UNITED STATES OF AMERICA

DEPARTMENT OF ENERGY

OFFICE OF FOSSIL ENERGY

LAKE CHARLES EXPORTS, LLC	)	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

DOE/FE ORDER NO. 3324-A

JULY 29, 2016

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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
BG	BG Group plc
BGLS	BG LNG Services, LLC
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPP	Clean Power Plan
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EUR	Estimated Ultimate Recovery
FE	Office of Fossil Energy, U.S. Department of Energy
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
FTA	Free Trade Agreement
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
LCE	Lake Charles Exports, LLC
LNG	Liquefied Natural Gas
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
ROD	Record of Decision

RWGTM	Rice World Gas Trade Model
Tcf	Trillion Cubic Feet
TRR	Technically Recoverable Resources
VOC	Volatile Organic Compound

I. INTRODUCTION

On August 7, 2013, the Office of Fossil Energy of the Department of Energy (DOE/FE) issued Order No. 3324 to Lake Charles Exports, LLC (LCE)[1] pursuant to section 3 of the Natural Gas Act (NGA)[2] (LCE Conditional Order).[3] In that Order, DOE/FE conditionally granted the portion of LCE's Application (filed in 2011,[4] and twice amended[5]) that requested long-term, multi-contract authority to export domestically produced liquefied natural gas (LNG) to nations with which the United States has not entered into 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). Under the terms of that Order, LCE is conditionally authorized to export LNG in the full volume requested—up to 15 million metric tons per annum (mtpa), which LCE states is equivalent to approximately 730 billion cubic feet per year (Bcf/yr) of natural gas (2.0 Bcf per day (Bcf/d))—by vessel from an existing LNG import terminal in Lake Charles, Calcasieu Parish, Louisiana (Lake Charles Terminal). The Lake Charles Terminal is owned and operated by Lake Charles LNG Company, LLC (Lake Charles LNG).

In March 2014, Lake Charles LNG and Lake Charles LNG Export Company, LLC (Lake Charles LNG Export) filed a joint application with the Federal Energy Regulatory Commission

[1] LCE is currently owned by subsidiaries of Royal Dutch Shell plc and Energy Transfer Equity, L.P. *See infra* § IV.A.

[2] 15 U.S.C. § 717b. 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 17, 2014.

[3] *Lake Charles Exports, LLC*, DOE/FE Order No. 3324, FE Docket No. 11-59-LNG, Order Conditionally Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Lake Charles Terminal to Non-Free Trade Agreement Nations (Aug. 7, 2013) [hereinafter LCE Conditional Order].

[4] Application of Lake Charles Exports, LLC for Long-Term Authorization to Export Liquefied Natural Gas, FE Docket No. 11-59-LNG (May 6, 2011) [hereinafter LCE App.]

[5] *See* Lake Charles Exports, LLC, Amendment to Application for Long-Term Authorization to Export Liquefied Natural Gas, FE Docket No. 11-59-LNG (May 26, 2011) [hereinafter LCE 2011 Amendment]; Lake Charles Exports, LLC, Application to Amend Long-Term Authorization to Export Liquefied Natural Gas to Free Trade Agreement Countries and Amendment to Application for Long-Term Authorization to Export Liquefied Natural Gas to Non-Free Trade Agreement Countries, FE Docket No. 11-59-LNG (Dec. 17, 2013) [hereinafter 2013 Amendment].

(FERC).[6] They requested authority to modify the facilities at the Lake Charles Terminal to permit LNG to be loaded from the Terminal's storage tanks onto vessels berthed at the marine facility, and to install liquefaction facilities that would permit natural gas to be received by pipeline at the Terminal and liquefied for export (Liquefaction Project).[7] At the time that DOE/FE was reviewing LCE's Application in this proceeding, FERC had not yet completed its review of the proposed Liquefaction Project, including its review of environmental impacts under the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4321 *et seq*.

For this reason, in the Conditional Order, DOE/FE reviewed the record evidence and entered findings only on the non-environmental issues considered under NGA section 3(a), including the economic impacts, international impacts, and security of natural gas supply associated with LCE's proposed exports.[8] Because DOE must also consider environmental issues, DOE/FE conditioned that Order on: (i) FERC's satisfactory completion of the NEPA review process for the proposed Liquefaction Project, and (ii) DOE/FE's own issuance of a Finding of No Significant Impact (FONSI) or a Record of Decision (ROD) under NEPA.[9] Specifically, DOE/FE stated that it "intends to complete its NEPA review as a cooperating agency in FERC's review of the Liquefaction Project," and explained that the Conditional Order

[6] Lake Charles LNG Company, LLC was formerly known as Trunkline LNG Company, LLC. Lake Charles LNG Export Company, LLC was formerly known as Trunkline LNG Export, LLC. The corporate names were changed in 2014. *See, e.g.*, *Lake Charles LNG Export Co., LLC*, DOE/FE Order No. 3252-A, FE Docket No. 13-04-LNG, Order Granting Request to Amend DOE/FE Order No. 3252 and Pending Application to Reflect Corporate Name Change (Mar. 18, 2015).

[7] The application was filed in FERC Docket No. CP14-120-000 (Liquefaction Docket). Applications related to the Liquefaction Project were filed by Lake Charles LNG in FERC Docket CP14-122-000 (Conversion Docket) and by Trunkline Gas Company, LLC in FERC Docket No. CP14-119-000 (Certificate Docket). *See infra* at 9, § XI.C.

[8] *See infra* § III.

[9] LCE Conditional Order, DOE/FE No. 3324, at 133-34 (Term and Condition Para. H).

"indicates … DOE/FE's determination at this time on all but the environmental issues in this proceeding."[10]

As explained below, FERC's environmental review process is now complete, and DOE/FE has issued a ROD for the proposed Liquefaction Project at the Lake Charles Terminal (DOE/EIS-0491). Because the conditions imposed by DOE/FE in the Conditional Order have been met, DOE/FE is issuing this Final Opinion and Order subject to the additional conditions set forth below.

In issuing this Order, we note that DOE/FE previously authorized both LCE (in DOE/FE Order No. 2987[11]) and Lake Charles LNG Export (in DOE/FE Order No. 3252[12]) to export LNG in the same volume requested in this Application (730 Bcf/yr) from the Lake Charles Terminal 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).[13] Additionally, concurrently with the issuance of this Order, DOE/FE is issuing a long-term export authorization, DOE/FE Order No. 3868, to Lake Charles LNG Export in FE Docket No. 13-04-LNG.[14] That order authorizes Lake Charles LNG Export to export the same volume of LNG as both this Order and the prior two FTA orders from the Lake Charles Terminal to non-FTA countries (730 Bcf/yr). Because the

[10] *Id*. (stating that "DOE/FE's participation as a cooperating agency … is intended to avoid duplication of effort by agencies with overlapping environmental review responsibilities, to achieve early coordination among agencies, and to concentrate public participation in a single forum.").
[11] *Lake Charles Exports, LLC*, DOE/FE Order No. 2987, FE Docket No. 11-59-LNG, Order Granting Long-Term Authorization to Export Liquefied Natural Gas by Vessel from the Lake Charles Terminal to Free Trade Agreement Nations (July 22, 2011) [hereinafter LCE FTA Order].
[12] *Lake Charles LNG Export Co., LLC (formerly Trunkline LNG Export, LLC*), DOE/FE Order No. 3252, FE Docket No. 13-04-LNG, Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Lake Charles Terminal to Free Trade Agreement Nations (Mar. 7, 2013).
[13] 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.
[14] *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).

source of LNG for all four of these export authorizations is the proposed Lake Charles Liquefaction Project, none of the volumes authorized for export in those orders—DOE/FE Order Nos. 2987, 3252, 3324-A, and 3868—are additive to one another. *See infra* §§ IV.D, XIII.I. In its application filed in FE Docket No. 13-04-LNG, Lake Charles LNG Export made clear that it was "not seeking to export any additional volumes of LNG from the Lake Charles facility."[15]

DOE/FE Proceeding. On June 13, 2011, DOE/FE published a Notice of LCE's Application in the *Federal Register*.[16] The Notice of Application called on interested persons to submit protests, motions to intervene, notice of intervention, and comments by August 12, 2011. DOE/FE received 15 comments in support of the Application. In opposition to the Application, DOE/FE received one comment submitted by the Industrial Energy Consumers of America (IECA) and one motion to intervene and protest submitted by the American Public Gas Association (APGA). LCE did not oppose APGA's motion to intervene, but filed an answer to APGA's protest and IECA's comment. DOE/FE has considered these filings in both the Conditional Order and this Order. *See infra* §§ IV.D, VI.

Additionally, in evaluating whether LCE's Application has been shown to be inconsistent with the public interest under NGA section 3(a), DOE/FE has considered the following economic and environmental studies:

[15] Lake Charles LNG Export Co., LLC (formerly Trunkline LNG Export Co., LLC), Application for Long-Term Authorization to Export Liquefied Natural Gas, FE Docket No. 13-04-LNG, at 1 (Jan. 10, 2013).
[16] U.S. Dep't of Energy; Lake Charles Exports, LLC, Application for Long-Term Authorization To Export Liquefied Natural Gas, 76 Fed. Reg. 34,212 (June 13, 2011) [hereinafter Notice of 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.[17] In relevant part, the 2012 EIA Study examined how prescribed levels of natural gas exports (at 6 Bcf/d and 12 Bcf/d) above baseline cases could affect domestic energy markets. 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.

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.[18] On May 29, 2014, DOE announced plans to undertake new economic studies to gain a better understanding of how potentially higher

[17] *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).

[18] 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.

levels of U.S. LNG exports—at levels between 12 and 20 Bcf/d of natural gas—would affect the public interest.[19]

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).[20] The 2014 EIA 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).[21]

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 2015 (2015 LNG Export Study or 2015 Study).[22] 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 in volumes ranging from 12 to 20 Bcf/d of natural gas under a range of assumptions, including U.S. resource endowment, U.S. natural gas demand, international LNG market dynamics, and other factors. The analysis covers the 2015 to 2040 time period.

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[19] *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).
[20] 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.
[21] 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.
[22] 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.

Additional 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.[23] 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 this Order—in a volume of LNG equivalent to 2.0 Bcf/d (730 Bcf/yr) of natural gas—brings DOE/FE's cumulative total of approved non-FTA exports of LNG and compressed natural gas (CNG) to 15.22 Bcf/d of natural gas.[24] 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.

(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

[23] 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 …").

[24] As explained above, we are concurrently issuing DOE/FE Order No. 3868 to Lake Charles LNG Export. However, because the volume in that non-FTA export authorization is not additive to the volume being authorized in this Order, the cumulative total of approved non-FTA exports of LNG and CNG remains 15.22 Bcf/d of natural gas.

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).[25] 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.[26]

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 published NETL's report entitled, *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States* (LCA GHG Report).[27] 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

[25] 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.
[26] 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.
[27] 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.

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 FERC Proceeding. As noted above, in March 2014, Lake Charles LNG and Lake Charles LNG Export filed an application in FERC Docket No. CP14-120-000 (Liquefaction Docket), seeking authorization under section 3(a) of the NGA to site, construct, and operate the Liquefaction Project at the Lake Charles Terminal. Lake Charles LNG filed an application in FERC Docket No. CP14-122-000 (Conversion Docket), seeking authorization to convert its existing NGA section 7 certificated facilities at the Lake Charles Terminal to section 3 jurisdiction. Additionally, Trunkline Gas Company, LCC (Trunkline Gas) filed a related application in FERC Docket No. CP14-119-000 (Certificate Docket), seeking authorization to abandon, construct, operate, and modify certain interstate natural gas pipelines. The three dockets were joined for purposes of FERC's review.[28]

In accordance with NEPA, FERC issued a draft EIS for the Liquefaction Project and other facilities modifications on April 10, 2015, and a final EIS on August 14, 2015.[29] The final EIS recommended that FERC subject any approval of the proposed Liquefaction Project to 96 mitigation measures that "should … further reduce the environmental impacts that would otherwise result from construction and operation of the project."[30]

[28] *See Trunkline Gas Co., LLC, et al.*, Order Granting Section 3 and Section 7 Authorizations and Approving Abandonment, 153 FERC ¶ 61,300, at PP 1-4 (Dec. 17, 2015) [hereinafter FERC Order].
[29] *See id.* at PP 89, 91; Federal Energy Regulatory Comm'n, Final Environmental Impact Statement for the Lake Charles Liquefaction Project, Docket Nos. CP14-119-000, CP14-120-000, and CP14-122-000 (Aug. 2015) [hereinafter Final EIS].
[30] *See* Final EIS at ES-13.

