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UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

IN THE MATTER OF	**)**	
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VENTURE GLOBAL LNG, LLC	**)**	**FE DOCKET NO. 13-69-LNG**

SIERRA CLUB'S MOTION TO INTERVENE, PROTEST, AND COMMENTS

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In the above-captioned docket, Venture Global LNG, LLC (Venture Global) requests authorization to export approximately five million tons per annum (mtpa), or approximately 0.67 billion cubic feet per day (bcf/d), of natural gas as liquefied natural gas (LNG) from a natural gas liquefaction and LNG export terminal located along the Calcasieu Ship Channel in Cameron Parish, Louisiana. Sierra Club hereby moves to intervene in this docket, protests this proposal, and offers related comments.

Venture Global fails to acknowledge many of the project's harmful effects while failing to support Venture Global's assertions of purported benefit. The proposed export project will cause extensive environmental harm, impacting the environment around the export site, inducing harmful natural gas production, and likely increasing global greenhouse gas emissions. DOE/FE cannot authorize exports without fairly weighing significant environmental and economic impacts of this production. *See NAACP v. Federal Power Comm'n*, 425 U.S. 662, 670 n.4 (1976). Exports will also harm the public interest by increasing domestic gas prices and causing related economic damage.

While Venture Global's project will have real harms, Venture Global's assertions of benefits are unsupported. Ten of the nineteen pages of Venture Global's application argue that the project will provide "unique" benefits by delivering LNG to Haiti and other—unspecified—developing nations where LNG will purportedly substitute for other fossil fuels. The application's emphasis on Haiti is out of proportion with the fact that merely states that it is in "discussions" regarding possible delivery only of 4 to 7 percent of the project's output to Haiti. Tellingly, Venture Global, like every other export applicant, seeks authorization to export to the highest bidder—i.e., "to any country which has, or in the future develops, the capacity to import LNG via ocean-going carriers (either directly or by use of LNG containers transported on ocean-going carriers)." App. at 2. Venture Global provides no basis for concluding that its project will deliver even this small fraction of its proposed LNG output to Haiti if market rates in other destinations (accounting for transportation costs, etc.) are higher. On the other hand, if Haiti is the highest bidder for LNG exports, then Venture Global would hardly be "unique" in its willingness to deliver LNG to Haiti. Beyond this undue emphasis on Haiti, Venture Global assertion of benefits rest primarily on the NERA macroeconomic study—a study that shows that exports will raise gas prices and eliminate jobs.

Because Sierra Club's members have a direct interest in avoiding the environmental harms Venture Global's proposal will cause and in ensuring that any exports do not adversely affect domestic consumers, Sierra Club moves to intervene in FE Docket No. 13-69-LNG and protests Venture Global's application.

I. Sierra Club Should be Granted Intervention

Sierra Club members live and work throughout the area that will be affected by Venture Global's export proposal, including in the regions of Louisiana that will be affected by supporting infrastructure. Sierra Club members also live in the domestic gas fields that will likely see increased production as a result of the proposed exports. Sierra Club members everywhere will also be affected by the increased gas prices that would result from completion of proposed LNG export facilities like the Venture Global project. As of April 2014, Sierra Club had 2,954 members in Louisiana and 632,604 members overall.[1]

To protect our members' interests, Sierra Club moves to intervene in FE Docket No. 13-69-LNG, pursuant to 10 C.F.R. § 590.303. Consistent with that rule, Sierra Club states that its rights and interests in these matters include, but are not limited to, the following:

- The environmental consequences of any gas exports from the Venture Global project, including emissions and other pollution associated with the liquefaction process, environmental damage associated with construction and operation of the facility and associated infrastructure, environmental impacts caused by shipping traffic, and the emissions associated with all phases of the process from production to combustion.
- The environmental and economic consequences of any expansion or change in natural gas production, especially in shale gas plays, as a result of increased gas exports. Members living in these regions will be affected by the damage to air, land, and water resources caused by the increasing development of these plays, and the public health risks caused by these harms.
- The economic impacts of any gas exports from the Venture Global project, whether individually or in concert with exports from other such facilities, including the consequences of price changes upon members' finances, consumer behavior generally, and industrial and electrical generating facilities whose fuel choices may be affected by price changes. Sierra Club, in particular, works to reduce U.S. and global dependence on fossil fuels, including coal, gas, and oil,

[1] Attached Declaration of Yolanda Andersen at ¶ 7, attached as Exhibit 1.

and to promote clean energy and efficiency in order to protect public health and the environment. To the extent changes in gas prices increase the use and production of coal and oil, Sierra Club's interests in this proceeding are directly implicated.

- The public disclosure, in National Environmental Protection Act and other documents, of all environmental, cultural, social, and economic consequences of Venture Global's proposal, and of all alternatives to that proposal.

In short, Sierra Club's members have vital economic, aesthetic, spiritual, personal, and professional interests in the expansion project.

The Club has demonstrated the vitality of these interests in many ways. Sierra Club runs national advocacy and organizing campaigns dedicated to reducing American dependence on fossil fuels, including natural gas, and to protecting public health. These campaigns, including its Beyond Coal campaign and its Beyond Natural Gas campaign, are dedicated towards promoting a swift transition away from fossil fuels and to reducing the impacts of any remaining natural gas extraction.

Thus, although 10 C.F.R. § 590.303 states no particular standard for intervention, Sierra Club has interests in these proceedings that would be sufficient to support intervention on any standard. This motion to intervene must be granted.[2]

II. Service

Pursuant to 10 C.F.R. § 590.303, Sierra Club identifies the following persons for service of correspondence and communications regarding these applications.

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[2] If any other party opposes this motion, we respectfully request leave to reply. *Cf.* 10 C.F.R. §§ 590.302, 590.310 (allowing for procedural motions and briefing in these cases).

III. Sierra Club Protests this Application Because It Is Not In the Public Interest and Is Not Supported by Adequate Environmental and Economic Analysis

Section 3 of the Natural Gas Act provides that DOE/FE cannot authorize exports unless it finds the exports to be in the public interest. 15 U.S.C. § 717b. DOE/FE must consider environmental factors in the course of this public interest analysis. *NAACP*, 425 U.S. at 670 n.4; *Jordan Cove, L.P.*, DOE/FE Order 3413, 6, 7 (March 24, 2014). Accordingly, DOE/FE cannot proceed with Venture Global's application without fully evaluating the environmental impacts of Venture Global's proposal. The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4332 *et seq*., provides the congressionally mandated procedure for assessment of these impacts, and NEPA requires that these procedures be completed "at the earliest possible time," *i.e.*, "*before* decisions are made and *before* actions are taken." 40 C.F.R. §§ 1501.2, 1500.1(b) (emphases added). Similarly, for proposals that will require an EIS, such as this one, DOE regulations provide that DOE "shall take no action" until the EIS is completed. 10 C.F.R. § 1021.211 (emphasis added). Accordingly, DOE/FE cannot proceed with Venture Global's request for export authorization until the NEPA process is completed, including preparation of an Environmental Impact Statement.

Venture Global's application is silent as to important environmental impacts of the proposal. As we explain below, the proposal will cause many types of significant environmental harm, and these harms must be considered as part of DOE/FE's public interest analysis. First, the construction and operation of the liquefaction facilities, export terminal, and related pipelines will directly impact local water quality, habitats, and air quality. Second, the project will induce additional natural gas production in the United States, primarily hydraulic fracturing (fracking) of unconventional gas sources, thus causing the myriad environmental harms associated with such production. Third, the project will increase domestic gas prices, likely causing an increase in coal-fired electricity generation and thus increasing emissions of greenhouse gases, conventional, and toxic air pollutants. Fourth, notwithstanding Venture Global's assertion that LNG exports will displace use of heavy fuel oil and other fossil fuels, it is likely that LNG exports will also compete against wind, solar, and other clean renewable energy sources that would have lower environmental impacts.

Moreover, DOE/FE must reject Venture Global's threadbare economic arguments in support of its proposal. Domestically, exports will have adverse economic impacts as a result of increasing gas prices, lost jobs, and increased coal-fired electricity generation. Communities where increased gas production occurs will likely suffer from the "resource curse" and end up worse off than they would have been otherwise. LNG exports will result in net domestic job losses and economic harm to most Americans, overwhelming the purported economic benefits Venture Global asserts. Internationally, DOE/FE must disregard Venture Global's outsize rhetoric regarding Haiti entirely unless Venture Global provides an enforceable commitment—or at least a clear and convincing

indication—that Haiti will actually receive a meaningful share of Venture Global's output.
For these reasons, the reasons stated in Sierra Club's initial and reply comments on the NERA LNG study (which we incorporate here by reference),[3] and the other reasons set forth below, Sierra Club files this protest, pursuant to 10 C.F.R. § 590.304.

A. Legal Standards

DOE/FE has significant substantive and procedural obligations to fulfill before it can authorize Venture Global's export application. Here, we discuss some of these obligations created by the Natural Gas Act, National Environmental Policy Act, and the Endangered Species Act, before explaining why these obligations preclude Venture Global's request for authorization.

1. Natural Gas Act

Pursuant to the Natural Gas Act and subsequent delegation orders, DOE/FE must determine whether Venture Global's proposal to export LNG to nations which have not signed a free trade agreement (FTA) with the United States is in the public interest.[4] While Venture Global contends that the sole determinant of this inquiry is whether "a proposed export will not jeopardize domestic supply during the term of the export," App. at 14, Courts, DOE/FE, and the Federal Energy Regulatory Commission (FERC) all agree that the "public interest" at issue in this provision is wide ranging, including environmental impacts as well as economic impacts.

Section 3 of the Act provides:

> [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 [DOE/FE] authorizing it do so. [DOE/FE] shall issue such order upon application unless, after opportunity for hearing, it finds that the proposed exportation or importation will not be consistent with the public interest.

[3] DOE/FE has commissioned a two part study of the economic impats of LNG exports. Energy Information Adminstration, *Effect of Increased Natural Gas Exports on Domestic Energy Markets*, (2012) ("EIA Export Study"), attached as Exhibit 2; NERA Economic Consulting, *Macroeconomic Impacts of LNG Exports from the United States* (2012) ("NERA Study"), attached as Exhibit 3. Sierra Club and others submitted extensive comments on these studies. Sierra Club Initial NERA Comment, attached as Exhibit 4; Synapse Analysis of NERA Study, attached as Exhibit 5; Sierra Club Reply NERA Comment, attached as Exhibit 6.
[4] The Natural Gas Act separately provides that DOE/FE must approve exports to nations that have signed a free trade agreement requiring national treatment for trade in natural gas "without modification or delay." 15 U.S.C. § 717b(c).

15 U.S.C. § 717b(a).[5]

Courts interpreting this provision have long held that the "public interest" encompasses the environment. Although the public interest inquiry is rooted in the Natural Gas Act's "fundamental purpose [of] assur[ing] the public a reliable supply of gas at reasonable prices," *United Gas Pipe Line Co v. McCombs*, 442 U.S. 529 (1979), the Natural Gas Act also grants DOE/FE "authority to consider conservation, environmental, and antitrust questions." *NAACP v. Federal Power Comm'n*, 425 U.S. 662, 670 n.4 (1976) (citing 15 U.S.C. § 717b as an example of a public interest provision); *see also id.* at 670 n.6 (explaining that the public interest includes environmental considerations). Subsequent cases have confirmed *NAACP*'s holding that the purposes of the Natural Gas Act include environmental issues. *Pub. Utilities Comm'n of State of Cal. v. F.E.R.C.*, 900 F.2d 269, 281 (D.C. Cir. 1990). In interpreting an analogous public interest provision applicable to hydroelectric power and dams, the Supreme Court has explained that the public interest determination "can be made only after an exploration of all issues relevant to the 'public interest,' including future power demand and supply, alternate sources of power, the public interest in preserving reaches of wild rivers and wilderness areas, the preservation of anadromous fish for commercial and recreational purposes, and the protection of wildlife." *Udall v. Fed. Power Comm'n*, 387 U.S. 428, 450 (1967) (interpreting § 7(b) of the Federal Water Power Act of 1920, as amended by the Federal Power Act, 49 Stat. 842, 16 U.S.C. § 800(b)). Other courts have applied *Udall*'s holding to the Natural Gas Act. *See, e.g.*, *N. Natural Gas Co. v. Fed. Power Comm'n*, 399 F.2d 953, 973 (D.C. Cir. 1968) (interpreting section 7 of the Natural Gas Act).[6]

DOE/FE and FERC have also acknowledged the breadth of the public interest inquiry and recognized that it encompasses environmental concerns. Most recently, DOE/FE explained that factors weighing on the public interest "include economic impacts, international impacts, security of natural gas supply, and environmental impacts, among others."[7] DOE rules require export applicants to provide information documenting "[t]he potential environmental impact of the project." 10 C.F.R. § 590.202(b)(7). DOE Delegation Order No. 0204-111 interpreted the NGA's public interest standard to

[5] The statute vests authority in the "Federal Power Commission," which has been dissolved. DOE/FE has been delegated the former Federal Power Commission's authority to authorize natural gas exports. Department of Energy Redelegation Order No. 00-002.04E (Apr. 29, 2011). *See also* Executive Orders 12038 & 10485 (vesting any executive authority to allow construction of export facility in the Federal Power Commission and its successors).

[6] Further support for the inclusion of environmental factors in the public interest analysis is provided by NEPA, which declares that all federal agencies must seek to protect the environment and avoid "undesirable and unintended consequences." 42 U.S.C. § 4331(b)(3).

[7] Jordan Cove, DOE/FE Order No. 3413, 6-7 (March 24, 2014); accord *Phillips Alaska Natural Gas Corporation and Marathon Oil Company*, 2 FE ¶ 70,317, DOE FE Order No. 1473, 1999 WL 33714706, *22 (April 2, 1999) (specifically enumerating environmental concerns as a factor in the public interest analysis).

require consideration of matters beyond the mere "domestic need for the gas to be exported."[8] Similarly, in FERC's recent order approving siting, construction, and operation of LNG export facilities in Sabine Pass, Louisiana, FERC considered potential environmental impacts of the terminal as part of its public interest assessment, which is analogous to DOE/FE's.[9]

In the face of this extensive authority indicating that the public interest inquiry requires consideration of environmental impacts, Venture Global's argument that the public interest turns solely on the adequacy of gas supply rests only on citation to DOE/FE's outdated import guidance. App. at 14. Venture Global argues that, because this guidance favors competitive markets for gas, impacts on domestic gas prices should be beyond the scope of DOE/FE's analysis. *Id.* Even if the guidance's determination not to directly prices of imported gas broadly implied that price impacts are outside the scope of analysis, this in no way implies that environmental impacts can or should similarly be excluded. More generally, however, the import guidance is itself outdated, and DOE/FE should reject Venture Global's argument that this import applies to exports. App. at 9. This thirty year old guidance does not reflect current understanding of the environmental impacts of gas production and consumption, nor does its reasoning apply to exports. In 1984, DOE published *Policy Guidelines and Delegation Orders Relating to the Regulation of Imported Natural Gas*, 49 Fed. Reg. 6,684 (Feb. 22, 1984). The primary issue confronted by these guidelines was whether to directly regulate prices at which gas could be imported from Canada.[10] DOE/FE determined that, if U.S. buyers were willing to pay market rates for imported gas, this would generally demonstrate a need for that gas.[11] This reasoning underlying this guidance does not apply to exports. First, the question before DOE/FE here is not to regulate the prices at which gas can be exported, but rather, whether to allow exports at all. A foreign purchaser's willingness to outbid domestic purchasers does not demonstrate that the US does not "need" that gas. Similarly, international gas markets and a foreign purchaser's willingness to pay for U.S. exports do not account for the environmental impacts of those exports. As we explain below, LNG exports have extensive environmental impacts, all of which have severe costs, but these costs are externalized by existing markets. Moreover, these costs are generally borne by the US public, whereas the benefits accrue to a small subset of US citizens and to the foreign purchasers of LNG. Accordingly, international gas markets are a wildly inappropriate indicator of the impacts of exports on the public interest.

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[8] DOE Delegation Order No. 0204-111, at 1, 49 Fed. Reg. 6686, 6690 (Feb. 22, 1984). This order has been rescinded, but DOE/FE continues to cite it in discussing export applications. *See, e.g.,* Freeport Conditional Authorization, DOE/FE Order 3282, at 7.

[9] 139 FERC ¶ 61,039, PP 29-30 (Apr. 14, 2012). Sierra Club contends that other aspects of this order were wrongly decided, as was FERC's subsequent denial of Sierra Club's petition for rehearing, as we explain below.

[10] 49 Fed. Reg. at 6,684-85.

[11] *Id.*

Sierra Club recognizes that DOE/FE has referred to this guidance in prior export proceedings,[12] but in those proceedings, DOE/FE neither acknowledged nor discussed these differences between imports and exports. In this regard, the import guidance is akin to DOE/FE's outdated practice of conditionally authorizing export applications. Although DOE/FE conditionally authorized several export applications, DOE/FE has recently recognized that the purported policy justification for conditional authorizations does not apply to the export context, and DOE/FE has proposed to abandon this practice. Similarly, although DOE/FE's recent conditional export authorizations have relied on DOE/FE's import guidance, DOE/FE must acknowledge that the reasoning underlying this guidance has no application to the export context.

Finally, although DOE/FE has adopted a presumption that LNG export applications are consistent with the public interest, this presumption is rebuttable and not determinative. The D.C. Circuit has explained to DOE/FE that this presumption is "highly flexible, creating *only* rebuttable presumptions and leaving parties free to assert other factors." *Panhandle Producers & Royalty Owners Ass'n v. Economic Regulatory Admin.*, 822 F.2d 1105, 1110-11, 1113 (D.C. Cir. 1987) (emphasis added) (internal quotation marks omitted). Put differently, although DOE/FE may "presume" that an application should be granted, this presumption is not determinative, and DOE/FE retains an independent duty to determine whether an application is, in fact, in the public interest. *See* 10 C.F.R. § 590.404.

2. National Environmental Policy Act

NEPA requires federal agencies to consider and disclose the "environmental impacts" of proposed agency actions. 42 U.S.C. § 4332(C)(i). Agencies must "carefully consider [ ] detailed information concerning significant environmental impacts" and NEPA "guarantees that the relevant information will be made available" to the public. *Dep't of Transp. v. Public Citizen*, 541 U.S. 752, 768 (2004) (quoting *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989)). DOE/FE's NEPA obligations are informed by general regulations promulgated by the Council on Environmental Quality and by additional agency-specific regulations promulgated by DOE. *See* 10 C.F.R. § 1021.103 (DOE regulation adopting CEQ NEPA regulations in full). These regulations implement NEPA via procedures that "insure that environmental information is available to public officials and citizens *before* decisions are made and *before* actions are taken." 40 C.F.R. § 1500.1(b) (emphases added). Agencies must "integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values." 40 C.F.R. § 1501.2. "It is DOE's policy to follow the letter and spirit of NEPA; comply fully with the [CEQ] Regulations and apply the NEPA review process early in the planning stages for DOE proposals." 10 C.F.R. § 1021.100. In particular, while an EIS is being prepared "DOE *shall take no action* concerning the

[12] *See, e.g.,* Jordan Cove, DOE Order 3413, at 7-8.

proposal that is the subject of the EIS" until the EIS is complete and a formal Record of Decision has been issued. 10 C.F.R. § 1021.211 (emphasis added). More generally, prior to completion of NEPA review, CEQ directs agencies to avoid actions that would tend to "limit the choice of reasonable alternatives," or "tend[] to determine subsequent development." 40 C.F.R. § 1506.1.

