

# The Fossil Report

Oak Ridge National Laboratory Fossil Energy Program

July - August 2000

Energy Technology for the Future...and for the World

## Progress Made on FY 2001 Appropriations

With FY 2001 just around the corner, Congress made considerable progress on appropriations for the new fiscal year before departing the Hill for the August recess.

Thus far, the House has drafted and approved appropriations for all the major funding agencies, including the Department of Energy.

The Senate has drafted the appropriations for the Department of Energy, but still lacks drafts on three of the appropriations. Final approval of the Senate appropriations will

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## Report on Carbon Dioxide and Energy Available

[Statoil](#), Norway's state-owned oil and gas company, has produced a CD-ROM entitled *CO<sub>2</sub> and Energy*.

The report provides a short description of the Sleipner Gas Field in the North Sea and a report of carbon dioxide extraction and injection operations at the site.

The CD covers the role of CO<sub>2</sub> in enhanced oil recovery and includes a copy of a climate change simulation model.

A highlight of the CD-ROM is an animation of the Sleipner Project, taking the viewer from production of the natural gas, through the separation of the carbon dioxide, to storage of the CO<sub>2</sub> in a deep saline reservoir.

The CD-ROM may be obtained by contacting [Astrid Fjell](#) at Statoil.

## Climate Change Mitigation Options Reported

The [United Kingdom Royal Commission on Environmental Pollution](#) has just released a report entitled *Energy - The Changing Climate*.

The report examines the causes for climate change and the methods by which a mitigation of those changes can be realized. In addition to a focus on problems faced by the UK, the scope of the report reaches the entire world community.

The Commission examines various scenarios for energy supply and demand in the UK, under the assumption that CO<sub>2</sub> emissions from the burning of fossil fuels would be reduced to 60 percent of current levels by the year 2050.

The [full report](#) may be read and downloaded from the Commission's Web site.

## Fossil Energy Program Annual Report on Web

[The Fossil Energy Program Annual Progress Report](#) is now available on the Fossil Energy Program Web site.

This report covers progress made at Oak Ridge National Laboratory from April 1999 through March 2000 on materials research, environmental activities in support of the DOE Fossil Energy Clean Coal Technology Program, and work on carbon sequestration technologies.

Also included are reports of bioprocessing research, oil and gas production and environmental research, and modeling activities for the Strategic Petroleum Reserve.

*The Fossil Report* is published bimonthly for Oak Ridge National Laboratory Fossil Energy Program staff.

Send comments to:

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Editor and Publisher

**UT Researchers Win National Science Foundation Grant**

*University of Tennessee Public Information*

Two University of Tennessee professors are leading a national team of educators, scientists, and engineers in a \$2.7 million effort to create mathematical models that will predict more accurately how long materials will last, and to develop new, advanced materials with longer lifetimes.

Drs. [Peter Liaw](#) and [Raymond Buchanan](#) won the grant from the National Science Foundation.

Dr Liaw is a current participant on the ORNL Fossil Energy Program, leading a project on fatigue and fracture behavior of Cr-based alloys and intermetallic materials.

Dr. Buchanan is a former participant, whose work involved aqueous corrosion of iron aluminides.

The grant, entitled "Materials Lifetime Science and Engineering," will provide 30 collaborators at eight institutions with support for 13 graduate students and 4 under-



*Dr. Peter Liaw*

graduates per year for five years.

The program is a joint effort involving the University of Tennessee, Lehigh and Rutgers Universities, Oak Ridge National Laboratory, the Engineering Technology Center of Analysis & Technology, Inc., Boeing Company, General Electric Company, and Haynes International, Inc.

The objective of the work is to develop mathematical models that

better predict the lifetimes of existing and advanced materials.

More specifically, the aim is to accurately predict the lifetimes of structural components—including jet engines, turbine components, surgical implant devices, and bridges—which are subjected to cyclic-fatigue loading in corrosive environments.

Both conventional materials, such as aluminum alloys and steels, and advanced materials, such as metal-matrix and ceramic-matrix composites, biomedical materials, superalloys, intermetallics, and nanostructural materials, will be studied.