On December 17, 2015, FERC issued an Order Granting Section 3 and Section 7 Authorizations and Approving Abandonment (FERC Order), which authorized Lake Charles LNG to site, construct, and operate the proposed Liquefaction Project subject to 95 of the 96 environmental conditions recommended in the final EIS. Those environmental conditions are set forth in Appendix B of FERC's Order. FERC explained that one of the environmental conditions recommended in the final EIS was not included as a condition of its Order because Trunkline Gas had filed the required information.[31] The FERC Order also granted the requested authorizations in the related Conversion and Certificate Docket proceedings, subject to the same environmental conditions. Details of the FERC Order are discussed below. *See infra* § XI.C.

Sierra Club timely requested rehearing of the FERC Order. FERC granted rehearing for purposes of further consideration in February 2016 and denied the rehearing request on June 30, 2016.[32]

DOE/FE's Record of Decision Under NEPA and NGA Section 3(a) Authorization.

After an independent review, and having been a cooperating agency in the EIS preparation, DOE/FE adopted FERC's final EIS for the Lake Charles Liquefaction Project (FERC/EIS-0258F, adopted as DOE/EIS-0491), and EPA published a notice of the adoption on July 15, 2016.[33] As the final EIS for the Lake Charles Liquefaction Project, this EIS serves as the basis of DOE's environmental review in both this proceeding and in the parallel Lake Charles LNG Export proceeding (FE Docket No. 13-04-LNG). Concurrently with this Order, DOE/FE is

[31] *See* FERC Order at P 92 n.85.
[32] *Trunkline Gas Co., LLC, et al.*, Order Denying Reh'g, 155 FERC ¶ 61,328 (June 30, 2016) [hereinafter FERC Order Denying Reh'g].
[33] U.S. Envtl. Prot. Agency, Environmental Impact Statements; Notice of Availability, 81 Fed. Reg. 46,077 (July 15, 2016) (providing notice that DOE/FE adopted FERC's final EIS for the Lake Charles Liquefaction Project).

issuing a ROD for the proposed Liquefaction Project and other related facility modifications.[34] As discussed below, this Order grants LCE's Application and is conditioned on LCE's compliance with the 95 environmental conditions adopted in the FERC Order.

II. SUMMARY OF FINDINGS AND CONCLUSIONS

This Order presents DOE/FE's findings and conclusions on all issues associated with LCE'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: LCE's Application, as amended; the comments, motion, and protest submitted in response to the Application; FERC's final EIS on the proposed Liquefaction Project; the FERC Order granting authorization for Lake Charles LNG and Lake Charles LNG Export to site, construct, and operate the Liquefaction Project; the FERC Rehearing Order; DOE/FE's 2014 and 2015 LNG Export Studies; the Addendum; the LCA GHG Report; and public comments received on DOE/FE's various analyses.

On the basis of this record, DOE/FE has determined that APGA—the only protestor in this proceeding—has not demonstrated that the proposed exports will be inconsistent with the public interest, as would be required to deny LCE's Application under NGA section 3(a). DOE/FE therefore authorizes LCE's export of domestically produced LNG from the proposed Lake Charles LNG Terminal to non-FTA countries in a total volume equivalent to 730 Bcf/yr of natural gas. This authorization is subject to the Terms and Conditions and Ordering Paragraphs

[34] In the ROD, DOE/FE is concurrently issuing a Floodplain Statement of Findings, as required by 10 C.F.R. Part 1022 (Floodplain and Wetland Environmental Review Requirements).

set forth herein, which incorporate by reference the 95 environmental conditions imposed by FERC. *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[35]] 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.[36]

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

[35] 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.

[36] *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)).

impacts, among others. To conduct this review, DOE/FE looks to record evidence developed in the application proceeding.[37]

DOE/FE's prior decisions have also looked to certain principles established in its 1984 Policy Guidelines.[38] The goals of the Policy Guidelines are to minimize federal control and 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.[39]

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.[40]

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

[37] *See*, *e.g.*, *Sabine Pass*, DOE/FE Order No. 2961, at 28-42 (reviewing record evidence in issuing conditional authorization).
[38] New Policy Guidelines and Delegations Order Relating to Regulation of Imported Natural Gas, 49 Fed. Reg. 6684 (Feb. 22, 1984) [hereinafter 1984 Policy Guidelines].
[39] *Id*. at 6685.
[40] *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)).

particular case to be appropriate."[41] In February 1989, the Assistant Secretary for Fossil Energy assumed the delegated responsibilities of the Administrator of ERA.[42]

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

IV. DESCRIPTION OF REQUEST

LCE has applied for, and been conditionally granted, long-term, multi-contract authorization to export domestically produced LNG by vessel from the Lake Charles Terminal to non-FTA countries in a volume equivalent to approximately 730 Bcf/yr of natural gas (2 Bcf/d). LCE requests a 25-year term of authorization, commencing on the earlier of the date of first export or 10 years from the date of the issuance of this Order. As set forth in the 2013 Amendment to its Application, LCE seeks to export this LNG on its own behalf and as agent for other entities that will hold title to the LNG at the point of export.[43]

A. Description of Applicant

LCE is a Delaware limited liability company with its principal place of business in Houston, Texas. In a Notice of Change in Control[44] recently given effect by DOE/FE,[45] LCE

[41] DOE Delegation Order No. 0204-111, at 1; *see also* 1984 Policy Guidelines, 49 Fed. Reg. at 6690.
[42] *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)).
[43] 2013 Amendment at 2-4.
[44] Lake Charles Exports, *et al.*, LLC, FE Docket Nos. 11-59-LNG, *et al.*, Notice of Change in Control (Feb. 17, 2016).

states that, on February 15, 2016, Royal Dutch Shell, plc (Shell) acquired all of the share capital of BG Group plc (BG). Prior to the transaction, LCE was owned by subsidiaries of BG and Energy Transfer Equity, L.P. (ETE), and LCE's affiliate, BG LNG Services, LLC (BGLS), was an indirect subsidiary of BG. As a result of the acquisition, LCE is now owned by subsidiaries of Shell and ETE. BGLS is now an indirect wholly-owned by subsidiary of Shell. According to LCE, LCE will remain the authorization holder and/or applicant in its existing DOE/FE proceedings.

DOE/FE takes administrative notice that Shell is a public limited company incorporated in the United Kingdom and headquartered in the Netherlands. ETE is a Delaware master limited partnership with its principal place of business in Dallas, Texas.

B. Description of Facility

LCE states that FERC certificated the Lake Charles Terminal in 1977, with the original construction completed in 1981.[46] In 2001, BGLS entered into a firm terminalling services agreement under which it subscribed all the capacity of the Lake Charles Terminal to receive, store, and vaporize LNG. LCE states that, in cooperation with BGLS, Lake Charles LNG (formerly Trunkline LNG) has expanded and enhanced the Terminal through the construction of additional storage capacity, additional gas-fired vaporization capacity, an additional marine berth, ambient air vaporization equipment, and natural gas liquids extraction capability.[47]

According to LCE, the Lake Charles Terminal currently has a firm sustained sendout capacity of 1.8 Bcf/d and a peak sendout capacity of 2.1 Bcf/d of natural gas. The Terminal has

[45] U.S. Dep't of Energy, Lake Charles Exports, LLC, *et al.* Notice of Change in Control, FE Docket Nos. 11-59-LNG, *et al.* (July 26, 2016).
[46] LCE App. at 3 (citing *Trunkline LNG Co., et al.*, 58 FPC 726 (Opinion No. 796), *order on reh'g* 58 FPC 2935 (1977) (Opinion No. 796-A)).
[47] *See id.*

four LNG storage tanks with a combined capacity of approximately 2.7 million barrels (425,000 cubic meters) of LNG, or approximately 9.0 Bcf of natural gas. The Terminal's natural gas liquids processing facilities also allow the extraction of ethane and other heavier hydrocarbons from the LNG stream.

C. Liquefaction Project

In 2014, Lake Charles LNG and Lake Charles LNG Export applied for authorization from FERC to site, construct, and operate new facilities at the Lake Charles Terminal for the liquefaction and export of natural gas. Among other features, this Liquefaction Project will consist of a new liquefaction facility including three liquefaction trains; modifications and upgrades at the existing LNG terminal; and approximately 0.5 mile of 48-inch diameter feed gas line in Calcasieu Parish, Louisiana, to supply natural gas to the liquefaction facility from existing gas transmission pipelines.[48]

LCE states that, following completion of the Liquefaction Project, the Lake Charles Terminal will be bi-directional, and its peak and sustained sendout capabilities will not be affected.

D. Procedural History

Pertinent aspects of LCE's procedural history with DOE/FE are summarized below.

2011 Amendment to Application. On May 26, 2011, LCE amended the Application in two respects. First, LCE clarified that it was requesting authorization to export LNG from the Terminal on its own behalf or as agent for its affiliate, BGLS. Second, LCE stated that its anticipated long-term export contract with BGLS will have a 25-year term that will run

[48] *See* Trunkline LNG Company, LLC *et al.,* Supplemental Notice of Intent to Prepare an Environmental Impact Statement for the Planned Lake Charles Liquefaction Project and Request for Comments on Environmental Issues, FERC Docket No. PF12-8-000, at 2 (Mar. 21, 2013).

concurrently with the requested export authorization, not a 20-year term as stated in the Application. The Conditional Order reflects these requested amendments to the Application.

FTA Order (DOE/FE Order No. 2987). On July 22, 2011, in DOE/FE Order No. 2987, DOE/FE granted the portion of LCE's Application requesting long-term, multi-contract authorization to export LNG to FTA countries in a volume equivalent to 730 Bcf/yr of natural gas—the same volume requested for non-FTA exports in this Order.[49] This authorization is for a 25-year term, beginning on the date of first export or 10 years from the date the authorization was issued (July 22, 2021), and permits LCE to export the LNG on its own behalf or as agent for BGLS.

In the 2013 Amendment (described below), LCE asked DOE/FE to amend this authorization to allow LCE to export LNG on its own behalf and as agent for other entities that will hold title to the LNG at the point of export—not only for BGLS. DOE/FE granted that request on July 26, 2016, and LCE is now authorized to export LNG on its own behalf and as agent for other entities to FTA countries under DOE/FE Order No. 2987.[50]

2013 Amendment to Application. On December 17, 2013, LCE filed an Amendment to both the Conditional Order and its FTA Order (DOE/FE Order No. 2987).[51] As relevant to this proceeding, LCE asked DOE/FE to amend the Conditional Order to: (i) allow LCE to act as agent for multiple entities that hold title to LNG at the point of export, after registering such entities with DOE/FE, and (ii) to permit entities exporting LNG pursuant to the Conditional Order (or a subsequent final order) to sell the LNG to purchasers other than LCE. In the

[49] *See Lake Charles Exports, LLC,* DOE/FE Order No. 2987, *supra* note 11.
[50] U.S. Dep't of Energy, Letter Order re: *Lake Charles Exports, LLC,* DOE/FE Order No. 2987, FE Docket No. 11-59-LNG (July 26, 2016).
[51] *See* 2013 Amendment, *supra* note 5, at 2-4.

Amendment, LCE states that BGLS was, and continues to be, the sole holder of capacity in the Lake Charles Terminal.[52] However, due to "significant commercial developments" in the time period since LCE filed the Application, BGLS "desires to assign a portion of the capacity … to one or more entities."[53] LCE states that these amendments to the Application would provide LCE with this additional flexibility. This Order reflects those requested changes.

E. Business Model

As set forth in the 2013 Amendment, LCE requests authorization to export LNG on its own behalf or as agent for any other entities that may hold title to LNG at the point of export after registering such entities with DOE/FE. LCE states that it will comply with all DOE/FE requirements for exporters and agents, including registration requirements. LCE further states that, when acting as agent, it will register with DOE/FE each LNG title holder for which it seeks to export LNG as agent, and will comply with other registration requirements, as set forth in recent DOE/FE orders.[54]

In the 2013 Amendment, LCE also requests permission for entities exporting LNG pursuant to this Order to sell the LNG to purchasers other than LCE. LCE would like BGLS (or any entity to which BGLS transfers its capacity) to have the flexibility to make alternative sales arrangements rather than being limited to selling the LNG to LCE alone.[55] This Order reflects those requested changes.

[52] *See id*.
[53] *Id*. at 4.
[54] *See id*. at 3-4.
[55] *See id*. at 4.

F. Source of Natural Gas

LCE states that it will export natural gas available in the United States natural gas pipeline system. LCE anticipates the source of natural gas supply for its proposed exports will include the Texas and Louisiana producing regions and the offshore producing regions in the Gulf of Mexico, but that the natural gas may be produced anywhere in the lower 48 states.

