PROGRAM facts

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

**Fuels and Energy Efficiency**

07/2001

# FUTURE FUELS

## *FY2002 New Activity*


### CONTACT POINTS

**Richard P. Noceti**
Product Manager
National Energy Technology Laboratory
P.O. Box 10940
626 Cochrans Mill Road
Pittsburgh, PA 15236-0940
(412) 386-5955
(412) 386-4822 fax
noceti@netl.doe.gov


### CUSTOMER SERVICE

(800) 553-7681

### WEBSITE

www.netl.doe.gov

The U.S. Department of Energy's (DOE) Office of Fossil Energy (FE) has developed a Clean Liquid Fuels Program whose overall goal is to promote the development and deployment of technologies that will produce clean, high performance fuels from a variety of secure energy resources. The program addresses key technical and policy issues that span the production, processing, delivery, and end-use of these fuels. The Clean Liquid Fuels Program has five major elements: Exploration, Production and Transport of Petroleum Crude; Petroleum Environmental Solutions; Ultra-Clean Fuels; Future Fuels; and Infrastructure Reliability and Product Integrity. The Future Fuels program element (a proposed New Activity for FY2002) is discussed below.

## Background

The U.S. currently imports 56 percent of its petroleum, and imports are projected to increase to over 65 percent by 2020. Domestic oil production continues to decline and crude oil quality continues to deteriorate. Worldwide, conventional petroleum production is expected to peak and then irreversibly decline sometime during this century. The U.S. transportation sector (that accounts for 2/3's of all petroleum use) is responsible for 80 percent of carbon monoxide emissions, one half of the nitrogen oxides, and 40 percent of the volatile organic compounds (VOC) emitted into our air. Further, transportation is responsible for one third of total manmade carbon dioxide [a greenhouse gas] emissions. It is inevitable that a sustainable energy supply will eventually be necessary with the transition extremely complicated. Technology developed under the proposed Future Fuels activity will enable our Nation to more capably make this transition.

A hydrogen economy will eventually emerge as applicable technologies are developed, perfected and deployed. It is not yet clear how the transition to a hydrogen economy will be achieved, but the issue of what infrastructure changes will be necessary and how to manage these changes must be addressed. A transportation fleet based on fuel cells and running on reformable fuels may be the path leading to the widespread distribution of gaseous hydrogen as the fuel of choice. However, such an interim solution may not be viable and other more direct methods of hydrogen distribution and utilization may prove preferable. The issues surrounding the transformation of our domestic transportation sector from one based on liquid fuels from petroleum, to one based on hydrogen (most likely at first from a diverse mix of fossil resources) are the subject of this Future Fuels technology development initiative.

# Future Fuels

*FY2002 New Activity*

## Benefits

This Future Fuels initiative will promote the development and deployment of a series of fuels to power future transportation and other clean fuel systems. These fuels will:

- facilitate the smooth transition from carbon based transportation fuels to a sustainable hydrogen economy with incremental development of the necessary production, delivery, and end-use infrastructure;
- be produced from fossil resources in the mid-term and from renewable, sustainable sources in the long-term;
- continue to reduce pollutants and greenhouse gas emissions from fossil fuel use until a zero emission goal is attained;
- significantly reduce the Nation's dependence on imported oil; and
- maintain the leadership and competitive position of the U.S. energy industry and foster the development of spin-off technologies applicable to other energy use sectors.

## Description

The Future Fuels element of the Clean Liquid Fuels Program consists of R&D components, supporting science, and plans for a hydrogen demonstration program. Cooperation exists between this Fossil Energy program element and those programs within Energy Efficiency and Renewable Energy (EERE) that deal with hydrogen energy. Anticipated technology development activities will include:

- Development of hydrocarbon and oxygenated fuels suitable for onboard reforming to hydrogen. These fuels may be compatible with the existing storage and transportation infrastructure and could be used in internal combustion engines as the transportation fleet transitions from internal combustion to hybrid to fuel cell power.
- Investigation of methods for production, storage and membrane purification of hydrogen from fossil feedstocks using configurations that concentrate carbon dioxide produced for subsequent sequestration. Of particular note is a unique NETL hydrogen membrane test facility (part of the NETL's Ultra-Clean Fuels Focus Area) that allows separations to be conducted at high temperature and pressure.

In the longer-term, storage of elemental hydrogen at high energy densities will become important. In addition to compressed gas and liquid storage, other storage methods including advanced hydrides and carbon nanotubes will be investigated.

Closely linked to the above are parallel developments in advanced materials, bioprocessing, fuel cells, turbines, and carbon sequestration. Lightweight carbon materials for use as structural components and in low rolling resistance tires will be investigated, as well as high-temperature, hydrogen-resistant alloys, biological production of fuels and new developments in turbine-fuel cell power systems.