For purposes of the intersection of NEPA and the NGA, the NGA designated the former Federal Power Commission as the "lead agency" for NEPA purposes. 15 U.S.C. § 717n. The lead agency prepares NEPA documents for an action that falls within the jurisdiction of multiple federal agencies. FERC has since generally filled that role, preparing the NEPA documents for LNG export and import decisions, as it did in *Sabine Pass*. *See* 10 C.F.R. § 1021.342 (providing for interagency cooperation). Whichever agency plays the lead NEPA role, however, DOE's ultimate NEPA obligations are the same: DOE may not move forward until the full scope of the action *it* is considering – here, the approval of LNG export – has been properly considered. Thus, if the NEPA analysis that another agency prepares is inadequate to fully inform DOE/FE's decision or discharge DOE/FE's NEPA obligations, DOE/FE must prepare a separate EIS.[13]

NEPA requires preparation of an "environmental impact statement" (EIS) where, as here, the proposed major federal action would "significantly affect[] the quality of the human environment." 42 U.S.C. § 4332(C). DOE/FE regulations similarly provide that "[a]pprovals or disapprovals of authorizations to import or export natural gas . . . involving major operational changes (such as a major increase in the quantity of liquefied natural gas imported or exported)" will "normally require [an] EIS." 10 C.F.R. Part 1021, Appendix D, D9. As we explain below, an EIS is required here.

An EIS must describe:

i. the environmental impact of the proposed action,

ii. any adverse environmental effects which cannot be avoided should the proposal be implemented,

iii. alternatives to the proposed action,

[13] *See Sabine Pass LNG*, FERC Dkt. CP11-72-001, 140 FERC ¶ 61,076 P 32 (July 26, 2012) ("DOE has separate statutory responsibilities with respect to authorizing the export of LNG from Sabine Pass; thus it has an independent legal obligation to comply with NEPA."), DOE/FE Dkt. 10-111-LNG, Order 2961-A, 27 (Aug. 7, 2012) (DOE/FE recognizes that it is "responsible for conducting an independent review" of FERC's analysis and determining whether "the record needs to be supplemented in order for DOE/FE to meets its statutory responsibilities under section 3 of the NGA and under NEPA.").

> iv. the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
>
> v. any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

42 U.S.C. § 4332(C). The alternatives analysis "is the heart of the environmental impact statement." 40 C.F.R. § 1502.14. Here, the proposed action is to export LNG from a to be constructed facility; DOE/FE must consider alternatives to this action. DOE/FE must take care not to define the project purpose so narrowly as to prevent the consideration of a reasonable range of alternatives. *See, e.g.*, *Simmons v. U.S. Army Corps of Eng'rs*, 120 F.3d 664, 666 (7th Cir. 1997). If it did otherwise, it would lack "a clear basis for choice among options by the decisionmaker and the public." *See* 40 C.F.R. § 1502.14.

An EIS must also describe the direct and indirect effects and the cumulative impacts of a proposed action. 40 C.F.R §§ 1502.16, 1508.7, 1508.8; *N. Plains Resource Council v. Surface Transp. Bd.*, 668 F.3d 1067, 1072-73 (9th Cir. 2011). These terms are distinct from one another: Direct effects are "caused by the action and occur at the same time and place." 40 C.F.R. § 1508.8(a). Indirect effects are also "caused by the action" but:

> are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effect on air and water and other natural systems, including ecosystems.

40 C.F.R. § 1508.8(b). Cumulative impacts, finally, are not causally related to the action. Instead, they are:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7. The EIS must give each of these categories of effect fair emphasis.

Agencies may also prepare "programmatic" EISs, which address "a group of concerted actions to implement a specific policy or plan; [or] systematic and connected agency decisions allocating agency resources to implement a specific statutory program or executive directive." 40 C.F.R. § 1508.17(b)(3); *see also* 10 C.F.R. § 1021.330 (DOE regulations discussing programmatic EISs). As we discuss below, such an EIS is appropriate here.

3. Endangered Species Act

The Endangered Species Act (ESA) directs that all agencies "shall seek to conserve endangered species." 16 U.S.C. § 1531(c)(1). Consistent with this mandate, DOE/FE must ensure that its approval of Venture Global's proposal "is not likely to jeopardize the continued existence of any endangered species . . . or result in the destruction or adverse modification of [critical] habitat of such species." 16 U.S.C. § 1536(a)(2). "Each Federal agency shall review its actions at the earliest possible time to determine whether any action may affect listed species or critical habitat." 50 C.F.R. § 402.14(a); *see also* 16 U.S.C. § 1536(a)(2).

Here, DOE/FE's section 1536 inquiry must be wide-ranging, because Venture Global's export proposal will increase gas production across the Gulf region, if not nationwide. Thus, DOE/FE must consider not just species impacts at the proposed project site (although it must at least do that), but the effects of increased gas production across the full region the terminal affects.

To make this determination, DOE/FE should, first, conduct a biological assessment, including the "results of an on-site inspection of the area affected," "[t]he views of recognized experts on the species at issue," a review of relevant literature, "[a]n analysis of the effects of the action on the species and habitat, including consideration of cumulative effects, and the results of any related studies," and "[a]n analysis of alternate actions considered by the Federal agency for the proposed action." *See* 50 C.F.R. § 402.12(f). If that assessment determines that impacts are possible, DOE/FE must enter into formal consultation with the Fish and Wildlife Service and the National Marine Fisheries Service, as appropriate, to avoid jeopardy to endangered species or adverse modification of critical habitat as a result of its approval of Venture Global's proposal. 16 U.S.C. § 1536(a), (b).

B. DOE/FE's NEPA, NGA, and ESA Analyses Must Consider The Broad Context of All Pending Export Applications, Pipelines, and Studies

As explained above, the NGA, NEPA, and the ESA all require DOE/FE's determination to be informed by the context in which the proposed project would occur. DOE/FE's analysis must not be confined to local, direct effects of the particular applications; DOE/FE must consider the broader constellation of indirect and cumulative effects. Here, to accurately analyze Venture Global's application in context, DOE/FE must also take into account the other pending LNG export proposals. This broader backdrop of related and similar projects must inform the NEPA alternatives analysis. Finally, DOE/FE must not grant any authorization (final or conditional) prior to completion of the NEPA process, including the above analyses.[14]

1. A Full EIS Is Required Prior to DOE/FE Action

Although Venture Global appears to argue that NEPA review may either be postponed or may not be required at all, App. at 18, it is clear that the project will have significant environmental impacts that must be considered in a full Environmental Impact Statement prior to DOE/FE action.

NEPA requires an EIS where a proposed major federal action would "significantly affect[] the quality of the human environment." 42 U.S.C. § 4332(C). The effects that must be considered as part of the NEPA analysis, including the significance determination, include the project's direct, indirect, and cumulative environmental impacts, including "ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, [and] economical" impacts. 40 C.F.R. § 1508.8. The agency must assess the significance of those impacts in light of "considerations of both context and intensity." *Id.* § 1508.27. The pertinent contexts range from short-term local impacts to regional and global impacts. 40 C.F.R. § 1508.27(a); *The Mountaineers v. U.S. Forest Serv.*, 445 F. Supp. 2d 1235, 1245 (W.D. Wash. 2006) (noting the mandate to consider both local and regional impacts). Intensity "refers to the severity of the impact" and involves factoring in ten considerations, enumerated in 40 C.F.R. § 1508.27(b), including effects on public health and safety, controversy or uncertainty regarding effects on the environment, and the cumulative effects of the action and other related actions. If there is a "substantial question" as to the severity of impacts, an EIS must be prepared. *See Klamath Siskiyou Wildlands Ctr. v. Boody*, 468 F.3d 549, 561-62 (9th Cir. 2006) (holding that the "substantial question" test sets a "low standard" for plaintiffs to meet). Considerations of both context and intensity militate in favor of preparing an EIS for the Project.

Here, the proposed exports and the terminal they would require would have severe adverse environmental impacts, plainly surpassing the threshold of "significance" that mandates preparation of a full EIS. As we explain elsewhere, LNG exports will induce additional gas production that, every year, will potentially emit millions of tons of methane pollution, emit tens of thousands of tons of VOC and hazardous air pollutants, and require of hundreds of millions of tons of fresh water.[15] DOE/FE regulations categorically state that "[a]pprovals or disapprovals of authorizations to import or export natural gas . . . involving major operational changes (such as a major increase in

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[14] Similarly, Sierra Club protests any request for final, rather than conditional, authorizations prior to completion of NEPA review.
[15] Sierra Club, *et al.*, comment on NERA Macroeconomic Study at 32, 40.

the quantity of liquefied natural gas imported or exported)" will "normally require [an] EIS." 10 C.F.R. Part 1021, Appendix D, D9.

Venture Global's astounding argument that "approval of this Application does not constitute a federal action significantly affecting the human environment," App. at 18, appears to rest on a severe misunderstanding of the applicable law. Although Venture Global cites DOE Categorical Exclusion B5.7, 10 C.F.R. Part 1021, Subpart D Appendix B, this categorical exclusion is plainly inapplicable here. Categorical Exclusion B5.7 to "minor operational changes (such as changes in natural gas throughput, transportation, and storage operations) *but not new construction*."(emphasis added) Venture Global proposes to construct and operate a *new* LNG export terminal. Nor does the fact that "Venture Global will be seeking all necessary federal, state and local permits to construct the necessary export facilities for the Project" mean that granting the application will not have significant environmental impacts. NEPA does not allow DOE/FE to assume that, because other agencies will be asked to take related actions regarding a project, the DOE/FE action has no significant impact.

Finally, consistent with the recently proposed change in DOE/FE procedure, DOE/FE must not issue a conditional authorization for the project prior to completion of NEPA review. DOE/FE cannot complete a public interest determination without weighing environmental factors. Because these factors are integral to DOE/FE's decision, DOE/FE must weigh environmental interests at the same time that it weighs all other interests. It may not parcel them into a separate process without irrationally ignoring important aspects of the problem before it. Thus, although DOE/FE regulations permit "conditional" orders in general, *see* 10 C.F.R. § 590.402, this authority cannot extend to the specific context of LNG export authorizations. Indeed, because an EIS is required here, DOE regulations specifically prohibit taking any action prior to completion of the EIS. 10 C.F.R. § 1021.211 (DOE "shall take no action" concerning a proposal that is the subject of an EIS until the EIS is completed).

2. NEPA and Natural Gas Act Review Must Consider Potential Plans to Expand The Proposed Project

Venture Global's pending application seeks authorization to export 5 MTPA of LNG from a facility to e constructed on a 69 acre site. App. at 1-2. Yet Venture Global's website indicates that the project will be developed in two stages, with an *initial* capacity of 5 MTPA, without specifying the capacity of the second stage.[16] This website similarly states that the total facility will utilize a 109 acre site.

[16] Venture Global LNG, *VG LNG* (2014), available http://ventureglobalIng.com/vg-lng/, and attached as Exhibit 7.

This planned expansion must be considered in the environmental review for the pending (stage-one) application, at the very least as part of the cumulative impacts analysis.

3. DOE/FE Must Consider the Cumulative Effect of All Pending Export Proposals, and DOE/FE Should Do So with A Programmatic EIS

DOE/FE must consider the cumulative effects of all of the export applications currently pending before DOE/FE. The public, after all, will not experience each proposed terminal as an individual project: It will experience them cumulatively, through the gas and electricity prices that they will raise and the environmental damage that they will cause. All analysts and observers have agreed, for example, that higher volumes of exports will cause greater gas price increases. Indeed, several models indicate that prices increase non-linearly with export volumes. That is, going from 4 to 6 bcf/d in exports, for example, may impact domestic prices more than going from 0 to 2 bcf/d.[17]

Venture Global's export proposal is only one of many before DOE/FE, and DOE/FE must consider these projects' cumulative impacts. Yet the EIA modeling and the NERA study do not provide a basis for such consideration. EIA's "high" scenario considered 12 bcf/d of demand created by exports, or roughly 10.9 bcf/d of gas exported as LNG. This is less than a third of the 35.95 bcf/d of exports to non-free trade agreement nations for which applications have been filed with DOE/FE.[18] Indeed, DOE/FE has *already* granded final or conditional approval to applications representing export volumes near the upper limit of the scenarios modeled by EIA: as of May 2014, DOE/FE has finally or conditionally approved 9.27 bcf/d of exports to nFTA nations. With the exception of the 1.8 bcf/d Freeport, TX projects, these exports will rely on natural gas to drive liquefaction equipment, which EIA estimates increases gas demand by 10%. This brings the total gas

[17] Robert Brooks, *Using GPCM to Model LNG Exports from the US Gulf Coast* 5 (2012), available at http://www.rbac.com/press/LNG%20Exports%20from%20the%20US.pdf, attached as Exhibit 8. The Deloitte Study submitted in connection with the Excelerate application similarly predicts that doubling exports will more than double price impacts thereof. Deloitte MarketPoint, *Analysis of Economic Impact of LNG Exports from the United States*, at 3, 24 ("Deloitte Study"), attached as Exhibit 9 (originally filed as Appendix F to Excelerate Liquefaction Solutions I, LLC, *Application for Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas to Non-Free Trade Agreement Countries*, DOE/FE Dkt. 12-146-LNG (Oct. 5, 2012)). One reason prices may increase this way is that domestic gas consumers differ in their ability to reduce gas consumption. Robert Brooks, *Using GPCM to Model LNG Exports from the US Gulf Coast*, 7 (2012). As export volumes increase, increasing numbers of inflexible domestic consumers are forced to compete with exports, further driving up prices. When export volumes are lower, by contrast, price-sensitive domestic consumers can respond to price increases by reducing their consumption, freeing gas supplies for exports and limiting price impacts. The Brooks study, which estimates low price-sensitivity, predicts significantly higher price increases than the EIA study. *Id.* at 5, 7.

[18] Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of June 11, 2014), attached as Exhibit 10.

demand associated with these approvals to 10 bcf/d, only 2 bcf/d lower than the 12 bcf/d "high" scenarios modeled by EIA. DOE/FE cannot review the pending application without calling on EIA to redo its model with a "high" scenario that models the volume of proposed exports. If all proposed exports proceed, bringing exports to roughly 50% of current lower-48 gas production, it may be that this truly momentous change in demand alters domestic markets in ways not foreseen by EIA's modeling of smaller (yet still large) export scenarios.

DOE/FE cannot shirk the obligation to consider the full volume of proposed exports. NEPA requires consideration of this full export volume, prohibiting DOE/FE from granting these applications or others on the assumption that the authorized activity will not actually occur. Under NEPA, an agency may only exclude analysis of an event and its consequences when the event "is so 'remote and speculative' as to reduce the effective probability of its occurrence to zero." *See New York v. NRC*, 681 F.3d 471, 482 (D.C. Cir. 2012); *see also San Luis Obispo Mothers for Peace v. Nuclear Regulatory Comm'n*, 449 F.3d 1016, 1031 (9th Cir. 2006) (same). Here, DOE/FE cannot rule out as speculative the possibility of all proposed exports occurring. We note that EPA has repeatedly and explicitly requested consideration of this broader context. EPA, *Scoping Comments – The Jordan Cove Energy Project LP*, FERC Dkts. PF12-7 and PF12-17, at 3 (Oct. 29, 2012) ("[W]e recommend discussing the proposed project in the context of the larger energy market, including existing export capacity *and export capacity under application to the Department of Energy*, and clearly describe how the need for the proposed action has been determined."),[19] EPA, *Scoping Comments – Cove Point Liquefaction Project*, FERC Dkt. PF12-16-000, at 2 (Nov. 15, 2012) ("We recommend discussing the proposed project in the context of the broader energy market, *including existing and proposed LNG export capacity*."),[20] EPA, *Scoping Comments – The Oregon LNG Export Project and Washington Expansion Project*, FERC Dkts. PF12-18 and PF12-20, at 3 (Dec. 26, 2012).[21]

Applicants may argue that it cannot be assumed: (1) that all proposed projects will be approved, or (2) that all approved projects actually will be built, but these uncertainties do not justify excluding pending proposals from cumulative impacts review. On the first issue, DOE/FE's obligation is to understand the impacts of proposed projects and decide whether to approve them in light of these impacts. Analyzing the proposals' cumulative impacts does not require DOE/FE to assume that all proposed projects will be approved; instead, it informs DOE/FE of potential consequences so that it can decide *whether* to approve all proposals or only a subset. Courts have held that agencies must consider the cumulative impacts of proposed projects together with other pending proposals. *See NRDC v. Callaway*, 524 F.2d 79, 87 (2d Cir. 1975) (holding that the cumulative impacts analysis for a proposed dredge spoil dumping project should have included another

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[19] Attached as Exhibit 11 (emphasis added).
[20] Attached as Exhibit 12 (emphasis added).
[21] Attached as Exhibit 13.

dredge spoil project that was still "subject to approval and funding by Congress"); *People ex rel. Van de Kamp v. Marsh*, 687 F. Supp. 495, 500 (N.D. Cal. 1988) (stating that, in cumulative impacts analysis, "[t]he agency must consider other proposals" and even "contemplated actions that are not yet formalized proposals"); *see also Kleppe v. Sierra Club*, 427 U.S. 390, 410 (1976) (holding, in a related context, that "when several *proposals* for . . . related actions that will have cumulative or synergistic environmental impact . . . are pending concurrently before an agency, their environmental consequences must be considered together") (emphasis added).

Second, even though it is not certain that all exports DOE/FE approves will occur, this sort of uncertainty does not automatically justify refusal to analyze pending projects' cumulative impacts. If it did, agencies could avoid analysis of future projects in almost every case, by reasoning that market factors out of their control could prevent them from being constructed. Here, every good faith export applicant believes that its proposed project is feasible. DOE/FE therefore must analyze the cumulative impact of all proposals together.

If DOE/FE looks—wrongly—only at the range of exports it deems likely to occur, DOE/FE must not underestimate this likelihood. DOE/FE's recent conditional authorization of the Jordan Cove nFTA application, for example, mistakenly relies on the NERA Study's prediction of export volumes.[22] As Sierra Club has previously explained, NERA understates the market for likely exports. NERA concluded that exports would only occur when the spread between US gas prices and prices in potential foreign markets exceeded the cost of liquefying, transporting, and regassifying US produced gas. But NERA overstates these transaction costs and ignores the ways in which "take-or-pay" contracts that appear likely to dominate this industry will distort this market.

As to transaction costs, proposed West Coast terminals will have significantly lower costs for export to Asia than will the Gulf Coast facilities NERA considered. The proponents of the proposed Jordan Cove Energy Project explained that its transportation costs to Japan were significantly lower than those assumed by the NERA Study. Although Jordan Cove Energy Project would face higher facility construction and thus liquefaction costs than Gulf Coast facilities, Jordan Cove asserts that, in aggregate, its total processing and transportation costs will be $0.44/MMBtu lower than the estimates used by NERA.[23] Accordingly, insofar as the cost of processing and transporting LNG sets the ceiling on price increases resulting from exports, that ceiling could be $0.44/MMBtu higher than the NERA Study estimates. $0.44/MMBtu represents roughly 5 to 10% of NERA's predicted 2035 wellhead gas prices, meaning

[22] *See, e.g.*, Jordan Cove, DOE Order 3413.