V. APPLICANT'S PUBLIC INTEREST ANALYSIS

In the Application, LCE states that its proposed export of domestically produced LNG is not inconsistent with the public interest, and meets the standard under NGA section 3(a), on the basis of six factors: (i) domestic natural gas supplies and resource base; (ii) domestic natural gas demand; (iii) impact of the Liquefaction Project on U.S. natural gas market prices; (iv) benefits to the local, regional, and national economy; (v) balance of trade; and (vi) global environmental benefits.[56] We issued the Conditional Order to LCE, in part, on the basis of that evidence.[57] In this Order, we incorporate by reference LCE's public interest analysis in the Application and DOE/FE's findings related to that evidence set forth in the Conditional Order, as supplemented herein.[58]

VI. CURRENT PROCEEDING BEFORE DOE/FE

A. Overview

In response to the Notice of Application published in the *Federal Register* on June 13, 2011, DOE/FE received 15 comments in support of the Application. Comments in support were submitted by Dan Morrish, Senator for the State of Louisiana with eight other Representatives

[56] LCE App. at 6-23.
[57] LCE Conditional Order at 16-27, 121-23.
[58] *See id.*

and Senators for the State of Louisiana;[59] Robert Adley, Senator for the State of Louisiana; Mary L. Landrieu, then the United States Senator from the State of Louisiana; Mike Michot, Senator for the State of Louisiana; Henry L. Burns, Representative for the State of Louisiana; Bill Cooper, President of the Center for Liquefied Natural Gas; Sherri Smith Cheek, Senator for the State of Louisiana; Richard Buford, Representative for the State of Louisiana; Jane H. Smith, Representative for the State of Louisiana; James L. Keffer, Representative for the State of Texas; Randy Roach, Mayor of the City of Lake Charles, Louisiana; John Fleming, United States Representative from the State of Louisiana; Stephen F. Smith, President of EXCO Resources, Inc.; Charles W. Boustany, Jr., United States Representative from the State of Louisiana; and the Lake Charles Harbor & Terminal District.

The Industrial Energy Consumers of America (IECA) submitted a comment in opposition and the American Public Gas Association (APGA) filed a timely motion to intervene and protest.

B. Comments in Support of the Application

The non-intervener comments submitted in support of LCE's Application largely focus on benefits that the commenters anticipate from a grant of the requested authorization. For example, Louisiana State Senator Dan Morrish, in a comment joined by eight other members of the Louisiana State Legislature, states that LCE's proposed Liquefaction Project is in the public interest because, among other reasons, it will boost Louisiana's local and regional economy through resource development, an enhanced tax base, direct and indirect job creation, and increased overall economic activity. Senator Morrish further states that the Liquefaction Project

[59] In addition to Senator Morrish, the comment was signed by Senator Willie Mount, Senator John Smith, Representative Mike Danahay, Representative A. B. Franklin, Representative Brett Geyman, Representative John E. Guinn, Representative Bob Hensgens, and Representative Chuck Kleckley.

will have a ripple effect throughout the regional economy by creating additional employment opportunities from increased markets for shale gas.

Many of the commenters—including U.S Representative John Fleming; Louisiana State Senators Dan Morrish, Robert Adley, and Sherri Smith Cheek; Louisiana State Representatives Mike Michot, Henry L. Burnes, Richard Burford, and Jane H. Smith; Mayor of Lake Charles Randy Roach; and the Lake Charles Harbor & Terminal District—note that LCE's parent companies (at the time of their filings) have been longstanding members of the business community in Louisiana and have regularly invested in the Lake Charles community and terminal. They further state that BG has created additional employment and economic investment in Louisiana by significantly investing in shale gas production and exploration within the state.

Then-U.S. Senator Mary Landrieu asserts that the Liquefaction Project will result in investment of $1.5 to $2.0 billion per train. She states that the Project will generate many millions of dollars in wages (including hundreds of millions of dollars associated with construction jobs alone), and that, once complete, the Lake Charles Terminal will provide 60 to 80 permanent jobs per train. She contends that the Project will reduce the U.S. balance of payments by approximately $4 billion annually. U.S. Representative Charles W. Boustany, Jr., likewise discusses these direct and indirect economic benefits.

Bill Cooper, President of the Center for Liquefied Natural Gas, states that the discovery and development of additional natural gas resources in the United States will allow for domestic LNG exports without adversely affecting the domestic need for natural gas. According to Mr. Cooper, the requested authorization will help maintain the United States'

competitive opportunities in energy production and trade, as well as provide for significant investments in Louisiana.

Louisiana State Senator Sherri Smith Cheek maintains that allowing LNG exports will assure price stability to natural gas markets for Louisiana and the United States by putting domestically produced natural gas into the international marketplace. According to Senator Cheek, allowing LNG exports is consistent with DOE's stated policy of promoting competition in the marketplace by allowing commercial parties to freely negotiate their own trade arrangements. Stephen F. Smith, the president of EXCO Resources, Inc. (a producer of natural gas in Louisiana and Texas), similarly comments that the Liquefaction Project will help to stabilize the natural gas market, in addition to providing other benefits.

Representative James L. Keffer of the Texas House of Representatives comments that LCE's requested authorization will provide benefits beyond the State of Louisiana. Mr. Keffer states that the Liquefaction Project will benefit Texas exploration and production companies by providing additional markets for the abundant natural gas produced in Texas. According to Mr. Keffer, both of LCE's parent companies are significant employers in Texas, with BG having its global LNG headquarters in Houston and SUG having a presence in Texas since 1929. In his view, the Liquefaction Project will generate engineering and management jobs that will benefit Texas, and will support long-term employment at both BG and SUG in Texas.

Finally, the City of Lake Charles, Louisiana, passed a resolution dated August 3, 2011, that is appended to the comment of Mayor Roach. The City expressed support for the Liquefaction Project, emphasizing the direct and indirect jobs that will be associated with the Project during development, construction, and operation.

C. Comment of IECA in Opposition to the Application

In its comment, IECA urges DOE/FE to deny LCE's Application.[60] IECA states that it is a nonpartisan association of leading manufacturing companies with more than 750,000 employees nationwide.

IECA first contends that exporting natural gas will drive up both domestic demand for natural gas and domestic prices for the manufacturing sector and the public. Specifically, IECA asserts that a 10 cent increase in the price of natural gas will increase consumer costs by almost $2.5 billion per year. Citing the example of manufacturers who rely on natural gas for feedstock and fuel, IECA asserts that, when natural gas prices rise, so too will the cost of plastic and fertilizer for every American consumer and farmer.

IECA argues that, even without the impact of increased demand from LNG exports, the domestic prices of natural gas will increase by almost $18 billion per year. IECA points to natural gas futures prices on the Chicago Mercantile Exchange where, in August 2011, the September 2011 Henry Hub contracts traded at $4.00 per MMBtu, whereas the December 2015 price traded at $5.765 per MMBtu—an increase of 44 percent. IECA states that U.S. demand for natural gas increased by 3.4 percent between 2000 and 2010, and that the expected export capacity at the Lake Charles Terminal would comprise roughly 3 percent of current U.S. demand (approximately 0.73 trillion cubic feet per year (Tcf/yr)). IECA thus argues that "the LCE terminal is a new significant demand by itself" that will "drive up relative [natural gas] prices."[61]

IECA next criticizes LCE's reliance on EIA's natural gas supply, demand, and price forecasts. IECA contends that:

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[60] Industrial Energy Consumers of America, Comment in Opposition to Approving LNG Export Application, FE Docket No. 11-59-LNG, at 1 (Aug. 12, 2011) [hereinafter IECA Comment].
[61] *Id*.

- EIA's forecasts underestimate demand for natural gas and price;
- EIA forecasts do not account for potential regulations imposed by states or the federal government that may limit or halt the practice of hydraulic fracturing or drilling in particular regions, or increase production costs—meaning that, not only are EIA supply forecasts likely too generous, but EIA price forecasts are likely too low; and
- LCE relies on EIA forecasts as evidence that future potential recoverable reserves of shale gas are adequate for both domestic and export supply, but industry data shows that natural gas rig count is in a downward trend—placing LCE's adequacy of supply in question.

Finally, IECA charges that EIA's recent 10-year history of forecasting natural gas prices is poor, with EIA failing to forecast any of the significant price increases.

IECA characterizes LCE's claim that exporting natural gas will not impact relative prices as "not realistic."[62] In IECA's view, approving natural gas exports sets the stage for U.S. natural gas prices to be set globally at higher levels. IECA states that LCE's Application fails to address this issue of domestic versus international natural gas pricing.

IECA argues that LCE's data illustrates that higher natural gas prices (*e.g.*, increasing marginal costs of production) are necessary to justify new production of natural gas. For this reason, IECA contends that exporting natural gas is inconsistent with the public interest and, specifically, with U.S. energy security and independence. IECA maintains that the United States should be exporting the drilling technology to extract natural gas, not the natural gas itself.

IECA further asserts that the U.S. manufacturing sector is heavily dependent on the price of energy, especially natural gas. According to IECA, the higher relative natural gas prices would reduce the competitiveness of the manufacturing sector, thereby reducing U.S. exports and affecting the U.S. balance of trade.

[62] *Id*. at 3.

D. APGA's Motion for Leave to Intervene and Protest

On August 10, 2011, APGA filed a motion to intervene and protest opposing LCE's Application.[63] APGA states that it is a national, non-profit association of publicly-owned natural gas distribution systems across 36 states. According to APGA, its members include municipal gas distribution systems, public utility districts, and other public agencies that purchase natural gas. APGA argues that LCE's Application is inconsistent with the public interest and should be denied.

APGA first argues that the quantity of domestic natural gas at issue in this and related LNG export proceedings is substantial and will "allow exporters to potentially undermine America's best opportunity to foster energy independence."[64] APGA further contends that, if DOE/FE approves LCE's Application, the United States will be jeopardizing national security and increasing consumer prices on the basis of "problematic gas supply data."[65]

On the issue of energy independence, APGA asserts that the current availability of domestically produced natural gas has created "a previously unimaginable opportunity" for the United States to achieve energy independence.[66] APGA states that, instead of exporting domestic natural gas, the United States should use the natural gas domestically to displace imported petroleum and coal—for example, by replacing gasoline-powered vehicles with natural gas-powered vehicles. APGA submits that this change in transportation fuel would significantly reduce U.S. dependence on foreign oil, enhance U.S. security and strategic interests, and reduce the U.S. trade deficit.

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[63] American Public Gas Ass'n, Motion for Leave to Intervene and Protest Application, FE Docket No. 11-59-LNG (Aug. 10, 2011) [hereinafter APGA Mot.].
[64] *Id*. at 5.
[65] *Id*.
[66] *Id*.

APGA further states that exporting natural gas could tie domestic natural gas prices to international markets that often have higher, less stable prices. APGA asserts that the current domestic natural gas market is competitive, liquid, and transparent because it benefits from the security and political stability in North America. By contrast, foreign gas markets are tied to the global oil market and are more susceptible to unstable regimes, cartels, and distant events. APGA argues that U.S. policymakers should preserve rather than undermine the stability of domestic commodity markets, while at the same time adopting policies that expand domestic demand.

APGA next asserts that exporting LNG would inflate demand and prices by forcing U.S. consumers to compete with end-users in other nations that must pay more for natural gas. According to APGA, a price increase in the domestic market would make natural gas less competitive in this country as a replacement fuel for less clean, higher carbon-content fuels. APGA also takes issue with LCE's claim that DOE/FE should approve LCE's Application regardless of the impact of the proposed export on domestic prices. APGA argues that DOE/FE's public interest analysis should focus on the domestic need for natural gas and threats to domestic supply.

APGA cautions that there are a number of uncertainties associated with future natural gas production. In particular, APGA argues that EIA's reports referenced by LCE contain warning signs concerning the ultimate size of the technically and economically recoverable shale gas resource base in the United States. APGA also discusses alleged environmental and safety concerns at both the state and national level concerning the technology associated with hydraulic fracturing.

APGA next contends that predictions concerning natural gas supply have not always proved out. According to APGA, LCE's corporate parents made miscalculations in the past concerning natural gas supplies in the context of LNG imports. APGA cautions that if the United States ultimately has less recoverable natural gas than projected, a grant of LCE's Application predicated on a domestic over-supply could exacerbate that domestic supply situation.

Finally, APGA urges DOE/FE to pursue a policy that focuses on fostering energy independence by increasing the current and long-term availability of natural gas.[67] APGA claims that an increased use of natural gas domestically, in lieu of oil imports, will benefit the U.S. economy by reducing the trade deficit.

E. LCE's Answer to APGA and IECA

On August 25, 2011, LCE filed an Answer to APGA's protest and IECA's comment in opposition to the Application.[68] LCE asserts that DOE/FE should reject APGA's and IECA's arguments for several reasons.

