

DOE/EIS-0357D-S1

**SUPPLEMENT TO THE DRAFT
ENVIRONMENTAL IMPACT STATEMENT
FOR THE
GILBERTON COAL-TO-CLEAN FUELS
AND POWER PROJECT**

GILBERTON, PENNSYLVANIA



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U.S. DEPARTMENT OF ENERGY

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RESPONSIBLE AGENCY

U.S. Department of Energy (DOE)

TITLE

Supplement to the Draft Environmental Impact Statement for the Gilberton Coal-to-Clean Fuels and Power Project (DOE/EIS-0357D-S1)

LOCATION

Gilberton, Pennsylvania

CONTACTS

Additional copies or information concerning this Supplement to the Draft Environmental Impact Statement (EIS) can be obtained from Ms. Janice L. Bell, National Environmental Policy Act (NEPA) Document Manager, U.S. Department of Energy, National Energy Technology Laboratory, 626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, PA 15236-0940. Telephone: 412-386-4512. E-mail: janice.bell@netl.doe.gov.

This Supplement to the Draft EIS (DOE/EIS-0357D-S1) is available on the Internet via the DOE National Environmental Policy Act (NEPA) web site at <http://www.eh.doe.gov/nepa>, or via the National Energy Technology Laboratory web site at <http://www.netl.doe.gov>. In addition, the Supplement and the Draft EIS (DOE/EIS-0357) can be obtained from Ms. Janice Bell at the above address. In addition, this Supplement to the Draft EIS has been distributed to persons who received a copy of the Draft EIS and to those who have expressed an interest since its publication.

For general information on DOE's NEPA process, contact Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (GC-20), U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585-0103. Telephone: 202-586-4600, or leave a toll-free message at 1-800-472-2756.

ABSTRACT

The DOE has prepared this Supplement to the Draft EIS to correct information regarding carbon dioxide (CO₂) emissions from the proposed Gilberton plant, to provide information on the feasibility of carbon sequestration of the CO₂ emissions from the Gilberton plant, and to present additional information regarding CO₂-related cumulative impacts associated with potential future deployment of the proposed technology.

The Draft EIS for the Gilberton Coal-to-Clean Fuels and Power Project (DOE/EIS-0357), issued in December 2005, assesses the potential environmental impacts that would result from a proposed DOE action to provide cost-shared funding for construction and operation of facilities near Gilberton, Pennsylvania, which have been proposed by WMPI PTY, LLC, for producing electricity, steam, and liquid fuels from anthracite coal waste (culm). The proposed project was selected by DOE for further consideration under the Clean Coal Power Initiative (CCPI) to demonstrate the integration of coal waste gasification and Fischer-Tropsch (F-T) synthesis of liquid hydrocarbon fuels at commercial scale. The Draft EIS evaluates potential impacts of the proposed facilities on land use, aesthetics, air quality, geology, water resources, floodplains, wetlands, ecological resources, socioeconomic resources, waste management, human health, and noise. The Draft EIS also evaluates potential impacts on these resource areas for a scenario resulting from the no-action alternative (DOE would not provide cost-shared funding) in which the proposed facilities would not be built or operated.

DOE received comments from the Natural Resources Defense Council (NRDC) regarding how the Draft EIS addressed carbon dioxide (CO₂) emissions from the proposed project in letters dated February 7, 2006, June 2, 2006, June 5, 2006, and August 9, 2006 (see Attachment). In addition, DOE staff met with NRDC representatives on June 27, 2006, to ensure that the Department understood the comments. The comments expressed concern about the potential impacts on global warming and questioned the accuracy of the annual rate of CO₂ emission reporting in the Draft EIS. These comments also requested DOE to enhance the analysis of potential CO₂-related cumulative impacts, to further explore the feasibility of CO₂ sequestration, and to provide a public comment opportunity on the revised sections of the EIS. Comments on CO₂ emissions and carbon sequestration were also received from the following organizations and members of the public: the Coalition of Concerned Coal Region Citizens; the Mid-Atlantic Environmental Law Center; the Citizens for Pennsylvania's Future (Penn's Future); Mike Ewall; Edward and Helen Sluzis; and James Kotcon (see Attachment). These comments were similar in nature to those received from the NRDC, and therefore, are addressed as described below.

