UNITED STATES OF AMERICA

DEPARTMENT OF ENERGY

OFFICE OF FOSSIL ENERGY

CAMERON LNG, LLC	)	FE DOCKET NO. 11-162-LNG

OPINION AND ORDER DENYING REQUEST FOR REHEARING OF ORDERS GRANTING LONG-TERM, MULTI-CONTRACT AUTHORIZATION TO EXPORT LIQUEFIED NATURAL GAS BY VESSEL FROM THE CAMERON LNG TERMINAL IN CAMERON AND CALCASIEU PARISHES, LOUISIANA, TO NON-FREE TRADE AGREEMENT NATIONS

DOE/FE ORDER NO. 3391-B

SEPTEMBER 24, 2015

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FREQUENTLY USED ACRONYMS

Bcf/d	Billion Cubic Feet per Day
Bcf/yr	Billion Cubic Feet per Year
CEQ	The Council on Environmental Quality
CH_4	Methane
DOE	U.S. Department of Energy
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
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
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Analysis
LNG	Liquefied Natural Gas
NEMS	National Energy Modeling System
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NGA	Natural Gas Act
ROD	Record of Decision

I. INTRODUCTION

The Department of Energy's (DOE or the Department) Office of Fossil Energy (DOE/FE) has issued two complementary orders—DOE/FE Order Nos. 3391[1] (Conditional Order) and 3391-A[2] (Final Order)—granting the application of Cameron LNG, LLC (Cameron LNG) filed on December 21, 2011 (Application).[3] In that Application, Cameron LNG requested 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] Those Orders authorized Cameron LNG 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 of LNG, for a term of 20 years.[5] The proposed exports will originate from liquefaction and related facilities under construction by Cameron LNG (Liquefaction Project) at the existing Cameron LNG Terminal (Cameron Terminal), which Cameron LNG owns and operates in Cameron and Calcasieu Parishes, Louisiana.

[1] *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 Conditional Order].
[2] *Cameron LNG, LLC*, DOE/FE Order No. 3391-A, FE Docket No. 11-162-LNG, Final Opinion & Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Cameron LNG Terminal in Cameron Parish, Louisiana, to Non-Free Trade Agreement Nations (Sept. 10, 2014) [hereinafter Final Order].
[3] Application of Cameron LNG, LLC for Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas to Non-Free Trade Agreement Countries, FE Docket No. 11-162-LNG (Dec. 21, 2011) [hereinafter Cameron LNG 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 on January 17, 2012. *Cameron LNG, LLC*, DOE/FE Order No. 3059, FE Docket No. 11-45-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).
[5] DOE/FE authorized Cameron LNG to export the 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. The Final Order contained numerous additional terms and conditions, which superseded those set forth in the Conditional Order. *See* Final Order at 88-102 (§§ XI-XIII).

The Conditional Order, issued February 11, 2014, entered findings on all non-environmental issues under section 3(a) of the Natural Gas Act (NGA), 15 U.S.C. § 717b(a). DOE/FE determined that intervenors and other participants in the proceeding had not demonstrated that Cameron LNG's proposed exports would be inconsistent with the public interest, as would be required to deny the authorization. DOE/FE therefore granted Cameron LNG's Application, but conditioned the export authorization on: (i) satisfactory completion of Cameron LNG's environmental review process under the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4321 *et seq*., then on-going before the Federal Energy Regulatory Commission (FERC); and (ii) issuance by DOE/FE of a finding of no significant impact or a record of decision (ROD) under NEPA. DOE/FE stated that, "[w]hen the environmental review is complete, DOE/FE will reconsider its public interest determination in light of the information gathered as part of that review," and observed that, "[t]his procedure will not foreclose the choice of reasonable alternatives or influence subsequent development."[6]

DOE/FE participated as a cooperating agency in FERC's NEPA review of the Liquefaction Project. On April 30, 2014, FERC issued its final environmental impact statement (EIS) for the Liquefaction Project and a related Pipeline Project being developed by Cameron LNG's affiliate, Cameron Interstate Pipeline, LLC (Cameron Interstate).[7] The final EIS recommended that FERC approve the Liquefaction and Pipeline Projects subject to 76 mitigating environmental conditions. On June 19, 2014, FERC issued an Order Granting Authorization Under Section 3 of the Natural Gas Act and Issuing Certificates, which authorized Cameron LNG

[6] Conditional Order at 130.
[7] *Cameron LNG, LLC, et al.*, FERC Docket Nos. CP13-25-000, *et al*., Final Environmental Impact Statement Cameron Liquefaction Project (Apr. 30, 2014) [hereinafter Final EIS]; *see also* 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).

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.[8] After an independent review, DOE/FE adopted FERC's final EIS for the Cameron Liquefaction Project (DOE/EIS-0488) on August 7, 2014, and the U.S. Environmental Protection Agency (EPA) issued a notice of the adoption on August 15, 2014.[9]

On September 10, 2014, DOE/FE issued the Final Order in which it granted final authorization for Cameron LNG to export LNG to non-FTA countries up to the equivalent of 1.7 Bcf/d. The Final Order was conditioned on Cameron LNG's compliance with the 76 environmental conditions recommended in the final EIS and adopted in the FERC Order.[10] Concurrently with the Final Order, DOE/FE issued a ROD for Cameron LNG's proposed exports of LNG from the Liquefaction Project.[11]

Sierra Club has asked DOE/FE to grant rehearing of the Conditional Order (to the extent relied upon or incorporated by reference in the Final Order), the Final Order, and the ROD for Cameron LNG's Application. Sierra Club asks DOE/FE to withdraw these actions pending further inquiry into the environmental impacts of Cameron LNG's proposed exports or, in the alternative, to withdraw the Conditional and Final Orders and deny Cameron LNG's Application.[12] For the reasons set forth below, DOE/FE denies Sierra Club's Request for Rehearing, and affirms the findings and conclusions in the Conditional and Final Orders and the ROD.

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[8] *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].
[9] U.S. Envtl. Prot. Agency, Environmental Impact Statements; Notice of Availability, 79 Fed. Reg. 48,140 (Aug. 15, 2014).
[10] *See* Final Order at 97-98 (Ordering Para. H).
[11] U.S. Dep't of Energy, Record of Decision & Floodplain Statement of Findings for the Cameron LNG, LLC Export Application, 79 Fed. Reg. 55,443 (Sept. 16, 2014).
[12] Sierra Club, Request for Rehearing, FE Docket No. 11-162-LNG, at 1 (Oct. 10, 2014) [hereinafter Rehearing Request].

II. PROCEDURAL BACKGROUND

A. DOE/FE and FERC Proceedings

The Conditional Order, as supplemented by the Final Order, provides the history of the Cameron Terminal and describes the proposed Liquefaction Project. These Orders also set forth the procedural history of Cameron LNG's proceedings before DOE/FE and FERC, including arguments made by Sierra Club in each proceeding.

When an applicant seeks authority both to export LNG and to construct a terminal for that purpose, DOE and FERC work together to avoid duplication of effort in the environmental review required under NEPA. In such cases, FERC is the "lead agency" and DOE/FE is the "cooperating agency" within the meaning of the regulations of the Council on Environmental Quality (CEQ) that implement NEPA.[13]

The present case fits within that framework. On August 4, 2010, FERC granted Cameron LNG's request to commence the pre-filing review process for the proposed Liquefaction Project. Shortly thereafter, FERC issued a Notice of Intent to Prepare an Environmental Impact Statement of the Liquefaction and Pipeline Projects.[14] The pre-filing proceeding involved a public scoping process to determine the issues requiring environmental review under NEPA.

