UNITED STATES OF AMERICA

DEPARTMENT OF ENERGY

OFFICE OF FOSSIL ENERGY

DELFIN LNG LLC	)	FE DOCKET NO. 13-147-LNG

OPINION AND ORDER GRANTING LONG-TERM, MULTI-CONTRACT AUTHORIZATION TO EXPORT LIQUEFIED NATURAL GAS BY VESSEL FROM A PROPOSED FLOATING LIQUEFACTION PROJECT AND DEEPWATER PORT 30 MILES OFFSHORE OF LOUISIANA TO NON-FREE TRADE AGREEMENT NATIONS

DOE/FE ORDER NO. 4028

JUNE 1, 2017

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FREQUENTLY USED ACRONYMS

AEO	Annual Energy Outlook
API	American Petroleum Institute
Bcf/d	Billion Cubic Feet per Day
Bcf/yr	Billion Cubic Feet per Year
CEQ	Council on Environmental Quality
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPP	Clean Power Plan
DOE	U.S. Department of Energy
DWPA	Deepwater Port Act
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EUR	Estimated Ultimate Recovery
FE	Office of Fossil Energy, U.S. Department of Energy
FERC	Federal Energy Regulatory Commission
FLNGV	Floating Liquefied Natural Gas Vessel
FTA	Free Trade Agreement
FWNRL	Fairwood Welbeck Natural Resources Pte. Ltd.
GDP	Gross Domestic Product
GEM	Global Economic Model
GHG	Greenhouse Gas
GIM	Global Industry Model
GWP	Global Warming Potential
IECA	Industrial Energy Consumers of America
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt-Hour
LCA	Life Cycle Analysis
LNG	Liquefied Natural Gas
MARAD	U.S. Department of Transportation Maritime Administration
Mcf	Thousand Cubic Feet
MMBtu	Million British Thermal Units
mtpa	Million Metric Tons per Annum
MWh	Megawatt-Hour
NEMS	National Energy Modeling System
NEPA	National Environmental Policy Act
NERA	NERA Economic Consulting
NETL	National Energy Technology Laboratory
NGA	Natural Gas Act
NOx	Nitrogen Oxides

PM	Particulate Matter
ROD	Record of Decision
RWGTM	Rice World Gas Trade Model
Tcf	Trillion Cubic Feet
TRR	Technically Recoverable Resources
USCG	U.S. Coast Guard
V4EI	Veterans for Energy Independence, LLC
VOC	Volatile Organic Compound

I. INTRODUCTION

On November 12, 2013, Delfin LNG LLC (Delfin) filed an application (Application)[1] with the Office of Fossil Energy (FE) of the Department of Energy (DOE) under section 3(a) of the Natural Gas Act (NGA)[2] for long-term, multi-contract authorization to export domestically produced liquefied natural gas (LNG). Delfin seeks authorization to export the LNG in a volume equivalent to approximately 657.5 billion cubic feet per year (Bcf/yr) of natural gas (1.8 Bcf per day (Bcf/d)) by vessel from a proposed floating liquefaction facility to be located in West Cameron Block 167 (WC 167) in the Gulf of Mexico, offshore of Cameron Parish, Louisiana (Liquefaction Facility). Delfin seeks authorization to export this LNG over a 20-year term to any country with which the United States does not have a free trade agreement (FTA) requiring national treatment for trade in natural gas, and with which trade is not prohibited by U.S. law or policy (non-FTA countries). Delfin seeks to export this LNG on its own behalf and as agent for other entities that hold title to the LNG at the time of export. Delfin requests that this authorization commence on the earlier of the date of the first export of each train or seven years from the date the authorization is issued.

Delfin states that its floating Liquefaction Facility will be a "deepwater port" within the meaning of the Deepwater Port Act of 1974, as amended.[3] The Deepwater Port Act authorizes the ownership, construction, and operation of LNG terminals in federal waters of the Outer Continental Shelf.[4] As such, Delfin's Liquefaction Facility will require a deepwater port license

[1] Delfin LNG LLC, Application for Long-Term Authorization to Export LNG to Non-Free Trade Agreement Countries, FE Docket No. 13-147-LNG (Nov. 12, 2013) [hereinafter Delfin App.].
[2] 15 U.S.C. § 717b(a). The authority to regulate the imports and exports of natural gas, including liquefied natural gas, under section 3 of the NGA (15 U.S.C. § 717b) has been delegated to the Assistant Secretary for FE in Redelegation Order No. 00-006.02 issued on November 12, 2014.
[3] 33 U.S.C. § 1501 *et seq.*; *see also* 33 C.F.R. Part 148.
[4] *See* 33 U.S.C. §§ 1501, 1503(a). The Deepwater Port Act originally applied only to oil import terminals, but was amended in 2002 to include natural gas import terminals. *See* Maritime Transportation Security Act of 2002, Pub.

from the U.S. Department of Transportation Maritime Administration (MARAD), in conjunction with the U.S. Coast Guard (USCG).[5] In a Record of Decision (ROD) dated March 13, 2017—entitled *The Secretary of Transportation's Decision on the Deepwater Port License Application of Delfin LNG, LLC*—MARAD authorized the issuance of this license to Delfin subject to conditions, as discussed below.[6] Under the optimized design of the proposed Liquefaction Facility (or "Port")[7] approved by MARAD, each of the four floating liquefied natural gas vessels (FLNGVs) comprising the Facility would produce 3.3 million metric tons per annum (mtpa) of LNG for export, or 13.3 mtpa for the entire Facility, which is equivalent to 657.5 Bcf/yr of natural gas for export.[8] On the basis of this ROD, and upon Delfin's acceptance of the conditions to be attached to its deepwater port license, MARAD will issue the license to Delfin.[9]

Additionally, the onshore components of the proposed Liquefaction Facility—including the natural gas pipelines, natural gas compressor station, gas supply header, and metering station (collectively, the Delfin Onshore Facility or "DOF")—fall under the jurisdiction of the Federal Energy Regulatory Commission (FERC). The Delfin Onshore Facility is subject to separate regulatory approval by FERC pursuant to sections 7(b) and 7(c) of the NGA. Delfin's application for the NGA section 7 authorization is currently pending in FERC Docket No. CP15-

L. No. 107-295, 116 Stat. 2064 (section 106 of the Maritime Transportation Security Act amending the Deepwater Port Act to allow the construction of offshore terminals for storing, transporting, and handling natural gas). Additionally, section 312 of the Coast Guard and Maritime Administration Act of 2012 (H.R. 2838) further amended the Deepwater Port Act (33 U.S.C. § 1502(9)(A)) to include natural gas export terminals. *See* Delfin App. at 4 n.3.

[5] Delfin App. at 4.

[6] U.S. Dep't of Transportation, *The Secretary's Decision on the Deepwater Port License Application of Delfin LNG LLC* (Mar. 13, 2017) [hereinafter MARAD ROD].

[7] MARAD refers to the Liquefaction Facility as Port Delfin. Therefore, unless otherwise stated, references to the proposed Liquefaction Facility and the Port are used interchangeably.

[8] *See* MARAD ROD at 10-11; U.S. Dep't of Transportation Maritime Admin. & U.S. Coast Guard, *Final Environmental Impact Statement for Port Delfin Deepwater Port Application*, USCG Docket No. USCG-2015-0472, at xxii, 2-1 (Nov. 28, 2016) [hereinafter Final EIS].

[9] *See* MARAD ROD at 67-68 (describing MARAD's process in issuing the ROD and license separately).

490.[10] To date, FERC has not yet issued a final decision concerning the Delfin Onshore Facility. We note, however, that MARAD analyzed the Delfin Onshore Facility in its environmental review of the Liquefaction Facility as a "reasonably foreseeable connected action[]" under the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4321 *et seq*.[11] FERC was a cooperating agency in that process.

Previously, in DOE/FE Order No. 3393 (FE Docket No. 13-129-LNG), DOE/FE granted an application from Delfin requesting authority to export LNG to countries with which the United States has, or in the future may enter into, a FTA requiring national treatment for trade in natural gas (FTA countries).[12] Under the terms of that order, Delfin is authorized to export LNG in the same volume requested in this Application (657.5 Bcf/yr) from the proposed Liquefaction Facility to FTA countries.[13] Because the source of LNG for Delfin's FTA order and this Order is the Liquefaction Facility, the two export volumes are not additive. DOE/FE is issuing this Opinion and Order subject to the additional conditions set forth below.

DOE/FE Proceeding. On March 26, 2014, DOE/FE published a Notice of Delfin's Application in the *Federal Register*.[14] The Notice of Application called on interested persons to submit protests, motions to intervene, notices of intervention, and comments by May 27, 2014.

[10] 15 U.S.C. § 717f(b), (c); *see also* MARAD ROD at 6 n.4 (stating that the ROD "applies only to Port structures located beyond State seaward boundaries and associated components of the Port located seaward of the high water mark," not to the FERC-jurisdictional onshore facilities).
[11] *See* MARAD ROD at 23-24, 45.
[12] The United States currently has FTAs requiring national treatment for trade in natural gas with Australia, Bahrain, Canada, Chile, Colombia, Dominican Republic, El Salvador, Guatemala, Honduras, Jordan, Mexico, Morocco, Nicaragua, Oman, Panama, Peru, Republic of Korea, and Singapore. FTAs with Israel and Costa Rica do not require national treatment for trade in natural gas.
[13] *Delfin LNG LLC*, DOE/FE Order No. 3393, FE Docket No. 13-129-LNG, Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from a Proposed Floating Liquefaction Project and Deepwater Port 30 Miles Offshore of Louisiana to Free Trade Agreement Nations (Feb. 20, 2014) [hereinafter Delfin FTA Order].
[14] Delfin LNG LLC, Application for Long-Term Authorization To Export Liquefied Natural Gas Produced from Domestic Natural Gas Resources to Non-Free Trade Agreement Countries for a 20-Year Period, 79 Fed. Reg. 16,782 (Mar. 26, 2014) [hereinafter Notice of Application].

In response, DOE/FE received three filings opposing the Application: (i) a motion in opposition submitted by V4EI, LLC (V4EI); (ii) a motion to intervene, protest, and comments submitted by Sierra Club; and (iii) a motion for leave to intervene and protest submitted by the American Public Gas Association (APGA). In support of the Application, DOE/FE received one motion to intervene and comments submitted by the American Petroleum Institute (API). DOE/FE has considered these filings in its review of Delfin's Application. *See infra* §§ VI, XII.

Additionally, in evaluating the public interest under NGA section 3(a), DOE/FE has considered the following economic and environmental studies in its review of Delfin's Application:

(1) Economic Studies:

In 2011, DOE/FE engaged the U.S. Energy Information Administration (EIA) and NERA Economic Consulting (NERA) to conduct a two-part study of the economic impacts of U.S. LNG exports, which together was called the "2012 LNG Export Study." DOE/FE published a notice of availability of the 2012 LNG Export Study in the *Federal Register* for public comment. The 2012 LNG Export Study is described below (*infra* § VII.A), and DOE/FE responded to the public comments in connection with the LNG export proceedings identified in that notice.[15] In relevant part, the NERA Study projected that, across all scenarios studied—assuming either 6 Bcf/d or 12 Bcf/d of LNG export volumes—the United States would experience net economic benefits from allowing LNG exports.

[15] *See*, *e.g.*, *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 3792, FE Docket No. 15-63-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel From the Sabine Pass LNG Terminal Located in Cameron Parish, Louisiana, to Non-Free Trade Agreement Nations, at 66-121 (Mar. 11, 2016).

By May 2014, in light of the volume of LNG exports to non-FTA countries then-authorized by DOE/FE and the number of non-FTA export applications still pending, DOE/FE determined that an updated study was warranted to consider the economic impacts of exporting LNG from the lower-48 states to non-FTA countries.[16] On May 29, 2014, DOE announced plans to undertake new economic studies to gain a better understanding of how potentially higher levels of U.S. LNG exports—at levels between 12 and 20 Bcf/d of natural gas—would affect the public interest.[17]

DOE/FE commissioned two new macroeconomic studies. The first, *Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets*, was performed by EIA and published in October 2014 (2014 EIA LNG Export Study or 2014 Study).[18] The 2014 Study assessed how specified scenarios of increased natural gas exports could affect domestic energy markets. At DOE's request, this 2014 Study served as an update of EIA's January 2012 study of LNG export scenarios and used baseline cases from EIA's 2014 *Annual Energy Outlook* (AEO 2014).[19]

The second study, *The Macroeconomic Impact of Increasing U.S. LNG Exports*, was performed jointly by the Center for Energy Studies at Rice University's Baker Institute and Oxford Economics under contract to DOE/FE (together, Rice-Oxford) and published in October

[16] Because there is no natural gas pipeline interconnection between Alaska and the lower 48 states, DOE/FE generally views those LNG export markets as distinct. DOE/FE therefore focuses on LNG exports from the lower-48 states for purposes of determining macroeconomic impacts.
[17] *See* U.S. Dep't of Energy, Office of Fossil Energy, Request for an Update of EIA's January 2012 Study of Liquefied Natural Gas Export Scenarios, *available at*: http://energy.gov/fe/downloads/request-update-eia-s-january-2012-study-liquefied-natural-gas-export-scenarios (May 29, 2014) (memorandum from FE to EIA).
[18] U.S. Energy Information Administration, *Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets* (Oct. 2014), *available at*: https://www.eia.gov/analysis/requests/fe/pdf/lng.pdf.
[19] Each Annual Energy Outlook (AEO) presents EIA's long-term projections of energy supply, demand, and prices. It is based on results from EIA's National Energy Modeling System model. *See infra* § VII.A.

2015 (2015 LNG Export Study or 2015 Study).[20] The 2015 Study is a scenario-based assessment of the macroeconomic impact of levels of U.S. LNG exports, sourced from the lower-48 states, under different assumptions including U.S. resource endowment, U.S. natural gas demand, international LNG market dynamics, and other factors. The 2015 Study considered export volumes ranging from 12 to 20 Bcf/d of natural gas, as well as a high resource recovery case examining export volumes up to 28 Bcf/d of natural gas. The analysis covers the 2015 to 2040 time period. Further information about the 2014 and 2015 Export Studies is set forth below. *See infra* §§ VII.B, VII.C, VIII.

On December 29, 2015, DOE/FE published a Notice of Availability of the 2014 and 2015 LNG Export Studies in the *Federal Register*, and invited public comment on those Studies.[21] DOE received 38 comments in response to the Notice of Availability, of which 14 comments opposed the conclusions in the 2014 and 2015 Studies and/or LNG exports generally, 21 expressed support for the Studies, and three took no position. *See infra* § VIII.

The grant of export authority in this Order—in a volume of LNG equivalent to 1.8 Bcf/d (657.5 Bcf/yr) of natural gas—brings DOE/FE's cumulative total of approved non-FTA exports of LNG and compressed natural gas (CNG) to 21.0 Bcf/d of natural gas. Because the 2014 and 2015 Studies examined U.S. LNG exports in excess of 12 Bcf/d, we find it appropriate to review those Studies as part of our public interest review in this proceeding.

[20] Center for Energy Studies at Rice University Baker Institute and Oxford Economics, *The Macroeconomic Impact of Increasing U.S. LNG Exports* (Oct. 29, 2015), *available at*: http://energy.gov/sites/prod/files/2015/12/f27/20151113_macro_impact_of_lng_exports_0.pdf.

[21] U.S. Dep't of Energy, Macroeconomic Impacts of LNG Exports Studies; Notice of Availability and Request for Comments, 80 Fed. Reg. 81,300, 81,302 (Dec. 29, 2015) [hereinafter Notice of Availability] (providing a 45-day public comment period "to help inform DOE in its public interest determinations of the authorizations sought in the 29 non-FTA export applications identified …").

(2) Environmental Studies:

On June 4, 2014, DOE/FE issued two notices in the *Federal Register* proposing to evaluate different environmental aspects of the LNG production and export chain. First, DOE/FE announced that it had conducted a review of existing literature on potential environmental issues associated with unconventional natural gas production in the lower-48 states. The purpose of this review was to provide additional information to the public concerning the potential environmental impacts of unconventional natural gas exploration and production activities, including hydraulic fracturing. DOE/FE published its draft report for public review and comment, entitled *Draft Addendum to Environmental Review Documents Concerning Exports of Natural Gas from the United States* (Draft Addendum).[22] DOE/FE received comments on the Draft Addendum and, on August 15, 2014, issued the final Addendum with its response to the public comments contained in Appendix B.[23]

Second, DOE/FE commissioned the National Energy Technology Laboratory (NETL), a DOE applied research laboratory, to conduct an analysis calculating the life cycle greenhouse gas (GHG) emissions for LNG exported from the United States. *See infra* § X.A. The purpose of this analysis was to determine: (i) how domestically-produced LNG exported from the United States compares with regional coal (or other LNG sources) for electric power generation in Europe and Asia from a life cycle GHG perspective, and (ii) how those results compare with natural gas sourced from Russia and delivered to the same markets via pipeline. DOE/FE

[22] Dep't of Energy, Draft Addendum to Environmental Review Documents Concerning Exports of Natural Gas From the United States, 79 Fed. Reg. 32,258 (June 4, 2014). DOE/FE announced the availability of the Draft Addendum on its website on May 29, 2014.

[23] Dep't of Energy, Addendum to Environmental Review Documents Concerning Exports of Natural Gas From the United States, 79 Fed. Reg. 48,132 (Aug. 15, 2014) [hereinafter Addendum]; *see also* http://energy.gov/fe/addendum-environmental-review-documents-concerning-exports-natural-gas-united-states; *infra* § IX. We take administrative notice of the Addendum in this proceeding.

published NETL's report entitled *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States* (LCA GHG Report).[24] DOE/FE also received public comment on the LCA GHG Report, and provides its response to those comments in this Order. *See infra* § X.B.

With respect to both the Addendum and the LCA GHG Report, DOE/FE has taken all public comments into consideration in this decision and has made those comments, as well as the underlying studies, part of the record in this proceeding. As explained below, neither the Addendum nor the LCA GHG Report are required by NEPA, but DOE/FE believes that these documents will inform its review of the public interest under NGA section 3(a), and are responsive to concerns previously raised in this proceeding.

Parallel MARAD Proceeding. In granting Delfin's application for a deepwater port license, MARAD found that the construction and operation of Delfin's proposed Port (*i.e.*, Liquefaction Facility) will be "in the national interest" under section 4(c)(3) of the Deepwater Port Act, and meets other required statutory criteria.[25] Specifically, MARAD found that the Liquefaction Facility will have a beneficial effect on local and national economic growth; will expand and diversify U.S. energy infrastructure; will provide a reliable source of clean energy to U.S. allies in the event of market disruption; will have a low impact on the availability and cost of natural gas in the U.S. domestic market; and is consistent with other national policy goals and objectives, including environmental quality.[26]

[24] Dep't of Energy, Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas From the United States, 79 Fed. Reg. 32,260 (June 4, 2014) [hereinafter LCA GHG Report]. DOE/FE announced the availability of the LCA GHG Report on its website on May 29, 2014.
[25] 33 U.S.C. § 1503(c)(3) (allowing the Secretary of Transportation to issue a license for a deepwater port if, in relevant part, "he determines that the construction and operation of the deepwater port will be in the national interest and consistent with national security and other national policy goals and objectives, including energy sufficiency and environmental quality").
[26] *See* MARAD ROD at 65, 68.

In addition to the statutory requirements of the Deepwater Port Act, MARAD was required to review Delfin's Application under NEPA. As part of its environmental review, MARAD issued a draft environmental impact statement (EIS) for the Port on July 15, 2016,[27] and a final EIS[28] on November 28, 2016.[29] The EIS evaluated the potential environmental impact of the proposed Port, and recommended that MARAD subject any approval of Delfin's deepwater port license to several conditions. MARAD describes many of these conditions in the ROD, but states that the "precise conditions … will be set forth in the License upon its issuance."[30] Additional details of the ROD are discussed below. *See infra* § XI.C.

DOE/FE's Adoption of the EIS and Issuance of a Record of Decision Under NEPA, and NGA Section 3(a) Authorization. After an independent review, DOE/FE adopted MARAD's EIS for the proposed Delfin Liquefaction Facility (DOE/EIS-0531) on April 18, 2017, and the U.S. Environmental Protection Agency (EPA) published a notice of the adoption on April 28, 2017.[31] Concurrently with this Order, DOE/FE is issuing a Record of Decision (ROD) for the proposed Liquefaction Facility.[32] As discussed below, this Order grants the Application and is conditioned on Delfin's receipt of all connected local, state and federal permits—including FERC's NGA section 7 authorization for the Delfin Onshore Facility—as

[27] *See id*. at 14 n.24; *see also* U.S. Dep't of Transp. Maritime Admin., Deepwater Port License Application: Delfin LNG LLC, Delfin LNG Deepwater Port; Notice of Availability; Notice of Public Meeting; Request for Comments, 81 Fed. Reg. 46,157 (July 15, 2016) (notice of availability of Draft EIS).
[28] *See supra* note 8.
[29] *See* MARAD ROD at 14 n.28; *see also* U.S. Dep't of Transp. Maritime Admin., Deepwater Port License Application: Delfin LNG LLC, Delfin LNG Deepwater Port; Final Application, Public Hearing, and Final Environmental Impact Statement, 81 Fed. Reg. 85,678 (Nov. 28, 2016) (notice of availability of Final EIS).
[30] MARAD ROD at 16; *see also id.* at 49-59.
[31] U.S. Envtl. Prot. Agency, Environmental Impact Statements; Notice of Availability, 82 Fed. Reg. 19,715 (Apr. 28, 2017) (providing notice that DOE has adopted the final EIS for the Delfin Liquefaction Facility).
[32] U.S. Dep't of Energy, Delfin LNG LLC, Record of Decision and Floodplain Statement of Findings for the Delfin LNG LLC Application to Export Liquefied Natural Gas to Non-Free Trade Agreement Countries, FE Docket No. 13-147-LNG (June 1, 2017).

well as meeting all conditions in MARAD's forthcoming deepwater port license and the FERC order (when issued).

II. SUMMARY OF FINDINGS AND CONCLUSIONS

This Order presents DOE/FE's findings and conclusions on all issues associated with Delfin's proposed exports under NGA section 3(a), including both environmental and non-environmental issues. As the basis for this Order, DOE/FE has reviewed a substantial administrative record that includes (but is not limited to) the following: Delfin's Application; the motions to intervene and/or protests opposing the Application filed by V4EI, Sierra Club, and APGA; the motion to intervene supporting the Application filed by API; DOE/FE's 2014 and 2015 LNG Export Studies; the Addendum; the LCA GHG Report; public comments received on DOE/FE's various analyses; MARAD's final EIS; and MARAD's ROD approving Delfin's deepwater port license with conditions.

On the basis of this record, DOE/FE has determined that it has not been shown that Delfin's proposed exports will be inconsistent with the public interest, as is required to deny Delfin's Application under NGA section 3(a). DOE/FE therefore authorizes Delfin's export of domestically produced LNG from its proposed floating Liquefaction Facility to non-FTA countries in a total volume equivalent to 657.5 Bcf/yr of natural gas. This authorization is subject to the Terms and Conditions and Ordering Paragraphs set forth herein, which incorporate by reference the conditions to the deepwater port license discussed in the ROD (to be established in Delfin's forthcoming license). *See infra* §§ XIII-XV.

III. PUBLIC INTEREST STANDARD

Section 3(a) of the NGA sets forth the standard for review of the Application:

> [N]o person shall export any natural gas from the United States to a foreign country or import any natural gas from a foreign country without first having secured an

> order of the [Secretary of Energy[33]] authorizing it to do so. The [Secretary] shall issue such order upon application, unless after opportunity for hearing, [he] finds that the proposed exportation or importation will not be consistent with the public interest. The [Secretary] may by [the Secretary's] order grant such application, in whole or part, with such modification and upon such terms and conditions as the [Secretary] may find necessary or appropriate.

15 U.S.C. § 717b(a). This provision creates a rebuttable presumption that a proposed export of natural gas is in the public interest. DOE/FE must grant such an application unless opponents of the application overcome that presumption by making an affirmative showing of inconsistency with the public interest.[34]

While section 3(a) establishes a broad public interest standard and a presumption favoring export authorizations, the statute does not define "public interest" or identify criteria that must be considered. In prior decisions, however, DOE/FE has identified a range of factors that it evaluates when reviewing an application for export authorization. These factors include economic impacts, international impacts, security of natural gas supply, and environmental impacts, among others. To conduct this review, DOE/FE looks to record evidence developed in the application proceeding.[35]

DOE/FE's prior decisions have also looked to certain principles established in its 1984 Policy Guidelines.[36] The goals of the Policy Guidelines are to minimize federal control and

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[33] The Secretary's authority was established by the Department of Energy Organization Act, 42 U.S.C. § 7172, which transferred jurisdiction over imports and export authorizations from the Federal Power Commission to the Secretary of Energy.

[34] *See, e.g.*, *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961, FE Docket No. 10-111-LNG, Opinion and Order Conditionally Granting Long-Term Authorization to Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations, at 28 (May 20, 2011) [hereinafter *Sabine Pass*]; *see also Phillips Alaska Natural Gas Corp. & Marathon Oil Co.*, DOE/FE Order No. 1473, FE Docket No. 96-99-LNG, Order Extending Authorization to Export Liquefied Natural Gas from Alaska, at 13 (April 2, 1999) [hereinafter *Phillips Alaska Natural Gas*], citing *Panhandle Producers & Royalty Owners Ass'n v. ERA*, 822 F.2d 1105, 1111 (D.C. Cir. 1987).

[35] *See, e.g.*, *Sabine Pass*, DOE/FE Order No. 2961, at 28-42 (reviewing record evidence in issuing conditional authorization).

[36] New Policy Guidelines and Delegations Order Relating to Regulation of Imported Natural Gas, 49 Fed. Reg. 6684 (Feb. 22, 1984) [hereinafter 1984 Policy Guidelines].

involvement in energy markets and to promote a balanced and mixed energy resource system. The Guidelines provide that:

> The market, not government, should determine the price and other contract terms of imported [or exported] natural gas …. The federal government's primary responsibility in authorizing imports [or exports] will be to evaluate the need for the gas and whether the import [or export] arrangement will provide the gas on a competitively priced basis for the duration of the contract while minimizing regulatory impediments to a freely operating market.[37]

While nominally applicable to natural gas import cases, DOE/FE subsequently held in Order No. 1473 that the same policies should be applied to natural gas export applications.[38]

In Order No. 1473, DOE/FE stated that it was guided by DOE Delegation Order No. 0204-111. That delegation order, which authorized the Administrator of the Economic Regulatory Administration to exercise the agency's review authority under NGA section 3, directed the Administrator to regulate exports "based on a consideration of the domestic need for the gas to be exported and such other matters as the Administrator finds in the circumstances of a particular case to be appropriate."[39] In February 1989, the Assistant Secretary for Fossil Energy assumed the delegated responsibilities of the Administrator of ERA.[40]

Although DOE Delegation Order No. 0204-111 is no longer in effect, DOE/FE's review of export applications has continued to focus on: (i) the domestic need for the natural gas proposed to be exported, (ii) whether the proposed exports pose a threat to the security of domestic natural gas supplies, (iii) whether the arrangement is consistent with DOE/FE's policy

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[37] *Id*. at 6685.
[38] *Phillips Alaska Natural Gas*, DOE/FE Order No. 1473, at 14 (citing *Yukon Pacific Corp.*, DOE/FE Order No. 350, Order Granting Authorization to Export Liquefied Natural Gas from Alaska, 1 FE ¶ 70,259, at 71,128 (1989)).
[39] DOE Delegation Order No. 0204-111, at 1; *see also* 1984 Policy Guidelines, 49 Fed. Reg. at 6690.
[40] *See* Applications for Authorization to Construct, Operate, or Modify Facilities Used for the Export or Import of Natural Gas, 62 Fed. Reg. 30,435, 30,437 n.15 (June 4, 1997) (citing DOE Delegation Order No. 0204-127, 54 Fed. Reg. 11,436 (Mar. 20, 1989)).

of promoting market competition, and (iv) any other factors bearing on the public interest described herein.

IV. DESCRIPTION OF REQUEST

Delfin requests long-term, multi-contract authorization to export domestically produced LNG, on its own behalf and as agent for other entities that will hold title to the LNG, by vessel from the proposed Liquefaction Facility to non-FTA countries. Delfin seeks to export LNG in a volume equivalent to 657.5 Bcf/yr of natural gas (1.8 Bcf/d) over a 20-year term, beginning on the date of first export of each train or seven years from the date of issuance of the requested authorization, whichever is sooner.

Specifically, Delfin requests that, in light of the "planned phased development" of its Facility—with successive trains expected to become operational from 2017 through 2021—DOE/FE construe the "date of first export" on a train-specific basis.[41] Under this approach, exports from the first train, if placed in operation in 2017, would extend for 20 years from that first export. However, if the third train were placed in operation in 2020, exports from the third train would be authorized for 20 years from the start of *that train's* export operations (rather than only 17 years, if based on the date of first export from the first train). Delfin acknowledges that this phased approach has not been previously adopted by DOE/FE but asserts that it will facilitate the orderly development of its Facility and its customer contracting.[42]

[41] Delfin App. at 9.
[42] *See id.*

A. Description of Applicant

Delfin is a Louisiana limited liability company with its principal place of business in Dallas, Texas. Delfin states that it is a wholly-owned subsidiary of Fairwood Peninsula Energy LLC (Fairwood Peninsula).

According to Delfin, Fairwood Peninsula is a Delaware limited liability company formed by executives from both the Fairwood Group (based in India and Singapore) and the Peninsula Group (based in the United States). Delfin describes the corporate structure as follows:

- Fairwood Peninsula is owned by FWNR Energy Holdings (USA) Corporation (Fairwood USA) and the Peninsula Group.
- Fairwood USA is a Delaware corporation and a subsidiary of Fairwood Welbeck Natural Resources Pte. Ltd. (FWNRL).
- FWNRL is part of the Fairwood Group, an India-based group of companies with investments in energy, transportation, and urbanization. FWNRL is a company organized and existing under the laws of Singapore, with its principal place of business in Singapore.
- The Peninsula Group is a privately owned, Texas-based group of companies with interests in land development, construction projects, and oil and gas.

Delfin states that principals of FWNRL and the Peninsula Group have been working on the development of Delfin's Liquefaction Facility for several years.[43]

B. Proposed Liquefaction Facility

Delfin proposes to develop, own, and operate its floating Liquefaction Facility in West Cameron Block 167 in the Gulf of Mexico, approximately 30 miles offshore of Cameron Parish, Louisiana. Delfin states that Liquefaction Facility will utilize four floating LNG vessels (FLNGVs) for the planned liquefaction and storage. According to Delfin, the FLNGVs will be moored at purpose-built single point moorings located as near the terminus of the existing

[43] *See id*. at 2-3.

pipeline in West Cameron Block 167 as operationally and safely as possible (expected to be within approximately 2000 feet). The FLNGVs will have the capability to export LNG to off-taking LNG carriers utilizing a ship-to-ship, side transfer process.[44]

Delfin states that the platform is the terminus and metering point of the existing Enbridge Offshore Pipelines (UTOS) natural gas pipeline system, and is connected to the shore via an existing 42-inch diameter, 30-mile long gas pipeline. Delfin states that the pipeline system commenced operation in 1978 and previously was utilized for the purpose of transporting offshore natural gas production to onshore connections with Transcontinental Gas Pipe Line, Natural Gas Pipeline Company of America, and ANR Pipeline Company, as well as to nearby gas processing plants. Delfin asserts that, because of significantly decreased flow volumes, the UTOS gas pipeline could no longer be economically operated for its original purpose. As a result, in 2011, FERC authorized the pipeline to abandon its services and certificates, while deferring the final disposition of its facilities.[45] Delfin maintains that the system has been idle since that time.

Delfin states that its parent company, FWNRL, has entered into a letter of intent with the owner of the UTOS pipeline system that provides FWNRL the exclusive right to acquire the pipeline system, subject to the satisfaction of certain conditions including regulatory approvals.[46] Delfin intends to recommission and to reverse the flow on the existing 42-inch pipeline for purposes of delivering feed gas to the Liquefaction Facility. According to Delfin, the existing pipeline is anticipated to have capacity to transport up to 1.8 Bcf/d of natural gas from the Louisiana coastline to Delfin's proposed Liquefaction Facility. Delfin states that, following the

[44] A site plan for the mooring system and other site depictions are attached to the Application as Appendix D.
[45] *See* Delfin App. at 5 (citing *Enbridge Offshore Pipelines (UTOS) LLC*, 136 FERC ¶ 62,269 (2011)).
[46] *See id*.

reactivation of its previous onshore interconnections with the major interstate pipelines and modifications to reverse flow, the pipeline will allow the Liquefaction Facility to access the domestic natural gas interstate pipeline system.[47]

Delfin states that it has entered into a memorandum of understanding (MOU) with a midstream LNG company to provide at least the first two FLNGVs. According to Delfin, the focus of the MOU is to develop fast track, modular, mid-scale liquefaction solutions of approximately 2.5 million metric tons per annum (mtpa) per train, based on existing technology and using completed Front-End Engineering and Designs. Delfin anticipates that the third and fourth LNG trains will be provided by new-build FLNGVs. Delfin states that these two trains will provide liquefaction capacity of 4.0 mtpa each, bringing the total capacity of the Liquefaction Facility to approximately 13 mtpa of LNG.[48]

C. Procedural History

On October 7, 2013, in FE Docket No. 13-129-LNG, Delfin filed a separate application requesting authorization under NGA section 3(c) to export the same volume of LNG requested herein (657.5 Bcf/yr) from the Liquefaction Facility to FTA countries for a 20-year period. On February 20, 2014, DOE/FE granted that application in DOE/FE Order No. 3393.[49] Delfin states that the non-FTA export volume requested in the Application is the same volume of LNG as approved in DOE/FE Order No. 3393, and therefore would not be additive to that FTA export volume.[50]

[47] A map showing both the location of WC 167 and the existing gas pipeline is attached to the Application as Appendix C.
[48] *See* Delfin App. at 7.
[49] *See supra* note 13.
[50] Delfin App. at 2, 8.

D. Business Model

Delfin requests authorization to export LNG on its own behalf or as agent for other entities who hold title to the LNG at the time of export. Delfin states that it will comply with all DOE/FE requirements for exporters and agents, including registration requirements. Delfin states that it is engaged in commercial negotiations with numerous potential customers. Delfin states that, consistent with DOE/FE precedent, it will file under seal any relevant long-term commercial agreements for natural gas liquefaction and LNG export services between Delfin and its customers, once those agreements have been executed.[51]

E. Source of Natural Gas

Delfin intends to export domestically produced natural gas sourced from both conventional and non-conventional production. Delfin anticipates that this natural gas will be available from the interstate pipeline grid, and delivered through the connection to its dedicated, existing pipeline to the proposed Liquefaction Facility. Delfin states that, through its connection with the interstate pipeline systems, the Liquefaction Facility will have the capability to access abundant, diverse supplies of natural gas across the United States, including Texas and Louisiana.[52]

V. APPLICANT'S PUBLIC INTEREST ANALYSIS

Delfin contends that its proposed exports are consistent with the public interest under section 3(a) of the NGA. Specifically, Delfin asserts that DOE/FE's approval of its Application will be consistent with DOE/FE's 1984 Guidelines; will not pose a threat to domestic supply security; will support development of domestic natural gas; will reduce the United States' trade imbalance; and will promote international relations. Delfin also contends that DOE/FE's 2012

[51] *See id*. at 7-10.
[52] *See id.* at 5, 7.

Export Study and other economic studies (incorporated herein by reference) provide evidence that the United States will benefit from the export of domestically produced LNG, consistent with the public interest. In support of this position, Delfin address the following factors: (i) the unique benefits of the proposed Liquefaction Facility; (ii) the adequacy of domestic supply of natural gas; (iii) potential effect on domestic natural gas prices; and (iv) domestic benefits of LNG exports.[53]

A. Unique Benefits of the Liquefaction Facility

Delfin states that the offshore location of its proposed Liquefaction Facility provides unique benefits relative to shore-based LNG export terminals. First, Delfin states that its offshore location enables it to avoid certain environmental and land-owner concerns that arise with shore-based facilities, as well as seaway congestion issues that (according to Delfin) may be problematic for some LNG export terminals to be located on the Gulf Coast. Delfin notes that because its FLNGVs are powered and mobile, they can be moved away from the mooring location to avoid hurricanes or other storm systems that could pose a threat to or interrupt service.[54]

Delfin next states that it "expects to be among the most environmentally friendly LNG liquefaction facilities in the world."[55] The Liquefaction Facility will burn only natural gas, and will use air cooling and closed loop cooling (and no sea water) for all of its systems. Delfin states that it will utilize existing domestic natural gas infrastructure (such as the UTOS pipeline), thereby avoiding the need for new construction while providing a new use for infrastructure otherwise slated for abandonment. Finally, Delfin contends that the Liquefaction Facility will

[53] *See* Delfin App. at 10-15.
[54] *Id*. at 16.
[55] *Id*.

result in economic benefits to the Louisiana coast region by stimulating new production of natural gas and utilizing existing processing services in the area.[56]

B. Adequacy of Domestic Supply

Delfin argues that, in light of the "dramatic" recent successes of domestic natural gas exploration and production, sufficient reserves exist to satisfy both domestic demand for LNG and Delfin's proposed exports.[57] Relying on the 2012 NERA Study, Delfin argues that all available data continues to confirm (and, indeed, strengthen) DOE/FE's conclusion in recent LNG export orders that adequate natural gas supplies exist to meet the demands for LNG. According to Delfin, DOE/FE has recognized that proved reserves of domestic natural gas have been increasing dramatically—with EIA's estimates of proved reserves increasing from 177,427 Bcf in 2000 to 304,625 Bcf in 2010 (a 72 percent increase), compared to an increased production of 16 percent over that period.[58] Delfin also asserts that EIA's estimates—as well as the latest study by the Potential Gas Committee of the Colorado School of Mines—show that the United States' technically recoverable reserves (TRR) have "skyrocketed" over the past decade.[59] According to Delfin, recent estimates of TRR equate to over 90 years of supply at the 2012 domestic consumption level of 25.63 Tcf.[60]

Next, Delfin asserts that increased demand for natural gas to be exported as LNG will stimulate additional production of domestic natural gas supplies. Delfin cites a study by ICF International concluding that 79 to 88 percent of LNG export volumes will be offset by increasing domestic natural gas production.[61] Delfin further contends that this natural gas

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[56] *See id*. at 17.
[57] *See id*.
[58] *See id*. at 18.
[59] *Id*. at 19.
[60] *See* Delfin App. at 19 (citations omitted).
[61] *See id*. at 20 (citing ICF Int'l, *U.S. LNG Exports: Impacts on Energy Markets and the Economy* (May 15, 2013)) [hereinafter ICF International study].

production will have the added benefit of increasing the production of natural gas liquids (NGLs), which it asserts will contribute more broadly to the public benefit of LNG exports.