[23] Comment of Jordan Cove Energy Project on NERA study, at 2 (Jan. 24, 2013), available at http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/Joan_Darby01_24_13.pdf, attached as Exhibit 14.

NERA may have significantly underestimated the price range within which exports will occur.[24] Although Sierra Club raised this argument in its initial and reply comments on the NERA study,[25] DOE/FE has not addressed it in any of the recent export conditional authorizations.[26]

As to contract structure, previous export applicants have adopted "take or pay" liquefaction services arrangements, wherein would-be importers will be required to pay a fee to reserve terminal capacity, regardless of whether that capacity is actually used to liquefy and export gas.[27] The "pay" provision constitutes a sunk cost that will effectively raise the price ceiling under which exports will occur. For example, if the cost to liquefy, transport, and regassify gas is $4/MMBtu, but an importer has entered a "take or pay" contract reserving terminal capacity but requiring payment of $1.50/MMBtu[28] for unused capacity, the importer will have an incentive to import gas so long as the spread between US and foreign prices exceeds $2.50/MMBtu, whereas NERA predicts that no exports will occur once the price spread falls below $4/MMBtu. Exports may continue to occur – and domestic prices may therefore continue to rise – even where NERA predicts that exports will cease.[29] Again, in its recent conditional authorizations, DOE/FE has ignored this aspect of Sierra Club's argument. Sierra Club does not contend that contracts will "lock up natural gas for export" such that exports will occur regardless of market conditions in the US or abroad.[30] Instead, Sierra Club has shown that market forces and the industry structure will likely cause exports to occur in certain conditions where NERA concluded that exports would not, such that the overall volume of exports is likely to be higher than NERA forecasts. Thus, DOE/FE's cumulative impact analysis must not be limited to the volumes of exports the NERA study predicts, both because DOE/FE's statutory obligations prevent DOE/FE from excluding proposed projects from the cumulative effects analysis on the assumption that those projects are economically unlikely to occur, and because NERA understates the range of projects that are likely to occur. We further note that EIA's most recent Annual Energy Outlook forecasts 9.6 bcf/d of US LNG exports by 2029.[31]

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[24] NERA Study, *supra* n.3 at 50.

[25] Sierra Club Initial NERA Comment, *supra* n.3, at 12-13, Sierra Club Reply NERA Comment, *supra* n.3, at 11-12; *see also* Jordan Cove, DOE/FE Order 3413, at 116 (summarizing this argument).

[26] *See, e.g.,* Jordan Cove, DOE/FE Order 3413, at 116, 122-123.

[27] *See Sabine Pass* DOE Order No. 2961, at 4 (May 20, 2011); Cheniere Energy April 2011 Marketing Materials, *available at* http://tinyurl.com/cqpp2h8 (last visited Jan. 13, 2013), at 14.

[28] Within the $1.40 to $1.75/MMBtu range of "capacity fees" contemplated by Sabine Pass's parent company, Cheniere Energy April 2011 Marketing Materials at 14.

[29] *See* NERA Study, *supra* n.3, at 37-46.

[30] Jordan Cove, DOE Orer 3413, at 118.

[31] *See, e.g.* EIA, Annual Energy Outlook 2014 Early Release Overview, at 2 (Dec. 16, 2013) (forecasting peak US LNG exports of 3.5 tcf per year, or 9.6 bcf/d, achieved in 2029), available at http://www.eia.gov/forecasts/aeo/er/pdf/0383er(2014).pdf and attached as Exhibit 15.

DOE/FE can best analyze the pending export proposals' cumulative impacts by preparing a programmatic EIS. Such a programmatic EIS would allow DOE/FE and the public to understand these proposals' relationship and their cumulative environmental and economic impacts, thus improving DOE/FE's ability to make informed decisions on export terminal applications and allowing DOE/FE, the public, and industry to identify prudent alternatives to serve the public interest and minimize environmental impacts. In acting on the many pending LNG export applications, DOE/FE is making what is functionally a programmatic decision to radically alter the U.S. natural gas market by allowing for large-scale LNG export. DOE/FE has already acknowledged that a programmatic approach is appropriate for discussion of the economic impacts of exports, commissioning nationwide studies of the impacts of exports from EIA and NERA. Environmental impacts should be similarly analyzed. The individual applications should be informed by an EIS that is adequate to inform this programmatic decision, rather than conducting piecemeal, application-by-application analysis.

In summary, to determine whether Venture Global's export proposal is consistent with the public interest, DOE/FE must consider not only the effect of the particular proposal, but the effect of that proposal in conjunction with all proposals so far approved and all reasonably foreseeable future proposals. Moreover, this analysis must examine the possibility that all proposals that receive approval will export to the fully authorized extent.

4. The Alternatives Analysis Must Consider This Broader Context

Both NEPA and the NGA require DOE/FE to fully consider alternatives to Venture Global's proposal. Specifically, the NGA public interest analysis requires an "exploration of all issues relevant to the 'public interest'," an inquiry which the Supreme Court held in *Udall* must be wide-ranging. In that case, which concerned hydropower, the regulatory agency was required to consider, for instance, "alternate sources of power," the state of the power market generally, and options to mitigate impacts on wildlife. 387 U.S. at 450. Here, likewise, DOE/FE must consider alternatives to Venture Global's export proposal that would better serve the public interest, broadly analyzing other approaches to structuring LNG exports and gas use generally, given exports' sweeping effects on the economy.

NEPA is designed to support this sort of broad consideration. As mentioned, the alternatives analysis is "the heart of the environmental impact statement," designed to offer "clear basis for choice among options by the decisionmaker and the public." 40 C.F.R. § 1502.14. Crucially, the alternatives must include "reasonable alternatives not within the jurisdiction of the lead agency," and must include "appropriate mitigation measures not already included in the proposed action or alternatives." *Id.* Because alternatives are so central to decisionmaking and mitigation, "the existence of a viable but unexamined alternative renders an environmental impact statement inadequate."

Oregon Natural Desert Ass'n, 625 F.3d at 1122 (internal alterations and citations omitted).

Here, DOE/FE must consider a broad range of alternatives to Venture Global's proposal, including alternatives that would alter or minimize the economy-wide impacts of the many pending export proposals. Even if DOE/FE does not have jurisdiction to directly order implementation of some of these alternatives, it must include them nonetheless.

DOE/FE should consider, at a minimum and without limitation, the following alternatives:

> (1) Whether, consistent with the EIA Export Study, exports, if allowed, should move forward in smaller quantities or on a slower time table to mitigate the domestic economic and environmental impacts associated with large export volumes or rapid export schedules;
>
> (2) Whether export from other locations would better serve the public interest by mitigating or better distributing economic or environmental impacts;
>
> (3) Whether limitations on the sources of exported gas – e.g., limiting export from particular plays, formations, or regions – would help to mitigate environmental and economic impacts;
>
> (4) Whether conditioning export on the presence of an adequate regulatory framework, including the fulfillment of the recommendations for safe production made by the DOE's Shale Gas Subcommittee, would better serve the public interest by ensuring that the production increases associated with export will not increase poorly regulated unconventional gas production;
>
> (5) Whether to delay, deny, or condition exports based upon their effect on the U.S. utility market (including changes in air pollution emissions associated with the impacts of increased export demand on fuel choice);
>
> (6) Whether to require exporters to certify that any unconventional gas produced as a result of their proposal (or shipped through their facilities) has been produced in accordance with all relevant environmental laws and according to a set of best production practices (such as that discussed by the DOE's Shale Gas Subcommittee);
>
> (7) Whether to permit exports only if the export facilities are designed and operated so as to minimize their environmental impacts;
>
> (8) Whether to deny export proposals altogether as contrary to the public interest.

Other alternatives are no doubt also available, but DOE/FE must at a minimum consider the possibilities listed above, as they are reasonable and bear directly on the public interest determination before it.

C. Venture Global's Proposal Will Have Numerous Harmful Environmental and Other Effects and Is Contrary to The Public Interest

LNG exports will have wide ranging effects on the public and environment. Gas exported as LNG must come from somewhere. The only options are an increase in domestic supply to match this new demand or a decrease in other domestic consumption to free up gas that would otherwise be used elsewhere, both of which have significant environmental impacts. The US will likely see a combination of both, as explained in the Energy Information Administration's January 2012 LNG Export Study and numerous other analyses.[32] These analyses uniformly agree that the predominant effect will be an increase in supply, provided by gas producers increasing their output in response to exports' demand. The extra demand created by exports will also cause increases in domestic gas prices, which will cause some domestic consumers (primarily in the electricity generating sector) to reduce their consumption (according to EIA, primarily but not exclusively by switching to coal).

Thus, the proposed project will impact the environment on many levels:

- At and near the terminal site, as a result of construction and operation of the liquefaction and export facilities.
- In the regions where gas production increases in response to exports.
- Nationwide, as coal consumption increases in response to higher gas prices.
- Globally, as greenhouse gas emissions increase as a result of increased gas production and combustion.

Each level of impacts carries environmental cost—which have significant economic impact—as well as more traditional economic impacts. For example, increases in domestic gas prices will limit real wage growth, eliminate jobs in manufacturing and other domestic industries, disrupt communities, and regressively transfer wealth from working class families to large corporations. Available evidence indicates that even when these environmental and intra-US distributional effects are ignored (although they must not be), LNG exports will likely have a negative impact on GDP and other measures of aggregate welfare.[33] Each of these adverse impacts require additional consideration in the NEPA process and in DOE/FE's ongoing review of the economic impacts of gas

[32] *EIA Export Study*, *supra* n.3, at 10.

[33] *See* Kemal Sarica & Wallace E. Tyner, *Economic and Environmental Impacts of Increased US Exports of Natural Gas* (Purdue Univ., Working Paper, 2013) (available from the authors); *see also* Wallace Tyner, Initial Comment on NERA Study (Jan. 14, 2013) (summarizing the results of the above study), attached as Exhibit 16.

exports. Even the evidence of adverse impacts available now, however, greatly overwhelms Venture Global's assertion that its proposal will provide economic benefits.

DOE/FE cannot rely on its prior authorization of exports from other terminals to demonstrate that the current application is in the public interest. Prior decisions by DOE/FE are not binding and the agency retains an independent duty to determine whether an application is, in fact, in the public interest. *See* 10 C.F.R. § 590.404.

1. Local Environmental Impacts

Venture Global proposes to build a new LNG export terminal at a 109-acre site on the Calcasieu Ship Channel, south of Lake Charles in Cameron Parish, Lousiana.[34] The export terminal would consist of multiple modular LNG trains, a moon pool, a berthing terminal, two LNG storage tanks, a power facility, and various administrative and control buildings as well as new pipelines needed to connect the facility to nearby intra- and inter-state pipeline systems.[35] Construction and operation of these liquefaction and export facilities and related pipelines will have a range of adverse environmental effects. Sierra Club cannot provide a thorough discussion of local impacts in this filing, because the precise nature and extent of these impacts will depend on the final site design and plan, which Venture Global has not yet provided. However, these effects undoubtedly impact the public interest; DOE/FE must consider these impacts in its public interest analysis; and Sierra Club, together with the broader public, must be given an opportunity to comment on these issues once additional information is available. At this time, we identify the types of issues that the facility is likely to have, informed by the designs of other facilities. Adverse environmental effects include (but are not limited to) air pollution, disruption of aquatic habitat, increased noise and light pollution, and impacts on fish and wildlife related to the preceding impacts. These impacts must be considered in both the NEPA analysis and in DOE/FE's public interest determination.

a. Local Air Emissions

Both construction and operation of the export terminal, related pipelines and supporting infrastructure will likely emit harmful quantities of carbon monoxide (CO), nitrogen oxides (NO_x), volatile organic chemicals (VOC), greenhouse gases (GHGs), sulfur dioxides (SO_x) and particulate matter (PM_{10} and $PM_{2.5}$). At this stage, we discuss solely the emissions associated with operation of the project.

VOC and NO_x

Liquefaction and export equipment will emit harmful amounts of VOC and NOx. Sources of these pollutants include the liquefaction trains, pipeline compressor stations, ships,

[34] Venture Global LNG, *VG LNG* (2014), *supra* n.16.
[35] *Id.* and App. at 6.

and other equipment. Liquefaction trains in particular can emit many thousands of tons per year of NOx when powered by simple-cycle gas turbines, as has been proposed by other LNG export terminals.[36] Reviewing the amount of VOC and NOx pollution expected from other LNG export proposals can be illustrative here. To use one recent nearby LNG application as an example, the Magnolia LNG project is expected to have the potential to emit 88 tons per year ("tpy") of VOCs and 1,549 tpy of NOx.[37]

These emissions will harm the environment because VOC and NOx contribute to the formation of ground-level ozone (also called smog). Smog pollution harms human respiratory systems and has been linked to premature death, heart failure, chronic respiratory damage, and premature aging of the lungs.[38] Smog may also exacerbate existing respiratory illnesses, such as asthma and emphysema, or cause chest pain, coughing, throat irritation and congestion. Children, the elderly, and people with existing respiratory conditions are the most at risk from ozone pollution.[39] Significant ozone pollution also damages plants and ecosystems.[40]

Ozone also contributes substantially to global climate change over the short term. According to a recent study by the United Nations Environment Program (UNEP), behind carbon dioxide and methane, ozone is now the third most significant contributor to human-caused climate change.[41]

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[36] FERC, *Environmental Assessment for the Sabine Pass Liquefaction Project* (Sabine Pass EA), Dkt. CP11-72, at 2-56, t.2.7-7; Corpus Christi Liquefaction *et al.*, FERC Dkt. CP12-507, Resource Report 9, 9-7 to 9-9 (Aug. 31, 2012).

[37] Magnolia LNG Project, FERC Dkt. 14-347, Resource Report 9 – Air Quality and Noise, (Apr. 30, 2014) (Magnolia Resource Report 9) at 22, Table 9.2-5, attached as Exhibit 17.

[38] EPA, *Proposed New Source Performance Standards and Amendments to the National Emissions Standards for Hazardous Air Pollutants for the Oil and Natural Gas Industry: Regulatory Impact Analysis*, 4-25 (July 2011) ("O&G NSPS RIA"), *available at* http://www.epa.gov/ttnecas1/regdata/RIAs/oilnaturalgasfinalria.pdf, attached as Exhibit 18; Jerrett *et al.*, *Long-Term Ozone Exposure and Mortality*, New England Journal of Medicine (Mar. 12, 2009), *available at* http://www.nejm.org/doi/full/10.1056/NEJMoa0803894#t=articleTop, attached as Exhibit 19.

[39] *See* EPA, *Ground-Level Ozone, Health Effects*, *available at* http://www.epa.gov/glo/health.html attached as Exhibit 20. EPA, Nitrogen Dioxide, Health, available at http://www.epa.gov/air/nitrogenoxides/health.html, attached as Exhibit 21.

[40] O&G NSPS RIA, *supra* n.38, at 4-26.

[41] *Id. See also* United Nations Environment Programme and World Meteorological Organization, (2011): *Integrated Assessment of Black Carbon and Tropospheric Ozone: Summary for Decision Makers* (hereinafter "UNEP Report,") available at http:// www.unep.org/dewa/Portals/67/pdf/Black_Carbon.pdf, at 7, attached as Exhibit 22.

CO

Operation of LNG export terminals and related pipelines such as the proposed project also causes emissions of CO. Again, for instance, the Magnolia export project has the potential to emit 853 tpy of CO from operation of the export terminal alone.[42]

CO can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues.[43] CO can be particularly harmful to persons with various types of heart disease, who already have a reduced capacity for pumping oxygenated blood to the heart. "For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion."[44]

GHGs

Operation of LNG export terminals such as the proposed project also results in emission of greenhouse gases. For example, Magnolia anticipates that operation of its export terminal will emit over 2.1 million tpy of carbon dioxide equivalent in greenhouse gases each year.[45] These greenhouse gas emissions will increase global warming, harming both the local and global environments. The impacts of global warming include "increased air and ocean temperatures, changes in precipitation patterns, melting and thawing of global glaciers and ice, increasingly severe weather events, such as hurricanes of greater intensity, and sea level rise."[46] A warming climate will also lead to loss of coastal land in densely populated areas, shrinking snowpack in Western states, increased wildfires, and reduced crop yields.[47] More frequent heat waves as a result of global warming have already affected public health, leading to premature deaths, and threats to public health are only expected to increase as global warming intensifies. For example, a warming climate will lead to increased incidence of respiratory and infectious disease, greater air and water pollution, increased malnutrition, and greater casualties from fire, storms, and floods.[48] Vulnerable populations—such as children, the elderly, and those with existing health problems—are the most at risk from these threats.

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[42] Magnolia Resource Report 9 at 22, Table 9.2-5.

[43] EPA, Carbon Monoxide, Health, http://www.epa.gov/air/carbonmonoxide/health.html, last visited Dec. 14, 2012, attached as Exhibit 23.

[44] *Id.*

[45] Magnolia Resource Report 9 at 22, Table 9.2-5.

[46] Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 76 Fed. Reg. at52,738, 52,791-22 (citing U.S. EPA, 2011 U.S. GREENHOUSE GAS INVENTORY REPORT EXECUTIVE SUMMARY (2011),)), attached as Exhibit 24.

[47] *Id.* at 66,532–33.

[48] EPA, *Climate Change, Health and Environmental Effects*, *available at* http://epa.gov/climatechange/effects/health.html, attached as Exhibit 25.

Sulfur Dioxide

Operation of Venture Global's proposed project has the potential to emit large quantities of SO_2; the Magnolia export terminal is expected to emit an estimated 136 tons of SO_2 for each year of operation.[49] Sulfur dioxide causes respiratory problems, including increased asthma symptoms. Short-term exposure to sulfur dioxide has been linked to increased emergency room visits and hospital admissions. Sulfur dioxide reacts in the atmosphere to form particulate matter (PM), an air pollutant which causes a great deal of harm to human health.[50] PM is discussed separately below. Sulfur dioxide can also cause haze, or decreased visibility.

Particulate Matter/Fugitive Dust

Operation of LNG export terminals, especially diesel engines used onsite, emits particulate matter. For example, the Magnolia terminal has the potential to emit an estimated 101 tpy of of PM10/ PM2.5.[51] PM consists of tiny particles of a range of sizes suspended in air. Small particles pose the greatest health risk. These small particles include "inhalable coarse particles," which are smaller than 10 micrometers in diameter (PM_{10}), and "fine particles" which are less than 2.5 micrometers in diameter ($PM_{2.5}$). PM_{10} is primarily formed from crushing, grinding or abrasion of surfaces. $PM_{2.5}$ is primarily formed by incomplete combustion of fuels or through secondary formation in the atmosphere.[52]

PM causes a wide variety of health and environmental impacts. PM 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. Sensitive populations, include the elderly, children, and people with existing heart or lung problems, are most at risk from PM pollution.[53] PM also reduces visibility,[54] and may damage important cultural resources.[55] Black carbon, a component of PM emitted by combustion sources such as flares and older diesel engines, also warms the climate and thus contributes to climate change.[56]

[49] Magnolia Resource Report 9 at 22, Table 9.2-5.
[50] EPA, Sulfur Dioxide, Health, *available at* http://www.epa.gov/air/sulfurdioxide/health.html, attached as Exhibit 26.
[51] Magnolia Resource Report 9 at 22, Table 9.2-5.
[52] *See* EPA, Particulate Matter, Health, *available at* http://www.epa.gov/pm/health.html, attached as Exhibit 27; BLM, *West Tavaputs Plateau Natural Gas Full Field Development Plan Final Environmental Impact Statement* ("West Tavaputs FEIS"), at 3-19 (July 2010), *available at* http://www.blm.gov/ut/st/en/fo/price/energy/Oil_Gas/wtp_final_eis.html.
[53] O&G NSPS RIA, *supra* n.38, at 4-19; EPA, Particulate Matter, Health
[54] EPA "Visibility – Basic Information" http://www.epa.gov/visibility/what.html, attached as Exhibit 28.
[55] *See* EPA, Particulate Matter, Health, *supra* n.52; West Tavaputs EIS, *supra* n.52, at 3-19; O&G NSPS RIA, *supra* n.38, at 4-24.
[56] UNEP Report at 6; IPCC (2007) at Section 2.4.4.3.

b. Other Local Impacts

The proposed project will also likely impact local water quality, fish and wildlife, and other environmental resources. The Sierra Club intends to submit comments during the NEPA process that more fully explore local environmental impacts in light of the project design.