In considering these comments, DOE found that the annual rate of CO₂ emissions reported in the Draft EIS included only the total quantity of CO₂ that would be emitted directly from the proposed facilities. The reported quantity did not include a larger quantity of CO₂ in a concentrated stream exiting the Rectisol unit that would also be emitted. It was previously anticipated that this stream would be sold; however, the industrial participant has informed DOE that the commercial sale of the CO₂ would not occur in the foreseeable future, and therefore, all of the CO₂ would be emitted to the atmosphere. In response to comments, DOE has revised the document to clarify the total CO₂ emissions rate. In addition, DOE has enhanced the discussion of cumulative impacts and the discussion of the feasibility of carbon sequestration.

To further the purposes of NEPA, DOE is issuing for public comment these revised pages of the EIS that address CO₂. Please note that this Supplement to the Draft EIS contains only those sections/pages affected by comments related to CO₂ emissions and associated issues, including carbon sequestration. DOE is requesting comments only on these sections. ***All changes to the text contained in the Draft DOE/EIS-0357 are shown in boldface italics font (as is this sentence).***

PUBLIC COMMENTS

DOE encourages public participation in the NEPA process and invites the public to comment on this Supplement to the Draft EIS during a 45-day comment period ending February 27, 2007. DOE will consider late comments to the extent practicable. Comments may be submitted in writing to Ms. Janice L. Bell at the above address. Comments may also be submitted by fax to: (412) 386-4806; electronically to: jbelle@netl.doe.gov; or via a toll-free telephone number: 1-866-576-8240. DOE will consider comments on this Supplement to the Draft EIS in preparing the Final EIS, together with comments on the Draft EIS. Commenters do not need to resubmit their earlier comments.

REVISIONS TO CO₂-RELATED DISCUSSIONS IN DRAFT DOE/EIS-0357

Pursuant to 10 CFR 1021.314, this Supplement to the Draft Environmental Impact Statement (DOE/EIS-0357) for the Gilberton Coal-to-Clean Fuels and Power Project was prepared in response to comments received concerning carbon dioxide (CO₂) emission totals and the potential of the proposed action to capture and sequester CO₂ emissions. The primary focus of the comments was the total amount of CO₂ emissions that would be generated by the integrated facility. In response to comments, DOE has determined that the concentrated CO₂ stream exiting the gas cleanup system had not been included in the CO₂ emission total. This Supplement presents the sections of the Draft EIS that were modified to revise the CO₂ emission total and other sections of the Draft EIS related to CO₂ emissions and carbon sequestration, including sections that consider the impacts of commercial operation and cumulative impacts. It should be noted that this Supplement contains only those sections/pages affected by comments related to CO₂ emissions and sequestration. The U.S. Department of Energy is requesting comments only on these sections. *All changes to the text contained in the Draft DOE/EIS-0357 are shown in boldface italics font (as is this sentence).*

From the **Summary**

Carbon dioxide emissions to the atmosphere resulting from the operation of the proposed facilities would include CO₂ emitted by facility operations (832,000 tons per year) and concentrated CO₂ exiting the gas cleanup system (1,450,000 tons per year). While it was previously anticipated that the concentrated CO₂ stream would be sold as a byproduct, the industrial participant has informed DOE that the commercial sale of the CO₂ would not occur in the foreseeable future. Therefore, all of the CO₂ would be emitted to the atmosphere. In combination, these sources would increase global CO₂ emissions by about 2,282,000 tons per year, adding to global emissions of CO₂ resulting from fossil fuel combustion, which are estimated to have been 26,000,000,000 tons in the year 1999 (IPCC 2001).

From **Section 2 The Proposed Action and Alternatives**

2.1 Proposed Action

2.1.6 Outputs, Discharges, and Wastes

2.1.6.1 Air Emissions

Based on a plant operating rate of 7,500 hours per year (an 85% capacity factor), air emissions from the proposed facilities would total less than 100 tons per year for each of the criteria pollutants. SO₂ emissions would be about 29 tons per year, NO_x emissions would be about 70 tons per year, particulate emissions would be about 23 tons per year, and CO emissions would be about 54 tons per year. VOC emissions would be about 28 tons per year (see footnote b of Table 2.1.1 for potential-to-emit annual emissions included in the air permit application submitted to the Pennsylvania Department of Environmental Protection). Trace emissions of other pollutants would include

mercury, beryllium, sulfuric acid mist, hydrochloric acid, hydrofluoric acid, benzene, arsenic, and various heavy metals, which are not yet quantified but for which an air quality permit has been issued by the Pennsylvania Department of Environmental Protection with annual limits to ensure that the proposed facilities would be a minor new source of the pollutants (Section 4.1.2.2). *The proposed facilities would also produce about 2,282,000 tons per year of CO₂. Although CO₂ is not regulated as an air pollutant, it is a greenhouse gas that is generally regarded by a large body of scientific experts as contributing to global warming and climate change (IPCC 2001).*

From Section 4 Environmental Consequences

4.1 Proposed Action

4.1.2 Atmospheric Resources and Air Quality

4.1.2.2 Operation

Global Climate Change

A worldwide environmental issue is the possibility of changes in the global climate (e.g., global warming) as a consequence of increasing atmospheric concentrations of greenhouse gases.