For these reasons, Delfin states that all available evidence and projections show that current natural gas reserves will support the expected demand for LNG, including the proposed exports, through at least 2040. Accordingly, Delfin argues there is no "domestic need" for its proposed exports, and thus its proposed exports are consistent with the public interest.[62]

C. Impact on Domestic Natural Gas Prices

Citing DOE/FE precedent, Delfin states that DOE/FE takes very seriously the economic impacts of higher natural gas prices and any potential increase in natural gas price volatility that could result from LNG exports. Delfin points to the 2012 LNG Export Study—and, specifically, the conclusions in the NERA Study—in asserting that the impact of LNG exports on domestic natural gas prices will be relatively minor.[63] Delfin contends that other economic studies that considered the likely price effects of LNG exports have reached conclusions similar to that reached by NERA, including the ICF International study cited above.[64]

Delfin emphasizes that, when assessing the impact of any projected cost increases from LNG exports, historically low natural gas prices constitute the current base line. Delfin also points out that natural gas consumers have enjoyed tremendous savings as a result of the success of the shale gas revolution. For example, using data from the 2010 Manufacturing Energy Consumption Survey, EIA announced that the average annual natural gas price paid by manufacturers decreased by 36 percent between 2006 and 2010 (from $7.59 to $4.83 million).[65] Delfin asserts that natural gas prices have fallen further since that survey was conducted.

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[62] *See id*. at 20.
[63] *See id*. at 21 (citing NERA Study, Exec. Summary, at 2).
[64] *See id*. at 21-22.
[65] *See id*. at 22-23 (citing EIA, "Cost of Natural Gas Used in Manufacturing Sector Has Fallen" (Sept. 13, 2013)).

Delfin next argues that incremental demand of natural gas from new uses, such as LNG exports, is needed to spur on the natural gas production boom that has benefitted consumers. According to Delfin, even if LNG exports increase natural gas prices marginally, U.S. natural gas prices will remain attractively priced. Delfin contends that domestic manufacturers and other consumers will continue to enjoy the competitive advantage of inexpensive domestic natural gas supplies, as overseas consumers of U.S.-sourced LNG will bear the significant added costs associated with liquefaction, tanker transportation, and regasification. Finally, Delfin asserts that new baseload demand associated with LNG export projects should reduce, not increase, price volatility.[66]

D. Domestic Benefits of LNG Exports

Citing the NERA Study, Delfin maintains that the United States will experience net economic benefits from LNG exports regardless of the level of exports.[67] Delfin asserts that this conclusion has been confirmed by other studies, including those undertaken by the Brookings Institute and ICF International. In fact, Delfin argues, the ICF International study found even stronger support for LNG exports than the NERA Study, projecting an increase in gross domestic product (GDP) and job growth as LNG exports increase.[68]

Delfin next argues that the increased jobs associated with LNG exports are an important part of the public interest consideration. Delfin points to the White House's 2010 National Export Initiative[69] and a 2010 report by the U.S. Department of Commerce's International Trade Administration to demonstrate the "fundamental role" that exports play (and will continue to

[66] *See id*.
[67] *See* Delfin App. at 24.
[68] *See id*. (citing ICF International study at 2).
[69] National Export Initiative, 75 Fed. Reg. 12,433 (Mar. 16, 2010).

play) in the United States economy. Delfin maintains that "[t]he advent of LNG exports worth billions of dollars will add tens of thousands of additional jobs to the U.S. economy."[70] Delfin adds that LNG exports will help realign the U.S. balance of trade by allowing the United States to export some of its abundant natural gas.

Beyond these economic factors, Delfin LNG asserts that allowing LNG exports will have positive international consequences, as DOE/FE has recognized in past LNG export orders. Delfin argues that LNG exports from the United States have the potential to fundamentally alter the world's energy and economic map, and to benefit this country's allies around the globe, especially in Asia, Europe, and the Caribbean. Citing a report by the James A. Baker III Institute for Public Policy at Rice University, Delfin emphasizes these and other international and geopolitical benefits associated with increased domestic natural gas production which, in turn, Delfin states will be fostered by its LNG exports.[71]

Finally, citing EPA estimates on air emissions, Delfin argues that its proposed exports will have significant environmental benefits because natural gas is a cleaner-burning fuel than other fossil fuels. Delfin points out that LNG exports from the United States may substitute for coal or fuel oil usage overseas, thereby sharing the environmental benefits of natural gas with other nations.[72]

VI. CURRENT PROCEEDING BEFORE DOE/FE

A. Overview

In response to the Notice of Application published in the *Federal Register* on March 26,

[70] Delfin App. at 26.
[71] *See id.* at 27 (citing "Shale Gas and U.S. National Security," Medlock, Myers, Jaffe, & Hartley, published by the James A. Baker III Institute for Public Policy (July 19, 2011)).
[72] *See id*. at 29.

2014, DOE/FE received four timely-filed motions to intervene in this proceeding.[73] Of those, API moved to intervene in support of the Application.[74] V4EI[75], Sierra Club[76], and APGA[77] moved to intervene and protest in opposition to the Application. Delfin filed a consolidated response to the comments and protests submitted by Sierra Club, APGA, and V4EI.[78] Sierra Club subsequently filed a renewed motion to reply and reply in response to Delfin's Response.[79]

B. API's Motion to Intervene and Comments

On May 27, 2014, API filed a motion to intervene in this proceeding and comments supporting the Application. API states that it is a national trade association representing more than 600 member companies involved in all aspects of the oil and gas industry in the United States. API states that its members include owners and operators of LNG import and export facilities in the United States and around the world, as well as owners and operators of LNG vessels, global LNG traders, and manufacturers of essential technology and equipment used all along the LNG value chain. API states that its members—many of whom operate in the Gulf

[73] Additionally, on January 3, 2014 (prior to publication of the *Federal Register* notice), the Texas Alliance of Energy Producers (Alliance) filed a "Petition and Motion" and supporting amicus brief asking DOE to issue an order establishing a "separate and simultaneous process" for the review of applications for LNG exports to non-FTA countries from offshore deepwater natural gas ports subject to the Deepwater Port Act. However, we find that the issues raised in the Alliance's amicus brief were mooted by DOE's issuance of its Procedures for Liquefied Natural Gas Export Decisions (79 Fed. Reg. 48,132 (Aug. 15, 2014)), as well as by the issuance of this Order. Additionally, the Alliance's petition and motion were denied by operation of law when DOE/FE did not act on the filing within 30 days. 10 C.F.R. § 590.302(c).
[74] American Petroleum Inst., Motion to Intervene and Comments in Support Approval of Export Application, FE Docket No. 13-147-LNG (May 27, 2014) [hereinafter API Mot.].
[75] V4EI, LLC, Motion in Opposition, FE Docket No. 13-147-LNG (May 27, 2014) [hereinafter V4EI Mot.].
[76] Sierra Club, Motion to Intervene, Protest, and Comments, FE Docket No. 13-147-LNG (May 27, 2014) [hereinafter Sierra Club Mot.].
[77] American Public Gas Ass'n, Motion for Leave to Intervene and Protest, FE Docket No. 13-147-LNG (May 27, 2014) [hereinafter APGA Mot.].
[78] Delfin LNG, LLC, Response to Motions to Intervene and Protests, FE Docket No. 13-147-LNG (June 11, 2014) [hereinafter Response].
[79] Sierra Club, Renewed Motion to Reply and Reply, FE Docket No. 13-147-LNG (June 27, 2014) [hereinafter Sierra Club Reply].

Coast region—have a direct and immediate interest in this proceeding that cannot be adequately protected by any other party.

API expresses its support of Delfin's Application and urges DOE/FE to grant the requested authorization. In particular, API contends that DOE's 2012 LNG Export Study remains sound, and that, "across all scenarios, the United States stands to gain net economic benefits from allowing LNG exports."[80] API points out that DOE, in a later non-FTA export authorization, compared three years of subsequent AEO reference cases, and "found that those data validated (indeed, supported more strongly) the LNG Export Study's original conclusions."[81]

Additionally, API maintains that the EIA's *Annual Energy Outlook* 2014 (AEO 2014), released in May 2014, supports DOE's continued approval of LNG exports. API asserts that a comparison of the AEO 2014 data to the AEO 2011 data used in the 2012 LNG Export Study confirms that LNG exports will benefit the United States, and demonstrates that the projected impact of LNG exports on U.S. natural gas prices is lower than originally believed.[82]

Next, API describes a study that it commissioned by ICF International and attached to its motion. The study, published in November 2013, is entitled, *U.S. LNG Exports: State-Level Impacts on Energy Markets and the Economy*.[83] According to API, the ICF State Study confirms the conclusions of both AEO 2014 and the 2012 LNG Export Study—specifically, that the net effect of U.S. GDP and employment generated by LNG exports is projected to be

[80] API Mot. at 3.
[81] *Id*. at 3-4 (internal citations omitted).
[82] *See id*. at 4.
[83] *See* API Mot. at 6 (citing ICF Int'l, *U.S. LNG Exports: State-Level Impacts on Energy Markets and the Economy* (Nov. 2013) [hereinafter ICF State Study]).

positive, while having only a moderate impact on U.S. natural gas prices.[84] Additionally, focusing on the benefits of Delfin's proposed Liquefaction Facility to the State of Louisiana, API asserts that the ICF State Study found that "by 2035, increased LNG exports could create $16.2 billion in additional state income and create over 74,000 jobs."[85] In sum, API contends that approval of Delfin's Project will help to reduce unemployment and boost state income, which API asserts will benefit the national economy as a whole.[86]

C. V4EI's Motion to Intervene and Protest

On May 27, 2014, V4EI filed a motion to intervene and protest. V4EI states that V4EI is an acronym for Veterans for Energy Independence. V4EI states that it is a limited liability company with members who are military veterans who have served in United States foreign conflicts. V4EI states its members have a direct interest in this proceeding for numerous reasons, including: (i) many of its members are consumers of natural gas who are (or will be) adversely affected by any increase in the price of natural gas; (ii) many of its members are consumers of electricity who will be adversely affected if increased demand for LNG exports results in unprecedented price increases for electricity; (iii) its members are active military reserve members who may be called into service if the United States fails to consider the foreign policy consequences and national security implications of the proposed exports; and (iv) the approval of additional LNG export demands will serve to postpone the displacement of coals plants with cleaner types of electric generation, thereby prolonging the harmful health impacts to V4EI members associated with the continued operation of coal-fired plants.[87]

[84] *See id*.
[85] *Id*. & n.9.
[86] *See id*. at 6.
[87] V4EI Mot. at 2-4.

First, V4EI argues that the NGA is a consumer protection statute, and that DOE/FE is "'bound under [NGA Section 3] to protect the American consumer'" when determining whether to issue non-FTA LNG export authorizations.[88] V4EI contends that consistency with the public interest under the NGA is measured by whether American consumers are getting a fair and reasonable price for natural gas. V4EI dismisses Delfin's reliance on DOE/FE's 2012 LNG Export Study, stating that the Study fails to serve the purposes of the NGA.[89] V4EI also criticizes DOE's application of its 1984 Guidelines. According to V4EI, the 1984 Guidelines were intended to apply to *imports* of natural gas, not exports, such that DOE/FE's analysis on the basis of those Guidelines is "out of context."[90] V4EI contends that DOE/FE consequently has both ignored its obligation to create an adequate record for export applications and failed to comply with the "core consumer protection mandate" of the NGA.[91]

V4EI argues that neither Delfin LNG nor the 2012 LNG Export Study make any effort to analyze the competitiveness in the international market for natural gas, which V4EI characterizes as oligopolistic and potentially antagonistic to the interests of the United States. V4EI emphasizes that a 2013 Institute of Energy Economics study at the University of Cologne found that the global gas market is "'regionally interlinked but not perfectly integrated.'"[92] V4EI acknowledges that U.S. LNG exports may have a "modulating effect" on world prices, but contends they will not alter the fundamental structure of the international market, are more likely to raise U.S. natural gas prices, and will expose U.S. consumers to price shocks associated with the "oligopolistic" international market.[93]

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[88] *Id.* at 5 (citation omitted).
[89] *See id.* at 6.
[90] *Id.* at 10.
[91] *Id.*
[92] *Id.* at 12 (citation omitted).
[93] V4EI Mot. at 12-13.

V4EI further asserts that the 2012 LNG Export Study demonstrates that exports will raise the price of natural gas, which V4EI contends will harm American consumers of natural gas. According to V4EI, any increases in U.S. GDP would benefit only private natural gas companies and their investors, "turn[ing] the NGA on its head."[94] V4EI further argues that neither Delfin's Application nor the 2012 LNG Export Study addresses the "regional and seasonal implications of export policies," which it deems "critical" to consider.[95] V4EI argues that the 2012 LNG Export Study ignores economic research demonstrating that exporting U.S. LNG may jeopardize America's manufacturing renaissance through increased natural gas and electricity prices (among other reasons) and through the so-called "resource curse."[96] Additionally, V4EI contends that the 2012 LNG Export Study generally discounts price volatility, despite evidence of substantial volatility in U.S. prices at the regional, national, and international levels.[97]

Next, VEI4 asserts that DOE/FE has failed to consider the overall effect of all LNG export applications approved or pending before DOE/FE. Consequently, according to V4EI, DOE/FE has not developed an adequate record to support the conclusion that these export applications "in the aggregate" are consistent with the public interest.[98] V4EI acknowledges that "expectations for natural gas resources are substantially in excess of the current proven reserves," but claims that "those expectations have yet to reach the level of certainty to qualify as proven by the EIA."[99]

According to V4DI, Delfin and DOE/FE have both failed to consider national energy requirements adequately. Specifically, V4EI contends the 2012 LNG Export Study does not

[94] *Id*. at 14.
[95] *Id*. at 15.
[96] *Id*.
[97] *See id*. at 17.
[98] *Id*. at 23.
[99] V4EI Mot. at 23-24.

consider the many federal and state policies, market trends, and current regional shortages that indicate higher natural gas demand in the United States. V4EI states that demand for natural gas will increase as more intermittent renewable energy generation is brought online and as coal-fired power generation declines. V4EI also argues there will be increased demand for natural gas in the transportation and manufacturing sectors.[100]

V4EI states that stable domestic energy prices in the United States are dependent on the security and stability of domestic natural gas supply. V4EI argues that DOE/FE must assess the linkage between the natural gas and power markets to gauge domestic gas demand accurately as a basis for its public interest review, and that ignoring this linkage runs contrary to the NGA's consumer protection mandate. Citing the wholesale electricity pricing of the PJM Regional Transmission Organization during the extremely cold winter of 2013-2014, V4EI argues that real world conditions—including insufficient regional natural gas transportation infrastructure—increase the threat of a "natural gas demand driven run up" in electricity prices.[101] V4EI maintains that the 2012 LNG Export Study ignored regional natural gas infrastructure limitations, and in turn underestimated actual seasonal and regional domestic natural gas demand. V4EI contends that, by granting long-term LNG export authorizations, DOE/FE is supporting the construction of export infrastructure over the expansion of domestic natural gas infrastructure, at the risk of critical domestic demand.[102]

Finally, V4EI argues that neither Delfin nor DOE/FE have substantively addressed the trade, national security, and foreign policy aspects of the public interest analysis contemplated in the 1984 Guidelines. V4EI specifically contends that Delfin has provided no evidence that

[100] *See id*. at 24-26.
[101] *Id*. at 28.
[102] *See id*. 28-31.

DOE/FE's approval of its Application will provide U.S. allies with natural gas, counteract concentration within the global natural gas markets, or advance national security interests. In sum, V4EI contends that Delfin's Application is devoid of substantial evidence on many relevant factors considered by DOE/FE in its public interest determination under the NGA.[103]

D. APGA's Motion to Intervene and Protest

APGA filed a Motion for Leave to Intervene and Protest on May 27, 2014. APGA is a national non-profit association of publicly-owned natural gas distribution systems, with approximately 700 members in 36 states. APGA states that its membership covers 950 not-for-profit retail distribution entities that are owned by, and accountable to, the citizens they serve, including municipal gas distribution systems, public utility districts, county districts, and other public agencies that have natural gas distribution facilities. APGA maintains that its members are active participants in the domestic market for natural gas where they secure the supplies of natural gas to serve their end users. APGA states that it has a direct and substantial interest in this proceeding that cannot be adequately represented by any other party.

In protesting the Application, APGA asserts that Delfin's request for authority to export domestic LNG to non-FTA countries is inconsistent with the public interest and should be denied. APGA argues that the proposed exports will increase domestic natural gas prices, burdening households and jeopardizing potential growth in the U.S. manufacturing sector, as well as the nation's transition away from more environmentally damaging fossil fuels.[104]

APGA first argues that the EIA 2012 Study, conducted as part of DOE's 2012 LNG Export Study, concluded that LNG exports will increase prices, with higher volumes causing more drastic increases. APGA points out that the NERA Study, also part of DOE's 2012 LNG

[103] *See id*. at 31-34.
[104] APGA Mot. at 3.

Export Study, found that exports would yield net economic benefits but would raise domestic natural gas prices. According to APGA, these price increases would burden the U.S. consumers who can least afford the increase and disadvantage domestic manufacturing. APGA argues that DOE/FE must go beyond the EIA and NERA Studies to consider the tradeoffs entailed by exporting an increasingly valuable U.S. fuel, rather than supporting and enhancing the use of natural gas domestically.[105]

APGA points out that, as of April 18, 2014, DOE/FE had received 43 applications for LNG export authority to FTA or non-FTA countries. APGA states that the total applied-for export capacity (to both FTA and non-FTA countries) would increase the daily demand for natural gas by roughly 58 percent.[106] APGA contends that authorization of this large quantity for export will have an impact on natural gas demand, will increase domestic natural gas and electricity prices, will inhibit the United States' ability to forge a path toward energy independence, and will undermine sustained economic growth in key manufacturing sectors.[107]

APGA states that increased natural gas prices due to LNG exports will raise the costs of both natural gas and electric energy, arguing that such increases threaten other domestic industries such as steel and petrochemical manufacturing.[108] APGA further contends that price increases due to exports will both (i) jeopardize the viability of natural gas as a "bridge-fuel" in the transition away from carbon-intensive and otherwise environmentally problematic coal-fired electric generation, and (ii) inhibit efforts to foster natural gas as a major transportation fuel.

[105] *Id*. at 3-4.
[106] *See id*. at 5.
[107] *See id*. at 5-6.
[108] *See id*. at 10-11.

AGPA claims that these steps are necessary to wean the United States from its historic, high-risk dependence on foreign oil.[109]

In particular, APGA contends that new environmental regulations will soon force coal retirements, and that future greenhouse gas regulations may cause additional retirements in the future. Sustained low prices for natural gas, according to APGA, will help to keep electricity prices from spiking higher during this transition. A spike in electricity prices, APGA adds, will have adverse rippling effects on the U.S. economy.[110]

At the same time, APGA contends that Delfin's plan to export natural gas will not prove economically viable. APGA believes that economically recoverable domestic natural gas may prove less robust than projected, especially given associated environmental costs and concerns regarding the long-term productivity of shale gas wells.[111] APGA states that foreign alternatives (such as LNG exports from Australia and Qatar) will soon remove the price arbitrage opportunity that Delfin (and others) seek to take advantage of, as natural gas reserves from shale formations and export capacity expand around the world. According to APGA, as other nations develop their resources and export capacity and as U.S. natural gas prices increase due to the proposed exports, international and domestic prices will converge. This, in turn, will "leav[e] the U.S. with the worst of all worlds, i.e., higher domestic prices that thwart energy independence and that undermine the competitiveness of the manufacturing sector that relies heavily on natural gas as a process fuel."[112]

Finally, APGA contends that DOE/FE has failed to overcome any of the above claims and that the NERA Study is fundamentally flawed. APGA acknowledges the findings in the

[109] *See id*. at 4, 6, 10-15.
[110] APGA Mot. at 13-14.
[111] *See id*. at 4.
[112] *Id*. at 15.

NERA Study that U.S. LNG exports are likely to yield net benefits to the national economy. APGA asserts, however, that LNG exports will disproportionately benefit the natural gas production sector while harming all consumers, resulting in "dire" distributional consequences.[113] APGA also criticizes assumptions in the NERA Study that, in turn, rely on EIA's AEO data. According to APGA, DOE/FE is not justified in relying on models that include historical data from a time period during which the United States sought to speed the pace of LNG *imports*.[114] These models, according to APGA, "are incapable of making long-term predictions for periods that follow dramatic change"—*i.e.*, the shale gas boom and resulting opportunities to export LNG.[115]

E. Sierra Club's Motion to Intervene, Protest, and Comments

On May 27, 2014, Sierra Club filed a motion to intervene, protest, and comments opposing Delfin's Application.[116] Sierra Club states that its members live and work throughout the area that will be affected by Delfin's Liquefaction Facility, including in the domestic natural gas fields that likely will see increased production as a result of the exports.[117] Specifically, Sierra Club states that, as of April 2014, it had 2,954 members in Louisiana and 632,604 members overall. Sierra Club states that its members have vital economic, aesthetic, spiritual, personal, and professional interests in the proposed Liquefaction Project.[118]

Sierra Club contends that Delfin's requested authorization is not in the public interest and is not supported by adequate environmental and economic analysis, as is required to satisfy the NGA and NEPA.

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[113] *Id*. at 18-19.
[114] *Id*. at 21-22.
[115] *Id*. at 22.
[116] Sierra Club Mot. at 1.
[117] *See id*.
[118] *See id*. at 2.

1. Alleged Scope of Environmental Impact Statement

Sierra Club asserts that DOE/FE cannot proceed with approving exports from Delfin's Liquefaction Facility until the NEPA process is completed and properly considered.[119] Sierra Club states that DOE/FE must prepare a separate EIS if the NEPA analysis prepared by another agency is inadequate to inform DOE/FE's decision or discharge DOE/FE's NEPA obligations.[120]

Sierra Club asserts that DOE/FE must consider Delfin's Project against the backdrop of export applications pending before DOE/FE and those already approved.[121] Specifically, Sierra Club argues that the NGA and NEPA, as well as the Endangered Species Act, require DOE/FE to consider Delfin's Application in the context in which the proposed project will occur.[122] Sierra Club contends that DOE/FE's analysis must not be confined only to the local, direct effects of Delfin's Application, but must also consider the indirect and cumulative effects from Delfin's proposal and all other LNG export proposals currently pending.[123] Sierra Club asserts that this broader backdrop must inform the NEPA alternatives analysis. Additionally, Sierra Club asserts that Delfin's proposal will present novel engineering, logistical, and environmental issues, as no NEPA review has been completed before for an offshore, deepwater LNG export terminal.[124]

Sierra Club maintains that DOE/FE can best conduct this NEPA analysis by preparing a programmatic EIS that considers the cumulative impacts of all potential future exports from the proposed Delfin Liquefaction Facility, plus all other natural gas export proposals currently approved and pending before DOE/FE. In support of this position, Sierra Club argues that DOE/FE can only exclude analysis of an event when it is so remote and speculative as to reduce

[119] *See id*. at 8.
[120] *Id.*
[121] Sierra Club Mot. at 11.
[122] *See id*.
[123] *See id*.
[124] *Id.* at 12.

the effective probability of its occurrence to zero.[125] Sierra Club further states that it would be a mistake to rely on the 2012 NERA Study's prediction of export volumes. The NERA Study, according to Sierra Club, understated the market for likely exports by concluding that exports would only occur when the spread between U.S. gas prices and prices in potential foreign markets exceeded the cost of liquefying, transporting, and re-gasifying domestic production. Sierra Club contends that NERA overstated these transaction costs, particularly the costs of exporting from proposed West Coast terminals, and ignored the ways in which "take-or-pay" contracts are likely to distort the market.[126]

Sierra Club disputes the argument that all proposed projects may not be approved or that not all approved projects will actually be built, stating that these uncertainties do not justify excluding pending proposals from cumulative impacts review. Sierra Club claims that analyzing cumulative impact does not require DOE/FE to assume all proposed projects will be approved; rather, Sierra Club contends, such analysis informs DOE/FE of potential consequences so that DOE/FE can decide whether to approve all projects or only a subset.[127]

Next, Sierra Club argues that NEPA and the NGA require DOE/FE to consider a broad range of alternatives to Delfin's proposed Facility, including but not limited to: whether DOE/FE should allow LNG exports but on a smaller-scale and a slower time-table; whether the source of exported natural gas should be restricted to certain plays, formations, or regions; whether to delay, deny, or condition exports based upon their effect on the U.S. utility market; and whether to deny export proposals altogether as contrary to the public interest.[128]

[125] Sierra Club Mot. at 13 (citations omitted).
[126] *See id*. at 14-15.
[127] *See id*. at 14.
[128] *See id*. at 17-18.

2. Alleged Environmental Impacts from the Requested Authorization

Sierra Club maintains that the construction and operation of Delfin's proposed Liquefaction Facility will have a range of adverse local environmental effects. Sierra Club states that it cannot thoroughly discuss these impacts because their precise nature and extent will depend on the final site design and plan of the Liquefaction Facility (which, at that time, Delfin had not yet provided).[129]

Nevertheless, Sierra Club charges that both construction and operation of the planned Facility will emit harmful quantities of carbon monoxide, nitrogen oxides, volatile organic chemicals, and GHGs, and also will likely emit harmful sulfur dioxides and particulate matter. Sierra Club asserts that each of these types of emissions will have injurious environmental and health impacts. Sierra Club further argues that the proposed Facility's offshore location does not eliminate these local impacts because "air emissions from the offshore are likely to affect onshore air quality."[130]

Addressing local air emissions, Sierra Club charges that both construction and operation of the proposed Terminal will emit harmful quantities of carbon monoxide, nitrogen oxides, volatile organic chemicals, and GHGs, and also will likely emit harmful sulfur dioxides and particulate matter. Sierra Club asserts that each of these types of emissions will have injurious environmental and health impacts.[131]

In addition to air emissions, Sierra Club maintains that the proposed project will likely have deleterious environmental impacts on local water quality, fish and wildlife, and other

[129] *See id*. at 21.
[130] *Id*.
[131] *See* Sierra Club Mot. at 21-25.

environmental resources. Sierra Club states that it intends to submit comments during the NEPA process that will explore these impacts.[132]

Next, Sierra Club argues that the export of additional volumes of LNG from the proposed Liquefaction Facility likely will have environmental impacts greater than the local impacts because the planned exports will induce additional natural gas production in the United States.[133] Sierra Club asserts that these impacts are reasonably foreseeable, and that NEPA and the NGA require DOE/FE to consider the effects of this additional production. Sierra Club points out that the EIA Study concluded that roughly 63 percent of natural gas demand created by exports will be met with new production. In the context of this proceeding, Sierra Club states that this data equates to an additional 1.25 Bcf/d of natural gas production.[134] Sierra Club further argues that Delfin relies upon a report by ICF International concluding that up to 88 percent of LNG export volumes will be offset by increasing natural gas production.[135]

Sierra Club observes that Delfin does not dispute that additional natural gas production will result from the proposed exports. Sierra Club maintains that available tools enable DOE/FE to predict where this increased production will occur, specifically citing the NEMS model employed by EIA in the EIA Study. Sierra Club states that a model employed by Deloitte Marketpoint is also capable of identifying the geographic region in which additional production will occur.[136]

Sierra Club asserts that much of the induced production will come from shale gas and other unconventional sources, citing the EIA Study for EIA's projection that 72 percent of the

[132] *See id*. at 25.
[133] *See id*.
[134] *See id*. at 26.
[135] *See id*. at 25.
[136] *See id*. at 28-29.

increased production will come from shale gas, 13 percent from tight gas, and 8 percent from coalbed sources.[137]

Sierra Club states that air pollution is emitted during all stages of natural gas production. Sierra Club claims that natural gas production operations emit methane (CH4), volatile organic compounds (VOCs), nitrogen oxides (NOx), sulfur dioxide (SO_2), hydrogen sulfide, particulate matter (PM), and significant quantities of hazardous air pollutants (HAPs) that contribute to cancer risks and other acute public health problems.[138]

Sierra Club asserts that methane is the dominant pollutant from the oil and gas sector, and that EPA has identified natural gas systems as the largest contributor to anthropogenic methane emissions in the United States. Sierra Club argues that methane is a potent greenhouse gas that substantially contributes to global climate change.

Sierra Club states that the natural gas industry is also a major source of VOCs and NOx. Sierra Club asserts that, as a result of significant VOC and NOx emissions associated with oil and gas development, numerous areas of the country with heavy concentrations of drilling are now suffering from serious ozone problems. Sierra Club identifies the Dallas-Fort Worth area in Texas, the Wyoming Upper Green River Basin, and the Uintah Basin in Northeastern Utah in particular as ozone non-attainment areas where there is a significant concentration of oil and gas production activities. As another example, Sierra Club states that, in 2008, the Colorado Department of Public Health and Environment concluded that the smog-forming emissions from oil and gas operations exceeded vehicle emissions for the entire state. According to Sierra Club, significant development in the San Juan Basin in southeastern Colorado and northwestern New Mexico, in combination with several coal-fired power plants in the vicinity, has caused serious

[137] *See id*. at 32 n.85 (citing 2012 EIA Study at 11).
[138] *See* Sierra Club Mot. at 32.

ozone pollution, which in turn has increased emergency room visits associated with high ozone levels. Sierra Club states that emissions from oil and natural gas development are also harming air quality in national parks and wilderness areas. Sierra Club asserts that as oil and gas development moves into new areas, particularly as a result of the boom in shale resources, ozone problems are likely to follow. Moreover, Sierra Club charges that VOCs are likely to be co-emitted with HAPs (such as benzene) which are carcinogenic and endocrine disrupters.[139]

Sierra Club argues that oil and gas production also emits sulfur dioxide, primarily from natural gas processing plants, and that some natural gas in the United States contains hydrogen sulfide. Sierra Club reports that EPA has concluded that the potential for hydrogen sulfide emissions from the oil and gas industry is "significant."[140] According to Sierra Club, hydrogen sulfide can be emitted during all stages of development, including exploration, extraction, treatment and storage, transportation, and refining. Sierra Club asserts that, although direct monitoring of hydrogen sulfide emissions is limited, there is evidence that these emissions may be substantial. Sierra Club states that people living near gas wells that have been exposed to hydrogen sulfide have reported eye, nose, and throat irritation, nose bleeds, dizziness, and headaches. Although hydrogen sulfide was originally included in the Clean Air Act's list of hazardous air pollutants, Sierra Club acknowledges that it has since been removed from the list, but disputes that the removal was appropriate.[141]

Sierra Club states that the oil and gas industry is also a major source of PM pollution, which is generated by heavy equipment used to move and level earth during well pad and road construction. According to Sierra Club, PM emissions from the oil and gas industry are leading

[139] *See id*. at 38-41.
[140] *Id*. at 43 (citation omitted).
[141] *See id*. at 43 & n.152.

to significant pollution problems. For example, according to Sierra Club, monitors in Uintah and Duchesne Counties in Utah have repeatedly measured wintertime PM concentrations above federal standards. Sierra Club maintains that these elevated levels of PM have been linked to oil and gas activities in the Uinta Basin.[142]

Focusing on Delfin LNG's requested authorization, Sierra Club argues that the proposed Project will induce significant production-related air emissions. Specifically, Sierra Club asserts that Delfin LNG's proposed exports will induce approximately 723.25 Bcf/yr of new natural gas demand, which will amount to 455.65 Bcf/yr in new natural gas production. Assuming a 1.0 percent leak rate, this new natural gas demand allegedly will be responsible for the incremental emission of 94,775 tons per year of methane, 13,828 tpy of VOCs, and 1,005 tpy of HAPs.[143]

Next, Sierra Club states that increased natural gas production will transform the landscape of regions overlying shale gas plays, bringing industrialization to previously rural landscapes and significantly affecting ecosystems, plants, and animals. According to Sierra Club, land use disturbance associated with natural gas development impacts plants and animals through direct habitat loss (where land is cleared for natural gas uses) and indirect habitat loss (where adjacent land loses some of its important characteristics).[144]

Sierra Club argues that natural gas production also poses risks to ground and surface water. Sierra Club notes that most of the increased production will involve hydraulic fracturing, a process of injecting various chemicals into gas-bearing formations at high pressures to fracture rock and release natural gas. According to Sierra Club, each step of this process presents a risk to water resources. Sierra Club states that hydraulic fracturing requires large quantities of water

[142] *See id*. at 44.
[143] *See id*. at 45 & Table 1.
[144] *See id*. at 46.

and that the large water withdrawals could drastically impact aquatic ecosystems and human communities. Sierra Club also contends that hydraulic fracturing poses a serious risk of groundwater contamination from the chemicals added to the drilling mud and fracturing fluid and from naturally occurring chemicals in deeper formations mobilized during the hydraulic fracturing process. Sierra Club asserts that contamination can occur through several methods, including where the well casing fails or where the fractures created through drilling intersect an existing, poorly sealed well. Sierra Club asserts that hydraulic fracturing has resulted in groundwater contamination in at least five documented instances. According to Sierra Club, EPA has investigated groundwater contamination likely resulting from hydraulic fracturing in Pavillion, Wyoming, and Dimock, Pennsylvania, concluding that surface pits previously used for storage of drilling wastes and produced/flowback waters were a likely source of contamination for shallower waters, while hydraulic fracturing likely explained deeper contamination.[145]

Sierra Club states that natural gas production, particularly hydraulic fracturing, produces liquid and solid wastes, including drilling mud, drill cuttings, "flowback" (the fracturing fluid that returns to the surface after the hydraulic fracturing is completed), and produced water (a mixture of water naturally occurring in the shale formation and lingering fracturing fluid). Sierra Club argues that these wastes must be managed and disposed. Sierra Club states that drilling mud, drill cuttings, flowback, and produced water are often stored on site in open pits that can have harmful air emissions, can leach into shallow groundwater, and can fail and result in surface discharges. Sierra Club also notes that flowback and produced water must be disposed offsite, with a common method being underground injection wells. Sierra Club claims that

[145] *See* Sierra Club Mot. at 49-53.

underground injection of hydraulic fracturing wastewater appears to have induced earthquakes in several regions—a phenomenon known as induced seismicity.[146]

Sierra Club states that, in addition to the above-described production-related impacts, Delfin's export proposal will increase air pollution by increasing the amount of coal used for domestic electricity production. Citing the 2012 EIA Study, Sierra Club states that exports will cause natural gas prices to rise, leading to increased electricity generation from coal. Specifically, Sierra Club maintains that EIA projected that 72 percent of the decrease in natural gas-fired electricity production due to gas exports will be replaced by coal-fired production, which, according to Sierra Club, will increase emissions of both traditional air pollutants and greenhouse gases.[147] Sierra Club urges DOE/FE to take a hard look at the change in domestic GHG emissions that would result.[148]

Additionally, Sierra Club argues that LNG exports will increase greenhouse gas emissions not only domestically but also internationally. Sierra Club contends that a recent study by the International Energy Agency predicts that international trade in LNG will lead many countries to use natural gas in place of renewable energy (instead of displacing fossil fuels), and to increase their levels of energy consumption.[149] Additionally, Sierra Club claims that the liquefaction, transportation, and regasification process is energy intensive and increases the lifecycle GHG emissions of LNG compared to methods of consumption where the natural gas remains in a gaseous phase. Sierra Club argues that, for these reasons, LNG has little, if any, advantage over coal, and thus it is unlikely LNG exports would reduce global GHG emissions. Moreover, even if imported LNG were to displace other fossil fuels, Sierra Club asserts that the

[146] *See id*. at 54-56.
[147] *See id*. at 57.
[148] *See id*. at 58.
[149] *See id*. at 59.

resulting reductions will be much less than those needed to stabilize atmospheric GHG emissions below a "catastrophic level."[150] Sierra Club contends that DOE/FE must investigate policy options that would encourage the emissions reductions necessary to avert climate disaster.[151]

3. Alleged Economic Impacts from the Requested Authorization

Addressing economic consequences, Sierra Club broadly contends that LNG exports will increase domestic natural gas prices which, in turn, "will harm the majority of the American public by decreasing real wages and reducing employment in energy-intensive industries."[152]

Sierra Club asserts that the both the 2012 EIA and NERA Studies understate the extent to which prices for natural gas will increase in response to LNG exports.[153] According to Sierra Club, these Studies suffer from three flaws. First, Sierra Club alleges neither Study considers the full volume of exports that are proposed. Second, the NERA Study allegedly understates the likelihood of any particular volume of exports occurring by failing to account for the effect of sunk costs in export agreements and by overstating the cost of LNG transport. Third, Sierra Club states that the 2012 EIA and NERA Studies understate the rate at which LNG exports may be phased in, and as such, they fail to address the potential for price spikes.[154]

Sierra Club maintains that DOE/FE must look at the effect "given price increases" will have on the public generally.[155] Sierra Club argues that exports will cause domestic price increases for natural gas, resulting in a decline of employment in manufacturing while consumers allegedly will face higher total natural gas bills despite using less natural gas.[156]

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[150] Sierra Club Mot. at 62.
[151] *See id*.
[152] *Id*. at 63.
[153] *See id*. at 16.
[154] *See id*. at 63-64.
[155] Sierra Club Mot. at 66.
[156] *See id*.