2. Induced Gas Production

Further, and likely greater, environmental impacts will result from increased gas production. Venture Global, the EIA, NERA, essentially every other LNG export applicant, and other informed commenters all agree that LNG exports will induce additional production in the United States. EIA anticipates that production will increase by roughly 63% of the amount of demand created by exports.[57]

Available tools also allow DOE to predict where increased production will occur, although such localized predictions are not necessary for meaningful analysis of environmental impacts. NEPA and the NGA therefore require DOE/FE to consider the effects of this additional production. Although DOE/FE refused to consider induced production in the earlier *Sabine Pass* proceeding, that order applied the wrong legal standard of foreseeability and is factually incorrect (and factually distinct from the present case) as it understates DOE/FE's ability to predict induced drilling.

a. Venture Global's Proposal Will Induce Additional U.S. Gas Production

Venture Global's application acknowledges, as it must, that exports will induce additional production. *See, e.g.,* App. at 13 (Venture Global's exports will "encourage the development of new domestic natural gas resources that might not otherwise be developed, if not for the opportunity to be marketed internationally."). The EIA and private modelers agree that domestic gas production will increase in response to exports. These models roughly agree as to the size of this increase, and they have the capacity to predict where this additional production will occur.

EIA and private modelers agree that US LNG exports will increase domestic production by at least 60 percent of the demand created by export projects (*i.e.*, the volume of gas exported together with the gas necessary for the operation of export facilities). EIA provides the specific estimate for its reference cases at 63%;[58] The EIA further predicts that "about three quarters of this increased production [will come] from shale sources," with the remainder derived from other production types.[59] EIA further notes to liquefy 1

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[57] EIA Export Study, *supra* n.3 at 6, 10.

[58] From the EIA Export Study, *supra* n.3 at 6, 10. *See also, e.g.*, Deloitte MarketPoint, Analysis of Economic Impact of LNG Exports from the United States, at 3, 24 ("Deloitte Study"), *supra* n.17.

[59] EIA Study at 6.

bcf of gas, an additional 0.1 bcf of gas is typically required to run liquefaction equipment, bringing demand from this facility to 0.73 bcf/d. As EIA predicts 63% of new demand to be supplied by increased production, the EIA's estimates indicate that Venture Global will induce an additional 0.46 bcf/d of production.

Available information also predicts where this additional production will occur. Venture Global explains that the most likely sources of gas for the proposed exports are from across the Gulf Shore region. App. at 6. Available models can provide more sophisticated predictions as to where production supplying additional exports from Venture Global would occur. EIA's core analytical tool is the National Energy Modeling System ("NEMS"). NEMS was used to produce the EIA exports study. NEMS models the economy's energy use through a series of interlocking modules that represent different energy sectors on geographic levels.[60] Notably, the "Natural Gas Transmission and Distribution" module models the relationship between U.S. and Canadian gas production, consumption, and trade, specifically projecting U.S. production, Canadian production, imports from Canada, *etc*.[61] For each region, the module links supply and demand annually, taking transmission costs into account, in order to project how demand will be met by the transmission system.[62] Importantly, the Transmission Module is *already* designed to model LNG imports and exports, and contains an extensive modeling apparatus allowing it to do so on the basis of production in the U.S., Canada, and Mexico.[63] At present, the Module focuses largely on LNG imports, reflecting U.S. trends up to this point, but it also already links the Supply Module to the existing Alaskan *export* terminal and projects exports from that site and their impacts on production.[64]

Similarly, EIA's "Oil and Gas Supply" module models individual regions and describes how production responds to demand across the country. Specifically, the Supply Module is built on detailed state-by-state reports of gas production curves across the country.[65] As EIA explains, "production type curves have been used to estimate the technical production from known fields" as the basis for a sophisticated "play-level model that projects the crude oil and natural gas supply from the lower 48."[66] The module distinguishes coalbed methane, shale gas, and tight gas from other resources, allowing for specific predictions distinguishing unconventional gas supplies from conventional

[60] EIA, *The National Energy Modeling System: An Overview*, 1-2 (2009), attached as Exhibit 29, available at http://www.eia.gov/oiaf/aeo/overview/pdf/0581(2009).pdf.
[61] *Id.* at 59.
[62] EIA, *Model Documentation: Natural Gas Transmission and Distribution Module of the National Energy Modeling System*, 15-16 (2012), attached as Exhibit 30, *available at* http://www.eia.gov/FTPROOT/modeldoc/m062(2011).pdf.
[63] *See id.* at 22-32.
[64] *See id.* at 30-31.
[65] EIA, *Documentation of the Oil and Gas Supply Module*, 2-2 (2011), attached as Exhibit 31, *available at* http://www.eia.gov/FTPROOT/modeldoc/m063(2011).pdf.
[66] *Id.* at 2-3.

supplies.[67] The module further projects the number of wells drilled each year, and their likely production – which are important figures for estimating environmental impacts.[68] In short, the supply module "includes a comprehensive assessment method for determining the relative economics of various prospects based on future financial considerations, the nature of the undiscovered and discovered resources, prevailing risk factors, and the available technologies. The model evaluates the economics of future exploration and development from the perspective of an operator making an investment decision."[69] Thus, for each play in the lower 48 states, the EIA is able to predict future production based on existing data. The model is also equipped to evaluate policy changes that might impact production; according to EIA, "the model design provides the flexibility to evaluate alternative or new taxes, environmental, or other policy changes in a consistent and comprehensive manner."[70] Thus, there is no technical barrier to modeling where exports will induce production going forward. Indeed, EIA used this model for its export study, which forecast production and price impacts.

Deloitte Marketpoint has provided similar discussion of the ways exports will induce domestic production.[71] Deloitte explains that its "World Gas Model" includes detailed global gas resources, including modeling of "575 plays in the US alone."[72] For this model, "Within each major region are very detailed representations of many market elements: production, liquefaction, transportation, market hubs, regasification and demand by country or sub area."[73] This includes modeling individual "producers, pipelines, refineries, ships, distributors, and consumers." *Id*. Deloitte applied this model to another proposal and derived specific volumes of predicted production increases in five distinct shale gas plays.[74] While Deloitte only provides as aggregate estimates for other shale plays and for non-shale sources, it appears that Deloitte's model is capable of providing geographically specifying where this aggregated production will occur. We offer no opinion at this time about the strengths or weaknesses of Deloitte's models relative to EIA's. We simply note that multiple tools exist which allow predictions of how and where production will respond to exports.

b. Induced Production Must Be Considered in the NEPA and NGA Analyses

NEPA regulations, applicable case law, and recent EPA scoping comments all call for DOE/FE to consider the environmental effects of induced production. As noted above,

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[67] *Id.* at 2-7.
[68] *See id.* at 2-25 to 2-26.
[69] *Id.* at 2-3.
[70] *Id.*
[71] Deloitte Study, *supra* n.17, at 14.
[72] *Id.* at 25.
[73] *Id.* at 24.
[74] *Id.*

NEPA requires consideration of "indirect effects" of the proposed action, which include "growth inducing effects" and "reasonably foreseeable" effects "removed in distance" from the site of the proposed action. 40 C.F.R. § 1508.8(b). Here, induced production is not only an effect of the project – it is part of the justification offered for it, App. at 13, and is the premise for Venture Global's contention that LNG exports will minimally raise gas prices.[75] It is therefore plainly a "reasonably foreseeable" effect that must be analyzed in NEPA.

Several courts have held that natural resource production and other analogous upstream impacts induced by new infrastructure development must be considered in NEPA. The Eighth Circuit illustrated the "reasonably foreseeable" standard in analogous circumstances considering the converse of the dynamic here, holding that increased consumption was a reasonably foreseeable consequence of increased supply. *Mid States Coalition for Progress v. Surface Transportation Board*, 345 F.3d 520 (8th Cir. 2003). At issue there was Surface Transportation Board award of a certificate of "public convenience and necessity" for construction of a rail line under 49 U.S.C. § 10901. 345 F.3d at 533. This line would provide an additional, shorter, faster, and cheaper route to market for low-sulfur coal mined in the Powder River Basin. *Id.* at 549. Sierra Club argued that the project would therefore increase nationwide consumption of coal, consequently increasing emissions of many harmful air pollutants, and that NEPA required consideration of this effect. *Id.* The Board had refused to analyze the impacts of this increased coal consumption. Specifically, the Board argued that any changes in domestic coal consumption would occur regardless of whether the line was built, because existing rail lines already provided a route between the mines and existing demand. *Id.* The court rejected the Board's view. The project would increase the availability of inexpensive low sulfur coal, making coal "a more attractive option" to potential consumers. *Id.* Provision of a cheaper and more plentiful supply of coal would "most assuredly affect the nation's long-term demand for coal." *Id.* Accordingly, an increase in coal consumption was reasonably foreseeable, and NEPA required consideration of this impact. *Id.*

Similarly, the Ninth Circuit recently held that, where the Surface Transportation Board was considering a proposal to expand a railway line which would enable increased coal production at several mines, NEPA required the Board to consider the impacts of increased mining. *N. Plains Resource Council v. Surface Transp. Bd.*, 668 F.3d 1067, 1081-82 (9th Cir. 2011). In *Northern Plains*, the court pointed to the agency's reliance on the induced coal mine development "to justify the financial soundness of the proposal," *id.* at 1082. Because the agency anticipated induced coal production in justifying its proposal, such production was reasonably foreseeable, and NEPA analysis

[75] Specifically, increases in gas production in response to exports underly the EIA, NERA, Deloitte, and other estimates of the price impacts of exports. If production did not increase in response to exports, these entities' methodology would indicate significantly higher price impacts.

of its impacts was required. Here, a decision by DOE/FE to rely on the supposed economic benefits of increased production, while simultaneously ignoring the impacts of this production, would be squarely inconsistent with *Northern Plains*.

Border Power Plant Working Group v. DOE, 260 F. Supp. 2d 997 (S.D. Cal. 2003), also required consideration of upstream environmental impacts induced by the construction of new energy infrastructure. That case involved applications to construct and operate transmission lines across the U.S.-Mexico border. The court held that DOE/FE was required to consider the environmental effects of upstream electricity generation induced by the new infrastructure, rejecting DOE/FE's decision to exclude these upstream impacts from analysis.[76] *Id.* at 1017. Consideration of induced impacts was required even though the upstream electricity generation would occur in Mexico, outside the jurisdiction of DOE or any other U.S. agency. *Id.* at 1016-17. Here, too, DOE/FE is required to consider the impacts of natural gas production induced by Venture Global's proposal, regardless of DOE/FE's regulatory authority over that production.

EPA has also argued, in comments it submitted regarding other LNG export proposals, that induced production should be included in NEPA review. In comments on the draft EIS for the Cameron, Louisiana, export proposal, EPA "recommend[ed] the FEIS consider the extent to which implementation of the proposed project could increase the demand for domestic natural gas extraction, as well as potential environmental impacts associated with the potential increased production of natural gas."[77] In scoping comments for the Excelerate project in Texas, EPA recommended that in light of the regulatory definition of indirect effects and the EIA Export Study's prediction of induced production, FERC should "consider available information about the extent to which drilling activity might be stimulated by the construction of an LNG export facility on the Gulf coast, and any potential environmental effects associated with that drilling expansion."[78] EPA used similar language regarding the Jordan Cove and Oregon LNG proposals.[79] EPA's scoping comments for the Cove Point facility in Maryland also recommended analyzing "indirect effects related to gas drilling and combustion," and stressed that, in addition to reviewing the *economic* impacts of induced drilling, DOE/FE

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[76] The final EIS for the project at issue in *Border Power Plant Working Group*, produced after remand from the court, is available at http://energy.gov/nepa/downloads/eis-0365-final-environmental-impact-statement. Upstream air quality impacts are considered in pages 4-43 to 4-65 of this final EIS.
[77] EPA, Comments on Cameron Draft EIS, FERC Dkts. CP13-25, CP13-27, at 6 (March 3, 2014), attached as Exhibit 32.
[78] EPA, *Scoping Comments – Excelerate Liquefaction Solutions*, FERC Dkt. PF13-1, at 14 (Apr. 9, 2013), attached as Exhibit 33.
[79] EPA, *Scoping Comments – The Jordan Cove Energy Project LP*, *supra* n.19, at 14, EPA, *Scoping Comments – The Oregon LNG Export Project and Washington Expansion Project*, *supra* n.21

should "thoroughly consider the indirect and cumulative *environmental* impacts" of export.[80]

Although DOE/FE "accept[ed] and adopt[ed] [FERC's] determination that induced shale gas production is not a reasonably foreseeable effect [of LNG exports] for purposes of NEPA analysis" in its August 2012 *Sabine Pass* order, DOE/FE should not follow *Sabine Pass* here. The *Sabine Pass* order contained factual and legal errors and thus should not be the basis for future DOE/FE decisions.[81] Although DOE/FE denied our petition for rehearing of that order, DOE/FE did so without reaching the merits of our petition, and as such, DOE/FE has not responded to the errors we identified therein.[82]

The first flaw in DOE/FE's *Sabine Pass* decision is that DOE/FE refused to analyze reasonably foreseeable future environmental effects based on its unlawful demand that these effects' scope and nature first be known with a high degree of certainty. DOE/FE stated that it is "unknown" if "any" new production will result from the proposed exports. *Sabine Pass* at 28. Although it is true that the precise scope of production impacts cannot be determined with complete certainty, certainty is not required. "An impact is 'reasonably foreseeable' if it is 'sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision.'" *City of Shoreacres v. Waterworth*, 420 F.3d 440, 453 (5th Cir. 2005) (quoting *Sierra Club v. Marsh*, 976 F.2d 763, 767 (1st Cir. 1992)). NEPA requires "[r]easonable forecasting and speculation," and courts "must reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as 'crystal ball inquiry.'" *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n*, 481 F.2d 1079, 1092 (D.C. Cir. 1973). As explained above, every available source concludes that it is *likely* that the majority of exported gas will come from induced additional production. Thus, an aggregate production increase is unarguably a "reasonably foreseeable" consequence of exports.

DOE/FE's second error in *Sabine Pass* was to adopt FERC's conclusion that induced production was outside the scope of NEPA analysis because "while it may be the case that additional shale gas development will result from the Liquefaction Project, the amount, timing and location of such development activity is simply unknowable at this time." *Sabine Pass* at 13 (quoting 140 FERC ¶ 61,076, P9 (July 26, 2012)). Such specific, localized predictions are not required for meaningful environmental analysis, but even if they were, DOE/FE has the resources to provide them.

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[80] EPA, *Scoping Comments – Cove Point Liquefaction Project*, *supra* n.20, at 2-3 (emphasis added).

[81] DOE is not bound by its prior decisions: it may reverse its position "with or without a change in circumstances" so long as it provides "a reasoned analysis" for the change. *Louisiana Pub. Serv. Comm'n v. FERC*, 184 F.3d 892, 897 (D.C. Cir. 1999) (quoting *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 57 (1983)).

[82] DOE/FE Order 2961-B, Jan. 25, 2013.

As a threshold matter, analysis of the environmental impacts of induced gas production does not require knowledge of the precise sites where additional production will occur. Environmental costs (and the economic costs that accompany them) can be determined in the aggregate. The net increases in, for instance, air pollution associated with the number of wells that will be induced can be quantified based on EPA's emissions inventories, for instance. The net volumes of waste can similarly be derived from industry reports and state discharge figures. And these impacts can be localized, at a minimum, by region. Indeed, for some of the environmental impacts of production, such as emissions of many air pollutants and consumption of water, the impacts are likely to be experienced at the regional level, so there may be little value in localizing them further. Even for those impacts that are more closely tied to a specific location, such as habitat fragmentation, DOE/FE can and must acknowledge that the impact will occur, including an estimate of the severity of the impact averaged across potential locations. *See Scientists' Inst. for Pub. Info.*, 481 F.2d at 1096-97 (where there are reasonable estimates of the deployment of nuclear power plants, the amount of waste produced, and the land needed to store waste, NEPA required analysis of the impacts of such storage even though the agency could not predict *where* such storage would occur). Finally, useful analysis of the amount of greenhouse gases that will be emitted by induced production, and the effects thereof, can be performed without knowing where these emissions will occur.

Even if DOE/FE were to conclude, wrongly, that NEPA only requires analysis of induced drilling impacts that can be predicted to occur in a particular location, DOE/FE has the tools to make precisely that prediction, as explained in the previous section. If such local impact predictions are not yet in the record, NEPA regulations provide that DOE/FE "shall" obtain this information unless DOE/FE demonstrates that the costs of obtaining it are "exorbitant." 40 C.F.R. § 1502.22.

In summary, all the available evidence indicates that Venture Global's proposed exports will induce additional gas production in the U.S. This increase is reasonably foreseeable, and its environmental effects must be analyzed under NEPA.

c. Induced Production Will Impose Significant Environmental Harms

Natural gas production—from both conventional and unconventional sources—is a significant air pollution source, can disrupt ecosystems and watersheds, leads to industrialization of entire landscapes, and presents challenging waste disposal issues. DOE/FE must consider the increase in these environmental harms that exports are likely to stimulate.

Much of the induced production resulting from exports is likely to come from shale gas and other unconventional sources. EIA has concluded that "[o]n average, across all cases and export scenarios, the shares of the increase in total domestic production coming from shale gas, tight gas, [and] coalbed sources are 72 percent, 13 percent, [and] 8 percent," respectively.[83]

A subcommittee of the DOE's Secretary of Energy's Advisory Board recently highlighted "a real risk of serious environmental consequences" resulting from continued expansion of shale gas production.[84] Shale gas production (as well as coalbed and tight sands production) requires the controversial practice of hydraulic fracturing, or fracking. As we explain below, natural gas production in general, and fracking in particular, impose a large number of environmental harms.