LCE contends that APGA and IECA fail to meet the standard set forth in NGA section 3(a), and, in particular, fail to overcome the statutory presumption favoring applications to export natural gas. LCE also states that the 1984 Policy Guidelines reject the level of federal control and involvement in energy markets that APGA and IECA advocate.[69]

LCE argues that it cited U.S. government data, government studies, and publicly available third-party studies, and put forth a substantial analysis of the public interest factors

[67] *Id*. at 12.
[68] Answer of Lake Charles Exports, LLC to the Protest of the American Public Gas Association and the Comment of the Industrial Energy Consumers of America, FE Docket No. 11-59-LNG (Aug. 25, 2011) [hereinafter LCE Answer].
[69] *Id*. at 3-4 (quoting *Sabine Pass*, DOE/FE Order No. 2961, at 28).

weighing in favor of DOE/FE's approval of LCE's proposed exports. By contrast, LCE states that APGA and IECA merely "'have alleged a variety of negative consequences to the public interest[] from a grant of the requested authorization[].'"[70] According to LCE, APGA and IECA fail to support their arguments by factual studies or analyses, and do not show why DOE/FE should deny the Application.

LCE maintains that DOE/FE previously rejected a majority of APGA's and IECA's arguments in *Sabine Pass*, DOE/FE Order No. 2961.[71] LCE asserts that APGA's and IECA's arguments again do not "'demonstrate[] that any potential negative impacts associated with a grant of the requested authorization are likely to outweigh the overall benefits.'"[72] For example, as to anticipated benefits to local, regional, and national economies, LCE counters that IECA's charts offered in rebuttal, showing increases in natural gas prices from 1999 through 2007 in relation to other macroeconomic statistics, "prove nothing" with respect to harm to manufacturing associated with exporting LNG. LCE states that "the only evidence in the record" shows that LCE's proposed exports will not have a material effect on natural gas prices.[73]

In rebutting arguments concerning LCE's reliance on EIA data, LCE charges that IECA failed to quantify impacts that regulation and proposed legislation might have on natural gas supply or to provide evidence to contradict LCE's analyses. LCE points to the "relatively flat long-run cost curve for natural gas production" in arguing that, even if IECA's arguments would shift total demand on the cost curve constructed by LCE, such a shift "likely would have little

[70] *Id*. at 4 (quoting Order No. 2961 at 30).
[71] *See id*. at 5.
[72] *Id*. at 6 (quoting Order No. 2961 at 30).
[73] *Id*. at 7.

effect on natural gas prices," and would not undermine the curve itself.[74]

LCE contends that APGA ignores DOE/FE's findings in Order No. 2961, such as DOE/FE's finding that "sufficient evidence exists regarding the supply of natural gas [in the United States."[75] LCE stresses that the burden is on APGA and IECA to show the proposed exports are not in the public interest, which LCE argues they have failed to do. LCE also endorses DOE/FE's position in Order No. 2961 that, despite any uncertainty concerning the domestic supply of natural gas, "gas supply data coupled with monitoring of future supply and demand is sufficient to ensure [that exporting LNG] is not inconsistent with the public interest."[76]

Finally, LCE disputes APGA's and IECA's contention that, instead of granting LCE's Application, DOE/FE should adopt a policy favoring domestic consumption of natural gas and/or the exportation of shale gas drilling technology. LCE states that such a position would amount to a new federal policy at odds with NGA section 3(a) and the 1984 Policy Guidelines. In LCE's view, "[i]t is not the role of DOE/FE … to restructure how energy resources are consumed in the United States or to advocate for specific technology exports."[77]

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

[74] LCE Answer at 8.
[75] *Id*. at 12.
[76] *Id*.
[77] *Id*. at 13.

countries.[78] 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 warranted to better inform its public interest review under section 3 of the NGA.[79] Accordingly, DOE/FE engaged EIA and NERA Economic Consulting to conduct a two-part study of the economic impacts of LNG exports.[80]

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. 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.[81] 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

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[78] *Sabine Pass*, DOE/FE Order No. 2961, *supra* note 36.
[79] *See id*. at 33 (stating that DOE/FE "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.").
[80] *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).
[81] *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 under a range of global natural gas supply and demand scenarios, including scenarios with unlimited LNG exports. DOE published the NERA Study, *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).[82] 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.[83] DOE/FE received over 188,000 initial comments and over 2,700 reply comments, of which approximately 800 were unique.[84] 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.[85] DOE/FE responded to those public comments in connection with the LNG export proceedings identified in the NOA.[86]

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[82] 77 Fed. Reg. at 73,627.
[83] *Id*. at 73,628.
[84] 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).
[85] *See* 77 Fed. Reg. at 73,629 & n.4.
[86] *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).

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 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,[87] as it had been vacated at the time, or other proposed EPA rulemakings.[88] 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 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.

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[87] 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).
[88] 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.

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 between 0.03 and 0.07 percent of GDP over the period of 2026–2040, or $7 to $20 billion annually in today's prices.

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.[89] 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 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

[89] 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.

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;
- 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 reach 12 to 20 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.

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 marginally positive international benchmarks, (iii) 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.[90]

[90] 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.

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 between 0.03 and 0.07 percent of GDP from 2026-2040, or $7 to $20 billion annually in today's prices. 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.

- ***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 gas prices dampen domestic consumption and erode U.S. export competitiveness. In total, higher prices reduce GDP by 0.1 percent from 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.

- ***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.

- ***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.

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.[91]

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."[92]

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.[93]

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.[94] 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:

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[91] 80 Fed. Reg. at 81,302.
[92] *Id.*
[93] *See, e.g., Public Citizen v. F.A.A.*, 988 F.2d 186, 197 (D.C. Cir. 1993).
[94] Unless specifically noted, the comments address the 2015 LNG Export Study.

- 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 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."[95] 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."[96]

We also take note of EIA's projections in AEO 2016 for natural gas supply, demand, and prices. The AEO 2016 Reference case incorporates the Clean Power Plan (CPP) final rule[97] 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 natural gas consumption for the year 2040 (the end of the forecast period in these Outlooks) was projected to increase by 7.6 Bcf/d between AEO 2014 and AEO 2016 (from 86.7 Bcf/d to 94.3 Bcf/d), total 2040 lower-48 domestic dry gas production was projected to increase by nearly twice that amount, increasing by 14.9 Bcf/d (from 99.7 Bcf/d to 114.6 Bcf/d). In addition, the projected 2040 Henry Hub price declined from $8.03 per million British thermal units (MMBtu) to $4.86/MMBtu (both prices in constant 2015 dollars), despite projected Reference case 2040 net exports (including both

[95] 2015 Study at 8.
[96] 2014 Study at 25.
[97] 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).

pipeline and LNG exports) rising from 15.9 Bcf/d in AEO 2014 to 20.7 Bcf/d in AEO 2016. As described here, the AEO 2016 Reference case, even more so than the AEO 2014, projects robust domestic supply conditions that are more than adequate to meet domestic needs and supply exports.

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 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.[98] 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 from 12 Bcf/d to 20 Bcf/d 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 today's prices) over 2026-2040 than in the 12 Bcf/d export case.[99] 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

[98] 2015 Study at 14.
[99] *See id.*

scenario for the applicable baseline."[100] This equals an annual net increase to GDP of $12 billion to $20 billion across the scenarios from the 2014 LNG Export Study.[101] 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

[100] 2014 Study at 12.
[101] *See id*. at 32 ("Gross Domestic Product" in 2005 U.S. dollars).

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. 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.[102] 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).[103] 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.)."[104] As a result, "the manufacturing sector in aggregate is little impacted."[105] The 2014 Study found that

[102] 2015 Study at 22.
[103] *Id*. at 68.
[104] *Id*. at 67.
[105] *Id*.

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."[106]

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 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

[106] 2014 Study at 26.

profitability of U.S. gas producers typically exceeds the negative impacts of higher domestic natural gas prices associated with increased LNG exports."[107]

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. 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

[107] 2015 Study at 16.

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 note, however, that the Application in this proceeding is unopposed.

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 2016 Reference case projection of dry natural gas production in 2035 increased significantly (by 37.3 Bcf/d) as compared with AEO 2011, while projections of domestic natural gas consumption in 2035 also increased in AEO 2016 compared with AEO 2011 (by 16.6 Bcf/d). Even with higher production and consumption, the 2035 projected natural gas market price in the Reference case declined from $7.72/MMBtu (2015$) in AEO 2011 to $4.91/MMBtu (2015$) in AEO 2016. The implication of the latest EIA projections in AEO 2016 is that a greater quantity of natural gas is projected to be available at a lower cost than estimated five 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 2014, the latest year statistics are available. Of particular note is that, since 2000, proved reserves have increased 108 percent to 368,704 Bcf, while production has increased only 38 percent, demonstrating the growing supply of natural gas available under existing economic and operating conditions.

Table 5: U.S. Dry Natural Gas Proved Reserves[108]

	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

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.[109]

DOE/FE notes that EIA's estimates of lower-48 natural gas TRR have increased from 1,816 Tcf in AEO 2010 to 1,996 Tcf in AEO 2015.[110] 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.

[108] EIA, *U.S. Dry Natural Gas Proved Reserves* (May 18, 2016), *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).

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

[110] *See* U.S. Energy Information Administration, *Assumptions to the Annual Energy Outlook 2015* (Sept. 2015), Table 9.2. Technically recoverable U.S. dry natural gas resources as of January 1, 2013, at 130, *available at*: http://www.eia.gov/forecasts/aeo/assumptions/pdf/0554(2015).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. The latest reserve assumptions for the 2016 AEO have not been published as of the issuance of this Order.

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 83 years of natural gas supply at the 2015 domestic consumption level of 27.47 Tcf. 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 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."[111] 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 market.[112] 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."[113]

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.

[111] 2015 Study at 83.
[112] *Id.* at 64.
[113] 2014 Study at 12.

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;

- 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 note 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.[114] 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 $15 across the scenarios; the spread for NBP-Henry Hub in 2040 is roughly $3 to nearly $8.[115] 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

[114] 2015 Study at 58.
[115] *Id*. at 52.

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 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.[116] DOE provided a summary of the comments received and responses to substantive comments in Appendix B of the Addendum.[117] 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.[118]

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 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.

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[116] Addendum at 3.
[117] *Id*. at 79-151.
[118] *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).

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.[119] 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.

Table 6: Water Intensity[120]

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

[119] Addendum at 10.
[120] *Id*. at 11 (Table 2).

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."[121] The following table shows the variation in the proportion of water usage by activity in shale gas regions:

Table 7: Water Usage in Shale Gas Regions[122]

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

[121] *Id.* at 12.
[122] *Id.* at 12 (Table 3) (citations omitted).

developed. However, the Addendum states that "when standard industry practices and preventative measures are deployed, only minor impacts are likely to result."[123]

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.[124] The Addendum acknowledges, however, that while 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.[125]

The fluid used for hydraulic fracturing consists of over 98 percent water, but also may include several different chemical compounds.[126] 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.[127]

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[123] *Id.* at 13.
[124] 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).
[125] *Id.* at 14.
[126] *Id.* at 14-15.
[127] *Id.* at 18.

Further, chemical additives may contaminate groundwater should the integrity of the casing or cement seal of the well be compromised.[128]

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.

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."[129] 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."[130]

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:

[128] *Id.*
[129] Addendum at 19.
[130] *Id.*

Table 8: Source Categories of Airborne Emissions from Upstream Natural Gas Activities (EPA, 2013)[131]

Category	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.

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[132] and EPA's 2013 update to those standards covering storage tanks.[133] 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 HAPs. According to the Addendum, the intermittent nature of air

[131] *Id*. at 23 (Table 6).
[132] *Id*. at 20-22.
[133] *Id*. at 22.

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.[134]

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 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.[135] 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.[136]

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

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[134] *See id*. at 32.
[135] 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).
[136] *Id*. at 44.

"emissions of GHGs from the upstream industry are of similar magnitude for both conventional and unconventional sources."[137]

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 relatively low."[138] 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 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."[139] 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

[137] *Id.* at 40.
[138] *Id.* at 51.
[139] *Id*. at 52.

principally one of alarm to the public and minor property damage, as opposed to significant disruption.[140]

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."[141] 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."[142] 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 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

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

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*.[143] On June 4, 2014, DOE/FE provided notice of the documents in the *Federal Register* and invited public comment.[144] 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 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?

[143] *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://energy.gov/fe/LCA-GHG-Report (link to "NETL Natural Gas LCA Model and Analysis") [hereinafter NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*].

[144] 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*.

- 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.[145]

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:

[145] 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[146]

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.[147] • 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

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

		coal. Additionally, U.S. mining data and U.S. plant operations 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.[148] 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

[148] *See* LCA GHG Report at 3 (*citing* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Gener*ation).

extraction and transport of sub-bituminous and bituminous coal in the United States as a proxy 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,[149] (3) coal type (sub-bituminous or bituminous),[150] (4) the flaring rate for natural gas,[151] (5) transport distance (ocean tanker for LNG transport, and rail for coal transport),[152] and (6) the efficiency of the destination power plant.