In December 2012, at the completion of the pre-filing proceeding, Cameron LNG and Cameron Interstate jointly filed a formal application with FERC. Cameron LNG sought

[13] FERC's lead agency role was codified by section 313 of the Energy Policy Act of 2005 (Pub. L. 109-58) (Aug. 8, 2005), which amended section 15 of the NGA (15 U.S.C. § 717n). *See* 15 U.S.C. § 717n(b)(1). The CEQ regulations implementing NEPA define a "cooperating agency" as "any Federal agency other than a lead agency which has jurisdiction by law or special expertise" with respect to any proposed action for which a NEPA analysis is prepared. 40 C.F.R. § 1508.5. The selection and responsibilities of a cooperating agency are described in 40 C.F.R. § 1501.6. DOE has issued regulations stating that it will perform its NEPA responsibilities in accordance with the CEQ regulations. 10 C.F.R. §§ 1021.101, 1021.103.

[14] *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).

authorization to site, construct, and operate the Liquefaction and Pipeline Projects. Cameron Interstate requested 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.

FERC issued the final EIS on April 30, 2014.[15] Subsequently, on June 19, 2014, FERC issued the FERC Order authorizing Cameron LNG to site, construct, and operate the Liquefaction Project, and authorizing Cameron Interstate to construct the Pipeline Project, subject to the 76 environmental conditions recommended in the EIS.[16] Sierra Club sought rehearing of the FERC Order. FERC rejected that request as having been filed out of time.[17]

In connection with this and other LNG export proceedings, on June 4, 2014, DOE/FE provided notice in the *Federal Register* of two separate documents that proposed 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 aspects associated with unconventional gas production in the lower-48 states. 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*.[18]

[15] Final EIS, *supra* note 7.
[16] FERC Order, *supra* note 8.
[17] *Cameron LNG, LLC, et al.*, Notice Rejecting Request for Rehearing and Dismissing Request for Stay, 148 FERC ¶ 61,073 (July 29, 2014). Subsequently, Sierra Club and two other parties submitted a Request for Rehearing and Answer to Motion to Strike, asking FERC to accept its late-filed request for rehearing. On September 26, 2014, FERC issued an order that denied that request for rehearing and "explain[ed] why the arguments in Sierra Club's original request for rehearing would have been unavailing" even if timely. *Cameron LNG, LLC, et al.*, Order Denying Rehearing, 148 FERC ¶ 61,237, at 1 (Sept. 26, 2014).
[18] 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) [hereinafter Draft Addendum]. DOE/FE announced the availability of the Draft Addendum on its website on May 29, 2014.

DOE/FE received comments on the Draft Addendum and, on August 15, 2014, issued the final Addendum with its response to the public comments contained in Appendix B.[19]

Second, DOE/FE commissioned the National Energy Technology Laboratory (NETL), a DOE applied research laboratory, to conduct an analysis estimating the life cycle greenhouse gas (GHG) emissions for LNG exported from the United States and combusted for electric generation in Europe or Asia. The report compared the life-cycle GHG emissions of U.S.-exported LNG to other sources of natural gas available in Europe and Asia, as well as those of regionally-sourced coal. On May 29, 2014, DOE/FE published NETL's report entitled, *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States* (referred to as the LCA GHG Report),[20] as well as a 200-page supporting document entitled, *Life Cycle Analysis of Natural Gas Extraction and Power Generation.*[21] DOE/FE received public comment on the LCA GHG Report and supporting document, and provided its response to those comments in the Final Order.

DOE/FE issued the Final Order on September 10, 2014. In the Final Order, DOE/FE: (i) independently reviewed FERC's NEPA analysis and other outstanding environmental issues, including public comments received on the Addendum and LCA GHG Report; (ii) considered the environmental information that had been developed and the related arguments of the commenters and parties, and found that it had not been demonstrated that Cameron LNG's

[19] Dep't of Energy, Addendum to Environmental Review Documents Concerning Exports of Natural Gas From the United States, 79 Fed. Reg. 48,132 (Aug. 15, 2014) [hereinafter Addendum].
[20] 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). DOE/FE announced the availability of the LCA GHG Report on its website on May 29, 2014.
[21] *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").

requested authorization was inconsistent with the public interest; and (iii) granted Cameron LNG's Application subject to further conditions, including the 76 environmental conditions adopted in the FERC Order.[22]

B. Sierra Club's Request for Rehearing of DOE's Orders

Sierra Club filed its Rehearing Request on October 10, 2014. On October 28, 2014, Cameron LNG filed a Motion for Leave to Answer and Answer of Cameron LNG, LLC to Sierra Club's Request for Hearing.[23] On November 5, 2014, DOE/FE issued an order granting Sierra Club's Rehearing Request for the limited purpose of further consideration.[24] On November 25, 2014, DOE/FE issued an order granting Cameron LNG's Motion for Leave to Answer for the limited purpose of further consideration.[25]

III. DISCUSSION

A. The Rebuttable Presumption Derives from the Natural Gas Act

1. Sierra Club's Position

Sierra Club asserts that DOE/FE erred in finding that section 3(a) of the NGA establishes a rebuttable presumption that exports of natural gas are in the public interest. Likewise, Sierra Club challenges the proposition that *Panhandle Producers & Royalty Owners Ass'n v. Economic Regulatory Administration*, 822 F.2d 1105 (D.C. Cir. 1987) (*Panhandle Producers*) recognized a statutory presumption applicable to LNG export proceedings. Instead, Sierra Club submits that

[22] *See* Final Order at 19-21, 36-96.
[23] Cameron LNG, LLC, Motion for Leave to Answer and Answer of Cameron LNG, LLC to Sierra Club's Request for Rehearing, FE Docket No. 11-162-LNG (Oct. 28, 2014) [hereinafter Cameron LNG Answer].
[24] *Cameron LNG, LLC*, Order Granting Rehearing for Further Consideration, FE Docket No. 11-162-LNG (Nov. 5, 2014).
[25] *Cameron LNG, LLC*, Order Granting Motion for Leave to Answer for the Purpose of Further Consideration, FE Docket No. 11-162-LNG (Nov. 25, 2014). In this Order, DOE/FE grants Cameron's Motion for Leave to Answer because the Answer is relevant to our consideration of the issues raised in Sierra Club's Rehearing Request. *See infra* at 35.

the presumption addressed in *Panhandle Producers* applied only to import proceedings and was derived from DOE Policy Guidelines adopted in 1984 rather than the language of the NGA.[26] Sierra Club further states that DOE wrongly applied a presumption that the environmental impacts of the proposed exports would be consistent with the public interest.

2. Cameron LNG's Answer

Cameron LNG asserts that Sierra Club is mistaken in arguing both that the rebuttable presumption is inapplicable to export proceedings, and that it concerns only the non-binding policy adopted in 1984 rather than the language of the NGA.[27] Cameron LNG maintains that Sierra Club restricts its argument to a discussion of *Panhandle Producers*, an import case, whereas DOE/FE has found in numerous cases that the presumption is statutory in nature and also applies to export proceedings. In support of its position, Cameron LNG cites *Phillips Alaska Natural Gas Corp. and Marathon Oil Co.*, DOE/FE Opinion and Order No. 1473 (Apr. 2, 1999),[28] *as amended ConocoPhillips Alaska Natural Gas Corp.*, DOE Order No. 1473-A (Jan.