International scientific consensus has indicated that the earth's climate is changing and that human activity is a factor (IPCC 2001). The atmosphere allows a large percentage of incoming solar radiation to pass through to the earth's surface and be converted to heat energy (infrared radiation) that does not pass back through the atmosphere as easily as the solar radiation passes in. The result is that heat energy is "trapped" near the earth's surface.

Greenhouse gases include water vapor, CO₂, methane, nitrous oxide, O₃, and several chlorofluorocarbons. The greenhouse gases constitute a small percentage of the earth's atmosphere; however, their collective effect is to keep the temperature of the earth's surface about 60°F warmer, on average, than it would be if no atmosphere existed. Water vapor, a natural component of the atmosphere, is the most abundant greenhouse gas. The second-most abundant greenhouse gas is CO₂. *It has been estimated that CO₂ concentrations in the atmosphere have increased by 31% since 1750 (IPCC 2001) and by 19% from 1959 to 2003 (Keeling and Whorf 2005).* Fossil fuel burning is the primary contributor to increasing concentrations of CO₂ (IPCC 2001). The increasing CO₂ concentrations *likely* have contributed to a corresponding increase in *temperature in the lower atmosphere*. The globally averaged temperature in the lower atmosphere *has increased by about 1 to 1.4 °F in the last hundred years (IPCC 2001)*. Because CO₂ is *relatively* stable in the atmosphere and essentially uniformly mixed throughout the troposphere and stratosphere, the climatic impact of CO₂ emissions does not depend on *where the emissions occur*.

Carbon dioxide emissions resulting from the operation of the proposed facilities would add about 2,282,000 tons per year to global CO₂ emissions, thus adding to global emissions of CO₂ resulting from fossil fuel combustion, which are estimated to have been 26,000,000,000 tons in the

year 1999 (IPCC 2001). A more recent study estimated global emissions of CO₂ from fossil fuel combustion to be 28,320,940,000 tons in the year 2003 (Marland et al. 2006). The total emissions from WMPI would include CO₂ emitted directly to the atmosphere by facility operations (832,000 tons per year) plus the concentrated CO₂ stream separated in the gas cleanup system (1,450,000 tons per year; Radizwon 2006), which would be emitted at the site. Section 5.1.4 discusses the possible feasibility of CO₂ sequestration during the 50-year life of the plant.

From **4.2 POLLUTION PREVENTION AND MITIGATION MEASURES**

Pollution prevention and mitigation measures have been incorporated by WMPI as part of the design of the proposed project. The proposed facilities' use of anthracite culm as feedstock would allow reclamation of land currently stockpiled with culm and would provide a beneficial use for *this waste* material. Also, the quality of water returned to the mine pool following use by the proposed facilities would be improved. WMPI plans to sell the coarse slag and elemental sulfur as byproducts to offsite customers. In addition, mitigation measures have been developed to minimize potential environmental impacts. Table 4.2.1 lists the pollution prevention and mitigation measures that WMPI would provide during the construction and operation of the proposed facilities.

Additional mitigation measures have been considered for the concentrated stream of CO₂ exiting the Rectisol unit. The measures considered include the sale of the concentrated CO₂ stream and geologic sequestration of this stream. However, it has been determined that these options would not be feasible during the project demonstration phase. The industrial participant has informed DOE that sale of the CO₂ byproduct would not occur in the foreseeable future. In addition, DOE has considered the potential to reduce project CO₂ emissions using geologic sequestration. This is not a reasonable option because sequestration technology is not sufficiently mature to be implemented at production scale during the demonstration period for the proposed facilities. The future potential for geologic sequestration of CO₂ during commercial operation of the proposed facilities is discussed in Section 5.1.4.

