UNITED STATES OF AMERICA

DEPARTMENT OF ENERGY

OFFICE OF FOSSIL ENERGY

CAMERON LNG, LLC	)	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

DOE/FE ORDER NO. 3391-A

SEPTEMBER 10, 2014

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FREQUENTLY USED ACRONYMS

AEO	Annual Energy Outlook
APGA	American Public Gas Association
API	American Petroleum Institute
Bcf/d	Billion Cubic Feet per Day
Bcf/yr	Billion Cubic Feet per Year
CEQ	The Council on Environmental Quality
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalents
DOE	U.S. Department of Energy
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
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
FTA	Free Trade Agreement
GHG	Greenhouse Gas
GWP	Global Warming Potential
HAP	Hazardous Air Pollutant
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt-Hour
LCA	Life Cycle Analysis
LNG	Liquefied Natural Gas
LTA	Liquefaction Tolling Agreement
Mcf	Thousand Cubic Feet
MMBtu	Million British Thermal Units
mtpa	Million Metric Tons per Annum
MWh	Megawatt-Hour
NEPA	National Environmental Policy Act
NERA	NERA Economic Consulting
NETL	National Energy Technology Laboratory
NGA	Natural Gas Act
PM	Particulate Matter
ROD	Record of Decision
Tcf/yr	Trillion Cubic Feet per Year
VOC	Volatile Organic Compound

I. INTRODUCTION

On February 11, 2014, the Office of Fossil Energy of the Department of Energy (DOE/FE) issued Order No. 3391 to Cameron LNG, LLC (Cameron) pursuant to section 3(a) of the Natural Gas Act (NGA)[1] (Conditional Order or Order No. 3391).[2] In that order, DOE/FE conditionally granted Cameron's Application[3] for long-term, multi-contract authorization to export domestically produced liquefied natural gas (LNG) by vessel to nations with which the United States has not entered into a free trade agreement providing for national treatment for trade in natural gas (non-FTA nations).[4] DOE/FE conditionally authorized Cameron to export LNG in a volume equivalent to 620 billion cubic feet per year (Bcf/yr) of natural gas (1.7 Bcf per day (Bcf/d)), or approximately 12 million metric tons per annum (mtpa) of LNG, for a term of 20 years. The authorization term was to commence on the earlier of the date of first commercial export or seven years from the date the order was issued (February 11, 2021). The proposed exports will originate from the existing Cameron LNG Terminal (Cameron Terminal), located in Hackberry, Cameron Parish, Louisiana, from liquefaction and related facilities to be constructed by Cameron (Liquefaction Project). DOE/FE authorized Cameron to export this

[1] 15 U.S.C. § 717b(a). This authority is delegated to the Assistant Secretary for Fossil Energy pursuant to Redelegation Order No. 00-002.04F (July 11, 2013).
[2] *Cameron LNG, LLC*, DOE/FE Order No. 3391, FE Docket No. 11-162-LNG, Order Conditionally 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 (Feb. 11, 2014) [hereinafter Cameron Conditional Order].
[3] Application of Cameron LNG, LLC for Long-Term Authorization to Export LNG to Non-Free Trade Agreement Countries, FE Docket No. 11-162-LNG (Dec. 21, 2011) [hereinafter Cameron App.].
[4] Cameron previously sought authorization to export the same quantity of LNG to any country 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). DOE/FE granted that FTA authorization by order dated January 17, 2012. *See infra* Section IV.B.

LNG on its own behalf and as an agent for other entities that hold title to the LNG, after registering each such entity with DOE/FE.[5]

In December 2012, Cameron had filed a separate application with the Federal Energy Regulatory Commission (FERC) to site, construct, and operate the Liquefaction Project under NGA section 3. At the time that DOE/FE issued the Conditional Order to Cameron in this proceeding, Cameron's application was pending before FERC in FERC Docket CP13-25-000. The Conditional Order addressed the record evidence and entered findings on all non-environmental issues considered under NGA section 3(a), including the economic impacts, international impacts, and security of gas supply associated with Cameron's proposed exports. *See infra* Section III (public interest standard). Because DOE/FE must also consider environmental issues, DOE/FE conditioned its authorization on the satisfactory completion of Cameron's environmental review process under the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4321 *et seq*., and on DOE/FE's issuance of a finding of no significant impact or a record of decision (ROD).[6] 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 "indicates … DOE/FE's determination at this time on all but the environmental issues in this proceeding."[7]

FERC reviewed Cameron's application for the Liquefaction Project in FERC Docket No. CP13-25-000 in conjunction with the application of Cameron's affiliate, Cameron Interstate Pipeline, LLC (Cameron Interstate), in FERC Docket No. CP13-27-000. Cameron Interstate had

[5] The Conditional Order contained numerous terms and conditions, which we are adopting in this Order. *See infra* Sections XI, XIII.
[6] *See* Cameron Conditional Order at 142-43 (Ordering Para. F).
[7] *See id*. at 141 (Terms and Conditions § H) (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.").

requested from FERC a certificate of public convenience and necessity to construct and operate pipeline and compression facilities enabling it to transport domestically produced natural gas to the Cameron Terminal for processing, liquefaction, and export (Pipeline Project).[8] *See infra* Section IV.A.

In accordance with NEPA, FERC issued a draft Environmental Impact Statement (EIS) for the proposed Liquefaction Project on January 10, 2014,[9] and a final EIS on April 30, 2014.[10] The final EIS recommended that FERC approve Cameron's proposed Liquefaction Project subject to 76 environmental conditions. Accordingly, on June 19, 2014, FERC issued an Order Granting Authorization Under Section 3 of the Natural Gas Act and Issuing Certificates (FERC Order), which authorized Cameron to site, construct, and operate the Liquefaction Project, and for Cameron Interstate to construct the Pipeline Project, subject to the 76 environmental conditions contained in Appendix A of that order.[11] Details of the FERC Order are discussed below. *See infra* Section VI.

Sierra Club and Gulf Restoration Network (collectively, Sierra Club) had jointly intervened in Cameron's proceeding before FERC, challenging the adequacy of the draft EIS. Sierra Club asserted, in part, that the draft EIS failed to consider: (i) the indirect effects of induced natural gas production associated with the proposed Liquefaction Project, and (ii) the cumulative impacts from all proposed export terminals, including the LNG export applications

[8] In the FERC proceeding, Cameron Interstate requested a certificate of public convenience and necessity pursuant to NGA section 7, 15 U.S.C. § 717f, and various FERC regulations.
[9] *See* Cameron LNG, LLC, Cameron Interstate Pipeline, LLC; Notice of Availability of the Draft Environmental Impact Statement for the Proposed Cameron Liquefaction Project, 79 Fed. Reg. 3197 (Jan. 17, 2014). At the time DOE/FE issued the Conditional Order, FERC's public comment period for the draft EIS was on-going.
[10] *See* Cameron LNG, LLC, Cameron Interstate Pipeline, LLC; Notice of Availability of the Final Environmental Impact Statement for the Proposed Cameron Liquefaction Project, 79 Fed. Reg. 26,244 (May 7, 2014).
[11] *Cameron LNG, LLC, et al.*, Order Granting Authorization Under Section 3 of the Natural Gas Act and Issuing Certificates, 147 FERC ¶ 61,230 (June 19, 2014) [hereinafter FERC Order].

already approved by or pending before DOE/FE and FERC.[12] In its Order, FERC rejected those arguments.

First, FERC found that Sierra Club had not demonstrated that the Liquefaction Project would induce additional natural gas production and, even assuming that the Liquefaction Project would do so, such production is not "reasonably foreseeable" within the meaning of NEPA.[13] Second, as to Sierra Club's argument for a cumulative environmental impact analysis, FERC found that Sierra Club was, in fact, seeking a programmatic EIS when there was no "program" before FERC that required such action under NEPA.[14] FERC concluded that the Liquefaction and Pipeline Projects, if built and operated consonant with the specified environmental conditions, would be an "environmentally acceptable action."[15] Sierra Club sought rehearing of the FERC Order, but FERC rejected that request as having been filed out of time.[16]

On August 7, 2014, after an independent review, DOE/FE adopted FERC's final EIS for the Cameron Liquefaction Project (DOE/EIS-0488), and the U.S. Environmental Protection Agency (EPA) published a notice of the adoption on August 15, 2014.[17] Concurrently with this Order and pursuant to NEPA, DOE/FE is issuing a ROD for Cameron's proposed exports of LNG

[12] *See* FERC Order at 25-27. Sierra Club is also an intervenor in this proceeding and raised similar arguments in opposing DOE/FE's grant of Cameron's Application. *See infra* Sections VII.C, X.A.
[13] FERC Order at 25 (quoting 40 C.F.R. § 1508.8(b)).
[14] *Id*. at 26 (citing 40 C.F.R. § 1508.18(b)(3)).
[15] FERC Order at 28.
[16] *Cameron LNG, LLC, et al.*, 148 FERC ¶ 61,073 (July 29, 2014) (Notice Rejecting Request for Rehearing and Dismissing Request for Stay). Subsequently, Sierra Club and Gulf Restoration Network submitted a Request for Rehearing and Answer to Motion to Strike, asking FERC to accept its late-filed request for rehearing. On September 8, 2014, FERC issued an order granting Sierra Club's request for rehearing of FERC's July 29, 2014 Notice for further consideration.
[17] U.S. Envtl. Prot. Agency, Environmental Impact Statements; Notice of Availability, 79 Fed. Reg. 48,140 (Aug. 15, 2014) (providing notice that DOE/FE adopted FERC's final EIS No. 20140229 for the Cameron Liquefaction Project).

from the Liquefaction Project.[18] The condition imposed by DOE/FE in the Conditional Order having been met, DOE/FE will now issue this final Opinion and Order. As discussed below, this Order is conditioned on Cameron's compliance with the 76 environmental conditions recommended in the final EIS and adopted in the FERC Order.

In connection with this and other LNG export proceedings, 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 gas production in the lower-48 states. The purpose of this review was to provide additional information to the public concerning the potential environmental impacts of unconventional natural gas exploration and production activities, including hydraulic fracturing. DOE/FE published its draft report for public review and comment, entitled *Draft Addendum to Environmental Review Documents Concerning Exports of Natural Gas from the United States* (Draft Addendum).[19] As detailed below, DOE/FE received comments on the Draft Addendum and, on August 15, 2014, issued the final Addendum (hereafter Addendum) with its response to the public comments contained in Appendix B.[20]

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. The purpose of this analysis was to

[18] 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).
[19] 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.
[20] 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).

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).[21] DOE/FE also received public comment on the LCA GHG Report, and provides its response to those comments in this Order. *See infra* Section IX.B.

With respect to both the Addendum and the LCA GHG Report, DOE/FE has taken all public comments into consideration in this decision and has made those comments, as well as the underlying studies, part of the record in this proceeding.[22] 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. Below, we discuss these documents, as well as other environmental issues evaluated as part of our public interest review.

II. SUMMARY OF FINDINGS AND CONCLUSIONS

As noted above, the Conditional Order (DOE/FE Order No. 3391) presented DOE/FE's findings and conclusions on the non-environmental issues associated with Cameron's proposed exports. DOE/FE compiled an administrative record based on submissions by persons who intervened in, protested, and commented on Cameron's Application. DOE/FE also considered

[21] 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.

[22] By electronic mail, DOE/FE notified all parties to this proceeding of the issuance of both the draft Addendum and the LCA GHG Report, as well as the opportunity to submit comments on those documents.

the LNG Export Study described below.[23] Based on that record, DOE/FE reviewed a number of public interest considerations and determined that intervenors and commenters had not demonstrated that the requested authorization would be inconsistent with the public interest, as would be required to deny Cameron's Application under NGA section 3(a).[24]

This Order adopts the key findings, terms, and conditions of the Conditional Order, and focuses on the remaining issue: the potential environmental impacts of Cameron's proposed exports. Based on a review of the record in this proceeding—including the final EIS on the proposed Liquefaction Project, the FERC Order granting authorization for Cameron to site, construct, and operate the Liquefaction Project, as well as the Addendum and LCA GHG Report—DOE/FE finds that the proposed exports have not been shown to be inconsistent with the public interest.

On this basis, DOE/FE grants final authorization for Cameron's proposed exports of domestically produced LNG from the Cameron Terminal. Cameron's exports are authorized in a volume equivalent to 620 Bcf/yr of natural gas, as requested in the Application. *See infra* Section XI.I. This authorization is subject to the Terms and Conditions and Ordering Paragraphs discussed below, which incorporates by reference the 76 environmental conditions imposed by FERC. *See infra* Sections XI-XIII.

III. PUBLIC INTEREST STANDARD

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

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[23] *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 (Federal Register Notice of Availability of the LNG Export Study); LNG Export Study – Related Documents, *available at* http://energy.gov/fe/downloads/lng-export-study-related-documents (EIA Analysis (Study - Part 1) & (NERA Economic Consulting Analysis (Study - Part 2)).