[26] According to Sierra Club, the U.S. Court of Appeals for the District of Columbia Circuit in *Panhandle Producers* reviewed certain presumptions regarding natural gas imports set forth in DOE's *New Policy Guidelines and Delegation Orders from Secretary of Energy to Economic Regulatory Administration and Federal Energy Regulatory Commission Relating to the Regulation of Imported Natural Gas*, 49 Fed. Reg. 6684 (Feb. 22, 1984) [hereinafter 1984 Policy Guidelines]. Sierra Club asserts that the "two specific rebuttable presumptions" arising from the 1984 Policy Guidelines are: (i) if the terms of a natural gas import contract are flexible enough, the natural gas will be delivered only if it is competitive; and (ii) if the imported gas is competitive, it will fill a domestic need. Rehearing Request at 2-3 (citing *Panhandle Producers*, 822 F.2d at 1111). Sierra Club further contends that *Panhandle Producers* did not reach the question of whether any presumptions regarding imports or exports were compelled by the NGA. *Id*. at 3.

[27] Cameron LNG Answer at 5-6.

[28] *See Phillips Alaska Natural Gas Corp. & Marathon Oil Co.*, DOE/FE Opinion & Order No. 1473, Order Extending Authorization to Export Liquefied Natural Gas from Alaska, FE Docket No. 96-99-LNG, at 13, 57 (Apr. 2, 1999) (finding that a five-year extension for authorization holders to export LNG to Japan has not been shown to be inconsistent with the public interest where, in relevant part, "Section 3 [of the NGA] creates a statutory presumption in favor of approval of an export application, and the Department must grant the requested … extension unless it determines the presumption is overcome by evidence … that the proposed export will not be consistent with the public interest") (citing, *inter alia*, *Panhandle Producers*, 822 F.2d at 1111).

30, 2008)[29]—an export proceeding under the NGA in which DOE applied the rebuttable presumption.

Cameron LNG next disputes Sierra Club's assertion that, in authorizing the proposed exports, DOE/FE presumed that the Liquefaction Project will not have environmental impacts that would be inconsistent with the public interest. Cameron LNG asserts that environmental impacts are one of several factors that DOE/FE considers in evaluating the public interest. According to Cameron LNG, the rebuttable presumption in NGA section 3(a) does not apply to any single public interest factor, but to DOE/FE's public interest determination generally. Consequently, Cameron LNG argues that a showing of negative environmental impacts associated with proposed exports does not, on its own, require DOE/FE to find that the rebuttable presumption in favor of those exports has been overcome. Cameron LNG contends that DOE/FE must also consider any countervailing positive effects associated with the proposed exports as part of the public interest analysis. Thus, according to Cameron LNG, an opponent of an application may overcome the rebuttable presumption only by showing that those exports are inconsistent with the public interest on the basis of all relevant factors.[30]

3. DOE/FE Analysis

The rebuttable presumption comes from the language of NGA section 3(a), which requires the Department to issue both export and import authorizations "*unless*, after opportunity for a hearing, it finds that the proposed exportation or importation will not be consistent with the public interest."[31] DOE interprets these words to mean that, for the Department to deny an

[29] *ConocoPhillips Alaska Natural Gas Corp*., DOE/FE Order Nos. 261-G, 1473-A, & 1580-A, Order Amending Authority to Export Liquefied Natural Gas from Alaska (Jan. 30, 2008) (amending orders solely to substitute authorization holder due to corporate name change).
[30] Cameron LNG Answer at 6-7.
[31] 15 U.S.C. § 717b(a) (emphasis added).

application, it must make an affirmative finding based on record evidence that the proposed import or export is inconsistent with the public interest. The Department refers to this as a rebuttable presumption because, absent evidence demonstrating that a proposed export or import is inconsistent with the public interest, the Department must grant the requested authorization. Sierra Club claims that the court in *Panhandle Producers* "did not reach the question of whether any presumptions regarding imports or exports were compelled by the Natural Gas Act."[32] But in fact the court stated that "§ 3 [of the NGA] requires an affirmative showing of inconsistency with the public interest to *deny* an application."[33]

The rebuttable presumption in section 3(a) may affect the Department's ultimate judgment whether to grant or deny an application, but it does not affect the Department's obligations under NEPA. NEPA places an independent obligation on the Department to obtain information relating to the environmental impacts that may result from its decisions and to take a "hard look" at those impacts.[34] The rebuttable presumption has no bearing on these independent NEPA obligations and did not affect the Department's performance of those obligations in this proceeding.

As the record demonstrates, the Department took the "hard look" at Cameron LNG's export proposal required by NEPA. Consistent with section 313 of the Energy Policy Act of 2005, which designates FERC as the lead agency for NEPA purposes,[35] the Department participated as a cooperating agency in FERC's environmental review. The Department independently reviewed the EIS prepared by FERC and adopted all 76 environmental conditions

[32] Rehearing Request at 3.
[33] *Panhandle Producers*, 822 F.2d at 1111 (emphasis in original); *see also id*. at 1112 (describing the court's earlier decision in *West Virginia Pub. Serv. Comm. v. DOE*, 681 F.2d 847, 856 (D.C. Cir. 1982), as having "explicitly found that the statute created a presumption in favor of authorization.").
[34] 42 U.S.C. § 4332.
[35] 15 U.S.C. § 717n(b)(1).

recommended by FERC staff and adopted in the FERC Order. In fulfilling its responsibilities under NEPA, the Department applied no presumptions regarding the potential environmental impacts associated with Cameron LNG's proposed exports, as the record shows. We therefore reject Sierra Club's argument concerning DOE/FE's interpretation of the NGA and application of the rebuttable presumption.

B. DOE/FE's Analysis of Indirect and Cumulative Environmental Impacts Satisfied the National Environmental Policy Act

1. Sierra Club's Position

Sierra Club asserts that DOE/FE's environmental review failed to comply with NEPA because FERC's EIS, which DOE/FE adopted, did not take a "hard look" at the indirect and cumulative impacts of LNG exports.[36] Sierra Club asserts that, whether or not FERC did so, DOE/FE should have analyzed the environmental impacts of natural gas production activities that would be induced by LNG exports. Sierra Club states that induced production is a reasonably foreseeable consequence of increased demand for natural gas due to LNG exports. Sierra Club offers the National Energy Modeling System (NEMS) developed by the U.S. Energy Information Administration (EIA) as a methodology DOE/FE could have used to determine where, in what quantity, and under what circumstances exports would induce additional gas production.[37] According to Sierra Club, the NEMS model underlying the Department's 2012 LNG Export Study predicted how production would respond to exports.[38] Sierra Club asserts that because NEMS is built on "play-level" modeling, EIA must have already developed forecasts of where

[36] *See* Rehearing Request 3-4.
[37] *See id*. at 10-11.
[38] In 2011, the Department engaged the U.S. Energy Information Administration (EIA) and NERA Economic Consulting to conduct a two-part study of the economic impacts of LNG exports. In relevant part, EIA published its study, *Effect of Increased Natural Gas Exports on Domestic Energy Markets*, in January 2012 [hereinafter EIA 2012 Study]. Using the NEMS model, EIA examined the impact of two DOE/FE-prescribed levels of assumed natural gas exports (at 6 Bcf/d and 12 Bcf/d) under numerous scenarios and cases based on EIA's 2011 projections. Both the 2012 EIA and NERA Studies are discussed in detail in the Conditional Order (§§ I, VI, VIII).

production would increase in response to exports. According to Sierra Club, the specific environmental impacts of these additional natural gas production activities include increased generation of ozone precursors (*e.g.*, volatile organic chemicals and hazardous air pollutants) and methane releases resulting in additional GHG emissions into the atmosphere. Sierra Club also contends that DOE/FE's NEPA analysis was flawed because it did not examine the environmental impacts of switching from natural gas to coal in the generation of electricity, which Sierra Club contends could be induced by natural gas exports.[39]

2. Cameron LNG's Answer

Cameron LNG maintains that Sierra Club failed to establish a reasonably close causal relationship between induced production and the Liquefaction Project as would be necessary to conclude that induced production is reasonably foreseeable. Cameron LNG submits that both DOE and FERC drew reasonable boundaries and exercised reasonable judgment in concluding that insufficient facts exist to consider the timing, location, and scope of future gas production. Cameron LNG contends that, although DOE concluded that there would be additional production due to LNG export licensing, this does not establish a causal connection between a particular project and particular effects.

