

Fuels

Funding Schedule by Activity

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	\$ Change	% Change
Fuels					
Transportation Fuels and Chemicals.....	21,432	21,927	16,000	-5,917	-27.0%
Solid Fuels and Feedstocks.....	5,808	5,986	0	-5,986	-100.0%
Advanced Fuels Research.....	3,193	3,308	0	-3,308	-100.0%
.....					
Total, Fuels	30,433	31,221	16,000	-15,221	-48.8%

Description

The mission of the Fuels program is to create public benefits by conducting the research necessary to promote the transition to a hydrogen economy. Research will target reducing costs and increasing efficiency of derived hydrogen from coal feedstocks as part of the President's Hydrogen Fuel Initiative.

Benefits

Coal has the potential to be an affordable resource that can produce the large amounts of hydrogen needed in the mid-term for the Nation to begin the transition to a hydrogen economy. Hydrogen produced from Coal and used in advanced technologies, especially in efficient fuel cell vehicles (FCVs), will improve energy security by reducing the United States' oil imports by over 3 million barrels per day for every 100 million FCVs or nearly half of the U.S. fleet. Even without sequestration, production and use of coal-derived hydrogen in 100 million FCVs is estimated to also reduce carbon dioxide, a greenhouse gas (GHG), by 278 million tons per year, a reduction of 24 percent of the carbon dioxide emissions associated with the current U.S. light-duty vehicle fleet. Nitrogen oxide (NO_x) emissions will be reduced by about 100,000 tons per year, while sulfur oxides (SO_x) and particulate matter emissions would be reduced by 43 thousand tons and 40 thousand tons, respectively. When hydrogen production from fossil fuels is combined with carbon sequestration, carbon dioxide emissions will be reduced by over 530 million tons per year for each 100 million FCVs, a reduction of 45 percent for the current U.S. light-duty vehicle fleet. Also, a 250-year supply of coal to produce hydrogen ensures that there will be a clean and affordable alternative to imported oil.

Background

Currently, the United States imports approximately 11 million barrels per day of petroleum crude and finished products (55% of consumption). By 2025 imports are projected to rise to 19.8 million barrels per day of crude and refined products (68% of consumption). Coal-derived hydrogen can be an important part of a strategy to diversify and expand our domestic fuel resource base, reduce emissions from the transportation sector, and help limit our reliance on imported oil.

In addition to energy security issues, major challenges facing transportation are urban and regional air pollution and emissions of greenhouse gases. EIA 2000 data indicates that of man-made emissions, the U.S. transportation sector is responsible for nearly 80 percent of the carbon monoxide (CO), over one half of the nitrogen oxides (NO_x), and 40 percent of the volatile organic compounds (VOC). Vehicles are responsible for about 35% of the U.S. energy sector's carbon dioxide production. As the Nation transitions toward advanced engine platforms, ultra-low emission vehicles and eventually to near-zero emission vehicles, such as the Administration's fuel cell-powered "FreedomCAR", the demand for hydrogen will increase dramatically. The Administration's Hydrogen Fuel Initiative is a coordinated effort among the Department's Offices (EERE, FE, NE, Science) to provide the technology for the private sector to meet the anticipated hydrogen demand and the infrastructure needed to provide the hydrogen to the end-user. Our large domestic resources of coal can provide high volume, low-cost, hydrogen for fuel cells in the longer term.

Research will address the development of technologies to produce, distribute and store hydrogen as an affordable, safe fuel for consumers. Specifically, this research activity will encompass a technology envelope that begins with the separation of hydrogen from mixed gas streams and conclude with the interface of the hydrogen with fuel cells and other end-use systems. In FY 2004, research will target the development of technologies (1) capable of economically producing large quantities of pure hydrogen from coal-derived synthesis gas, (2) capable of safely and economically storing, distributing and handling hydrogen derived from coal gasification processes for end-use in the utility, transportation, commercial, industrial and residential markets, and (3) that will enable hydrogen from coal feedstocks to play a major role in the transition to sustainable hydrogen based energy systems.

Centralized production of hydrogen from coal feedstocks will produce a concentrated stream of carbon dioxide which will facilitate its economic capture and sequestration. There are two routes to supplying hydrogen from these advanced coal gasification facilities. A portion of the hydrogen can be separated from the mixed gas stream (i.e. synthesis gas) which is produced during the gasification process and then stored for distribution. The other alternative is to produce, via synthesis gas conversion processes, zero-sulfur, high hydrogen content coal-derived fuels that can be moved through the present distribution system, then reformed at facilities in close proximity to the customer or directly on-board the vehicle.

Detailed Justification

(dollars in thousands)

FY 2003	FY 2004	FY 2005
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Transportation Fuels and Chemicals **21,432** **21,927** **16,000**

This program conducts laboratory and process research to develop advanced technology for producing ultra clean fuels and hydrogen from coal by use of gasification technology possibly with coproduction of electricity and other products.

• **Reactor/Process Development** **2,400** **1,491** **0**

No funding is requested for this activity in FY 2005.

(dollars in thousands)

FY 2003	FY 2004	FY 2005
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FY 2003 and FY 2004 funding will be used to continue the coproduction feasibility studies to establish optimal marketable products and plant configurations for specific facilities for production of clean synthesis gas derived liquid fuels, clean electric power and heat based on coal gasification.

- **Syngas Membrane Technology** **6,310** **6,552** **0**

In FY 2005 no funds are requested for this activity.