[24] *See* Cameron Conditional Order at 125-35.

> [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[25]] 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.[26]

While section 3(a) establishes a broad public interest standard and a presumption favoring export authorizations, the statute does not define "public interest" or identify criteria that must be considered. In prior decisions, however, DOE/FE has identified a range of factors that it evaluates when reviewing an application for export authorization. These factors include economic impacts, international impacts, security of natural gas supply, and environmental impacts, among others. To conduct this review, DOE/FE looks to record evidence developed in the application proceeding.[27]

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[25] 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.

[26] *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).

[27] *See, e.g.*, *Sabine Pass*, DOE/FE Order No. 2961, at 28-42 (reviewing record evidence in issuing conditional authorization); *LNG Devel. Co., LLC (d/b/a/ Oregon LNG)*, DOE/FE Order No. 3465, FE Docket No. 12-77-LNG, Order Conditionally Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Oregon LNG Terminal in Warrenton, Clatsop County, Oregon to Non-Free Trade Agreement Nations (July 31, 2014), at 8-28, 132-43 (same) [hereinafter *Oregon LNG*].

DOE/FE's prior decisions have also looked to certain principles established in its 1984 Policy Guidelines.[28] 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.[29]

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.[30]

In Order No. 1473, DOE/FE stated that it was guided by DOE Delegation Order No. 0204-111. That delegation order, which authorized the Administrator of the Economic Regulatory Administration to exercise the agency's review authority under NGA section 3, directed the Administrator to regulate exports "based on a consideration of the domestic need for the gas to be exported and such other matters as the Administrator finds in the circumstances of a particular case to be appropriate."[31] In February 1989, the Assistant Secretary for Fossil Energy assumed the delegated responsibilities of the Administrator of ERA.[32]

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

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[28] New Policy Guidelines and Delegations Order Relating to Regulation of Imported Natural Gas, 49 Fed. Reg. 6684 (Feb. 22, 1984) [hereinafter 1984 Policy Guidelines].
[29] *Id*. at 6685.
[30] *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)).
[31] DOE Delegation Order No. 0204-111, at 1; *see also* 49 Fed. Reg. at 6690.
[32] *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)).

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

A. Description of Applicant

Cameron is a limited liability company organized under the laws of Delaware, with its executive offices located in San Diego, California. Information about Cameron's corporate ownership structure is discussed below. *See infra* Section IV.B.

Cameron owns the Cameron Terminal and has an existing interconnection with Cameron Interstate. Cameron Interstate, an affiliate of Cameron, is an interstate pipeline regulated by FERC. Cameron Interstate's facilities consist primarily of a 36.2 mile pipeline connecting the Cameron Terminal with five other interstate pipelines.[33]

According to Cameron, the construction and operation of the Cameron Terminal was initially authorized in 2003.[34] In that order, FERC authorized the Cameron Terminal to send out up to 1.5 Bcf/d of regasified LNG to domestic markets. In a subsequent order, issued in 2007, FERC authorized Cameron to construct and operate additional facilities expanding the maximum send-out capacity to 1.8 Bcf/d.[35] Cameron states that it completed construction of the Cameron Terminal and placed it into service in July 2009.

The Terminal initially was used for the sole purpose of receiving and storing foreign-sourced LNG, re-gasifying such LNG, and sending it out for delivery to domestic markets. In

[33] *See* Cameron App. at 4.
[34] *Cameron LNG, LLC*, 104 FERC ¶ 61,269 (2003).
[35] *Cameron LNG, LLC*, 118 FERC ¶ 61,019 (2007).

January 2011, FERC authorized Cameron to operate the Cameron Terminal for the additional purpose of exporting previously imported (*i.e.*, foreign sourced) LNG on behalf of its customers.[36]

B. Procedural History

Cameron's procedural history with DOE/FE is summarized as follows:

FTA Order (DOE/FE Order No. 3059). On January 17, 2012, in Order No. 3059, DOE/FE granted Cameron's request to export domestically produced LNG from the existing Cameron Terminal to countries with which the United States has, or in the future enters into, a FTA requiring the national treatment for trade in natural gas (FTA countries).[37] Pursuant to that FTA Order, Cameron is authorized to export LNG, on its own behalf and as agent for other entities, in a volume equivalent to 620 Bcf/yr of natural gas for a 20-year term commencing on the earlier of the date of first export or seven years from the date the authorization was issued (January 17, 2019).[38]

Non-FTA Conditional Order (DOE/FE Order No. 3391). Two years later, on February 11, 2014, DOE/FE issued the non-FTA Conditional Order to Cameron, in which it conditionally authorized Cameron to export LNG in a volume equivalent to 620 Bcf/yr of natural gas to non-FTA countries. The export volumes authorized in Cameron's FTA Order and the Conditional Order are identical. As a condition of both the Conditional Order and this Order, the

[36] *Cameron LNG, LLC*, 134 FERC ¶ 61,049 (2011).
[37] *Cameron LNG, LLC*, DOE/FE Order No. 3059, FE Docket No. 11-145-LNG, Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Cameron LNG Terminal to Free Trade Agreement Nations (Jan. 17, 2012) [hereinafter Cameron FTA Order].
[38] *See id.* at 6-7.

volume of LNG approved for export to non-FTA countries is not additive to Cameron's FTA authorization.[39] *See infra* Sections XI.I, XIII.

Notice of Execution of LNG Tolling Agreements and Joint Agreements. On May 23, 2013, Cameron filed a Notice of Execution of LNG Tolling Agreements and Joint Agreements.[40] Cameron informed DOE/FE that it had signed LNG tolling capacity agreements for 20-year terms with each of the following three customers: GDF SUEZ S.A., Mitsui & Co., Ltd., and affiliates of Mitsubishi Corporation. According to Cameron, each agreement is for 4 mtpa of LNG. Cameron states that the tolling capacity agreements are subject to a final investment decision to proceed by each party.[41]

Change in Control Order (DOE/FE Order No. 3452). In its Application in this proceeding, Cameron stated that it was a direct, wholly owned subsidiary of Sempra LNG Holdings II, LLC (Sempra LNG Holdings), and an indirect, wholly owned subsidiary of Sempra Energy (Sempra), a publicly traded corporation. Subsequently, in February 2014, Cameron submitted a separate application requesting DOE/FE's approval to transfer indirect control of the two export authorizations that it currently holds (the FTA Order and the Conditional Order) due to a proposed change in the ownership structure of its parent company, Sempra LNG Holdings. Cameron sought DOE/FE's approval of this proposed transaction as required under DOE/FE regulations (10 C.F.R. § 590.405)[42] and the Conditional Order.[43]

[39] *See* Cameron Conditional Order at 142 (Ordering Para. C).
[40] Notice of Cameron LNG, LLC of Execution of LNG Tolling Agreements and Joint Agreements and Comments Regarding Sequencing of Application Review, FE Docket No. 11-162-LNG (May 23, 2013).
[41] References to contracts and agreements are synonymous for purposes of this Order.
[42] "Authorizations by the Assistant Secretary to import or export natural gas shall not be transferable or assignable, unless specifically authorized by the Assistant Secretary." 10 C.F.R. § 590.405.
[43] Cameron Conditional Order at 145 (Ordering Para. N, requiring DOE/FE approval prior to any change in control of the authorization holder).

Cameron stated that the interest of Sempra LNG Holdings in Cameron will be transferred to Cameron LNG Holdings LLC (Cameron Holdings), also a wholly owned subsidiary of Sempra LNG Holdings. At the same time, Sempra LNG Holdings will cause to be issued additional membership shares equal to a 49.8% interest in Cameron Holdings to affiliates of its three terminal service customers (GDF SUEZ S.A, Mitsui & Co., Ltd., and affiliates of Mitsubishi Corporation), each of which will hold a 16.6% interest. Cameron stated that only its upstream ownership structure will be affected by this transaction, and therefore it will remain the holder of both the FTA and non-FTA authorizations. Cameron further stated that the change in control will not affect the existing Cameron Terminal or modify the proposed Liquefaction Project. On this basis, DOE/FE granted Cameron's application and approved the proposed change in control on June 27, 2014, in DOE/FE Order No. 3452.[44]

C. Liquefaction Project

Cameron states that the Terminal presently consists of two marine berths, three full containment LNG storage tanks, LNG vaporizing systems, and associated utilities. According to Cameron, the proposed facilities would include natural gas pre-treatment, liquefaction, and export facilities with a capacity up to 12 mtpa of LNG, plus upgrades to the existing equipment and additional utilities.[45]

Cameron states that the Liquefaction Project facilities will permit natural gas to be received by pipeline at the Terminal, liquefied, and loaded from the Terminal's storage tanks onto vessels berthed at the existing marine facility. The Liquefaction Project will be designed to allow bi-directional service but, according to Cameron, will not increase the number of ship

[44] *See Cameron LNG, LLC*, DOE/FE Order No. 3452, FE Docket Nos. 14-001-CIC, 11-162-LNG & 11-145-LNG, Order Approving Change in Control of Export Authorizations (June 27, 2014).
[45] Cameron App. at 13.

transits currently authorized for the Terminal. The total amount of LNG processed would not exceed the current maximum authorized send-out rate of 1.8 Bcf/d from the Terminal to the interstate pipeline system.

D. Business Model

Cameron requests authorization to export LNG on its own behalf and as agent for others. In those instances in which Cameron exports LNG on its own behalf, Cameron states that it will either take title to the natural gas at a point upstream of the Cameron Terminal, or it will purchase LNG from a customer of the Terminal prior to export. In other cases, Cameron anticipates that it will act as agent for the customers of the Terminal without taking title.

To ensure that its proposed exports are lawful, Cameron states that it will comply with all DOE/FE requirements for an exporter or agent. To comply with DOE/FE requirements for an agent, Cameron states that it will register with DOE/FE each LNG title holder for whom Cameron seeks to export as agent, and will provide DOE/FE with a written statement by the title holder acknowledging and agreeing to (i) comply with all requirements in Cameron's long-term export authorization, and (ii) include those requirements in any subsequent purchase or sale agreement entered into by the title holder. Cameron also states it will file under seal with DOE/FE any relevant long-term commercial agreements that it enters into with the LNG title holders on whose behalf the exports are performed.

At the time it submitted its Application, Cameron had not yet entered into any long-term commercial agreements for the LNG it proposes to export. As noted above, however, Cameron subsequently notified DOE/FE that it has executed 20-year tolling capacity agreements with GDF SUEZ, Mitsui, and affiliates of Mitsubishi Corporation. According to Cameron, the

contracted amount represents 100 percent of the total volume of LNG authorized for export in the Conditional Order (as well as in Cameron's FTA order, DOE/FE Order No. 3059).

E. Source of Natural Gas

Cameron states that natural gas will be delivered to the Cameron Terminal, through the Cameron interstate pipeline, from five major interstate pipelines, thereby allowing access to a variety of supply options. Cameron states that the source of the natural gas will include the vast supplies of natural gas available from the Texas and Louisiana producing regions. Cameron further states that the Barnett, Haynesville, and Eagle Ford Shale formations will serve as additional sources of natural gas for the Liquefaction Project.

V. 2012 LNG EXPORT STUDY

DOE/FE's public interest analysis in the Conditional Order relied in significant part on the two-part LNG Export Study, commenced in 2011 and published in 2012.

On May 20, 2011, approximately seven months before Cameron filed its Application, DOE/FE issued *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961 (*Sabine Pass*), the Department's first order conditionally granting a long-term authorization to export LNG produced in the lower-48 states to non-FTA countries.[46] In August 2011, with other non-FTA applications pending before it, DOE/FE determined that study of the cumulative economic impact of LNG exports was warranted to better inform its public interest review under section 3

[46] *Sabine Pass*, DOE/FE Order No. 2961. In August 2012, DOE/FE granted Sabine Pass's final authorization. *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). *See also* Sabine Pass Liquefaction, LLC, DOE/FE Order No. 2961-B, FE Docket No. 10-111-LNG, Opinion and Order Denying Request for Rehearing of Order Denying Motion for Late Intervention, Dismissing Request for Rehearing of Order No. 2961-A, and Dismissing Motion for a Stay Pendente Lite (Jan. 25, 2013).

of the NGA.[47] Accordingly, 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 LNG exports.[48]

First, DOE/FE requested that EIA assess how prescribed levels of natural gas exports above baseline cases could affect domestic energy markets. EIA examined the impact of two DOE/FE-prescribed levels of assumed natural gas exports (6 Bcf/d and 12 Bcf/d) 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.[49] EIA published its study, *Effect of Increased Natural Gas Exports on Domestic Energy Markets*, in January 2012 (2012 EIA Study).[50] As detailed in the Conditional Order, 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.[51]

Second, DOE contracted with NERA to assess the potential macroeconomic impact of LNG exports. Building on the EIA Study, NERA analyzed the potential macroeconomic impacts of LNG exports under a range of global natural gas supply and demand scenarios, including scenarios with unlimited LNG exports. DOE published the NERA study, *Macroeconomic*

[47] *See Sabine Pass*, DOE/FE Order No. 2961, at 33 (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.").
[48] *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 (Federal Register Notice of Availability of the LNG Export Study).
[49] The Annual Energy Outlook (AEO) presents long-term projections of energy supply, demand, and prices. It is based on results from EIA's National Energy Modeling System (NEMS) model.
[50] *See* LNG Export Study – Related Documents, *available at* http://energy.gov/fe/downloads/lng-export-study-related-documents (EIA Analysis (Study - Part 1)).
[51] *See* Cameron Conditional Order at 23-33 (2012 EIA Study).