Cameron LNG also challenges Sierra Club's assertion that the NEMS modeling methodology supports meaningful discussion of induced production. According to Cameron LNG, Sierra Club never showed how NEMS models, which it contends "may work on a generic national basis for gross amounts of gas consumption or LNG exports," would produce reliable results for a single point export terminal with numerous pipeline interconnections to the nationwide pipeline grid.[40] Further, Cameron LNG states that the determination of the extent

[39] Rehearing Request at 17-18.
[40] Cameron LNG Answer at 14.

and effects of potential cumulative impacts from a proposed project, particularly the geographic scope, falls to the "'special competency of the appropriate agency,'" *i.e.*, to FERC as the lead agency.[41] Cameron LNG further states that the Addendum avoided trying to characterize incremental environmental impacts from a specific project or even from non-FTA exports generally. Cameron LNG submits that DOE/FE provided this information for the United States as a whole to the extent appropriate.

3. DOE/FE Analysis

a. Induced Natural Gas Production

The CEQ regulations implementing NEPA require that agencies consider the "indirect effects" of proposed actions. "Indirect effects," the regulations provide, "are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable."[42] Courts have articulated two principles useful in interpreting this provision. The first is that NEPA requires "a reasonably close causal relationship" between the environmental effect and the alleged cause.[43] The Supreme Court has stated that "a 'but for' causal relationship is insufficient to make an agency responsible for a particular effect under NEPA and the relevant regulations."[44] Rather, in considering the strength of the causal relationship required by NEPA, the Supreme Court has "analogized . . . to the 'familiar doctrine of proximate cause from tort law,'" instructing courts to "'look to the underlying policies or legislative intent in order to draw a manageable line between those causal changes that may make an actor responsible for an effect and those that do not.'"[45] The second principle is that "inherent in NEPA and its implementing

[41] *Id*. (citation omitted).
[42] 40 C.F.R. § 1508.8(b); *see also* 10 C.F.R. § 1021.200 (adopting CEQ's regulations for the Department).
[43] *Metropolitan Edison Co. v. People Against Nuclear Energy*, 460 U.S. 766, 774 (1983).
[44] *Dep't of Transp. v. Public Citizen*, 541 U.S. 752, 767 (2004) [hereinafter *Public Citizen*].
[45] *Id*. (quoting *Metropolitan Edison Co.*, 460 U.S. at 774 n.7).

regulations is a 'rule of reason.'"[46] With respect to indirect effects, the rule of reason counsels that agencies are not required to address remote or speculative consequences, where insufficient information is available to permit meaningful consideration.[47]

Sierra Club claims the Department violated NEPA by failing to consider the environmental impacts of increased natural gas production that may result indirectly from authorizing Cameron LNG to export LNG to non-FTA countries. The causal relationship Sierra Club posits is an economic one. Sierra Club argues that a decision to authorize exports of natural gas from the United States to non-FTA countries may increase the price of natural gas in the United States, and therefore concludes the Department must examine the consequences of that potential price increase, including increased domestic production of natural gas and increased consumption of coal, which competes with natural gas as a fuel for electric generation. We do not read Sierra Club's petition to argue that the Department must examine the environmental impacts of producing the very molecules of natural gas that will be exported by Cameron LNG. Rather, we understand Sierra Club to contend that the Department must examine the environmental impacts of the economically marginal natural gas production that may be induced as a result of granting an export authorization to Cameron LNG and other similarly situated applicants.

The Department does not dispute the economic logic that authorizing exports of natural gas to non-FTA countries could, all else equal, exert upward pressure on domestic natural gas

[46] *Id*. at 767 (citation omitted).

[47] *See, e.g.*, *N. Plains Res. Council v. Surface Transp. Bd.*, 668 F.3d 1067, 1078 (9th Cir. 2011) ("Each project is different, and the agency is required to rationally explain its decision in the context of project-specific effects."); *Hammond v Norton*, 370 F. Supp. 2d 226, 241 (D.D.C. 2005) ("The setting of the objectives and the range of alternatives to be considered by an agency are governed by a 'rule of reason.' All that NEPA requires is that the agency weigh all reasonable alternatives and come to a fully-informed decision."); *Hoosier Envtl. Council v. U.S. Army Corps of Engineers*, 105 F. Supp. 2d 953, 974-975 (S.D. Ind. 2000) (upholding issuance of a permit to a casino riverboat, in part, because associated indirect effects were "tenuous and speculative" and therefore excluded from NEPA analysis under the "rule of reason").

prices as foreign purchasers compete with domestic purchasers. Nor does the Department dispute that higher natural gas prices could lead to increased natural gas production at the national level, among other potential economic consequences (including decreased domestic consumption of natural gas, increased pipeline imports of natural gas from Canada, and increased use of competing resources). Indeed, EIA's 2012 Study modeled the effects that exporting natural gas at levels of 6 and 12 Bcf/d at "high" and "slow" ramp-up scenarios could have on the energy sector.[48] EIA projected that "[u]nder Reference case conditions, about 63 percent, on average, of the increase in exports in each of the four scenarios is accounted for by increased production [of natural gas], with most of the remainder from decreased consumption [of natural gas] from 2015 to 2035."[49] EIA further projected that, of the increased production, over 90% would come from unconventional sources, such as shale gas, tight gas, and coalbed methane.[50]

Although natural gas exports may increase domestic production *at the margin*, we reject the conclusion that the environmental impacts of such marginal production are "reasonably foreseeable" within the meaning of the CEQ's regulations and the applicable case law. To the contrary, it would be impossible to identify with any confidence the marginal production at the wellhead or local level that would be induced by Cameron LNG's exports over the period of its non-FTA authorization. Natural gas will be produced in substantial quantities across the United States regardless of how the Department rules on Cameron LNG's Application. As the Department observed in the Final Order:

> There is … fundamental uncertainty as to where any additional production would occur and in what quantity. As the Addendum

[48] *See supra* note 38; Conditional Order at 24-25.
[49] 2012 EIA Study, *supra* note 38, *available at* http://www.energy.gov/sites/prod/files/2013/04/f0/fe_eia_lng.pdf, at 10 (Jan. 2012).
[50] *Id*. at 11; *see also* Final Order at 73.

> 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.[51]

Further, insofar as Cameron LNG's Application is viewed cumulatively with other similar applications to export LNG to non-FTA countries, the Department has observed that there is considerable market uncertainty regarding the aggregate quantity of exports that will ultimately materialize:

> [T]here 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.[52]

Sierra Club emphasizes the potential for economic modeling tools, such as EIA's NEMS model, to render the environmental impacts of export-induced production reasonably foreseeable. But where, as here, it is fundamentally uncertain how natural gas production at the local level will respond to price changes at the national level, an environmental analysis attempting to quantify local impacts would be more misleading than informative.[53] Economic modeling results are a product of the parameters that are entered into the model. In this context,

[51] Final Order at 74 (citations omitted).
[52] *Id*. (citing Conditional Order at 81 n.84).
[53] *See Mayo Found. v. Surface Transp. Bd.*, 472 F.3d 545, 555-56 (8th Cir. 2006) (rejecting Sierra Club's argument that the Surface Transportation Board must use the NEMS model as the basis for analyzing local-level environmental impacts).

the key parameter that would be used as a modeling input is the price elasticity of natural gas production, estimated at a sufficiently local level so as to analyze how the production would impact specific natural resources and human health. But, due to the limitations of estimating geology at the local level—as well as the uncertainties of predicting local regulation, land use patterns, and the development of supporting infrastructure—estimating the price elasticity of natural gas supply at the local level is much more speculative than doing so at the national level where local idiosyncrasies are averaged out.

