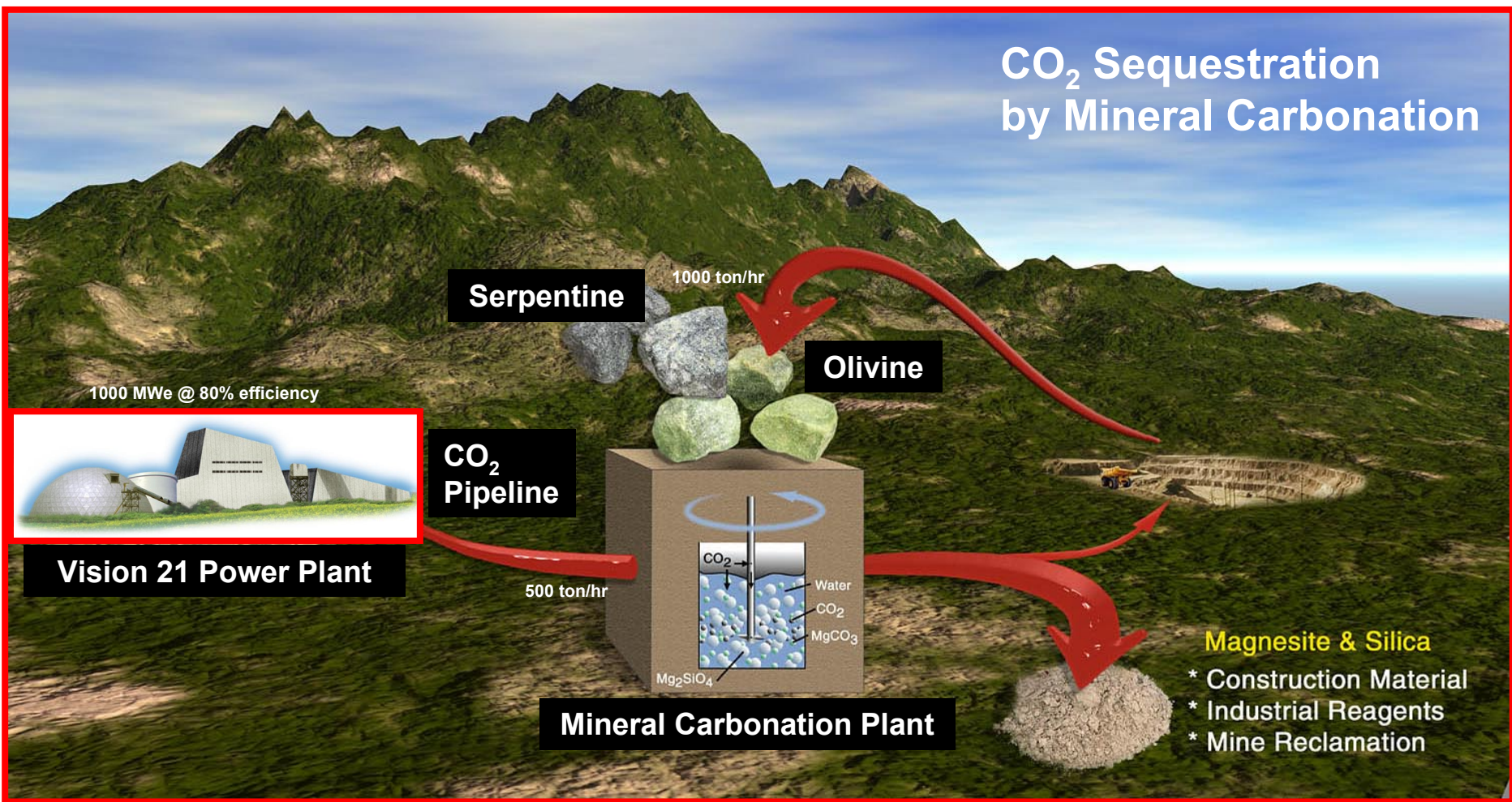
In order to effectively develop Mineral Sequestration, a multi-laboratory Working Group was formed in the Summer of 1998, participants include:

- **Albany Research Center**
- **Arizona State University**
- **Los Alamos National Laboratory**
- **National Energy Technology Laboratory**



Mineral Carbonation Concept

CO₂ Sequestration by Mineral Carbonation



Courtesy of Albany Research Center