**Fifteenth Materials Conference Scheduled**

The [Fifteenth Annual Conference on Fossil Energy Materials](#), is scheduled for April 30 - May 3, 2001, at the Hyatt Hotel in Knoxville, Tennessee.

Details—including registration and conference agenda—will be posted on the ORNL [Fossil Energy Program](#) Web Site in the near future.

**Langley Named Manager**

[Lorie Langley](#) has joined the ORNL Fossil Energy Program to lead the Natural Gas Infrastructure, Methane Hydrates, and CO<sub>2</sub> Sequestration Programs.

The Natural Gas Infrastructure Program encompasses gas research and technology development for distribution, transmission, storage, and production of natural gas.

Lorie has successfully positioned ORNL as a laboratory leader for research in the Methane Hydrates Program, which is structured within the Natural Gas Supply Program of DOE Fossil Energy.

Lorie will be ORNL's principal liaison to the newly created [Strategic Center for Natural Gas](#), located within the National Energy Technology Laboratory, and will be the ORNL Program Manager for all activities associated with the Strategic Center for Natural Gas.

The ORNL CO<sub>2</sub> Sequestration Program is one of three new fossil energy initiatives at ORNL—along with methane hydrates and fuel cells.

Lorie joined ORNL in 1995 in the Engineering Technology Division after 10 years in engineering consulting.

She has served for the past two years as Technical Assistant to the Associate Laboratory Director for Energy & Engineering Sciences.

**Revised FWPs May be Needed**

As FY 2001 approaches, it is important to be aware of the possibility that revised field work proposals may be necessary.

Each principal investigator should discuss with the appropriate DOE program manager, well in advance of the start of FY 2001, whether a revised field work proposal is needed.

Questions regarding your specific situation should be directed to [Paul Carlson](#).



*Dr. Raymond Buchanan*

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not occur until September.

The House approved the Interior and Related Agencies appropriations—the prime source of funds for the Fossil Energy Program—on June 14, while the Senate gave its approval on its version of the bill on July 18.

Congress returns to work on September 5, with less than a month to complete the appropriations prior to the start of the new fiscal year. It will be a busy month.

The House and Senate will face significant pressure to raise funding above the levels they have proposed thus far to avoid a Presidential veto. President Clinton has threatened to veto the bills, unless Congress brings funding up to the levels he has requested.

Higher budget surpluses are a major focus of out-year budget projections.

That focus, coupled with the November elections looming on the horizon and the desire to finish work well in advance, may place Congress in a position to grant the President the budget levels he has requested.

With this scenario as a real possibility, FY 2001 is likely to be a very good year for research. The next month of activity in Congress will reveal just how good that year will be.

## Symposium to Address Ordered Intermetallic Alloys

[Joachim Schneibel](#), ORNL Metals & Ceramics Division, is one of the organizers of a [symposium](#) scheduled for the Fall 2000 meeting of the Materials Research Society.

The symposium will cover the whole range of research on high-temperature, ordered intermetallic alloys.

A wide range of materials and crystal structures will be addressed—aluminides, silicides, Laves phases, multiphase alloys, and composites containing intermetallic phases.

The emphasis of the symposium will be structural materials and their responses to different environments.

Functional properties, as they relate to structural capabilities, will also be addressed.

Schneibel is a researcher on the ORNL Fossil Energy Program, working on the development of Mo-Si alloys.

## Important Meetings

[2000 Fuel Cell Seminar](#)  
**October 30 - November 2, 2000**  
**Oregon Convention Center**  
**Portland Oregon**

[Materials Research Society 2000 Fall Meeting](#)  
**November 27 - December 1, 2000**  
**Hynes Convention Center**  
**Boston, Massachusetts**

Nano- and Microstructural-Materials; Semiconductors; Metals; Materials Processing & Analysis; Defects, Mechanics & Length Scales; Device & Functional Materials; Inorganic Materials; Organic & Biomaterials

[First National Conference on Carbon Sequestration](#)  
**May 15-17, 2001**  
**Renaissance Washington DC Hotel**  
 Separation & Capture; Sequestration of CO<sub>2</sub> in Geologic Formations; Enhancing Natural Sinks; Advanced Conversion Concepts; Modeling & Assessments; Emissions Trading & Offsets

## Hydrogen Separation Membranes Focus of New Project

A new activity will soon get underway to develop novel designs for compact hydrogen separation membranes. The work will also model the resultant designs to determine their feasibility for manufacturing.