Sierra Club's argument concerning "play level" modeling also does not persuade us that the environmental impacts of induced production are reasonably foreseeable. The term "plays" refers to subsurface geologic formations containing substantial quantities of natural gas and may be used in reference to shale gas[54] or tight gas.[55] The shale plays, to which we believe Sierra Club is referring, overlap and stretch for thousands of square miles below diverse surface environments.[56] While the size of the shale plays makes them more reliable units for generating projections from economic models than smaller units such as counties, their size also makes them less useful units for analyzing impacts to environmental resources such as air,[57] water,[58] or

[54] Addendum at 6, Fig. 2 (Approximate Locations of Current Producing Gas Shales and Prospective Shales).
[55] *See id*. at 7, Fig. 3 (Location of Currently Active Areas for Tight Sand Development and Production).
[56] *See id.* at 54, Table 13 (Attributes of Major Shale Gas Plays in the United States) (estimating the size of seven major shale plays ranging from 5,000 square miles for the Barnett Shale to 95,000 square miles for the Marcellus Shale). Each of the most active shale basins to date is different, and each has a unique set of exploration criteria and operational challenges. *See id*. at 6.
[57] Air pollutants largely concentrate in the local area in which they are emitted. Without knowing where incremental natural gas production will occur within a particular shale play, the impacts to air quality of such production cannot be well understood. For example, with respect to ozone—the only air pollutant Sierra Club describes as amenable to regional discussion—the Addendum presents a map that overlays ozone non-attainment zones with the shale basins. *See* Addendum at 29, Fig. 8 (National Map Showing Ozone Nonattainment Areas Superimposed on Major Shale Gas Basins). The non-attainment zones appear near urban areas and bear little recognizable relationship to the subsurface geology. Without knowing where in relation to existing ozone concentrations the incremental production would occur, the play-level modeling Sierra Club urges would not enable DOE/FE to characterize the environmental and human health impacts posed by such production.
[58] *See* Addendum at 10-19 (describing potential impacts to water quantity and quality, and concluding that "specific impacts to water resources cannot be predicted even on a regional level").

land.[59] An economic model that estimated induced production across each shale play would provide no information about where any incremental production would arise within those shale plays and would not render the environmental impacts of such production reasonably foreseeable in a manner that would facilitate meaningful analysis.

Such an analysis would also be without limit. Because the price elasticity of natural gas production is likely to be positive in every producing region in the country and because there is a robust interstate pipeline system in the United States, it is likely that upward pressure on natural gas prices nationally could encourage at least some additional production in every producing region in the lower-48 states. The logic of Sierra Club's argument, therefore, would compel the Department, before acting on an application to export natural gas, to undertake an environmental impact statement or environmental assessment that examines separately the environmental impacts of natural gas production in every producing region in the country. Were such a requirement law, it would impose an unreasonable and unrealistic burden on the Department's ability to act on the LNG export applications before it. And the weight of this burden would be misplaced: Unlike state and local regulators, or other federal agencies such as EPA and the U.S. Department of the Interior, the Department of Energy lacks any authority to regulate the environmental effects of natural gas production, much less to address issues identified at the local, regional, or play level.

In sum, there is no "reasonably close causal relationship" between any particular environmental impacts of induced natural gas production and the Department's decision in this

[59] Given the geographic expanse of the shale plays, characterizing the land use impacts of new, incremental wells would not be possible without knowing where those new wells would be located. On this point, Sierra Club suggests that DOE/FE could have estimated how many wells in each play would be necessary to meet projected export demand. Absent an understanding of what land would be affected, however, an attempt to estimate the total number of wells would not have meaningfully informed our decision.

case.[60] The causal chain linking the Department's decision to environmental impacts resulting from induced natural gas production is probabilistic and attenuated—not close and proximate as the Supreme Court has stated must be evident to bring the effects within the scope of NEPA review.

Nevertheless, even though the environmental impacts of induced natural gas production are not "reasonably foreseeable," the Department has taken all reasonable steps to ensure that its public interest review was informed by a consideration of the general environmental impacts of natural gas production. On June 4, 2014, DOE/FE issued the draft Addendum, which, as noted above, presented a discussion of environmental issues associated with unconventional gas production in the lower-48 states based on DOE's review of existing literature, regulations, and best management practices. The Addendum focused on the environmental impacts of unconventional natural gas production in the United States because of the projections by EIA in its 2012 Study that over 90% of incremental production resulting from exports would come from unconventional sources (i.e. shale gas, tight gas, and coalbed methane). The Addendum contained chapters separately considering water resources, air quality, greenhouse gases, induced seismicity, and land use impacts.[61] After a 45-day comment period, the Department received 40,745 comments on the Addendum in 18 separate submissions, including comments from Sierra Club and its members. On August 15, 2014, the Department issued a final version of the Addendum, with textual changes resulting from the comments and a comment response chapter addressing each discrete issue raised in the comments. Although the Department has consistently maintained that an analysis of the environmental impacts of induced natural gas

[60] *Metropolitan Edison Co.*, 460 U.S. at 774.
[61] *See* Final Order at 36-45 (summarizing the Addendum's findings).

production falls outside the scope of what NEPA requires, the Department nonetheless observed NEPA's procedural requirements in publishing and taking comments on the Addendum.

In its Rehearing Request, Sierra Club offers three reasons why it believes the Addendum fails to satisfy the NEPA obligation it believes the Department has with respect to induced natural gas production. First, Sierra Club claims that information in the Addendum contradicts information in other documents in the Department's record. Sierra Club states that the EIS prepared by FERC claims that no natural gas production will be induced by Cameron LNG's Liquefaction Project and therefore conflicts with the Addendum. But the pages from the Final EIS cited in Sierra Club's Rehearing Request do *not* state that no additional production will be induced by the Liquefaction Project—only that that such production is not "reasonably foreseeable" within the meaning of the CEQ regulations.[62] This is the same conclusion that the Department reached in the Addendum.[63]

Second, Sierra Club claims that the Addendum cannot be used for NEPA compliance because "the Addendum and NETL reports . . . reach different conclusions regarding [1] the potency of methane as a greenhouse gas and [2] the amount of air pollution emitted by natural gas production."[64] On the former point, the Department's reasoning for selecting the global warming potential (GWP) for methane used in the LCA GHG Report is explained below in Section III.C.2. The claim that the Addendum reached a "different conclusion[]" than the LCA GHG Report regarding the GWP for methane[65] mischaracterizes the Addendum's objective. The Addendum did not seek to resolve scientific uncertainty regarding the heat-trapping effects of methane. Rather, the Addendum sought to explain what was known on this subject in order to

[62] Final EIS at L-96-97, *cited in* Rehearing Request at 4 n.3.
[63] *See* Addendum at 2 (citing 40 C.F.R. § 1508.7).
[64] Rehearing Request at 4-5.
[65] *Id*. at 4.

inform this proceeding. To that end, the Addendum explained that it had included the carbon dioxide equivalency factor for methane used in the 2007 Intergovernmental Panel on Climate Change's (IPCC) report in Table 7 "to maintain consistency with the EPA's Inventory reports and to allow usage of EPA's estimate for total greenhouse gas emissions from all sources," but it also described the values from the most recent IPCC reports (then in draft) as well as those of other scholars.[66] Finally, there was no inconsistency in the conclusions regarding air pollution emissions for the reasons explained in section III.C.1 of this Order.