Sierra Club next contends that the proposed Liquefaction Facility will harm U.S. workers and the domestic economy. Sierra Club maintains that the available evidence, including the NERA Study, indicates that the proposed exports will decrease wages and make most U.S. families worse off financially—particularly given the expected job losses in energy intensive industries.[157] Even in regions where exports spur additional natural gas production, Sierra Club contends that the resulting temporary growth in jobs likely will lead to long-term economic decline, as the regions suffer from the "resource curse" and" boom-bust" cycle that plague extractive economies. Moreover, Sierra Club contends that LNG exports will promote a regressive transfer of wealth, from wage earning households to shareholders in the natural gas industry.[158]

For these reasons, Sierra Club contends that DOE/FE cannot rely on the 2012 NERA Study's broad conclusion that the United States will experience net economic benefits from LNG exports. Sierra Club states that this conclusion rests on a forecast of net GDP growth. Sierra Club submits that other economic studies—such as a working paper prepared by Purdue University economists Kemal Sarica and Wallace E. Tyner—found that exports would cause a net reduction in GDP.[159] Sierra Club also maintains that the NERA Study excluded certain factors that would drive down GDP. These excluded factors, according to Sierra Club, include the environmental impacts (and associated costs) of natural gas production, processing, and liquefaction. Sierra Club claims that the economic costs of environmental harm erodes the net benefit that NERA predicts, even if such costs can be difficult to monetize. [160]

[157] *See id*. at 66.
[158] *See id*. at 66-69.
[159] *See id*. at 70 & n.277.
[160] *See id*. at 70-71.

In sum, Sierra Club asserts that DOE/FE cannot rationally approve the Application based on the record before it. If DOE/FE nonetheless approves the Application, Sierra Club argues that DOE/FE must impose rigorous monitoring conditions, to include monitoring of regional and national economic dislocations and disruptions caused by natural gas extraction, national increases in natural gas and electricity prices (and resulting shifts to more polluting fuels), and related environmental impacts.[161]

F. Delfin's Consolidated Response

On June 11, 2014, Delfin filed a consolidated response (Response) to the comments and protests submitted by Sierra Club, APGA, V4EI, and API. Delfin notes that API fully supports Delfin's Project. Delfin states that Sierra Club, APGA, and V4EI oppose the Project, not based on any specific features of the Project but rather based on their general opposition to LNG exports and, in the case of Sierra Club, to increased natural gas production. Delfin asserts that these protests focus largely on matters beyond the scope of the issues to be resolved by DOE/FE in this proceeding, and ultimately fail to overcome the presumption that Delfin's proposed LNG exports are in the public interest.

1. Protestors' Interests are Insufficient to Justify Intervention

Delfin argues that the protestors' interests are insufficient to justify intervention in this proceeding. According to Delfin, the motions filed by Sierra Club, APGA, and V4EI contain only generalized statements of interest that fail to justify their interventions in this proceeding. Delfin states that, although Sierra Club claims a portion of its members live and work in the State of Louisiana, neither APGA nor V4EI specify any specific interest in Delfin's proposed Liquefaction Facility. Delfin contends that none of the interests expressed by the protestors are

[161] *See id*. at 71-73.

sufficiently particularized to Delfin's Project to create a legally cognizable right that warrants granting intervention. Delfin further contends that the protestors appear to have only general opposition to all liquefaction and export of U.S. natural gas, no matter the geography, design, or other facts in any one proceeding. Delfin argues that, for these reasons, DOE/FE should deny these motions to intervene.

2. Delfin's Proposed Exports Are Consistent with the Public Interest

Delfin argues the protestors' claims fail to provide any basis to conclude Delfin's proposed exports would be inconsistent with the public interest. Delfin states that, pursuant to Section 3(a) of the NGA, DOE/FE "shall issue" an order authorizing natural gas exports unless it finds that the proposed exportation "will not be consistent with the public interest."[162] Delfin contends that, to overcome this rebuttable presumption, an opponent must affirmatively demonstrate that the proposal is inconsistent with the public interest. Delfin asserts that the protests focus on issues that are common to all LNG export projects, and that neither Sierra Club nor APGA have advanced any new or Delfin-specific arguments. Instead, Delfin asserts these protestors "have simply regurgitated their familiar arguments that have been repeatedly rejected by DOE/FE."[163] Delfin asserts V4EI similarly raises generic policy arguments.

Delfin also urges DOE/FE to reject the protestors' challenge to Delfin's evidence that the Liquefaction Facility will generate economic benefits for the United States. Delfin asserts that the evidence in the record shows that U.S. LNG exports will provide net economic benefits to the United States, despite protestors' general claims that LNG exports will not result in economic benefits.

[162] Delfin Response at 11.
[163] *Id.*

Delfin also contends that LNG exports will have only a modest impact on natural gas prices, and argues that DOE/FE has repeatedly rejected the protestors' claims that the 2012 LNG Export Study is unreliable. Delfin points out that DOE/FE has verified the soundness of the 2012 LNG Export Study, and that other independent analyses of the impact of LNG exports on domestic natural gas prices have found very modest price effects. Delfin states that the 2013 and 2014 Annual Energy Outlooks and the 2014 NERA study all conclude that current projections of domestic supply and demand conditions are more, not less, favorable to LNG exports than previously thought. Delfin also asserts that any modest price increases from current low price levels would still leave natural gas prices lower than they have been historically, and would only serve to bring the U.S. natural gas markets back into equilibrium.

Delfin rejects APGA's argument that the United States cannot tolerate a high volume of LNG exports, based on the total volume of LNG exports requested in pending applications to DOE/FE. Delfin states that, in reality, the number of LNG export applications has very little bearing on the economic impact of LNG exports, due to the significant expenses and regulatory barriers involved in exporting LNG.

Delfin concludes that the flaws in the protestors' economic arguments are evident because they could be applied regardless of the source of new natural gas demand—foreign or domestic, LNG-related or not. Delfin asserts that the protestors' argument is that LNG exports are contrary to the public interest simply because they will increase the demand for natural gas. Delfin urges DOE/FE to reject this argument, as it has to date.

3. Sierra Club's NEPA Arguments Are Inapplicable

Delfin urges DOE/FE to reject Sierra Club's arguments outright, stating that Sierra Club's comments are essentially identical to comments Sierra Club has filed in virtually every

LNG export proceeding, as well as in numerous other natural gas infrastructure cases. More specifically, Delfin argues that a generalized consideration of shale well drilling techniques is not required by NEPA because it is not a reasonably foreseeable or causally related action, among other reasons. Delfin also contends that its Facility will be unique (as compared to onshore LNG terminals) in that it will not require significant disturbance of land, will maximize use of existing infrastructure, and will rely on existing processing facilities currently underutilized—rendering Sierra Club's environmental arguments even less applicable to this proceeding.

Delfin asserts that DOE/FE should reject Sierra Club's NEPA arguments because such matters are not presently before DOE. Delfin states that MARAD and USCG have exclusive jurisdiction over the siting, construction, and operation of Delfin's Project, and are the lead agencies for purposes of conducting the environmental analysis required here by NEPA. Delfin states that while it anticipates DOE/FE will participate as a cooperating agency, Sierra Club's NEPA arguments, including its call for a programmatic EIS, are being made prematurely and before the wrong agency.

Delfin also argues that NEPA does not require consideration of upstream shale gas development. Delfin states that DOE/FE has already held that shale well development effects are not required to be considered under NEPA for LNG export projects, and argues such development is not a "reasonably foreseeable" effect of Delfin's proposed exports. Delfin also notes that DOE/FE, FERC, and the courts have consistently rejected Sierra Club's arguments in this regard.

4. U.S. Geopolitical Interests Will Be Advanced

Delfin rejects V4EI's claims that its proposed exports pose a threat to U.S. security and will increase the likelihood of military conflict globally. Delfin contends that V4EI's claims that

exports of LNG from Delfin's proposed Facility would increase the potential for armed conflict are flatly untrue and have been rejected by relevant experts. To the contrary, Delfin argues, the proposed exports will provide significant geopolitical benefits to the United States, its allies, and its trading partners, as DOE/FE has found in other LNG export orders. Additionally, Delfin argues that APGA's desire to put foreign trade last is contrary to U.S. geopolitical interests. According to Delfin, APGA seeks to invoke a protectionist policy that will harm all U.S. businesses who participate in the global marketplace, including manufacturers.

G. Sierra Club's Renewed Motion to Reply and Reply

Sierra Club filed a Renewed Motion to Reply and Reply on June 27, 2014. Sierra Club contends that the public interest test set forth in NGA section 3(a) requires DOE/FE to conduct a "searching" public interest inquiry that fully considers Sierra Club's environmental arguments.[164] Sierra Club maintains that Delfin's Answer to the Protests misstates important questions of fact and law that bear on the public interest, and Sierra Club should therefore be granted leave to reply.

Sierra Club agrees with Delfin's contention that some of the issues raised by Sierra Club in this proceeding are similar to those it has raised in other proceedings, but states that Delfin's proposed exports will cause "additional, marginal injuries" to Sierra Club's members.[165] Sierra Club maintains that these additional injuries, combined with Sierra Club's desire to preserve its right to seek judicial review, justifies its ability to intervene here.

Sierra Club reasserts the position set forth in its motion that DOE/FE must consider environmental impacts, including induced production of natural gas. Sierra Club argues that DOE/FE must act to prevent environmental harm associated with induced natural gas production

[164] Sierra Club Renewed Mot. at 1.
[165] *Id*. at 2.

because DOE/FE has the authority and duty to consider environmental impacts in its public interest analysis.

Next, Sierra Club rejects Delfin's argument that projected demands from its proposed exports are not "sufficiently foreseeable." Sierra Club asserts that Delfin does not acknowledge that EIA's NEMS model, among other tools, can predict where natural gas production will increase in response to Delfin's natural gas demand. Sierra Club further contends that DOE/FE must quantify the increase in greenhouse gas (GHG) emissions that would result from the proposed Liquefaction Facility, including emissions from natural gas production induced from Delfin's exports.[166]

Finally, Sierra Club reiterates its arguments that the 2012 LNG Export Study understates the likely economic impacts of LNG exports, including domestic price impacts to natural gas. For these reasons, Sierra Club contends that DOE/FE cannot reach a public interest determination, or take any action, without a NEPA analysis that considers induced natural gas production associated with this Project.

VII. DOE/FE'S LNG EXPORT STUDIES

A. 2012 LNG Export Study

On May 20, 2011, DOE/FE issued Order No. 2961, DOE/FE's first order conditionally granting a long-term authorization to export LNG produced in the lower-48 states to non-FTA countries.[167] By August 2011, with several other non-FTA export applications then pending before it, DOE/FE determined that further study of the economic impacts of LNG exports was

[166] *See id*. at 5.
[167] *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961, FE Docket No. 10-111-LNG, Opinion and Order Conditionally Granting Long-Term Authorization to Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations (May 20, 2011).

warranted to better inform its public interest review under section 3 of the NGA.[168] Accordingly, DOE/FE engaged EIA and NERA Economic Consulting to conduct a two-part study of the economic impacts of LNG exports.[169]

First, in August 2011, DOE/FE requested that EIA assess how prescribed levels of natural gas exports above baseline cases could affect domestic energy markets. Using its National Energy Modeling System (NEMS), EIA examined the impact of two DOE/FE-prescribed levels of assumed LNG exports—equivalent to 6 Bcf/d and 12 Bcf/d of natural gas—under numerous scenarios and cases based on projections from EIA's 2011 *Annual Energy Outlook* (AEO 2011), the most recent EIA projections available at that time.[170] The new scenarios and cases examined by EIA included a variety of supply, demand, and price outlooks. EIA published its study, *Effect of Increased Natural Gas Exports on Domestic Energy Markets*, in January 2012.[171] EIA generally found that LNG exports will lead to higher domestic natural gas prices, increased domestic natural gas production, reduced domestic natural gas consumption, and increased natural gas imports from Canada via pipeline.

Second, DOE contracted with NERA to assess the potential macroeconomic impact of LNG exports by incorporating EIA's then-forthcoming case study output from the NEMS model into NERA's general equilibrium model of the U.S. economy. NERA analyzed the potential macroeconomic impacts of LNG exports under a range of global natural gas supply and demand scenarios, including scenarios with unlimited LNG exports. DOE published the NERA Study,

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[168] DOE/FE stated in *Sabine Pass* that it "will evaluate the cumulative impact of the [Sabine Pass] authorization and any future authorizations for export authority when considering any subsequent application for such authority." *Id*. at 33.

[169] *See* 2012 LNG Export Study, 77 Fed. Reg. 73,627 (Dec. 11, 2012), *available at*: http://energy.gov/sites/prod/files/2013/04/f0/fr_notice_two_part_study.pdf (Notice of Availability of the LNG Export Study).

[170] The Annual Energy Outlook (AEO) presents long-term projections of energy supply, demand, and prices. It is based on results from EIA's NEMS model.

[171] *See* LNG Export Study – Related Documents, *available at*: http://energy.gov/fe/downloads/lng-export-study-related-documents (EIA Analysis (Study - Part 1)).

Macroeconomic Impacts of LNG Exports from the United States, in December 2012 (NERA Study). Among its key findings, NERA projected that the United States would gain net economic benefits from allowing LNG exports. For every market scenario examined, net economic benefits increased as the level of LNG exports increased.

In December 2012, DOE/FE published a Notice of Availability (NOA) of the EIA and NERA studies (collectively, the 2012 LNG Export Study or Study).[172] DOE/FE invited public comment on the Study, and stated that its disposition of the then-pending non-FTA LNG export applications would be informed by the Study and the comments received in response thereto.[173] DOE/FE received over 188,000 initial comments and over 2,700 reply comments, of which approximately 800 were unique.[174] The comments were posted on the DOE/FE website and entered into the public records of the 15 LNG export proceedings identified in the NOA.[175] DOE/FE responded to those public comments in connection with the LNG export proceedings identified in the NOA.[176]

B. 2014 EIA LNG Export Study, *Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets*

1. Methodology

DOE/FE asked EIA to evaluate the impact of increased natural gas demand, reflecting possible exports of U.S. natural gas, on domestic energy markets using the modeling analysis presented in AEO 2014 as a starting point. DOE/FE requested an assessment of how specified

[172] 77 Fed. Reg. at 73,627.
[173] *Id*. at 73,628.
[174] Because many comments were nearly identical form letters, DOE/FE organized the initial comments into 399 docket entries, and the reply comments into 375 entries. *See* http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/export_study_initial_comments.html (Initial Comments – LNG Export Study) & http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/export_study_reply_comments.html (Reply Comments – LNG Export Study).
[175] *See* 77 Fed. Reg. at 73,629 & n.4.
[176] *See, e.g.*, *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 3792, at 66-121 (Mar. 11, 2016).

scenarios of increased exports of LNG from the lower-48 states could affect domestic energy markets, focusing on consumption, production, and prices. At DOE/FE's request, EIA assumed three LNG export scenarios, including exports of:

- 12 Bcf/d, phased in at a rate of 2 Bcf/d each year beginning in 2015;
- 16 Bcf/d, phased in at a rate of 2 Bcf/d each year beginning in 2015; and
- 20 Bcf/d, phased in at a rate of 2 Bcf/d each year beginning in 2015.

EIA noted that the ramp-up specified by DOE/FE for these scenarios is extremely aggressive and intended to provide results that show an outer envelope of domestic production and consumption responses that might follow from the approval of exports beyond 12 Bcf/d. Accordingly, EIA also included a 20 Bcf/d export scenario, applied to the AEO 2014 Reference case, with a delayed ramp-up to identify the impact of higher LNG exports implemented at a slower pace, referred to as the "Alt 20 Bcf/d scenario."

DOE/FE requested that EIA consider the above scenarios in the context of baseline cases from EIA's AEO 2014. These five cases are:

- The AEO 2014 Reference case;
- The High Oil and Gas Resource (HOGR) case, which reflects more optimistic assumptions about domestic natural gas supply than the Reference case;
- The Low Oil and Gas Resource (LOGR) case, which reflects less optimistic assumptions about domestic oil and natural gas supply than the Reference case;
- The High Economic Growth (HEG) case, in which the U.S. gross domestic product grows at an average annual rate 0.4 percentage points higher than in the Reference case, resulting in higher domestic energy demand; and
- The Accelerated Coal and Nuclear Retirements (ACNR) case, in which higher costs for running existing coal and nuclear plants result in accelerated capacity retirements and greater reliance on natural gas to fuel electricity generation than in the Reference case.

Taken together, the four scenarios and five cases presented 16 case scenarios:

Table 1: Case Scenarios Considered By EIA in Analyzing Impacts of LNG Exports

	AEO 2014 Cases	Export Scenarios
1	Reference	12 Bcf/d
2	Reference	16 Bcf/d
3	Reference	20 Bcf/d
4	Reference	Alt 20 Bcf/d
5	HOGR	12 Bcf/d
6	HOGR	16 Bcf/d
7	HOGR	20 Bcf/d
8	LOGR	12 Bcf/d
9	LOGR	16 Bcf/d
10	LOGR	20 Bcf/d
11	HEG	12 Bcf/d
12	HEG	16 Bcf/d
13	HEG	20 Bcf/d
14	ACNR	12 Bcf/d
15	ACNR	16 Bcf/d
16	ACNR	20 Bcf/d

EIA used the five AEO 2014 cases described above as the starting point for its analysis and made several changes to represent the export scenarios specified in the study request. EIA exogenously added LNG exports from the lower-48 states in its model runs, using the NEMS model, to reach the targeted LNG export levels.

The Mid-Atlantic and South Atlantic regions were each assumed to host 1 Bcf/d of LNG export capacity, the Pacific region was assumed to host 2 Bcf/d, with all of the remaining Lower 48 states' export capacity hosted along the Gulf Coast in the West South Central Census division. In addition to the volume of natural gas needed to satisfy the levels of LNG exports defined in the scenarios, a supplemental volume of gas is required in order to liquefy natural gas for export as LNG. EIA assumed that this volume would equal 10 percent of the LNG export volume. The additional natural gas consumed during the liquefaction process is counted as fuel use within the U.S. region where liquefaction occurs.

As in AEO 2014, U.S. natural gas pipeline imports and exports and U.S. LNG imports are endogenously determined in the model. However, LNG exports out of Alaska were set exogenously to the projected level from the corresponding baseline cases.

One further modeling change was applied only in export scenario runs using the Accelerated Coal and Nuclear Retirements case. This case was included in the Study to reflect a baseline with high use of natural gas and low use of coal for electricity generation that is driven by factors other than favorable natural gas supply conditions and low natural gas prices, which are considered in the High Oil and Gas Resource case. In order to represent a situation in which increased coal generation is not an available response to higher domestic natural gas prices, coal-fired generation was not allowed to rise above the Accelerated Coal and Nuclear Retirements baseline level when the DOE/FE export scenarios were implemented.

2. Scope of EIA Study

The EIA Study recognizes that projections of energy markets over a 25-year period are highly uncertain, and that many events—such as supply disruptions, policy changes, and technological breakthroughs—cannot be foreseen. Other acknowledged limitations on the scope of the EIA Study include:

- NEMS is not a world energy model and does not address the interaction between the potential for additional U.S. natural gas exports and developments in world natural gas markets;

- Global natural gas markets are not fully integrated, and their nature could change substantially in response to significant changes in natural gas trading patterns. Future opportunities to profitably export natural gas from the United States depend on the future of global natural gas markets, the inclusion of relevant terms in specific contracts to export natural gas, and the assumptions in the various cases analyzed;

- Given its focus on the domestic energy system, NEMS does not fully account for interactions between energy prices and the global economy that could benefit the U.S. economy; and

- Measures of domestic industrial activity in NEMS are sensitive to both the composition of final U.S. demand and changes in domestic energy prices. However, NEMS does not account for the impact of domestic and global energy price changes on the global utilization pattern for existing manufacturing capacity or the siting of new capacity inside or outside of the United States in energy-intensive industries.

3. Results of the 2014 EIA LNG Export Study

EIA generally found that LNG exports will lead to higher domestic natural gas prices, increased domestic natural gas production, reduced domestic natural gas consumption, and higher levels of economic output (as measured by real gross domestic product or GDP). The impacts of exports, according to EIA, are as follows:

Increased natural gas prices. EIA stated that larger export levels would lead to larger domestic price increases. Percentage changes in delivered natural gas prices would be lower than percentage changes in producer prices, particularly for residential and commercial customers.

Increased natural gas production and supply. Increased exports would result in increased natural gas production that would satisfy 61 to 84 percent of the increase in natural gas exports, with a minor additional contribution from increased imports from Canada. Across most cases, EIA states that about three-quarters of this increased production would come from shale sources.

Decreased natural gas consumption. Due to higher prices, EIA projects a decrease in the volume of natural gas consumed domestically. EIA states that the electric power generation mix would shift toward other generation sources, including coal and renewable fuels. EIA indicates that there also would be a small reduction in natural gas use in all sectors from efficiency improvements and conservation.

Increased levels of GDP. EIA states that increased energy production would spur investment, which would more than offset the adverse impact of somewhat higher energy prices. GDP increases would range from 0.05 to 0.17 percent and generally increase with the amount of added LNG exports.

4. Increased Natural Gas Prices

EIA found that natural gas prices would increase generally across all of the export scenarios, with the greatest impact during the first 10 years when LNG exports are ramping up. The smallest price change over the baseline occurs in the High Oil and Gas Resource case. The Low Oil and Gas Resource case yields the largest price response.

EIA notes that the percentage changes in producer natural gas prices and delivered prices to customers compared to the AEO 2014 Reference case baseline would vary, but would be relatively modest. Prices paid to producers would increase from 4 to 11 percent under the 12 and 20 Bcf/d scenario, respectively, while prices paid by residential customers would rise even less—from 2 to 5 percent under the 12 and 20 Bcf/d scenarios.

5. Increased Natural Gas Production and Supply

EIA projected that most of the additional natural gas needed for export would be provided by increased domestic production with a minor contribution from increased pipeline imports from Canada. The remaining portion of the increased export volumes would be offset by decreases in consumption resulting from higher prices associated with the increased exports.

6. Decreased Domestic Natural Gas Consumption

EIA projected that greater export levels would lead to decreases in domestic natural gas consumption. This decrease would occur largely within the electric power sector. EIA projected that over the 2015-40 period, the decline in natural gas consumption from electric power

generators, on average, contributes from 10 to 18 percent to the levels of natural gas needed for the increased LNG export demands, across all cases and scenarios. The Study noted that the trade-off in natural gas-fired generation and generation from competing fuels varies depending on the case, and generally depends on the generation fuel mix in the base scenarios.

7. Energy-Related Carbon Dioxide Emissions

EIA projected that the use of natural gas to provide energy for added liquefaction, combined with the displacement of natural gas by more carbon-intensive fuels in end-use sectors, causes an increase in U.S. CO_2 emissions over the analysis period in most pairings of export scenarios and baselines. The Study noted that the increased use of coal in the electric power sector and the increased use of liquids in the industrial sector generally result in a net increase in CO_2 emissions. The Study also noted that, despite the CO_2 emission increases projected in the LNG export scenarios, energy-related CO_2 emissions remain below the 2005 level in each year of the projection period across all pairings of scenarios and baselines.

EIA's analysis did not include the U.S. Environmental Protection Agency's (EPA) Transport Rule,[177] as it had been vacated at the time, or other proposed EPA rulemakings.[178] EIA also did not analyze global CO_2 emissions or life cycle emissions. DOE looked at these latter issues in a separate analysis—the LCA GHG Report, discussed below in Section IX.

8. Increased End-User Natural Gas and Electricity Delivered Prices

EIA projected increased total end-use energy expenditures across the range of LNG export scenarios and baselines. Implementation of the 12 Bcf/d scenario under Reference case conditions is projected to increase total end-use energy expenditures by $9 billion per year, or

[177] U.S. Envtl. Prot. Agency, Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals; Final Rule, 76 Fed. Reg. 48,208 (Aug. 8, 2011).
[178] Legislation and regulations assumed for the 2014 Annual Energy Outlook and 2014 EIA Study are available at http://www.eia.gov/forecasts/archive/aeo14/section_legs_regs.cfm.

0.6 percent on average, from 2015-2040. For the 20 Bcf/d scenario, total end-use energy expenditures are projected to rise by $18 billion per year, or 1.3 percent on average, from 2015 to 2040. EIA projected that increased end-use expenditures on natural gas account for one-third of additional expenditures.

9. Increased Gross Domestic Product

EIA projected that increased LNG exports leads to higher economic output, as measured by real GDP, as increased energy production spurs investment. This higher economic output is enough to overcome the negative impact of higher domestic energy prices over the projection period. EIA projected that implementing the export scenarios specified for this Study increased GDP by 0.05 to 0.2 percent over the 2015-2040 period depending on the export scenario. The GDP gains from increasing LNG exports are positive across all cases, although relatively modest.

C. 2015 LNG Export Study, *The Macroeconomic Impact of Increasing U.S. LNG Exports*

The Center for Energy Studies at Rice University's Baker Institute and Oxford Economics (hereinafter, Rice-Oxford) were commissioned by Leonardo Technologies, Inc. (LTI) on behalf of DOE/FE to undertake a scenario-based assessment of the macroeconomic impact of alternative levels of U.S. LNG exports under a range of assumptions concerning U.S. resource endowment, U.S. natural gas demand, and the international market environment—referred to herein as the 2015 Study.

1. Overview of Rice-Oxford's Findings in the 2015 Study

The key findings of the 2015 Study include the following:

Rising LNG exports are associated with a net increase in domestic natural gas production. The 2015 Study finds that the majority of the increase in LNG exports is accommodated by expanded domestic production rather than reductions in domestic demand.

As exports increase, the spread between U.S. domestic prices and international benchmarks narrows. In every case, greater LNG exports raise domestic prices and lower prices internationally. The majority of the price movement (in absolute terms) occurs in Asia.

The overall macroeconomic impacts of higher LNG exports are marginally positive, a result that is robust to alternative assumptions for the U.S. natural gas market. With external demand for U.S. LNG exports at 20 Bcf/d, the impact of increasing exports from 12 Bcf/d is 0.03 percent of GDP over the period of 2026–2040, or $7 billion annually in constant 2015 dollars. In the high resource recovery (LNG20_HRR) case where U.S. LNG exports reach a volume of 28 Bcf/d, the impact of increasing exports from 12 Bcf/d is 0.07 percent of GDP over the period 2026-2040, or $20 billion annually in constant 2015 dollars.

An increase in LNG exports from the United States will generate small declines in output at the margin for some energy-intensive, trade-exposed industries. The sectors that appear most exposed are cement, concrete, and glass, but the estimated impact on sector output is very small compared to expected sector growth to 2040.

Negative impacts in energy-intensive sectors are offset by positive impacts elsewhere. Other industries benefit from increasing U.S. LNG exports, especially those that supply the natural gas sector or benefit from the capital expenditures needed to increase production. This includes some energy-intensive sectors and helps offset some of the impact of higher energy prices.

2. Methodology

Rice-Oxford's analysis in the 2015 Study used a highly specialized, multi-stage modeling approach. First, the Rice World Gas Trade Model (RWGTM) was used to simulate various alternative futures for the global natural gas market.[179] These output data were input into the Oxford Economics Global Economic Model (GEM) and Global Industry Model (GIM) to simulate broad macroeconomic and sectors impacts of the various alternative paths for the global natural gas market.

According to Rice-Oxford, the 2015 Study analyzed a wide range of scenarios in order to establish conclusions that are not dependent on any particular set of starting conditions for the U.S. or international natural gas markets. The scenario assumptions fall along two core dimensions. In one dimension, Rice-Oxford considered different U.S. domestic market conditions regarding resources and domestic demand. In the other dimension, Rice-Oxford considered specific circumstances that result in different international demand pull for U.S.-sourced LNG for each domestic scenario. The domestic scenarios were:

- Reference domestic case;
- High Resource Recovery (HRR) case, which reflects a higher level of recoverable resource in the United States;
- Low Resource Recovery (LRR) case, which reflects a lower level of recoverable resource in the United States; and
- High Natural Gas Demand (Hi-D) case, which reflects a higher level of demand in the United States.

The international demand scenarios were:

- Reference international case;

[179] The Rice World Gas Trade Model is an equilibrium global natural gas model, as described in Annex B of the 2015 LNG Study. The model has 290 regional demand areas that cover countries having 90 percent of the global energy demand, and 140 natural gas resource and production regions modeled on recent authoritative resource estimates.

- Global demand for U.S. LNG supports 12 Bcf/d of exports;
- Global demand for U.S. LNG supports 20 Bcf/d of exports but U.S. exports do not exceed 12 Bcf/d;
- Global demand for U.S. LNG supports 20 Bcf/d of exports but U.S. exports do not exceed 20 Bcf/d; and
- Global demand for U.S. LNG supports 20 Bcf/d of exports and U.S. exports are endogenously determined by the RWGTM.

The table below outlines the approach.

Table 2: Rice-Oxford Study Scenarios

		Domestic Scenarios			
International Demand Scenarios		Reference	High Resource Recovery	Low Resource Recovery	High Natural Gas Demand
Reference		Ref_Ref	Ref_HRR	Ref_LRR	Ref_Hi-D
Global Demand for U.S. LNG Supports 12 Bcf/d		LNG12_Ref	LNG12_HRR	LNG12_LRR	LNG12_Hi-D
Global Demand for U.S. LNG Supports 20 Bcf/d	U.S. LNG Exports 12 Bcf/d	LNG20_Ref12	LNG20_HRR12	LNG20_LRR12	LNG20_Hi-D12
	U.S. LNG Exports 20 Bcf/d	LNG20_Ref20	LNG20_HRR20	LNG20_LRR20	LNG20_Hi-D20
	U.S. LNG Exports Endogenous	LNG20_Ref	LNG20_HRR	LNG20_LRR	LNG20_Hi-D

In general, when reading the case nomenclature in the table above, Rice-Oxford notes for a case "N1_N2X," N1 denotes the name of the international demand scenario, N2 denotes the domestic scenario, and X (either 12 or 20 Bcf/d) denotes the level of LNG exports that can occur from the United States based on the scenario. If X is not present, this means that the amount of

LNG exports from the United States is fully endogenous to (*i.e.*, internally generated within) the scenario being considered.

3. Natural Gas Market Assumptions Across International Demand Scenarios

Rice-Oxford constructed the scenarios of the 2015 Study to show sufficient international market opportunity to support commercially viable LNG exports from the United States in accordance with the volumes indicated in each case. Various assumptions are made about the international natural gas market so as to stimulate investment in the U.S. upstream sector and the commensurate development of LNG export infrastructure. These scenario assumptions primarily constrain alternative sources of global supply, such as foreign shale production or LNG capacity, to leave more global natural gas demand to be met by U.S. LNG. The Reference, Global Demand for U.S. LNG at 12 Bcf/d (LNG12), and Global Demand for U.S. LNG at 20 Bcf/d (LNG20) international demand scenarios adjust shale resource availability, pipeline, and LNG infrastructure expansion opportunities outside the United States, and natural gas demand in different countries. Table 3 below presents key assumptions used in the 2015 Study.

For U.S. LNG exports to exceed 12 Bcf/d of natural gas, several unlikely developments in the global natural gas market were included in the 2015 Study. For example, accessible global shale resources were limited to 3,542 Tcf in the LNG20 Scenario compared to 8,407 Tcf in the Reference case. Other assumptions in Table 3 are equally drastic, such as assuming no foreign LNG export capacity comes online after 2020. Without significant assumptions of this magnitude, U.S. LNG exports in the Rice World Gas Trade Model would not reach the 12 or 20 Bcf/d export levels (or, for that matter, the high resource recovery case of 28 Bcf/d of exports).

Table 3: Select Natural Gas Market Assumptions Across International Demand Scenarios

		Reference	LNG12	LNG20
Accessible Shale Resource (trillion cubic feet)	**World**	8,407	6,500	3,542
	Africa	1,918	1,918	0
	Asia and Pacific	2,107	1,075	90
	China	1,285	390	0
	Australia	529	529	90
	Europe	444	0	0
	South America	1,786	1,786	1,260
	North America	1,839	1,839	1,839
	US	829	829	829
	Canada	498	498	498
	Mexico	513	513	513
	Rest of World	314	86	0
LNG New Build Capability		No limits	Limited expansion capabilities in selected locations	Only U.S. has expansion capability beyond 2020
Pipeline New Build Capability		No limits	No future expansions of Central Asian pipelines to China	LNG12 plus existing Russia-China pipeline supply agreements dissolve
Demand		In all scenarios, a CO_2 trading platform is in place in Europe and the United States is assumed to retire 61 GWs of coal by 2030	Chinese gas demand rises in response to policies to limit coal use; Japanese nukes remain offline	LNG12 case plus CO_2 reduction protocols targeting coal use in India, Indonesia, South Korea, and a handful of other smaller coal consuming nations

4. The Rice World Gas Trade Model

The Rice World Gas Trade Model (or RWGTM) is used in the 2015 Study to investigate how various assumptions about international and domestic demand and resource availability could impact the U.S. natural gas market over the coming decades. The Rice World Gas Trade Model proves and develops resources, constructs and utilizes transportation infrastructure, and calculates prices to equate demands and supplies while maximizing the present value of producer

profits within a competitive framework. New capital investments in production and delivery infrastructure thus must earn a minimum return for development to occur. The debt-equity ratio is allowed to differ across different categories of investment, such as proving resources, developing wellhead delivery capability, constructing pipelines, and developing LNG infrastructure. By developing supplies, pipelines, and LNG delivery infrastructure, the Rice World Gas Trade Model provides a framework for examining the effects of different economic and political influences on the global natural gas market within a framework grounded in geologic data and economic theory.

5. The Oxford Global Economic Model and Global Industry Model

Rice-Oxford stated that the Global Economic Model is the world's leading globally integrated macro model, used by over 100 clients around the world, including finance ministries, leading banks, and blue-chip companies. The Global Economic Model covers 46 countries, including the United States, Canada, the EU, and major emerging markets including China and India. The model provides a rigorous, consistent structure for analysis and forecasting, and allows the implications of alternative global scenarios and policy developments to be analyzed at both the macro and sector level.

The Global Economic Model is an error correction model, a form of a multiple time series model that estimates the speed at which a dependent variable returns to its equilibrium after a shock to one or more independent variables. Rice-Oxford noted that this form of model is useful as estimating both the short and long run effects of variables on the given variable in question. The Global Economic Model exhibits "Keynesian" features in the short run. Factor prices are sticky and output is determined by aggregate demand. In the long-run, its properties are Neoclassical, such that prices adjust fully, the equilibrium is determined by supply factors

(productivity, labor and capital), and attempts to raise growth by boosting demand only lead to higher prices.

Linked to the Global Economic Model is the Global Industry Model. This model, based upon standard industrial classifications and updated quarterly, has a detailed breakdown of output by sector across 100 sectors and 67 countries. The model includes a particularly detailed breakdown in the manufacturing sector, covering eight key sectors: metals, chemicals, motor vehicles, engineering and metal goods, electronics and computers, textiles and clothing, aerospace, and other intermediate goods. The Global Industry Model generates forecasts for both gross output and gross value added (output excluding intermediate consumption).

6. Results of the 2015 LNG Export Study

In the 2015 Study, Rice-Oxford generally found that LNG exports will lead to: (i) increased domestic natural gas production, (ii) a narrowing of the spread between domestic prices and international benchmarks, (iii) marginally positive macroeconomic impacts, and (iv) small declines in output at the margin for some energy-intensive industries that are offset by positive impacts elsewhere.

Table 4 below indicates the level of U.S. LNG exports in the year 2040 for every case considered. The Rice World Gas Trade Model Reference International and Domestic Scenario (Ref_Ref case) has 6.38 Bcf/d of U.S. LNG exports in 2040. With the Reference International Demand Scenario and different Domestic Scenarios, U.S. LNG exports range from 5.20 Bcf/d to 6.74 Bcf/d.[180]

[180] Additional explanation of the Ref_Ref case is provided in the 2015 LNG Export Study. The Study explains that, although U.S. LNG exports increase in the Ref_Ref case, the impact of U.S. LNG exports and other global supply developments on international domestic prices ultimately places a check on the total volume of U.S. LNG exports. Specifically, the price spreads in the international marketplace weaken to the point that full cost recovery of U.S. LNG export facilities currently under construction is compromised for about a decade. Although those facilities operate during that time period, further investment in LNG export capacity is stymied until global demand expands to stimulate new capital flows into the U.S. LNG export value chain. *See* 2015 LNG Export Study at 41.

Table 4: U.S. LNG Exports in 2040 Across Cases (Bcf/d)

		Domestic Scenarios			
International Demand Scenarios		Reference	High Resource Recovery	Low Resource Recovery	High Natural Gas Demand
Reference		6.38	6.74	5.20	6.36
Global Demand for U.S. LNG Supports 12 Bcf/d		11.18	16.30	6.73	9.02
Global Demand for U.S. LNG Supports 20 Bcf/d	U.S. LNG Exports 12 Bcf/d	11.81	11.82	11.80	11.81
	U.S. LNG Exports 20 Bcf/d	18.82	19.74	*	*
	U.S. LNG Exports Endogenous	22.34	28.05	18.02	20.37

* The level of exports in these cases is the same as in the "U.S. LNG Exports Endogenous" cases.