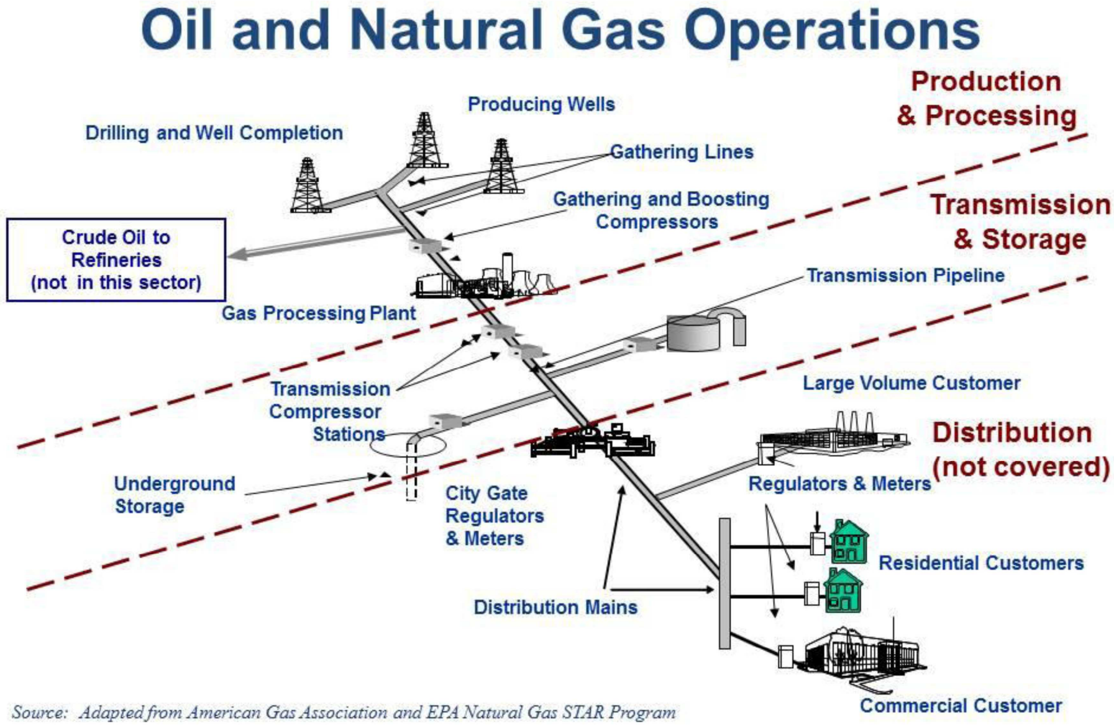
i. Natural Gas Production is a Major Source of Air Pollution

Natural gas production is a significant source of greenhouse gases and other air pollutants, including methane (CH_4), volatile organic compounds (VOCs), nitrogen oxides (NO_x), sulfur dioxide (SO_2), hydrogen sulfide (H_2S), and particulate matter (PM_{10} and $PM_{2.5}$). These operations also emit listed hazardous air pollutants (HAPs) in significant quantities, and so contribute to cancer risks and other acute public health problems. Pollutants are emitted during all stages of natural gas development, including (1) oil and natural gas production, (2) natural gas processing, (3) natural gas transmission, and (4) natural gas distribution.[85] Within these development stages, the major sources of air pollution include wells, compressors, pipelines, pneumatic devices, dehydrators, storage tanks, pits and ponds, natural gas processing plants, and trucks and construction equipment.

[83] EIA Export Study, *supra* n.3, at 11.
[84] DOE, Secretary of Energy's Advisory Board, Shale Gas Production Subcommittee Second 90-Day Report (2011) at 10, attached as Exhibit 34. *See also* DOE, Shale Gas Production Subcommittee First 90-Day Report, attached as Exhibit 35.
[85] EPA, Oil and Natural Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution, Background Technical Support Document for the Proposed Rules, at 2-4 (July 2011) ("2011 TSD"), attached as Exhibit 36.

Figure **1**, drawn from EPA's regulation of some of the aspects of this sector, summarizes these emission points.

Figure 1: The Oil and Natural Gas Sector



1. Greenhouse Gas Emissions from Gas Production

Methane is the primary pollutant emitted by gas production. Emissions occur as result of intentional venting or unintentional leaks during drilling, production, processing, transmission and storage, and distribution. For example, methane is emitted when wells are completed and vented, as part of operation of pneumatic devices and compressors, and as a result of leaks (fugitive emissions) in pipelines, valves, and other equipment.

Methane is a potent greenhouse gas: the Intergovernmental Panel on Climate Change estimates that fossil methane has 36 times the global warming potential of carbon dioxide over a 100 year time frame and at least 86 times the global warming potential of carbon dioxide over a 20-year time frame.[86]

EPA has recognized methane emissions from natural gas production and systems as a major contributor to climate change, and many recent studies indicate that EPA has in fact understated the scope of the problem. EPA has identified natural gas systems as the

[86]IPCC, Climate Change 2013: The Physical Science Basis: Chapter 8, page 714, Table 8.7, attached as Exhibit 37. Methane is also an ozone precursor. EPA, *Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews*, 76 Fed. Reg. 52,738, 52,791 (Aug. 23, 2011).

"single largest contributor to United States anthropogenic methane emissions," amounting to over 40% of the total.[87] Even when using a global warming potential that has been superceded by recent higher estimates, EPA concluded that methane emissions from the oil and gas production industry constituted 5% of all carbon dioxide equivalent (CO_2e) emissions in the country.[88]

The question of how much methane is released during gas production has received extensive recent attention. EPA's 2013 greenhouse gas inventory, which is based on industry's self-reported data and assumed emission factors, implies that about 1.5% of gross gas production leaks to the atmosphere in one way or another.[89] Numerous other recent studies indicate that the EPA assessment is, if anything, too low, and that actual emissions may be significantly higher. An August 2011 report from the Worldwatch Institute and Deutsche Bank summarizes much of the work that had been done at that point.[90] The Worldwatch Report discussed three prior reports that used "bottom-up" methodologies, based on assumed emissions from individual components and sources in the gas production sector; these were reports by Dr. Robert Howarth et al., of Cornell,[91] Mohan Jiang et al. of Carnegie-Mellon,[92] and Timothy Skone of NETL.[93] The Worldwatch Report separately derived a "top-down" estimate, which produced a result similar to the NETL estimate.[94] These various assessments are summarized in the following chart.

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[87] *Id.* at 52,792 (Aug. 23, 2011).

[88] *Id.* at 52,791–92.

[89] EPA's 2013 inventory does not explicitly state the leak rate for natural gas production. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2011*, Table ES-2 (2013), attached as Exhibit 38. EPA's prior inventory implied a leak rate of 2.4%, as extrapolated by a previous study. Alvarez *et al.*, *Greater focus needed on methane leakage from natural gas infrastructure*, Proceedings of the National Academy of Science (Apr. 2012) at 1, attached as Exhibit 39. Because the current inventory's sector-wide emissions estimates for the same time periods have been reduced by roughly 1/3, the current inventory implies a leak rate of roughly 1.5%.

[90] Mark Fulton *et al.*, *Comparing Life-Cycle Greenhouse Gas Emissions from Natural Gas and Coal* (Aug. 25, 2011) ("Worldwatch Report"), attached. as Exhibit 40.

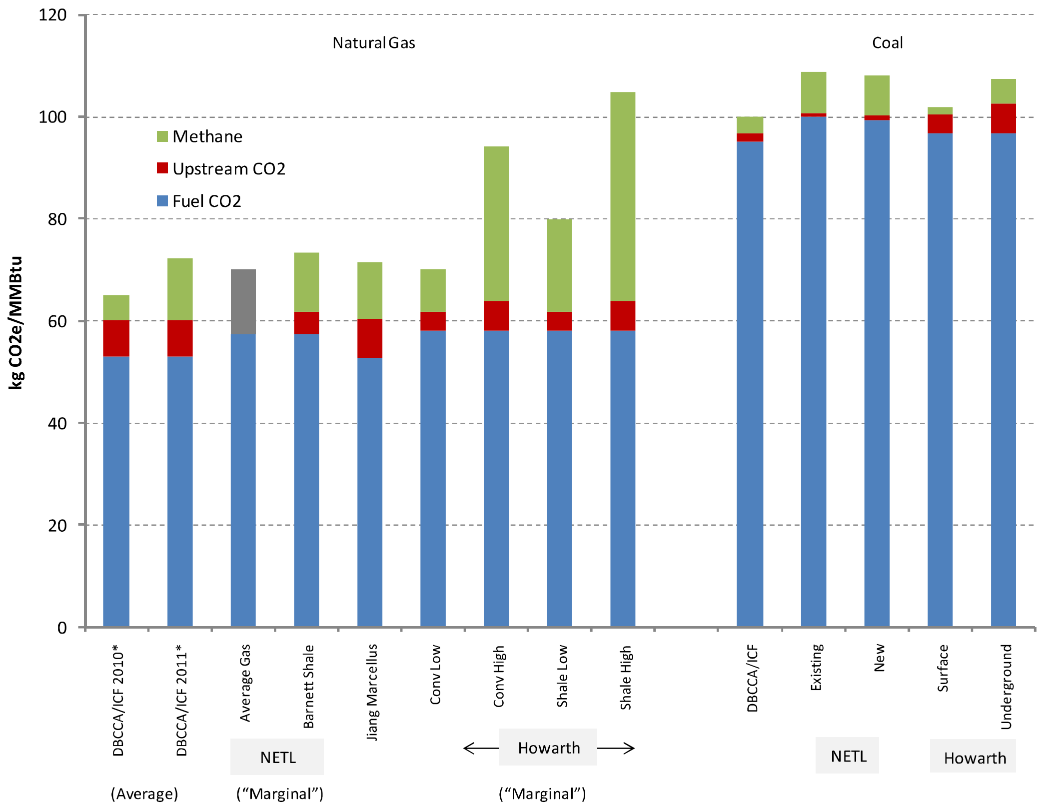
[91] Robert W. Howarth *et al*., *Methane and the greenhouse-gas footprint of natural gas from shale formations*, Climactic Change (Mar. 2011), attached as Exhibit 41.

[92] Mohan Jiang *et al.*, *Life cycle greenhouse gas emissions of Marcellus shale gas*, Environ. Res. Letters 6 (Aug. 2011), attached as Exhibit 42.

[93] The Worldwatch Report discusses Timothy J. Skone, *Life Cycle Greenhouse Gas Analysis of Natural Gas Extraction and Delivery in the United States*, Presentation to Cornell (May 12, 2011), attached as Exhibit 43. NETL published a more complete version of this analysis after the Worldwatch Report was released. Timothy J. Skone, *Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production* (Oct. 24, 2011), attached to as Exhibit 44.

[94] Worldwatch Report, *supra* n.90 at 9.

Figure 2: Comparison of Recent Life-Cycle Assessments[95]



Source: DBCCA Analysis 2011; NETL 2011; Jiang 2011; Howarth 2011. Note: NETL Average Gas study includes bar shaded grey due to inability to segregate upstream CO2 and methane values, which were both accounted for in the study. See page 10 for more information. *2011 EPA methodology compared to 2010.

As this figure demonstrates, although the 2011 studies differ, most of them estimate production greenhouse gas emissions (combined methane and "upstream CO_2") in a similar range. Synthesizing these studies, the Worldwatch Report estimated, using a now-outdated methane global warming potential of 25, that normalized life-cycle GHG emissions from domestic natural gas production at approximately 20.1 kilograms, or over 44 pounds, of CO_2e per MMBtu of gas produced.[96] This is roughly comparable to EPA's implied 1.5% leak rate estimate.

Studies completed since 2011 indicate that methane emissions from gas production could be much higher. One study looking specifically to emissions from gas production in the Dallas-Fort Worth area, in the Barnett Shale, concluded that gas production in this region (which is subject to a number of strict pollution controls because of its ozone non-attainment status) had a leak rate of approximately 1.5%.[97] This study cautions,

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[95] *Id.* at 3.
[96] *Id.* at 15 Ex. 8.
[97] Jeffrey Logan et al., Joint Inst. for Strategic Analysis, Natural Gas and the Transformation of the U.S. Energy Sector (2012) ("JISEA report") at 5, available at http://www.nrel.gov/docs/fy13osti/55538.pdf and

however, that its bottom-up methodology can understate emissions, and this study failed to account for emissions from liquids unloading at the well site.
Two studies of Colorado's Denver-Julesberg Basin have concluded that during gas production alone (not including emissions from downstream segments of the industry - transmission and distribution), the gas leak rate was about 4%.[98] The same team of researchers found even higher methane rates in Utah's Uinta Basin, estimating escaped methane at 9 ± 3% of total production.[99] Most troublingly, a California study identified a 17% leak rate for oil and gas operations in the Los Angeles basin.[100]

Two studies released in the past six months specifically criticize EPA's estimates of greenhouse gas emissions from gas production as too low. In December of 2013, a paper published by Scot M. Miller *et al.* in the Proceedings of the Natural Academy of Sciences reviewed atmospheric measurements of methane and concluded that "The US EPA recently decreased its CH_4 emission factors for fossil fuel extraction and processing by 25–30% (for 1990–2011), but we find that CH_4 data from across North America instead indicate the need for a larger adjustment of the opposite sign."[101] Conservatively using 25%, the bottom of Miller *et al.*'s 'larger than 25-30%' conclusion, this study indicates a leak rate of roughly 3%. In February, a paper published in Science similarly concluded that bottom-up estimates like EPA's greenhouse gas inventory underestimate methane emissions from gas production.[102]

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attached as Exhibit 45. This study concluded that greenhouse gas emissions from natural gas production add 78g CO_2e/kWh to the total emissions associated with electricity generating at an efficient modern combined cycle natural gas plant, a figure similar to what Worldwatch estimates. *Id.* at 25.

[98] The 4% estimate is provided by the more recent of these studies, Petron, et al., *A new look at methane and non-methane hydrocarbon emissions from oil and natural gas operations in the Colorado Denver-Julesburg Basin*, 119:9 J. Geophys. Res. Atmospheres (June 3, 2014). abstract available at http://onlinelibrary.wiley.com/doi/10.1002/2013JD021272/abstract, attached as Exhibit 46. This is consistent with an earlier study, by the same lead author, which estimated using top-down techniques that 2.3 to 7.7% of production was vented in the studied and concluded more generally that "the methane source from natural gas systems in Colorado is most likely underestimated by at least a factor of two." Petron, et al., *Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study*, 117:D4 J. Geophys. Res. Atmospheres 4304 (Feb. 21, 2012), DOI 10.1029/2011JD016360, attached as Exhibit 47.

[99] Karion, *et al*., *Methane emissions estimate from airborne measurements over a western United States natural gas field*, 40:16 Geophysical Research Letters 4393 (Aug. 27, 2013), abstract available at http://onlinelibrary.wiley.com/doi/10.1002/grl.50811/abstract, attached as Exhibit 48. *See also* J. Tollefson, *Methane leaks erode green credentials of natural gas*, Nature (Jan. 2, 2013), attached as Exhibit 49.

[100] Peischl, J., *et al.*, *Quantifying sources of methane using light alkanes in the Los Angeles basin, California*, J. Geophys. Res. Atmos (2013), attached as Exhibit 50.

[101] Miller, S., *et al.*, *Anthropogenic emissions of methane in the United States*, Proceedings of the National Academy of Sciences (Dec. 10, 2013) ("PNAS Study"), at 20022, attached as Exhibit 51.

[102]Brandt, A.R., *et al*, *Methane Leaks from North American Natural Gas Systems*, Science, Vol. 343, no. 6172 at pp. 733-735 (Feb. 14, 2014), attached as Exhibit 52.

The additional production that would be induced in response to Venture Global's proposed project could have emissions that are even higher than these nationwide estimates. One reason is that, according to EIA's predictions, additional production that results from exports will include a higher proportion of unconventional gas than the current production mix, and these unconventional sources are likely to have higher greenhouse gas emissions. As noted above, the EIA Export Study predicts that extraction induced by exports will overwhelmingly be from shale gas sources.[103] Several studies have found that shale gas has higher production emissions than conventional sources. Notably, EPA recently estimated methane emissions from a conventional well completion at only 0.80 tons, while completion of a hydraulically fractured well yielded 158.55 tons of methane.[104] Furthermore, if exports disproportionately increase production near the terminal rather than evenly increasing production nationwide, this production could have higher than average emissions: the Miller *et al.* study found that methane emissions from gas production in the south central United States were particularly severe.[105] Even if DOE determines that it is impossible to assess whether or how emissions from production induced by Venture Global's proposal would differ from average national production emissions, DOE must analyze the greenhouse gas emissions that would result from production increases if it assumed that the nationwide data is representative.

2. Non-greenhouse Gas Air Pollution from Gas Production

***Volatile Organic Compounds (VOCs) and NO_x*:** The gas industry is also a major source of two other ozone precursors: VOCs and NO_x.[106] VOCs are emitted from well drilling and completions, compressors, pneumatic devices, storage tanks, processing plants, and as

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[103] EIA Export Study, *supra* n.3, at 11.

[104] *See* 2011 TSD, *supra* n.85 at 4-7 (Table 4-2). Although JISEA recently found greenhouse gas emissions from unconventional production in the Barnett shale to be "similar to levels reported in the literature from conventional natural gas," JISEA, *supra* n.97, at 4, that study's estimates may be too low. First, the JISEA study used data from the Barnett Shale, which is located in an ozone nonattainment area where emissions are likely to be rigorously controlled. It is therefore possible that its results may not generalize well to production in other plays. Second, the study did not include emissions associated with liquids unloading, a practice that involves removal of liquids from the well and consequent release of greenhouse gases, based on the assumption that liquids unloading is not frequently practiced in unconventional production. A recent industry survey suggests that liquids unloading is in fact practiced in unconventional production, however, so it may be appropriate to add emissions from liquids unloading to JISEA's life-cycle emissions total. Adding emissions associated with liquids unloading would contribute an additional 6 to 28 grams of CO2e/kWh, or even 100g under low-recovery conditions. JISEA, *supra* n.97, at 29 (citing Terri Shires & Miriam Lev-On, *Characterizing Pivotal Sources of Methane Emissions from Unconventional Natural Gas Production,* 11-14 (2012), attached as Exhibit 53.).

[105] PNAS Study, *supra* n.101, at 20021.

[106] *See, e.g.*, Al Armendariz, *Emissions from Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements* (Jan. 26, 2009), available at http://www.edf.org/documents/9235_Barnett_Shale_Report.pdf (hereinafter "Barnett Shale Report") at 24, attached as Exhibit 54.

fugitives from production and transmission.[107] The primary sources of NO_x are compressor engines, turbines, and other engines used in drilling and hydraulic fracturing.[108] NO_x is also produced when gas is flared or used for heating.[109]

As a result of significant VOC and NO_x emissions associated with oil and gas development, numerous areas of the country with heavy concentrations of drilling are now suffering from serious ozone problems. For example, the Dallas Fort Worth area in Texas is home to substantial oil and gas development. Within the Barnett shale region, as of September 2011, there were more than 15,306 gas wells and another 3,212 wells permitted.[110] Of the nine counties surrounding the Dallas Fort Worth area that EPA has designated as "nonattainment" for ozone, five contain significant oil and gas development.[111] A 2009 study found that summertime emissions of smog-forming pollutants from these counties were roughly comparable to emissions from motor vehicles in those areas.[112]

Oil and gas development has also brought serious ozone pollution problems to rural areas, such as western Wyoming.[113] On July 20, 2012, the US EPA designated Wyoming's Upper Green River Basin as a marginal nonattainment area for ozone.[114] In an extended assessment, the Wyoming Department of Environmental Quality ("WDEQ") found that ozone pollution was "primarily due to local emissions from oil and gas . . . development activities: drilling, production, storage, transport, and treating."[115] In the winter of 2011, the residents of Sublette County suffered thirteen days with ozone concentrations considered "unhealthy" under EPA's current air-quality index, including days when the

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[107] *See, e.g.,* 2011 TSD, *supra* n.85, at 4-7, 5-6, 6-5, 7-9, 8-1; *see also* Barnett Shale Report, *supra* n.106, at 24.