Impacts of LNG Exports from the United States, in December 2012.[52] 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.[53]

On December 11, 2012, DOE/FE published a Notice of Availability of the EIA and NERA studies (collectively, the LNG Export Study).[54] DOE/FE invited public comment on the LNG Export Study, and stated that its disposition of Cameron's Application and 14 other LNG export applications then pending would be informed by the Study and the comments received in response thereto.[55]

As discussed in the Conditional Order, DOE/FE received more than 188,000 initial comments and over 2,700 reply comments, of which approximately 800 were unique.[56] DOE/FE extensively reviewed and responded to these public comments in the Conditional Order.[57] Some of the comments submitted by Sierra Club, *et al*.[58] and others in response to the Notice of Availability addressed environmental issues, which DOE/FE determined were outside the scope of the LNG Export Study proceeding. In Cameron's Conditional Order, DOE/FE stated:

> [P]ersons wishing to raise questions regarding the environmental review of the present Application are responsible for doing so within the FERC proceedings.

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[52] *See* LNG Export Study – Related Documents, *available at* http://energy.gov/fe/downloads/lng-export-study-related-documents (NERA Economic Consulting Analysis (Study - Part 2)).
[53] *See* Cameron Conditional Order at 33-48 (NERA Study).
[54] 77 Fed. Reg. at 73,627.
[55] *Id*. at 73,628. DOE/FE specifically invited comment on "the impact of LNG exports on: domestic energy consumption, production, and prices, and particularly the macroeconomic factors identified in the NERA analysis, including Gross Domestic Product (GDP), welfare analysis, consumption, U.S. economic sector analysis, and … any other factors included in the analyses." *Id*. at 73,629.
[56] *See* Cameron Conditional Order at 4-5.
[57] *See id*. at 71-125 (Section VIII).
[58] In the LNG Export Study proceeding, Sierra Club filed comments on behalf of itself and a coalition of non-profit organizations, including Catskill Citizens for Safe Energy, Center for Biological Diversity, Clean Air Council, Columbia Riverkeeper, Delaware Riverkeeper, Lower Susquehanna Riverkeeper, Shenandoah Riverkeeper, and Upper Green River Alliance (collectively, Sierra Club).

> Insofar as a participant in the FERC proceeding actively raises concerns over the scope or substance of environmental review but is unsuccessful in securing that agency's consideration of its stated interests, DOE/FE reserves the right to address the stated interests within this proceeding.

Accordingly, DOE/FE has considered the environmental comments submitted in the LNG Export Study proceeding as part of the record in this proceeding. Where not already addressed in FERC's or DOE/FE's review of the intervenors' protests and comments, these issues are discussed below.

On the basis of the two-part Study and its review of the comments, DOE/FE explained that, "[t]he conclusion of the LNG Export Study is that the United States will experience net economic benefits from issuance of authorizations to export domestically produced LNG."[59] DOE/FE further found that the LNG Export Study is "fundamentally sound and supports the proposition that [Cameron's] proposed authorization will not be inconsistent with the public interest."[60]

In the Conditional Order, DOE/FE also considered more recent EIA projections in response to criticisms by commenters that the AEO 2011 projections were based on outdated data and significantly underestimated actual and future demand for natural gas. DOE/FE explained its basis for relying on the AEO 2011 projections, yet also concluded that post-AEO 2011 EIA projections would not have materially affected the findings of the LNG Export Study.[61] At the time DOE/FE issued Cameron's Conditional Order, projections from EIA's AEO 2014 Early Release Overview were the most recent available and thus were considered by DOE/FE. However, in May 2014, EIA issued its most recent update, the Annual Energy

[59] *See* Cameron Conditional Order at 130.
[60] *Id.* at 131.
[61] *See id.* at 75-79, 129-30.

Outlook 2014 (AEO 2014), with projections to 2040.[62] Below, we consider the AEO 2014 projections and conclude that they do not undermine our conclusions regarding the consistency of Cameron's proposed exports with the public interest.[63] *See infra* Section X.D. With this background, we turn to the present stage of this proceeding.

VI. FERC PROCEEDING AND GRANT OF AUTHORIZATION TO CAMERON

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 two parts: a mandatory pre-filing process during which environmental review required by NEPA commences;[64] and a formal application process that starts no sooner than 180 days after issuance of a notice that the pre-filing process has commenced.[65]

Cameron initiated FERC's NEPA pre-filing review process on July 26, 2010, when it submitted a letter to FERC requesting use of the pre-filing procedures. On August 4, 2010, the Director of the Office of Energy Projects at FERC issued a letter order in Docket No. PF10-24-000 granting Cameron's request to commence the pre-filing review process. Shortly thereafter, FERC issued a Notice of Intent to Prepare an Environmental Impact Statement of the Liquefaction and Pipeline Projects.[66]

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[62] U.S. Energy Information Administration, *Annual Energy Outlook 2014* (May 7, 2014), *available at* http://www.eia.gov/forecasts/aeo/ [hereinafter AEO 2014].
[63] *See* Cameron Conditional Order at 79.
[64] 18 C.F.R. § 157.21.
[65] 18 C.F.R. § 157.21(a)(2)(ii).
[66] *See* Cameron Interstate Pipeline, LLC, Cameron LNG, LLC; Notice of Intent To Prepare an Environmental Impact Statement for the Planned Cameron Expansion Project and Cameron LNG Liquefaction Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting, 77 Fed. Reg. 48,145 (Aug. 13, 2012).

DOE agreed to participate as a cooperating agency in FERC's preparation of Cameron's environmental assessment,[67] as set forth in the Notice of Intent.[68] Consistent with its practice, FERC mailed the Notice of Intent to federal, state, and local government representatives and agencies, elected officials, environmental and public interest groups, Native American Tribes, other interested parties, and local libraries and newspapers.

B. FERC's Environmental Review

On December 26, 2012, Cameron began the second part of FERC's approval process by filing its formal application in FERC Docket No. CP13-25-000 for authorization to site, construct, and operate the Liquefaction Project under NGA section 3. For purposes of hearing and decision, FERC reviewed Cameron's Application in conjunction with Cameron Interstate's application for the Pipeline Project.

As noted above, FERC issued its draft EIS for the Project on January 10, 2014. FERC mailed the draft EIS to persons likely to have an interest in the EIS, including various environmental and public interest groups. On April 30, 2014, FERC issued a final EIS, which was published in the *Federal Register* on May 7, 2014, and addressed timely comments received on the draft EIS. The final EIS was mailed to the same parties as the draft EIS, as well as to those who commented on the draft EIS.

The final EIS addresses numerous environmental issues including potential impacts on wetlands, essential fish habitat, federally listed species, traffic, noise, air quality, cumulative environmental effects, and public safety.[69] FERC staff concluded that "construction and

[67] 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."); *see also id.* § 1501.6(b) (responsibilities of a cooperating agency).
[68] *See* 77 Fed. Reg. at 48,146.
[69] Final EIS at ES-4.

operation of the Cameron Liquefaction Project would result in mostly temporary and short-term environmental impacts."[70] Based on its environmental analysis, FERC staff identified 76 recommended mitigation measures. FERC staff determined that implementation of the mitigation measures proposed by Cameron, as well as FERC's recommended mitigation measures, "would ensure that impacts in the Project area would be avoided or minimized and would not be significant."[71] FERC staff recommended that, if FERC approved Cameron's requested authorization, the 76 mitigation measures outlined in the final EIS be included as conditions of FERC's order.[72]

C. FERC's Order Granting Cameron's Authorization

On June 19, 2014, FERC issued its Order granting Cameron's requested authorization to site, construct, and operate the proposed Liquefaction Project and a certificate to Cameron Interstate to construct and operate the associated Pipeline Project.

FERC concluded that Sierra Club's claims with respect to purported adverse impacts of induced natural gas production had no bearing on the FERC proceeding because Sierra Club did not identify any induced production specifically connected to the Cameron proposal. FERC further concluded that, with the 76 environmental conditions required by its Order, Cameron's Liquefaction Project would result in "only minimal environmental impacts and can be constructed and operated safely," and thus was not inconsistent with the public interest.[73] On this basis, FERC adopted the 76 mitigation measures recommended in the EIS as environmental conditions of its Order.[74]

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[70] *Id*. at 5-1.
[71] *See id*.
[72] *Id*. at 5-14.
[73] FERC Order at 11.
[74] *See id*. at 29, 31-46.

FERC also addressed Sierra Club's contention that the EIS was deficient because it failed to consider the indirect effects of induced gas production associated with the Liquefaction Project. FERC cited NEPA regulations implemented by the Council on Environmental Quality (CEQ), which state that "indirect effects" of a proposed action are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable."[75] FERC noted that the EIS considered the indirect effects of construction and operation of the Liquefaction Project on, among other things, vegetation, communities, public parks, socioeconomic impacts, and noise. FERC concluded, however, that "induced production is not caused by the Liquefaction Project; no specific shale-play has been identified as a source of natural gas for the project, nor has Sierra Club identified any."[76]

FERC stated that even if, for the sake of argument, it agreed that the Liquefaction Project would cause induced production, such production is not reasonably foreseeable. FERC noted that the Liquefaction Project will receive natural gas via interconnections with five major interstate pipelines. According to FERC, these pipelines cross multiple shale gas and conventional gas plays. Through their interconnections with other pipeline systems, these pipelines effectively provide access to essentially all of the production areas in the lower-48 states. Thus, FERC concluded it would be speculative to try to determine where the natural gas processed by the Liquefaction Project would originate, or where the wells, gathering line locations, and the potential associated environmental impacts would occur.[77]

Next, FERC addressed Sierra Club's assertion that the EIS failed to consider the cumulative environmental impacts from all proposed export terminals, including export

[75] 40 C.F.R. § 1508.8(b).
[76] FERC Order at 25.
[77] *Id*. at 25-26.

applications pending or approved by DOE. FERC found no merit in Sierra Club's argument, concluding that Sierra Club effectively was seeking a programmatic EIS for a program that is not before the Commission.[78] FERC found that the EIS properly considered cumulative impacts involving reasonably foreseeable liquefaction and export projects, and other reasonably foreseeable oil and gas facilities in the vicinity of the proposed Project. FERC took notice of the EIS conclusion that the potential impacts of any reasonably foreseeable projects, when combined with the impacts of the proposed Liquefaction Project, would not result in significant cumulative impacts.[79]

Because Cameron's proposed pipeline route overlaps existing rights-of-way, and the remainder of the route is adjacent or parallel to existing rights of way, FERC noted that the EIS found no need to evaluate alternative pipeline routes. The EIS evaluated 12 system alternatives for the Liquefaction Project, including five operating LNG import terminals in the Gulf of Mexico area, and seven proposed or planned liquefaction and export projects along the Gulf Coast. FERC noted that all of the systems were eliminated from further consideration for reasons that include the need for substantial construction beyond that currently proposed, production volume limitations, in-service dates scheduled significantly beyond Cameron LNG's commitments to its customers, and environmental impacts that were considered comparable to or greater than those of the proposed Project.

FERC stated that the final EIS also considered a system alternative that would consist of two or more export facilities providing the required amount of LNG to fulfill Cameron LNG's contractual agreements with customers. According to FERC, that alternative was also eliminated

[78] *See id*. at 26.
[79] *See id*. at 26-27.

from further consideration for the same reasons as the other alternatives. Additionally, the EIS analyzed facility locations for the Liquefaction Project that would eliminate or lessen impacts on wetlands. According to FERC, however, these locations would be greater than five miles from the proposed facility and thus did not warrant additional consideration.[80]

FERC stated that it reviewed the information and analyses contained in the record regarding the potential environmental effects of the Liquefaction and Pipeline Projects, including the draft EIS, public comments, and the final EIS. FERC agreed with the conclusions presented in the EIS and found that approval of the Liquefaction and Pipeline Projects, if constructed and operated as described in the EIS, is "an environmentally acceptable action."[81] FERC granted both Cameron's and Cameron Interstate's requested authorization and imposed the 76 environmental mitigation measures as conditions to the FERC Order.[82]

VII. CURRENT PROCEEDING BEFORE DOE/FE

A. Overview

As noted above, the Conditional Order (DOE/FE Order No. 3391) conditionally granted Cameron's Application but reserved the environmental issues raised in the proceeding for future review and decision. In its Application in this proceeding, Cameron states that the export of LNG from the United States provides consuming nations with access to natural gas as an alternative to more carbon-intensive fuels such as coal and fuel oil. Cameron asserts that LNG will displace consumption of coal in power generation and deter the construction of coal-fired generation capacity in many locations around the world. Cameron argues that LNG will act as a bridge until some countries can develop their own unconventional natural gas resources.