The impacts of exports, according to Rice-Oxford, included:

Increase in domestic natural gas production. The 2015 Study found that the majority of the increase in LNG exports is accommodated by expanded domestic production rather than reductions in domestic demand. Domestic production continues to increase through the time horizon when LNG export volumes can expand to 20 Bcf/d of natural gas, rising 4 percent on average from 2026-2040. In the high resource recovery case with 28 Bcf/d of exports, natural gas production rose 8.5 percent on average from 2026-2040.

As exports increase, the spread between U.S. domestic prices and international benchmarks narrows. In every case, greater LNG exports raise domestic prices and lower prices internationally. The majority of the price movement (in absolute terms) occurs in Asia. The Japan Korea Marker (JKM) price declines in dollar terms by an amount that is roughly six

times greater than the price increase at Henry Hub in the United States. Rice-Oxford states that this is the result of the international market conditions that are simulated in the LNG20 cases. Additionally, the LNG demand stimulus is primarily the result of highly constrained supply potentials plus higher demand in Asia. Although shale potential is also constrained in Europe in the LNG20 cases, the change relative to the Reference international case is small compared to the change in Asia.

Marginally positive overall macroeconomic impacts. This result is robust to alternative assumptions for the U.S. natural gas market. With external demand for domestically produced LNG exports at 20 Bcf/d of natural gas, the impact of increasing exports in excess of 12 Bcf/d is 0.03 percent of GDP from 2026-2040, or $7 billion annually in constant 2015 dollars. In the high resource recovery case where U.S. LNG exports reach 28 Bcf/d, the impact of increasing exports in excess of 12 Bcf/d is 0.07 percent of GDP from 2026-2040, or $20 billion annually in constant 2015 dollars. The 2015 Study detailed several key drivers of the macroeconomic impacts:

- ***U.S. LNG Production and Investment:*** When U.S. LNG exports rise to 20 Bcf/d from 12 Bcf/d, natural gas production is 4.0 percent higher in the domestic Reference case. This is associated with a rise in net fuel exports of just 0.02 percent of GDP over the period 2026-2040 and additional investment of 0.06 percent of GDP. There are positive multipliers from the extra production and investment, as activity is stimulated in the rest of the economy, and as a result total output is 0.1 percent higher from 2026-2040. Across the four cases with endogenously determined exports, impacts on GDP are between 0.05 and 0.07 percent on average over the 2026-2040 period, with the biggest impact in the high resource recovery case where production responds the most.

- ***U.S. Natural Gas Prices:*** The Henry Hub price is, on average, 4.3 percent higher in the 20 Bcf/d export case than the 12 Bcf/d case over the period 2026–2040. As noted above, higher natural gas prices dampen domestic consumption and erode U.S. export competitiveness. In total, higher prices reduce GDP by 0.1 percent from 2026-2040. For the case where exports reach 28 Bcf/d, the Henry Hub price is 7.5 percent higher than the 12 Bcf/d case over the period 2026–2040.

- ***U.S. Profits:*** Profits in the 20 Bcf/d export case are higher given the rise in prices, production and export volumes, but the scale of the impact is small relative to the size of GDP. Profits are 0.03 percent of GDP higher in the 20 Bcf/d case compared with the 12 Bcf/d case. The rise in profit is also modest because it is assumed U.S. producers receive the Henry Hub price on LNG exports rather than the price in the destination market. It assumed that 95 percent of profits are distributed to households and this results in a marginal increase in consumption and GDP from 2026-2040. In cases where exports exceed 20 Bcf/d, higher natural gas prices help drive producers' and exporters' profits marginally higher, though the larger increase in natural gas prices generates a larger impact on consumer prices in the long run, offsetting some of the positive demand impacts.

- ***Rest of World Natural Gas Production and Investment:*** Production in the rest of the world is little changed when U.S. LNG exports increase to 20 Bcf/d from 12 Bcf/d. Due to the Study's scenario assumptions, international demand conditions remain unchanged, and the addition of incremental U.S. LNG exports displaces very little supply from the rest of the world. As a result, capital expenditures by the natural gas sector in the rest of the world remain broadly unchanged when the United States increases LNG exports. This result is similar in cases where exports exceed 20 Bcf/d.

- ***Rest of World Natural Gas Prices:*** The increase in the availability of cheaper U.S. natural gas exports on the world market dampens natural gas price increases in Asia, though prices in Europe are little affected. The marginal decline in natural gas prices both boosts real income in the rest of the world—which boosts demand and is positive for U.S. exports—and boosts the competitiveness of Asian firms relative to U.S. companies, which is negative for U.S. exports. However, the small impact on gas prices and the relative unimportance of natural gas to total energy supply in Asia means that the impact on consumption in Asia is limited as is the competitiveness boost enjoyed by Asian firms from lower natural gas prices. As a result, the overall impact on U.S. GDP is limited. In cases where exports exceed 20 Bcf/d, there is a greater convergence of domestic natural gas prices with world prices as the Henry Hub price increase is greater than in the case where LNG exports could not exceed 20 Bcf/d. The price impacts are small and have little noticeable impact on inflation rates over the forecast period.

Small declines in output at the margin for some energy-intensive, trade-exposed industries. The sectors that appear most exposed are cement, concrete, and glass, but the estimated impact on sector output is very small compared to expected sector growth to 2040.

Negative impacts in energy-intensive sectors are offset by positive impacts elsewhere. Other industries benefit from increasing U.S. LNG exports, especially those that

supply the natural gas sector and/or benefit from the capital expenditures needed to increase production. This includes some energy-intensive sectors and helps offset some of the impact of higher energy prices.

VIII. COMMENTS ON THE 2014 AND 2015 LNG EXPORT STUDIES AND DOE/FE ANALYSIS

DOE/FE published the Notice of Availability of the 2014 and 2015 LNG Export Studies in the *Federal Register* on December 29, 2015, seeking public comment on both studies. DOE/FE specifically invited comment on:

> [T]he potential impact of LNG exports on domestic energy consumption, production, and prices; the macroeconomic factors identified in the two studies, including Gross Domestic Product, consumption, U.S. economic sector analysis, and U.S. LNG export feasibility analysis; and any other factors included in the analyses.[181]

DOE noted that, "[w]hile this invitation to comment covers a broad range of issues, the Department may disregard comments that are not germane to the present inquiry."[182]

DOE/FE has reviewed the 38 comments submitted in response to the NOA. Of those, 14 comments opposed the two Studies and/or exports of LNG, 21 supported the Studies, and three took no position. Below, DOE/FE summarizes: (i) the pertinent arguments by topic, with reference to representative comments, and (ii) DOE/FE's basis for the conclusions that it drew in reviewing those comments. In so doing, DOE/FE has responded to the relevant, significant issues raised by the commenters.[183]

[181] 80 Fed. Reg. at 81,302.
[182] *Id.*
[183] *See, e.g.*, *Public Citizen v. F.A.A.*, 988 F.2d 186, 197 (D.C. Cir. 1993).

A. Data Inputs and Estimates of Natural Gas Demand

1. Comments

Several commenters, including Sierra Club, the Industrial Energy Consumers of America (IECA), Cascadia Wildlands, Wim de Vriend, and Hair on Fire Oregon, challenge the data used as inputs to the LNG Export Studies.[184] Specifically, these commenters assert that the 2015 LNG Export Study relies on inaccurate assumptions that fail to reflect "current conditions" adversely affecting the viability of exporting domestically produced LNG from the United States. Citing various articles and natural gas industry reports, these commenters point to the following conditions—some of which they acknowledge arose after the 2015 LNG Export Study was published:

- An oversupplied global energy market due to the rapid expansion worldwide of LNG terminals ("supply glut"), which commenters allege will be the status quo for years to come;
- The drop in international oil prices, which allegedly has reduced or eliminated the price advantage for U.S. LNG exports;
- The difference in costs between greenfield and brownfield LNG projects and the associated risks to capital, given the alleged uncertainties associated with LNG exports;
- The declining costs of and advances in renewable energy sources, which allegedly will compete directly with U.S. LNG in end markets;
- Japan's re-starting of some of its nuclear power plants;
- The increasing prevalence of carbon trading regimes internationally (*e.g.*, China), making natural gas less of a viable energy source; and
- China's slowing economy.

According to Sierra Club and other commenters, these conditions undermine the assumptions and constraints of the 2015 LNG Export Study, calling into question the Study's conclusions that LNG exports will provide a slight benefit to GDP. Sierra Club further contends that, in

[184] Unless specifically noted, the comments address the 2015 LNG Export Study.

light of these changing conditions, DOE should have revisited the 2012 LNG Export Study, rather than conducting new studies to analyze the marginal effects of higher LNG export volumes.

2. DOE/FE Analysis

We note that the 2015 LNG Export Study modeled a wide range of possible future supply and demand conditions, including alternative assumptions for domestic resource availability, domestic natural gas demand, and a range of international supply and demand conditions that generate different potential market pull for U.S. LNG exports. The 2015 Study scenarios were constructed so there was sufficient international demand to support commercially viable LNG export flows from the United States in accordance with the volumes indicated in each case. This approach allowed Rice-Oxford to assess the macroeconomic impacts of increased levels of U.S. LNG exports under global market conditions where that trade would occur. The 2015 LNG Export Study found that "the overall macroeconomic impacts of higher LNG exports are marginally positive, a result that is robust to alternative assumptions for the U.S. natural gas market."[185] That is, the macroeconomic results are similar across the different scenarios examined. The energy market conditions noted by the commenters would, all else being equal, reduce international demand for U.S. LNG exports. The 2014 LNG Export Study included cases with levels of U.S. LNG exports below 20 Bcf/d, specifically 12 and 16 Bcf/d. The 2014 LNG Export Study found that "GDP gains from increasing LNG exports are positive across all cases, although relatively modest."[186]

[185] 2015 Study at 8.
[186] 2014 Study at 25.

We also take note of EIA's projections in the *Annual Energy Outlook* 2017 (AEO 2017), published on January 5, 2017,[187] for natural gas supply, demand, and prices. The AEO 2017 Reference case incorporates the Clean Power Plan (CPP) final rule[188] and assumes that all states choose to meet a mass-based standard to cover both existing and new sources of carbon dioxide emissions. Although Reference case lower-48 domestic dry natural gas production for the year 2040 (the end of the forecast period in AEO 2014) increased by 2.9 Bcf/d between AEO 2014 and AEO 2017 (from 99.4 Bcf/d to 102.3 Bcf/d), the projected 2040 Henry Hub price declined from $8.15 per million British thermal units (MMBtu) to $5.07/MMBtu (both prices in constant 2016 dollars). While some of the increased lower-48 production goes to satisfy increased domestic consumption, the majority supports a 2.0 Bcf/d increase in the projected lower-48 Reference case 2040 net exports from 13.7 Bcf/d in AEO 2014 to 15.6 Bcf/d in AEO 2017. This increase in net lower-48 exports reflects both a decrease in net pipeline exports of 3.0 Bcf/d and an increase in net LNG exports of 5.0 Bcf/d.

AEO 2017 also included a Reference case without implementation of the Clean Power Plan. In that case, lower-48 dry natural gas production for the year 2040 was 101.6 Bcf/d, and the projected 2040 Henry Hub price was $5.01. As described here, both AEO 2017 Reference cases (with and without the Clean Power Plan), even more so than the AEO 2014, project robust domestic supply conditions that are more than adequate to meet domestic needs and supply exports.

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[187] U.S. Energy Info. Admin., *Annual Energy Outlook* 2017 (Jan. 2017), *available at*: http://www.eia.gov/outlooks/aeo/.

[188] U.S. Envtl. Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,662 (Oct. 23, 2015) (effective Dec. 22, 2015). On February 9, 2016, the U.S. Supreme Court issued a stay of the effectiveness of this rule pending review. *See Chamber of Commerce, et al. v. EPA, et al.*, Order in Pending Case, 577 U.S. ___ (2016). Additionally, on April 28, 2017, the U.S. Court of Appeals for the District of Columbia Circuit issued an order holding the case in abeyance for 60 days. *See West Virginia, et al. v. EPA, et al.*, Order, Case No. 15-1363 (D.C. Cir. April 28, 2017).

B. Distributional Impacts

1. Gross Domestic Product (GDP)

a. Comments

Several commenters, including IECA, allege that any macroeconomic benefits from the 2015 LNG Export Study are likely overstated. Cascadia Wildlands, Sierra Club, and Hair on Fire Oregon, among others, allege that, in concluding that LNG exports would create a net benefit to the economy, the 2015 Study relied too heavily on the fact that exports will increase GDP while failing to give adequate weight to projected domestic natural gas price increases, foreign natural gas price decreases, and deleterious socio-economic, sectoral, and regional impacts on consumers, households, and the middle class, including wage-earners. Additionally, Cascadia Wildlands notes that the 2015 Study concludes that economic benefits associated with LNG exports are only "marginally positive," and asserts that this margin is so small as to be within the margin of error for the Study's calculations. IECA argues that the 2015 Study fails to account for the lost capital investment opportunity that would have occurred in the absence of LNG exports, as well as for the significant jobs that would have been created in the United States had it not been for higher natural gas prices, thus eliminating any "marginally positive" benefits associated with LNG exports.

Conversely, a number of other commenters, including American Petroleum Institute (API), Exxon Mobil Corporation, African American Environmentalist Association, William Shughart, Western Energy Alliance, and the City of Tulsa's Office of the Mayor, assert that LNG exports will create jobs and boost the economy. For example, the African American Environmentalist Association states that a report by ICF International shows that LNG exports will result in a net gain in employment in the United States, and that the job impacts of LNG exports will grow larger as export volumes rise.

b. DOE/FE Analysis

The 2015 LNG Export Study analyzed the macroeconomic impacts of LNG exports in five areas. These are U.S. natural gas production and investment, U.S. natural gas prices, recycling of extra profits from the U.S. natural gas sector, changes to natural gas production and investment in the rest of the world, and international natural gas prices.[189] Although some commenters assert that the 2015 Study failed to give adequate weight to changes in natural gas prices, Rice-Oxford noted that the first two areas of impact—U.S. natural gas production and investment and U.S. natural gas prices—are the most significant for the United States and broadly offset each other.

The Studies found that increasing LNG exports could increase GDP by up to $20 billion. The 2015 Rice-Oxford Study found in its Reference domestic case (the 20 Bcf/d export case) that, in the long run, U.S. GDP was 0.03 percent higher on average ($7.7 billion annually in constant 2015 dollars) over 2026-2040 than in the 12 Bcf/d export case.[190] In the high resource recovery case, where exports reached 28 Bcf/d of natural gas, the 2015 Study found that U.S. GDP was 0.07 percent higher on average ($20 billion annually in constant 2015 dollars) over 2026-2040 than in the 12 Bcf/d export case. The 2015 Study's result of GDP gains is consistent with the results of the EIA 2014 LNG Export Study. The 2014 EIA Study found that GDP increases across all cases "range from 0.05% to 0.17% and generally increase with the amount of added LNG exports required to fulfill an export scenario for the applicable baseline."[191] This equals an annual net increase to GDP of $12 billion to $20 billion across the scenarios from the

[189] 2015 Study at 14.
[190] *See id*.
[191] 2014 Study at 12.

2014 LNG Export Study.[192] These increases are significant, and the Studies project higher levels of employment with increased LNG exports.

2. Sectoral Impacts

a. Comments

Some commenters debate whether LNG exports will impact the domestic energy-intensive, trade-exposed (EITE) sectors disproportionately, at too high a cost to the U.S. economy to justify exporting LNG. Specifically, IECA and Citizens Against LNG assert that increasing LNG exports reduces the cost of natural gas to our global competitors and simultaneously increases the domestic cost of natural gas and electricity—negatively impacting EITE industries. According to these commenters, exporting LNG will drive up the price of natural gas for American consumers and manufacturers, eliminate jobs, and create a financial burden in an already stressed American economy. IECA further contends that the 2015 Study fails to include the "relative cost impact" to EITE industries, *i.e.*, "the combined impact of lower prices to our global competitors and higher prices domestically," and thus overstates the macroeconomic results associated with LNG exports. Stating that the 2015 Study fails to cite any studies on the price sensitivity of EITE industries, IECA also questions whether any research on EITE industries was conducted as part of the Study.

Other commenters, including API and ExxonMobil, dispute these arguments. They challenge the notion that an LNG export industry cannot co-exist with a growing domestic manufacturing base. API, ExxonMobil, and Golden Pass Products, LLC emphasize the size and productivity of the U.S. natural gas resource base, contending that there is an abundance of natural gas to support both LNG export demand and continued growth in the EITE industries.

[192] *See id*. at 32 ("Gross Domestic Product" in 2005 U.S. dollars).

These commenters note that the vast supply of natural gas in the United States will continue to support current gains in domestic manufacturing, even as LNG exports take place. They also state that LNG exports will both sustain and increase domestic production of natural gas, which, in turn, will provide EITE industries with a greater supply of natural gas at more stable prices, allowing them to stay globally competitive.

Other commenters, such as John L. Rafuse, LNG Allies, and American Council for Capital Formation, maintain that there would be serious consequences to hindering the export of LNG. They state that, if exports are prohibited or constrained, the United States will lose economic benefits that other countries will capture as those countries begin extracting their shale gas resources and competing in the global LNG export market. Many commenters, including Institute for 21st Century Energy, Western Energy Alliance, API, and Golden Pass Products, LLC, similarly assert that it would not be in the public interest for DOE to limit LNG exports in contravention of U.S. free trade principles.

b. DOE/FE Analysis

With respect to the argument that natural gas confers greater value on the U.S. economy when used in manufacturing than when produced for export, we begin with the observation that more natural gas is likely to be produced domestically if LNG exports are authorized than if they are prohibited. There is no one-for-one trade-off between natural gas used in manufacturing and gas diverted for export. The competition between the demand for natural gas for domestic consumption and the demand for natural gas for export is captured in the modelling for the 2014 and 2015 Studies. In scenarios with increased levels of U.S. LNG exports, both Studies found that greater economic benefits, in terms of GDP, accrued to the U.S. economy due to those exports.

The 2015 Study used the Oxford Economics Global Industry Model (GIM) to model the impact of increased LNG exports on activity at the sector level. The Global Industry Model covers 100 sectors in 67 countries. In that model, forecasts for individual industries are driven by the macroeconomic forecast—consumption, investment, and exports—combined with detailed modeling of industry interactions, such as supply-chain linkages.[193] The 2015 Study presented sector-level impacts for energy-intensive sectors, including chemicals, basic metals and metal products, and non-metallic minerals (which, in turn, includes cement and glass).[194] The 2015 Study projected that the overall impact across sectors is small compared with the expected growth in sector output through 2040.

The 2015 Study noted that higher natural gas prices have a negative impact for energy-intensive manufacturing sectors, and some sectors (glass, cement, and chemicals) will see small declines in output with increased levels of LNG exports. Rice-Oxford found that these declines are "outweighed by gains in manufacturing industries that benefit from increased investment in the natural gas sector and increased construction activity, such as metals, as well as industry gains attributable to the increase in overall demand (*i.e.*, consumer products, food, etc.)."[195] As a result, "the manufacturing sector in aggregate is little impacted."[196] The 2014 Study found that natural gas price increases would initially challenge EITE industries, "but adverse impacts [would be] ameliorated as energy prices return to base levels and GDP begins to increase."[197]

With respect to the argument that some industries derive greater economic value from natural gas than others, we continue to be guided by the long-standing principle established in

[193] 2015 Study at 22.
[194] *Id*. at 68.
[195] *Id*. at 67.
[196] *Id*.
[197] 2014 Study at 26.

our Policy Guidelines that resource allocation decisions of this nature are better left to the market, rather than to DOE, to resolve.

3. Household and Distributional Impacts

a. Comments

Several commenters, including Sierra Club, IECA, Hair on Fire Oregon, Torrey Byles, Cascadia Wildlands, and Citizens Against LNG, maintain that, for most citizens, the macroeconomic benefits of LNG exports, if any, will be minimal. These commenters contend that the main beneficiaries of LNG exports will be a narrow band of the population, chiefly wealthy individuals in the natural gas industry, foreign investors, and those holding stock or having retirement plans invested in natural gas companies. They assert that, by contrast, a majority of Americans will experience negative economic impacts, such as higher gas and electric bills, without sharing in the benefits of the exports.

b. DOE/FE Analysis

The 2015 LNG Export Study analyzed the macroeconomic impacts of LNG exports in five areas. The 2015 Study projected that, for the economy as a whole, "the positive impacts of higher U.S. gas production, greater investment in the U.S. natural gas sector, and increased profitability of U.S. gas producers typically exceeds the negative impacts of higher domestic natural gas prices associated with increased LNG exports."[198]

As noted previously, DOE believes that the public interest generally favors authorizing proposals to export natural gas that have been shown to lead to net benefits to the U.S. economy. While there may be circumstances in which the distributional consequences of an authorizing decision could be shown to be so negative as to outweigh net positive benefits to the U.S.

[198] 2015 Study at 16.

economy as a whole, we do not see sufficiently compelling evidence that those circumstances are present here. None of the commenters advancing this argument has performed a quantitative analysis of the distributional consequences of authorizing LNG exports at the household level. Given the findings in the 2014 and 2015 Studies that exports will benefit the U.S. economy as a whole in terms of increased GDP, and absent stronger record evidence on the distributional consequences of authorizing the proposed exports, we cannot say that those exports are inconsistent with the public interest on these grounds.

4. Regional Impacts

a. Comments

Many commenters, including Oregon Wild and Harriett Heywood, address the issue of negative and positive regional impacts potentially associated with LNG exports. For example, Ninette Jones and Paula Jones assert that shale gas development and production will have a negative impact on local industries that is incompatible with extraction-related activities, such as agriculture and tourism. These commenters, along with Oregon Wild, identify specific ways in which they allege local communities near shale gas production areas, pipelines, and/or LNG export terminals could be adversely affected by increases in natural gas production and LNG exports. They cite property devaluation, degradation of infrastructure, environmental and public health issues, harm to local economies, and safety risks, among other issues.

Other commenters seek to rebut these concerns by identifying the positive regional benefits associated with LNG exports, both in regions where shale development and production occur, and the regions in which LNG export terminals may be located. The African American Environmentalist Association, the Small Business & Entrepreneurship Council, Women Impacting Public Policy, Our Energy Movement, Center for Liquefied Natural Gas, Sempra LNG, and Western Energy Alliance cite regional economic benefits associated with each LNG

project, including the potential for new jobs, substantial direct and indirect business income, and millions of dollars in new tax revenue. Jordan Cove Energy Project, L.P., affirms the positive regional befits associated with LNG exports, but contends that the 2014 and 2015 LNG Export Studies fail to consider these positive regional impacts to the disadvantage of pending LNG projects subject to review by DOE/FE.

b. DOE/FE Analysis

We agree with the commenters who contend that a general consideration of regional impacts is outside of the scope of the 2014 and 2015 LNG Export Studies, and that regional impacts are appropriately considered by DOE/FE on a case-by-case basis during the review of each LNG export application. We have addressed these issues in the Discussion and Conclusions below.

C. Estimates of Domestic Natural Gas Supplies

1. Comments

Clarence Adams and other commenters assert that, in addition to underestimating the demand for domestically produced natural gas, the 2015 Study overestimates future domestic supplies of natural gas. Mr. Adams contends that several factors may limit domestic supplies of natural gas, including: (i) new sources of LNG coming online internationally, (ii) increasing resistance to hydraulic fracturing in the United States, and (iii) the shorter-than-expected productivity of shale gas wells. According to these commenters, lower than estimated supplies of natural gas will exacerbate the likely price increases due to exports.

Contrary to these arguments, many commenters, such as API, the City of Tulsa's Office of the Mayor, Tara Shumata Lee, and Triana Energy, LLC, argue that the United States has abundant domestic natural gas reserves.

Other commenters, such as Oregon Wild, Torrey Byles, and Sierra Club, contend that, to

become energy independent, the United States must preserve its supplies of finite domestic energy resources, not export them. They argue that authorizing LNG exports will hasten the depletion of this country's natural gas resource base. In their view, investment in LNG exports will take away from potential investment in renewable energy supplies, compounding this country's dependency on fossil fuels.

2. DOE/FE Analysis

a. Measures of Supply

Before turning to a consideration of the specific comments, it is important to note the various measures of natural gas supply. DOE/FE notes that, by three measures of supply, there are adequate natural gas resources to meet demand associated with the requested authorization. Because these supply estimates have changed over time, however, DOE/FE will continue to monitor them to inform future decisions. These estimates include:

i) AEO natural gas estimates of production, price, and other domestic industry fundamentals. The AEO 2017 Reference case projection of dry natural gas production in 2035 increased significantly (by 27.9 Bcf/d) as compared with AEO 2011, while projections of domestic natural gas consumption in 2035 also increased in AEO 2017 compared with AEO 2011 (by 11.3 Bcf/d). Even with higher production and consumption, the 2035 projected natural gas market price in the Reference case declined from $7.87/MMBtu (2016$) in AEO 2011 to $5.09/MMBtu (2016$) in AEO 2017. The implication of the latest EIA projections in AEO 2017 is that a significantly greater quantity of natural gas is projected to be available at a lower cost than estimated six years ago.

ii) Proved reserves of natural gas. Proved reserves of natural gas have been increasing. Proved reserves are those volumes of oil and natural gas that geologic and engineering data demonstrate with reasonable certainty to be recoverable in future years from

known reservoirs under existing economic and operating conditions. The R/P ratio measures the number of years of production (P) that proved reserves (R) represent at current production rates. Typically industry maintains proved reserves at about 10 years of production, but as Table 5 below demonstrates, reserves have increased from 9.2 years of production in 2000 to 13.9 years of production in 2015, the latest year statistics are available. Of particular note is that, since 2000, proved reserves have increased 73 percent to 307,730 Bcf, while production has increased only 44 percent, demonstrating the growing supply of natural gas available under existing economic and operating conditions.

Table 5: U.S. Dry Natural Gas Proved Reserves[199]

	Proved Reserves (R)		**U.S. Dry Natural Gas Estimated Production (P)**		
Year	**(Bcf)**	**Percent change versus year 2000**	**(Bcf)**	**Percent change versus year 2000**	**R/P Ratio - Years**
2000	177,427	--	19,219	--	9.2
2005	204,385	15	18,458	-4	11.1
2010	304,625	72	22,239	16	13.7
2014	368,704	108	26,611	38	13.9
2015	307,730	73	27,818	44	11.1

iii) Technically recoverable resources (TRR). Technically recoverable resources have also increased significantly. Technically recoverable resources are resources in accumulations producible using current recovery technology but without reference to economic profitability. They include both proved reserves and unproved resources.[200]

[199] EIA, *U.S. Dry Natural Gas Proved Reserves* (Feb. 8, 2017), *available at*: http://www.eia.gov/dnav/ng/ng_enr_dry_dcu_nus_a.htm (additional calculations conducted to produce percentage change and R/P ratios).

[200] Unproved resources are generally less well known and therefore less precisely quantifiable than proved reserves, and their eventual recovery is less assured.

DOE/FE notes that EIA's estimates of lower-48 natural gas TRR have increased from 1,816 Tcf in AEO 2010 to 1,871 Tcf in AEO 2016.[201] EIA notes that these levels represent the starting values for the model, and that assumed future technological improvements in the model add to the TRR while production subtracts from the TRR.

b. Supply Impacts

The 2014 and 2015 Studies each conclude that, for the period of the analysis, the United States is projected to have ample supplies of natural gas resources that can meet domestic needs for natural gas and the LNG export market. Additionally, most projections of domestic natural gas resources extend beyond 20 to 40 years. While not all TRR is currently economical to produce, it is instructive to note that EIA's recent estimate of TRR equates to nearly 69 years of natural gas supply at the 2015 domestic consumption level of 27.31 Tcf.[202] Moreover, given the supply projections under each of the above measures, we find that granting the requested authorization is unlikely to affect adversely the availability of natural gas supplies to domestic consumers such as would negate the net economic benefits to the United States.

We further find that, given these estimates of supply, the projected price increases and increased price volatility that could develop in response to a grant of the requested LNG export authorization are not likely to negate the net economic benefits of the exports. This issue is discussed below. With regard to the adequacy of supply, however, it bears noting that while certain commenters contend that U.S. natural gas production would not be able to meet unlimited LNG exports and domestic demand, the 2015 Study supports a different conclusion. The 2015

[201] *See* U.S. Energy Information Administration, *Assumptions to the Annual Energy Outlook 2016* (Jan. 2017*)*, Table 9.2. Technically recoverable U.S. dry natural gas resources as of January 1, 2014, at 133, *available at*: http://www.eia.gov/outlooks/aeo/assumptions/pdf/0554(2016).pdf and U.S. Energy Information Administration, *Assumptions to the Annual Energy Outlook 2010* (Apr. 2010*)*, Table 9.2. Technically recoverable U.S. natural gas resources as of January 1, 2008, at 111, *available at*: http://www.eia.gov/oiaf/aeo/assumption/pdf/0554(2010).pdf.
[202] *See* U.S. Energy Information, Natural Gas Consumption by End Use http://www.eia.gov/dnav/ng/ng_cons_sum_dcu_nus_a.htm (Feb. 8, 2017)

Study included scenarios in which LNG exports were unconstrained. Should the U.S. resource base be less robust and more expensive than anticipated, U.S. LNG exports would be less competitive in the world market, thereby resulting in lower export levels from the United States. By way of example, the 2015 Study modeled a number of low resource recovery scenarios, which had U.S. resources that were less robust and more expensive than other cases. In these low resource recovery scenarios, U.S. wellhead natural gas prices were driven up by higher production costs, and prices increased to a level that lowered demand for exports compared to the Reference case. In other unconstrained cases evaluated with the high resource recovery scenarios, domestic natural gas production was able to keep up with the increased demand for U.S. LNG exports compared to the Reference case. In all of these cases, the supply and price response to LNG exports did not negate the net economic benefit to the economy from the exports.

c. Supply Impacts Related to Renewable Energy Sources

To the degree that natural gas prices may increase, alternative sources of energy will become more attractive to consumers and investors. Accordingly, the 2014 Study forecasts increases in electricity from renewable energy resources across the LNG export cases over the 2015-2040 timeframe. Therefore, we do not agree with the suggestion that LNG exports would diminish investment in renewable energy.

Further, the 2014 and 2015 Studies did not evaluate the steps to become energy independent, as that was not part of the criteria evaluated. However, both Studies concluded that the United States has ample supplies of natural gas resources that can both meet domestic needs for natural gas *and* allow for participation in the LNG export market, without a significant impact on supplies or prices for the period of the analysis under the assumptions made.

D. Modeling the LNG Export Business

1. Comments

Several commenters, including Hair on Fire Oregon, Torrey Byles, Sierra Club, and Citizens Against LNG, contend that the 2015 LNG Export Study incorrectly assumed that the financing of investments in natural gas supplies for export and in the LNG export projects that will be used for export operations would originate from U.S. sources. These commenters assert that, in fact, a substantial portion of the investment is being made by foreign entities, and these foreign entities—not domestic corporations—will reap the benefits of export activity in the form of royalties, tolling fees, income, and tax proceeds from the resale of LNG overseas.

In addition, Clarence Adams contends that the 2015 Study misrepresents the amount of natural gas used by LNG terminals in the liquefaction process, which understates the demand associated with exports. He contends that any volumes used in the liquefaction process (approximately 10 percent of the export volume) should be considered domestic consumption.

2. DOE/FE Analysis

The 2014 and 2015 Studies did not discuss the impact of foreign investment. The 2015 Study concluded that the main path for positive impacts to GDP from increased U.S. LNG exports is through higher production and greater investment in the natural gas sector in the United States. These positive impacts are "due to the fact that most of any U.S. LNG exports would be made possible by increased extraction rather than the diversion of natural gas supplies."[203] The 2015 Study also noted that the model assumes U.S. producers receive the U.S. benchmark Henry Hub price on LNG exports rather than the price in the international destination

[203] 2015 Study at 83.

market.[204] The 2014 Study stated that "increased energy production spurs investment, which more than offsets the adverse impact of somewhat higher energy prices when export scenarios are applied."[205]

As for consideration of the natural gas consumed in the liquefaction process, both the 2014 and 2015 Studies assumed a consumption level equal to 10 percent of the natural gas feedstock, which is included in the models.

E. Cost of Environmental Externalities

1. Comments

Sierra Club, along with Citizens Against LNG, Hair on Fire Oregon, Cascadia Wildlands, Oregon Wild, Torrey Byles, MA Rohrer, and Harriet Heywood, maintain that LNG exports will increase demand for natural gas, thereby increasing negative environmental and economic consequences associated with natural gas production. These and other commenters assert that the 2015 Study failed to consider the cost of environmental externalities that would follow such exports. The externalities identified by these commenters include:

- Environmental costs associated with producing more natural gas to support LNG exports, including the costs, risks, and impacts associated with hydraulic fracturing and drilling to produce natural gas; and costs associated with increased water scarcity to support hydraulic fracturing, especially in the drought-stricken regions of the West Coast;

- Environmental costs associated with the life cycle of U.S. LNG (hydraulic fracturing of shale gas, liquefaction, and export) in the form of increased emissions of GHGs and other air pollutants, climate change, and local impacts such as ocean acidification;

- Local and regional costs associated with LNG exports, including impacts on local communities and industries;

[204] *Id.* at 64.
[205] 2014 Study at 12.

- The costs associated with eminent domain, which may be necessary to build new pipelines to transport natural gas;

- The costs of hazards associated with LNG developments, such as costs for police, fire, and security personnel overseeing LNG tanker deliveries; risks associated with LNG-related explosions; and threats related to natural disasters, terrorism, and disruption of LNG facilities, storage tanks, and related systems;

- The potential regulatory costs and impacts of environmental regulations governing hydraulic fracturing and natural gas drilling; and

- The social costs of carbon and methane associated with natural gas emissions.

2. DOE/FE Analysis

All environmental issues are discussed below. *See infra* §§ IX-XII.

F. Prices and Volatility

1. Natural Gas Price Volatility

a. Comments

Several commenters, such as IECA, Sierra Club, MA Rohrer, and Citizens Against LNG, address potential natural gas price volatility associated with LNG exports. They contend that there is little evidence that domestic natural gas price volatility will be reduced by LNG exports. Rather, they argue that increases in LNG exports will increase demand for natural gas, driving up prices in the United States and adversely affecting electric and natural gas utility consumers, EITE industries, and residential consumers.

Sierra Club, Citizens Against LNG, and Torrey Byles also assert that, as domestic natural gas prices rise due to LNG exports, some electric power companies will want to switch from gas-based to coal-based electric generation. However, because there is less coal-fired capacity to switch to, coal-fired options could be limited, which will drive natural gas prices higher than expected. In this regard, they state that the 2014 EIA Study indicates that increasing exports of

LNG will cause increased domestic coal use in all export scenarios, but fails to address or quantify the environmental impacts of this switch.

b. DOE/FE Analysis

Natural gas price volatility can be measured in terms of short term changes—daily or monthly volatility—or over longer periods. Short term volatility is largely determined by weather patterns, localized service outages, and other factors that appear unlikely to be affected substantially by DOE export authorization decisions. Moreover, the 2014 and 2015 Studies were long-term analyses covering a 25-year period, and thus were not intended to focus on short term shocks or volatility.

To the extent commenters are concerned about the risk of large upward price spikes sustained over longer periods, such as those that occurred in 2005 and 2008, we do not agree that LNG exports will necessarily exacerbate this risk. First, as noted above, when domestic wholesale gas prices rise above the LNG netback price, LNG export demand is likely to diminish, if not disappear altogether. Therefore, under some international market conditions, LNG export facilities are likely to make natural gas demand in the United States more price-elastic and less conducive to sustained upward spikes. Second, in light of our findings regarding domestic natural gas reserves explained above, we see no reason why LNG exports would interfere with the market's supply response to increased prices. In any capital intensive industry, investments are made based on observed and anticipated market signals. In natural gas markets, if prices or expected prices rise above the level required to provide an attractive return on investment for new reserves and production, industry will make that investment to capture the anticipated profit. These investments spur development of reserves and production and increase availability of natural gas, exerting downward pressure on prices. This is part of the normal business cycle that was captured in the 2014 and 2015 Studies. On balance, we are not

persuaded that LNG exports are likely to increase substantially the volatility of domestic natural gas prices.

2. Linking the Domestic Price of Natural Gas to World Prices

a. Comments

Commenters, including IECA and Citizens Against LNG, argue that LNG exports could link domestic natural gas prices to the price of natural gas in the world market, and that this could exacerbate the potential increase in domestic natural gas prices as well as increase price volatility.

By contrast, API argues that natural gas prices will not rise to global prices because the market will limit the amount of U.S. natural gas that will be exported, since liquefaction, transportation, and regasification costs act as a cushion. API argues that, if this cushion disappears and the U.S. export price rises to the global LNG price, market forces will bring U.S. exports to a halt.

b. DOE/FE Analysis

The 2015 Study examined changes in three benchmark prices across the export scenarios: the Henry Hub price in the United States, the National Balancing Point (NBP) price in the United Kingdom, and the Japan Korea Marker (JKM) price. In general, the Henry Hub price rises as LNG exports increase, while the other benchmark prices decline. The 2015 Study stated that this is the result of allowing increased trade from the United States, thereby serving to relax the highly constrained supply situation internationally in the scenarios.[206] The 2015 Study presented the price spreads among JKM and Henry Hub and NBP and Henry Hub for all of the cases considered from 2015-2040. The JKM-Henry Hub price spread in 2040 ranges from $5 to over

[206] 2015 Study at 58.

$15 across the scenarios; the spread for NBP-Henry Hub in 2040 is roughly $3 to nearly $8.[207] The 2015 Study noted that the impact of LNG exports on the Henry Hub price depends on both domestic and international market considerations. For example, Henry Hub prices would rise with increased domestic demand for natural gas.