[108] *See, e.g.*, 2011 TSD, *supra* n.85, at 3-6; Barnett Shale Report, *supra* n.106, at 24; Air Quality Impact Analysis Technical Support Document for the Revised Draft Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project at 11 (Table 2.1).), attached as Exhibit 55.

[109] 2011 TSD, *supra* n.85, at 3-6; Colorado Department of Public Health and Environment, *Colorado Visibility and Regional Haze State Implementation Plan for the Twelve Mandatory Class I Federal Areas in Colorado*, Appendix D at 1 (2011), available at http://www.cdphe.state.co.us/ap/RegionalHaze/AppendixD/4-FactorHeaterTreaters07JAN2011FINAL.pdf and attached as Exhibit 56.

[110] Texas Railroad Commission history of Barnett Shale, attached as Exhibit 57.

[111] Barnett Shale Report, *supra* n.106, at 1, 3.

[112] *Id.* at 1, 25-26.

[113] Schnell, R.C, *et al*. (2009), "Rapid photochemical production of ozone at high concentrations in a rural site during winter," *Nature Geosci.* 2 (120 – 122). DOI: 10.1038/NGEO415, attached as Exhibit 58.

[114] EPA, *Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards*, 77 Fed. Reg. 30088, 30157 (May 21, 2012).

[115] Wyoming Department of Environmental Quality, Technical Support Document I for Recommended 8-hour Ozone Designation of the Upper Green River Basin (March 26, 2009) at viii, *available at* http://deq.state.wy.us/out/downloads/Ozone%20TSD_final_rev%203-30-09_jl.pdf, attached as Exhibit 59.

ozone pollution levels exceeded the worst days of smog pollution in Los Angeles.[116] In 2013, a Wyoming Department of Health study linked elevated levels of ozone pollution to increased visits at two local health clinics for respiratory-related complaints.[117] In the past, residents have faced repeated warnings regarding elevated ozone levels and the resulting risks of going outside[118] and WDEQ has drafted a plan, which includes weather forecasting, public updates and short-term ozone emission reduction measures, in anticipation of elevated ozone levels in 2014.[119]

Ozone problems are mounting in other Rocky Mountain states as well. In recent years Northeastern Utah's Uintah Basin has experienced severe ozone pollution. In the winter of 2012 to 2013, this region suffered over fifty days where air quality monitors measured ozone in excess of federal standards and some days where ozone levels were almost twice the federal standard.[120] The Utah Department of Environmental Quality has determined that "Oil and gas operations were responsible for 98-99 percent of volatile organic compound (VOC) emissions and 57-61 percent of nitrogen oxide (NOx) emissions," the primary chemical contributors to ozone formation.[121] The Bureau of Land Management (BLM) has similarly identified the multitude of oil and gas wells in the region as the primary cause of the ozone pollution.[122]

Rampant oil and gas development in Colorado and New Mexico is also leading to high levels of VOCs and NO_x. In 2008, the Colorado Department of Public Health and

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[116] EPA, *Daily Ozone AQI Levels in 2011 for Sublette County, Wyoming*, *available at* http://www.epa.gov/cgi-bin/broker?msaorcountyName=countycode &msaorcountyValue=56035&poll=44201&county=56035&msa=-1&sy=2011&flag=Y &_debug=2&_service=data&_program=dataprog.trend_tile_dm.sas, attached as Exhibit 60; *see also* Wendy Koch, *Wyoming's Smog Exceeds Los Angeles' Due to Gas Drilling*, USA Today, *available at* http://content.usatoday.com/communities/greenhouse/post/ 2011/03/wyomings-smog-exceeds-los-angeles-due-to-gas-drilling/1, attached as Exhibit 61.

[117] State of Wyoming, Department of Health, *Associations of Short-Term Exposure to Ozone and Respiratory Outpatient Clinic Visits — Sublette County, Wyoming, 2008–2011* (Mar. 1, 2013) at 3, available at http://www.health.wyo.gov/phsd/ehl/index.html and attached as Exhibit 62.

[118] *See, e.g.*, 2011 DEQ Ozone Advisories, Pinedale Online! (Mar. 17, 2011), http://www.pinedaleonline.com/news/2011/03/OzoneCalendar.htm (documenting ten ozone advisories in February and March 2011), attached as Exhibit 63; Wyoming Department of Environmental Quality, Ozone Advisory for Monday, Feb. 28, Pinedale Online! (Feb. 27, 2011), http://www.pinedaleonline.com/news/2011/02/OzoneAdvisoryforMond.htm, attached as Exhibit 64.

[119] *DEQ plans for the 2014 winter ozone season*, Pinedale Online! (Dec. 19, 2013), available at http://www.pinedaleonline.com/news/2013/12/DEQplansforthe2014wi.htm and attached as Exhibit 65.

[120] *See, e.g.*, Utah Dept. of Environmental Quality, *Utah's Environment 2013: Planning and Analysis: Uintah Basin Ozone Study* (updated Jan. 17, 2014), *available at* http://www.deq.utah.gov/envrpt/Planning/s12.htm and attached as Exhibit 66.

[121] Utah Dept. of Environmental Quality, *Uinta Basin: Ozone in the Uinta Basin* (Updated Jan. 28,2014), *available at* http://www.deq.utah.gov/locations/uintahbasin/ozone.htm, attached as Exhibit 67.

[122] BLM, *GASCO Energy Inc. Uinta Basin Natural Gas Development Draft Environmental Impact Statement* ("GASCO DEIS"), at 3-13, *available at* http://www.blm.gov/ut/st/en/fo/vernal/planning/nepa_/gasco_energy_eis.html, attached as Exhibit 68.

Environment concluded that the smog-forming emissions from oil and gas operations exceed vehicle emissions for the entire state.[123] Moreover, significant additional drilling has occurred since 2008. Colorado is now home to more than 51,000 wells.[124] On July 20, 2012, the US EPA designated the metropolitan Denver and the North Front Range area in Colorado as a marginal nonattainment area for ozone.[125] Additionally, portions of Colorado's Western Slope now qualify as a nonattainment area because the three year average ozone value is above the NAAQS.[126] Monitoring also shows that many other areas of the state have ozone pollution levels that exceed levels EPA has recognized as having significant health impacts.[127] In 2013, the Colorado Department of Public Health and Environment issued 42 advisories, cautioning active children and adults, older adults, and people with asthma to reduce prolonged or heavy outdoor exertion, for the Front Range region due to ozone levels that had been exceeded or were expected to be exceeded.[128]

There is also significant development in the San Juan Basin in southeastern Colorado and northwestern New Mexico, with approximately 35,000 wells in the Basin. As a result of this development and several coal-fired power plants in the vicinity, the Basin suffers from serious ozone pollution.[129] This pollution is taking a toll on residents of San Juan County. The New Mexico Department of Public Health has documented increased emergency room visits associated with high ozone levels in the County.[130]

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[123] 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), attached as Exhibit 69.

[124] Colorado Oil & Gas Conservation Commission, *Colorado Weekly & Monthly Oil and Gas Statistics*, at 11 (Jan. 7, 2014), available at http://cogcc.state.co.us/ (library—statistics—weekly/monthly well activity), attached as Exhibit 70.

[125] EPA, *Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards*, 77 Fed. Reg. at 30110, *supra* n.114.

[126] Colorado Air Quality Control Commission, 2013 Summer Ozone Season Review (Oct. 17, 2013) slides at 5, available at http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%22Review+of+the+2013+Ozone+Season+%2822+pages%29.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251896466011&ssbinary=true and attached as Exhibit 71.

[127] *Id.* at 2-11.

[128] Colorado Department of Public Health and the Environment, Forecasting Air Quality in Colorado (May 16, 2013) at slides 2-3, 5, available at http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%22Forecasting+Air+Quality+in+Colorado+-+15+pgs.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251854889571&ssbinary=true and attached as Exhibit 72.

[129] *See Four Corners Air Quality Task Force Report of Mitigation Options*, at vii (Nov. 1, 2007), *available at* http://www.nmenv.state.nm.us/aqb/4C/TaskForceReport.html, attached as Exhibit 73.

[130] Myers *et al.*, *The Association Between Ambient Air Quality Ozone Levels and Medical Visits for Asthma in San Juan County* (Aug. 2007), *available at* http://www.nmenv.state.nm.us/aqb/4c/Documents/SanJuanAsthmaDocBW.pdf, attached as Exhibit 74.

VOC and NO_x emissions from oil and gas development are also harming air quality in national parks and wilderness areas. Researchers have determined that numerous "Class I areas" – a designation reserved for national parks, wilderness areas, and other such lands[131] – are likely to be impacted by increased ozone pollution as a result of oil and gas development in the Rocky Mountain region. Affected areas include Mesa Verde National Park and Weminuche Wilderness Area in Colorado and San Pedro Parks Wilderness Area, Bandelier Wilderness Area, Pecos Wilderness Area, and Wheeler Peak Wilderness Area in New Mexico.[132] These areas are all near concentrated oil and gas development in the San Juan Basin.[133]

As oil and gas development moves into new areas, particularly as a result of the boom in development of shale resources, ozone problems are likely to follow. For example, regional air quality models predict that gas development in the Haynesville shale will increase ozone pollution in northeast Texas and northwest Louisiana and may lead to violations of ozone NAAQS.[134]

Moreover, VOCs are not simply ozone precursors. They are also co-emitted with a stew "hazardous air pollutants" (HAPs) including benzene. HAPs, by definition, are toxic and also may be carcinogenic. High levels of carcinogens, including benzene compounds, are associated with gas production sites. Unsurprisingly, recent risk assessments from Colorado document elevated health risks for residents living near gas wells.[135] Indeed, levels of benzene and other toxics near wells in rural Colorado were "higher than levels measured at 27 out of 37 EPA air toxics monitoring sites . . . including urban sites" in major industrial areas.[136] These pollution levels are even more concerning than these high concentrations would suggest because several of the toxics emitted by gas operations are endocrine disruptors, which are compounds known to harm human health by acting on the endocrine system even at very low doses; some such compounds may, in fact, be especially dangerous specifically at the low, chronic, doses one would expect near gas operations.[137]

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[131] *See* 42 U.S.C. § 7472(a).

[132] Rodriguez et al., *Regional Impacts of Oil and Gas Development on Ozone Formation in the Western United States*, 59 Journal of the Air and Waste Management Association 1111 (Sept. 2009), available at http://www.wrapair.org/forums/amc/meetings/091111_Nox/Rodriguez_et_al_OandG_Impacts_JAWMA9_09.pdf, attached as Exhibit 75.

[133] *Id.* at 1112.

[134] *See* Kemball-Cook et al., *Ozone Impacts of Natural Gas development in the Haynesville Shale,* 44 Environ. Sci. Technol. 9357, 9362 (2010), attached as Exhibit 76.

[135] L. McKenzie *et al.*, *Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources*, Science of the Total Environment (In Press, Mar. 22, 2012), attached as Exhibit 77.

[136] *Id.* at 16.

[137] *See* L. Vandenberg *et al.*, *Hormones and Endocrine-Disrupting Chemicals: Low-Dose Effects and Nonmonotonic Dose Responses*, Endocrine Disruption Review (2012), attached as Exhibit 78

Sulfur dioxide: Oil and gas production also emits sulfur dioxide, primarily from natural gas processing plants.[138] Sulfur dioxide is released as part of the sweetening process, which removes hydrogen sulfide from the gas.[139] Sulfur dioxide is also created when gas containing hydrogen sulfide (discussed below) is combusted in boilers or heaters.[140]

Hydrogen sulfide: Some natural gas contains hydrogen sulfide. Gas containing hydrogen sulfide above a specific threshold is classified as "sour gas."[141] According to EPA, there are 14 major areas in the U.S., found in 20 different states, where natural gas tends to be sour.[142] All told, between 15 and 20% of the natural gas in the U.S. may contain hydrogen sulfide.[143]

Given the large amount of drilling in areas with sour gas, EPA has concluded that the potential for hydrogen sulfide emissions from the oil and gas industry is "significant."[144] Hydrogen sulfide may be emitted during all stages of development, including exploration, extraction, treatment and storage, transportation, and refining.[145] For example, hydrogen sulfide is emitted as a result of leaks from processing systems and from wellheads in sour gas fields.[146]

Hydrogen sulfide emissions from the oil and gas industry are concerning because this pollutant may be harmful even at low concentrations.[147] Hydrogen sulfide is an air pollutant with toxic properties that smells like rotten eggs and can lead to neurological impairment or death. Long-term exposure to hydrogen sulfide is linked to respiratory infections, eye, nose, and throat irritation, breathlessness, nausea, dizziness, confusion,

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[138] 76 Fed. Reg., *supra* n.87, at 52,756.
[139] 2011 TSD, *supra* n.85, at 3-3 to 3-5.
[140] 76 Fed. Reg., *supra* n.87, at 52,756.
[141] *Id.* at 52,756. Gas is considered "sour" if hydrogen sulfide concentration is greater than 0.25 grain per 100 standard cubic feet, along with the presence of carbon dioxide. *Id.*
[142] EPA, 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 ii (1993) (hereinafter "EPA Hydrogen Sulfide Report"), attached as Exhibit 79.
[143] Lana Skrtic, *Hydrogen Sulfide, Oil and Gas, and People's Health* ("Skrtic Report"), at 6 (May 2006), *available at* http://www.earthworksaction.org/pubs/hydrogensulfide_oilgas_health.pdf, attached as Exhibit 80.
[144] EPA Hydrogen Sulfide Report, *supra* n. 142, at III-35.
[145] *Id.* at ii.
[146] 2011 TSD, *supra* n.85, at 2-3.
[147] *See* James Collins & David Lewis, *Report to CARB, Hydrogen Sulfide: Evaluation of Current California Air Quality Standards with Respect to Protections of Children* (2000), available at http://oehha.ca.gov/air/pdf/oehhah2s.pdf, attached as Exhibit 81.

and headaches.[148] Although hydrogen sulfide was originally included in the Clean Air Act's list of hazardous air pollutants, it was removed with industry support.[149]

Although direct monitoring of hydrogen sulfide around oil and gas sources is limited, there is evidence that these emissions may be substantial, and have a serious impact on people's health. For example, North Dakota reported 3,300 violations of an odor-based hydrogen sulfide standard around drilling wells.[150] People in northwest New Mexico and western Colorado living near gas wells have long complained of strong odors, including but not limited to hydrogen sulfide's distinctive rotten egg smell. Residents have also experienced nose, throat and eye irritation, headaches, nose bleeds, and dizziness.[151] An air sample taken by a community monitor at one family's home in western Colorado in January 2011 contained levels of hydrogen sulfide concentrations 185 times higher than safe levels.[152]

Particulate Matter (PM): The oil and gas industry is a major source of PM pollution. This pollution is generated by heavy equipment used to move and level earth during well pad and road construction. Vehicles also generate fugitive dust by traveling on access roads during drilling, completion, and production activities.[153] Diesel engines used in drilling rigs and at compressor stations are also large sources of fine PM/diesel soot emissions. VOCs are also a precursor to formation of $PM_{2.5}$.[154]

PM emissions from the oil and gas industry are leading to significant pollution problems. For example, monitors in Uintah County and Duchesne County, Utah have repeatedly measured wintertime $PM_{2.5}$ concentrations above federal standards.[155] These elevated levels of $PM_{2.5}$ have been linked to oil and gas activities in the Uinta Basin.[156] Modeling also shows that road traffic associated with energy development is pushing PM_{10} levels very close to violating NAAQS standards.[157]

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[148] EPA Hydrogen Sulfide Report, *supra* n. 142, at ii.

[149] *See* Pub. L. 102-187 (Dec. 4, 1991). We do not concede that this removal was appropriate. Hydrogen sulfide meets section 112 of the Clean Air Act's standards for listing as a hazardous air pollutant and should be regulated accordingly.

[150] EPA Hydrogen Sulfide Report, *supra* n. 142, at III-35.

[151] See Global Community Monitor, *Gassed! Citizen Investigation of Toxic Air Pollution from Natural Gas Development*, at 11-14 (2011), attached as Exhibit 82.

[152] *Id.* at 21.

[153] *See* GASCO DEIS, supra n.122, at App. J at 2.

[154] O&G NSPS RIA, *supra* n.38, at 4-18.

[155] GASCO DEIS, *supra* n.153, at 3-12.

[156] BLM, West Tavaputs Plateau Natural Gas Full Field Development Plan Final Environmental Impact Statement (July 2010), at 3-20, available at http://www.blm.gov/ut/st/en/fo/price/energy/Oil_Gas/wtp_final_eis.html.

[157] *See* GASCO DEIS, *supra* n.153, at 4-27.

In summary, gas production emits numerous harmful air pollutants. These pollutants take a serious toll on surrounding communities. For example, a research team led by the Colorado School of Public Health measured benzene and other pollutants released from unconventional well completions.[158] Elevated levels of these pollutants correspond to increased cancer risks for people living within half of a mile of a well[159] – a very large population which will increase as drilling expands.

3. Venture Global's Project Will Itself Will Induce Significant Production-related Air Emissions

As we have discussed above, under its current DOE/FE application, Venture Global proposes to export about 243.6 bcf/y of natural gas, and will demand approximately an additional 10% of this gas for the liquefaction process. Thus, Venture Global's proposal would create roughly 267.96 bcf/year of new gas demand. The EIA predicts that about 63% of demand for exports will come from new production, which in this case would amount to 168.81 bcf/year. EPA conversion factors allow us to estimate the emissions impacts of this new production. These leak rates, and EPA conversion factors between the typical volumes of methane, VOC, and HAP in natural gas,[160] make it possible to estimate the potential impact of increasing gas production in the way that LNG export would require.

The table below uses these conversion factors to calculate the emissions associated with producing 168.81 bcf/year of new gas demand, the likely inducement specifically attributable to the Venture Global application. We calculate for a 1% leak rate (which is included as a conservative case to reflect successful air pollution controls more extensive than those which EPA has promulgated), the 1.5% and 2.4% figures indicated past GHG inventories, and the 3.0% leak rate provided by the Miller *et al.* PNAS study. We also include the higher leak rates the NOAA studies suggest in studies of particular plays, but these are significant underestimates, because as explained above, the provided leak rates encompass only production, ignoring transmission and other emissions. Nonetheless, for each leak rate, we provide results for methane, VOC, and HAP.[161]

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[158] L. McKenzie *et al.*, *supra* n.135.
[159] *Id.* at 2.
[160] *See* 2011 TSD, *supra* n.85, at Table 4.2. EPA calculated average composition factors for gas from well completions. These estimates, which are based on a range of national data are robust, but necessarily imprecise for particular fields and points along the line from wellhead to LNG terminal. Nonetheless, they provide a beginning point for quantitative work. EPA's conversions are: 0.0208 tons of methane per mcf of gas; 0.1459 lb VOC per lb methane; and 0.0106 lb HAP per lb methane.
[161] These figures were calculated by multiplying the volume of gas to be exported (in bcf) by 1,000,000 to convert to mcf, and then by 63% to generate new production volumes. The new production volumes of gas were, in turn, multiplied by the relevant EPA conversion factors to generate tonnages of the relevant pollutants. These results are approximations: Although we reported the arithmetic results of this calculation, of course only the first few significant figures of each value should be the focus.