Third, Sierra Club claims that the Addendum is inadequate because it does not "consider the effects of the particular proposal under consideration."[67] But, to the extent that Cameron LNG's proposal leads to additional unconventional natural gas production in the United States, then surely the Addendum does inform DOE/FE's consideration of the effects of the proposal in its description of how unconventional gas production impacts various resource areas. The Addendum did not, however, attempt to quantify the environmental impacts associated with Cameron LNG's proposed exports or to apportion any potential environmental impacts across the many production areas currently active across the United States. For the reasons above, we believe that the speculative nature of such an effort would have made it of dubious value to our public interest review.

b. Increased Use of Coal

Sierra Club argues that the Department must examine the possible increased use of coal in electric power generation that may result from the Department's decision in this case. Sierra Club's argument centers on EIA's 2012 Study, which projected an increase in coal use as natural gas prices rise. The causal relationship between the Department's decision in this proceeding

[66] Addendum at 87 (DOE Response), 36.
[67] Rehearing Request at 9.

and the level of coal-fired generation in the United States is even more attenuated than its relationship to induced natural gas production. In effect, Sierra Club is arguing that any time a federal agency takes an action that will affect the supply or demand of a commodity, it must examine the impacts of producing or consuming that commodity, as well as the impacts of producing or consuming the *substitute* commodities with which it competes. What Sierra Club is proposing goes far beyond what the Supreme Court described must be a "manageable line" defining the scope of review required by NEPA.[68]

We also believe that certain assumptions underlying EIA's projections in its 2012 Study relevant specifically to coal-fired power generation are now out of date. As we observed in the Final Order, EIA's projections assume continuation of the regulations in force at the time of its analysis. EIA prepared the 2012 Study before several EPA rulemakings had been finalized. Most significantly, on August 3, 2015, EPA finalized rules under the Clean Air Act that will impose limits on GHG emissions from both new and existing coal-fired power plants.[69]

[68] *Public Citizen.*, 541 U.S. at 767 (quotation and citation omitted).
[69] U.S. Envtl. Protection Agency, Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units; Final Rule, *available at* http://www3.epa.gov/airquality/cpp/cps-final-rule.pdf (Aug. 3, 2015)**;** U.S. Envtl. Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule, *available at* http://www2.epa.gov/sites/production/files/2015-08/documents/cpp-final-rule.pdf (Aug. 3, 2015).

C. The Methodology Underlying the Life Cycle Greenhouse Gas (LCA GHG) Report Was Reasonable

1. Methane Leakage Rate

a. Sierra Club's Position

Sierra Club charges that DOE/FE has not adequately justified the methane leakage rate implied by the LCA GHG Study as compared to higher leakage rates estimated by other life cycle analyses. Sierra Club further asserts that the 1.2 percent leakage rate estimate attributed to NETL in the Final Order is lower than the "expected" cradle-to-liquefaction leakage rates provided by NETL in the LCA GHG Report—1.3 percent for conventional onshore production and 1.4 percent for shale gas production.[70] Sierra Club points out that, in the Addendum, NETL refers to five major studies that account for the GHG emissions from upstream natural gas, including three (Howarth, Burnham, and Weber)[71] that either provide or imply an estimate of methane leakage rates. Sierra Club claims that all of these studies estimate much higher methane leakage than does NETL, and states that "[w]hile NETL provided a basis for disagreeing with the highest of these estimates, [the Howarth study], nothing in the record explains why NETL's estimate is superior to Burnham and Weber."[72]

According to Sierra Club, DOE/FE correctly noted in the Final Order that the boundary conditions applied in the Burnham study differed from those in the LCA GHG Report, in that NETL reviewed "cradle-through-transmission" whereas Burnham included the additional step of distribution. Sierra Club maintains that the vast difference in methane emission estimates cannot be explained by the difference in boundary conditions or by other differences between NETL and

[70] Rehearing Request at 13-14.
[71] *See, e.g.*, 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 [hereinafter Burnham study]; 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 [hereinafter Weber study].
[72] Rehearing Request at 14.

the Burnham study. According to Sierra Club, Burnham estimated that 0.28 percent of methane produced was emitted during distribution, and that subtracting this 0.28 percent from Burnham's total estimate leaves a cradle-through-transmission leak rate of 2.47 percent for conventional onshore gas and 1.73 percent for unconventional gas.[73]

Sierra Club also addresses the statement in the Final Order that the Weber study made no mention of leakage rate. Sierra Club acknowledges that the Weber study does not discuss emissions in terms of leakage rate, but contends that the emissions estimates in the Weber study imply the same leakage rate that is set out in NETL's Unconventional Production Report and asserts that this leakage rate is explained by Bradbury 2014, as discussed in the NETL reports. Sierra Club contends: "Because NETL already determined that the Weber team's conclusions could be expressed as a leakage rate estimate, DOE cannot now argue that this work has no bearing on the appropriate estimate of leakage rates or, ultimately, methane emissions."[74]

Sierra Club also argues that the Department should have modeled methane emissions using "top-down" rather than "bottom-up" studies. Sierra Club cites five top-down studies that it claims estimate higher methane leakage rates of generally 3 percent or more on the basis of atmospheric measurements. According to Sierra Club, the Final Order acknowledges that top-down studies do not generally match bottom-up calculations due to different boundaries, but Sierra Club maintains that DOE/FE did not explain why the boundaries used in bottom-up studies are more appropriate.[75]

[73] *See id*. at 14.
[74] *Id*.
[75] *See id*. at 14-15.

Based on Brandt 2014 and other research,[76] Sierra Club maintains that bottom-up estimates are likely to be inaccurate. Sierra Club states that nothing in the Brandt study indicates that the broader top-down estimates, such as Miller 2013, are not representative, and that the three percent leakage rate indicated by Miller is more than double the rate used by DOE.[77] Sierra Club recognizes that leakage rate is an output of, rather than an input to, NETL's model. But Sierra Club's maintains that NETL's model produces an output that is so inconsistent with the outputs of other models that there is either a problem with the inputs to NETL's model or with the model itself. According to Sierra Club, DOE/FE did not provide a rational basis for using the NETL estimates instead of a higher methane leakage rate estimated by such top-down studies.

b. DOE/FE Analysis

The average methane leakage rate estimated in the LCA GHG Report is reasonable. Sierra Club is correct that NETL determined 1.3 percent and 1.4 percent to be the methane leakage rates for natural gas extracted using conventional extraction methods and extracted from the Marcellus Shale, respectively, as shown in Table 5-1 of the LCA GHG Report. But, as DOE/FE has explained, NETL determined that 1.2 percent is the expected "cradle-through-transmission" leakage rate for the *average* mix of domestic natural gas, which includes seven

[76] *See* Brandt, A. R., *et al*. (2014) Methane Leaks from North American Natural Gas Systems. *Science 343(6172)*, pp. 733-735 [hereinafter Brandt study]. Sierra Club also notes that, on June 19, 2014, after DOE/FE had released the draft Addendum and the LCA GHG Report, a new study by researchers at Carnegie Mellon and the National Oceanic and Atmospheric Administration was published that, Sierra Club claims, concludes that the most likely methane leakage rate is between 2 percent and 4 percent. Rehearing Request at 15 n.38 (citing Stefan Scheietzke *et al.*, "Natural Gas fugitive emissions rates constrained by global atmospheric methane and ethane," *Environmental Science & Technology* (June 19, 2014), DOI: 10.1021/es50104c). Although Sierra Club does not explain whether this study used a top-down or bottom-up modeling approach, its assertions regarding the study nevertheless are untimely. Sierra Club did not mention the study in its comments on the LCA GHG Report submitted to DOE/FE on July 21, 2014, and DOE/FE will not consider new evidence on rehearing.