From **Section 5 IMPACTS OF COMMERCIAL OPERATION**{tc "5. IMPACTS OF COMMERCIAL OPERATION"}

Following completion of the 3-year demonstration, three scenarios would be reasonably foreseeable: (1) a successful demonstration followed immediately by commercial operation of the facilities at approximately the same production level; (2) an unsuccessful demonstration followed by conversion of the facilities to an integrated gasification combined-cycle power plant; and (3) an unsuccessful demonstration followed by dismantlement of the facilities. *The following sections discuss the potential environmental consequences of these three scenarios. For the first two scenarios, the expected operating life of the facilities is assumed to be 50 years.*

From 5.1 COMMERCIAL OPERATION FOLLOWS DEMONSTRATION

Under the first scenario, the level of *most* short-term impacts during commercial operation would not change from those described for the demonstration (Section 4) because the proposed facilities would continue operating 24 hours-per-day with the same operating characteristics. *There could be differences, however, for impacts that accumulate with time (e.g., resource consumption, solid waste disposal, and buildup of greenhouse gases in the atmosphere). Also, changes in the environmental setting and other changes external to the facilities could result in changes in project impacts.*

From 5.1.4 Carbon Dioxide (CO₂) Emissions

Over the 50-year duration of commercial operation, the facilities could release a total of about 114,000,000 tons of CO₂ to the global atmosphere, consisting of about 42,000,000 tons of CO₂ emissions from facility operations and 72,000,000 tons of CO₂ recovered in the Rectisol unit. In the long term (following the demonstration phase), the industrial participant may negotiate the sale of the concentrated CO₂ stream for use in other types of industrial or commercial operations. In addition, during the 50-year period it might become feasible to reduce the project's contribution to global climate change by sequestering some of the recovered CO₂ (1,450,000 tons/yr) underground.

Underground storage, or geologic sequestration, of CO₂ is a promising technology¹ being actively investigated and tested nationally and internationally by DOE and other organizations (Davison et al. 2001, IPCC 2005). Most of the research projects being conducted are at a pilot or smaller scale. Large-scale commercial deployment of the most promising carbon sequestration technologies is expected to be technically practicable within the next 15 years (CO₂ Capture and Storage Working Group 2002). During the 50-year duration of commercial operation, a combination of economic incentives and new legal requirements might result in the industrial participant investigating the option to sequester CO₂ recovered from the proposed facilities.

The feasibility of any potential sequestration technology requires the availability of a suitable geologic setting. Based on geologic factors, there are two theoretically possible scenarios for future geologic sequestration of CO₂ from the proposed facilities: (1) sequestration at a regional sequestration site and (2) sequestration in the Schuylkill County area.

In the first scenario, regional sequestration could occur in Western Pennsylvania, where the Midwest Regional Carbon Sequestration Partnership has identified a potential for geologic sequestration of 76 gigatonnes (83 billion tons) of CO₂ in saline formations, depleted oil and gas

¹ *Potential geologic sequestration technologies include injection into depleted oil and gas fields (to enhance recovery of residual hydrocarbons in addition to trapping CO₂); injection into deep saline formations (in which CO₂ is trapped physically and also reacts chemically with dissolved substances in ground water, precipitating to form solid compounds that remain in the formation); and injection into unmineable coal seams (in which adsorption of CO₂ onto the coal displaces trapped methane, which can be extracted for sale as natural gas).*

fields, and coal seams (Battelle 2005). The region's sequestration capacity would be more than sufficient for the 72,000,000 tons of CO₂ that would be recovered during the facilities' 50-year operating life. A buried pipeline (similar to a natural gas pipeline) or extensive rail transportation (about 14,500 100-ton or 10,360 140-ton rail tanker cars per year) would be required to transport the CO₂ to an injection site in Western Pennsylvania (150 miles or more from Gilberton). Multiple injection wells would need to be installed and operated to receive the CO₂; multiple extraction wells also would be needed for CO₂ sequestration in depleted oil and gas fields or methane-bearing coal beds.

In the second scenario, sequestration could occur in the Schuylkill County area, in deep unmineable coal seams, while producing coal bed methane for sale as natural gas. While Midwest Regional Carbon Sequestration Partnership geologic mapping did not extend into Eastern Pennsylvania (Gupta 2006), analyses of the region's geology, geologic history, geologic structure, mining history, and measurements on coal samples suggest a considerable potential to recover methane from unmineable coals in the anthracite region (Milici 2004a and 2004b, Milici and Hatch 2004). DOE estimates² that a local carbon sequestration and coal bed methane production operation could sequester only a portion of the facilities' concentrated CO₂ stream, as the potential sequestration capacity in Schuylkill County could not accommodate the facilities' lifetime CO₂ production (72,000,000 tons).