[80] *See* FERC Order at 27.
[81] *Id*. at 28.
[82] *See id*. at 28-29.

Cameron contends that the potential reductions in global greenhouse gas emissions, and other undesirable byproducts of coal- or oil-fired generation, are substantial. Two parties protested the Application—the American Public Gas Association (APGA) and Sierra Club.

B. APGA's Protest of Cameron's Application

APGA filed a Motion for Leave to Intervene and Protest on April 23, 2012.[83] APGA's protest is mainly directed at the potential economic impacts of Cameron's proposed authorization, addressed in the Conditional Order. Insofar as APGA's protest can be construed as environmental in nature, APGA's argument (also made by Sierra Club) is that exports of domestically produced LNG will increase domestic natural gas prices, which in turn will decrease the capacity for natural gas to displace coal in domestic electric generation. This concern is addressed below. *See* Section X.C.1.

C. Sierra Club's Protest of Cameron's Application

Sierra Club (filing alone) filed a Motion to Intervene, Protest, and Comments on April 23, 2012.[84] All of Sierra Club's comments, except those addressing the environmental impacts of Cameron's proposal, were summarized and addressed in the Conditional Order.[85]

With respect to the environmental impacts associated with the proposed exports, Sierra Club makes many of the same arguments that it submitted in both FERC's Cameron proceeding and DOE/FE's LNG Export Study proceeding. Sierra Club argues that Cameron's proposal will have significant adverse environmental impacts not addressed in Cameron's Application. Sierra Club asserts that Cameron's proposed exports will lead to increased natural gas production,

[83] Cameron LNG, LLC, FE Docket No. 11-162-LNG, Motion for Leave to Intervene and Protest of the American Public Gas Association (Apr. 23, 2012) [hereinafter APGA Mot.].
[84] Cameron LNG, LLC, FE Docket No. 11-162-LNG, Sierra Club's Motion to Intervene, Protest, and Comments (Apr. 23, 2012) [hereinafter Sierra Club Mot.].
[85] Cameron Conditional Order at 126-35.

especially from unconventional resources such as shale, which would significantly harm air, water, and landscape resources. Similar to the argument made by APGA, Sierra Club also contends that Cameron's proposal will lead to increased domestic natural gas prices, which will increase domestic coal use and consequent air and water pollution.

Sierra Club asserts that natural gas production, from both conventional and unconventional sources, is a significant cause of environmental harm, disrupting ecosystems and watersheds. Sierra Club contends that a 2011 report of the Shale Gas Production Subcommittee of the Secretary of Energy Advisory Board identifies "a real risk of serious environmental consequences" resulting from continued expansion of shale gas production.[86] According to Sierra Club, LNG exports will induce further gas production, primarily from shale gas. Citing the 2012 EIA Study, Sierra Club states that shale gas sources would account for roughly 72% of the increase in domestic natural gas production expected to meet the demand of LNG exports. Sierra Club points out that Cameron's argument that the proposed project will create economic benefits rests largely on the premise that the proposed project will induce further shale gas extraction. Sierra Club states that it agrees with Cameron that LNG exports will induce additional natural gas extraction, and shale gas extraction in particular.

Sierra Club states that natural gas production is a major source of air pollution, both as direct emissions from production equipment and indirect emissions caused by natural gas replacing cleaner energy sources. Sierra Club claims that natural gas production operations emit methane (CH_4), volatile organic compounds (VOCs), nitrogen oxides (NOx), sulfur dioxide (SO_2), hydrogen sulfide (H_2S), particulate matter (PM), and significant quantities of hazardous

[86] Sierra Club Mot. at 14 (citing Secretary of Energy Advisory Board, *Shale Gas Production Subcommittee Second 90-Day Report* (Nov. 18, 2011) at 10).

air pollutants (HAPs) that contribute to cancer risks and other acute public health problems. Sierra Club asserts that methane is the dominant pollutant from the oil and gas sector, and that EPA has identified natural gas systems as the largest contributor to anthropogenic methane emissions in the United States.

Sierra Club argues that methane is a potent greenhouse gas that substantially contributes to global climate change while also causing environmental harm as an ozone precursor. Sierra Club points out that due to methane's effects on climate, EPA has found that methane, along with five other greenhouse gases, endanger the public health and welfare within the meaning of the Clean Air Act. Sierra Club states that methane also reacts in the atmosphere to form ozone, which damages vegetation, agricultural productivity, and cultural resources.

Sierra Club claims the natural gas industry is also a major source of VOCs and NOx. Sierra Club asserts that, as a result of significant VOC and NOx emissions associated with oil and gas development, numerous areas of the country with heavy concentrations of drilling are now suffering from serious ground-level ozone problems (smog). As one example, Sierra Club states that, in 2008, the Colorado Department of Public Health and Environment concluded that the smog-forming emissions from oil and gas operations exceed vehicle emissions for the entire state.[87] According to Sierra Club, smog pollution harms respiratory systems and has been linked to premature death, heart failure, chronic respiratory damage, and premature aging of the lungs. Sierra Club states that significant ozone pollution also damages plants and ecosystems. Sierra Club asserts that as oil and gas development moves into new areas, particularly as a result of the boom in shale resources, ozone problems are likely to follow.

[87] Sierra Club Mot. at 20 (citing Colo. Dept. of Public Health & Env't, Air Pollution Control Division, Oil and Gas Emission Sources, *Presentation for the Air Quality Control Commission Retreat*, at 3-4 (May 15, 2008)).

Sierra Club argues that oil and gas production also emits sulfur dioxide, primarily from natural gas processing plants, and that some natural gas in the United States contains hydrogen sulfide. Sierra Club asserts that hydrogen sulfide emissions from the oil and gas industry are especially concerning because the pollutant may be harmful even at low concentrations and can lead to neurological impairment or even death. Sierra Club states that long-term exposure to hydrogen sulfide is linked to respiratory infections, eye, nose, and throat irritation, breathlessness, nausea, dizziness, confusion, and headaches. Sierra Club reports that EPA has concluded that the potential for hydrogen sulfide emissions from the oil and gas industry is "significant."[88]

Sierra Club states that the oil and gas industry is also a major source of PM pollution, which is generated by heavy equipment used to move and level earth during well pad and road construction. According to Sierra Club, PM consists of tiny particles of a range of sizes suspended in air. Sierra Club states that PM causes a wide variety of health problems and has been linked to respiratory and cardiovascular problems, including coughing, painful breathing, aggravated asthma attacks, chronic bronchitis, decreased lung function, heart attacks, and premature death.

Sierra Club maintains that, based on recent information, the air quality impacts of natural gas production may be even greater than it currently estimates. Sierra Club cites a study based on direct monitoring of natural gas operations in Colorado, which (according to Sierra Club) finds that actual emissions from natural gas are larger than EPA's estimates and that

[88] *Id.* at 22 (quoting U.S. Envtl. Prot. Agency, Office of Air Quality Planning and Standards, *Report to Congress on Hydrogen Sulfide Air Emissions Associated with the Extraction of Oil and Natural Gas* (EPA-453/R-93-045), at III-35 (Oct. 1993)).

unconventional gas drilling is linked to increased cancer risk.[89] According to Sierra Club, EPA's recently-finalized new source performance standards and standards for HAPs will reduce some of the pollution problems from natural gas production, but they will not solve them.[90] For this reason Sierra Club argues that DOE/FE may not rely on EPA's rules to avoid the obligation to fully weigh and disclose the air pollution impacts associated with Cameron's proposed Liquefaction Project.

In addition to the air pollution impacts of natural gas production, Sierra Club argues that increased natural gas production will transform the landscape of regions overlying shale gas plays, bringing industrialization to previously rural landscapes and significantly affecting ecosystems, plants, and animals. According to Sierra Club, land use disturbance associated with natural gas development impacts plants and animals through direct habitat loss, where land is cleared for natural gas uses, and indirect habitat loss, where land adjacent to direct losses loses some of its important characteristics. As an example, Sierra Club cites a study of the Nature Conservancy, which (according to Sierra Club) found that a third of the species tracked by the Pennsylvania Natural Heritage Program are found in areas of the Marcellus Shale play projected to have a high probability of well development, with 132 species considered to be globally rare or critically endangered or imperiled.[91]

Sierra Club argues that natural gas production also poses risks to ground and surface water. Sierra Club notes that hydraulic fracturing involves a process of injecting various fracturing chemicals into gas-bearing formations at high pressures to fracture rock and release

[89] *Id*. at 24 (citing, *e.g.*, G. Pétron *et al.*, Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study, 117 J. of Geophysical Research 4304, DOI 10.1029/2011JD016360 (2012)).
[90] *Id*. at 25. *See infra* Section X.B, X.C.1.
[91] Sierra Club Mot. at 27 (citing the Nature Conservancy, *Pennsylvania Energy Impacts Assessment, Report 1: Marcellus Shale Natural Gas and Wind* (2010) at 29)).

natural gas. According to Sierra Club, each step of this process presents a risk to water resources. Sierra Club states that hydraulic fracturing requires large quantities of water and that the large water withdrawals could drastically impact aquatic ecosystems and human communities. Sierra Club also contends that hydraulic fracturing poses a serious risk of groundwater contamination from the chemicals added to the fracturing fluid and from naturally occurring chemicals mobilized during the hydraulic fracturing process from formations below the water table. Sierra Club asserts that contamination can occur through several methods, including where the well casing fails or where the fractures created through drilling intersect an existing, poorly sealed well. Sierra Club asserts that hydraulic fracturing has resulted in groundwater contamination in at least five documented instances and that EPA has found groundwater contamination likely resulting from hydraulic fracturing in Pavillion, Wyoming, and Dimock, Pennsylvania.[92]

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

[92] *Id.* at 31-33 (citing U.S. Envtl. Prot. Agency, *Draft Investigation of Ground Water Contamination near Pavillion, Wyoming* (Dec. 2011) and EPA Region III, *Action Memorandum - Request for Funding for a Removal Action at the Dimock Residential Groundwater Site* (Jan. 19, 2012)).

fracturing wastewater appears to have induced earthquakes in several regions—an issue known as "induced seismicity."

Sierra Club states that, in addition to the above-described production-related impacts, Cameron's export proposal will increase air pollution by increasing the amount of coal used for domestic electricity production. Citing the 2012 EIA Study, Sierra Club states that exports will cause natural gas prices to rise, leading to increased electricity generation from coal. Specifically, EIA projected that 72 percent of the decrease in natural gas-fired electricity production due to gas exports will be replaced by coal-fired production, which, according to Sierra Club, will increase emissions of both traditional air pollutants and greenhouse gases. Sierra Club argues that if DOE/FE allows exports of LNG, national efforts to control global warming will be frustrated and the public health and welfare will be endangered.

Sierra Club argues that Cameron overstates the benefits of the project. Sierra Club claims that the liquefaction, transportation, and regasification process is energy intensive and increases the lifecycle greenhouse gas emissions of LNG compared to methods of consumption where the natural gas remains in gaseous phase. Sierra Club argues that for this reason, LNG has little, if any, greenhouse gas emissions advantage over coal, and thus it is unlikely LNG exports would reduce global greenhouse gas emissions.

D. Cameron's Answer to APGA's and Sierra Club's Protests

In response to both APGA's and Sierra Club's protests, on May 8, 2012, Cameron filed an Answer to Motions to Intervene, Protests, and Comments.[93] Cameron argues that Sierra Club primarily raises general environmental concerns related to the exploration and production of

[93] Cameron LNG, LLC, FE Docket No. 11-162-LNG, Answer of Cameron LNG, LLC to Motions to Intervene, Protests, and Comments (May 8, 2012).

shale gas, and therefore its arguments are irrelevant to this proceeding. According to Cameron, such arguments could be germane to local permitting proceedings for natural gas exploration and production facilities, but they are irrelevant in this proceeding addressing the export of LNG. Cameron argues that DOE/FE is not required to consider the environmental impacts of a proposed project in determining whether the public interest warrants approval of the proposal. Rather, Cameron states, any environmental impacts associated with the Liquefaction Project are analyzed during the NEPA review, and therefore are properly considered in the FERC proceeding.