[77] Rehearing Request at 15.

extraction sources. The contribution of the other five sources of domestic natural gas (offshore, associated, tight gas, Barnett Shale, and coal bed methane) lower the average methane leakage to 1.2 percent, below the 1.3 percent and 1.4 percent reported for actual gas extracted using conventional on-shore extraction and from the Marcellus Shale. This means that the extraction, processing, and transmission of 1 kg of natural gas[78] in the United States releases 0.012 kg of methane to the atmosphere from the average mix of natural gas produced in the United States (excluding Alaskan production). Thus, NETL's expected value and range on methane emission rate are calculated results that capture the underlying uncertainty and variability of the natural gas system average performance. This approach results in a reasonable estimate, and we reject Sierra Club's arguments to the contrary.

We also reject Sierra Club's assertion that NETL's methane leakage rate is significantly lower than those used or calculated by other bottom-up studies. The Weber study, cited above, reconciled the boundaries from six studies (including work by NETL and Burnham) and demonstrated that the expected values and uncertainty ranges of NETL's upstream natural gas GHG emissions closely match the results for most other studies.

We likewise reject Sierra Club's argument that DOE/FE should have used a "top-down"[79] approach to derive a methane leakage rate. In the Final Order, DOE/FE responded by noting that researchers are currently working to discern why top-down studies do not match

[78] As a convention to improve comparability to other studies, NETL expresses leakage rate using delivered natural gas as a denominator; that is, methane emissions per unit of delivered natural gas, not methane emissions per unit of delivered methane.

[79] Rehearing Request at 9-14. For purposes of this discussion, bottom-up *data* account for emissions at the device level (*e.g.*, liquid unloading equipment, compressors, etc.), and bottom-up *models* aggregate multiple processes to compose a system. In contrast, top-down *data* account for emissions from an entire system (*e.g.*, a sector or geographical region), and top-down *models* apportion system emissions to the products of the system. Currently, the bottom-up models for natural gas systems are based mostly on engineering relationships and represent long-term operating regimes, while top-down models for natural gas systems represent measurements collected for specific regions during narrow time frames. *See* Final Order at 69.

bottom-up studies. DOE/FE also noted that, as research continues, scientists expect to learn more about the differences between these two types of methodologies.[80]

With that caveat in mind, our judgment is that, based on the scientific studies available at the time the analysis in this proceeding was performed, bottom-up studies are a more appropriate basis for analysis of methane emissions from U.S. natural gas systems than available top-down studies. The broad boundaries of top-down measurements may capture all emissions from natural gas production facilities within a study region; however, these emissions are not always distinguishable from emissions from nearby oil production activities, or emissions from other sectors that operate in the same region such as agriculture. Further, top-down measurements capture methane emissions only at a particular place and time. Thus, in the Final Order, we discussed the role of temporal and geographical representativeness as potential reasons for the differences between top-down and bottom-up results, while at the same time noting that research into that question is continuing. The top-down studies cited by Sierra Club represent valuable research that advance our understanding of methane emissions, but do not form a robust basis for estimating the leakage rate from U.S. natural gas systems in the aggregate.

2. Global Warming Potential of Methane

a. Sierra Club's Position

Sierra Club claims that the LCA GHG Report erroneously "understates the impact of each ton of methane pollution"[81] and that DOE/FE should have used Global Warming Potential

[80] *See id.*
[81] Rehearing Request at 16.

(GWP)[82] estimates drawn from the IPCC that include climate carbon feedbacks.[83] Sierra Club contends these estimates would have yielded a 20 percent higher GWP. According to Sierra Club, the IPCC has stated that including the climate-carbon feedback for methane and other non-carbon dioxide greenhouse gases—in which an increase in the atmospheric temperature causes a further increase in atmospheric concentration of carbon dioxide—provides a better estimate of the metric value. Sierra Club therefore argues that DOE should have used the IPCC's "20-year and 100-year fossil methane global warming potentials of 87 and 36, respectively."[84] Without providing a calculation or citation, Sierra Club asserts that using a GWP value of 36 for methane increases the life cycle GHG emissions from the scenarios by 20 percent relative to those calculated by NETL using a GWP value of 30.[85]

b. DOE/FE Analysis

The LCA GHG Report addresses an area of scientific study—the study of life cycle GHG emissions—that is constantly evolving. In the Report, NETL acknowledges the wide range of scenario variability, the uncertainty in the underlying modeled data, and other study limitations arising from this subject matter.[86] As explained below, NETL and DOE/FE made a reasoned evaluation of the scientific facts then-available concerning the potential impacts of U.S. LNG exports on global GHG emissions.

[82] GWP is a measure of how much energy the emissions of one ton of a gas will absorb over a given period of time, relative to the emissions of one ton of carbon dioxide. The larger the GWP, the more that a given gas warms the Earth compared to carbon dioxide over that time period. The time period usually used for GWPs is 100 years. GWPs provide a common unit of measure, which allows analysts to add up emissions estimates of different gases (*e.g.*, to compile a national greenhouse gas inventory), and allows policy-makers to compare emissions-reductions opportunities across sectors and gases. *See* U.S. Envtl. Protection Agency, *Understanding Global Warming Potentials*, http://www.epa.gov/climatechange/ghgemissions/gwps.html (last updated Sept. 11, 2015).
[83] Rehearing Request at 16.
[84] *Id*.
[85] *See id.*
[86] LCA GHG Report at 18 (Summary and Study Limitations).

NETL selected the GWP values and other parameters for its LCA GHG Report in the fall of 2013. At that time, working group papers for the IPCC's Fifth Assessment Report[87] were available in draft form. For the first time, those analyses produced two sets of GWP values for methane: GWP values based solely on the radiative forcing of methane and GWP values that also included an adder for climate-carbon feedbacks. Based on a perception of uncertainty underlying the climate carbon feedback adders, as well as their novelty and a lack of clear guidance from the IPCC at that time, NETL elected to use the GWP values without the climate carbon feedback adders as it had done in the past. Specifically, the LCA GHG Report uses 20- and 100-year methane GWPs of 85 and 30, respectively—as compared to the GWPs of 87 and 36 when climate carbon effects are included.

We agree with Sierra Club that using 20- and 100-year methane GWPs of 87 and 36 is most appropriate for use today and that climate carbon feedbacks should be captured in the GWP values for methane. Using these values, however, would not have materially affected the conclusions of the LCA GHG Report. Contrary to Sierra Club's suggestion, there is no one-for-one relationship between the GWP of methane and the total life-cycle GHG impact of U.S.-exported LNG because methane is not the only type of GHG emission. Natural gas energy systems release both methane and carbon dioxide. On a life cycle basis for delivered electricity, combustion at the power plant—which produces carbon dioxide emissions—accounts for the majority of GHG emissions. The following table depicts how the life cycle GHG emissions for three key scenarios in the LCA GHG Report would change depending on whether the 100-GWP

[87] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

for methane was 30 or 36. These changes were calculated by scaling the methane emissions in Figures 6-3 through 6-5 of the LCA GHG Report by a ratio of 36/30.

Table 1: Increase in GHG Emissions by Changing 100-year CH_4 GWP

Scenario	GHG Emissions (kg CO_2e/MWh)		
	GWP_{CH_4} = 30	GWP_{CH_4} = 36	% change
Natural gas power using U.S. LNG transported to Rotterdam	629	646	2.8%
Natural gas power using Russian NG transported by pipeline to Rotterdam	612	642	4.9%
Coal power using regional coal	1,089	1,090	0.1%

As this table demonstrates, using the 100-year methane GWP of 36 does not increase the 100-year GWP by 20 percent compared to NETL's estimates based on a GWP value of 30. Rather, the estimate of GHG emissions resulting from U.S.-exported LNG increases by 2.8 percent, the estimate for Russian gas increases by 4.9 percent, and the estimate for use of regional coal increases by 0.1 percent. This change in the GWP estimate would not have made a material difference to the conclusions of the LCA GHG Report.