[149] 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.

[150] The modeling parameters and values for the coal scenarios are provided in Table 5-3. *See* LCA GHG Report at 6.

[151] 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.

[152] The distances used for pipeline transport of Russian gas are provided in Table 5-2. *See id*. at 6.

For example, as shown in Table 5-1 of the LCA GHG Report, NETL used two different 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.[153] 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).[154]

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.[155] 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).[156]

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[153] *See* LCA GHG Report at 5.
[154] The methane leakage breakeven analysis is described in the LCA GHG Report at 14 and 15.
[155] *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.
[156] The study limitations are described in the LCA GHG Report at 18.

7. Results of the LCA GHG Report

NETL states that two primary conclusions may be drawn from the LCA GHG Report.[157] First, use of U.S. LNG exports to produce electricity in European and Asian markets will *not* 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.[158] (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.

[157] NETL's detailed study results, with corresponding figures, are set forth on pages 8 through 18 of the LCA GHG Report.

[158] 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.

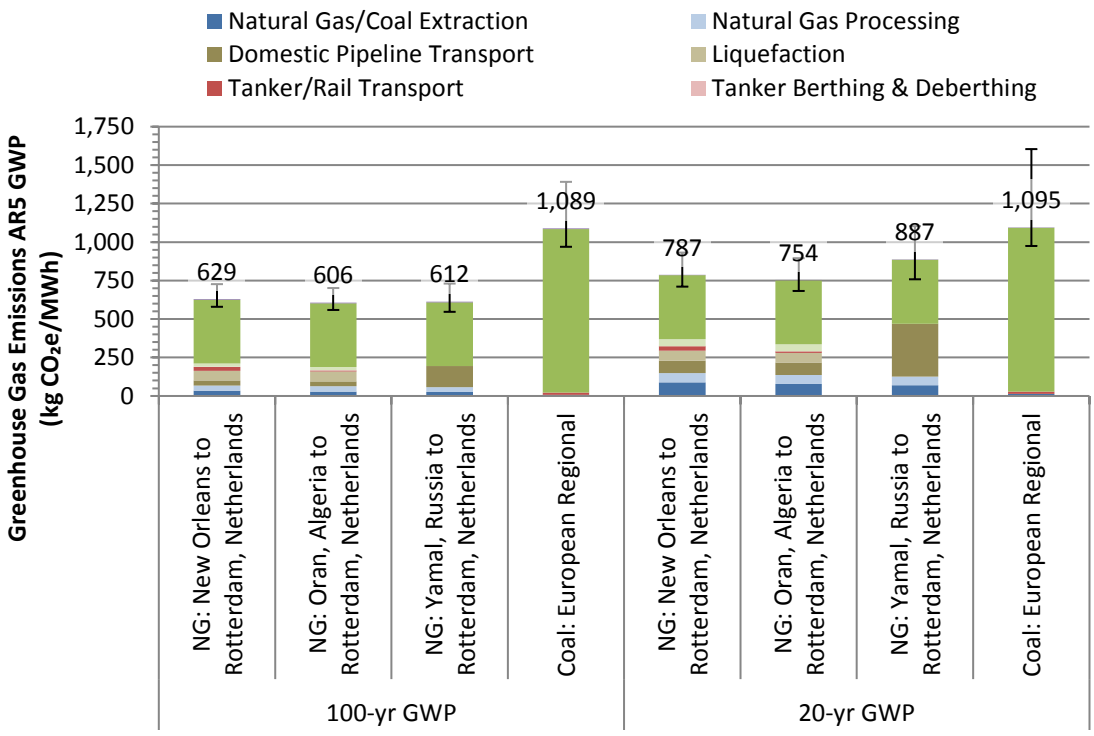

Figure 1: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe[159]

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

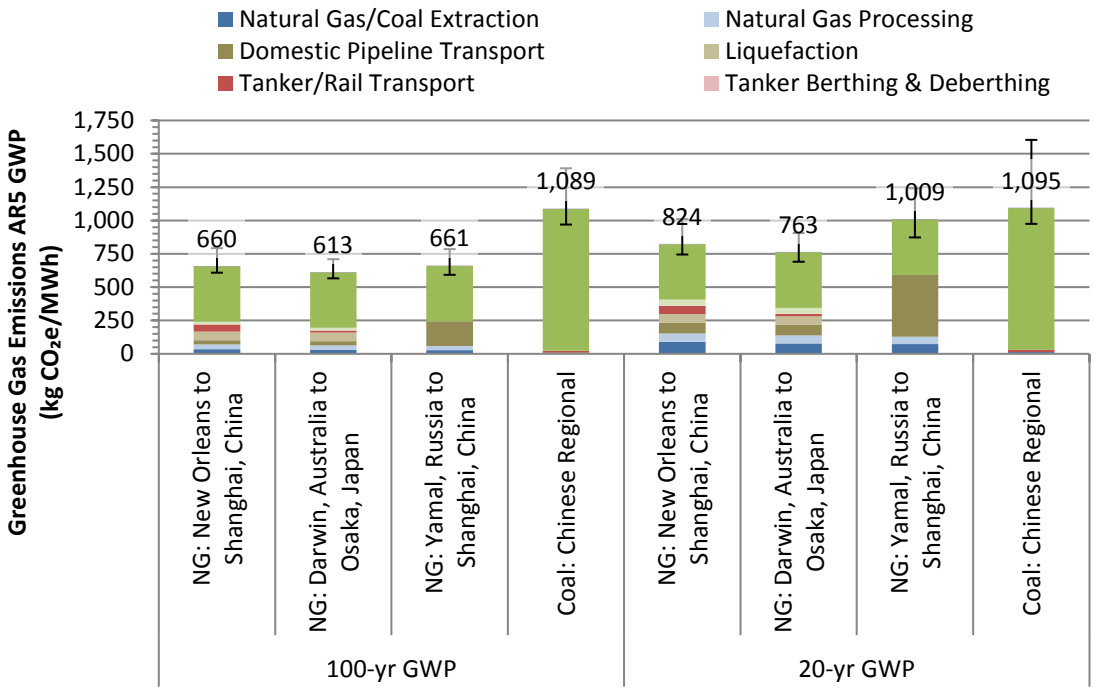

Figure 2: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia[160]

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.

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

[160] *See id*. at 10 (Figure 6-2).

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.[161]

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 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 below, [(415 – 1,063)/1,063 x 100]). The life cycle of baseload

[161] 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.

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 of carbon dioxide (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,[162] Food & Water Watch,[163] 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.

[162] 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.
[163] Food & Water Watch submitted comments in the form of a letter signed by 85 individuals representing various national, state, and local public interest groups.

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 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 the American Petroleum Institute (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.[164] API proposes the use of newer data for both 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

[164] 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.

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.[165]

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 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 LNG, and Freeport facilities) would lead to a 6% reduction in the feed rate of natural gas to the liquefaction plant.[166] 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.

[165] 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.
[166] *See id*.

(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,[167] after NETL's model had been finalized and during the time that NETL was completing the LCA GHG Report. These 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.[168] They also match the factors used by EPA's 2013 GHG inventory.[169]

NETL's current model accounts for liquids unloading emissions from conventional wells, but does not account for liquids unloading from unconventional wells. Applying liquids

[167] 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.
[168] *Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production: Summary and Analysis of API and ANGA Survey Responses*. Final Report (Sept. 21, 2012).
[169] U.S. Envtl. Prot. Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011 (Apr. 12, 2013).

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.[170] 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, 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

[170] *See* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*.

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 recently revised 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,[171] 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.[172] The LCA GHG Report does not account for the potential effects of the

[171] 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.

[172] 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.

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 refer to the same document.[173] 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.

[173] U.S. Envtl. Prot. Agency, Greenhouse Gas Emissions Reporting from the Petroleum and Natural Gas Industry: Background Technical Support Document (2011), *available at:* http://www.epa.gov/ghgreporting/documents/pdf/2010/Subpart-W_TSD.pdf.

This limitation is noted in the LCA GHG Report and is accounted for by uncertainty.[174] 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). 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.

[174] *See, e.g.,* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation.*

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%.[175] 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 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

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

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.[176] 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

[176] 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.

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.[177] 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[178] 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 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.

[177] 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.
[178] 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).

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

[179] 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.

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. FERC PROCEEDING AND GRANT OF AUTHORIZATION

A. FERC's Pre-Filing Procedures

Authorizations issued by FERC permitting the siting, construction, and operation of LNG export terminals are reviewed under NGA section 3(a) and (e), 15 U.S.C. § 717b(a), (e). FERC's approval process for such an application consists of a mandatory pre-filing process during which the environmental review required by NEPA commences,[180] and a formal application process that starts no sooner than 180 days after issuance of a notice that the pre-filing process has commenced.[181]

On April 6, 2012, FERC staff granted Lake Charles LNG's and Lake Charles LNG Export's request to use the pre-filing process in Docket No. PF12-8-000.[182] On September 14, 2012, FERC issued a Notice of Intent to Prepare an Environmental Impact Statement, Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting (NOI).[183]

Consistent with its practice, FERC published the NOI in the *Federal Register* and mailed it to federal, state, and local government representatives and agencies, elected officials, environmental and public interest groups, Native American Tribes, property owners in the vicinity of the proposed facilities, other interested parties, and local libraries and newspapers. In the NOI, FERC identified several issues that, in its view, deserve attention based on a preliminary review of the planned facilities and the environmental information provided by the

[180] 18 C.F.R. § 157.21.
[181] *Id*. § 157.21(a)(2)(i-ii).
[182] FERC Order at P 85.
[183] *See id*.; *see also* 77 Fed. Reg. 58,373 (Sept. 20, 2012).

applicants. These issues included "potential impacts and potential benefits of construction workforce on local housing, infrastructure, public services, and economy; potential impacts on recreational fishing and aquatic resources in the Calcasieu Ship Channel; potential impacts on wetlands on the 240-acre site; potential visual effects on surrounding areas; and public safety and hazards associated with the transport of natural gas and LNG."[184]

On March 21, 2013, FERC issued a supplemental NOI to describe additional non-liquefaction facilities that were added after the initial NOI was issued.[185]

B. FERC's Environmental Review

On March 25, 2014, Lake Charles LNG and Lake Charles LNG Export began the second part of FERC's approval process by filing the formal application to site, construct, and operate the Liquefaction Project.[186] DOE, among other federal agencies, participated as a cooperating agency in FERC's environmental review of the Liquefaction, Conversion, and Certificate Docket proceedings.[187]

FERC issued the draft EIS on April 10, 2015, and published the notice of availability for the draft EIS on April 16, 2015.[188] Based on the FERC staff's analysis, public scoping, and agency consultation, the major issues associated with the Project that were addressed in the draft EIS include impacts on water quality, wetlands, vegetation, wildlife and aquatic resources,

[184] 77 Fed. Reg. at 58,374.
[185] FERC Order at P 85 (citing Supp. NOI).
[186] *See id*. at P 1.
[187] *See id*. at P 88; *see also* LCE Conditional Order at 16; 40 C.F.R. § 1501.6 ("In addition, any other Federal agency which has special expertise with respect to any environmental issue, which should be addressed in the statement may be a cooperating agency upon request of the lead agency."); *id*. § 1501.6(b) (responsibilities of a cooperating agency).
[188] Final EIS at ES-2; *see also* Federal Energy Regulatory Comm'n, Notice of Availability of the Draft Environmental Impact Statement for the Proposed Lake Charles Liquefaction Project, 80 Fed. Reg. 20,489 (Apr. 16, 2015).

threatened and endangered species, housing and traffic, air quality and noise, GHG emissions, safety, and both cumulative and indirect impacts.[189]

In accordance with CEQ's NEPA regulations, FERC provided a 45-day public comment period on the draft EIS. During this time, FERC held a public meeting and accepted written comments on the EIS from Sierra Club, several federal agencies, and interested individuals.[190]

On August 14, 2015, FERC staff issued the final EIS for the proposed Liquefaction Project. The final EIS responds to comments received on the draft EIS. Among other issues, the final EIS addresses geology, soils, water resources, wetlands, wildlife and aquatic resources, air quality and noise, cumulative impacts, and alternatives.[191]

Based on its environmental analysis, FERC staff concluded that, "if the project is constructed and operated in accordance with applicable laws and regulations, the project will result in adverse environmental impacts." [192] However, "the impacts described in the final EIS will be adequately minimized with the implementation of the … proposed mitigation and [the FERC] staff's recommendations …."[193] FERC staff identified 96 environmental mitigation measures, which it recommended that FERC attach as conditions to any authorization of the Liquefaction Project and related proceeding.[194]

[189] FERC Order at P 92.
[190] *See id*. at P 89 & n.82.
[191] *See id*. at P 91.
[192] *Id*. at P 92.
[193] *Id*.
[194] Final EIS at ES-13.