Next, Cameron contends that Sierra Club seeks to have DOE/FE expand the public interest standard of the NGA into a generalized review of drilling and production techniques that may or may not be used in the future to deliver natural gas to the Cameron Terminal. Quoting a FERC order, Cameron states:

> The words 'public interest' in a regulatory statute [are] not a broad license to promote the general public welfare, but the words take meaning from the purposes of the regulatory legislation .. .. [I]n the case of the NGA, the purpose is to encourage the orderly development of plentiful supplies of natural gas at reasonable prices.[94]

Cameron contends it has demonstrated that the authorization sought in the Application is in the public interest. According to Cameron, the protests submitted in this proceeding are insufficient to overcome the presumption in favor of granting Cameron's Application for authorization to export LNG to non-FTA countries.

Cameron also argues that, in acting as a cooperating agency in the NEPA process, DOE/FE is not required to conduct its own independent NEPA analysis and may rely on a favorable NEPA analysis from FERC. Addressing Sierra Club's concerns over the

[94] *Id*. at 8 (quoting *North Baja Pipeline, LLC*, 123 FERC ¶ 61,073, at 81 (2008).

environmental impacts of hydraulic fracturing and harm from increased natural gas production, Cameron states that DOE/FE's review is limited to the exportation of LNG from the Cameron Terminal. For that reason, Cameron contends that conducting a detailed NEPA analysis of the issues associated with Marcellus Shale production is not appropriate in the environmental review of the proposed Liquefaction Project.

Cameron cites FERC's decision in *Central New York Oil and Gas Company, LLC*[95] in which FERC held that Marcellus Shale development and its associated effects were not sufficiently causally-related to a pipeline that had been proposed in the region. Cameron argues that, likewise, its proposal is not dependent on the development of Marcellus Shale production, and therefore is not sufficiently causally connected to warrant consideration of such impacts in a NEPA analysis. Cameron asserts that, even if a causal connection did exist, any potential impacts would not be reasonably foreseeable, and thus would be outside the scope of NEPA review. Cameron contends that an environmental analysis of production wells is more appropriately within the purview of the state regulatory bodies that regulate the siting, permitting, construction, and operation of such wells.

E. Sierra Club's Reply to Cameron's Answer

Sierra Club filed a Motion to Reply and Reply Comments on May 23, 2012.[96] In Sierra Club's Motion to Reply, Sierra Club argues that induced gas production is a reasonably foreseeable consequence of approving LNG exports. Sierra Club notes that Cameron relies on induced production in arguing that LNG exports will create additional jobs through increased production. Sierra Club argues that Cameron urges DOE/FE to use one standard of

[95] *Central New York Oil and Gas* Company, 137 FERC ¶ 61,121 at 92-95 (2011) (Order Issuing Certificate).
[96] Cameron LNG, LLC, FE Docket No. 11-162-LNG, Sierra Club's Motion to Reply and Reply Comments (May 23, 2012).

foreseeability when assessing economic benefits and another, more stringent standard when assessing environmental impacts. Sierra Club cites a decision of the United States Court of Appeals for the D.C. Circuit in which the court held there was no reason to believe environmental forecasts would be any less accurate than forecasts of economic benefits, and that an agency could not impose a higher standard of certainty on environmental review.[97] Sierra Club further argues that, to determine the environmental impacts of Cameron's proposal, it is not necessary to identify each hypothetical or potential gas production site that might one day be developed. Sierra Club asserts that DOE/FE must perform a macro-level analysis of the aggregate impact of wells sufficient to provide the natural gas the project will require.

Sierra Club also argues that state regulation of natural gas production does not relieve DOE/FE of the obligation to consider the environmental impacts of induced natural gas production. Finally, Sierra Club asserts that Cameron provided no meaningful response to Sierra Club's characterization of the environmental harms caused by increased natural gas production from LNG exports, and states that Sierra Club produced the only material in the record regarding environmental effects.

F. Cameron's Answer to Sierra Club's Reply

On June 7, 2012 Cameron filed an Answer in Opposition to Sierra Club's Motion to Reply and Reply Comments.[98] Cameron reiterates that Sierra Club fails to overcome the rebuttable presumption of NGA Section 3(a) that LNG exports are in the public interest. Cameron again argues that Sierra Club is incorrect in asserting that DOE/FE must consider

[97] *Id.* at 5 (citing *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n*, 481 F.2d 1079, 1092 (D.C. Cir. 1973)).
[98] Cameron LNG, LLC, FE Docket No. 11-162-LNG, Answer of Cameron LNG, LLC in Opposition to Sierra Club's Motion to Reply and Reply Comments (June 7, 2012).

environmental issues as part of the public interest determination and that FERC, as the lead agency performing the NEPA analysis, is the proper agency before which any environmental arguments need to be made.

Cameron also rejects Sierra Club's continued calls for DOE/FE to consider the potential environmental effects of additional shale gas production induced by LNG exports. Cameron cites three occasions that FERC has rejected the argument that a NEPA analysis must take into account the general effects of increased shale gas production.[99] In each case, Cameron contends that FERC determined that shale gas development and associated potential environmental impacts were not sufficiently causally related to the natural gas project to warrant the type of review that Sierra Club seeks in this proceeding. Additionally, Cameron asserts that, in each case, FERC found that the environmental effects of the type invoked by Sierra Club were not "reasonably foreseeable" under the CEQ regulations, not because shale gas production is not reasonably foreseeable in a general sense, but because impacts from specific new well sites and related environmental effects at such sites are highly speculative and cannot be estimated in any meaningful way.

Cameron further contends that Sierra Club confuses the statutory obligations of a public interest analysis under NGA Section 3(a) and an environmental review under NEPA when Sierra Club argues that Cameron relies on the benefits of increased natural gas production for its conclusion that the Liquefaction Project is in the public interest, but does not consider cumulative and indirect effects of increased production in a NEPA analysis. Cameron maintains

[99] *See id*. at 6 (citing *Texas Eastern Transmission, LP*, 139 FERC ¶ 61,138 at 70-73 (2012); *Sabine Pass Liquefaction, LLC*, 139 FERC ¶ 61,039 at 94-99 (2012); *Central N.Y. Oil & Gas Co.*, 137 FERC ¶ 61,121 at 81-107 (2011), *reh'g denied*, 138 FERC ¶ 61,104 at 33-56 (2012), *petition denied, Coalition for Responsible Growth & Resource Conserv. v. FERC*, 485 Fed. Appx. 472 (2012)).

that it is possible that benefits from LNG exports to the economy and the security of the United States can (and should) be identified for purposes of DOE/FE's public interest analysis, while at the same time causal, reasonably foreseeable effects are not identifiable for purposes of a NEPA analysis.

VIII. 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.[100] DOE provided a summary of the comments received and responses to substantive comments in Appendix B of the Addendum.[101] 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

[100] Addendum at 3.
[101] *Id*. at 79-151.

Export Study, projected that more than 90% of the incremental natural gas produced to supply LNG exports would come from these unconventional sources.[102]

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.

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.[103] 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, the following table captures differences in water intensity across energy sources.

[102] *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).
[103] Addendum at 10.

Table 1: Water Intensity[104]

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

The Addendum also explains that, despite its relatively low long-term water intensity, shale gas production could impact water supply in specific areas, particularly arid regions such as the Eagle Ford Shale play in Texas. The Addendum notes that the relationship between shale gas production and water quantity is principally a local issue, and that the degree of impact depends on "the local climate, recent weather patterns, existing water use rates, seasonal fluctuations, and other factors."[105] The following table shows the variation in the proportion of water usage by activity in shale gas regions:

[104] *Id*. at 11 (Table 2).
[105] *Id*. at 12.

Table 2: Water Usage in Shale Gas Regions[106]

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

[*Bgal/yr = billion gallons per year]

2. Water Quality

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

Runoff from the construction of access roads and other earth-disturbing activities can lead to temporary increases in turbidity and sedimentation in surface waters when well sites are being developed. However, the Addendum states that "when standard industry practices and preventative measures are deployed, only minor impacts are likely to result."[107]

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

[106] *Id.* at 12 (Table 3) (citations omitted).
[107] *Id.* at 13.

protect fresh water aquifers.[108] 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.[109]

The fluid used for hydraulic fracturing consists of over 98 percent water, but also may include several different chemical compounds.[110] 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.[111] Further, chemical additives may contaminate groundwater should the integrity of the casing or cement seal of the well be compromised.[112]

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

[108] 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).
[109] *Id.* at 14.
[110] *Id.* at 14-15.
[111] *Id.* at 18.
[112] *Id.*

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."[113] 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."[114]

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 the table below:

[113] Addendum at 19.
[114] *Id.* at 19.

Table 3: Source Categories of Airborne Emissions from Upstream Natural Gas Activities (EPA, 2013)[115]

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[116] and EPA's 2013 update to those standards covering storage tanks.[117] 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

[115] *Id*. at 23 (Table 6).
[116] *Id*. at 20-22.
[117] *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.[118]

C. GHG Emissions

Separate from the LCA GHG Report described below in Section IX, 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.[119] 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.[120]

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[118] *Id*. at 32.
[119] 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).
[120] *Id*. at 44.

Finally, the Addendum summarizes the existing literature estimating GHG emissions and methane leakage rates from the upstream natural gas industry, noting that most studies suggest that "emissions of GHGs from the upstream industry are of similar magnitude for both conventional and unconventional sources."[121]

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."[122] 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."[123] 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

[121] *Id.* at 40.
[122] *Id.* at 51.
[123] *Id*. at 52.

principally one of alarm to the public and minor property damage, as opposed to significant disruption.[124]

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."[125] 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."[126] 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.

IX. 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

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

for use in electric power generation. The study was intended to inform DOE/FE's decisionmaking 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*.[127] On June 4, 2014, DOE/FE provided notice of the documents in the *Federal Register* and invited public comment.[128] 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* Section IX.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?

[127] *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*].

[128] 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 Cameron's 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.[129]

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 below:

Table 4: LCA GHG Scenarios Analyzed by NETL[130]

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	The power plant is located near the LNG import site.

[129] 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.
[130] The four scenarios are set forth in the LCA GHG Report at 2.

	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.	
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.[131] • It is transported by pipeline directly to a natural gas power plant in either Europe or Asia.	The pipeline distance was calculated based on a "great circle distance" (the shortest possible distance between two points on a sphere) between the Yamal district in Siberia and a power plant located in either Rotterdam or Shanghai.
4	• Coal is extracted in either Europe or Asia. It is transported by rail to a domestic coal-fired power plant.	This scenario models two types of coal widely used to generate steam-electric power: surface mined sub-bituminous coal and underground mined bituminous coal. Additionally, U.S. mining data and U.S. plant operations 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.

[131] Yamal, Siberia, was chosen as the extraction site because that region accounted for 82.6% of natural gas production in Russia in 2012.

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.[132] NETL also assumed that the efficiencies used at the destination power plants (in Rotterdam and Shanghai) were the same as those used in the U.S. model.

5. Coal Modeling Approach

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

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

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,[133] (3) coal type (sub-bituminous or bituminous),[134] (4) the flaring rate for natural gas,[135] (5) transport distance (ocean tanker for LNG transport, and rail for coal transport),[136] and (6) the efficiency of the destination power plant.

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

[133] 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.
[134] The modeling parameters and values for the coal scenarios are provided in Table 5-3. *See* LCA GHG Report at 6.
[135] 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.
[136] The distances used for pipeline transport of Russian gas are provided in Table 5-2. *See id*. at 6.

distance from Russia.[137] 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).[138]

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.[139] 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).[140]

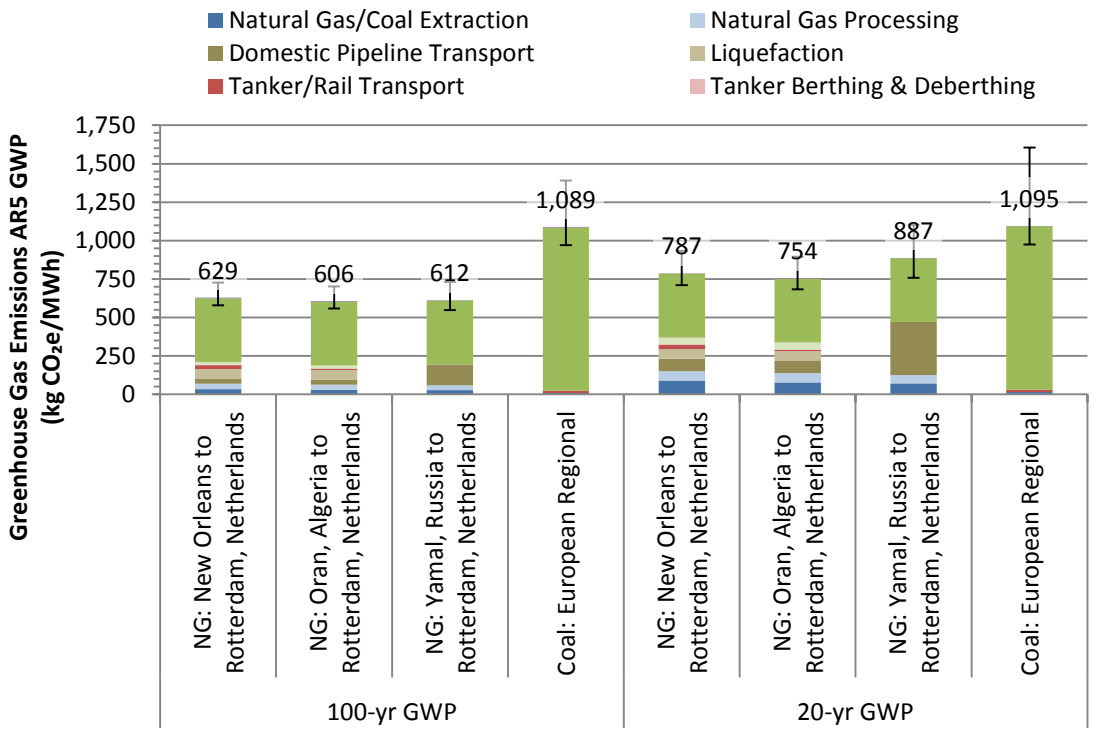
7. Results of the LCA GHG Report

NETL states that two primary conclusions may be drawn from the LCA GHG Report.[141] 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, NETL's analysis indicates that, for most scenarios in both the European and Asian regions, the generation of

[137] *See* LCA GHG Report at 5.
[138] The methane leakage breakeven analysis is described in the LCA GHG Report at 14 and 15.
[139] *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.
[140] The study limitations are described in the LCA GHG Report at 18.
[141] NETL's detailed study results, with corresponding figures, are set forth on pages 8 through 18 of the LCA GHG Report.

power from imported natural gas has lower life cycle GHG emissions than power generation from regional coal.[142] (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.