The work, led by [Tim Armstrong](#), ORNL Fossil Energy Program Manager of Fuel Cells And Functional Materials, will be performed jointly at Oak Ridge National Laboratory and [Eltron Research, Inc.](#)

Designs will be chosen for scale-up, and a prototype device will be fabricated and tested using material supplied by Eltron. Single cells will be tested at both Eltron and ORNL. ORNL will build a pressurized cell to facilitate testing of the membranes developed.

ORNL and Eltron will work together to develop a simple, standard cell design, possibly a small tubular membrane, to use as a standard test cell for all materials developed. The standard design will be used for all process development.

**Carbon Dioxide Sequestration is Big Business in the North Sea**

The North Sea, tempestuous arm of the North Atlantic between the eastern coast of Great Britain and Europe, is one of the most inhospitable parts of the world. Gale-force winds, waves up to sixty feet, and cold. Violent storms blowing toward the south-eastern coastline make navigation particularly hazardous.

It is in this particularly unwelcome environment, however, that some of the world's most promising gas and oil reservoirs have been located. Since the late 1970s, major oil companies have set up massive platforms to harvest from the earth's prodigious storehouse the precious fuels so necessary to our everyday lives.

One such platform, squatting like a giant insect atop a rich field of natural gas, has special significance in this age of awareness of global warming and the need to sequester carbon dioxide.

The platform, operated by [Statoil](#), the state-owned Norwegian gas and oil company, is perched above the Sleipner Gas Field about 130 nautical miles west of Stavanger, Norway. Norway, the world's third largest oil exporting country, also exports large quantities of natural gas to Europe.

What sets Statoil apart is that it has distinguished itself as a leader in ocean sequestration of carbon dioxide.

Gas from the Sleipner field contains 9 percent CO<sub>2</sub>, and that level must be reduced to 2.5 percent before the gas can be sold.

The practice, accepted by the industry, of venting CO<sub>2</sub> to the atmosphere during gas production is clearly out of step with the current awareness of global warming issues.

Additionally, the Norwegian tax on carbon emissions gave Statoil a powerful incentive to develop an effective way to remove and sequester the carbon dioxide contained in the natural gas. The cost for installation of the rig to separate and sequester the car-



*The Sleipner A platform in the North Sea.  
Courtesy of Statoil*

bon dioxide was \$80 million. The carbon tax, were the CO<sub>2</sub> allowed to escape to the atmosphere, would be \$50 million per year.

Statoil has been pumping gas from this vast reservoir since 1993, beginning with the Sleipner A platform. Gas from this field, known as Sleipner East, is pumped through the Statpipe, Europipe, and Zeepipe pipelines to Germany and Belgium.

Production began in the Sleipner West field in 1996 from the Sleipner B platform, which is connected to the Sleipner T gas treatment unit.

It is the Sleipner T unit which is responsible for the sequestration of the carbon dioxide resulting from the gas production operations.

The Sleipner T rig, weighing over 8,000 tons and located between the Sleipner A and Sleipner B platforms,

has two 240-ton absorption columns, each 13 feet in diameter and 66 feet tall. The rig also contains an amine regeneration plant.

The CO<sub>2</sub> produced along with the gas is absorbed by a mixture of amines in the columns and subsequently separated from the amines in the regeneration portion of the rig. The extracted CO<sub>2</sub> is then compressed and injected into an aquifer

3,280 feet below the sea floor.

In this manner, Statoil sequesters 1 million tons of carbon dioxide per year.

If the same amount of carbon dioxide were released to the atmosphere, the carbon dioxide emissions of Norway would increase by 3 percent.



*The Sleipner T and A platforms in the North Sea.  
Courtesy of Statoil*