Additionally, prices for U.S. LNG would include the cost of inland transportation, liquefaction, shipping, and regasification. The 2015 Study's model assumed competition among different suppliers, such that buyers would have no incentive to buy natural gas from the United States if the delivered price after liquefaction and transportation is higher than the alternative delivered LNG price from other sources. DOE/FE agrees that a competitive market would behave in this manner and U.S. natural gas prices would be lower than international LNG prices in such a market by at least the costs previously described. Further, the introduction of LNG exported from the United States into the international market would tend to exert downward pressure on the prevailing higher delivered price for LNG in those foreign markets and could weaken the "oil-indexed" pricing terms.

For these reasons, we agree with those commenters who maintain that LNG exports from the United States will have difficulty competing with LNG exports from other countries unless domestic U.S. natural gas can be produced much cheaper. There is no evidence before us demonstrating that the prices of natural gas or LNG in the international market are more volatile than the prices in the U.S. domestic market.

IX. DOE/FE ADDENDUM TO ENVIRONMENTAL REVIEW DOCUMENTS CONCERNING EXPORTS OF NATURAL GAS FROM THE UNITED STATES

On June 4, 2014, DOE/FE published the Draft Addendum for public comment. The purpose of the Addendum, DOE/FE explained, was to provide information to the public regarding

[207] *Id*. at 52.

the potential environmental impacts of unconventional natural gas production. Although not required by NEPA, DOE/FE prepared the Addendum in an effort to be responsive to the public and to provide the best information available on a subject that had been raised by commenters in this and other LNG export proceedings. The 45-day comment period on the Draft Addendum closed on July 21, 2014. DOE/FE received 40,745 comments in 18 separate submissions, and considered those comments in issuing the Addendum on August 15, 2014.[208] DOE provided a summary of the comments received and responses to substantive comments in Appendix B of the Addendum.[209] DOE/FE has incorporated the Draft Addendum, comments, and final Addendum into the record in this proceeding.

The Addendum focuses on the environmental impacts of unconventional natural gas production, which primarily includes production from shale formations, but also includes tight gas and coalbed methane production. DOE/FE elected to focus the Addendum on unconventional production because such production is considered more likely than other forms of production to increase in response to LNG export demand. EIA's 2012 Study, published as part of the LNG Export Study, projected that more than 90 percent of the incremental natural gas produced to supply LNG exports would come from these unconventional sources.[210]

Although the 2012 EIA Study made broad projections about the types of resources from which additional production may come, the Addendum stated that DOE cannot meaningfully estimate where, when, or by what particular method additional natural gas would be produced in response to non-FTA export demand. Therefore, the Addendum focuses broadly on

[208] Addendum at 3.
[209] *Id*. at 79-151.
[210] *See* LNG Export Study – Related Documents, *available at* http://energy.gov/fe/services/natural-gas-regulation/lng-export-study (EIA 2012 Study) at 11 (total from shale gas, tight gas, and coalbed sources).

unconventional production in the United States as a whole, making observations about regional differences where appropriate.

The Addendum discusses several categories of environmental considerations—Water Resources, Air Quality, Greenhouse Gas, Induced Seismicity, and Land Use Impacts—each of which is summarized briefly below.

A. Water Resources

1. Water Quantity

Natural gas production from shale resources requires water at various stages of development, approximately 89 percent of which is consumed through the process of hydraulic fracturing.[211] The Addendum presents information regarding water usage for shale gas production both in comparison to other energy sources and other regional uses. Although production of natural gas from shale resources is more water-intensive than conventional natural gas production, it is substantially less water-intensive than many other energy sources over the long term after the well has been put into production. As shown in the Addendum, Table 6 below captures differences in water intensity across energy sources.

[211] Addendum at 10.

Table 6: Water Intensity[212]

Energy Source	Range in Water Intensity (gallons/mmBtu)
Conventional Natural Gas	~0
Shale Gas	0.6 – 1.8
Coal (no slurry transport)	2 – 8
Nuclear (uranium at plant)	8 – 14
Conventional oil	1.4 – 62
Oil Shale Petroleum (mining)	7.2 – 38
Oil Sands Petroleum (*in situ*)	9.4 – 16
Synfuel (coal gasification)	11 – 26
Coal (slurry transport)	13 – 32
Oil Sands Petroleum (mining)	14 – 33
Syn Fuel (coal Fischer-Tropsch)	41 – 60
Enhanced Oil Recovery	21 – 2,500
Fuel ethanol (irrigated corn)	2,500 – 29,000
Biodiesel (irrigated soy)	13,800 – 60,000

The Addendum also explains that, despite its relatively low long-term water intensity, shale gas production could impact water supply in specific areas, particularly arid regions such as the Eagle Ford Shale play in Texas. The Addendum notes that the relationship between shale gas production and water quantity is principally a local issue, and that the degree of impact depends on "the local climate, recent weather patterns, existing water use rates, seasonal fluctuations, and other factors."[213] The following Table 7 shows the variation in the proportion of water usage by activity in shale gas regions:

[212] *Id*. at 11 (Table 2).
[213] *Id*. at 12.

Table 7: Water Usage in Shale Gas Regions[214]

Play	Public Supply (%)	Industry & Mining (%)	Power Generation (%)	Irrigation (%)	Livestock (%)	Shale Gas (%)	Total Water Use (Bgals/yr) *
Barnett 1	82.7	4.5	3.7	6.3	2.3	0.4	133.8
Eagle Ford[2]	17	4	5	66	4	3 – 6	64.8
Fayetteville[1]	2.3	1.1	33.3	62.9	0.3	0.1	378
Haynesville[1]	45.9	27.2	13.5	8.5	4.0	0.8	90.3
Marcellus[1]	12.0	16.1	71.7	0.1	0.01	0.06	3,570
Niobrara[3]	8	4	6	82		0.01	1,280

[*Bgal/yr = billion gallons per year]

2. Water Quality

Observing that water quality concerns may have received more attention than any other aspect of unconventional natural gas production, the Addendum addresses water quality issues arising from four aspects of unconventional natural gas production: construction, drilling, use of hydraulic fracturing fluids, and handling of flowback and produced waters.

Runoff from the construction of access roads and other earth-disturbing activities can lead to temporary increases in turbidity and sedimentation in surface waters when well sites are being developed. However, the Addendum states that "when standard industry practices and preventative measures are deployed, only minor impacts are likely to result."[215]

Drilling in unconventional natural gas production requires penetrating shallower fresh water aquifers. Referring to NETL's *Modern Shale Gas Development in the United States: A Primer*, the Addendum briefly explains the manner in which such drilling can be undertaken to protect fresh water aquifers.[216] The Addendum acknowledges, however, that while

[214] *Id.* at 12 (Table 3) (citations omitted).
[215] *Id.* at 13.
[216] Addendum at 13-14 (citing GWPC and ALL Consulting. 2009. *Modern Shale Gas Develop. In the United States: A Primer*. Nat'l Energy Tech. Lab.; *available at*: http://www.netl.doe.gov/File%20Library/Research/Oil-Gas/Shale_Gas_Primer_2009.pdf).

unconventional natural gas formations are thousands of feet below aquifers associated with public water supply or surface hydrological connection, poor construction practices may cause failure of a casing or cement bond. This failure, in turn, could lead to potential contamination of an aquifer. The Addendum also observes that drilling may create connections with existing fractures or faults, or improperly plugged or abandoned wells, allowing contaminants to migrate through the subsurface.[217]

The fluid used for hydraulic fracturing consists of over 98 percent water, but also may include several different chemical compounds.[218] These compounds can vary from well to well based on site specific geological information. The Addendum describes federal and state efforts to gather information and require disclosure of the types of chemical additives being used in hydraulic fracturing. The risks posed by the use of these fluids may come from spills and leakages during transport to the well, storage on the well pad, or during the chemical mixing process.[219] Further, chemical additives may contaminate groundwater should the integrity of the casing or cement seal of the well be compromised.[220]

The Addendum considers the potential environmental impacts associated with produced water recovered during flowback operations. Produced water may contain elevated levels of total dissolved solids, salts, metals, organics, and natural occurring radioactive materials, as well as the chemicals included in the fracturing fluid noted above. The Addendum discusses the three principal ways of mitigating the impacts associated with produced water: minimization of the quantity of water used, recycling and re-use of produced water, and disposal.

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[217] *Id.* at 14.
[218] *Id.* at 14-15.
[219] *Id.* at 18.
[220] *Id.*

Concluding its discussion of water resources, the Addendum observes that "[u]nconventional natural gas production, when conforming to regulatory requirements, implementing best management practices, and administering pollution prevention concepts, may have temporary, minor impacts to water resources."[221] Further, risks may arise when best practices are not employed: "[I]mproper techniques, irresponsible management, inadequately trained staff, or site-specific events outside of an operator's control could lead to significant impacts on local water resources."[222]

B. Air Quality

The Addendum discusses air pollutants emitted at different stages of the natural gas production process. These emissions and their sources are captured in Table 8 below:

Table 8: Source Categories of Airborne Emissions from Upstream Natural Gas Activities (EPA, 2013)[223]

	Type of Emissions	Sources of Emissions
Combustion Emissions	NO_x and carbon monoxide (CO) resulting from the burning of hydrocarbon (fossil) fuels. Air toxics, PM, un-combusted VOCs, and CH_4 are also emitted.	Engines, heaters, flares, incinerators, and turbines.
Vented Emissions	VOCs, air toxics, and CH_4 resulting from direct releases to the atmosphere.	Pneumatic devices, dehydration processes, gas sweetening processes, chemical injection pumps, compressors, tanks, well testing, completions, and workovers.
Fugitive Emissions	VOCs, air toxics, and CH_4 resulting from uncontrolled and under-controlled emissions.	Equipment leaks through valves, connectors, flanges, compressor seals, and related equipment and evaporative sources including wastewater treatment, pits, and impoundments.

[221] Addendum at 19.
[222] *Id.*
[223] *Id.* at 23 (Table 6).

The Addendum describes the existing regulatory framework relating to such emissions, as well as the U.S. Environmental Protection Agency's (EPA) 2012 New Sources Performances Standards for hydraulically fractured natural gas wells[224] and EPA's 2013 update to those standards covering storage tanks.[225] The Addendum also summarizes the existing literature on each significant category of air pollutant and describes the potential contribution of oil and gas production activities to ground-level ozone pollution and reduced visibility in sensitive areas.

The Addendum concludes its discussion of air quality by stating that natural gas development leads to both short- and long-term increases in local and regional air emissions, especially methane, VOCs, and hazardous air pollutants. According to the Addendum, the intermittent nature of air emissions from sources such as wells makes it difficult to analyze impacts at the regional level. As more data become available, a better understanding of trends in local and regional air quality and potential impacts may emerge.[226]

C. GHG Emissions

Separate from the LCA GHG Report described below, the Addendum includes a discussion of GHG emissions associated with unconventional natural gas production— principally methane and carbon dioxide. The Addendum describes the nature of GHG emissions from each phase of the production process, including: well drilling and completion; gas production; well re-completions, workovers, and maintenance; gas processing; and gas transmission and storage.

The Addendum also summarizes regulations affecting GHG emissions from upstream natural gas activity. As in the air quality section, the Addendum discusses EPA's 2012 New Source Performance Standards regulations. The Addendum also describes EPA's publication in

[224] *Id*. at 20-22.
[225] *Id.* at 22.
[226] *Id*. at 32.

April 2014 of five technical white papers on potentially significant sources of emissions in the oil and gas sector, including completions and ongoing production of hydraulically fractured oil wells, compressors, pneumatic valves, liquids unloading, and leaks.[227] EPA stated that it will use these white papers, along with input from peer reviewers and the public to determine how best to pursue emissions reductions from these sources, possibly including the development of additional regulations.[228]

Finally, the Addendum summarizes the existing literature estimating GHG emissions and methane leakage rates from the upstream natural gas industry, noting that most studies suggest that "emissions of GHGs from the upstream industry are of similar magnitude for both conventional and unconventional sources."[229]

D. Induced Seismicity

The Addendum provides information on induced seismicity across various types of energy resource activities, namely the production of natural gas, gas condensates, and oil from currently targeted unconventional plays. More specifically, it provides greater detail about the potential for induced seismicity from hydraulic fracturing and wastewater disposal via injection, which is one method of disposing of produced water. Because the duration of injection of hydraulic fracturing fluids is generally minutes or hours and the quantity of injected fluid is relatively low, the Addendum states that "the probability of injecting enough fluid into a natural fault to trigger a felt earthquake is low."[230] By contrast, the Addendum states that the "incidence of felt earthquakes is higher for wastewater disposal via wastewater injection wells because a large volume of water is

[227] Addendum at 22 (*citing* U.S. Envtl. Prot. Agency, Office of Air Quality Planning & Standards, *White Papers on Methane and VOC Emissions*, *available at*: http://www.epa.gov/airquality/oilandgas/whitepapers.html) (released April 15, 2014).
[228] *Id.* at 44.
[229] *Id.* at 40.
[230] *Id.* at 51.

injected over a longer period of time without any withdrawal of fluids, with the result that fluid pressures can be increased within a large area surrounding the injection well."[231] The Addendum identifies seismic events thought to have been triggered by wastewater disposal into injection wells in Oklahoma, Colorado, Arkansas, and Ohio.

Addressing the severity of seismic events induced by natural gas activities, the Addendum cites a 2013 National Research Council report characterizing the risk of induced seismicity as principally one of alarm to the public and minor property damage, as opposed to significant disruption.[232]

E. Land Use

The Addendum addresses potential land use impacts resulting from unconventional natural gas production. Land use impacts arise from the construction and development of new access roads, heavy truck traffic on existing local roadways, well pads, pipeline rights of way, and other structures such as compressor stations. The Addendum includes discussions of increased vehicle traffic, habitat fragmentation, reflective light pollution, noise, and other impacts associated with these land use changes. According to the Addendum, "[t]he real issue with land use impacts is not the minor impacts related to each well pad, access road, or pipeline."[233] Rather, "[w]hen the impacts from these individual components of shale gas development are considered in aggregate, or cumulatively, the impacts become magnified on an ecosystem or regional scale."[234] The Addendum identifies siting and design considerations that may minimize land use impacts, as well as traffic and road way impacts associated with large vehicles and concerns for vehicular safety

[231] *Id*. at 52.
[232] *Id* at 55-56 (citing *Induced Seismicity Potential in Energy Technologies*. National Research Council. The National Academies Press, Washington, D.C. (2013) at 5).
[233] Addendum at 62.
[234] *Id*.

for the motoring public.

X. DOE/FE LIFE CYCLE GREENHOUSE GAS PERSPECTIVE ON EXPORTING LIQUEFIED NATURAL GAS FROM THE UNITED STATES

A. Description of LCA GHG Report

In January 2014, DOE/FE commissioned NETL to undertake a study analyzing the life cycle emissions of greenhouse gases (GHG), including carbon dioxide (CO_2) and methane (CH_4), associated with natural gas produced in the United States and exported as LNG to other countries for use in electric power generation. The study was intended to inform DOE/FE's decision-making under NGA section 3(a) and to provide additional information to the public. The study—entitled *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States* (LCA GHG Report)—estimated the life cycle GHG emissions of domestically produced LNG (also referred to as U.S. LNG) exports to Europe and Asia, compared with alternative fuel supplies (such as regional coal and other imported natural gas), for electric power generation in the destination countries.

NETL published the LCA GHG Report on May 29, 2014, as well as a 200-page supporting document entitled, *Life Cycle Analysis of Natural Gas Extraction and Power Generation.*[235] On June 4, 2014, DOE/FE provided notice of the documents in the *Federal Register* and invited public comment.[236] The 45-day public comment period closed July 21, 2014. In this section, we summarize the scope of the LCA GHG Report, as well as its methods, limitations, and

[235] *See* Dep't of Energy, Nat'l Energy Tech. Lab., *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States* (May 29, 2014), *available at:* http://energy.gov/fe/life-cycle-greenhouse-gas-perspective-exporting-liquefied-natural-gas-united-states; *see also* Dep't of Energy, Nat'l Energy Tech. Lab., *Life Cycle Analysis of Natural Gas Extraction and Power Generation* (May 29, 2014), *available at:* http://www.netl.doe.gov/energy-analyses/temp/NaturalGasandPowerLCAModelDocumentationNG%20Report_052914.pdf [hereinafter NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*].

[236] Dep't of Energy, Notice of Availability of Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States and Request for Comment, 79 Fed. Reg. 32,260 (June 4, 2014). The NETL documents and all comments received were placed in the administrative record for each of the 25 non-FTA export application dockets then before DOE/FE, including this docket. *See id*.

conclusions. Below, we summarize the public comments on the Report and respond to those comments. *See infra* § X.B.

1. Purpose of the LCA GHG Report

The LCA GHG Report was designed to answer two principal questions:

- How does LNG exported from the United States compare with regional coal (or other LNG sources) used for electric power generation in Europe and Asia, from a life cycle GHG perspective?
- How do those results compare with natural gas sourced from Russia and delivered to the same European and Asian markets via pipeline?

In establishing this framework, NETL considered the following:

- In what countries will the natural gas produced in the United States and exported as LNG be used?
- How will the U.S. LNG be used in those countries, *i.e.*, for what purpose?
- What are the alternatives to using U.S. LNG for electric power generation in those countries?

Because the exact destination country (or countries) of U.S. LNG cannot be predicted for this study, NETL considered one medium-distance destination (a location in Europe) and one long-distance destination (a location in Asia). NETL chose Rotterdam, Netherlands, as the European destination and power plant location, and Shanghai, China, as the Asian location. NETL used other locations for the alternative sources of natural gas and coal, as specified in the Report. NETL also determined that one of the most likely uses of U.S. LNG is to generate electric power in the destination countries. In considering sources of fuel other than U.S. LNG, NETL assumed that producers in Europe and Asia could generate electricity in the following ways: (1) by obtaining natural gas from a local or regional pipeline, (2) by obtaining LNG from a LNG producer located closer geographically than the United States, or (3) by using regional coal supplies, foregoing natural gas altogether.

Using this framework, NETL developed four study scenarios, identified below. To compare scenarios, NETL used a common denominator as the end result for each scenario: one megawatt-hour (MWh) of electricity delivered to the consumer, representing the final consumption of electricity. Additionally, NETL considered GHG emissions from all processes in the LNG supply chains—from the "cradle" when natural gas or coal is extracted from the ground, to the "grave" when electricity is used by the consumer. This method of accounting for cradle-to-grave emissions over a single common denominator is known as a life cycle analysis, or LCA.[237]

Using this LCA approach, NETL's objective was to model realistic LNG export scenarios, encompassing locations at both a medium and long distance from the United States, while also considering local fuel alternatives. The purpose of the medium and long distance scenarios was to establish likely results for both extremes (*i.e.*, both low and high bounds).

2. Study Scenarios

NETL identified four modeling scenarios to capture the cradle-to-grave process for both the European and Asian cases. The scenarios vary based on where the fuel (natural gas or coal) comes from and how it is transported to the power plant. For this reason, the beginning "cradle" of each scenario varies, whereas the end, or "grave," of each scenario is the same because the uniform goal is to produce 1 MWh of electricity. The first three scenarios explore different ways to transport natural gas; the fourth provides an example of how regional coal may be used to generate electricity, as summarized in Table 9 below:

[237] The data used in the LCA GHG Report were originally developed to represent U.S. energy systems. To apply the data to this study, NETL adapted its natural gas and coal LCA models. The five life cycle stages used by NETL, ranging from Raw Material Acquisition to End Use, are identified in the LCA GHG Report at 1-2.

Table 9: LCA GHG Scenarios Analyzed by NETL[238]

Scenario	Description	Key Assumptions
1	• Natural gas is extracted in the United States from the Marcellus Shale. • It is transported by pipeline to an LNG facility, where it is cooled to liquid form, loaded onto an LNG tanker, and transported to an LNG port in the receiving country (Rotterdam, Netherlands, for the European case and Shanghai, China, for the Asian case). • Upon reaching its destination, the LNG is re-gasified, then transported to a natural gas power plant.	The power plant is located near the LNG import site.
2	• Same as Scenario 1, except that the natural gas comes from a regional source closer to the destination. • In the European case, the regional source is Oran, Algeria, with a destination of Rotterdam. • In the Asian case, the regional source is Darwin, Australia, with a destination of Osaka, Japan.	Unlike Scenario 1, the regional gas is produced using conventional extraction methods, such as vertical wells that do not use hydraulic fracturing. The LNG tanker transport distance is adjusted accordingly.
3	• Natural gas is produced in the Yamal region of Siberia, Russia, using conventional extraction methods.[239] • It is transported by pipeline directly to a natural gas power plant in either Europe or Asia.	The pipeline distance was calculated based on a "great circle distance" (the shortest possible distance between two points on a sphere) between the Yamal district in Siberia and a power plant located in either Rotterdam or Shanghai.
4	• Coal is extracted in either Europe or Asia. It is transported by rail to a domestic coal-fired power plant.	This scenario models two types of coal widely used to generate steam-electric power: surface mined sub-bituminous coal and underground mined bituminous coal. Additionally, U.S. mining data and U.S. plant operations

[238] The four scenarios are set forth in the LCA GHG Report at 2.
[239] Yamal, Siberia, was chosen as the extraction site because that region accounted for 82.6% of natural gas production in Russia in 2012.

		were used as a proxy for foreign data.

In all four scenarios, the 1 MWh of electricity delivered to the end consumer is assumed to be distributed using existing transmission infrastructure.

3. GHGs Reported as Carbon Dioxide Equivalents

Recognizing that there are several types of GHGs, each having a different potential impact on the climate, NETL normalized GHGs for the study. NETL chose carbon dioxide equivalents (CO_2e), which convert GHG gases to the same basis: an equivalent mass of CO_2. CO_2e is a metric commonly used to estimate the amount of global warming that GHGs may cause, relative to the same mass of CO_2 released to the atmosphere. NETL chose CO_2e using the global warming potential (GWP) of each gas from the 2013 Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (IPCC, 2013). The LCA GHG Report applied the respective GWPs to a 100-year and a 20-year time frame.

4. Natural Gas Modeling Approach

NETL states that its natural gas model is flexible, allowing for the modeling of different methods of producing natural gas. For Scenario 1, all natural gas was modeled as unconventional gas from the Marcellus Shale, since that shale play reasonably represents new marginal gas production in the United States. For Scenarios 2 and 3, the extraction process was modeled after conventional onshore natural gas production in the United States. This includes both the regional LNG supply options that were chosen for this study (Algeria for Europe and Australia for Asia) and extraction in Yamal, Siberia, for pipeline transport to the power plants in Europe and Asia.

In the above three natural gas scenarios, the natural gas is transported through a pipeline, either to an area that processes LNG (Scenarios 1 and 2) or directly to a power plant (Scenario 3). NETL's model also includes an option for all LNG steps—from extraction to consumption—known as an LNG supply chain. After extraction and processing, natural gas is transported through a pipeline to a liquefaction facility. The LNG is loaded onto an ocean tanker, transported to an LNG terminal, re-gasified, and fed to a pipeline that transports it to a power plant. NETL assumed that the natural gas power plant in each of the import destinations already exists and is located close to the LNG port.

The amount of natural gas ultimately used to make electricity is affected by power plant efficiency. Therefore, the efficiency of the destination power plant is an important parameter required for determining the life cycle emissions for natural gas power. The less efficient a power plant, the more gas it consumes and the more GHG emissions it produces per unit of electricity generated. For this study, NETL used a range of efficiencies that is consistent with NETL's modeling of natural gas power in the United States.[240] NETL also assumed that the efficiencies used at the destination power plants (in Rotterdam and Shanghai) were the same as those used in the U.S. model.

5. Coal Modeling Approach

NETL modeled Scenario 4, the regional coal scenario, based on two types of coal: bituminous and sub-bituminous. Bituminous coal is a soft coal known for its bright bands. Sub-bituminous coal is a form of bituminous coal with a lower heating value. Both types are widely used as fuel to generate steam-electric power. NETL used its existing LCA model for the extraction and transport of sub-bituminous and bituminous coal in the United States as a proxy

[240] *See* LCA GHG Report at 4 (*citing* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*).

for foreign extraction in Germany and China. Likewise, NETL modeled foreign coal production as having emissions characteristics equivalent to average U.S. coal production. No ocean transport of coal was included to represent the most conservative coal profile (whether regionally sourced or imported).

The heating value of coal is the amount of energy released when coal is combusted, whereas the heat rate is the rate at which coal is converted to electricity by a power plant. Both factors were used in the model to determine the feed rate of coal to the destination power plant (or the speed at which the coal would be used). For consistency, this study used the range of efficiencies that NETL modeled for coal power in the United States. The study also assumed the same range of power plant efficiencies for Europe and Asia as the U.S. model.

6. Key Modeling Parameters

NETL modeled variability among each scenario by adjusting numerous parameters, giving rise to hundreds of variables. Key modeling parameters described in the LCA GHG Report include: (1) the method of extraction for natural gas in the United States, (2) methane leakage for natural gas production,[241] (3) coal type (sub-bituminous or bituminous),[242] (4) the flaring rate for natural gas,[243] (5) transport distance (ocean tanker for LNG transport, and rail for coal transport),[244] and (6) the efficiency of the destination power plant.

For example, as shown in Table 5-1 of the LCA GHG Report, NETL used two different

[241] The key modeling parameters for the natural gas scenarios are provided in Table 5-1 (LNG) and Table 5-2 (Russian natural gas). *See* LCA GHG Report at 6. The key parameters for natural gas extraction, natural gas processing, and natural gas transmission by pipeline are set forth in Tables 5-4, 5-5, and 5-6, respectively. *See id*. at 7-8.
[242] The modeling parameters and values for the coal scenarios are provided in Table 5-3. *See* LCA GHG Report at 6.
[243] Flaring rate is a modeling parameter because the global warming potential of vented natural gas, composed mostly of methane, can be reduced if it is flared, or burned, to create CO_2. *See id*. at 7.
[244] The distances used for pipeline transport of Russian gas are provided in Table 5-2. *See id*. at 6.

ranges for methane leakage rates for Scenarios 1 and 2: from 1.2 to 1.6% for natural gas extracted from the Marcellus Shale, and from 1.1 to 1.6% from gas extracted using conventional extraction methods. For Scenario 3 (the Russian cases), however, NETL used a higher range for methane leakage rates for both the European and Asian locations, in light of the greater pipeline distance from Russia.[245] As the pipeline distance increases, the total methane leakage from pipeline transmission also increases, as does the amount of natural gas that is extracted to meet the same demand for delivered natural gas. Notably, as part of the study, NETL conducted a methane leakage breakeven analysis to determine the "breakeven leakage" at which the life cycle GHG emissions for natural gas generated power would equal those for the coal Reference case (Scenario 3).[246]

In sum, NETL noted that the LCA study results are sensitive to these key modeling parameters, particularly changes to natural gas and coal extraction characteristics, transport distances, and power plant performance.[247] NETL also identified several study limitations based on the modeling parameters, including: (1) NETL's LCA models are U.S.-based models adapted for foreign natural gas and coal production and power generation, and (2) the specific LNG export and import locations used in the study represent an estimate for an entire region (*e.g.*, New Orleans representing the U.S. Gulf Coast).[248]

7. Results of the LCA GHG Report

NETL states that two primary conclusions may be drawn from the LCA GHG Report.[249] First, use of U.S. LNG exports to produce electricity in European and Asian markets will *not*

[245] *See* LCA GHG Report at 5.
[246] The methane leakage breakeven analysis is described in the LCA GHG Report at 14 and 15.
[247] *See* LCA GHG Report at 5. To ensure that the study results were robust, NETL conducted several side analyses and sensitivity calculations, as discussed in the LCA GHG Report.
[248] The study limitations are described in the LCA GHG Report at 18.
[249] NETL's detailed study results, with corresponding figures, are set forth on pages 8 through 18 of the LCA GHG Report.

increase GHG emissions on a life cycle perspective, when compared to regional coal extraction and consumption for power production. As shown below in Figures 1 and 2, NETL's analysis indicates that, for most scenarios in both the European and Asian regions, the generation of power from imported natural gas has lower life cycle GHG emissions than power generation from regional coal.[250] (The use of imported coal in these countries will only increase coal's GHG profile.) Given the uncertainty in the underlying model data, however, NETL states that it is not clear if there are significant differences between the corresponding European and Asian cases other than the LNG transport distance from the United States and the pipeline distance from Russia.

[250] Although these figures present an expected value for each of the four scenarios, NETL states that the figures should not be interpreted as the most likely values due to scenario variability and data uncertainty. Rather, the values allow an evaluation of trends only—specifically, how each of the major processes (*e.g.*, extraction, transport, combustion) contribute to the total life cycle GHG emissions. *See* LCA GHG Report at 8-9.

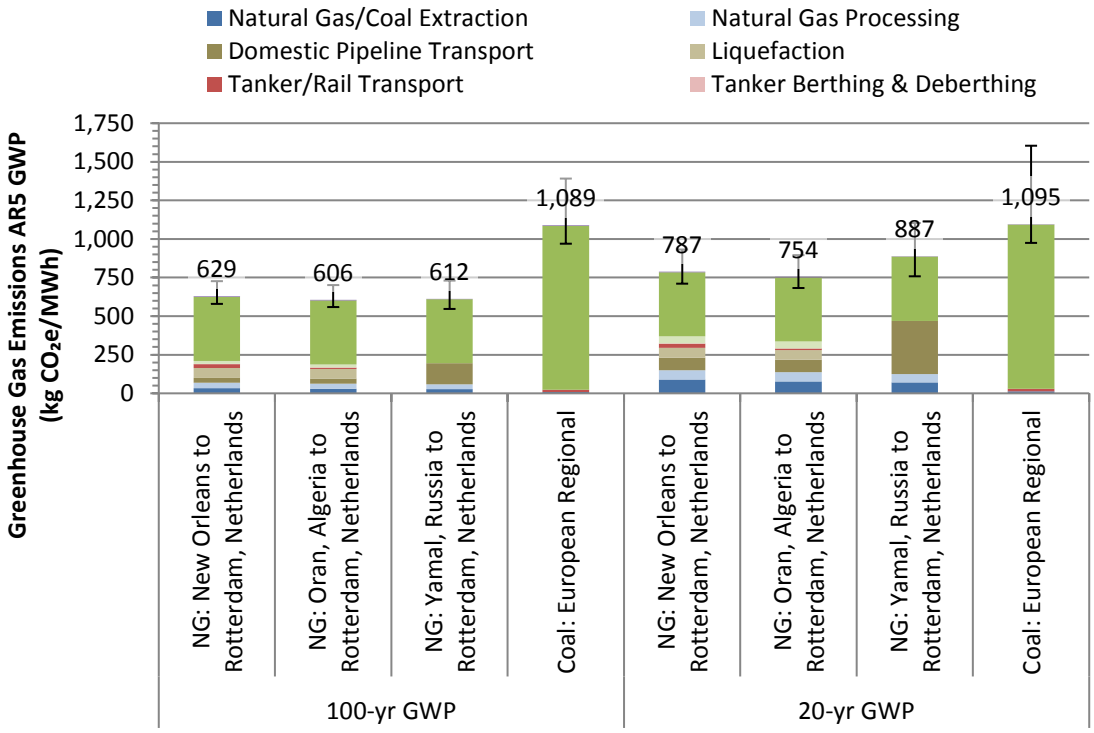

Figure 1: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe[251]

[251] LCA GHG Report at 9 (Figure 6-1).

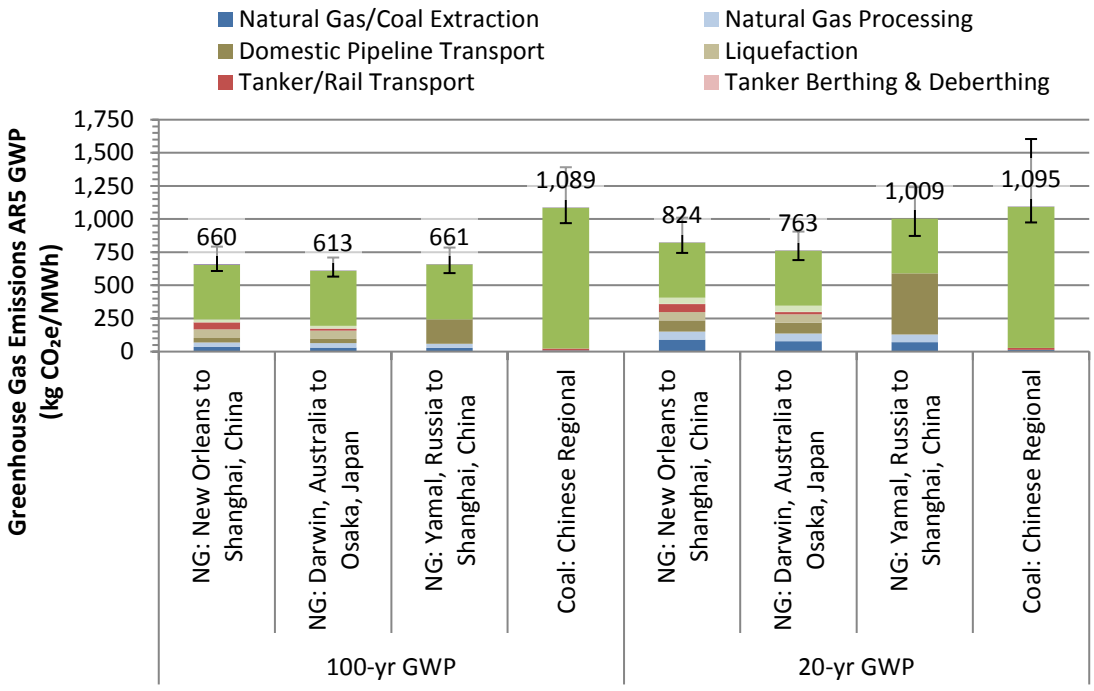

Figure 2: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia[252]

Second, there is an overlap between the ranges in the life cycle GHG emissions of U.S. LNG, regional alternative sources of LNG, and natural gas from Russia delivered to the European or Asian markets. Any differences are considered indeterminate due to the underlying uncertainty in the modeling data. Therefore, the life cycle GHG emissions among these sources of natural gas are considered similar, and no significant increase or decrease in net climate impact is anticipated from any of these three scenarios.

[252] LCA GHG Report at 10 (Figure 6-2).

B. Comments on the LCA GHG Report and DOE/FE Analysis

As discussed above, the LCA GHG Report compares life cycle GHG emissions from U.S. LNG exports to regional coal and other imported natural gas for electric power generation in Europe and Asia. Following the close of the public comment period on the LCA GHG Report, DOE/FE identified 18 unique submissions received from the general public, interest groups, industry, and academia/research institutions, which DOE/FE categorized into seven distinct comments.[253]

DOE/FE identifies below: (i) the pertinent arguments by topic, with reference to representative comments, and (ii) DOE/FE's basis for the conclusions that it drew in reviewing those comments. In so doing, DOE/FE will respond to the relevant, significant issues raised by the commenters.

1. Study Conclusions

a. Comments

Several commenters, including Citizens Against LNG and Oregon Wild, claim that the life cycle GHG emissions from natural gas are higher than those from coal.

b. DOE/FE Analysis

These comments assert that natural gas has higher GHGs than coal, but they do not cite data sources applicable to the comparison of U.S.-exported LNG to regional coal, nor do they acknowledge that the different end uses of coal and natural gas (i.e., heating, power, or transportation) affect their relative life cycle GHG performance. If the characteristics of each fuel (most critically, the carbon content per unit of the fuel's energy) and power plant

[253] In some instances, single letters were sent on behalf of a group of people. In one case, multiple copies of a form letter were received from 149 individuals, hereinafter referred to as "Concerned Citizens." Most of the individuals in the Concerned Citizens group live in New York, but other states and countries are also represented.

efficiencies are considered, the lower per-MWh CO_2 emissions from natural gas power plants in comparison to coal power plants make natural gas lower than coal in the context of power plant operations by 61% (see Table 10 below, [(415 – 1,063)/1,063 x 100]). The life cycle of baseload electricity generation is a reasonable basis for comparing natural gas and coal because both types of fuels are currently used on a large scale by baseload power plants.

Table 10 shows the life cycle GHG emissions CO_2, methane (CH_4), nitrous oxide (N_2O), and sulfur hexafluoride (SF_6) from natural gas and coal systems and demonstrates the importance of power plant operations to total life cycle GHG emissions over 100- and 20-year GWP timeframes. This table is representative of European end-use scenarios, which consume natural gas exported from the United States and coal extracted in Europe. (This table is based on the same data as used by Figure 6-1 of the LCA GHG Report.)

Table 10: Life Cycle GHG Emissions from Natural Gas and Coal Systems (kg CO_2e/MWh)

Life Cycle Process	100-yr GWP		20-yr GWP	
	Natural Gas: New Orleans to Rotterdam, Netherlands	Coal: European Regional	Natural Gas: New Orleans to Rotterdam, Netherland	Coal: European Regional
Natural Gas/Coal Extraction	33.9	7.8	88.7	13.6
Natural Gas Processing	34.5	-	60.4	-
Domestic Pipeline Transport	32.3	-	81.4	-
Liquefaction	63.6	-	63.6	-
Tanker/Rail Transport	25.0	14.4	28.4	15.3
Tanker Berthing & Deberthing	1.5	-	1.6	-
LNG Regasification	20.0	-	45.3	-
Power Plant Operations	415	1,063	415	1,064
Electricity T&D	3.4	3.4	2.5	2.5
Total	**629**	**1,089**	**787**	**1,095**

2. Boundaries of the LCA GHG Report

a. Comments

Sierra Club,[254] Food & Water Watch,[255] Americans Against Fracking *et al*., Susan Sakmar, and Concerned Citizens, among others, contend that the LCA GHG Report has flawed boundaries and scenarios. In particular, these commenters contend that the LCA GHG Report assumes that LNG will displace coal power without also accounting for the displacement of renewable energy.

b. DOE/FE Analysis

The boundaries of the LCA were developed with respect to questions about two fossil fuels, coal and natural gas, and where they come from. The scenarios in the LCA do not model displacement of any kind. These two scenarios are purely attributional, meaning that they focus on independent supply chains for each scenario and do not account for supply or demand shifts caused by the use of one fuel instead of another fuel.