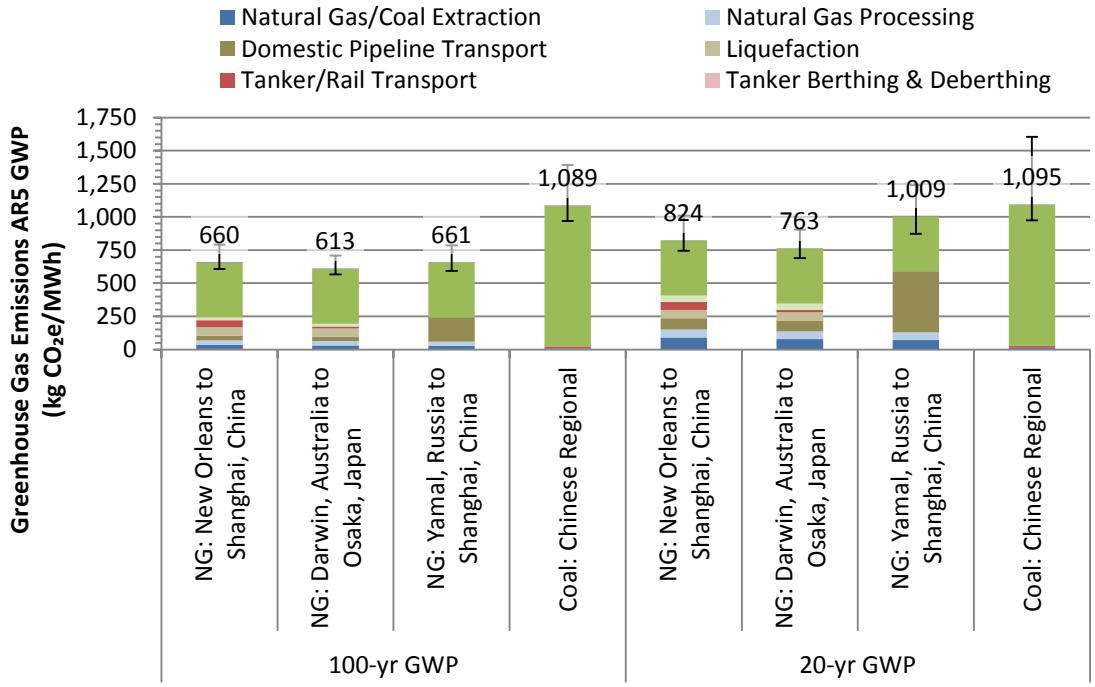
Table 5: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe[143]



[142] 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.

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

Table 6: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia[144]



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

[144] LCA GHG Report 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.[145]

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

[145] 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.

The following table 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 7: 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,[146] Food & Water Watch,[147] 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.

[146] 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.

[147] 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 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.[148] 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, and Freeport (each of whom has been conditionally granted a non-FTA LNG export order by DOE/FE) that, according to API, produce 0.26, 0.29 and 0.12 tonnes of CO_2e per tonne of LNG, respectively. The majority of a liquefaction facility's energy is generated by combusting incoming natural gas, so the GHG intensity of a liquefaction facility is directly related to its efficiency. As API correctly points out, the LCA model assumes a GHG intensity of 0.44 tonnes of CO_2e per tonne of LNG; this GHG

[148] 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.

intensity is representative of a facility that consumes 12% of incoming natural gas as plant fuel.[149]

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, and Freeport facilities) would lead to a 6% reduction in the feed rate of natural gas to the liquefaction plant.[150] 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.

[149] 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.
[150] *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,[151] 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.[152] They also match the factors used by EPA's 2013 GHG inventory.[153]

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

[151] 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.
[152] *Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production: Summary and Analysis of API and ANGA Survey Responses.* Final Report (Sept. 21, 2012).
[153] 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.[154] When liquids unloading is added to unconventional natural gas in our 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 natural gas processing, liquefaction, ocean transport, regasification, power plant operations, and

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

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 will be in full effect by January 2015, 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.[155] The LCA GHG Report does not account for the potential effects of the NSPS rules on natural gas emissions because the scope of the LCA accounts for GHG emissions from natural gas being produced today. EPA's Regulatory Impact Analysis estimated that the final NSPS rule would reduce annual methane emissions in 2015 by 18 million metric tons, meaning

[155] 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.

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

(3) Coal Methane Data

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

Methane emissions from coal mines are based on data collected by EPA's Coalbed Methane Outreach Program and have been organized by coal type and geography. Due to data limitations, the LCA GHG Report used this data as a proxy for emissions from foreign coal. This limitation is noted in the LCA GHG Report and is accounted for by uncertainty.[157] The bounds on coal methane uncertainty were informed by the variability in coal mine methane

[156] 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.

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

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.

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%.[158] 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 released to the atmosphere, and 0.068 kg is flared by environmental controls or combusted for processing and transmission energy.

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

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.[159] Again, a boundary difference explains why the two leakage rates are not directly comparable. Burnham et al.'s leakage rate includes natural gas distribution, which is an additional transport step beyond transmission. Natural gas distribution moves natural gas from the "city gate" to small scale end users (commercial and residential consumers). NETL's leakage rate ends after natural gas transmission, the point at which natural gas is available for large scale end users such as power plants. The natural gas distribution system is a highly-branched network that uses vent-controlled devices to regulate pressure. This boundary difference explains why Burnham et al.'s leakage rate is higher than NETL's rate. Sierra Club

[159] 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.

also compares NETL's leakage rate to a shale gas analysis conducted by Weber et al.[160] 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[161] 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.

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.[162] 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

[160] 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.
[161] 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).
[162] 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.

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.

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.

X. DISCUSSION AND CONCLUSIONS

In reviewing the potential environmental impacts of Cameron'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. To accomplish these purposes, DOE/FE has reviewed a wide range of information, including:

- Cameron's Application and the submissions of protestors, intervenors, and commenters to the Application;

- FERC's final EIS and June 19 Order, including the 76 environmental conditions recommended in the final EIS and adopted by FERC in that Order;
- Comments regarding potential environmental impacts submitted in response to the 2012 LNG Export Study;
- The Draft Addendum, comments received in response to the Draft Addendum, and the final Addendum; and
- The LCA GHG Report (and the supporting NETL document), including comments submitted in response to those documents.

A. Compliance with NEPA

1. Adoption of FERC's Final EIS

DOE/FE participated in FERC's environmental review of the proposed Liquefaction Project as a cooperating agency and has examined the arguments submitted by the intervenors who challenged FERC's reasoning and conclusions. Because DOE was a cooperating agency, DOE/FE is permitted to adopt FERC's final EIS, provided that DOE/FE has conducted an independent review of the EIS and determines that its comments and suggestions have been satisfied.[163] For the reasons set forth below, DOE/FE has not found that the arguments raised in the FERC proceeding, the current proceeding, or the LNG Export Study proceeding detract from the reasoning and conclusions contained in the final EIS. Accordingly, DOE has adopted the EIS (DOE/EIS-0488),[164] and hereby incorporates the reasoning contained in the EIS in this Order.

2. Scope of NEPA Review

Sierra Club intervened in Cameron's proceeding before FERC, challenging the adequacy of the draft EIS. Sierra Club asserted that the draft EIS did not have a sufficiently broad scope because it failed to consider the indirect effects of induced natural gas production associated with

[163] *See* 40 C.F.R. § 1506.3(c).
[164] *See supra* Section I (citing 79 Fed. Reg. 48,140).

the Liquefaction Project.[165] FERC rejected Sierra Club's argument. FERC found that Sierra Club had not demonstrated that the Liquefaction Project would induce additional upstream gas production. Even assuming that the Liquefaction Project would induce additional gas production, FERC found that such production is not "reasonably foreseeable" within the meaning of NEPA. We find that FERC's environmental review covered all reasonably foreseeable environmental impacts of the Liquefaction Project,[166] and that NEPA does not require the review to include induced upstream natural gas production.

Fundamental uncertainties constrain our ability to foresee and analyze with any particularity the incremental natural gas production that may be induced by permitting exports of LNG to non-FTA countries. EIA's 2012 Study projected that incremental natural gas production in the United States would account for 63% of LNG export volumes and, of that amount, 93% would come from unconventional production.[167] 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

[165] FERC Order at 225-27. Sierra Club made similar arguments on induced production when it filed comments in response to DOE/FE's LNG Export Study.
[166] Under applicable CEQ regulations, "indirect effects" of a proposed action are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." 40 C.F.R. § 1508.8(b).
[167] *See* LNG Export Study – Related Documents, *available at* http://energy.gov/fe/services/natural-gas-regulation/lng-export-study (EIA 2012 Study) at 11.

cannot be analyzed with any particularity. To begin, there is uncertainty as to the aggregate quantity of natural gas that ultimately may be exported to non-FTA countries. Receiving a non-FTA authorization from DOE/FE does not guarantee that a particular facility would be financed and built; nor does it guarantee that, if built, market conditions would continue to favor export 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 8 new facilities were built and those facilities have seen declining use in the past decade.[168]

There is also fundamental uncertainty as to where any additional production would occur and in what quantity. As the Addendum illustrates, nearly all of the environmental issues presented by unconventional natural gas production are local in nature, affecting local water resources, local air quality, and local land use patterns, all under the auspices of state and local regulatory authority. As DOE explained in *Sabine Pass*, DOE/FE Order No. 2961-A, without knowing where, in what quantity, and under what circumstances additional gas production will arise, the environmental impacts resulting from production activity induced by LNG exports to non-FTA countries are not "reasonably foreseeable" within the meaning of the CEQ's NEPA regulations.[169]

3. Cumulative Environmental Impacts

Sierra Club asserted both in comments to FERC on the draft EIS and in the current proceeding that the draft EIS was deficient because it failed to consider the cumulative environmental impacts from all proposed export terminals, including export applications pending or approved by DOE. FERC found no merit to Sierra Club's argument for a cumulative

[168] *See* Conditional Order at 81 n.84.
[169] *Sabine Pass*, DOE/FE Order No. 2961-A, at 11 (quoting 40 C.F.R. § 1508.7).

environmental impact analysis that looked at *all* LNG export applications pending before or approved by DOE. As noted above, FERC found that Sierra Club was, in effect, seeking a programmatic EIS when there was no "program" before FERC that met the definition under CEQ guidelines.[170] In rejecting this argument, FERC determined the EIS properly considered cumulative impacts including, among other things, reasonably foreseeable liquefaction and export projects, and other reasonably foreseeable oil and gas facilities in the vicinity of the proposed Liquefaction Project. FERC also took notice of the EIS's conclusion that the potential environmental impacts of any reasonably foreseeable projects, when combined with the impacts of Cameron's proposed project, would not result in significant cumulative environmental impacts.[171] We agree with FERC's reasoning and adopt its analysis concerning cumulative environmental impacts.

B. 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.[172] Nevertheless, a decision by DOE/FE to authorize exports to non-FTA nations could accelerate that development by some increment. For this reason, and because the environmental impacts associated with shale gas development have been raised by Sierra Club and other commenters, DOE/FE prepared and received public comment on the Addendum. As discussed above, the Addendum reviewed the academic and technical literature covering the most significant issues associated with unconventional gas production, including impacts to water resources, air quality, greenhouse gas emissions, induced seismicity, and land use.