C. FERC's Order Granting Authorization

1. Overview

On December 17, 2015, FERC issued an Order Granting Section 3 and Section 7 Authorizations and Approving Abandonment to Lake Charles LNG and Lake Charles LNG Export under NGA section 3 and to Trunkline Gas under NGA section 7(b) and (c), respectively.[195] Specifically, FERC authorized Lake Charles LNG and Lake Charles LNG to construct and operate the Liquefaction Project and convert its facilities and operations to NGA section 3 jurisdiction; and authorized Trunkline Gas to abandon, construct, operate, and modify the related interstate pipeline facilities—each subject to conditions enumerated in the FERC Order.[196]

2. Greenhouse Gas Emissions

Addressing claims raised by Sierra Club and others, FERC rejected the argument that the EIS failed to adequately analyze direct, cumulative, and indirect impacts on climate change from GHG emissions, stating:

> We do not believe the potential increase of GHG emissions associated with the production, transport, and combustion are causally related to our action in approving this project, nor are the potential environmental effects reasonably foreseeable as contemplated by [CEQ's] regulations.[197]

FERC reiterated its view that "there is no standard methodology to determine whether, and to what extent, a project's incremental contribution to GHG emissions would result in physical effects on the environment, either locally or globally."[198] In addition, FERC reasoned that countries seeking to import natural gas will continue to negotiate and find natural gas supplies,

[195] *See* FERC Order, *supra* note 28.
[196] *See id*. at P 4.
[197] *Id*. at P 116.
[198] *Id*.

and therefore, end use consumption of natural gas "will likely occur regardless of whether the project before us is approved."[199]

Next, FERC addressed claims that it should consider DOE's Addendum and LCA GHG Report, discussed herein, as part of its decision-making under NGA section 3. In FERC's view, the Addendum and LCA GHG Report "provide certain general estimates about the environmental impacts associated with natural gas production and end use," but "[t]hose impacts are not specific to the proposal before us."[200] Quoting DOE's statements in the Addendum, FERC maintained that "in the absence of information regarding where and when additional [natural] gas production will arise, the environmental impacts of such production 'are not reasonably foreseeable within the meaning of the CEQ's NEPA regulations,' and 'cannot [be] meaningfully analyze[d].'"[201] FERC further observed that, "to the extent that natural gas production replaces the use of other carbon-based energy sources, DOE found [in the Addendum] that there may be a net positive impact in terms of climate change."[202] Turning to DOE's LCA GHG Report, FERC pointed to DOE's conclusion that "U.S. LNG exports for

[199] *Id*. FERC also disagreed with EPA's recommendation that the draft EIS should have included calculations of GHG emissions from end use of the natural gas exported by the proposed Liquefaction Project, as did the draft EIS for the proposed Jordan Cove Energy and Pacific Connector Gas Pipeline Project in Oregon. According to FERC, the State of Louisiana (unlike the State of Oregon in the Jordan Cove proceeding) did not undertake and file a life-cycle GHG analysis in the Lake Charles LNG proceeding, nor is there record evidence in the proceeding regarding the expected destination of the LNG as there was in the Jordan Cove proceeding. FERC further stated that "any life-cycle analysis of the emissions from LNG vessel transits to possible markets or the emissions from the end use combustion of natural gas are too speculative to permit any meaningful consideration." *Id*. at P 117. For these reasons, FERC disagreed with EPA's suggestion "as it would require [FERC] to engage in speculative analyses and provide information that will not meaningfully inform the decision-making process." *Id*.
[200] *Id*. at P 118.
[201] FERC Order at P 118 (quoting Addendum at 2) (internal quotations omitted).
[202] *Id*. at P 119 (citing Addendum at 44).

power production in European and Asian markets will not increase life-cycle GHG emissions, when compared to regional coal extraction and consumption for power production."[203]

3. Cumulative Impacts

FERC determined that the cumulative impacts of the proposed Project identified in the final EIS will be minor or insignificant. In the final EIS, FERC staff found that the greatest potential for cumulative impacts is on socioeconomic conditions and land transportation—specifically, "[c]oncurrent construction of the proposed project and other projects in the area would result in increased workers in the area, which could exceed available housing and result in impacts on public services."[204] FERC therefore stated that some workers may be required to obtain housing in more distant parishes with longer commutes, causing (among other issues) increased traffic in the vicinity of the Project. FERC noted, however, that the large workforce associated with simultaneously constructed projects would have a beneficial cumulative effect on revenues and property taxes for the State of Louisiana and/or affected parishes. Therefore, on the basis of the environmental mitigation measures adopted as conditions of FERC's authorizations, FERC "concur[red] with the final EIS' conclusion that impacts of the project, when added with other projects' impacts, will not result in any significant cumulative impacts."[205]

4. Indirect Effects of Increased Natural Gas Production

FERC rejected the commenters' assertion that FERC should consider the environmental impacts associated with increasing natural gas production that would be induced by operation of

[203] *Id*. (citing LCA GHG Report at 18).
[204] *Id*. at P 125 (citing Final EIS at 4-105 through 4-214 & Table 4.13.1)
[205] *Id* at P 126.

the Project.[206] First, FERC stated that Sierra Club, in comments on the draft EIS, asserted that there are reliable predictions to show that the proposed Project will induce additional natural gas production, as well as available tools to predict where the production increases will occur.[207] Sierra Club further argued that the increased production will impose significant environmental harms, such as various air pollution problems. Second, FERC stated that EPA filed comments on the draft EIS recommending that the final EIS consider the environmental impacts associated with increased natural gas production—specifically, the analysis in DOE's Addendum assessing the potential impacts likely to occur from increased production.[208]

In response to these comments, FERC pointed out that the final EIS stated that an analysis of increased natural gas production would be too speculative because "the impacts cannot be described with sufficient specificity to make such an analysis useful."[209] Specifically, FERC staff determined in the final EIS that: (i) "the environmental impacts associated with natural gas production from shale sources are not reasonably foreseeable, because the project does not depend on the development of natural gas from shale resources," and (ii) "determining the well and gathering line locations and environmental impacts is not feasible, as the market at any given time would determine the source of natural gas."[210] Addressing EPA's recommendation concerning DOE's Addendum, FERC acknowledged that the final EIS did not include an analysis of the indirect impacts of induced natural gas production, principally because

[206] *See* FERC Order at P 127.
[207] *See id*. at P 127 (stating that Sierra Club cites EIA's NEMS model and Deloitte Marketpoint's World Gas Model in support of these assertions).
[208] *See id*. at P 128.
[209] *Id*. at P 129.
[210] *Id*. (citing Final EIS, Appendix L at L-29).

DOE's Addendum "did not specifically relate to impacts from the Liquefaction and Pipeline modification projects."[211]

FERC stated that, on September 28, 2015, EPA filed comments stating that the final EIS did not fully address its concerns regarding indirect effects of natural gas production. According to FERC, "EPA asserted that despite the fact that DOE's Addendum recognizes that the potential impacts from additional natural gas development will likely vary by production location, the study provides a conceptual level analysis of the types of impacts that are likely to occur from increased production."[212]

In response to both Sierra Club's and EPA's comments, FERC observed that "[i]ndirect impacts are defined [in the CEQ's NEPA regulations] as those 'which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.'"[213] According to FERC, to determine whether an impact should be studied as an indirect impact, FERC "must determine whether it: (i) is caused by the proposed action; and (2) is reasonably foreseeable."[214] Based on the meaning of both "causation" and "reasonably foreseeable" as developed in caselaw, FERC concluded that it "does not have jurisdiction over natural gas production":[215]

> The environmental effects resulting from natural gas production are generally neither caused by a natural gas infrastructure project nor are they reasonably foreseeable consequences of our approval of an infrastructure project, as contemplated by the CEQ regulations.

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[211] *Id*.
[212] FERC Order at P 130.
[213] *See id.* at P 131 (quoting 40 C.F.R. § 1508.8(b)).
[214] *Id*.
[215] *See id*. at PP 132-34 (citations omitted).

FERC reasoned that "[t]he potential impacts of natural gas production, with the exception of GHG and climate change, would be on a local and regional level."[216] FERC emphasized that "each locale includes unique conditions and environmental resources," such that "[p]roduction activities are located at a state and local level."[217] FERC also identified other relevant federal regulation, such as EPA's regulation of deep underground injection and disposal of wastewaters and liquids under the Safe Drinking Water Act, as well as air emissions under the Clean Air Act.

In FERC's view, a causal relationship sufficient to warrant analysis of the non-pipeline activity as an "indirect impact" would exist only if: (i) "the proposed pipeline would transport new production from a specified production area," and (ii) "that production would not occur in the absence of the proposed pipeline (*i.e.*, there will be no other way to move the gas)."[218] FERC asserted that, to date, it has not been presented with a proposed project that the record shows will cause the predictable development of natural gas reserves.

Rejecting the claim that potential environmental impacts resulting from natural gas production are "reasonably foreseeable," FERC next asserted that it generally does not have sufficient information to determine the origin of the natural gas that will be transported on a pipeline."[219] According to FERC, the states—not the Commission itself—have jurisdiction over the production of natural gas, and "thus would be most likely to have the information necessary to reasonably foresee future production."[220] FERC is "aware of no forecasts by such entities,

[216] FERC Order at P 134.
[217] *Id*.
[218] *Id*. at P 135 (citations omitted).
[219] *Id*. at P 136.
[220] *Id*.

making it impossible for [FERC] to meaningfully predict production-related impacts, many of which are highly localized."[221] FERC explained:

> [E]ven if the Commission knows the general source area of gas likely to be transported on a given pipeline, a meaningful analysis of production impacts would require more detailed information regarding the number, location, and timing of wells, roads, gathering lines, and other … facilities, as well as details about production methods, which can vary per producer and depending on the applications regulations in the various states.[222]

FERC thus concluded that the impacts of natural gas production are "'so nebulous'" that we "'cannot forecast [their] likely effects' in the context of an environmental analysis of the impacts related to a proposed interstate natural gas pipeline."[223]

Analyzing the proposed Liquefaction Project and the related Pipeline Modification Project, FERC likewise determined that "[these] projects do not depend on additional shale gas production, and no specific production area has been identified as a source of natural gas for the projects."[224] FERC noted that the studies and reports cited by the parties "are broad and do not show where or when additional development will occur if the project is approved."[225] FERC maintained that there was no showing of a sufficient causal link between the authorization of the Project and any additional production.[226] "Given that it is not known whether the Liquefaction and Pipeline Modifications will use natural gas derived from new production, and that the amount, timing, and location of any development activity is also unknown," FERC therefore

[221] FERC Order at P 136.
[222] *Id*.
[223] *Id*. (quoting *Habitat Educ. Ctr. v. U.S. Forest Serv.*, 609 F.3d 897, 902 (7th Cir. 2010)).
[224] *Id*. at P 137.
[225] *Id*.
[226] *See id*.

concluded that "the impact from induced natural gas production is not an indirect effect of the projects."[227]

5. Environmental Conclusions

In granting the authorization, FERC "agree[d] with the conclusions presented in the final EIS and [found] that approval of the proposed facilities, if constructed and operated as described in the final EIS, is an environmentally acceptable action."[228] On this basis, FERC determined that 95 of the 96 environmental mitigation measures recommended in the final EIS were appropriate conditions for the authorizations, as set forth in Appendix B of FERC's Order.[229]

D. Request for Rehearing of FERC Order

On January 19, 2016, Sierra Club timely requested rehearing of the FERC Order. FERC granted rehearing for purposes of further consideration on February 16, 2016, and denied the rehearing request on June 30, 2016.[230]

XII. DISCUSSION AND CONCLUSIONS

In reviewing LCE'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 export proposals 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:

- LCE's Application, the Amendment to the Application, and the submissions of APGA (the only intervenor-protestor) and commenters in response to the Application;

[227] FERC Order at P 138.
[228] *Id*. at P 139.
[229] *See supra* § I.
[230] *Trunkline Gas Co., LLC,* Order Denying Rehearing, *supra* note 32.

- FERC's EIS; FERC's December 17, 2015 Order, including the 95 environmental conditions adopted in that Order; and FERC's June 30, 2016 Rehearing Order;
- 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 EIA LNG Export Study and the 2015 LNG Export Study, including comments received in response to those Studies.

To avoid repetition, the following discussion focuses on arguments and evidence presented by LCE, APGA, and the commenters, 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 LNG Export Studies.

A. Procedural Issues

APGA timely filed a motion to intervene and protest opposing a grant of LCE's Application. LCE did not oppose APGA's motion, and instead filed an Answer to AGPA's protest pursuant to 10 C.F.R. § 590.304(f). *See supra* §§ VI.D, E. Therefore, APGA's motion to intervene is deemed granted. 10 C.F.R. § 590.303(g).