Table 1: Emissions Associated with Production of 168.81 bcf/y of Natural Gas

Leak Rate	Methane (tons)	VOC (tons)	HAP (tons)
1%	35,112	5,123	372
1.5%	52,669	7,684	558
2.4%	84,270	12,295	893
3.0%	105,337	15,369	1,117
4.0%	140,450	20,492	1,489
9%	316,012	46,106	3,350

Thus, Venture Global's proposal would be responsible for hundreds of thousands of tons of increased air pollution. Notably, the threshold for major source permitting under the Clean Air Act is generally just tens of tons of pollution; for greenhouse gases, it is generally 75,000 tons. Venture Global would thus greatly increase air pollution in the regions from which it draws its gas, imperiling public health and the global climate.

ii. Gas Production Disrupts Landscapes and Habitats

Increased oil and gas production will transform the landscape of regions overlying shale gas plays, bringing industrialization to previously rural landscapes, significantly affecting ecosystems, plants, and animals and potentially inducing earthquakes in areas surrounding fracking activity. These impacts are large and difficult to manage.

Land use disturbance associated with gas development impacts plants and animals through direct habitat loss, where land is cleared for gas uses, and indirect habitat loss, where land adjacent to direct losses loses some of its important characteristics.

Regarding direct losses, land is lost through development of well pads, roads, pipeline corridors, corridors for seismic testing, and other infrastructure. The Nature Conservancy (TNC) estimated that in Pennsylvania, "[w]ell pads occupy 3.1 acres on average while the associated infrastructure (roads, water impoundments, pipelines) takes up an additional 5.7 acres, or a total of nearly 9 acres per well pad."[162] New York's Department of Environmental Conservation reached similar estimates.[163] After initial drilling is completed the well pad is partially restored, but 1 to 3 acres of the well pad

[162] TNC, Pennsylvania Energy Impacts Assessment, Report 1: Marcellus Shale Natural Gas and Wind 10, 18 (2010), attached as Exhibit 83.
[163] N.Y. Dep't of Envtl. Conservation, Revised Draft Supplemental General Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, 5-5 (2011) ("NY RDSGEIS"), available at http://www.dec.ny.gov/energy/75370.html.

will remain disturbed through the life of the wells, estimated to be 20 to 40 years.[164] Associated infrastructure such as roads and corridors will likewise remain disturbed. Because these disturbances involve clearing and grading of the land, directly disturbed land is no longer suitable as habitat.[165]

Indirect losses occur on land that is not directly disturbed, but where habitat characteristics are affected by direct disturbances. "Adjacent lands can also be impacted, even if they are not directly cleared. This is most notable in forest settings where clearings fragment contiguous forest patches, create new edges, and change habitat conditions for sensitive wildlife and plant species that depend on "interior" forest conditions."[166] "Research has shown measureable impacts often extend at least 330 feet (100 meters) into forest adjacent to an edge."[167]

TNC's study of the impacts of gas extraction in Pennsylvania is particularly telling. TNC mapped projected wells across the state, considering how the wells and their associated infrastructure, including roads and pipelines, interacted with the landscape. TNC's conclusions make for grim reading. It concluded:

- About 60,000 new Marcellus wells are projected by 2030 in Pennsylvania with a range of 6,000 to 15,000 well pads, depending on the number of wells per pad;

- Wells are likely to be developed in at least 30 counties, with the greatest number concentrated in 15 southwestern, north central, and northeastern counties;

- Nearly two thirds of well pads are projected to be in forest areas, with forest clearing projected to range between 34,000 and 83,000 acres depending on the number of number of well pads that are developed. An additional range of 80,000 to 200,000 acres of forest interior habitat impacts are projected due to new forest edges created by well pads and associated infrastructure (roads, water impoundments);

- On a statewide basis, the projected forest clearing from well pad development would affect less than one percent of the state's forests, but forest clearing and fragmentation could be much more pronounced in areas with intensive Marcellus development;

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[164] Id. at 6-13.
[165] *Id.* at 6-68.
[166] Pennsylvania Energy Impacts Assessment, *supra* n.162, at 10.
[167] NY RDSGEIS, *supra* n.163, at 6-75.

- Approximately one third of Pennsylvania's largest forest patches (>5,000 acres) are projected to have a range of between 1 and 17 well pads in the medium scenario;

- Impacts on forest interior breeding bird habitats vary with the range and population densities of the species. The widely-distributed scarlet tanager would see relatively modest impacts to its statewide population while black-throated blue warblers, with a Pennsylvania range that largely overlaps with Marcellus development area, could see more significant population impacts;

- Watersheds with healthy eastern brook trout populations substantially overlap with projected Marcellus development sites. The state's watersheds ranked as "intact" by the Eastern Brook Trout Joint Venture are concentrated in north central Pennsylvania, where most of these small watersheds are projected to have between two and three dozen well pads;

- Nearly a third of the species tracked by the Pennsylvania Natural Heritage Program are found in areas projected to have a high probability of Marcellus well development, with 132 considered to be globally rare or critically endangered or imperiled in Pennsylvania. Several of these species have all or most of their known populations in Pennsylvania in high probability Marcellus gas development areas.

- Marcellus gas development is projected to be extensive across Pennsylvania's 4.5 million acres of public lands, including State Parks, State Forests, and State Game Lands. Just over 10 percent of these lands are legally protected from surface development.[168]

Increased gas production will exacerbate these problems, which is bad news for the state's lands and wildlife and the hunting, angling, tourism, and forestry industries that depend on them. Although TNC adds that impacts could be reduced with proper planning,[169] more development makes mitigation more difficult. Indeed, the Pennsylvania Department of Conservation and Natural Resources recently concluded that "zero" remaining acres of the state forests are suitable for leasing with surface disturbing activities, or the forests will be significantly degraded.[170]

These land disturbance effects will harm rural economies and decrease property values, as major gas infrastructure transforms and distorts the existing landscape. They will also

[168] Pennsylvania Energy Impacts Assessment, *supra* n.162, at 29.
[169] *See id.*
[170] Penn. Dep't of Conservation and Natural Resources, Impacts of Leasing Additional State Forest for Natural Gas Development (2011), attached as Exhibit 84.

harm endangered species in regions where production would increase in response to Venture Global's exports. Harm to these species and their habitat is inconsistent with the profound public interest in land and species conservation, as expressed in the Endangered Species Act and similar statutes.

Additionally, hydraulic fracturing activities have recently been found to induce earthquakes in areas surrounding fracked wells. In April 2014, state geologists in Ohio found a probable connection between a fracking operation and five earthquakes, including one strong enough to wake nearby residents from their sleep. The state geologists believe that the sand and water injected into a Mahoning County well during the hydraulic fracturing process may have increased pressure on a neaby unknown microfault, resulting in seismic events.[171] In response to this finding, the Ohio Department of Natural Resources announced stronger permit conditions for drilling near faults or other areas that have experienced seismic events in the past.[172] New permit conditions include a requirement that companies install sensitive seismic monitors for horizontal drilling that occurs within three miles of a known fault or area of seismic activity greater than 2.0 in magnitude.[173] In addition to Ohio data linking fracturing itself to increased seismicity, several other studies have linked disposal of fracking wastewater in underground injection wells to increased seismicity.[174]

iii. Gas Production Poses Risks to Ground and Surface Water

As noted above, most of the increased production that would result from Venture Global's proposal will likely be from shale and other unconventional gas sources, and producing gas from these sources requires hydraulic fracturing, or fracking.[175] Hydraulic fracturing involves injecting a base fluid (typically water),[176] sand or other proppant, and various fracturing chemicals into the gas-bearing formation at high pressures to fracture the rock and release additional gas. Each step of this process presents a risk to water resources. Withdrawal of the water may overtax the water source. Fracking itself may contaminate groundwater with either chemicals added to the fracturing fluid or with

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[171] Ohio Department of Natural Resources, *Ohio Announces Tougher Permit Conditions for Drilling Activities Near Faults and Areas of Seismic Activity* (April 11, 2014), available at http://www2.ohiodnr.gov/news/post/ohio-announces-tougher-permit-conditions-for-drilling-activities-near-faults-and-areas-of-seismic-activity and attached as Exhibit 85.
[172] *Id.*
[173] *Id.*
[174] *See, e.g.*, Katie M. Keranen *et al.*, *Potentially induced earthquakes in Oklahoma, USA: Links between wastewater injection and the 2011 M_w 5.7 earthquake sequence*, 6 Geology 699 (June 2013), doi:10.1130/G34045.1, available at https://profile.usgs.gov/myscience/upload_folder/ci2013May3015351271984Keranen%20etal%20Geology%202013.pdf and attached as Exhibit 86.
[175] *See* DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.84, at 8.
[176] The majority of hydraulic fracturing operations are conducted with a water-based fracturing fluid. Fracking may also be conducted with oil or synthetic-oil based fluid, with foam, or with gas.

naturally occurring chemicals mobilized by fracking. After the well is fracked, some water will return to the surface, composed of both fracturing fluid and naturally occurring "formation" water. This water, together with drilling muds and drill cuttings, must be disposed of without further endangering water resources.

Water Withdrawals

Fracking requires large quantities of water. The precise amount of water varies by the shale formation being fracked. The amount of water varies by well and by formation. For example, estimates of water needed to frack a Marcellus Shale wells range from 4.2 to over 7.2 million gallons.[177] In the Gulf States' shale formations (Barnett, Haynesville, Bossier, and Eagle Ford), fracking a single well requires from 1 to over 13 million gallons of water, with averages between 4 and 8 million gallons.[178] Fresh water constitutes 80% to 90% of the total water used to frack a well even where operators recycle "flowback" water from the fracking of previous wells for use in drilling the current one.[179] Many wells are fractured multiple times over their productive life.

Water withdrawals can drastically impact aquatic ecosystems and human communities. Reductions in instream flow negatively affect aquatic species by changing flow depth and velocity, raising water temperature, changing oxygen content, and altering streambed morphology.[180] Even when flow reductions are not themselves problematic, the intake structures can harm aquatic organisms.[181] Where water is withdrawn from aquifers, rather than surface sources, withdrawal may cause permanent depletion of the source. This risk is even more prevalent with withdrawals for fracking than it is for other withdrawals, because fracking is a consumptive use. Fluid injected during the fracking process is (barring accident) deposited below freshwater aquifers and into

[177] TNC, Pennsylvania Energy Impacts Assessment, *supra* n.162, at 10, 18; *accord* NY RDSGEIS, *supra* n.163, at 6-10 ("Between July 2008 and February 2011, average water usage for high-volume hydraulic fracturing within the Susquehanna River Basin in Pennsylvania was 4.2 million gallons per well, based on data for 553 wells."). Other estimates suggest that as much as 7.2 million gallons of frack fluid may be used in a 4000 foot well bore. NRDC, *et al.*, *Comment on NY RDSGEIS on the Oil, Gas and Solution Mining Regulatory Program* (Jan. 11, 2012) (Attachment 2, Report of Tom Myers, at 10), attached as Exhibit 87 ("Comment on NY RDSGEIS").

[178] Jean-Philippe Nicot, *et al.*, *Draft Report – Current and Projected Water Use in the Texas Mining and Oil and Gas Industry*, 52-54 (Feb. 2011) (water use from 1 to over 13 million gallons), attached as Exhibit 88; Jean-Philippe Nicot, *et al.*, *Oil & Gas Water Use in Texas: Update to the 2011 Mining Water Use Report* 11-14 (Sept. 2012) (updated data presented as averages), attached as Exhibit 89**.** DOE's Shale Gas Subcommittee generally states that nationwide, fracking an individual well requires between 1 and 5 million gallons of water. DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.84, at 19.

[179] NY RDSGEIS, *supra* n.163, at 6-13; *accord* Nicot 2012, *supra* n.178, at 54.

[180] NY RDSGEIS, *supra* n.163, at 6-3 to 6-4, *see also* Maya Weltman-Fahs, Jason M. Taylor, *Hydraulic Fracturing and Brook Trout Habitat in the Marcellus Shale Region: Potential Impacts and Research Needs*, 38 Fisheries 4, 6-7 (Jan. 2013), attached as Exhibit 90.

[181] NY RDSGEIS, *supra* n.163, at 6-4.

sealed formations.[182] Thus, the water withdrawn from the aquifer will be used in a way that provides no opportunity to percolate back down to the aquifer and recharge it.

Groundwater Contamination

Fracturing poses a serious risk of groundwater contamination. Contaminants include chemicals added to the fracturing fluid and naturally occurring chemicals that are mobilized from deeper formations to groundwater via the fracking process. Contamination may have several causes, such as improper well siting, poor well design and construction, including casing and cementing; blow-outs and other catastrophic accidents; leaks in wells, pipes, and waste pits; spills of hydraulic fracturing chemicals and waste; fracturing operations that were inappropriately conducted near an improperly plugged well, fractures that grew out of zone, or a combination of these causes. Although information on groundwater contamination is incomplete, the available research indicates that contamination has already occurred on multiple occasions.

One category of potential contaminants includes chemicals added to the drilling mud and fracturing fluid. The fluid used for slickwater fracturing is typically comprised of more than 98% fresh water and sand, with chemical additives comprising 2% or less of the fluid.[183] Chemicals are added as solvents, surfactants, friction reducers, gelling agents, bactericides, and for other purposes.[184] New York recently identified 322 unique ingredients used in fluid additives, recognizing that this constituted a partial list.[185] These chemicals include petroleum distillates; aromatic hydrocarbons; glycols; glycol ethers; alcohols and aldehydes; amides; amines; organic acids, salts, esters and related chemicals; microbicides; and others. Many of these chemicals present health risks.[186] Of particular note is the use of diesel, which the DOE Subcommittee has singled out for its harmful effects and recommended be banned from use as a fracturing fluid additive.[187] The minority staff of the House Committee on Energy and Commerce has determined that, despite diesel's risks, between 2005 and 2009 "oil and gas service companies injected 32.2 million gallons of diesel fuel or hydraulic fracturing fluids containing diesel fuel in wells in 19 states."[188]

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[182] *Id.* at 6-5; First 90-Day Report, *supra* n.84, at 19 ("[I]n some regions and localities there are significant concerns about consumptive water use for shale gas development.").
[183] NY RDSGEIS, *supra* n.163, at 5-40.
[184] *Id.* at 5-49.
[185] *Id.* at 5-41.
[186] *Id.* at 5-75 to 5-78.
[187] DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.84, at 25.
[188] Natural Resources Defense Council, Earthjustice, and Sierra Club, Comments [to EPA] on Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels 3, (June 29, 2011) (quoting Letter from Reps. Waxman, Markey, and DeGette to EPA Administrator Lisa Jackson 1 (Jan. 31, 2001)) ("Comment on Diesel Guidance"), attached as Exhibit 91.

Contamination may also result from chemicals naturally occurring in the formation. Flowback and produced water "may include brine, gases (e.g. methane, ethane), trace metals, naturally occurring radioactive elements (e.g. radium, uranium) and organic compounds."[189] For example, mercury naturally occurring in the formation becomes mixed in with water-based drilling muds, resulting in up to 5 pounds of mercury in the mud per well drilled in the Marcellus region.[190]

There are several vectors by which these chemicals can reach groundwater supplies. Perhaps the most common or significant are inadequacies in the casing of the vertical well bore.[191] The well bore inevitably passes through geological strata containing groundwater, and therefore provides a conduit by which chemicals injected into the well or traveling from the target formation to the surface may reach groundwater. The well casing isolates the groundwater from intermediate strata and the target formation. This casing must be strong enough to withstand the pressures of the fracturing process—the very purpose of which is to shatter rock. Multiple layers of steel casing must be used, each pressure tested before use, then centered within the well bore. Each layer of casing must be cemented, with careful testing to ensure the integrity of the cementing.[192]

Separate from casing failure, contamination may occur when the zone of fractured rock intersects an abandoned and poorly sealed well or natural conduit in the rock.[193] One recent study concluded, on the basis of geologic modeling, that frack fluid may migrate from the hydraulic fracture zone to freshwater aquifers in less than ten years.[194]

Available empirical data indicates that fracking has resulting in groundwater contamination in at least five documented instances. One study "documented the higher concentration of methane originating in shale gas deposits . . . into wells surrounding a producing shale production site in northern Pennsylvania."[195] By tracking certain isotopes of methane, this study – which the DOE Subcommittee referred to as "a recent, credible, peer-reviewed study" determined that the methane originated in the shale deposit, rather than from a shallower source.[196] Two other reports "have

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[189] Shale Gas Production Subcommittee First 90-Day Report, *supra* n.84, at 21; *see also* Comment on NY RDSGEIS, *supra* n.177, attachment 3, Report of Glen Miller, at 2.
[190] Comment on NY RDSGEIS, *supra* n.177, attachment 1, Report of Susan Harvey, at 92.
[191] DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.84, at 20.
[192] Comment on Diesel Guidance, *supra* n.188, at 5-9.
[193] Comment on NY RDSGEIS, *supra* n.177, attachment 3, Report of Tom Myers, at 12-15.
[194] Tom Myers, *Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers* (Apr. 17, 2012), attached as Exhibit 92.
[195] DOE, Shale Gas Production Subcommittee First 90-Day Report at 20 (citing Stephen G. Osborn, Avner Vengosh, Nathaniel R. Warner, and Robert B. Jackson, *Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing*, Proceedings of the National Academy of Science, 108, 8172-8176, (2011), attached as Exhibit 93).
[196] *Id.*

documented or suggested the movement of fracking fluid from the target formation to water wells linked to fracking in wells."[197] "Thyne (2008)[[198]] had found bromide in wells 100s of feet above the fracked zone. The EPA (1987)[[199]] documented fracking fluid moving into a 416-foot deep water well in West Virginia; the gas well was less than 1000 feet horizontally from the water well, but the report does not indicate the gas-bearing formation."[200]

More recently, EPA has investigated groundwater contamination in Pavillion, Wyoming and Dimock, Pennsylvania. In the Pavillion investigation, EPA's draft report concludes that "when considered together with other lines of evidence, the data indicates likely impact to ground water that can be explained by hydraulic fracturing."[201] EPA tested water from wells extending to various depths within the range of local groundwater. At the deeper tested wells, EPA discovered inorganics (potassium, chloride), synthetic organic (isopropanol, glycols, and tert-butyl alcohol), and organics (BTEX, gasoline and diesel range organics) at levels higher than expected.[202] At shallower levels, EPA detected "high concentrations of benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons."[203] EPA determined that surface pits previously used for storage of drilling wastes and produced/flowback waters were a likely source of contamination for the shallower waters, and that fracturing likely explained the deeper contamination.[204] The U.S. Geological Survey, in cooperation with the Wyoming Department of Environmental Quality, also provided data regarding chemicals found in wells surrounding Pavillion.[205] Although the USGS did not provide analysis regarding the likely source of the contaminants found, an independent expert who reviewed the USGS and EPA data at the request of Sierra Club and other environmental groups concluded that the USGS data supports EPA's findings.[206] EPA

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[197] Comment on NY RDSGEIS, *supra* n.177, attachment 3, Report of Tom Myers, at 13.