[170] 40 C.F.R. §§ 1508.7, 1508.8.
[171] *See* FERC Order at 27.
[172] Addendum at 2.

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.[173] In 2013, EPA updated those regulations to include storage tanks,[174] 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.[175]

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 identified in the Conditional Order and discussed below, but would have little more than a modest, incremental impact on

[173] 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).
[174] U.S. Envtl. Prot. Agency, Oil and Natural Gas Sector: Reconsideration of Certain Provisions of New Source Performance Standards; Final Rule, 77 Fed. Reg. 58,416 (Sept. 23, 2013).
[175] 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), discussed *supra* Section VIII.C.

the environmental issues identified by Sierra Club and others. 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. 15 U.S.C. § 717a(b).

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

Intervenors and commenters have expressed concern that exports of domestic natural gas to non-FTA nations may impact the balance of global GHG emissions in two principal ways: domestically, through their impact on the price and availability of natural gas for electric generation and other uses; and, internationally, through their effect on the GHG intensity and total amount of energy consumed in foreign nations.

1. 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)."[176] Further, EIA determined that, in the earlier years of the 2015 to 2035 period, "the amount of natural gas to coal switching is greater," with "coal play[ing] a more dominant role in replacing the decreased levels of natural gas consumption, which also tend to be greater in the earlier years."[177] 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."[178] 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.[179] 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 below (Section IX).

We further note that EIA's 2012 Study assumed the continuation of regulations in effect at the time the AEO 2011 was prepared.[180] Therefore, EIA's analysis did not include the impacts

[176] 2012 EIA Study at 18.
[177] *Id*.
[178] *Id*.
[179] *Id.* at 19.
[180] 2012 EIA Study at 12 n.7 ("The degree to which coal might be used in lieu of natural gas depends on what regulations are in-place that might restrict coal use. These scenarios reflect current laws and regulations in place at the time [AEO 2011] was produced.").

that EPA's Mercury and Air Toxics Standard[181] and its Transport Rule[182] may have on the extent to which the U.S. coal fleet would compensate for reduced use of natural gas. Nor did EIA's analysis capture the potential for broad regulation of carbon dioxide emissions from the electric power sector. After publication of the EIA Study in early 2012, EPA proposed two rules that, if finalized, would likely reduce the extent to which increased use of coal would compensate for reduced use of natural gas. In September 2013, EPA proposed a rule that would limit carbon dioxide emissions from new coal-fired electric-generating units.[183] And, in June 2014, EPA proposed a rule that would limit carbon dioxide emissions from existing coal-fired electric generating units.[184]

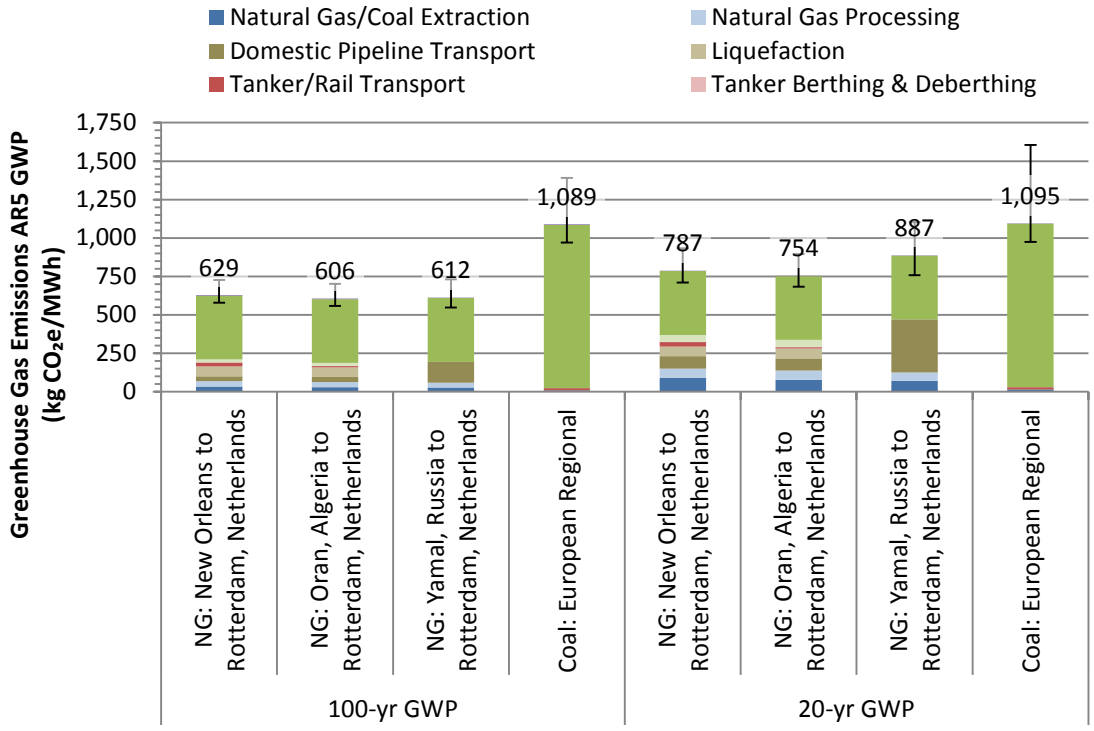
If finalized, these proposed rules appear to have the potential to mitigate significantly any increased emissions from the U.S. electric power sector that would otherwise result from increased use of coal, and perhaps to negate those increased emissions entirely. Therefore, on the record before us, we 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.

[181] 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).
[182] 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).
[183] U.S. Envtl. Prot. Agency, Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units; Proposed Rule, 79 Fed. Reg. 1,430 (Jan. 8, 2014).
[184] U.S. Envtl. Prot. Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule, 79 Fed. Reg. 34,830 (June 18, 2014).

2. International Impacts Associated with Energy Consumption in Foreign Nations

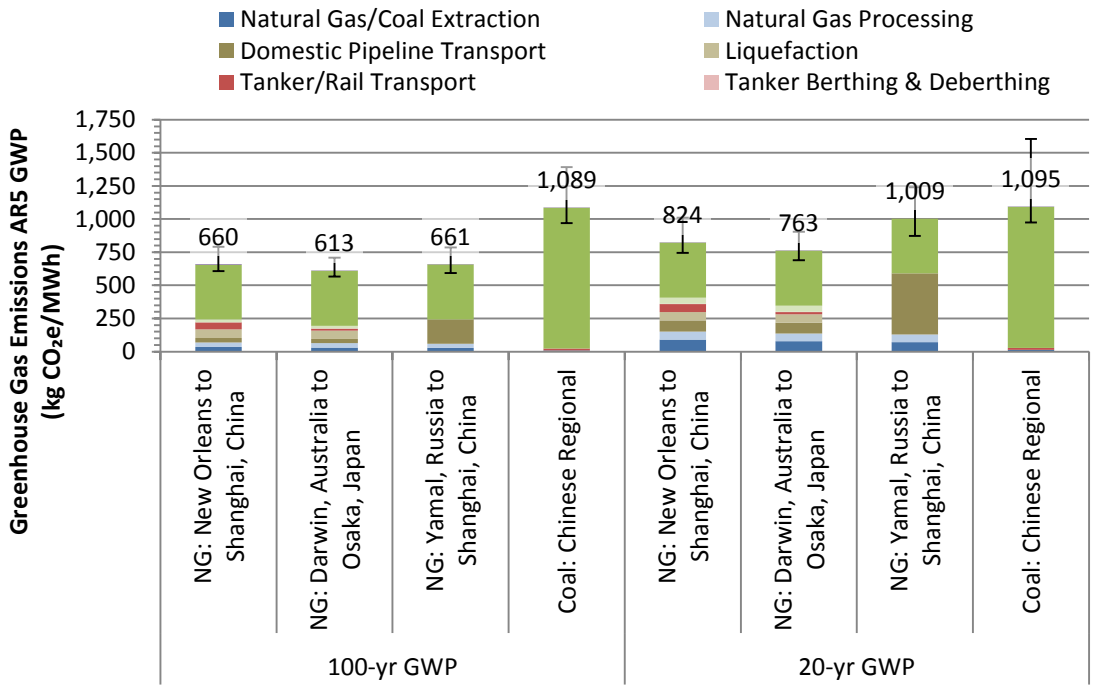
The LCA GHG Report estimated the life cycle GHG emissions of U.S. LNG exports to Europe and Asia, compared with certain other fuels used to produce electric power in those importing countries. The key findings for U.S. LNG exports to Europe and Asia are summarized in the following two figures (also presented above):

Table 8: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe[185]



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

Table 9: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia[186]



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.[187]

As Sierra Club observes, 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

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

Western Europe, 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.[188]

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 proceeding. 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 66% coal and 3% natural gas in 2012.[189] For India, installed electric generation capacity in 2014 is 59% coal and 9% natural gas.[190] 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% of total generation in 2011 and 89% in 2012 after the Fukushima disaster.[191] In Europe, use of fossil fuels is slightly less than in the Asian nations noted above but still

[188] Sierra Club observes that renewable energy has experienced significant growth in key LNG-importing countries such as India and China. Sierra Club does not, however, place the growth of renewable energy in the context of the aggregate use of fossil energy projects in those countries. Nor does Sierra Club 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.

[189] U.S. Energy Information Administration, China Analysis Brief (last updated Feb. 4, 2014), *available at:* http://www.eia.gov/countries/cab.cfm?fips=CH.

[190] U.S. Energy Information Administration, India Analysis Brief (last updated June 26, 2014), *available at:* http://www.eia.gov/countries/cab.cfm?fips=IN.

[191] U.S. Energy Information Administration, Japan Analysis Brief (last updated July 31, 2014), *available at:* http://www.eia.gov/countries/cab.cfm?fips=JA.

significant, comprising 68% and 49% of electric generation in the United Kingdom and Spain for 2012, respectively.[192]

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

D. LNG Export Study

As explained above and detailed in the Conditional Order, DOE/FE commissioned the two-part LNG Export Study and invited public comment. DOE/FE analyzed this material and determined that the LNG Export Study provides substantial support for conditionally granting Cameron's Application. The conclusion of the LNG Export Study is that the United States will experience net economic benefits from issuance of authorizations to export domestically produced LNG. We evaluated the initial and reply comments submitted in response to the LNG Export Study. Various commenters criticized the data used as inputs to the LNG Export Study and numerous aspects of the models, assumptions, and design of the Study. As discussed in the Conditional Order, however, we find that the LNG Export Study is fundamentally sound and

[192] EIA, International Energy Statistics, *available at:* http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=2&pid=alltypes&aid=12&cid=SP,UK,&syid=2008&eyid=2012&unit=BKWH. 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.

supports the proposition that the proposed authorization will not be inconsistent with the public interest.

Since the time we issued the Conditional Order earlier this year, we have seen no developments that would disturb these conclusions or alter the central conclusion of the LNG Export Study. To the contrary, we note that EIA's most recent projections, set forth in AEO 2014 (discussed *supra* Section V), continue to show market conditions that will accommodate increased exports of natural gas. When compared to the AEO 2013 Reference Case discussed in the Conditional Order (at 77-81), the AEO 2014 Reference Case projects marked increases in domestic natural gas production—well in excess of what is required to meet projected increases in domestic consumption.

Additionally, we note that a number of commenters on the LNG Export Study raised environmental concerns that were not germane to the economic issues addressed in the Study.[193] The Conditional Order did not address those comments, but did encourage those commenters to participate in FERC's environmental review of the Liquefaction Project.[194] We have independently reviewed the environmental comments on the LNG Export Study to ensure that all issues regarding the environmental impact of our decision on the proposed exports have been considered. We find that all such issues have been addressed in the EIS for the Liquefaction Project (which we have adopted) or in this Order.

E. Benefits of International Trade

We have not limited our review to the contents of the LNG Export Study or the environmental issues discussed herein, but have considered a wide range of other information.

[193] *See, e.g.*, the comments on the LNG Export Study submitted by the Delaware River Keepers, the Oregon Shores Conservation Coalition, and Citizen Power, among others.
[194] *See* Cameron Conditional Order at 113.

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."[195]

We have also considered the international consequences of our decision. We review applications to export LNG to non-FTA nations under section 3(a) of the NGA. The United States' commitment to free trade is one factor bearing on that review. An efficient, transparent international market for natural gas with diverse sources of supply provides both economic and strategic benefits to the United States and our allies. Indeed, increased production of domestic natural gas has significantly reduced the need for the United States to import LNG. In global trade, LNG shipments that would have been destined to U.S. markets have been redirected to Europe and Asia, improving energy security for many of our key trading partners. To the extent U.S. exports can diversify global LNG supplies, and increase the volumes of LNG available globally, 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 LNG Export Study and discussed in the Conditional Order.