FY 2003 and FY 2004 funding continued exploratory research activities of novel conversion concepts of promising chemical and small-scale physical conversion technology innovations. Continued research and development of a novel syngas ceramic membrane technology to enhance Fischer-Tropsch (F-T) gas conversion for environmentally superior liquid fuels and hydrogen. Conducted fundamental supporting fuels research at NETL. *Participants included: APCI, NETL, LANL, Univ. Of Alaska, Canmet, Praxair.*

- **Ultra Clean Fuels**..... **10,222** **8,786** **0**

In FY 2005 no funds are requested.

FY 2003 and FY 2004 funding continued cost-shared industrial research for the development of ultra-clean fuels technology for fossil resources (natural gas, petroleum, coal). Projects will continue to develop advanced technology for the production of natural gas derived synthesis gas and ultra-clean fuels. Funding will also be provided for the completion of a novel, molten metal reactor for production of hydrogen with a concentrated stream of carbon dioxide for capture from coal-based feedstock.

- **Hydrogen from Coal Research**..... **2,280** **4,879** **15,840**

In FY 2005, perform research for the development of novel technology for: 1) separating hydrogen from mixed gas streams (continuation) including polishing technology to remove remaining impurities prior to utilization (new); 2) producing high hydrogen content coal-derived liquids for subsequent reforming on-board vehicles and/or at distributed generation facilities (continuation); 3) storing and delivering hydrogen/liquid hydrogen carriers (continuation); 4) utilizing hydrogen in non-fuel cell powered applications (new); 5) small-scale hydrogen production systems with CO₂ capture/sequestration capability (new), and utilize NETL's computation science expertise to provide 6) the technical foundation upon which to facilitate the development of advanced system components associated with the production, delivery, storage and utilization of hydrogen from coal (continuation and expansion)

In FY 2004, initiate hydrogen from coal initiative by competitive procurement. Identify appropriate organizations to (1) establish the feasibility of emerging alternate coal-based hydrogen technologies, (2) investigate advanced separation technologies, and (3) utilize a combination of experimental and advanced computational methods to determine optimal reaction chemistries for producing hydrogen from coal-derived fuels. *Participants include: NETL, TBD.*

(dollars in thousands)

FY 2003	FY 2004	FY 2005
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FY 2003, continue funding to test advanced hydrogen separation membranes and evaluate carbon fibers for high density hydrogen storage; and initiate five new projects to separate hydrogen from mixed gas streams and produce hydrogen from coal-derived methanol via an advanced reforming process. *Participants include: NETL TBD.*

• **Program Support**..... **220** **219** **160**

Fund technical and program management support.

Solid Fuels and Feedstocks..... **5,808** **5,986** **0**

Research provided advanced technologies to produce clean high value carbon products from coal such as high purity carbon electrodes and specialty graphite. Composite fuels comprised of coal and waste biomass for greenhouse gas reduction and separation technology for producing additional clean coal from wastes.

• **Premium Carbon Products**..... **1,027** **987** **0**

No funding requested in FY 2005.

FY 2003 and FY 2004 funding is to continue development of novel processes to produce high value graphics, activated carbon, carbon fibers for high strength materials, carbon foams for military applications and carbon electrodes for batteries and fuel cells. *Participants include: Penn State, NETL.*

• **Advanced Separation** **2,881** **2,964** **0**

No funding requested in FY 2005.

FY 2003 and FY 2004 funding is to continue developing processes for reclamation of coal fines to monetize coal from waste coal sites and mitigate potential environmental issues associated with these sites; and to develop solid-liquid coal separation processes that have crosscutting applicability the mineral industry. *Participants include: Virginia Tech, WVU.*

• **Coal-derived Jet Fuels**..... **1,840** **1,975** **0**

No funding requested in FY 2005.

FY 2003 and FY 2004 funding is to initiate research and development to determine the technical requirements and cost implications of integrating the coal-derived jet fuel production and by-product processes into refinery operations.

• **Program Support**..... **60** **60** **0**

Fund technical and program management support.

Advanced Fuels Research..... **3,193** **3,308** **0**

(dollars in thousands)

FY 2003	FY 2004	FY 2005
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Provide the scientific underpinning for the development of advanced ultra clean liquid fuels and hydrogen technology from coal.

- **Advanced Research** **3,160** **3,275** **0**

No funding is requested for this activity in FY 2005.

FY 2003 and FY 2004 funding is to provide supporting science that will facilitate the development of high-efficiency, affordable processes for converting coal to high value fuels, including hydrogen and hydrogen precursors; and to develop a coal extraction process that provides precursor chemicals suitable for production of premium coal-derived materials.

- **Program Support**..... **33** **33** **0**

Fund technical and program management support.

Total, Fuels	30,433	31,221	16,000
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Explanation of Funding Changes

FY 2005 vs. FY 2004 (\$000)

Transportation Fuels and Chemicals

- Complete synthesis gas membrane activities to develop novel ceramic membrane reactors for producing synthesis gas and hydrogen production -6,552
- Complete reactor/process development and ultra-clean fuels activities for production of clean low sulfur liquid fuels -10,277
- Continue Hydrogen from Coal Research to developed improved, novel technology for the production of hydrogen and its separation, delivery, storage and utilization at lower cost including the initiation of studies for advanced concepts for simultaneous separation of carbon dioxide, H₂S and other trace components from hydrogen +10,961
- Program Support..... -59

Total, Transportation Fuels and Chemicals	-5,927
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FY 2005 vs. FY 2004 (\$000)

Solid Fuels and Feedstocks

• Complete premium carbon, advanced mining separation and jet fuel activities.....	-5,926
• Program Support.....	-60
Total, Solid Fuels and Feedstocks	-5,986

Advanced Fuels Research

• Complete advanced research activities for C1 conversion for producing clean liquid fuels and reformable fuels and coal extraction to produce high value products	-3,275
• Program Support.....	-33
Total, Advanced Fuels Research	-3,308

Total Funding Change, Fuels	-15,221
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