B. Non-Environmental Issues

In considering non-environmental issues in this proceeding, we have reviewed the Application; APGA's protest and the comments filed in this proceeding; and the 2014 and 2015 LNG Export Studies. We also take administrative notice of EIA's more recent authoritative supply data and projections, set forth in AEO 2015 and AEO 2016 as discussed below.

1. LCE's Application

Upon review of our findings in the Conditional Order issued in August 2013,[231] the non-FTA export authorizations issued to date, and the more recent DOE and EIA findings discussed herein, we find that several factors support a grant of LCE's authorization to export LNG in an amount equivalent to 730 Bcf/yr of natural gas.

First, the record supports a finding that there is ample supply of natural gas available to support the exports contemplated in the Application without affecting the availability of natural gas to meet domestic demand.

Second, as discussed below, the record demonstrates that domestic natural gas can be liquefied and exported to foreign markets in the volumes proposed in the Application with only a nominal effect on U.S. prices due to the proposed exports.

Third, we agree with LCE and the commenters supporting the Liquefaction Project that substantial economic and public benefits, including reductions to the U.S. trade deficit and the generation of significant tax revenues for federal, state, and local governmental entities, will follow from a grant of the Application.

2. Regional Impacts

As set forth in the Conditional Order, LCE 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 IECA contend that price increases resulting from LNG exports will hurt consumers of natural gas and electricity. They are also concerned that exports of LNG

[231] LCE Conditional Order at 121-23.

will undercut manufacturing industries in the United States and, in particular, will disadvantage the industries in 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.

Certain commenters on the 2014 and 2015 LNG Export Studies make several of the same arguments raised by APGA and IECA and challenge the sustainability of economic benefits in regions tied to resource extraction industries. In particular, these commenters contend that DOE/FE must consider a full range of counterfactual scenarios by evaluating whether the nation would be better off without LNG export, or with lower export volumes. They also challenge claimed regional economic benefits by focusing principally on the durability of economic benefits in natural gas producing regions. They assert 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.

On review, we do not agree with APGA and IECA that LCE'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 2015 and AEO 2016, 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 LCE's Application, neither APGA nor IECA offered detailed analyses specific to the local and regional economic impacts of LCE's proposal to contradict this evidence.

To the extent these commenters are claiming that the exports proposed by LCE 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 that the commenters 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, it seems more likely that LCE's ability to export to non-FTA countries 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.

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 15.22 Bcf/d of natural gas with the issuance of this Order).[232] The 2015 Study concluded that LNG exports at these levels (12 to 20 Bcf/d of natural gas) would result in higher U.S. natural gas prices, but that these price changes would remain in a relatively 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.[233]

We have also reviewed EIA's AEO 2016, published in June 2016. The Reference case of this projection includes the effects of the Clean Power Plan (CPP), discussed *supra* § VIII.A, which is intended to reduce carbon emissions from the power sector. DOE/FE assessed the AEO 2016 to evaluate any differences from AEO 2014, which formed the basis for the 2014 Study.

[232] *See infra* § XII.D.
[233] *See* 2015 Study at 8, 82.

Comparing key results from 2040 (the end of the projection period in Reference case projections from AEO 2014 and AEO 2016) shows that the latest Outlook foresees market conditions that would be even more supportive of LNG exports, including higher production and demand coupled with lower prices. Results from EIA's AEO 2016 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 same basis of higher production and demand with lower prices relative to AEO 2014.

For the year 2040, the AEO 2016 Reference case anticipates 15 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 nearly 40 percent. With regard to exports, the 2016 projection's 2040 net pipeline exports of 2.4 Bcf/d and total LNG exports of 18.4 Bcf/d (over 90 percent higher than total LNG exports in AEO 2014) illustrate the Outlook's view of a market environment supportive of exports.

In the AEO 2016 no-CPP case, for the year 2040, lower-48 production is almost 14 percent higher than in AEO 2014, with the Henry Hub price over 42 percent lower. Net pipeline exports of 2.8 Bcf/d and total LNG exports of 18.6 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 2016

	AEO 2014 Reference Case	**AEO 2016 Reference Case Includes Clean Power Plan**	**AEO 2016 Reference Case Without Clean Power Plan**
Lower-48 Dry Natural Gas Production (Bcf/d)	99.7	114.6	113.5
Total Natural Gas Consumption (Bcf/d)	86.7	94.3	92.6
Electric Power Sector Consumption (Bcf/d)	30.8	32.8	30.6
Net Exports by Pipeline (Bcf/d)	6.7	2.4	2.8
Net LNG Exports (Bcf/d)	9.2	18.2	18.4
LNG Exports – Total (Bcf/d)	9.6	18.4	18.6
Lower-48	7.4	18.4	18.6
Alaska	2.2	0.0	0.0
Henry Hub Spot Price ($/MMBtu)[Note 1]	**$8.03 (2015$)** $7.65 (2012$)	**$4.86 (2015$)**	**$4.65 (2015$)**

Note 1: Prices adjusted to 2015$ with the GDP implicit deflator for AEO 2014.

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 LCE'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 2016 continue to show market conditions that will accommodate increased exports of natural gas. When compared to the AEO 2014 Reference case, the AEO 2016 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 2015 and AEO 2016, but have considered a wide range of other information. For example, the National Export Initiative, established by Executive Order, sets an Administration 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."[234]

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

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

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, it 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 LCE'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 FERC's EIS

DOE/FE participated in FERC's environmental review of the proposed Lake Charles Liquefaction Project as a cooperating agency. Because DOE was a cooperating agency, DOE/FE is permitted to adopt FERC's final EIS for the Liquefaction Project, provided that DOE/FE has conducted an independent review of the EIS and determines that its comments and suggestions have been satisfied.[235] For the reasons set forth below, DOE/FE has not found that the arguments raised in the FERC 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,

[235] *See* 40 C.F.R. § 1506.3(c).

DOE has adopted the EIS (DOE/EIS-0491),[236] and hereby incorporates FERC's reasoning and findings in this Order.

2. Concerns Associated with Production from Shale Resources

APGA argues that there are "serious environmental concerns being raised at the state and national level about the technology associated with hydraulic fracturing."[237] APGA contends that DOE/FE may not ignore these concerns, particularly "in making policy decisions on applications that depend *entirely* for their viability on ample future natural gas from shale formations."[238]

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

[236] *See supra* § I.
[237] APGA Mot. at 11.
[238] *Id*. (emphasis in original).

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 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.[239]

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. Finally, we agree with APGA that "the affected states and the Federal Government are taking the health issue [surrounding hydraulic fracturing] seriously."[240]

3. 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.[241] Nevertheless, a decision by DOE/FE to authorize exports to non-FTA nations could accelerate that development by some increment. As discussed above, the Addendum reviewed the academic and technical literature covering the most significant issues associated with unconventional gas production,

[239] *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).
[240] APGA Mot. at 11 & n.28 (citations omitted).
[241] Addendum at 2.

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 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.[242] In 2013, EPA updated those regulations to include storage tanks,[243] 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.[244] 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

[242] 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).
[243] 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).
[244] U.S. Envtl. Prot. Agency, Office of Air Quality Planning & Standards, *White Papers on Methane and VOC Emissions, available at* http://www3.epa.gov/airquality/oilandgas/methane.html (released April 15, 2014).

gas production."[245] Specifically, as part of the Administration's efforts to address climate change, 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.[246] EPA issued the proposed rule in September 2015,[247] and the final rule on June 3, 2016.[248]

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.

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

Certain 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

[245] 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* http://www.epa.gov/airquality/oilandgas/pdfs/20150114fs.pdf.

[246] 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.").

[247] *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).

[248] *See supra* note 171.

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 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)."[249] 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

[249] 2012 EIA Study at 18.

"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."[250] 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."[251] 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.[252] 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 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.[253] Therefore, EIA's analysis included the impacts that EPA's Mercury and Air Toxics Standard[254] but not EPA's Transport Rule[255] 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 sulphur 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.

[250] *Id*.
[251] *Id*.
[252] *Id*. at 19.
[253] *See supra* § VI.B.
[254] 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).
[255] 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).

These rules, finalized in the fall of 2015, impose limits on GHG emissions from both new and existing coal-fired power plants.[256] 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 2016 incorporated the Clean Power Plan 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 Reference case—which includes 18.4 Bcf/d of LNG exports from the United States in 2040—electric power sector carbon dioxide emissions are projected to be 35 percent below 2005 levels in 2030 due to the implementation of the CPP. Natural gas generation increases by 44 percent in the Reference case from 2015 to 2040, and coal generation declines by 32 percent from 2015 to 2040.

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 XI.A (Figures 1 and 2):

[256] 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.

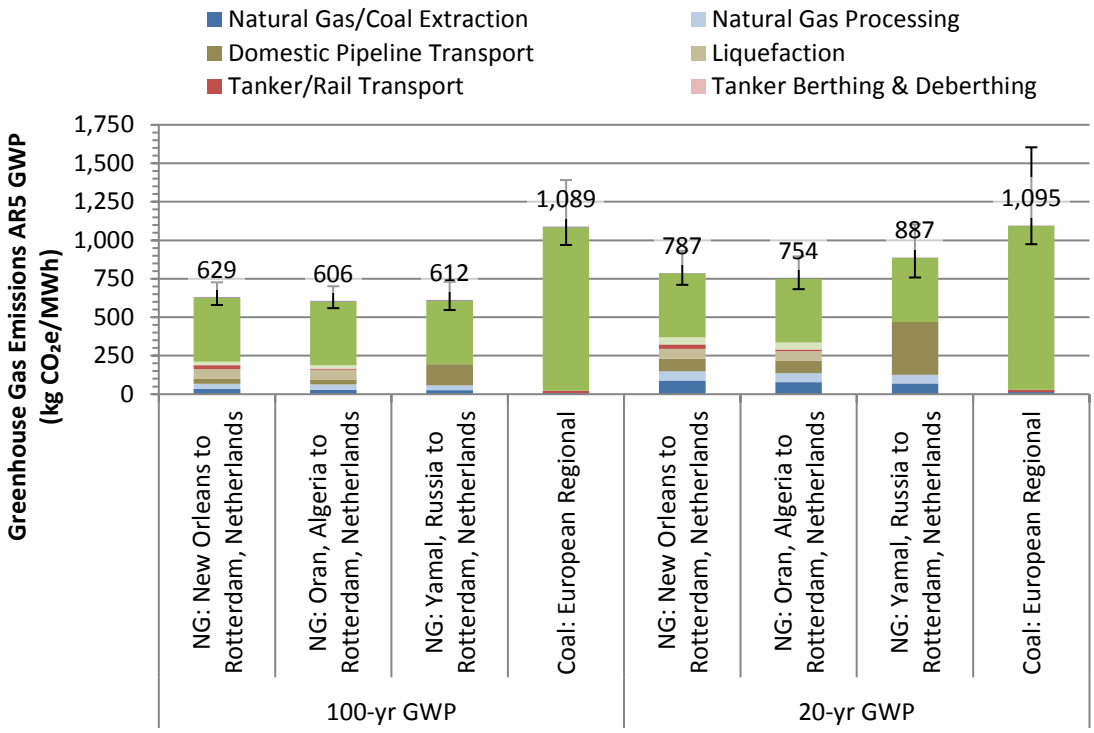

Figure 3: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe[257]

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

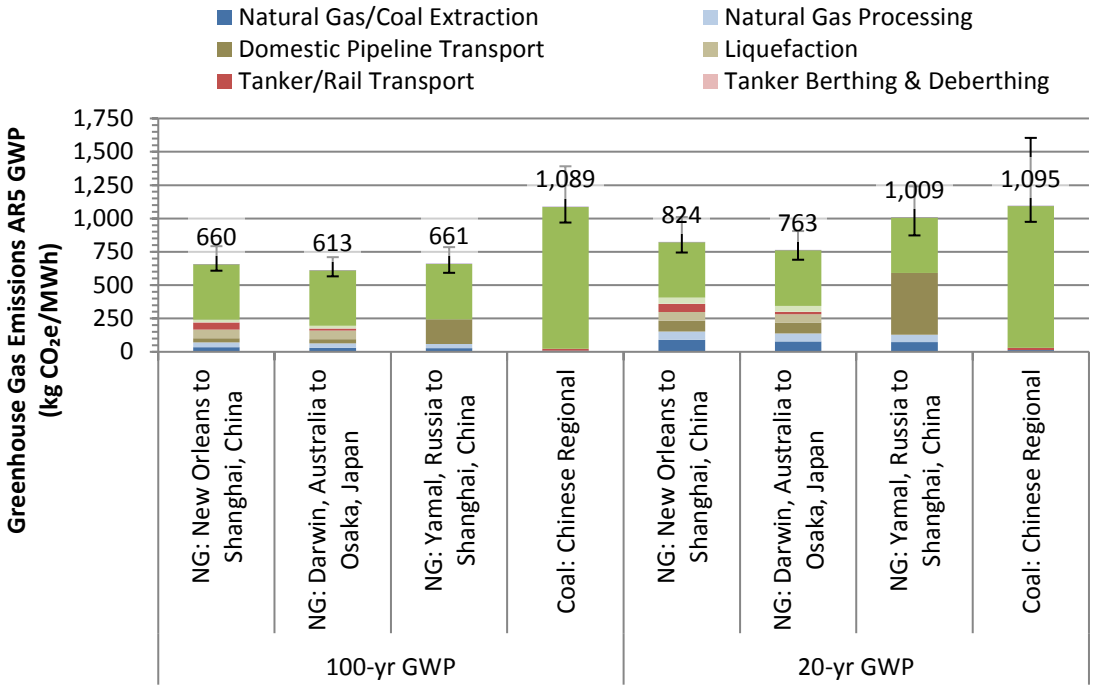

Figure 4: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia[258]

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.[259]

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,

[258] LCA GHG Report at 10 (Figure 6-2).
[259] *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.[260] For India, installed electric generation capacity in 2014 is

[260] U.S. Energy Information Administration, China Analysis Brief (last updated May 14, 2015), *available at:*

62 percent coal and 8 percent natural gas.[261] 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 86 percent in 2013 after the Fukushima disaster.[262] 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.[263]

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.