D. Consideration of Climate Impacts

1. Sierra Club's Position

Sierra Club claims that DOE/FE's consideration of climate impacts in its public interest analysis was based on unsupported assumptions and failed to place these impacts in the proper context. In the Final Order, DOE considered whether emissions from U.S.-exported LNG would be offset by displacement of combustion of other fossil fuels and avoidance of associated emissions. Sierra Club maintains that this approach is not the proper way to assess climate impacts and that the United States' international commitments require consideration of domestic

GHG emissions without consideration of displaced foreign emissions.[88] In addition, Sierra Club claims that DOE/FE's analysis of climate impacts focuses on the LCA GHG analysis but does not focus on "the simpler problem" represented by Cameron LNG's specific proposal with two thirds of output contracted to Japanese buyers.[89] Sierra Club asserts that this modeling effort for Cameron LNG's Liquefaction Project would not be unreasonably burdensome or speculative.

Sierra Club also maintains that the available evidence does not support DOE/FE's decision to compare the lifecycle of U.S. LNG solely to coal and other sources of gas. First, Sierra Club asserts that DOE provides no basis for comparing U.S. LNG against coal and natural gas used in China rather than the aggregate GHG intensity of China's generation fleet or, even more appropriately, the average GHG intensity of additional generation capacity that China is expected to add (based on EIA data). According to Sierra Club, DOE cited China's 2012 generation capacity, which was composed of 66 percent coal and 3 percent natural gas. Sierra Club maintains that it would have been reasonable to assume that U.S. LNG would be more likely to compete against sources of new capacity rather than existing sources, and states that the new capacity will be more than 50 percent renewables and, therefore, will have a significantly lower GHG intensity than DOE's estimate even under a 100-year GWP.[90]

Second, in the case of Japan, Sierra Club states that DOE did not forecast future Japanese generation even though this information is available. Sierra Club contends that DOE/FE has an obligation to seek out the environmental effects of the proposed project. However, Sierra Club states that the data of the International Energy Agency on which EIA relied indicates that the GHG intensity of Japan's aggregate mix is very near NETL's estimate of the intensity of U.S.

[88] Rehearing Request at 18.
[89] *See id*.
[90] *See id*. at 18-19.

LNG. Therefore, Sierra Club maintains that correcting any of the errors in NETL's assessment would likely lead to the conclusion that U.S. LNG has higher life-cycle emissions than the energy that U.S. LNG would likely displace in Japan.[91]

2. DOE/FE Analysis

The Department has thoroughly reviewed the GHG impacts of its decision. At the project level, the EIS describes direct GHG emissions resulting from the construction and operation of the Cameron Terminal, including the liquefaction process.[92] The Addendum contains a chapter devoted to GHG emissions and includes a range of estimates from the scientific literature of the GHGs emitted by producing and transporting natural gas from unconventional resources.[93] Finally, the LCA GHG Report analyzes the life-cycle GHGs emitted from U.S.-exported LNG that is re-gasified and combusted for electric power generation in Europe or Asia. The LCA GHG Report compares the life-cycle GHGs of U.S.-exported LNG to those of LNG exported from other producing countries, pipeline gas delivered from Russia, and domestic coal burned in both Europe and Asia.[94]

It is useful to compare the life-cycle GHG emissions of U.S.-exported LNG to other forms of generation because U.S.-exported LNG has the potential to displace other fuels and thus to avoid the emissions associated with burning those fuels. Sierra Club argues that the Department should have focused on the emissions solely within the United States because of the importance of the United States' international emissions reductions commitments. On the record before us, however, Sierra Club has provided no basis to support its contention that Cameron

[91] *See id*. at 19.
[92] Final EIS at 4-118 to 4-129.
[93] Addendum at 33-44.
[94] *See* Final Order at 45-55.

LNG's proposed exports, or U.S. LNG exports in general, will have a material effect on the ability of the United States to fulfill economy-wide emissions reductions targets.

The comparison cases used in the LCA GHG Report were well-chosen. When U.S.-exported LNG enters the marketplace, it will compete with LNG sourced from other countries. Therefore, the comparison of U.S.-sourced LNG to foreign-sourced LNG is clearly instructive. U.S.-exported LNG also will compete directly with pipeline deliveries from Russia in some markets, another form of "gas-on-gas" competition. Recognizing that the availability of U.S.-exported LNG may affect the electric power generation mix in importing countries, the LCA GHG Report also compared U.S.-exported LNG to coal produced domestically in both Europe and Asia. This comparison is likewise instructive because, as the Department explained in the Final Order, coal remains a prevalent choice for electric power generation in LNG-importing countries and competes with natural gas as a source of baseload power.[95]

It is important, however, to recognize the Department's limited aims in making these comparisons. In the Final Order, the Department made clear that the comparisons to coal and foreign-sourced gas in the LCA GHG Report did not themselves answer the ultimate question of how U.S. LNG exports would affect the global GHG balance because U.S. LNG could compete with other resources as well. The Department explained that, given the prevalence of coal and natural gas as sources of electric generation in LNG-importing countries, the comparison nonetheless provided useful information. Looking at the record before it, the Department concluded only that it did "not see a reason to conclude that U.S. LNG exports will significantly exacerbate global GHG emissions."[96]

[95] *See id*. at 82.
[96] *Id*. at 80-83.

The Department also explained why it was not attempting a more precise prediction regarding global GHG impacts. The Department explained that the compounded uncertainties in estimating how the availability of U.S. LNG exports would affect the market for every potential energy source in every importing country, along with the interventions of foreign governments in those markets, would render such an analysis too speculative to inform its public interest determination.[97] In its rehearing petition, Sierra Club suggests alternative comparisons the Department could have used to approach the difficult question of how U.S. LNG exports would affect the global GHG balance. For one, Sierra Club states that the Department could have analyzed Cameron LNG's specific LNG export proposal. With two-thirds of Cameron LNG's proposed output of LNG contracted to Japanese buyers, Sierra Club suggests that DOE should have focused solely on Japan, which Sierra Club characterizes as a "simpler problem."[98] We disagree. Focusing solely on Japan is a "simpler problem" only because it ignores that there is a global market for LNG. Even if *all* U.S.-exported LNG went to Japan, those exports would affect the global price of LNG, which in turn would affect energy systems in numerous countries, not only Japan.

Sierra Club also suggests that the Department should have compared the lifecycle GHG emissions of U.S.-exported LNG to those of the average new facility in China. But Sierra Club does not explain why this would be an appropriate comparison. To the extent that U.S.-exported LNG lowers the price of natural gas in a given country, that price change could affect dispatch and retirement decisions facing existing units as well as decisions of what new units to build. Moreover, even with respect to new capacity, it may not be valid to assume that natural gas

[97] *See id*. at 82.
[98] Rehearing Request at 18.

would compete directly with renewables in all nations given the potential intervention of public policy and the different role these resources play in an integrated electric system.

IV. CONCLUSION

We find that it has not been shown that a grant of the requested authorization is inconsistent with the public interest. We affirm our previous finding that the Application should be granted subject to the terms and conditions set forth in the Final Order.

V. ORDER

Pursuant to sections 3 and 19 of the Natural Gas Act, and for the reasons set forth above and in Order Nos. 3391 and 3391-A, it is ordered that:

A. Cameron LNG's Motion for Leave to Answer Sierra Club's Request for Rehearing is granted; and

B. Sierra Club's Request for Rehearing is denied.

Issued in Washington, D.C., on September 24, 2015.

Christopher A. Smith
Assistant Secretary
Office of Fossil Energy