3. Natural Gas Transport between Regasification and Power Plants

a. Comments

Sierra Club and Concerned Citizens, among others, assert that the LCA GHG Report does not account for natural gas transport between LNG regasification facilities and power plants in the importing countries.

b. DOE/FE Analysis

The choice to exclude transportation between regasification and the power plant was a modeling simplification. The sensitivity analysis of GHG emissions with changes to pipeline

[254] Sierra Club submitted comments on behalf of its members and supporters as well as Cascadia Wildlands, Otsego 2000, Inc., Columbia Riverkeeper, Stewards of the Lower Susquehanna, Inc., Friends of the Earth, Chesapeake Climate Action Network, Food and Water Watch, and EarthJustice.
[255] Food & Water Watch submitted comments in the form of a letter signed by 85 individuals representing various national, state, and local public interest groups.

transport distance, as illustrated by Figures 4-7 and 4-8 of NETL's *Life Cycle Analysis of Natural Gas Extraction and Power Generation,* shows that the *doubling* (i.e., a 100% increase) of natural gas pipeline transport distance increases the *upstream* GHG emissions from natural gas by 30%. When this upstream sensitivity is applied to the life cycle boundary of the LCA GHG Report, an additional 100 miles beyond the LNG import terminal increases the life cycle GHG emissions for the LNG export scenarios by 0.8%, and an additional 500 miles beyond the LNG import terminal increases the life cycle GHG emissions for the LNG export scenarios by 4% (using 100-year GWPs as specified by the IPCC Fifth Assessment Report). Although this parameter modification changes the results of the LCA slightly, it does not change the conclusions of the LCA GHG Report.

4. Data Quality for LNG Infrastructure, Natural Gas Extraction, and Coal Mining

a. Comments

Several commenters, including API, Concerned Citizens, and Sierra Club, commented on whether the data used in the LCA GHG Report is current and fully representative of the natural gas industry. In particular, API asserts that NETL's model is representative of inefficient liquefaction technologies that overstate the GHG emissions from the LNG supply chain, coal data that understates the methane emissions from coal mines, and natural gas extraction data that mischaracterizes "liquids unloading" practices.[256] API proposes the use of newer data for both

[256] For purposes of this term, we refer to EPA's description of "liquids unloading" as follows: "In new gas wells, there is generally sufficient reservoir pressure to facilitate the flow of water and hydrocarbon liquids to the surface along with produced gas. In mature gas wells, the accumulation of liquids in the well can occur when the bottom well pressure approaches reservoir shut-in pressure. This accumulation of liquids can impede and sometimes halt gas production. When the accumulation of liquid results in the slowing or cessation of gas production (i.e., liquids loading), removal of fluids (i.e., liquids unloading) is required in order to maintain production. Emissions to the atmosphere during liquids unloading events are a potentially significant source of VOC and methane emissions." U.S. Envtl. Prot. Agency, Office of Air Quality Planning & Standards, *Oil & Natural Gas Sector Liquids Unloading Processes,* Report for Oil & Gas Sector Liquids Unloading Processes Review Panel, at 2 (April 2014), *available at*: http://www.epa.gov/airquality/oilandgas/pdfs/20140415liquids.pdf.

liquefaction terminals in the United States and methane emission factors from unconventional natural gas extraction and coal mining. Concerned Citizens argue that the LCA GHG Report does not clearly identify its source of data for estimates of loss related to LNG production, shipping, and regasification, as well as the basis for estimates of pipeline losses from Russia. Sierra Club points to inaccurate referencing of EPA's Subpart W report, which was the basis for many of NETL's emission factors for natural gas extraction.

b. DOE/FE Analysis

(1) Liquefaction Data

API points to newer data for liquefaction facilities that have higher efficiencies than the liquefaction process in the LCA GHG Report. API points to the GHG intensities of the liquefaction facilities proposed by Sabine Pass, Cameron LNG, and FLEX, each of which has been granted one or more non-FTA LNG export orders by DOE/FE (*see infra* § XII.D). According to API, these proposed facilities will produce 0.26, 0.29, and 0.12 tonnes of CO_2e per tonne of LNG, respectively. The majority of a liquefaction facility's energy is generated by combusting incoming natural gas, so the GHG intensity of a liquefaction facility is directly related to its efficiency. As API correctly points out, the LCA model assumes a GHG intensity of 0.44 tonnes of CO_2e per tonne of LNG; this GHG intensity is representative of a facility that consumes 12% of incoming natural gas as plant fuel.[257]

The above GHG intensities and liquefaction efficiencies are not life cycle numbers, but represent only the gate-to-gate operations of liquefaction facilities, beginning with the receipt of processed natural gas from a transmission pipeline and ending with liquefied natural gas ready

[257] NETL (2010). NETL Life Cycle Inventory Data – Unit Process: LNG Liquefaction, Operation. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: May 2010 (version 01); *available at*: http://www.netl.doe.gov/File Library/Research/Energy Analysis/Life Cycle Analysis/UP_Library/DS_Stage1_O_LNG_Liquefaction_2010-01.xls.

for ocean transport. As illustrated by Figures 6-1 and 6-2 in the LCA GHG Report (reproduced as tables herein), liquefaction accounts for approximately 10% of the life cycle GHG emissions of U.S. LNG used for electric power generation in Europe and Asia. A doubling of liquefaction efficiency (thus achieving a GHG intensity comparable to the average of the Sabine Pass, Cameron, and Freeport facilities) would lead to a 6% reduction in the feed rate of natural gas to the liquefaction plant.[258] This feed rate reduction would also reduce natural gas extraction, processing, and transmission emissions by 6%, but would not affect the processes downstream from liquefaction (ocean tankers, power plants, and electricity transmission networks). Applying the increased liquefaction efficiency and the 6% reduction in feed rate to the results of the LCA GHG Report would reduce the life cycle GHG emissions for LNG export scenarios by only 1.5% (using 100-year GWPs as stated in the IPCC Fifth Assessment Report). Increasing liquefaction efficiency may significantly reduce the emissions from one point in the supply chain, but it does not change the conclusions of the LCA.

(2) Natural Gas Methane Data

API and Concerned Citizens criticize the quality of data that DOE/NETL uses for natural gas extraction. API's concern is that NETL overstates the GHG emissions from unconventional well completion. API compares NETL's emission factor for unconventional well completions (9,000 Mcf of natural gas/episode) to the emission factor that EPA states in its 2014 GHG inventory (approximately 2,500 Mcf of natural gas/episode). EPA revised its unconventional completion emission factor between its 2013 and 2014 inventory reports,[259] after NETL's model had been finalized and during the time that NETL was completing the LCA GHG Report. These

[258] *See id.*
[259] U.S. Envtl. Prot. Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012, *available at*: http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Main-Text.pdf.

factors are referred to as "potential emission factors" because they do not represent natural gas that is directly released to the atmosphere, but they represent the volume of natural gas that can be sent to flares and other environmental control equipment. NETL uses a potential emission factor of 9,000 Mcf of natural gas per each episode of shale gas hydraulic fracturing, and a potential emission factor of 3.6 Mcf of natural gas per each episode of liquids unloading (with 31 liquids unloading episodes per well-year). NETL's model augments potential emission factors with flaring, thereby reducing the amount of methane that is released to the atmosphere. These emission factors are consistent with the findings of a survey jointly conducted by API and America's Natural Gas Alliance and released in September 2012.[260] They also match the factors used by EPA's 2013 GHG inventory.[261]

NETL's current model accounts for liquids unloading emissions from conventional wells, but does not account for liquids unloading from unconventional wells. Applying liquids unloading to the unconventional wells in this analysis increases the life cycle GHGs by 0.6% for LNG export scenarios (using 100-year GWPs as stated in the IPCC Fifth Assessment Report). This 0.6% was estimated by assigning the liquid unloading emissions from onshore conventional natural gas to the upstream results for Marcellus Shale natural gas, followed by an expansion of the boundaries to a life cycle context. Simply put, liquids unloading accounts for 11% of the upstream GHG emissions from conventional onshore natural gas.[262] When liquids unloading is added to unconventional natural gas in the LCA model, it is scaled according to the unique production rates and flaring practices of unconventional wells in addition to the subsequent flows of natural gas processing, liquefaction, ocean transport, regasification, power plant operations,

[260] *Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production: Summary and Analysis of API and ANGA Survey Responses*. Final Report (Sept. 21, 2012).
[261] U.S. Envtl. Prot. Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011 (Apr. 12, 2013).
[262] *See* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*.

and electricity transmission. Thus, while liquids unloading may account for a significant share of *upstream* GHG emissions, none of the LCA GHG Report's conclusions would change with the addition of liquids unloading to unconventional natural gas extraction.

The potential emissions from unconventional well completions are modeled as 9,000 Mcf of natural gas per episode. It is important to remember that this factor does not represent methane emissions directly released to the atmosphere, but the flow of natural gas prior to environmental controls. For unconventional natural gas, NETL's model flares 15% of these potential emissions (flaring converts methane to CO_2, thus reducing the GWP of the gas) and apportions all completion emissions to a unit of natural gas by dividing them by lifetime well production (completion emissions occur as one-time episode that must be converted to a life cycle basis by amortizing them over total lifetime production of a well). Further, the life cycle GHG contributions from well completions are diluted when scaled to the subsequent flows of natural gas processing, liquefaction, ocean transport, regasification, power plant operations, and electricity transmission. However, in NETL's model, life cycle completion emissions are directly affected by the estimated ultimate recovery (EUR) of a well because the total amount of natural gas produced by a well is used as a basis for apportioning completion and other one-time emissions to a unit of natural gas produced. From an engineering perspective, wells with high EURs are more likely to have a high initial reservoir pressure that increases the potential completion emissions. A reasonable uncertainty range around the potential emissions from unconventional completion emissions (9,000 Mcf/episode) is -30% to +50% (6,100 to 13,600 Mcf/episode). This uncertainty range matches the scale of uncertainty around the Marcellus Shale EUR used in the LCA GHG Report (see Table 5-4 of the LCA GHG Report). This -30%

to +50% uncertainty around potential emissions from unconventional completions causes a -2% to 3% uncertainty around life cycle GHG emissions for the export scenarios of this analysis.

The New Source Performance Standards (NSPS) rules for the oil and natural gas sector, which EPA amended in a final rule published on June 3, 2016,[263] will achieve significant methane emission reductions primarily by requiring all new or modified wells to capture and control potential emissions of VOCs during natural gas well completion. In addition to well completion emissions, the NSPS rules target other point sources of VOC emissions from new and modified sources at natural gas extraction and processing sites, but they do not address liquids unloading.[264] The LCA GHG Report does not account for the potential effects of the NSPS rules on natural gas emissions because the scope of the LCA accounts for GHG emissions from natural gas being produced today. EPA's Regulatory Impact Analysis estimated that the final NSPS rule would reduce annual methane emissions in 2015 by 18 million metric tons, meaning that this rule will have the effect of reducing life cycle emissions from natural gas systems as new wells are developed and existing wells are modified. The likely effects of the NSPS rule therefore suggest that the conclusions of the LCA GHG Report are conservative with respect to the life cycle GHG emissions of natural gas produced in the United States.

Sierra Club contends that NETL's documentation, including the 200-page supporting LCA document, does not clearly cite EPA's Subpart W document. NETL's Report has three references to Subpart W, cited as EPA 2011a, 2011b, and 2011c. These three references should

[263] U.S. Envtl. Prot. Agency, Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources; Final Rule (40 C.F.R. Part 60), 81 Fed. Reg. 35,824 (June 3, 2016); *available at:* https://www.gpo.gov/fdsys/pkg/FR-2016-06-03/pdf/2016-11971.pdf.
[264] U.S. Envtl. Prot. Agency, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews (40 C.F.R. Part 63) (Apr. 17, 2012); *available at:* http://www.epa.gov/airquality/oilandgas/pdfs/20120417finalrule.pdf.

refer to the same document.[265] Future versions of the Report will correct these duplicate citations. Sierra Club also calls out the citation for EPA, 2012c, although this is a correct reference that points to EPA's documentation of New Source Performance Standards.

(3) Coal Methane Data

API and Concerned Citizens criticize the quality of data that DOE/NETL uses for coal extraction. In particular, API claims that coal mine methane emissions may be higher than the factors used by NETL. Concerned Citizens simply claim that NETL used a limited set of references to characterize coal mine emissions.

Methane emissions from coal mines are based on data collected by EPA's Coalbed Methane Outreach Program and have been organized by coal type and geography. Due to data limitations, the LCA GHG Report used this data as a proxy for emissions from foreign coal. This limitation is noted in the LCA GHG Report and is accounted for by uncertainty.[266] The bounds on coal methane uncertainty were informed by the variability in coal mine methane emissions between surface mines (subbituminous coal) and underground mines (bituminous coal) in the United States. The default parameters in NETL's model represent subbituminous coal, which has lower coal mine methane emissions than bituminous coal (these parameters are specified in Table 5-3 of the LCA GHG Report). If coal mines in Europe and Asia emit methane at rates similar to the underground, bituminous coal mines in the United States, then the life cycle GHG emissions from coal power would increase. This increase in coal mine methane emissions would increase the life cycle GHG emissions of coal power by 8 percent (from 1,089 to 1,180 kg CO_2e/MWh, using 100-year GWPs as stated in the IPCC Fifth Assessment Report).

[265] U.S. Envtl. Prot. Agency, Greenhouse Gas Emissions Reporting from the Petroleum and Natural Gas Industry: Background Technical Support Document (2011), *available at:* https://www.epa.gov/sites/production/files/2015-05/documents/subpart-w_tsd.pdf.
[266] *See, e.g.*, NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation.*

This uncertainty is illustrated by Figure 6-16 in the LCA GHG Report. Again, even though changes to coal mine methane emissions change the GHG results of the LCA, they do not change the conclusions of the LCA.

5. Methane Leakage Rate Used in the LCA GHG Report

a. Comments

A number of commenters, including Sierra Club, Food & Water Watch, Americans Against Fracking et al., and Zimmerman and Associates, claim that the methane leakage rate used by NETL is too low. They assert that it does not match top-down (or aerial) measurements recently conducted in regions with natural gas activity, nor does it match the leakage rate in a recent analysis of wellhead casings in Pennsylvania.

b. DOE/FE Analysis

Recent studies lack consensus concerning the extent and rates of leakage from the upstream natural gas supply chain, with the leakage rates reported by these studies ranging from less than 1% to as high as 10%.[267] One reason for this broad range of leakage rates is the fact that different analysts use different boundaries (*e.g.*, extraction only, extraction through processing, extraction through transmission, and extraction through distribution). Further, top-down measurements are taken over narrow time frames and limited geographic scopes that represent only a snapshot of operations. They do not necessarily represent long-term operations over a broad area.

Another reason for this range of leakage rates is confusion between leaks and losses. Natural gas leaks include emissions from pneumatically controlled devices, valves, compressor seals, acid gas removal units, dehydrators, and flanges. These leaks are a mix of methane and

[267] *See* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation* (Section 6.2.1) (identifying reports that include various leakage rates).

other hydrocarbons, and are a subset of total natural gas losses. Another type of loss includes flaring, which converts methane to CO_2 and thus reduces methane venting to the atmosphere. Similarly, the combustion of natural gas by reboilers in a natural gas processing plant or by compressors on a pipeline represents the loss of natural gas that is used to improve the purity of the gas itself and move it along the transmission network.

NETL's expected cradle-through-transmission leakage rate is 1.2%. In other words, the extraction, processing, and transmission of 1 kg of natural gas releases 0.012 kg of CH_4 to the atmosphere. In contrast, NETL's expected loss rate from the same boundary is approximately 8%: for the delivery of 1 kg of natural gas via a transmission pipeline, 0.012 kg of CH_4 is released to the atmosphere, and 0.068 kg is flared by environmental controls or combusted for processing and transmission energy.

Sierra Club compares NETL's leakage rate to a 1.54% leakage rate derived from EPA's 2013 GHG inventory. The two types of leakage rates (the 1.2% calculated by NETL's life cycle model and the 1.54% implied by EPA's 2013 inventory) are not directly comparable. LCAs and national inventories have different temporal boundaries. NETL's leakage rate is a life cycle number based on a 30-year time frame; it levelizes the emissions from one-time well completion activities over a 30-year time frame of steady-state production. The leakage rate implied by EPA's inventory represents 2011 industry activity; it captures the spike in completion emissions due to the atypically high number of wells that were completed that year. In other words, national inventories calculate all emissions that occur in a given year, while LCAs apportion all emissions that occur during a study period (*e.g.*, 30 years) to a unit of production (*e.g.*, 1 MWh of electricity generated). Both approaches are legitimate with respect to the unique goals of each type of analysis.

Sierra Club also compares NETL's 1.2% leakage rate to the 2.01% leakage rate calculated by Burnham et al.[268] Again, a boundary difference explains why the two leakage rates are not directly comparable. Burnham et al.'s leakage rate includes natural gas distribution, which is an additional transport step beyond transmission. Natural gas distribution moves natural gas from the "city gate" to small scale end users (commercial and residential consumers). NETL's leakage rate ends after natural gas transmission, the point at which natural gas is available for large scale end users such as power plants. The natural gas distribution system is a highly-branched network that uses vent-controlled devices to regulate pressure. This boundary difference explains why Burnham et al.'s leakage rate is higher than NETL's rate. Sierra Club also compares NETL's leakage rate to a shale gas analysis conducted by Weber et al.[269] We have reviewed Weber et al.'s work and do not see any mention of leakage rate.

It is also important to note that leakage rate is not an input to NETL's life cycle model. Rather, it is calculated from the outputs of NETL's life cycle model. NETL uses an approach that assembles all activities in the natural gas supply chain into a network of interconnected processes. The emissions from each process in this model are based on engineering relationships and emission factors from the EPA and other sources. This method is known as a "bottom-up" approach. Researchers are trying to discern why "top-down" studies such as Pétron's measurements in northeast Colorado[270] do not match the bottom-up calculations by NETL and other analysts. We believe that inconsistent boundaries (*i.e.*, bottom-up models that account for long term emissions at the equipment level in comparison to top-down measurements that

[268] Burnham, Andrew, et al. Life-cycle greenhouse gas emissions of shale gas, natural gas, coal, and petroleum. *Environmental Science & Technology* 46.2 (2011): 619-627.
[269] Weber, Christopher L., and Christopher Clavin. Life cycle carbon footprint of shale gas: Review of evidence and implications. *Environmental science & technology* 46.11 (2012): 5688-5695.
[270] Pétron, G., Frost, *et al*. (2012). Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study. *Journal of Geophysical Research: Atmospheres (1984–2012)*, *117*(D4).

encompass an entire region with more than one type of industrial activity over a narrow time frame) partly explain the differences between bottom-up and top-down results. As research continues, however, we expect to learn more about the differences between bottom-up and top-down methods.

Zimmerman and Associates references a recent study by Ingraffea et al. that assessed failure rates of well casings for oil and gas wells in Pennsylvania.[271] However, Ingraffea et al. do not calculate a methane leakage rate in their analysis; rather, they calculate the rate at which wells develop leaks. The rate at which leaks develop in well casings is a different phenomenon than the rate at which methane leaks from the natural gas supply chain. The former is a measurement of failure rates (the number of wells in a group that have leaks) and the latter is a measurement of the magnitude of total leakage (the amount of methane in extracted natural gas that is released to the atmosphere).

The breakeven analysis shown in Section 6 of the LCA GHG Report models hypothetical scenarios that increase the natural gas leakage rate to the point where the life cycle emissions from natural gas power are the same as those from coal power. The breakeven points between natural gas and coal systems are illustrated in Figures 6-8 and 6-9 of the Report. These results are based on the most conservative breakeven point, which occurs between the high natural gas cases (*i.e.*, lowest power plant efficiency, longest transport distance, and highest methane leakage) with the low coal case (*i.e.*, highest power plant efficiency and shortest transport distance). These graphs show that on a 100-year GWP basis, methane leakage would have to increase by a factor of 1.7 to 3.6, depending on the scenario, before the breakeven occurs. The

[271] Ingraffea, A. R., Wells, M. T., Santoro, R. L., & Shonkoff, S. B. (2014). Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania, 2000–2012. *Proceedings of the National Academy of Sciences*, *111*(30), 10955-10960.

breakeven methane leakage is lower for the 20-year GWP basis and, for some scenarios, is lower than the modeled leakage rate.

6. The Uncertainty Bounds of the LCA GHG Report

a. Comments

Concerned Citizens claim that the LCA GHG Report has significant uncertainty, and contend that "poor modeling is not a reason to dismiss impacts."

b. DOE/FE Analysis

The results of the LCA GHG Report are based on a flexible model with parameters for natural gas extraction, processing, and transport. Uncertainty bounds are assigned to three key parameters: well production rates, flaring rates, and transport distances. These uncertainty bars are not an indication of poor modeling. To the contrary, they are used to account for variability in natural gas systems. If the analysis did *not* account for uncertainty, the results would imply that the GHG emissions from natural gas systems are consistently a single, point value, which would be inaccurate. We therefore believe the chosen uncertainty bounds strengthen the LCA model, as opposed to indicating any weakness in modeling.

7. The LCA GHG Report and the NEPA Approval Process

a. Comments

Several commenters, including Citizens Against LNG, Dominion Cove Point LNG, Susan Sakmar, and Americans Against Fracking et al., note that the LCA GHG Report does not fulfill the requirements of an EIS as defined by NEPA. These commenters maintain that the LCA GHG Report should not be used as a basis for approving proposed LNG export terminals.

b. DOE/FE Analysis

We agree that the LCA GHG Report does not fulfill any NEPA requirements in this proceeding, nor has DOE/FE made any suggestion to that effect. The LCA GHG Report

addresses foreign GHG emissions and thus goes beyond the scope of what must be reviewed under NEPA.

XI. MARAD PROCEEDING AND GRANT OF DEEPWATER PORT LICENSE

A. Statutory Background

1. The Deepwater Port Act of 1974

The Deepwater Port Act of 1974 (Act), as amended, declares it to be the intent of Congress to "authorize and regulate the location, ownership, construction, and operation of deepwater ports in waters beyond the territorial limits of the United States."[272] The term "deepwater port" includes offshore LNG import and export terminals.[273]

Under the Deepwater Port Act, persons seeking to own, construct, and operate deepwater ports must submit an application to the Secretary of Transportation, who delegated to MARAD "the authority to issue, transfer, amend or reinstate a license … for the construction and operation of a deepwater port."[274] The Secretary of Transportation also delegated license processing functions to both MARAD and the United States Coast Guard (USCG) (now part of the Department of Homeland Security).[275] In this proceeding, the USCG assisted MARAD in developing the environmental and marine navigation aspects of the Record of Decision, among other duties.[276]

MARAD is required under the Act to evaluate whether an applicant has or will meet the statutory criteria for issuance of a deepwater port license.[277] Under section 4(c) of the Act, 33 U.S.C. § 1503(c), the MARAD Administrator must determine that the following nine criteria

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[272] 33 U.S.C. § 1501(a)(1).
[273] *See supra* at 1-2; *see also* MARAD ROD at 6 n.4 (citing 33 U.S.C. § 1502(9)),
[274] *See* MARAD ROD at 7-8 (internal citations omitted).
[275] *See id.* at 8.
[276] *See id*. at 18. Additionally, the USCG is required to approve an operations manual for each deepwater port. 33 U.S.C. § 1503(e)(1).
[277] *See* MARAD ROD at 26.

have been met:

> (1) The applicant is financially responsible;
>
> (2) The applicant will comply with applicable laws, regulations, and license conditions;
>
> (3) The construction and operation of the deepwater port will be in the national interest and consistent with national security and other national policy goals and objectives, including energy sufficiency and environmental quality;
>
> (4) The port will not unreasonably interfere with international navigation;
>
> (5) The applicant has demonstrated that the port will be constructed and operated using best available technology, so as to prevent or minimize adverse impact on the marine environment;
>
> (6) The EPA Administrator has advised MARAD that the port will conform to applicable provisions of the Clean Air Act, the Clean Water Act, and the Marine Protection, Research, and Sanctuaries Act;
>
> (7) MARAD has consulted about the proposed port with the Secretary of the Army, the Secretary of State, and the Secretary of Defense;
>
> (8) There is no objection to the port by a governor of any adjacent coastal states; and
>
> (9) The adjacent coastal state to which the port is to be directly connected by pipeline has developed, or is developing, an approved coastal zone management program as required by federal law.

As discussed below, MARAD found that Delfin's proposed Port meets each of these criteria.[278]

2. NEPA

In addition to the statutory requirements under the Deepwater Port Act, MARAD is

[278] *See id*. at 65-66.

required to review Delfin's application under NEPA—specifically, to evaluate the environmental impacts of Delfin's proposed port.[279]

B. MARAD's Procedural History

On May 8, 2015, Delfin submitted to MARAD and the USCG an application for a deepwater port license.[280] On July 16, 2015, a notice of Delfin's application was published in the *Federal Register*.[281]

On July 29, 2015, MARAD and the USCG commenced the environmental review process required by NEPA by publishing a Notice of Intent to Prepare an Environmental Impact Statement for the proposed Delfin port in the *Federal Register*.[282] DOE agreed to participate as a cooperating agency in MARAD's and the USCG's environmental review under NEPA.[283] As part of the public scoping process, MARAD and the USCG conducted public meetings and received comments from a variety of stakeholders, which served to identify issues for MARAD and USCG staff to address in the EIS.

On November 19, 2015, Delfin submitted an amended application to MARAD. In relevant part, the amendment proposed an increase in the liquefaction capacity of each of the four FLNGVs. MARAD published a notice of the amended application in the *Federal Register* on December 24, 2015.[284]

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[279] *See id*. at 12.
[280] *See id*. at 8.
[281] Deepwater Port License Application: Delfin LNG, LLC, Delfin LNG Deepwater Port; Notice of Application, 80 Fed. Reg. 42,162 (July 16, 2015).
[282] Deepwater Port License Application: Delfin LNG, LLC, Delfin LNG Deepwater Port; Notice of Intent to Prepare an Environmental Impact Statement, Notice of Public Meetings, and Request for Comments, 80 Fed. Reg. 45,270 (July 29, 2015).
[283] *See, e.g.*, Final EIS ES-1.
[284] Deepwater Port License Application: Delfin LNG, LLC, Delfin LNG Deepwater Port; Notice of Receipt of Amended Application and Request for Comments, 80 Fed. Reg. 80,455 (Dec. 24, 2015).

On July 15, 2016, MARAD and the USCG issued a Draft EIS.[285] In the Draft EIS, MARAD and the USCG addressed potential environmental impacts of the proposed Delfin Port, including impacts to water, biological, geological, and cultural resources; ocean and land use; air quality; and cumulative impacts.[286]

In accordance with the Council on Environmental Quality's (CEQ) NEPA regulations, MARAD and the USCG provided a 45-day comment period on the Draft EIS. During this time, MARAD and the USCG held two public meetings and accepted written public comments on the Draft EIS. In total, MARAD and the USCG received five written comments on the Draft EIS.[287]

On November 28, 2016, MARAD and the USCG issued the Final EIS.[288] The Final EIS responded to comments to the Draft EIS, and addressed the potential impacts of Delfin's proposed Port on water, biological, geological, and cultural resources; essential fish habitat; ocean and land use; onshore and offshore recreation; visual resources; transportation; air quality; noise; socioeconomics; safety; and, cumulative impacts.[289] The Final EIS also reviewed alternatives to the proposed action.[290]

Based on this environmental analysis, MARAD and the USCG concluded in the Final EIS that Delfin would adequately mitigate any environmental impacts through design modifications, implementation of Best Management Practices, and implementation of mitigation measures recommended by federal and state agencies.[291] Consequently, MARAD and the USCG

[285] Deepwater Port License Application: Delfin LNG, LLC, Delfin LNG Deepwater Port; Notice of Availability and Notice of Public Meetings for the Draft EIS, 81 Fed. Reg. 46,157 (July 15, 2016).
[286] *See supra* note 27.
[287] *See* MARAD ROD at 14.
[288] *See supra* notes 8, 29.
[289] *See* Final EIS at ES-9 to ES-17.
[290] *See id.* at ES-6.
[291] *See generally id.* at 4-14 to 4-243.

did not recommend additional environmental mitigation measures to be implemented.[292]

In December 2016, MARAD and the USCG held the final licensing hearings required by the Act. According to MARAD, attendees at these hearings expressed support for the anticipated new jobs and economic development associated with Delfin's proposed Port.[293] MARAD and the USCG received one public comment during the final comment period, suggesting that the FLNGVs should be built in the United States and crewed by U.S. citizens or legal residents.

Additionally, on March 8, 2017, the National Marine Fisheries Service (NMFS) provided comment on the impacts of Delfin's proposed port on threatened and endangered species and designated critical habitat under the Endangered Species Act (ESA) Section 7 consultation process. In that letter, NMFS concurred with MARAD's determination of effects on listed species and designated critical habitat, and indicated that all potential project effects were found to be discountable or insignificant.[294] On this basis, NMFS found that "the proposed action is not likely to adversely affect listed species under NMFS' purview, and therefore "consultation responsibilities under ESA for species under NMFS' purview [are] concluded."[295]

C. MARAD's Record of Decision

Under the Deepwater Port Act, MARAD is required to make a decision on an application for a deepwater port license within 90 days after the last public hearing on the application. MARAD held the last public hearing in this proceeding on December 14, 2016, and MARAD timely issued the ROD approving Delfin's Application, subject to certain conditions, on March 13, 2017.

The ROD provides an extensive discussion of MARAD's findings and conclusions under

[292] *See generally id.*
[293] *See* MARAD ROD at 14.
[294] *See id*. at 23.
[295] *Id*. (citing Federal Docket Mgmt. System, USCG 2015-0472-0119).

both the Deepwater Port Act and NEPA. Based on its review of the record, MARAD concludes that Delfin's requested license met the nine criteria required under the Deepwater Port Act, subject to certain conditions.

MARAD explains that these conditions to the deepwater port license were designed to "protect and advance the national interest, ensure adequate demonstration of financial capability [to construct and operate the port], and make certain that the deepwater port will be constructed and operated using best available technology so as to prevent or minimize adverse impact on the marine environment."[296] According to MARAD, "some, but not all" of the conditions are described in the ROD, and the "precise conditions required … will be set forth in the License upon its issuance."[297] We note that two of the conditions discussed in the ROD include: (i) a requirement for Delfin to obtain appropriate DOE authorization to export LNG from the port to FTA and non-FTA countries; and (ii) a requirement for Delfin to obtain the necessary authorization from FERC to construct and operate the Delfin Onshore Facility.[298]

Additionally, under NEPA, MARAD determined that the construction and operation of Delfin's port, as proposed, is the environmentally preferred alternative for the project.[299]

Below, we summarize the conclusions reached by MARAD that are most relevant to this proceeding.

1. National Interests Under the Deepwater Port Act

MARAD finds that the construction and operation of the Delfin Port (*i.e.*, the Liquefaction Facility) will be in the national interest because the Port: (i) will have a beneficial effect on economic growth, both on local and national levels; (ii) will expand and diversify U.S.

[296] MARAD ROD at 16.
[297] *Id*.
[298] *See id*. at 49-50.
[299] *See id*. at 48-49.

energy infrastructure; (iii) will provide a reliable source of clean energy to U.S. allies in the event of market disruption; and (iv) will have a low impact on the availability and cost of natural gas in the U.S. domestic market.[300] Additionally, MARAD "encourage[s] Delfin LNG to use U.S.-flagged vessels crewed with U.S. mariners to support Port operations."[301]

Addressing energy and national security interests, MARAD concludes that "the export of natural gas from the Port will not jeopardize the Nation's environmental security or the commodity's availability to domestic markets."[302] In support of this finding, MARAD cites data from the U.S. Energy Information Administration (EIA) analyzing U.S. natural gas reserves and production. MARAD further concludes that "[t]he export of natural gas will serve U.S. national security interests through the diversification of global natural gas supply, benefitting U.S. allies that are subject to unreliable natural gas supplies."[303]

MARAD finds that the construction of Delfin's Port will have a "positive impact" on employment levels in Louisiana.[304] Additionally, MARAD finds that the Port will create "numerous permanent jobs for the region," to support both the Port's operations and the vessels that utilize the Port.[305]

2. Environmental Considerations Under the Deepwater Port Act and NEPA

MARAD observes that Delfin will be utilizing a "first-of-its-kind" FLNGV to be operated on the Outer Continental Shelf. MARAD states that, by using air-cooled (rather than water-cooled) FLNGVs at the Port, Delfin will reduce the amount of water used in its industrial

[300] *See id*. at 65.
[301] *Id*.
[302] *Id*. at 67.
[303] *Id*.
[304] MARAD ROD at 67.
[305] *Id*.

processes, thereby minimizing impacts to the marine environment. Consequently, MARAD finds that Delfin's Port will constructed and operated using the best available technology.[306]

MARAD states the EPA Administrator did not inform MARAD of Delfin's inability to comply with certain federal environmental statutes, including the Clean Air Act and Clean Water Act. MARAD therefore concludes that Delfin's Port will be able to comply with those laws.[307]

MARAD further explains that, on January 12, 2017, EPA Region 6 submitted a final letter to MARAD in which it expressed "continuing concern" over the potential impacts of greenhouse gas (GHG) emissions associated with Delfin's proposal."[308] Specifically, EPA informed MARAD that the Final EIS did not provide "adequate analysis and information regarding GHG emissions associated with the production, transport, and combustion of the natural gas proposed to be exported."[309]

In response to this letter from EPA, MARAD finds that "the scope of the EIS for the Delfin LNG project meets the statutory requirement of NEPA and the [Deepwater Port] Act."[310] MARAD states that "the Final EIS includes an estimate of GHG emissions related to the proposed construction, operation, and decommissioning of the proposed Delfin LNG Port."[311] The Final EIS also analyzed "reasonably foreseeable connected actions" as required under NEPA, such as the federal actions of cooperating agencies, including but not limited to FERC for the certification of the components of the Delfin Onshore Project.[312]

MARAD acknowledges that the Final EIS "does not analyze the upstream effects from

[306] *See id*. 65-66.
[307] *See id*. at 66.
[308] *Id*. at 60.
[309] MARAD ROD at 60.
[310] *Id*.
[311] *Id*.
[312] *See id*.

potential induced production or downstream effects from the export of natural gas."[313] MARAD concludes, however, that "CEQ's final guidance on evaluating GHG impacts does not require NEPA analyses to include such unforeseeable effects."[314] On this basis, MARAD determines that the Final EIS properly evaluated the foreseeable direct and indirect impacts of the proposed port under NEPA.[315]

Addressing downstream GHG emissions from overseas transport, regasification, and combustion of export LNG, MARAD points to Delfin's LNG export proceedings before DOE/FE, including the Application in this proceeding. MARAD concludes that "[t]he necessary factors for a meaningful analysis"—including the demand for LNG to be exported from Delfin's Port, the destination(s) of Delfin's proposed exports, the transport routes, and the ultimate end uses of the LNG—"are unknown."[316] Therefore, MARAD finds that the downstream GHG emissions are likewise "not reasonably foreseeable."[317]

Finally, according to MARAD, EPA suggested that the Final EIS consider the LCA GHG Report discussed herein in evaluating downstream GHG emissions. MARAD reviews NETL's findings in the LCA GHG Report, and concludes that "[b]ecause NETL analyzed representative approaches for U.S. LNG exports, the general conclusions regarding GHG emissions from such exports are expected to apply to [Delfin's] project."[318]

3. Issuance of the Deepwater Port License

On the basis of the evidence discussed in the ROD, MARAD approves Delfin's

[313] *Id*.
[314] *Id*. at 60-61.
[315] *See id*. at 60.
[316] MARAD ROD at 61.
[317] *Id*.
[318] *Id*. at 61 n.89.

application to construct and operate the proposed Port. According to MARAD, Delfin must accept the conditions of the license, as described in the ROD. Once Delfin accepts the conditions, MARAD will issue the deepwater port license (with attendant conditions) to Delfin.[319]

XII. DISCUSSION AND CONCLUSIONS

In reviewing Delfin's Application to export LNG, DOE/FE has considered both its obligations under NEPA and its obligation under NGA section 3(a) to ensure that the proposed LNG exports are not inconsistent with the public interest. To accomplish these purposes, DOE/FE has examined a wide range of information addressing environmental and non-environmental factors, including:

- Delfin's Application; API's motion supporting the Application; the submissions of Sierra Club, APGA, and V4EI opposing the Application; Delfin's Consolidated Response; and Sierra Club's reply to Delfin's Response;
- MARAD's Final EIS and Record of Decision;
- The Draft Addendum, comments received in response to the Draft Addendum, and the final Addendum;
- The LCA GHG Report (and the supporting NETL document), including comments submitted in response to those documents; and
- The 2014 and 2015 LNG Export Studies, including comments received in response to those Studies.

To avoid repetition, the following discussion focuses on arguments and evidence presented by Delfin and the three intervenor-protestors opposing the Application (Sierra Club, APGA, and V4EI), to the extent that DOE/FE has not already addressed the same or substantially similar arguments in its responses to comments on the Addendum, the LCA GHG Report, and/or the 2014 and 2015 Studies.

[319] *See id*. at 67-68.

A. Motions to Intervene

API timely filed a motion to intervene in this proceeding. Delfin did not oppose API's motion and, therefore, API's motion is deemed granted. 10 C.F.R. § 590.303(g).