5. 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 Studies and many public comments identify significant uncertainties and even potential negative

http://www.eia.gov/beta/international/analysis.cfm?iso=CHN.

[261] 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

[262] U.S. Energy Information Administration, Japan Analysis Brief (last updated Jan. 30, 2015), *available at:* http://www.eia.gov/beta/international/analysis.cfm?iso=JPN.

[263] 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.

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 LCE'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[264] 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.[265] 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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[264] 49 Fed. Reg. at 6684 (Feb. 22, 1984).

[265] 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).

D. 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 LCE's proposed exports of LNG to non-FTA countries will be inconsistent with the public interest. For that reason, we are authorizing LCE'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 and the order being issued concurrently today to Lake Charles LNG Export, DOE/FE has now issued final non-FTA authorizations in a cumulative volume of exports totaling 15.22 Bcf/d of natural gas, or 5.56 Tcf/yr, for the 20 final authorizations issued to date—Sabine Pass Liquefaction, LLC (2.2 Bcf/d),[266] Carib Energy (USA) LLC (0.04 Bcf/d),[267] Cameron LNG, LLC (1.7 Bcf/d),[268] FLEX I (1.4 Bcf/d),[269] FLEX II (0.4 Bcf/d),[270] Dominion Cove Point LNG, LP (0.77 Bcf/d),[271] Cheniere Marketing, LLC and

[266] *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).
[267] *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).
[268] *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).
[269] *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).
[270] *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).

Corpus Christi Liquefaction, LLC (2.1 Bcf/d),[272] Sabine Pass Liquefaction, LLC Expansion Project (1.38 Bcf/d),[273] American Marketing LLC (0.008 Bcf/d),[274] Emera CNG, LLC (0.008 Bcf/d),[275] Floridian Natural Gas Storage Company, LLC,[276] Air Flow North American Corp. (0.002 Bcf/d),[277] Bear Head LNG Corporation and Bear Head LNG (USA), LLC (0.81 Bcf/d),[278] Pieridae Energy (USA) Ltd.,[279] Sabine Pass Liquefaction, LLC Design Increase (0.56 Bcf/d),[280]

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[271] *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).
[272] *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).
[273] *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).
[274] *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).
[275]*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).
[276] *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).
[277] *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).
[278] *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).
[279] *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).
[280] *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).

Cameron LNG, LLC Design Increase (0.42 Bcf/d),[281] Flint Hills Resources, LP (0.01 Bcf/d),[282] Cameron LNG, LLC Expansion Project (1.41 Bcf/d),[283] this Order (2.0 Bcf/d), and Lake Charles LNG Export Company, LLC.[284]

We note that the volumes authorized for export in this Order and the *Lake Charles LNG Export* order are both 730 Bcf/yr (2.0 Bcf/d), yet are not additive to one another because the source of LNG approved under both orders is from the Lake Charles Terminal. Likewise, the *Carib* 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.[285] 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.[286] 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

[281] *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).
[282] *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).
[283] *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).
[284] *Lake Charles LNG Export Co., LLC*, DOE/FE Order No. 3868, *supra* note 14.
[285] *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").
[286] *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").

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 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. LCE must abide by each Term and Condition or may face rescission of the authorization or other appropriate sanction.

A. Term of the Authorization

LCE requests a 25-year term for the authorization commencing from the date export operations begin. However, consistent with our prior non-FTA authorizations to date (including LCE's Conditional Order), we believe that caution recommends limiting this authorization to no longer than a 20-year term beginning from the date of first export. In imposing this condition, we are mindful that LNG export facilities are capital intensive and that, to obtain financing for such projects, there must be a reasonable expectation that the authorization will continue for a term sufficient to support repayment. We find that a 20-year term is likely sufficient to achieve this result. Accordingly, the 20-year term will begin on the data when LCE commences commercial export of domestically sourced LNG from the Lake Charles Terminal, but not before.

B. Commencement of Operations Within Seven Years

LCE requests this authorization to commence on the earlier of the date of first export or 10 years from the date of the issuance of this Order. DOE/FE will add as a condition of the authorization that LCE must commence commercial LNG export operations no later than seven years from the date of issuance of this Order. This seven-year time period is consistent with our practice in the final and conditional non-FTA export authorizations issued to date, including LCE's Conditional 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

LCE 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 Lake Charles Terminal. "Commissioning Volumes" are defined as the volume of LNG produced and exported under a short-term authorization 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 LCE's long-term contracts.[287] The Commissioning Volumes will not be counted against the maximum level of volumes previously authorized in LCE's FTA order (DOE/FE Order No. 2987) or in this Order.

D. Make-Up Period

LCE 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 LCE's FTA order (DOE/FE Order No. 2987) or in this Order. Insofar as LCE may seek to export additional volumes not previously authorized for export, it will be required to obtain appropriate authorization from DOE/FE.

[287] 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).

E. 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.[288] 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 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.[289]

[288] 10 C.F.R. § 590.405.
[289] 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. 65,641 (Nov. 5, 2014).

F. Agency Rights

LCE requests authorization to export LNG from the Liquefaction Project in a volume equivalent to 730 Bcf/yr on its own behalf and as agent for other entities that hold title to the LNG at the time of export. 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.[290] 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 authorization holder at the point of export.[291] 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.[292] 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.[293]

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[290] *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*].
[291] *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.
[292] *See Cameron LNG, LLC*, DOE/FE Order No. 3846.
[293] *See id*. at 128-29 (citation omitted).

To ensure that the public interest is served, this authorization shall be conditioned to require that where LCE proposes to export LNG from the Liquefaction Project 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.

G. 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."[294] 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 public disclosure, and DOE/FE determines it will be afforded confidential treatment in accordance with 10 C.F.R. § 1004.11.[295]

DOE/FE will require that LCE file or cause to be filed with DOE/FE any relevant long-term commercial agreements, including sale and purchase agreements, pursuant to which LCE 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 Lake

[294] 10 C.F.R. § 590.202(b).
[295] *Id*. § 590.202(e).

Charles Terminal, a long-term sales contract involving natural gas or LNG stored or liquefied at the Terminal, or an agreement to provide export services from the Terminal.

In addition, DOE/FE finds that section 590.202(c) of DOE/FE's regulations[296] requires that LCE file, or cause to be filed, all long-term contracts associated with the long-term supply of natural gas to the Lake Charles Terminal, whether signed by LCE or the Registrant, within 30 days of their execution.

DOE/FE recognizes that some information in LCE'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 Lake Charles Terminal, may be commercially sensitive. DOE/FE therefore will provide LCE the option to file or cause to be filed either unredacted contracts, or in the alternative (A) LCE may file, or cause to be filed, 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.

[296] *Id*. § 590.202(c).

H. Export Quantity

LCE sought authorization to export up to 730 Bcf/yr of natural gas (2.0 Bcf/d, or 15 mtpa), which is within the maximum liquefaction capacity of the Lake Charles Liquefaction Project as approved by FERC.[297] As set forth herein, this Order authorizes the export of LNG in the full amount requested, up to the equivalent of 730 Bcf/yr of natural gas.

I. Combined FTA and Non-FTA Export Authorization Volumes

LCE is currently authorized in DOE/FE Order No. 2987 to export domestically produced LNG to FTA countries in the same volume authorized in this Order, equivalent to approximately 730 Bcf/yr of natural gas. Additionally, LCE's affiliate, Lake Charles LNG Export Company, LLC, is authorized in DOE/FE Order Nos. 3252 and 3868 to export domestically produced LNG to FTA and non-FTA countries, respectively, in the same volume authorized in this Order. Because the source of LNG for all four of these export authorizations is the Lake Charles Liquefaction Project, none of the volumes authorized for export in DOE/FE Order Nos. 2987, 3252, 3324-A, and 3868 may be treated as additive to one another.

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 LCE's Application should be granted subject to the Terms and Conditions set forth herein. The following Ordering Paragraphs reflect current DOE/FE practice.

[297] FERC has authorized a design production capacity for the Liquefaction Project of 16.45 mtpa of LNG, which is a quantity greater than the requested export authority in the Application. FERC Order at P 10 n.13. Should LCE wish to export additional volumes from the Liquefaction Project, it will be required to apply to DOE/FE for new export authorization.

XV. ORDER

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

A. Lake Charles Exports, LLC (LCE) is authorized to export domestically produced LNG by vessel from the Lake Charles Terminal located in Lake Charles, Calcasieu Parish, Louisiana, in a volume equivalent to 730 Bcf/yr of natural gas. LCE is authorized to export this LNG 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 LCE commences commercial export of domestically sourced LNG from the Lake Charles Terminal, but not before. LCE 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 volume authorized in LCE's FTA order (DOE/FE Order No. 2987) or in this Order.

C. LCE 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 LCE's FTA order (DOE/FE Order No. 2987) or in this Order. Insofar as LCE may seek to export additional volumes not previously authorized for export, it will be required to obtain appropriate authorization from DOE/FE.

D. LCE 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 730 Bcf/yr of natural gas. This quantity is not additive to the export volume in LCE's FTA authorization, set forth in DOE/FE Order No. 2987, or the export volume in Lake Charles LNG Export's FTA or non-FTA authorizations, set forth in DOE/FE Order Nos. 3252 and 3868, respectively.

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. LCE 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 and FERC. Failure to comply with this requirement could result in rescission of this authorization and/or other civil or criminal remedies.

H. LCE shall ensure compliance with all terms and conditions established by FERC in the EIS, including the 95 environmental conditions adopted in the FERC Order. Additionally, this authorization is conditioned on LCE's on-going compliance with any other preventative and mitigative measures at the Lake Charles Terminal imposed by federal or state agencies.

I. (i) LCE shall file, or cause others to file, with the Office of Regulation and International Engagement a non-redacted copy of <u>all executed long-term contracts associated with the long-term export of LNG</u> as agent for other entities from the Lake Charles Terminal. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if LCE 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, LCE

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, LCE shall state why the redacted or non-disclosed information should be exempted from public disclosure.

(ii) LCE 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 Lake Charles Terminal. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if LCE 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, LCE 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, LCE shall state why the redacted or non-disclosed information should be exempted from public disclosure.

J. LCE, or others for whom LCE 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. 3324-A, issued July 29, 2016, in FE Docket No. 11-59-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 Lake Charles Exports, 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 Lake Charles Exports, LLC is made aware of all such actual destination countries.

K. LCE is permitted to use its authorization 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 LCE with all information necessary to permit LCE 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, LCE shall ensure that all persons required by this Order to register with DOE/FE have done so. Any failure by LCE 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 Lake Charles Terminal, LCE shall provide written notification of the date that the first export of LNG authorized in Ordering Paragraph A above occurred.

O. LCE shall file with the Office of Regulation and International Engagement, on a semi-annual basis, written reports describing the progress of the Lake Charles Liquefaction Project. 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 Liquefaction Project, the date the Liquefaction Project 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, LCE must comply with DOE/FE's Procedures for Change in Control Affecting Applications and Authorizations to Import or Export Natural Gas.[298] 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 LCE, 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.[299]

Q. Monthly Reports: With respect to the LNG exports authorized by this Order, LCE 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. 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

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

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. The unopposed motion to intervene submitted by the American Public Gas Association is deemed granted by operation of law. 10 C.F.R. § 590.303(g).

Issued in Washington, D.C., on July 29, 2016.

Christopher A. Smith
Assistant Secretary
Office of Fossil Energy