Under either scenario, carbon sequestration operations could have environmental impacts from the use and disturbance of land (for exploration activities, well fields, and CO₂ pipelines) and possibly from rail or truck transportation of CO₂. Any oil or gas production associated with CO₂ sequestration would produce local economic benefits along with potential environmental impacts from refining, storing, and transporting the hydrocarbon fuels. In addition, sequestration

² *The presence of methane in the area's coal is indicated by measurements on coal samples and by a history of "fire-damp" (methane) explosions in anthracite mines during the early years of mining (Milici 2004b). While the anthracite region's complex geologic structure would inhibit coal bed methane recovery, the U.S. Geological Survey has identified several areas in the Southern Anthracite Field (i.e., central Schuylkill County) where coal bed methane recovery might be feasible because rock strata are subhorizontal to gently inclined. Total coal bed thicknesses of 50 to 100 ft within the interval about 500 to 2,000 ft below the ground surface (Milici 2004a and 2004b) and in-place gas content expected to average around 300 ft³/ton may support future development of a commercially viable natural gas production operation, particularly if angled drill holes are used (Milici 2006).*

To estimate potential sequestration capacity in Schuylkill County, DOE assumed the coal has an average gas-in-place methane content of 100 ft³/ton (USGS data suggest that this is a conservative estimate); the density of CO₂ gas is 17,250 ft³/ton; 90% of the methane contained in the coal could be extracted and replaced by CO₂; and the volume of CO₂ sequestered would be twice the volume of methane extracted (Battelle 2005). Based on these assumptions, if one year's production of CO₂ from the proposed facilities (1,450,000 tons/year, or about 25 billion ft³/yr as gas) were injected, the injected material would utilize the CO₂ storage capacity of about 140,000,000 tons of in-place coal, while producing about 12.5 billion ft³/year (about 34,000,000 ft³/day) of natural gas (methane). Assuming that anthracite coal has a density of 1,500 kg/m³ (93 lb/ft³) and the average total thickness of suitable coal is 50 ft, sequestration of one year's CO₂ production would utilize the coal under 1,380 acres.

To sequester the entire 72,000,000 tons of CO₂ generated over the proposed facilities' 50-year operating life would require 6.9 billion tons of in-place coal, which exceeds the total unrecoverable coal reserve in Schuylkill County (Section 3.3.3).

combined with coal bed methane recovery could result in impacts from the pumping and disposing of water from the methane-bearing coal beds. In extracting coal bed methane, water is pumped from the coal beds to lower the pressure that keeps methane adsorbed to the surface of the coal, thus stimulating desorption of methane (USGS 2000). In the anthracite region, unmineable coal and surrounding rock layers are likely to contain abundant groundwater, which would contribute to the potential for impacts (Milici 2004b).

From Section 6 Cumulative Impacts

6.1 Air Quality

As discussed in Section 4.1.2.2, *the operation of the* proposed facilities would increase global CO₂ emissions by about 2,280,000 tons per year, *adding to global emissions of CO₂ resulting from fossil fuel combustion, which are estimated to have been 26,000,000,000 tons in the year 1999 (IPCC 2001).*

In addition, the successful demonstration of the integration of coal waste gasification and F-T synthesis of liquid hydrocarbon fuels at a commercial scale may encourage the development of similar facilities producing liquid hydrocarbon fuels from coal. Therefore, another consideration for evaluating potential cumulative impacts from the proposed facilities on greenhouse gas emission totals was to compare the greenhouse-gas contribution from the coal-to-liquids (CTL) technology to be demonstrated with the greenhouse-gas contribution from conventional technologies for producing liquid transportation fuels. Because coal has a higher carbon-to-hydrogen ratio than crude oil, production of liquid hydrocarbon fuel from coal generates more excess carbon (released as CO₂) than production of the same quantity of liquid fuel from petroleum.