Additionally, we find good cause to grant the motions to intervene submitted by Sierra Club, APGA, and VE4I, as well as Sierra Club's motion to reply to Delfin's Consolidated Response. Delfin filed its Consolidated Response opposing the motions on the basis that (among other reasons) the proposed intervenors failed to demonstrate an interest in this proceeding, and failed to provide affirmative evidence to show the economic impact of authorizing the proposed exports. Sierra Club moved to file a reply to that Response.

We find that the evidence presented in this proceeding, as well as in the 2014 and 2015 LNG Export Studies, indicate that the economic consequences of granting the Application could be far-reaching and could affect the interests of Sierra Club, APGA, V4EI, and their members. This fact alone is good cause to permit their intervention. In addition, each of these proposed intervenors raised issues that are relevant to the public interest and addressed herein. Delfin was afforded an opportunity to respond to these motions pursuant to 10 C.F.R. § 590.304(f), and did so. Accordingly, we will grant the motions to intervene, as well as Sierra Club's motion to reply to Delfin's Consolidated Response. *See infra* § XV (Ordering Paras. T, U).

B. Non-Environmental Issues

In considering non-environmental issues in this proceeding, we have reviewed Delfin's Application; the pleadings and comments submitted in this proceeding; and the 2014 and 2015

LNG Export Studies and comments thereto. We also take administrative notice of EIA's most recent authoritative supply data and projections, set forth in AEO 2017 and discussed below.[320]

1. Delfin's Application

Delfin's Application reviews natural gas supply and demand conditions in the United States and the likely impact that the proposed exports will have on natural gas prices. Delfin relies on EIA estimates in stating that the United States has significant natural gas resources available to meet both projected future domestic needs and supply gas for the proposed exports with only a modest incremental impact on domestic natural gas prices. Delfin also relies on studies by ICE International and the Brookings Institute in asserting that the proposed exports will yield significant local, regional, and national economic benefits and will generate additional international benefits. The 2012 LNG Export Study, the 2014 and 2015 LNG Export Studies, as well as more recent data in AEO 2017, provide additional support for the conclusion that the proposed exports of LNG will yield significant economic benefits.

Sierra Club, APGA, and V4EI have argued that Delfin's conclusions are unfounded. In particular, they each contend that the proposed exports would not yield economic benefits but, in fact, would increase natural gas prices significantly and result in other deleterious economic and societal impacts. They contend, for example, that the net economic benefits projected in the 2012 LNG Export Study will be slight and limited to a relatively small, affluent segment of the population. They argue that, independent of the distributional economic impacts of LNG

[320] As noted *supra* note 187, EIA released *Annual Energy Outlook* 2017 (AEO 2017) on January 5, 2017. The AEO 2017 includes both a Reference case that incorporates implementation of the Clean Power Plan, as well as a Reference case that does not incorporate the CPP. Both Reference Cases show natural gas production levels that favor exports, but that also have lower net LNG exports in 2040 (12.5 Bcf/d for the Reference Case with the CPP and 12 Bcf/d for the Reference Case without the CPP).

exports, the proposed exports will likely have a negative impact on the U.S. economy by increasing the price of natural gas and eliminating jobs in energy intensive industries.

APGA, V4EI, and Sierra Club further maintain that exports of LNG have the potential to drastically affect total U.S. natural gas supply. Accordingly, these intervenors contend that the proposed exports, and U.S. LNG exports generally, will result in significantly higher natural gas prices domestically than projected by Delfin. Sierra Club also challenges the sustainability of economic benefits in regions tied to resource extraction industries, as discussed below.

On review, DOE/FE finds that the evidence of record showing that the proposed exports would be in the public interest outweighs the concerns expressed by the intervenors. DOE has considered and rejected each of the arguments raised by the intervenors that bear on the validity of the 2012 NERA Study in this Order or in prior orders.[321] In regards to those arguments, the intervenors have adduced no additional substantive support for their views in this proceeding.

EIA's projections in AEO 2017 provide independent support for the proposition that domestic supplies will be adequate both to meet domestic needs *and* to supply Delfin's exports and other final non-FTA LNG exports previously authorized by DOE/FE. *See supra* § VIII.A. Further, Delfin asserts—and MARAD concluded in its ROD—that the proposed exports will benefit the local economy in and around Cameron Parish, Louisiana; Louisiana's state economy; the Gulf Coast regional economy; and/or the greater national economy. These conclusions are bolstered by the 2014 and 2015 LNG Export Studies. Accordingly, we find that the evidence shows that the market will be capable of sustaining the level of exports proposed in the Application over the term of the requested authorization without significant negative price or

[321] *See, e.g., Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 3669, FE Docket Nos. 13-30-LNG, 13-42-LNG, & 13-121-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Sabine Pass LNG Terminal Located in Cameron Parish, Louisiana, to Non-Free Trade Agreement Nations, at 94-158, 190 (June 26, 2015).

other impacts. For these reasons, as further discussed below, we find that none of the intervenors have overcome the statutory presumption that the requested exports are consistent with the public interest.

2. Regional Impacts

Delfin asserts that the proposed exports will stimulate local, regional, and national economies through direct and indirect job creation, increased economic activity, and tax revenues. The opponents of the Application attempt to counter these claims.

APGA and V4EI contend that the NERA Study, conducted as part of the 2012 LNG Export Study, concludes that price increases resulting from LNG exports will hurt consumers of natural gas and electricity. APGA is also concerned that exports of LNG will undercut a manufacturing renaissance in the United States and, in particular, will disadvantage the petrochemical industry for which natural gas is a significant cost component. APGA maintains that the United States should pursue policies that allow industry to invest in manufacturing industries rather than LNG export facilities because manufacturing provides a value-added benefit to the economy that multiplies the value of every dollar spent on natural gas.

Sierra Club makes several of the same arguments raised by APGA—specifically, it asserts that Delfin "ignores economic harm exports will cause and disregards the economic effect of environmental impacts."[322] Sierra Club also challenges the sustainability of economic benefits in regions tied to resource extraction industries, focusing principally on the durability of economic benefits in natural gas producing regions where drilling is occurring. In particular, Sierra Club contends that DOE/FE must consider a full range of counterfactual scenarios by evaluating whether the nation would be better off without LNG exports, or with lower export

[322] Sierra Club. Mot. at 1.

volumes. Sierra Club asserts that any "boom" in economic activity will be followed by a bust, and that the prospect of such an event demonstrates that a grant of the requested authorization is inconsistent with the public interest.[323]

We note that certain commenters on the 2014 and 2015 LNG Export Studies make several of the same arguments raised by these intervenors. In particular, these commenters contend that DOE/FE must consider a full range of counterfactual scenarios, and they likewise challenge claimed regional economic benefits and assert that any "boom" in economic activity will result in a "bust" to the detriment of the public interest.

On review, we do not agree with APGA, V4EI, or Sierra Club that Delfin's proposed exports will not yield net economic benefits or that the proposed exports will produce deleterious economic and societal impacts. The 2014 and 2015 LNG Export Studies, as well as EIA's supply data and projections in AEO 2017, show that the proposed exports are likely to generate net economic benefits for the United States. Further, we note that, in responding to the Notice of Application, none of the intervenors offered detailed analyses specific to the local and regional economic impacts of Delfin's proposal to contradict this evidence.

To the extent that Sierra Club, APGA, or other commenters are claiming that the exports proposed by Delfin will physically exhaust existing resources (*i.e.*, resulting in a "bust"), we refer to the section above in which we conclude that record evidence indicates that there will be substantial supply into the foreseeable future. To the extent they allege that "bust" cycles will be brought on by price declines that render existing natural gas resources uneconomic to produce, we do not see compelling evidence that the exports will exacerbate this risk. If anything, we agree with Delfin that it seems more likely that Delfin's ability to export to non-FTA countries

[323] *See id*. at 65.

will deepen and diversify the market for U.S.-produced natural gas, making the potential for a precipitous price-driven downturn in production activities less likely, not more likely.

Finally, we reject the claims that exports will have a negative impact on employment. Sierra Club points to a study conducted by Weinstein and Partridge (the Weinstein study) to support its position.[324] However, we have considered the analysis contained in the Weinstein study in several LNG export orders, and found that the Weinstein Study showed only a statistically insignificant decline in employment in the regions studied in the years before a drilling boom (2001 to 2005), compared to the years during the drilling boom (2005 to 2009).[325] This small decline could have been the result of other factors, particularly since the years of the drilling boom coincided with a national economic recession. On the other hand, comparing the same time periods, we found that the Weinstein study showed substantial gains in economic growth rates in counties with drilling operations as opposed to those without. For the same reasons provided in those orders, we reject Sierra Club's arguments here.[326]

3. Price Impacts

As discussed above, the 2014 and 2015 LNG Export Studies projected the economic impacts of LNG exports in a range of scenarios, including scenarios that exceeded the current amount of LNG exports authorized in the final non-FTA export authorizations to date (equivalent to a total of 21.0 Bcf/d of natural gas with the issuance of this Order).[327] The 2015 Study concluded that LNG exports at these levels (in excess of 12 Bcf/d of natural gas) would result in higher U.S. natural gas prices, but that these price changes would remain in a relatively

[324] Sierra Club Mot. at 67 & n.266 (discussing Weinstein and Partridge, *The Economic Value of Shale Natural Gas in Ohio*, Ohio State University, Swank Program in Rural-Urban Policy Summary & Report (Dec. 2010)).
[325] *See, e.g., Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 3669, at 192.
[326] *See id*.
[327] *See infra* § XII.E.

narrow range across the scenarios studied. However, even with these estimated price increases, the 2015 Study found that the United States would experience net economic benefits from increased LNG exports in all cases studied.[328]

We have also reviewed EIA's AEO 2017, published in January 2017. The Reference case of this projection includes the effects of the Clean Power Plan (CPP), discussed *supra*, which is intended to reduce carbon emissions from the power sector. DOE/FE assessed the AEO 2017 to evaluate any differences from AEO 2014, which formed the basis for the 2014 Study.

Comparing key results from 2040 (the end of the projection period in Reference case projections from AEO 2014) shows that the latest Reference case Outlook foresees lower-48 market conditions that would be even more supportive of LNG exports, including higher production and demand coupled with notably lower prices. Results from EIA's AEO 2017 no-CPP case, which is the same as the Reference case but does not include the CPP, are also more supportive of LNG exports on the basis of higher production with lower prices relative to AEO 2014.

For the year 2040, the AEO 2017 Reference case anticipates 3 percent more natural gas production in the lower-48 than AEO 2014. It also projects an average Henry Hub natural gas price that is lower than AEO 2014 by 38 percent. With regard to exports, the AEO 2017 projection's for 2040 net pipeline exports of 3.7 Bcf/d and lower-48 LNG exports of 12.1 Bcf/d (over 63 percent higher than lower-48 LNG exports in AEO 2014) illustrate a market environment supportive of LNG exports.

In the AEO 2017 no-CPP case, for the year 2040, lower-48 production is 2 percent higher than in AEO 2014, with the Henry Hub price 39 percent lower. Net pipeline exports of 3.8 Bcf/d

[328] *See* 2015 Study at 8, 82.

and total LNG exports of 12.7 Bcf/d again indicate a market supportive of exports. These differences are depicted in the table below:

Table 11: Year 2040 Reference Case Comparisons in AEO 2014 and AEO 2017

	AEO 2014 Reference Case	**AEO 2017 Reference Case Includes Clean Power Plan**	**AEO 2017 Reference Case Without Clean Power Plan**
Lower-48 Dry Natural Gas Production (Bcf/d)	99.4	102.3	101.4
Total Natural Gas Consumption (Bcf/d)	86.4	87.2	85.6
Electric Power Sector Consumption (Bcf/d)	30.7	30.2	28.5
Net Exports by Pipeline (Bcf/d)	6.6	3.7	3.8
Net LNG Exports (Bcf/d)	9.2	12.0	12.5
LNG Exports – Total (Bcf/d)	9.6	12.1	12.7
Lower-48	7.4	12.1	12.7
Alaska	2.2	0.0	0.0
Henry Hub Spot Price ($/MMBtu)(Note 1)	**$8.15 (2016$)** $7.65 (2012$)	**$5.07 (2016$)**	**$5.01 (2016$)**

Note 1: Prices adjusted to 2016$ with the AEO 2014 projection of a GDP price index.

4. Significance of the 2014 and 2015 LNG Export Studies

For the reasons discussed above, DOE/FE commissioned the 2014 EIA LNG Export Study and the 2015 LNG Export Study, and invited the submission of responsive comments on both Studies. DOE/FE has analyzed this material and determined that these two Studies provide substantial support for granting Delfin's Application. Specifically, the conclusion of the 2015 Study is that the United States will experience net economic benefits from issuance of authorizations to export domestically produced LNG.

We have evaluated the public comments submitted in response to the 2014 and 2015 LNG Export Studies. Certain commenters have criticized aspects of the models, assumptions, and design of the Studies. As discussed above, however, EIA's projections in AEO 2017 continue to show market conditions that will accommodate increased exports of natural gas. When compared to the AEO 2014 Reference case, the AEO 2017 Reference case projects increases in domestic natural gas production—well in excess of what is required to meet projected increases in domestic consumption. Accordingly, we find that the 2014 and 2015 LNG Export Studies are fundamentally sound and support the proposition that the proposed authorization will not be inconsistent with the public interest.

5. Benefits of International Trade

We have not limited our review to the contents of the 2014 and 2015 LNG Export Studies and the data from AEO 2017, but have considered a wide range of other information. For example, the National Export Initiative, established by Executive Order and cited by Delfin, sets a goal to "improve conditions that directly affect the private sector's ability to export" and to

"enhance and coordinate Federal efforts to facilitate the creation of jobs in the United States through the promotion of exports."[329]

We have also considered the international consequences of our decision. We review applications to export LNG to non-FTA nations under section 3(a) of the NGA. The United States' commitment to free trade is one factor bearing on that review. An efficient, transparent international market for natural gas with diverse sources of supply provides both economic and strategic benefits to the United States and our allies. Indeed, increased production of domestic natural gas has significantly reduced the need for the United States to import LNG. In global trade, LNG shipments that would have been destined to U.S. markets have been redirected to Europe and Asia, improving energy security for many of our key trading partners. To the extent U.S. exports can diversify global LNG supplies, and increase the volumes of LNG available globally, we agree with Delfin—and MARAD's conclusions in the ROD—that this will improve energy security for many U.S. allies and trading partners. As such, authorizing U.S. exports may advance the public interest for reasons that are distinct from and additional to the economic benefits identified in the 2014 and 2015 Studies.

C. Environmental Issues

In reviewing the potential environmental impacts of Delfin's proposal to export LNG, DOE/FE has considered both its obligations under NEPA and its obligation under NGA section 3(a) to ensure that the proposal is not inconsistent with the public interest.

1. Adoption of MARAD's Final EIS

DOE/FE participated in MARAD's environmental review of the proposed Delfin Liquefaction Project (or "Port) as a cooperating agency. Because DOE was a cooperating agency,

[329] National Export Initiative, 75 Fed. Reg. 12,433 (Mar. 16, 2010).

DOE/FE is permitted to adopt without recirculating MARAD's Final EIS, provided that DOE/FE has conducted an independent review of the EIS and determines that its comments and suggestions have been satisfied.[330] For the reasons set forth below, DOE/FE has not found that the arguments raised in the MARAD proceeding, the current proceeding, or the 2014 and 2015 LNG Export Study proceedings detract from the reasoning and conclusions contained in the Final EIS. Accordingly, DOE has adopted the EIS (DOE/EIS-0531),[331] and hereby incorporates the reasoning contained in the EIS in this Order.

2. Scope of NEPA Review

In the proceeding before MARAD, EPA Region 6 filed comments recommending that MARAD consider the potential for increased natural gas production and associated increased environmental impacts resulting from the proposed Delfin Port.[332] EPA stated, for example, that the Final EIS did not provide "adequate analysis and information regarding GHG emissions associated with the production, transport, and combustion of the natural gas proposed to be exported."[333]

As discussed above, MARAD responded to EPA's comments in the ROD, concluding that these issues are outside the scope of NEPA, and that "the scope of the EIS … meets the statutory requirement of NEPA and the [Deepwater Port] Act."[334] MARAD pointed out that the Final EIS "includes an estimate of GHG emissions related to the proposed construction, operation and decommissioning of the proposed Port."[335] Further, MARAD noted that the Final EIS analyzed "reasonably foreseeable connected actions" as required under NEPA, such as the

[330] *See* 40 C.F.R. § 1506.3(c).
[331] *See supra* § I (citing 82 Fed. Reg. 19,715).
[332] *See* MARAD ROD at 24, 60.
[333] *Id*. at 60 (citation omitted).
[334] *Id*.
[335] *Id*.

federal actions of cooperating agencies, including but not limited to FERC for the certification of the components of the Delfin Onshore Project.[336] Based on this record, we find that MARAD's environmental review covered all reasonably foreseeable environmental impacts of the proposed Delfin Liquefaction Facility,[337] and that NEPA does not require the review to include induced upstream natural gas production.

Fundamental uncertainties constrain our ability to foresee and analyze with any particularity the incremental natural gas production that may be induced by permitting exports of LNG to non-FTA countries—whether from unconventional shale gas formations or otherwise. For this reason, and because DOE/FE had received comments regarding the potential environmental impacts associated with unconventional production, DOE/FE produced the Addendum and made it available for public comment. The Addendum takes a broad look at unconventional natural gas production in the United States, with chapters covering water resources (including water quantity and quality), air quality, GHG emissions, induced seismicity, and land use.

The Addendum addresses unconventional natural gas production in the nation as a whole. It does not attempt to identify or characterize the incremental environmental impacts that would result from LNG exports to non-FTA nations. Such impacts are not reasonably foreseeable and cannot be analyzed with any particularity. To begin, there is uncertainty as to the aggregate quantity of natural gas that ultimately may be exported to non-FTA countries. Receiving a non-FTA authorization from DOE/FE does not guarantee that a particular facility would be financed and built; nor does it guarantee that, if built, market conditions would continue to favor export

[336] *See id.*
[337] Under CEQ's regulations, "indirect effects" of a proposed action are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." 40 C.F.R. § 1508.8(b).

once the facility is operational. To illustrate the point, of the more than 40 applications to build new LNG import facilities that were submitted to federal agencies between 2000 and 2010, only eight new facilities were built and those facilities have seen declining use in the past decade.[338]

There is also fundamental uncertainty as to where any additional production would occur and in what quantity. As the Addendum illustrates, nearly all of the environmental issues presented by unconventional natural gas production are local in nature, affecting local water resources, local air quality, and local land use patterns, all under the auspices of state and local regulatory authority. As DOE explained in *Sabine Pass*, Order No. 2961-A, without knowing where, in what quantity, and under what circumstances additional gas production will arise, the environmental impacts resulting from production activity induced by LNG exports to non-FTA countries are not "reasonably foreseeable" within the meaning of the CEQ's NEPA regulations.[339]

3. Cumulative Environmental Impacts

Sierra Club has asserted in this proceeding that DOE/FE's environmental review must consider the cumulative environmental impacts from all proposed and previously approved export authorizations and that a programmatic EIS is legally required for these purposes. We find that the environmental review conducted by MARAD took into account all reasonably foreseeable cumulative environmental impacts relating to the exports of LNG proposed in this proceeding.[340] In our view, Sierra Club is seeking a programmatic EIS where no broad federal

[338] *See Freeport LNG Expansion L.P., et al., LLC*, DOE/FE Order No. 3357, FE Docket No. 11-161-LNG, Order Conditionally Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Freeport LNG Terminal on Quintana Island, Texas to Non-Free Trade Agreement Nations, at 100-01 n.161 (Nov. 15, 2013) (FLEX II Conditional Order).
[339] *See Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961-A, FE Docket No. 10-111-LNG, Final Opinion and Order Granting Long-Term Authorization to Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations, at 11 (Aug. 7, 2012) (quoting 40 C.F.R. § 1508.7).
[340] *See, e.g.*, Final EIS 6-1 to 6-24 (reviewing cumulative impacts).

action such as the adoption of a new agency program had been proposed.[341] Thus, the EIS properly fulfilled its purpose of disclosing the environmental impacts of the Delfin Liquefaction Facility while also setting forth measures that would mitigate or minimize potential impacts. We, therefore, agree with MARAD's reasoning and adopt its analysis concerning cumulative environmental impacts.

4. Environmental Impacts Associated with Induced Production of Natural Gas

The current rapid development of natural gas resources in the United States likely will continue, with or without the export of natural gas to non-FTA nations.[342] Nevertheless, a decision by DOE/FE to authorize exports to non-FTA nations could accelerate that development by some increment. For this reason, DOE/FE prepared and received public comment on the Addendum and made the Addendum and the comments part of the record in this proceeding. As discussed above, the Addendum reviewed the academic and technical literature covering the most significant issues associated with unconventional gas production, including impacts to water resources, air quality, greenhouse gas emissions, induced seismicity, and land use.

The Addendum shows that there are potential environmental issues associated with unconventional natural gas production that need to be carefully managed, especially with respect to emissions of VOCs and methane, and the potential for groundwater contamination. These environmental concerns do not lead us to conclude, however, that exports of natural gas to non-FTA nations should be prohibited. Rather, we believe the public interest is better served by addressing these environmental concerns directly—through federal, state, or local regulation, or through self-imposed industry guidelines where appropriate—rather than by prohibiting exports

[341] 40 C.F.R. § 1502.4(b).
[342] Addendum at 2.

of natural gas. Unlike DOE, environmental regulators have the legal authority to impose requirements on natural gas production that appropriately balance benefits and burdens, and to update these regulations from time to time as technological practices and scientific understanding evolve. For example, in 2012, using its authority under the Clean Air Act, EPA promulgated regulations for hydraulically fractured wells that are expected to yield significant emissions reductions.[343] In 2013, EPA updated those regulations to include storage tanks,[344] and in 2014 EPA issued a series of technical white papers exploring the potential need for additional measures to address methane emissions from the oil and gas sector.[345] In January 2015, EPA announced a strategy for "address[ing] methane and smog-forming VOC emissions from the oil and gas industry in order to ensure continued, safe and responsible growth in U.S. oil and natural gas production."[346] Specifically, EPA has initiated a rulemaking to set standards for methane and VOC emissions from new and modified oil and gas production sources, and natural gas processing and transmission sources.[347] EPA issued the proposed rule in September 2015,[348] and the final rule on June 3, 2016.[349]

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[343] U.S. Envtl. Prot. Agency, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews; Final Rule, 77 Fed. Reg. 49,490 (Aug. 16, 2012).
[344] U.S. Envtl. Prot. Agency, Oil and Natural Gas Sector: Reconsideration of Certain Provisions of New Source Performance Standards; Final Rule, 78 Fed. Reg. 58,416 (Sept. 23, 2013).
[345] U.S. Envtl. Prot. Agency, Fact Sheet: EPA's Strategy for Reducing Methane and Ozone-Forming Pollution From the Oil and Natural Gas Industry (Jan. 14, 2015), *available at*: https://www.epa.gov/newsreleases/fact-sheet-epas-strategy-reducing-methane-and-ozone-forming-pollution-oil-and-natural.
[346] *Id*.
[347] The White House, Office of the Press Secretary, Fact Sheet: Administration Takes Steps Forward on Climate Action Plan by Announcing Actions to Cut Methane Emissions (Jan. 14, 2015), *available at* https://www.whitehouse.gov/the-press-office/2015/01/14/fact-sheet-administration-takes-steps-forward-climate-action-plan-anno-1 (stating that, in developing the proposed and final standards, EPA "will focus on in-use technologies, current industry practices, [and] emerging innovations … to ensure that emissions reductions can be achieved as oil and gas production and operations continue to grow.").
[348] *See* U.S. Environmental Protection Agency, Oil and Natural Gas Sector: Emission Standards for New and Modified Sources, Proposed Rule, 80 Fed. Reg. 56,593 (Sept. 18, 2015). EPA subsequently extended the public comment period on this proposed rule and two related proposed rules until December 4, 2015. *See* 80 Fed. Reg. 70,719 (Nov. 13, 2015).
[349] *See supra* note 263.

Section 3(a) of the NGA is too blunt an instrument to address these environmental concerns efficiently. A decision to prohibit exports of natural gas would cause the United States to forego entirely the economic and international benefits discussed herein, but would have little more than a modest, incremental impact on the environmental issues identified by intervenors. For these reasons, we conclude that the environmental concerns associated with natural gas production do not establish that exports of natural gas to non-FTA nations are inconsistent with the public interest.

5. Compliance with the Endangered Species Act

To comply with the Endangered Species Act (ESA), the final EIS adopted by MARAD reflected input from National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA) Section 7 consultation process on the impacts of Delfin's proposed Port on threatened and endangered species and designated critical habitat.[350] NMFS concurred with MARAD's determination of effects on listed species and designated critical habitat, and indicated that all potential project effects were found to be discountable or insignificant. On this basis, NMFS found that "'the proposed action is not likely to adversely affect listed species under NMFS' purview,'" and therefore "'consultation responsibilities under ESA for species under NMFS' purview [are] concluded.'"[351]

Sierra Club argues in the current proceeding that DOE/FE must conduct a broader inquiry to comply with ESA. Specifically, it contends that "DOE/FE must consider not just species impacts at the proposed project site (although it must at least do that), but the effects of increased gas production across the full region the terminal affects."[352] These arguments echo those that it

[350] *See* MARAD ROD at 46-47.
[351] *See id*. at 46 (citation omitted).
[352] Sierra Club Mot. at 10.

makes in support of a broader scope for NEPA review, *i.e.* the proposal to export LNG, if granted, will impact a wide area due to induced natural gas production activities. DOE need not repeat its arguments with respect to the appropriate scope of review over indirect effects except to observe that conducting a wider regional or national consultation regarding species impacts would add greatly to the burden of acting on applications to export natural gas to non-FTA countries. Moreover, the inability to predict at a local level the volumes of induced natural gas production would make such ESA analysis more speculative than informative. The scope of review undertaken by MARAD in the EIS was properly limited to reasonably foreseeable impacts of the proposed Delfin Liquefaction Facility and its use for the export of LNG. Accordingly, we reject Sierra Club's arguments in respect to the scope of ESA review.

6. Greenhouse Gas Impacts Associated with U.S. LNG Exports

Sierra Club and other commenters on the LCA GHG Report, the Addendum, and the 2014 and 2015 LNG Export Studies have expressed concern that exports of domestic natural gas to non-FTA nations may impact the balance of global GHG emissions through their impact domestically on the price and availability of natural gas for electric generation and other uses. They also have objected that exports of natural gas could have a negative effect on the GHG intensity and total amount of energy consumed in foreign nations.

a. Domestic Environmental Impacts Associated with Increased Natural Gas Prices

To the extent exports of natural gas to non-FTA nations increase domestic natural gas prices, those higher prices would be expected, all else equal, to reduce the use of natural gas in the United States as compared to a future case in which exports to non-FTA exports were prohibited. Within the U.S. electric generation sector, reduced demand for natural gas caused by higher prices would be balanced by some combination of reduced electric generation overall

(aided by conservation and efficiency measures), increased generation from other resources (such as coal, renewables, and nuclear), and more efficient use of natural gas (*i.e.*, shifting of generation to natural gas-fired generators with superior heat rates).

Although EIA's 2012 Study found that additional natural gas production would supply most of the natural gas needed to support added LNG exports, EIA modeled the effects of higher natural gas prices on energy consumption in the United States in the years 2015 through 2035, and found several additional results. In particular, EIA found that "under Reference case conditions, decreased natural gas consumption as a result of added exports are countered proportionately by increased coal consumption (72 percent), increased liquid fuel consumption (8 percent), other increased consumption, such as from renewable generation sources (9 percent), and decreases in total consumption (11 percent)."[353] Further, EIA determined that, in the earlier years of the 2015 to 2035 period, "the amount of natural gas to coal switching is greater," with "coal play[ing] a more dominant role in replacing the decreased levels of natural gas consumption, which also tend to be greater in the earlier years."[354] Likewise, "[s]witching from natural gas to coal is less significant in later years, partially as a result of a greater proportion of switching into renewable generation."[355] EIA ultimately projected that, for LNG export levels from 6 to 12 Bcf/d of natural gas and under Reference case conditions, aggregate carbon dioxide emissions would increase above a base case with no exports by between 643 and 1,227 million metric tons (0.5 to 1.0 percent) over the period from 2015 to 2035.[356] It is worth noting, however, that a substantial portion of these projected emissions came from consumption of natural gas in the liquefaction process, rather than from increased use of coal. The liquefaction

[353] 2012 EIA Study at 18.
[354] *Id*.
[355] *Id*.
[356] *Id*. at 19.

of natural gas is captured in the LCA GHG Report's estimate of the life cycle GHG emissions of U.S.-exported LNG, discussed above.

We further note that EIA's 2014 Study assumed the regulations in effect at the time the AEO 2014 was prepared.[357] Therefore, EIA's analysis included the impacts that EPA's Mercury and Air Toxics Standard[358] but not EPA's Transport Rule[359] as it had been vacated at the time. EIA's analysis in 2014 also captured the Clean Air Interstate Rule, which sets limits on regional sulfur dioxide and mono-nitrogen oxides (SO_2 and $NO_{x)}$. There are, however, other rules that were not final at the time of AEO 2014, including two then-proposed rules from EPA to reduce the extent to which the increased use of coal would compensate for reduced use of natural gas. These rules, finalized in the fall of 2015, impose limits on GHG emissions from both new and existing coal-fired power plants.[360] In particular, these rules have the potential to mitigate significantly any increased emissions from the U.S. electric power sector that would otherwise result from increased use of coal, and perhaps to negate those increased emissions entirely.

The AEO 2017 incorporated the Clean Power Plan (CPP) final rule in the Reference case and assumes that all states choose to meet a mass-based standard to cover both existing and new sources of carbon dioxide emissions. In the AEO 2017 Reference case—which includes 12.1 Bcf/d of LNG exports from the United States in 2040—electric power sector carbon dioxide

[357] *See supra* § VII.B.
[358] U.S. Envtl. Prot. Agency, National Emission Standards for Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial- Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units; Final Rule, 77 Fed. Reg. 9,304 (Feb. 16, 2012).
[359] U.S. Envtl. Prot. Agency, Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals; Final Rule, 76 Fed. Reg. 48,208 (Aug. 8, 2011).
[360] U.S. Envtl. Protection Agency, Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,510 (Oct. 23, 2015); U.S. Envtl. Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,662 (Oct. 23, 2015) (effective Dec. 22, 2015). As noted above, the U.S. Supreme Court has issued a stay of the effectiveness of this rule pending review, *see supra* note 188.

emissions are projected to be 37 percent below 2005 levels in 2040, decreasing from 2,416 million metric tons of carbon dioxide (MMmt CO2) in 2005 to 1,531 in 2040, due to the implementation of the CPP as well as decreasing use of coal-fired generation. Natural gas generation increases by 33 percent in the Reference case from 2015 to 2040, and coal generation declines by 31 percent from 2015 to 2040.

In the AEO 2017 Reference case that did not incorporate the Clean Power Plan, LNG exports from the United States are 12.7 Bcf/d in 2040 and electric power sector carbon dioxide emissions are projected to be 20 percent below 2005 levels in 2040, decreasing in this case from 2,413 MMmt CO2 in 2005 to 1,941 in 2040, which is primarily attributable to increased use of natural gas generation that still occurs without the CPP. Also in the 2017 AEO Reference Case without the CPP, natural gas generation still rises from 2015 to 2040, but to a lesser degree, with a 33 percent increase with the CPP and a 22 percent increase without it. Coal generation increases 3 percent from 2015 to 2040 without the CPP.

Therefore, on the record before us, we cannot conclude that exports of natural gas would be likely to cause a significant increase in U.S. GHG emissions through their effect on natural gas prices and the use of coal for electric generation.

b. International Impacts Associated with Energy Consumption in Foreign Nations

The LCA GHG Report estimated the life cycle GHG emissions of U.S. LNG exports to Europe and Asia, compared with certain other fuels used to produce electric power in those importing countries. The key findings for U.S. LNG exports to Europe and Asia are summarized in Figures 3 and 4 below, which are also presented above in Section IX.A (Figures 1 and 2):

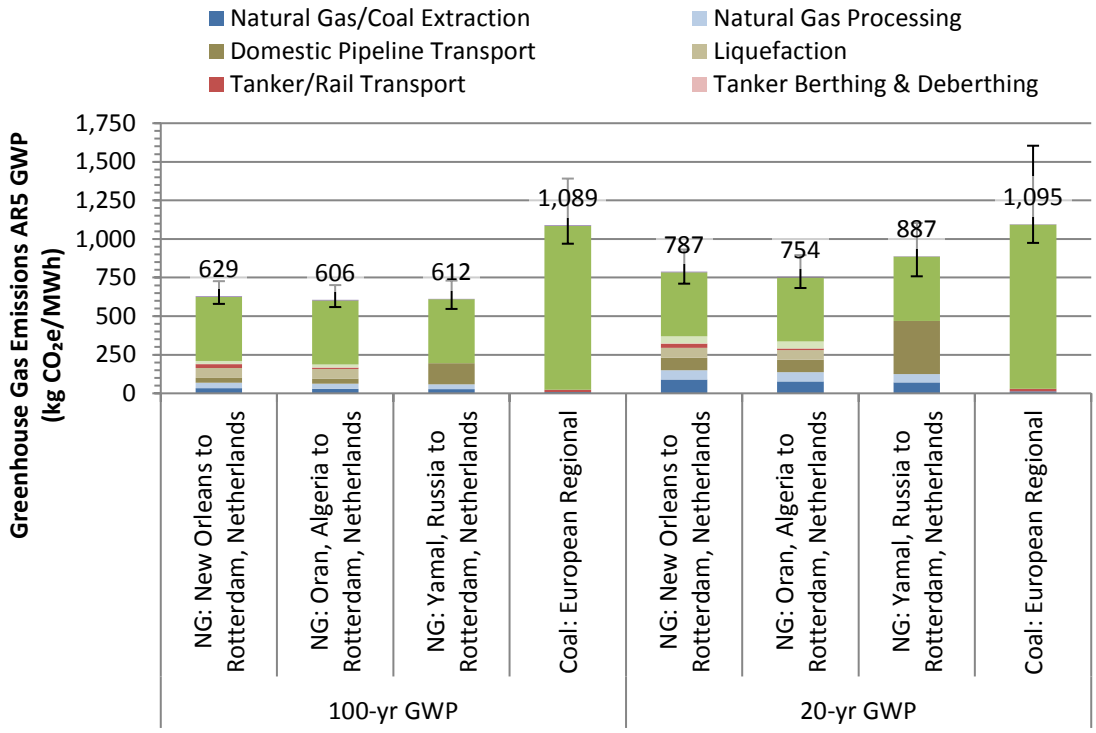

Figure 3: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe[361]

[361] LCA GHG Report at 9 (Figure 6-1).

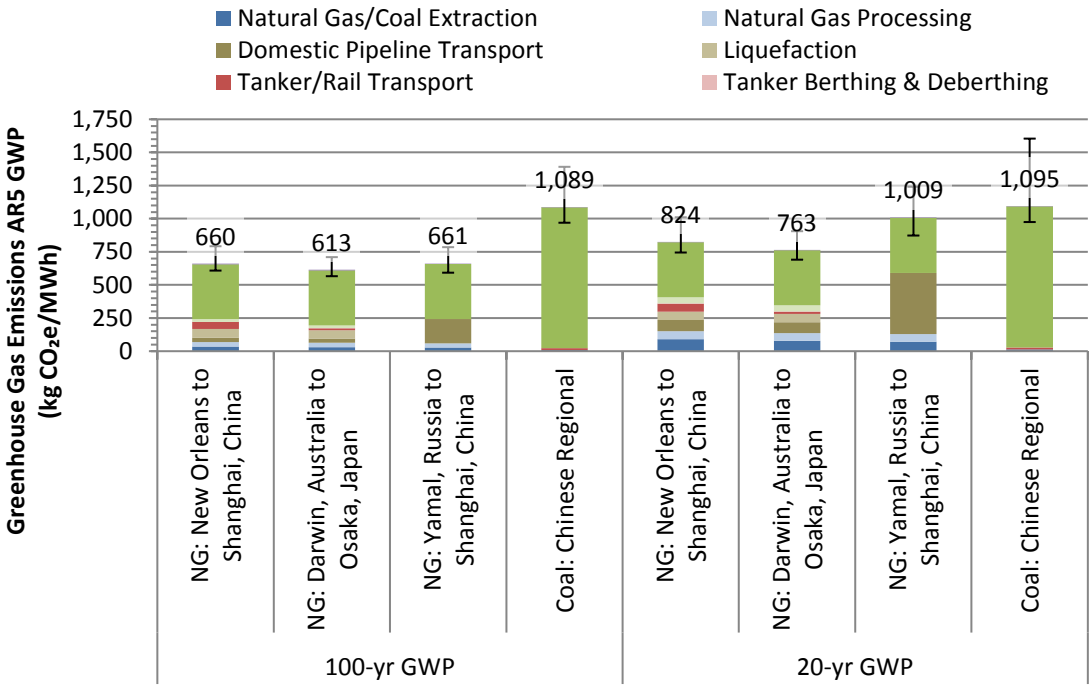

Figure 4: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia[362]

While acknowledging substantial uncertainty, the LCA GHG Report shows that to the extent U.S. LNG exports are preferred over coal in LNG-importing nations, U.S. LNG exports are likely to reduce global GHG emissions. Further, to the extent U.S. LNG exports are preferred over other forms of imported natural gas, they are likely to have only a small impact on global GHG emissions.[363]

The LCA GHG Report does not answer the ultimate question whether authorizing exports of natural gas to non-FTA nations will increase or decrease global GHG emissions, because regional coal and imported natural gas are not the *only* fuels with which U.S.-exported LNG would compete. U.S. LNG exports may also compete with renewable energy, nuclear energy, petroleum-based liquid fuels, coal imported from outside East Asia or Western Europe,

[362] LCA GHG Report at 10 (Figure 6-2).
[363] *Id*. at 9, 18.

indigenous natural gas, synthetic natural gas derived from coal, and other resources, as well as efficiency and conservation measures. To model the effect that U.S. LNG exports would have on net global GHG emissions would require projections of how each of these fuel sources would be affected in each LNG-importing nation. Such an analysis would not only have to consider market dynamics in each of these countries over the coming decades, but also the interventions of numerous foreign governments in those markets.