F. Other Considerations

Our decision is not premised on an uncritical acceptance of the general conclusion of the LNG Export Study of net economic benefits from LNG exports. Both the LNG Export Study and many public comments identify significant uncertainties and even potential negative impacts from LNG exports. The economic impacts of higher natural gas prices and potential increases in

[195] National Export Initiative, Exec. Order 13,534, 75 Fed. Reg. 12,433 (Mar. 16, 2010).

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 Cameron'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[196] 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.[197] Given these possibilities, DOE/FE recognizes the need to monitor market developments closely as the impact of successive authorizations of LNG exports unfolds.

[196] 49 Fed. Reg. at 6684.

[197] As we noted in the Conditional Order, some commenters on the LNG Export Study 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. § 717*o*).

G. Conclusion

We have reviewed the evidence in the record and have not found an adequate basis to conclude that Cameron's export of LNG to non-FTA countries will be inconsistent with the public interest. We find that opponents of the Application have failed to overcome the statutory presumption that the proposed export authorization is consistent with the public interest. For that reason, we are authorizing Cameron'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 decisionmaking the cumulative impacts of the total volume of all final non-FTA export authorizations. With the issuance of this Order, DOE/FE has now issued final non-FTA authorizations in a cumulative volume of exports totaling 3.94 Bcf/d of natural gas, or 1.438 Tcf/yr, for the three final authorizations issued to date—Sabine Pass (2.2 Bcf/d), Carib Energy (USA) LLC (0.04 Bcf/d),[198] and the current Order (1.7 Bcf/d). This total export volume is within the range of scenarios analyzed in the EIA and NERA studies, as discussed in the Conditional Order. NERA found that in all such scenarios—assuming either 6 Bcf/d or 12 Bcf/d of export volumes—the United States would experience net economic benefits. As discussed above, the submissions of the intervenors do not undermine the reasonableness of the findings in the LNG Export Study.

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

[198] The *Carib* order is being issued concurrently with this Order. *See 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).

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 LNG Export Study, like any study based on assumptions and economic projections, is inherently limited in its 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.

XI. 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. Cameron must abide by each term and condition or face rescission of its authorization or other appropriate sanction.

A. Term of the Authorization

Cameron requests a 20-year term for the authorization commencing from the date commercial export operations begin. This term is consistent with our practice in the final and conditional non-FTA export authorizations issued to date, including Cameron's Conditional Order. 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 date when Cameron commences commercial export of domestically sourced LNG at the Cameron Terminal, but not before.

B. Commencement of Operations Within Seven Years

Cameron requested this authorization to commence on the earlier of the date of first export or seven years from the date of the issuance of this Order. Consistent with the final and conditional non-FTA authorizations granted to date, DOE/FE will impose the condition that Cameron must commence commercial LNG export operations no later than seven years from the date of issuance of this Order. The purpose of this condition is to ensure that other entities that may seek similar authorizations are not frustrated in their efforts to obtain those authorizations by authorization holders that are not engaged in actual export operations.

C. Commissioning Volumes

Cameron 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 Cameron 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 Cameron's long-term contracts.[199] Commissioning Volumes will not be counted against the maximum level of volumes authorized in Cameron's FTA order (DOE/FE Order No. 3059) or in this Order.

D. Make-Up Period

Cameron 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 authorized for export in Cameron's FTA order (DOE/FE Order No. 3059) or in this Order. Insofar as Cameron may seek to export additional volumes not previously authorized for export, it will be required to obtain appropriate authorization from DOE/FE.

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.[200] As a condition of the similar authorization issued to Sabine Pass in 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,

[199] For additional discussion of Commissioning Volumes and the Make-Up Period referenced below, see *Oregon LNG*, DOE/FE Order No. 3465, at 144-45.
[200] 10 C.F.R. § 590.405.

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 of 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.

F. Agency Rights

As described above, Cameron requests authorization to export LNG on its behalf and as agent for other entities who themselves hold title to the LNG. DOE/FE previously addressed the issue of Agency Rights in Order No. 2913,[201] which granted FLEX authority to export LNG to FTA countries. 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.[202] 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

[201] *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*].
[202] *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.

well. DOE/FE reiterated its policy on Agency Rights procedures in *Gulf Coast LNG Export, LLC*.[203] In *Gulf Coast*, DOE/FE confirmed 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.[204]

To ensure that the public interest is served, the authorization granted herein shall be conditioned to require that where Cameron proposes to export LNG as agent for other entities who 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."[205] 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.[206]

DOE/FE will require that Cameron file or cause to be filed with DOE/FE any relevant long-term commercial agreements, including LTAs, pursuant to which Cameron exports LNG as agent for a Registrant. *See supra* Section IV.D.

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[203] *Gulf Coast LNG Export, LLC*, DOE/FE Order No. 3163, FE Docket No. 12-05-LNG, Order Granting Long-Term Multi-Contract Authority to Export LNG by Vessel from the Proposed Brownsville Terminal to Free Trade Agreement Nations (Oct. 16, 2012).
[204] *See id*. at 7-8.
[205] 10 C.F.R. § 590.202(b).
[206] *Id*. § 590.202(e).

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

In addition, DOE/FE finds that section 590.202(c) of DOE/FE's regulations[207] requires that Cameron file, or cause to be filed, all long-term contracts associated with the long-term supply of natural gas to the Cameron Terminal, whether signed by Cameron or the Registrant, within 30 days of their execution.

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

[207] *Id*. § 590.202(c).

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.

H. Export Quantity

Cameron has sought export authorization in a volume equivalent to 620 Bcf/yr of natural gas. As set forth herein, this Order authorizes the export of LNG in the full amount requested by Cameron, up to the equivalent of 620 Bcf/yr of natural gas.

I. Combined FTA and Non-FTA Export Authorization Volume

In this proceeding, Cameron seeks authorization to export LNG in a volume equivalent to 620 Bcf/yr (1.7 Bcf/d) of natural gas to non-FTA countries under NGA section 3(a). As stated above, Cameron is currently authorized under DOE/FE Order No. 3059 to export LNG from the same Terminal to FTA countries in an identical amount (620 Bcf/yr of natural gas).

The source of LNG proposed for both of Cameron's export authorizations is from the Cameron LNG Terminal. As to the Terminal's total production capacity, we note that Cameron has informed FERC as to a discrepancy on this point in the records before DOE/FE and FERC. In its Application to DOE/FE, Cameron stated that the proposed Liquefaction Project facilities will have "a capacity of up to 12 MTPA of LNG."[208] In its application to FERC, Cameron described its Liquefaction Project as "consisting of three liquefaction trains with a total production capacity sufficient to produce 12 [mtpa] of LNG *for export*."[209] More recently, in a letter to FERC dated March 4, 2014, FERC referenced this statement, noting that its application

[208] Cameron App. at 4.
[209] *Cameron LNG, LCC*, Docket No. CP13-25 (2012) (Application of Cameron LNG, LLC for Authorization Under Section 3 of the Natural Gas Act), at 4 (emphasis added).

to FERC "indicated that the facilities would produce, at a minimum, 12 [mtpa] of LNG for loading onto a LNG tanker for export," and acknowledging that this figure "corresponds to the export authorizations that Cameron LNG has received from the U.S. Department of Energy."[210] In its letter to FERC, however, Cameron clarified that 12 mtpa of LNG "is not an accurate statement of the actual maximum production capacity of the proposed liquefaction facilities."[211] In fact, "the aggregate maximum liquefaction capacity of the proposed facilities under optimal conditions is … approximately 14.954 [mtpa]," with each of the three liquefaction trains producing LNG in a volume of approximately 4.985 mtpa under such conditions.[212]

DOE/FE's policy is not to authorize exports that exceed the capacity of a LNG export terminal.[213] To ensure that its combined FTA and non-FTA export authorizations do not exceed the Terminal's export capacity as represented in the Application before DOE/FE, Cameron may not treat the volumes authorized for export in this proceeding as additive to the volumes previously authorized for export to FTA nations in Order No. 3059. As a consequence, we will limit the authorization for exports to non-FTA nations in this Order to the amount requested in the Application, the natural gas equivalent of 620 Bcf/yr. If Cameron wishes to export LNG from the Cameron Terminal in a volume greater than the equivalent of 620 Bcf/yr of natural gas (*i.e.*, 12 mtpa of LNG) based on a different maximum production capacity for the Terminal, it should seek authorization from DOE/FE for any additional amount.

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[210] Ltr. from William D. Rapp, Counsel for Cameron LNG, LLC to Kimberly D. Bose, Secretary of FERC, Docket No. CP13-25-000, at 1 (Mar. 4, 2014) (providing comments on draft EIS).
[211] *Id*.
[212] *Id*. at 1-2.
[213] *See Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3357, 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 162 (Nov. 15, 2013) ("There is no basis for authorizing exports in excess of the maximum liquefaction capacity of a planned facility.").

XII. FINDINGS

On the basis of the findings and conclusions set forth above and in Cameron's Conditional Order (DOE/FE Order No. 3391), 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 the Application should be granted subject to the terms and conditions set forth herein. The following ordering paragraphs reflect current DOE/FE practice and supersede the ordering paragraphs set forth in Cameron's Conditional Order.

XIII. ORDER

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

A. Cameron is authorized to export domestically produced LNG by vessel from the Cameron LNG Terminal in Cameron Parish, Louisiana, up to the equivalent of 620 Bcf/yr of natural gas for a term of 20 years to commence on the earlier of the date of first commercial export or seven years from the date that this Order is issued (September 10, 2021). Cameron is authorized to export this LNG on its own behalf and as agent for other entities who 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 Cameron commences commercial export of domestically sourced LNG from the Cameron Terminal, but not before. Cameron may export Commissioning Volumes prior to the commencement of the terms of this Order, pursuant to a separate short-term export authorization. The Commissioning Volumes will not be counted against the maximum level of volumes previously authorized in Cameron's FTA Order (DOE/FE No. 3059) or in this Order.

C. Cameron 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 total volume of LNG authorized for export in any of Cameron's LNG export orders. Insofar as Cameron may seek to export additional volumes not previously authorized for export, it will be required to obtain appropriate authorization from DOE/FE.

D. Cameron 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 620 Bcf/yr of natural gas. This quantity is not additive to Cameron's FTA authorization, set forth in DOE/FE Order No. 3059.

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. Cameron 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. Cameron shall ensure compliance with all terms and conditions established by FERC in the final EIS, including the 76 environmental conditions recommended in the EIS and adopted in the FERC Order at Appendix A. Additionally, this authorization is conditioned on Cameron's

on-going compliance with any other preventative and mitigative measures at the Cameron Terminal imposed by federal or state agencies.

I. (i) Cameron shall file, or cause others to file, with the Office of Oil and Gas Global Security and Supply a non-redacted copy of all executed long-term contracts associated with the long-term export of LNG on its own behalf or as agent for other entities from the Cameron Terminal. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if Cameron 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, Cameron 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, Cameron shall state why the redacted or non-disclosed information should be exempted from public disclosure.

(ii) Cameron shall file, or cause others to file, with the Office of Oil and Gas Global Security and Supply a non-redacted copy of all executed long-term contracts associated with the long-term supply of natural gas to the Cameron Terminal. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if Cameron 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, Cameron 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, Cameron shall state why the redacted or non-disclosed information should be exempted from public disclosure.

J. Cameron, or others for whom Cameron 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:

> Customer or purchaser acknowledges and agrees that it will resell or transfer LNG purchased hereunder for delivery only to countries identified in Ordering Paragraph F of DOE Order No. 3391-A, issued September 10, 2014, in FE Docket No. 11-162-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 Cameron LNG, LLC that identifies the country of destination, upon delivery, into which the exported LNG was actually delivered, and to include in any resale contract for such LNG the necessary conditions to insure that Cameron LNG, LLC is made aware of all such actual destination countries.

K. Cameron is permitted to use its authorization in order to export LNG as agent for other entities, after registering the other parties with DOE/FE. Registration materials shall include an acknowledgement and agreement by the Registrant to supply Cameron with all information necessary to permit Cameron 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, Cameron shall ensure that all persons required by this Order to register with DOE/FE have done so. Any failure by Cameron 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 Cameron Terminal, Cameron shall provide written notification of the date that the first export of LNG authorized in Ordering Paragraph A above occurred.

O. Cameron shall file with the Office of Oil and Gas Global Security and Supply, on a semi-annual basis, written reports describing the progress of the proposed 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 facility is expected to be operational, and the status of the long-term contracts associated with the long-term export of LNG and any long-term supply contracts.

P. Prior to any change in control of the authorization holder, Cameron must obtain the approval of the Assistant Secretary for Fossil Energy. 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 Cameron, 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.

Q. Monthly Reports: With respect to the LNG exports authorized by this Order, Cameron shall file with the Office of Oil and Gas Global Security and Supply, 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 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) of destination into which the exported LNG was actually delivered; (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 Oil and Gas Global Security and Supply, 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.

Issued in Washington, D.C., on September 10, 2014.

Christopher A. Smith
Principal Deputy Assistant Secretary
Office of Fossil Energy