Over the entire fuel cycle (from production of the raw material in a coal mine or oil well through utilization of the fuel in a vehicle) and considering all greenhouse gases, production and delivery of liquid transportation fuels from coal has been estimated to result in about 80% more greenhouse-gas emissions than from production and delivery of conventional petroleum-derived fuels (Marano and Ciferno 2001, Williams and Larson 2003, Williams et al. 2006). However, recovery and sequestration of CO₂ at a CTL production facility (Section 5.1) could reduce greenhouse gas emissions from CTL fuel production to levels below conventional petroleum-derived fuel production (Marano and Ciferno 2001). Based on a conceptual analysis of potential CO₂ capture and sequestration at facilities that produce liquid fuels from coal using technologies similar to those included in the proposed project, it has been estimated that CO₂ sequestration could reduce total fuel-cycle greenhouse gas emissions to 8% more than from the conventional petroleum-derived fuel cycle (Williams et al. 2006). With technology advancements, future large-scale CTL facilities are expected to be able to achieve higher rates of CO₂ capture and sequestration (Larson and Tingjin 2003, Southern States Energy Board 2006), potentially resulting

in life-cycle greenhouse-gas emissions that are lower than those resulting from use of conventional petroleum refineries that are not equipped for CO₂ capture and sequestration.

In estimating how increased use of CTL technology could affect total greenhouse gas emissions associated with liquid transportation fuels, DOE considered forecasts of the potential extent of CTL utilization in 2030. Using reference case assumptions, the Energy Information Administration (2006) has forecast that by 2030 U.S. CTL production will consume 94,000,000 tons of coal annually (5% of the nation's coal use) and produce the equivalent of 277,000,000 barrels of crude oil, supplying 2.75% of the nation's petroleum needs³. Based on this forecast and assuming the CTL fuel cycle generates 80% more greenhouse-gas emissions than production and delivery of conventional petroleum-derived fuels (Marano and Ciferno 2001, Williams and Larson 2003, Williams et al. 2006), the use of CTL technology for producing transportation fuels would cause the U.S. "petroleum" sector to release 2% more greenhouse gases in the year 2030 than if the same quantity of liquid fuel was produced from petroleum. If all CTL facilities employed carbon sequestration that reduced greenhouse-gas emissions from the CTL to about 8% more than the petroleum-derived liquid fuel cycle, the greenhouse-gas emission contribution of the U.S. "petroleum" sector in that same year would be about 0.2% higher than if the same quantity of liquid fuel was produced from petroleum. If fuel-cycle emissions from CTL technologies were reduced to 10% less than conventional petroleum technologies due to a combination of more efficient carbon capture and sequestration at CTL production facilities, increased capture of the methane released during coal mining, and other potential mitigation measures (Marano and Ciferno 2001), the greenhouse-gas emission contribution of the U.S. "petroleum" sector would be about 0.3% less than if the same quantity of liquid fuel was produced from petroleum.

Using high-range estimates of future oil prices (high oil prices would encourage more CTL production), the Energy Information Administration (2006) has forecast that in the year 2030 U.S. CTL production would consume 207,000,000 tons of coal (10% of the nation's coal use) and produce the equivalent of 617,000,000 barrels of crude oil, supplying 6.7% of the nation's petroleum needs. Based on this forecast and assuming the CTL fuel cycle generates 80% more greenhouse-gas emissions than production and delivery of conventional petroleum-derived fuels, expanded use of CTL technology to produce transportation fuels could cause the U.S. "petroleum" sector to release about 5% more greenhouse gas emissions than if the same quantity of fuel was produced from petroleum. However, carbon sequestration that reduced greenhouse-gas emissions from the CTL fuel cycle to about 8% more than the petroleum-derived liquid fuel cycle could reduce this greenhouse-gas emission increment to about 0.5% more than if the same quantity of

³ On December 5, 2006, the Energy Information Administration made an early release of a portion of its 2007 Energy Outlook (<http://www.eia.doe.gov/oiaf/aeo/index.html>, accessed December 7, 2006), including reference case projections for 2030, but no projections for other sets of assumptions. The reference case projections indicate 19% more CTL production in 2030 than was projected in the 2006 analysis. Resulting contributions to greenhouse gas emissions from the liquid fuels sector would be roughly 19% higher for the reference case than the values estimated based on 2006 projections. DOE expects to revise the final EIS to reflect the 2007 Energy Outlook report, which is planned for release early in 2007.

liquid fuel was produced from petroleum. If fuel-cycle emissions from CTL technologies were reduced to 10% less than conventional petroleum technologies due to more efficient CO₂ capture and sequestration and other measures, as discussed above, the greenhouse-gas emission contribution of the U.S. “petroleum” sector would be about 0.7% less than if the same quantity of liquid fuel was produced from petroleum.

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