For example, Sierra Club and other commenters have observed that renewable energy has experienced significant growth in key LNG-importing countries such as India and China. These commenters do not, however, place the growth of renewable energy in the context of the aggregate use of fossil energy projects in those countries. Nor do they explain the extent to which growth in renewable energy has been driven by public policies in those countries and how the availability of U.S. LNG exports would or would not impact the continuation of those policies.

The uncertainty associated with estimating each of these factors would likely render such an analysis too speculative to inform the public interest determination in this or other non-FTA LNG export proceedings. Accordingly, DOE/FE elected to focus on the discrete question of how U.S. LNG compares on a life cycle basis to regional coal and other sources of imported natural gas in key LNG-importing countries. This is a useful comparison because coal and imported natural gas are prevalent fuel sources for electric generation in non-FTA LNG-importing nations. For example, EIA notes that installed electric generation capacity in China was 63 percent coal and 4 percent natural gas in 2013.[364] For India, installed electric generation capacity in 2014 is

[364] U.S. Energy Information Administration, China Analysis Brief (last updated May 14, 2015), *available at:* http://www.eia.gov/beta/international/analysis.cfm?iso=CHN.

62 percent coal and 8 percent natural gas.[365] In both China and India, electric generation capacity is expected to increase substantially in coming years. For Japan, the largest importer of LNG in the world, electric generation from fossil fuels was 74 percent of total generation in 2011 and has increased in the years following the Fukushima disaster—most recently to 85 percent in 2014.[366] In Europe, use of fossil fuels is slightly less than in the Asian nations noted above but still significant, comprising 62 percent of electric generation in the United Kingdom and around half for Spain for 2014, respectively.[367]

The conclusions of the LCA GHG Report, combined with the observation that many LNG-importing nations rely heavily on fossil fuels for electric generation, suggests that exports of U.S. LNG may decrease global GHG emissions, although there is substantial uncertainty on this point as indicated above. In any event, the record does not support the conclusion that U.S. LNG exports will increase global GHG emissions in a material or predictable way. Therefore, while we share the commenters' strong concern about GHG emissions as a general matter, based on the current record evidence, we do not see a reason to conclude that U.S. LNG exports will significantly exacerbate global GHG emissions.

D. Other Considerations

Our decision is not premised on an uncritical acceptance of the general conclusion of the 2014 and 2015 LNG Export Studies of net economic benefits from LNG exports. Both of those

[365] U.S. Energy Information Administration, India Analysis Brief (last updated June 14, 2016), *available at* http://www.eia.gov/beta/international/analysis.cfm?iso=IND.
[366] U.S. Energy Information Administration, Japan Analysis Brief (last updated Feb. 2, 2017), *available at:* http://www.eia.gov/beta/international/analysis.cfm?iso=JPN; *see also* http://www.eia.gov/beta/international/data/browser/index.cfm#/?vo=0&v=H&start=1980&end=2014.
[367] EIA, International Energy Statistics, *available at:* http://www.eia.gov/beta/international/. To evaluate the effect that U.S. LNG exports may have on the mix of fuels used for electric generation in Western Europe also requires consideration of the role of the European Trading System (ETS). The ETS places a cap on GHG emissions. Therefore, where the cap is a binding constraint, the ETS ultimately may ensure that the availability of U.S.-exported LNG will not affect aggregate emissions.

Studies and many public comments identify significant uncertainties and even potential negative impacts from LNG exports. The economic impacts of higher natural gas prices and potential increases in natural gas price volatility are two of the factors that we view most seriously. Yet we also have taken into account factors that could mitigate such impacts, such as the current oversupply situation and data indicating that the natural gas industry would increase natural gas supply in response to increasing exports. Further, we note that it is far from certain that all or even most of the proposed LNG export projects will ever be realized because of the time, difficulty, and expense of commercializing, financing, and constructing LNG export terminals, as well as the uncertainties inherent in the global market demand for LNG. On balance, we find that the potential negative impacts of Delfin's proposed exports are outweighed by the likely net economic benefits and by other non-economic or indirect benefits.

More generally, DOE/FE continues to subscribe to the principle set forth in our 1984 Policy Guidelines[368] that, under most circumstances, the market is the most efficient means of allocating natural gas supplies. However, agency intervention may be necessary to protect the public in the event there is insufficient domestic natural gas for domestic use. There may be other circumstances as well that cannot be foreseen that would require agency action.[369] Given these possibilities, DOE/FE recognizes the need to monitor market developments closely as the impact of successive authorizations of LNG exports unfolds.

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[368] 49 Fed. Reg. at 6684 (Feb. 22, 1984).

[369] Some commenters previously asked DOE to clarify the circumstances under which the agency would exercise its authority to revoke (in whole or in part) previously issued LNG export authorizations. We cannot precisely identify all the circumstances under which such action would be taken. We reiterate our observation in *Sabine Pass* that: "In the event of any unforeseen developments of such significant consequence as to put the public interest at risk, DOE/FE is fully authorized to take action as necessary to protect the public interest. Specifically, DOE/FE is authorized by section 3(a) of the Natural Gas Act … to make a supplemental order as necessary or appropriate to protect the public interest. Additionally, DOE is authorized by section 16 of the Natural Gas Act 'to perform any and all acts and to prescribe, issue, make, amend, and rescind such orders, rules, and regulations as it may find necessary or appropriate' to carry out its responsibilities." *Sabine Pass*, DOE/FE Order No. 2961, at 33 n.45 (quoting 15 U.S.C. § 717o).

E. Conclusion

We have reviewed the evidence in the record and relevant precedent in earlier non-FTA export decisions and have not found an adequate basis to conclude that Delfin's proposed exports of LNG to non-FTA countries will be inconsistent with the public interest. We further find that the intervenor-protestors in this proceeding—V4EI, Sierra Club, and APGA—have failed to overcome the statutory presumption that the proposed export authorization is consistent with the public interest. For these reasons, we are authorizing Delfin's proposed exports to non-FTA countries subject to the limitations and conditions described in this Order.

In deciding whether to grant a final non-FTA export authorization, we consider in our decision-making the cumulative impacts of the total volume of all final non-FTA export authorizations. With the issuance of this Order, DOE/FE has now issued final non-FTA authorizations in a cumulative volume of exports totaling 21.0 Bcf/d of natural gas, or 7.67 trillion cubic feet per year, for the 26 final authorizations issued to date—Sabine Pass Liquefaction, LLC (2.2 Bcf/d),[370] Carib Energy (USA) LLC (0.04 Bcf/d),[371] Cameron LNG, LLC (1.7 Bcf/d),[372] FLEX I (1.4 Bcf/d),[373] FLEX II (0.4 Bcf/d),[374] Dominion Cove Point LNG,

[370] *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961-A, FE Docket No. 10-111-LNG, Final Opinion and Order Granting Long-Term Authorization to Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations (Aug. 7, 2012).
[371] *Carib Energy (USA) LLC*, DOE/FE Order No. 3487, FE Docket No. 11-141-LNG, Final Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers by Vessel to Non-Free Trade Agreement Nations in Central America, South America, or the Caribbean (Sept. 10, 2014).
[372] *Cameron LNG, LLC*, DOE/FE Order No. 3391-A, FE Docket No. 11-162-LNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Cameron LNG Terminal in Cameron Parish, Louisiana, to Non-Free Trade Agreement Nations (Sept. 10, 2014).
[373] *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3282-C, FE Docket No. 10-161-LNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Freeport LNG Terminal on Quintana Island, Texas, to Non-Free Trade Agreement Nations (Nov. 14, 2014) (FLEX I Final Order).
[374] *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3357-B, FE Docket No. 11-161-LNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Freeport LNG Terminal on Quintana Island, Texas, to Non-Free Trade Agreement Nations (Nov. 14, 2014) (FLEX II Final Order).

LP (0.77 Bcf/d),[375] Cheniere Marketing, LLC and Corpus Christi Liquefaction, LLC (2.1 Bcf/d),[376] Sabine Pass Liquefaction, LLC Expansion Project (1.38 Bcf/d),[377] American Marketing LLC (0.008 Bcf/d),[378] Emera CNG, LLC (0.008 Bcf/d),[379] Floridian Natural Gas Storage Company, LLC,[380] Air Flow North American Corp. (0.002 Bcf/d),[381] Bear Head LNG Corporation and Bear Head LNG (USA), LLC (0.81 Bcf/d),[382] Pieridae Energy (USA) Ltd.,[383] Sabine Pass Liquefaction, LLC Design Increase (0.56 Bcf/d),[384] Cameron LNG, LLC Design

[375] *Dominion Cove Point LNG, LP*, DOE/FE Order No. 3331-A, FE Docket No. 11-128-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas from the Cove Point LNG Terminal in Calvert County, Maryland, to Non-Free Trade Agreement Nations (May 7, 2015).
[376] *Cheniere Marketing, LLC and Corpus Christi Liquefaction, LLC*, DOE/FE Order No. 3638, FE Docket No. 12-97-LNG, Final Order and Opinion Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Proposed Corpus Christi Liquefaction Project to Be Located in Corpus Christi, Texas, to Non-Free Trade Agreement Nations (May 12, 2015).
[377] *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 3669, FE Docket Nos. 13-30-LNG, 13-42-LNG, & 13-121-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Sabine Pass LNG Terminal Located in Cameron Parish, Louisiana, to Non-Free Trade Agreement Nations (June 26, 2015).
[378] *American LNG Marketing LLC*, DOE/FE Order No. 3690, FE Docket No. 14-209-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers Loaded at the Proposed Hialeah Facility Near Medley, Florida, and Exported by Vessel to Non-Free Trade Agreement Nations (Aug. 7, 2015).
[379]*Emera CNG, LLC*, DOE/FE Order No. 3727, FE Docket No. 13-157-CNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Compressed Natural Gas by Vessel From a Proposed CNG Compression and Loading Facility at the Port of Palm Beach, Florida, to Non-Free Trade Agreement Nations (Oct. 19, 2015).
[380] *Floridian Natural Gas Storage Co., LLC*, DOE/FE Order No. 3744, FE Docket No. 15-38-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers Loaded at the Proposed Floridian Facility in Martin County, Florida, and Exported by Vessel to Non-Free Trade Agreement Nations (Nov. 25, 2015).
[381] *Air Flow North American Corp.*, DOE/FE Order No. 3753, FE Docket No. 15-206-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers Loaded at the Clean Energy Fuels Corp. LNG Production Facility in Willis, Texas, and Exported by Vessel to Non-Free Trade Agreement Nations in Central America, South America, the Caribbean, or Africa (Dec. 4, 2015).
[382] *Bear Head LNG Corporation and Bear Head LNG (USA)*, DOE/FE Order No. 3770, FE Docket No. 15-33-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export U.S.-Sourced Natural Gas by Pipeline to Canada for Liquefaction and Re-Export in the Form of Liquefied Natural Gas to Non-Free Trade Agreement Countries (Feb. 5, 2016).
[383] *Pieridae Energy (USA) Ltd.*, DOE/FE Order No. 3768, FE Docket No. 14-179-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export U.S.-Sourced Natural Gas Natural Gas by Pipeline to Canada for Liquefaction and Re-Export in the Form of Liquefied Natural Gas to Non-Free Trade Agreement Countries (Feb. 5, 2016).
[384] *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 3792, FE Docket No. 15-63-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel From the Sabine Pass LNG Terminal Located in Cameron Parish, Louisiana, to Non-Free Trade Agreement Nations (Mar. 11, 2016).

Increase (0.42 Bcf/d),[385] Flint Hills Resources, LP (0.01 Bcf/d),[386] Cameron LNG, LLC Expansion Project (1.41 Bcf/d),[387] Lake Charles Exports, LLC (2.0 Bcf/d),[388] Lake Charles LNG Export Company, LLC,[389] Carib Energy (USA), LLC (0.004),[390] Magnolia LNG, LLC (1.08 Bcf/d),[391] Southern LNG Company, L.L.C. (0.36 Bcf/d),[392] the FLEX Design Increase (0.34 Bcf/d),[393] Golden Pass Products LLC (2.02 Bcf/d),[394] and this Order.

We note that the volumes authorized for export in the *Lake Charles Exports* and *Lake Charles LNG Export* orders are both 2.0 Bcf/d, yet are not additive to one another because the source of LNG approved under both orders is the Lake Charles Terminal. Likewise, the *Carib*

[385] *Cameron LNG, LLC*, DOE/FE Order No. 3797, FE Docket No. 15-167-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Cameron Terminal Located in Cameron and Calcasieu Parishes, Louisiana, to Non-Free Trade Agreement Nations (Mar. 18, 2016).
[386] *Flint Hills Resources, LP*, DOE/FE Order No. 3829, FE Docket No. 15-168-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers and in Bulk Loaded at the Stabilis LNG Eagle Ford Facility in George West, Texas, and Exported by Vessel to Non-Free Trade Agreement Nations (May 20, 2016).
[387] *Cameron LNG, LLC*, DOE/FE Order No. 3846, FE Docket No. 15-90-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from Trains 4 and 5 of the Cameron LNG Terminal Located in Cameron and Calcasieu Parishes, Louisiana, to Non-Free Trade Agreement Nations (July 15, 2016).
[388] *Lake Charles Exports, LLC*, DOE/FE Order No. 3324-A, FE Docket No. 11-59-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Lake Charles Terminal in Calcasieu Parish, Louisiana, to Non-Free Trade Agreement Nations (July 29, 2016).
[389] *Lake Charles LNG Export Co., LLC*, DOE/FE Order No. 3868, FE Docket No. 13-04-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Lake Charles Terminal in Calcasieu Parish, Louisiana to Non-Free Trade Agreement Nations (July 29, 2016).
[390] *Carib Energy (USA) LLC*, DOE/FE Order No. 3937, FE Docket No. 16-98-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers Loaded at Designated Pivotal LNG, Inc. Facilities and Exported by Vessel to Non-Free Trade Agreement Nations in Central America, South America, or the Caribbean (Nov. 28, 2016).
[391] *Magnolia LNG, LLC*, DOE/FE Order No. 3909, FE Docket No. 13-132-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel From the Proposed Magnolia LNG Terminal to be Constructed in Lake Charles, Louisiana, to Non-Free Trade Agreement Nations (Nov. 30, 2016).
[392] *Southern LNG Company, L.L.C.*, DOE/FE Order No. 3956, FE Docket No. 12-100-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Elba Island Terminal in Chatham County, Georgia, to Non-Free Trade Agreement Nations (Dec. 16, 2016).
[393] *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3957, FE Docket No. 16-108-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Freeport LNG Terminal on Quintana Island, Texas, to Non-Free Trade Agreement Nations (Dec. 19, 2016).
[394] *Golden Pass Products LLC*, DOE/FE Order No. 3978, FE Docket No. 12-156-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Golden Pass LNG Terminal Located in Jefferson County, Texas, to Non-Free Trade Agreement Nations (Apr. 25, 2017).

and *Floridian* orders are both 14.6 Bcf/yr of natural gas (0.04 Bcf/d), yet are not additive to one another because the source of LNG approved under both orders is from the Floridian Facility.[395] Additionally, the volumes authorized for export in the *Bear Head* and *Pieridae US* orders are not additive; together, they are limited to a maximum of 0.81 Bcf/d to reflect the current capacity of the Maritimes Northeast Pipeline at the U.S.-Canadian border.[396] In sum, the total export volume is within the range of scenarios analyzed in the 2014 and 2015 LNG Export Studies. The 2015 Study found that in all such scenarios—assuming LNG export volumes totaling 12 Bcf/d up to 20 Bcf/d of natural gas—the United States would experience net economic benefits.

DOE/FE will continue taking a measured approach in reviewing the other pending applications to export domestically produced LNG. Specifically, DOE/FE will continue to assess the cumulative impacts of each succeeding request for export authorization on the public interest with due regard to the effect on domestic natural gas supply and demand fundamentals. In keeping with the performance of its statutory responsibilities, DOE/FE will attach appropriate and necessary terms and conditions to authorizations to ensure that the authorizations are utilized in a timely manner and that authorizations are not issued except where the applicant can show that there are or will be facilities capable of handling the proposed export volumes and existing and forecast supplies that support that action. Other conditions will be applied as necessary.

The reasons in support of proceeding cautiously are several: (1) the 2014 and 2015 LNG Export Studies, like any studies based on assumptions and economic projections, are inherently

[395] *See Floridian Natural Gas Storage Co., LLC*, DOE/FE Order No. 3744, at 22 (stating that the quantity of LNG authorized for export by Floridian in DOE/FE Order No. 3744 "will be reduced by the portion of the total approved volume of 14.6 Bcf/yr that is under firm contract directly or indirectly to Carib Energy (USA), LLC"); *see also id*. at 21 (Floridian "may not treat the volumes authorized for export in the [*Carib* and *Floridian*] proceedings as additive to one another.").

[396] *See Bear Head LNG Corporation and Bear Head LNG (USA)*, DOE/FE Order No. 3770, at 178-79 (stating that the quantity of LNG authorized for export by Bear Head LNG and Pieridae US "are not additive; together, they are limited to a maximum of 0.81 Bcf/d to reflect the current capacity of the M&N US Pipeline.").

limited in their predictive accuracy; (2) applications to export significant quantities of domestically produced LNG are a new phenomena with uncertain impacts; and (3) the market for natural gas has experienced rapid reversals in the past and is again changing rapidly due to economic, technological, and regulatory developments. The market of the future very likely will not resemble the market of today. In recognition of these factors, DOE/FE intends to monitor developments that could tend to undermine the public interest in grants of successive applications for exports of domestically produced LNG and, as previously stated, to attach terms and conditions to the authorization in this proceeding and to succeeding LNG export authorizations as are necessary for protection of the public interest.

XIII. TERMS AND CONDITIONS

To ensure that the authorization issued by this Order is not inconsistent with the public interest, DOE/FE has attached the following Terms and Conditions to the authorization. The reasons for each term or condition are explained below. Delfin must abide by each Term and Condition or may face rescission of the authorization or other appropriate sanction.

A. Term of the Authorization

Delfin requests a 20-year term for the authorization commencing from the date export operations begin. Specifically, Delfin requests that, in light of the "planned phased development" of its Facility—with successive trains expected to become operational from 2017 through 2021—DOE/FE construe the "date of first export" on a train-specific basis.[397] Under this approach, exports from the first train, if placed in operation in 2017, would extend for 20 years from that first export. However, if the third train were placed in operation in 2020, exports from the third train would be authorized for 20 years from the start of that train's export

[397] Delfin App. at 9.

operations (rather than only 17 years, if based on the date of first export from the first train). Delfin acknowledges that this phased approach has not been previously adopted by DOE/FE but asserts that it will facilitate the orderly development of its Facility and its customer contracting.[398]

Although a 20-year term is consistent with our practice in the non-FTA export authorizations issued to date, DOE/FE does not believe that the 20-year term should apply on a train-specific basis. Nor is such a phased approach necessary, as DOE/FE is granting Delfin the opportunity to export Make-Up Volumes, as described below. Therefore, the 20-year term will begin on the date when Delfin commences commercial export of domestically sourced LNG from the Delfin Liquefaction Facility, but not before.

B. Commencement of Operations Within Seven Years

Consistent with our prior non-FTA authorizations to date, DOE/FE will add as a condition of the authorization that Delfin must commence commercial LNG export operations from the Delfin Liquefaction Facility no later than seven years from the date of issuance of this Order. The purpose of this condition is to ensure that other entities that may seek similar authorizations are not frustrated in their efforts to obtain those authorizations by authorization holders that are not engaged in actual export operations.

C. Commissioning Volumes

Delfin will be permitted to apply for short-term export authorizations to export Commissioning Volumes prior to the commencement of the first commercial exports of domestically sourced LNG from the Delfin Liquefaction Facility. "Commissioning Volumes" are defined as the volume of LNG produced and exported under a short-term authorization

[398] *See id*.

during the initial start-up of each LNG train, before each LNG train has reached its full steady-state capacity and begun its commercial exports pursuant to Delfin's long-term contracts.[399] The Commissioning Volumes will not be counted against the maximum level of volumes previously authorized in Delfin's FTA authorization (DOE/FE Order No. 3393) or in this Order.

Delfin will be permitted to continue exporting for a total of three years following the end of the 20-year term established in this Order, solely to export any Make-Up Volume that it was unable to export during the original export period. The three-year term during which the Make-Up Volume may be exported shall be known as the "Make-Up Period."

The Make-Up Period does not affect or modify the total volume of LNG previously authorized in Delfin's FTA authorization (DOE/FE Order No. 3393) or in this Order. Insofar as Delfin may seek to export additional volumes not previously authorized for export, it will be required to obtain appropriate authorization from DOE/FE.

D. Transfer, Assignment, or Change in Control

DOE/FE's natural gas import/export regulations prohibit authorization holders from transferring or assigning authorizations to import or export natural gas without specific authorization by the Assistant Secretary for Fossil Energy.[400] As a condition of the similar authorization issued to Sabine Pass in DOE/FE Order No. 2961, DOE/FE found that the requirement for prior approval by the Assistant Secretary under its regulations applies to any change of effective control of the authorization holder either through asset sale or stock transfer or by other means. This condition was deemed necessary to ensure that, prior to any transfer or

[399] For additional discussion of Commissioning Volumes and the Make-Up Period referenced below, see *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order Nos. 3282-B & 3357-A, FE Docket Nos. 10-161-LNG & 11-161-LNG, Order Amending DOE/FE Order Nos. 3282 and 3357, at 4-9 (June 6, 2014).
[400] 10 C.F.R. § 590.405.

change in control, DOE/FE will be given an adequate opportunity to assess the public interest impacts of such a transfer or change.

DOE/FE construes a change in control to mean a change, directly or indirectly, of the power to direct the management or policies of an entity whether such power is exercised through one or more intermediary companies or pursuant to an agreement, written or oral, and whether such power is established through ownership or voting of securities, or common directors, officers, or stockholders, or voting trusts, holding trusts, or debt holdings, or contract, or any other direct or indirect means. A rebuttable presumption that control exists will arise from the ownership or the power to vote, directly or indirectly, 10 percent or more of the voting securities of such entity.[401]

E. Agency Rights

Delfin requests authorization to export LNG from the Delfin Liquefaction Facility on its own behalf and as agent for other entities that hold title to the LNG at the time of export, pursuant to long-term contracts. DOE/FE previously addressed the issue of Agency Rights in Order No. 2913, which granted Freeport LNG Expansion, L.P., *et al.* (FLEX) authority to export LNG to FTA countries.[402] In that order, DOE/FE approved a proposal by FLEX to register each LNG title holder for whom FLEX sought to export LNG as agent. DOE/FE found that this proposal was an acceptable alternative to the non-binding policy adopted by DOE/FE in *Dow Chemical*, which established that the title for all LNG authorized for export must be held by the

[401] For information on DOE/FE's procedures governing a change in control, see U.S. Dep't of Energy, Procedures for Changes in Control Affecting Applications and Authorizations to Import or Export Natural Gas, 79 Fed. Reg. 65,541 (Nov. 5, 2014) [hereinafter Procedures for Changes in Control].
[402] *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 2913, FE Docket No. 10-160-LNG, Order Granting Long-Term Authorization to Export Liquefied Natural Gas from Freeport LNG Terminal to Free Trade Nations (Feb. 10, 2011) [hereinafter *Freeport LNG*].

authorization holder at the point of export.[403] We find that the same policy considerations that supported DOE/FE's acceptance of the alternative registration proposal in Order No. 2913 apply here as well.

DOE/FE has reiterated its policy on Agency Rights procedures in prior authorizations, including in *Cameron LNG, LLC*, DOE/FE Order No. 3846.[404] In that order, DOE/FE determined that, in LNG export orders in which Agency Rights have been granted, DOE/FE shall require registration materials filed for, or by, an LNG title-holder (Registrant) to include the same company identification information and long-term contract information of the Registrant as if the Registrant had filed an application to export LNG on its own behalf.[405]

To ensure that the public interest is served, the authorization granted herein shall be conditioned to require that where Delfin proposes to export LNG from the Delfin Liquefaction Facility as agent for other entities that hold title to the LNG (Registrants), it must register with DOE/FE those entities on whose behalf it will export LNG in accordance with the procedures and requirements described herein.

F. Contract Provisions for the Sale or Transfer of LNG to be Exported

DOE/FE's regulations require applicants to supply transaction-specific factual information "to the extent practicable."[406] Additionally, DOE/FE regulations allow confidential treatment of the information supplied in support of or in opposition to an application if the submitting party requests such treatment, shows why the information should be exempted from

[403] *Dow Chem. Co.*, DOE/FE Order No. 2859, FE Docket No. 10-57-LNG, Order Granting Blanket Authorization to Export Liquefied Natural Gas, at 7-8 (Oct. 5, 2010), *discussed in Freeport LNG*, DOE/FE Order No. 2913, at 7-8.
[404] See *Cameron LNG, LLC*, DOE/FE Order No. 3846.
[405] *See id*. at 128-29 (citation omitted).
[406] 10 C.F.R. § 590.202(b).

public disclosure, and DOE/FE determines it will be afforded confidential treatment in accordance with 10 C.F.R. § 1004.11.[407]

DOE/FE will require that Delfin file or cause to be filed with DOE/FE any relevant long-term commercial agreements, including liquefaction tolling agreements, pursuant to which Delfin exports LNG as agent for a Registrant.

DOE/FE finds that the submission of all such agreements or contracts within 30 days of their execution using the procedures described below will be consistent with the "to the extent practicable" requirement of section 590.202(b). By way of example and without limitation, a "relevant long-term commercial agreement" would include an agreement with a minimum term of two years, an agreement to provide natural gas processing or liquefaction services at the Delfin Liquefaction Facility, a long-term sales contract involving natural gas or LNG stored or liquefied at the Delfin Liquefaction Facility, or an agreement to provide export services from the Delfin Liquefaction Facility.

In addition, DOE/FE finds that section 590.202(c) of DOE/FE's regulations[408] requires that Delfin file, or cause to be filed, all long-term contracts associated with the long-term supply of natural gas to the Delfin Liquefaction Facility, whether signed by Delfin or the Registrant, within 30 days of their execution.

DOE/FE recognizes that some information in Delfin's or a Registrant's long-term commercial agreements associated with the export of LNG, and/or long-term contracts associated with the long-term supply of natural gas to the Delfin Liquefaction Facility, may be commercially sensitive. DOE/FE therefore will provide Delfin the option to file or cause to be filed either unredacted contracts, or in the alternative (A) Delfin may file, or cause to be filed,

[407] *Id*. § 590.202(e).
[408] *Id*. § 590.202(c).

long-term contracts under seal, but it also will file either: i) a copy of each long-term contract with commercially sensitive information redacted, or ii) a summary of all major provisions of the contract(s) including, but not limited to, the parties to each contract, contract term, quantity, any take or pay or equivalent provisions/conditions, destinations, re-sale provisions, and other relevant provisions; and (B) the filing must demonstrate why the redacted information should be exempted from public disclosure.

To ensure that DOE/FE destination and reporting requirements included in this Order are conveyed to subsequent title holders, DOE/FE will include as a condition of this authorization that future contracts for the sale or transfer of LNG exported pursuant to this Order shall include an acknowledgement of these requirements.

G. Export Quantity

In the Application, Delfin sought authorization to export up 657.5 Bcf/yr of natural gas (1.8 Bcf/d), which is within the maximum liquefaction capacity of the Delfin Liquefaction Facility as approved by MARAD.[409] As set forth herein, this Order authorizes the export of LNG in the full amount requested, up to the equivalent of 657.5 Bcf/yr of natural gas.

H. Combined FTA and Non-FTA Export Authorization Volumes

Delfin is currently authorized in DOE/FE Order No. 3393 to export domestically produced LNG to FTA countries in a volume equivalent to approximately 657.5 Bcf/yr of natural gas. Because the source of LNG for that FTA order and this Order is the Delfin Liquefaction Facility, Delfin may not treat the volumes as additive to one another.

[409] *See* MARAD ROD at 10-11; Final EIS at xxii, 2-1.

XIV. FINDINGS

On the basis of the findings and conclusions set forth above, we find that it has not been shown that a grant of the requested authorization will be inconsistent with the public interest, and we further find that Delfin's Application should be granted subject to the Terms and Conditions set forth herein. The following Ordering Paragraphs reflect current DOE/FE practice.

XV. ORDER

Pursuant to section 3 of the Natural Gas Act, it is ordered that:

A. Delfin LNG LLC (Delfin) is authorized to export domestically produced LNG by vessel from the proposed floating Delfin Liquefaction Facility, to be located in West Cameron Block 167 in the Gulf of Mexico, offshore of Cameron Parish, Louisiana. Delfin is authorized to export this LNG in a volume equivalent to 657.5 Bcf/yr of natural gas on its own behalf and as agent for other entities that hold title to the natural gas, pursuant to one or more long-term contracts (a contract greater than two years).

B. The 20-year authorization period will commence when Delfin commences commercial export of domestically sourced LNG from the Delfin Liquefaction Facility, but not before. Delfin may export Commissioning Volumes prior to the commencement of the terms of this Order, pursuant to a separate short-term export authorization. The Commissioning Volumes will not be counted against the maximum level of volumes previously authorized in Delfin's FTA order (DOE/FE Order No. 3393) or in this Order.

C. Delfin may continue exporting for a total of three years following the end of the 20-year export term, solely to export any Make-Up Volume that it was unable to export during the original export period. The three-year Make-Up Period allowing the export of Make-Up Volumes does not affect or modify the maximum volume of LNG authorized for export in Delfin's existing FTA order (DOE/FE Order No. 3393) or in this Order. Insofar as Delfin may

seek to export additional volumes not previously authorized for export, it will be required to obtain appropriate authorization from DOE/FE.

D. Delfin must commence export operations using the planned liquefaction facilities no later than seven years from the date of issuance of this Order.

E. The LNG export quantity authorized in this Order is equivalent to 657.5 Bcf/yr of natural gas. This quantity is not additive to the export volume in Delfin's existing FTA order, set forth in DOE/FE Order No. 3393.

F. This LNG may be exported to any country with which the United States does not have a FTA requiring the national treatment for trade in natural gas, which currently has or in the future develops the capacity to import LNG, and with which trade is not prohibited by United States law or policy.

G. Delfin shall ensure that all transactions authorized by this Order are permitted and lawful under United States laws and policies, including the rules, regulations, orders, policies, and other determinations of the Office of Foreign Assets Control of the United States Department of the Treasury, MARAD, and FERC. Failure to comply with this requirement could result in rescission of this authorization and/or other civil or criminal remedies.

H. Delfin shall ensure compliance with all terms and conditions described by MARAD in its Record of Decision dated March 13, 2017, and/or imposed in MARAD's forthcoming deepwater port license for Delfin. Additionally, this authorization is conditioned on Delfin's receipt of all connected local, state, and federal permits (including FERC's authorization under Section 7 of the Natural Gas Act for the Delfin Onshore Facility), and on Delfin's on-going compliance with any other preventative and mitigative measures at the Delfin Liquefaction Facility imposed by MARAD or any other federal or state agencies.

I. (i) Delfin shall file, or cause others to file, with the Office of Regulation and International Engagement a non-redacted copy of all executed long-term contracts associated with the long-term export of LNG as agent for other entities from the Delfin Liquefaction Facility. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if Delfin has filed the contracts described in the preceding sentence under seal or subject to a claim of confidentiality or privilege, within 30 days of their execution, Delfin shall also file, or cause others to file, for public posting either: (a) a redacted version of the contracts described in the preceding sentence, or (b) major provisions of the contracts. In these filings, Delfin shall state why the redacted or non-disclosed information should be exempted from public disclosure.

(ii) Delfin shall file, or cause others to file, with the Office of Regulation and International Engagement a non-redacted copy of all executed long-term contracts associated with the long-term supply of natural gas to the Delfin Liquefaction Facility. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if Delfin has filed the contracts described in the preceding sentence under seal or subject to a claim of confidentiality or privilege, within 30 days of their execution, Delfin shall also file, or cause others to file, for public posting either: i) a redacted version of the contracts described in the preceding sentence, or ii) major provisions of the contracts. In these filings, Delfin shall state why the redacted or non-disclosed information should be exempted from public disclosure.

J. Delfin, or others for whom Delfin acts as agent, shall include the following provision in any agreement or other contract for the sale or transfer of LNG exported pursuant to this Order and any other applicable DOE/FE authorization:

> Customer or purchaser acknowledges and agrees that it will resell or transfer U.S.-sourced natural gas in the form of LNG purchased hereunder for delivery only to

countries identified in Ordering Paragraph F of DOE/FE Order No. 4028, issued June 1, 2017, in FE Docket No. 13-147-LNG and/or to purchasers that have agreed in writing to limit their direct or indirect resale or transfer of such LNG to such countries. Customer or purchaser further commits to cause a report to be provided to Delfin LNG LLC that identifies the country of destination (or countries) into which the exported LNG or natural gas was actually delivered and/or received for end use, and to include in any resale contract for such LNG the necessary conditions to insure that Delfin LNG LLC is made aware of all such actual destination countries.

K. Delfin is permitted to use its authorization in order to export LNG as agent for other entities, after registering such entities with DOE/FE. Registration materials shall include an acknowledgement and agreement by the Registrant to supply Delfin with all information necessary to permit Delfin to register that person or entity with DOE/FE, including: (1) the Registrant's agreement to comply with this Order and all applicable requirements of DOE/FE's regulations at 10 C.F.R. Part 590, including but not limited to destination restrictions; (2) the exact legal name of the Registrant, state/location of incorporation/registration, primary place of doing business, and the Registrant's ownership structure, including the ultimate parent entity if the Registrant is a subsidiary or affiliate of another entity; (3) the name, title, mailing address, e-mail address, and telephone number of a corporate officer or employee of the Registrant to whom inquiries may be directed; and (4) within 30 days of execution, a copy of any long-term contracts not previously filed with DOE/FE, described in Ordering Paragraph I of this Order.

L. Each registration submitted pursuant to this Order shall have current information on file with DOE/FE. Any changes in company name, contact information, change in term of the long-term contract, termination of the long-term contract, or other relevant modification, shall be filed with DOE/FE within 30 days of such change(s).

M. As a condition of this authorization, Delfin shall ensure that all persons required by this Order to register with DOE/FE have done so. Any failure by Delfin to ensure that all such

persons or entities are registered with DOE/FE shall be grounds for rescinding in whole or in part the authorization.

N. Within two weeks after the first export of domestically produced LNG occurs from the Delfin Liquefaction Facility, Delfin shall provide written notification of the date that the first export of LNG authorized in Ordering Paragraph A above occurred.

O. Delfin shall file with the Office of Regulation and International Engagement, on a semi-annual basis, written reports describing the progress of the Delfin Liquefaction Facility. The reports shall be filed on or by April 1 and October 1 of each year, and shall include information on the progress of the Delfin Liquefaction Facility, the date the Liquefaction Facility is expected to be operational, and the status of the long-term contracts associated with the long-term export of LNG and any long-term supply contracts.

P. With respect to any change in control of the authorization holder, Delfin must comply with DOE/FE's Procedures for Change in Control Affecting Applications and Authorizations to Import or Export Natural Gas.[410] For purposes of this Ordering Paragraph, a "change in control" shall include any change, directly or indirectly, of the power to direct the management or policies of Delfin, whether such power is exercised through one or more intermediary companies or pursuant to an agreement, written or oral, and whether such power is established through ownership or voting of securities, or common directors, officers, or stockholders, or voting trusts, holding trusts, or debt holdings, or contract, or any other direct or indirect means.[411]

Q. Monthly Reports: With respect to the LNG exports authorized by this Order, Delfin shall file with the Office of Regulation and International Engagement, within 30 days following the last day of each calendar month, a report indicating whether exports of LNG have been made.

[410] *See* Procedures for Changes in Control at 65,541-42.
[411] *See id*. at 65,542.

The first monthly report required by this Order is due not later than the 30th day of the month following the month of first export. In subsequent months, if exports have not occurred, a report of "no activity" for that month must be filed. If exports of LNG have occurred, the report must give the following details of each LNG cargo: (1) the name(s) of the authorized exporter registered with DOE/FE; (2) the name of the U.S. export terminal; (3) the name of the LNG tanker; (4) the date of departure from the U.S. export terminal; (5) the country (or countries) into which the exported LNG or natural gas is actually delivered and/or received for end use; (6) the name of the supplier/seller; (7) the volume in Mcf; (8) the price at point of export per million British thermal units (MMBtu); (9) the duration of the supply agreement; and (10) the name(s) of the purchaser(s).

(Approved by the Office of Management and Budget under OMB Control No. 1901-0294)

R. All monthly report filings shall be made to U.S. Department of Energy (FE-34), Office of Fossil Energy, Office of Regulation and International Engagement, P.O. Box 44375, Washington, D.C. 20026-4375, Attention: Natural Gas Reports. Alternatively, reports may be e-mailed to ngreports@hq.doe.gov or may be faxed to Natural Gas Reports at (202) 586-6050.

S. API's unopposed motion to intervene is deemed granted by operation of law.

T. The motions to intervene filed by Sierra Club, APGA, and V4EI are granted.

U. Sierra Club's reply to Delfin's Consolidated Response is granted.

Issued in Washington, D.C., on June 1, 2017.

John A. Anderson
Director, Office of Regulation and International Engagement
Office of Oil and Natural Gas
Office of Fossil Energy