[198] Dr. Myers relied on Geoffrey Thyne, *Review of Phase II Hydrogeologic Study* (2008), prepared for Garfield County, Colorado, *available at* http://cogcc.state.co.us/Library/Presentations/Glenwood_Spgs_HearingJuly_2009/(1_A)_ReviewofPhase-II-HydrogeologicStudy.pdf.

[199] Environmental Protection Agency, *Report to Congress, Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy*, vol. 1 (1987), *available at* nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=20012D4P.txt, attached as Exhibit 94.

[200] Comment on NY RDSGEIS, *supra* n.177, attachment 3, Report of Tom Myers, at 13.

[201] EPA, Draft Investigation of Ground Water Contamination near Pavillion, Wyoming, at xiii (2011), available at http://www.epa.gov/region8/superfund/wy/pavillion/EPA_ReportOnPavillion_Dec-8-2011.pdf, attached as Exhibit 95. EPA has not yet released a final version of this report, instead recently extending the public comment period to September 30, 2013. 78 Fed. Reg. 2396 (Jan. 11, 2013).

[202] *Id.* at xii.

[203] *Id.* at xi.

[204] *Id.* at xi, xiii.

[205] USGS, *Groundwater-Quality and Quality-Control Data for two Monitoring Wells near Pavillion, Wyoming, April and May 2012*, USGS Data Series 718 p.25 (2012), attached as Exhibit 96.

[206] Tom Myers, *Assessment of Groundwater Sampling Results Completed by the U.S. Geological Survey* (Sept. 30, 2012), attached as Exhibit 97. Another independent expert, Rob Jackson of Duke University, has

recently stated that it would turn further investigation of contamination of Pavillion over to Wyoming, such that EPA will not finalize its draft report, but that EPA "stands behind its work and data" in the draft report.[207]

EPA also identified elevated levels of hazardous substances in home water supplies near Dimock, Pennsylvania.[208] EPA's initial assessment concluded that "a number of home wells in the Dimock area contain hazardous substances, some of which are not naturally found in the environment," including arsenic, barium, bis(2(ethylhexyl)phthalate, glycol compounds, manganese, phenol, and sodium.[209] Arsenic, barium, and manganese were present in five home wells "at levels that could present a health concern."[210] Many of these chemicals, including arsenic, barium, and manganese, are hazardous substances as defined under CERCLA section 101(14). *See* 42 U.S.C. § 9604(a); 40 C.F.R. § 302.4. EPA's assessment was based in part on "Pennsylvania Department of Environmental Protection (PADEP) and Cabot Oil and Gas Corporation (Cabot) sampling information, consultation with an EPA toxicologist, the Agency for Toxic Substances and Disease Registry (ATSDR) Record of Activity (AROA), issued, 12/28/11, and [a] recent EPA well survey effort."[211] The PADEP information provided reason to believe that drilling activities in the area led to contamination of these water supplies. Drilling in the area began in 2008, and was conducted using the hazardous substances that have since been discovered in well water. Shortly thereafter methane contamination was detected in private well water. The drilling also caused several surface spills. Although EPA ultimately concluded that the five homes with potentially unsafe levels of hazardous substances had water treatment systems sufficient to mitigate the threat, [212] the Dimock example indicates the potential for gas development to contaminate groundwater.

The serious groundwater contamination problems experienced at the Pavillion and Dimock sites demonstrate a possibility of contamination, and attendant human health risks. Such risks are not uncommon in gas field sites, and will be intensified by

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stated that the USGS and EPA data is "suggestive" of fracking as the source of contamination. Jeff Tollefson, *Is Fracking Behind Contamination in Wyoming Groundwater?*, Nature (Oct. 4, 2012), attached as Exhibit 98. *See also* Tom Myers, *Review of DRAFT: Investigation of Ground Water Contamination near Pavillion Wyoming* (April 30, 2012) (concluding that EPA's initial study was well-supported), attached as Exhibit 99.

[207] http://www2.epa.gov/region8/pavillion (last accessed Aug. 2, 2013), attached as Exhibit 100.

[208] EPA Region III, Action Memorandum - Request for Funding for a Removal Action at the Dimock Residential Groundwater Site (Jan. 19, 2012), available at http://www.epaosc.org/sites/7555/files/Dimock%20Action%20Memo%2001-19-12.PDF, attached as Exhibit 101; EPA, *EPA Completes Drinking Water Sampling in Dimock, Pa.* (Jul. 25, 2012), attached as Exhibit 102.

[209] EPA Region III Action Memorandum, *supra* n.208 , at 1, 3-4.

[210] *EPA Completes Drinking Water Sampling in Dimock, Pa.*, *supra* n.208.

[211] EPA Region III Action Memorandum, *supra* n.208 , at 1.

[212] *EPA Completes Drinking Water Sampling in Dimock, Pa.*, *supra* n.208.

production for export. DOE/FE must account for these risks, as well, in its economic evaluation.

Waste Management

Fracturing produces a variety of liquid and solid wastes that must be managed and disposed of. These include the drilling mud used to lubricate the drilling process, the drill cuttings removed from the well bore, the “flowback” of fracturing fluid that returns to the surface in the days after fracking, and produced water that is produced over the life of the well (a mixture of water naturally occurring in the shale formation and lingering fracturing fluid). Because these wastes contain the same contaminants described in the preceding section, environmental hazards can arise from their management and ultimate disposal.

On site, drilling mud, drill cuttings, flowback and produced water are often stored in pits. Open pits can have harmful air emissions, can leach into shallow groundwater, and can fail and result in surface discharges. Many of these harms can be minimized by the use of seal tanks in a “closed loop” system.[213] Presently, only New Mexico mandates the use of closed loop waste management systems, and pits remain in use elsewhere.

Flowback and produced water must ultimately be disposed of offsite. Some of these fluids may be recycled and used in further fracturing operations, but even where a fluid recycling program is used, recycling leaves concentrated contaminants that must be disposed of. The most common methods of disposal are disposal in underground injection wells or through water treatment facilities leading to eventual surface discharge.

Underground injection wells present risks of groundwater contamination similar to those identified above for fracking itself. Gas production wastes are not categorized as hazardous under the Safe Drinking Water Act, 42 U.S.C. § 300f *et seq.*, and may be disposed of in Class II injection wells. Class II wells are brine wells, and the standards and safeguards in place for these wells were not designed with the contaminants found in fracking wastes in mind.[214]

Additionally, underground injection of fracking wastes appears to have induced earthquakes in several regions. For example, underground injection of fracking waste in

[213] *See, e.g.,* NY RDSGEIS, *supra* n.163, at 1-12.
[214] *See* NRDC et al., Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy (Sept. 8, 2010), attached as Exhibit 103.

Ohio has been correlated with earthquakes as high as 4.0 on the Richter scale.[215] Underground injection may cause earthquakes by causing movement on existing fault lines: "Once fluid enters a preexisting fault, it can pressurize the rocks enough to move; the more stress placed on the rock formation, the more powerful the earthquake."[216] Underground injection is more likely than fracking to trigger large earthquakes via this mechanism "because more fluid is usually being pumped underground at a site for longer periods."[217] In light of the apparent induced seismicity, Ohio has put a moratorium on injection in the affected region. Similar associations between earthquakes and injection have occurred in Arkansas, Texas, Oklahoma and the United Kingdom.[218] In light of these effects, Ohio and Arkansas have placed moratoriums on injection in the affected areas.[219] The recently released abstract of a forthcoming United States Geological Survey study affirms the connection between disposal wells and earthquakes.[220]

As an alternative to underground injection, flowback and produced water is also sent to water treatment facilities, leading to eventual surface discharge. This presents a separate set of environmental hazards, because these facilities (particularly publicly owned treatment works) are not designed to handle the nontraditional pollutants found in fracking wastes. For example:

> One serious problem with the proposed discharge (dilution) of fracture treatment wastewater via a municipal or privately owned treatment plant is the observed increases in trihalomethane (THM) concentrations in drinking water reported in the public media (Frazier and Murray, 2011), due to the presence of increased bromide concentrations. Bromide is more reactive than chloride in formation of trihalomethanes, and even though bromide

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[215] Columbia University, Lamont-Doherty Earth Observatory, Ohio Quakes Probably Triggered by Waste Disposal Well, Say Seismologists (Jan. 6, 2012), available at http://www.ldeo.columbia.edu/news-events/seismologists-link-ohio-earthquakes-waste-disposal-wells, attached as Exhibit 104.
[216] *Id.*
[217] *Id.*
[218] *Id.*; *see also* Alexis Flynn, Study Ties Fracking to Quakes in England, Wall Street Journal (Nov. 3, 2011), *available at* http://online.wsj.com/article/ SB10001424052970203804204577013771109580352.html, attached as Exhibit 105.
[219] Lamont-Doherty Earth Observatory; Arkansas Oil and Gas Commission, Class II Commercial Disposal Well or Class II Disposal Well Moratorium (Aug. 2, 2011), *available at* http://www.aogc.state.ar.us/Hearing%20Orders/2011/July/180A-2-2011-07.pdf, attached as Exhibit 106.
[220] Ellsworth, W. L., et al., Are Seismicity Rate Changes in the Midcontinent Natural or Manmade?, Seismological Society of America, (April 2012), available at http://www2.seismosoc.org/FMPro?-db=Abstract_Submission_12&-recid=224&-format=%2Fmeetings%2F2012%2Fabstracts%2Fsessionabstractdetail.html&-lay=MtgList&-find, attached as Exhibit 107.

> concentrations are generally lower than chloride concentrations, the increased reactivity of bromide generates increased amounts of bromodichloromethane and dibromochloromethane (Chowdhury, et al., 2010). Continued violations of an 80microgram/L THM standard may ultimately require a drinking water treatment plant to convert from a standard and cost effective chlorination disinfection treatment to a more expensive chloramines process for water treatment. Although there are many factors affecting THM production in a specific water, simple (and cheap) dilution of fracture treatment water in a stream can result in a more expensive treatment for disinfection of drinking water. This transfer of costs to the public should not be permitted.[221]

Similarly, municipal treatment works typically to not treat for radioactivity, whereas produced water can have high levels of naturally occurring radioactive materials. In one examination of three samples of produced water, radioactivity (measured as gross alpha radiation) were found ranging from 18,000 pCi / L to 123,000 pCi/L, whereas the safe drinking water standard is 15 pCi/L.[222]

3. Environmental Impacts of Increased Domestic Gas Prices

Just as all observers agree that exports will increase gas production, all observers agree that exports will increase domestic gas prices. Venture Global agrees with this consensus, as it must, disputing only the magnitude of the increase. App. at 14-15. As we explain elsewhere, the EIA and NERA studies, and materials submitted in connection with this application, all understate the likely price increase that would result from proposed LNG exports.

Gas price increases will significantly increase domestic use of coal for electricity generation. This effect will occur for any level of price increases, although higher price increases will cause a greater shift. The EIA Export Study predicts that the decrease in domestic gas consumption in response to exports and export-driven price increases will "primarily" occur in the electric sector, with producres replacing some gas fired generation with coal.[223] Specifically, EIA predicts that 72 percent of the decrease in gas-fired electricity production will be replaced by coal-fired production, with increased

[221] Comment on NY RDSGEIS, *supra* n.177, attachment 3, Report of Glen Miller, at 13.
[222] *Id.* at 4.
[223] EIA Export Study, *supra* n.3 at 6; *see also id.* at 17 ("[H]igher natural gas prices lead electric generators to burn more coal and less natural gas.").

liquid fuel consumption, increased renewable generation, and decreases in total consumption (8, 9, and 11 percent, respectively) making up the remainder of the gap.[224]

The shift from gas- to coal-fired electricity generation will increase emissions of both traditional air pollutants and greenhouse gases. Gas-fired power plants generate less than a third of the nitrogen oxides and one percent of the sulfur oxides that coal-fired plants generate.[225] Thus, the EIA Export Study demonstrates that exports will harm the environment by causing the opposite shift here.[226]

Coal-fired plants also release roughly twice the carbon dioxide combustion emissions as gas-fired plants, although, as discussed above, this combustion advantage is substantially offset by the greenhouse gases emitted during gas production. Nonetheless, the *EIA Export Study* concluded that under every scenario modeled, exports would produce a significant increase in domestic greenhouse gas emissions, as illustrated by the table below.

[224] *Id.* at 18.
[225] EPA, Air Emissions, http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html, attached as Exhibit 108.
[226] The NERA report did not examine shifts within the domestic power sector in detail, and the NERA study authors acknowledge that EIA uses a more sophisticated model that is better able to predict electricity sector responses to gas prices. The NERA report explains that "EIA's NEMS model has a detailed bottom-up representation of the electricity sector, while the electricity sector in the NERA model is a nested CES function with limited technologies. This means that NEMS allows for switching from natural gas-based generation to other technology types easily, while the possibility of switching out of natural gas is more limited and controlled in the NERA model." NERA Study, *supra* n.3 207 (appx. D, figs. 176-78 and accompanying text). Thus, although the NERA study predicts a smaller electricity sector response to gas prices than did the EIA, *id.*, FERC should rely on the more sophisticated EIA predictions.

Table 2: Cumulative CO_2 Emissions from 2015 to 2035 With Various Export Scenarios[227]

Case	no added exports	low/slow	low/rapid	high/slow	high/rapid
Reference					
Cumulative carbon dioxide emissions	125,056	125,699	125,707	126,038	126,283
Change from baseline		643	651	982	1,227
Percentage change from baseline		0.5%	0.5%	0.8%	1.0%
High Shale EUR					
Cumulative carbon dioxide emissions	124,230	124,888	124,883	125,531	125,817
Change from baseline		658	653	1,301	1,587
Percentage change from baseline		0.5%	0.5%	1.0%	1.3%
Low Shale EUR					
Cumulative carbon dioxide emissions	125,162	125,606	125,556	125,497	125,670
Change from baseline		444	394	335	508
Percentage change from baseline		0.4%	0.3%	0.3%	0.4%
High Economic Growth					
Cumulative carbon dioxide emissions	131,675	131,862	132,016	131,957	132,095
Change from baseline		187	341	282	420
Percentage change from baseline		0.1%	0.3%	0.2%	0.3%

Source: U.S. Energy Information Administration, National Energy Modeling System, with emissions related to natural gas assumed to be consumed in the liquefaction process included.

As explained above, a substantial body of recent scientific evidence demonstrates that past estimates of emissions from natural gas production are too low. Thus, while Sierra Club has no reason to doubt EIA's assessment of the extent to which any given price increase would cause US electricity producers to switch from gas to coal, DOE/FE must take a hard look at the change in domestic greenhouse gas emissions that would result from this shift. The need for such additional analysis, however, merely underscores the importance of searching NEPA review.

4. Environmental Impacts of End User Consumption of LNG

LNG exports are likely to cause still further environmental harm by increasing net global greenhouse gas emissions. DOE/FE must reject Venture Global's argument that "[e]xporting natural gas can have significant environmental benfits, specifically because natural gas is a much cleaner-burning fuel than other fossil fuels" and that the "importation of LNG and availability of natural gas will permit the displacement of existing and future [heavy fuel oil] and diesel generating units for power generation" in Haiti and other "Caribbean island economies." App. at 16. Countries importing LNG will likely use imported gas, at least in part, in place of renewable sources of energy or conservation. There is no evidence indicating that the primary effect of LNG exports will

[227] From the *EIA Export Study*, *supra* n.3, at 19.

be substitution other fossil fuel consumption. Although Venture Global repeatedly discusses fuel switching in Haiti, *etc.*, as we explain elsewhere in this Protest, the Application indicates that a slim percentage, if any, of the gas exported from the Venture Global project will be sent to Haiti. Furthermore, even where LNG displaces high-carbon fuels such as coal, the additional greenhouse gas emissions associated with the LNG process mean that such substitution will have little, if any, climate benefit. NEPA and the NGA require DOE/FE to take a hard look at whether the net effect of US LNG exports will be an increase in greenhouse gas emissons.

First, importing countries are likely to use LNG, at least in part, in place of renewable resources or conservation and efficiency measures. The International Energy Agency (IEA) concludes that increased use of natural gas is unlikely to reduce global greenhouse gas emissions. The IEA's recent *Golden Rules for a Golden Age of Gas* report predicts that international trade in LNG and other measures to increase global availability of natural gas will lead many countries to use natural gas in place of wind, solar, or other renewables, displacing these more environmentally beneficial energy sources instead of displacing other fossil fuels, and that these countries may also increase their overall energy consumption beyond the level that would occur with exports.[228] The IEA goes on to conclude that high levels of gas production and trade will produce "only a small net shift" in global greenhouse gas emissions, with atmospheric CO_2 levels stabilizing at over 650 ppm and global warming in excess of 3.5 degrees Celsius, "well above the widely accepted 2°C target."[229] Competition between LNG and renewables is likely given the growing role renewables will play in potential importing markets. For example, a June 2013 report by Bernstein Research predicts that in China, "wind and solar will expand from roughly 61GW and 8.3GW of installed capacity currently to 250GW and 200GW, respectively, by the end of the decade. In combination, wind and solar will account for roughly half of incremental power generation over the rest of the decade."[230] Forecasts for India are similar, with HSBC concluding that wind power is already at "parity," or cost-competitiveness, with new coal fired generation[231] and HSBC and KPMG predicting that photovoltaic power will reach parity between 2016 and 2018.[232] In Europe, renewables constitute 55% of new electric generating capacity installed since 2000, and 72% of new capacity installed in 2013, with wind power the single most installed power

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[228] International Energy Agency, *Golden Rules for a Golden Age of Gas*, Ch. 2 p. 91 (2012), available at http://www.iea.org/publications/freepublications/publication/WEO2012_GoldenRulesReport.pdf, attached as Exhibit 109.

[229] *Id.*

[230] Bernstein Research, *Asian Coal & Power: Less, Less, Less... The Beginning of the End of Coal*, 37 (June 2013), attached as Exhibit 110.

[231] Sophie Vorrath, *Wind at parity with new coal in India, solar to join by 2018: HSBC*, RenewEconomy (Jul. 11, 2013), available at http://reneweconomy.com.au/2013/wind-at-parity-with-new-coal-in-india-solar-to-join-by-2018-hsbc-14836 and attached as Exhibit 111.

[232] *Id.*, KPMG, *The Rising Sun: Grid parity gets closer*, (Sept. 2012), available at http://indiasmartgrid.org/en/knowledge-center/Reports/Rising-Sun-2%20%20KPMG%20Report%202012.pdf and attached as Exhibit 112.

source in 2013.[233] Notably, China, India, and the European Union have been identified as some of the most likely markets for US LNG exports. Because renewables are already competitive with fossil fuels in these markets, there is little reason to assume that LNG imports would compete with fossil fuels but not renewables.

Notably, electric sector competition between renewables and gas in the US is fundamentally different than competition between renewables and LNG in foreign markets. This is because liquefying, transporting, and regasifying gas for LNG exports is costly, making domestic gas much more price competitive than imported LNG. Thus, while EIA predicts that the US electricity sector's primary response to exports will be a switch to increased use of domestic coal rather than a switch to increased use of renewables and conservation, this prediction does not necessarily apply to markets that heavily rely on imports for both coal and gas, making both fossil fuels relatively much more expensive than renewables

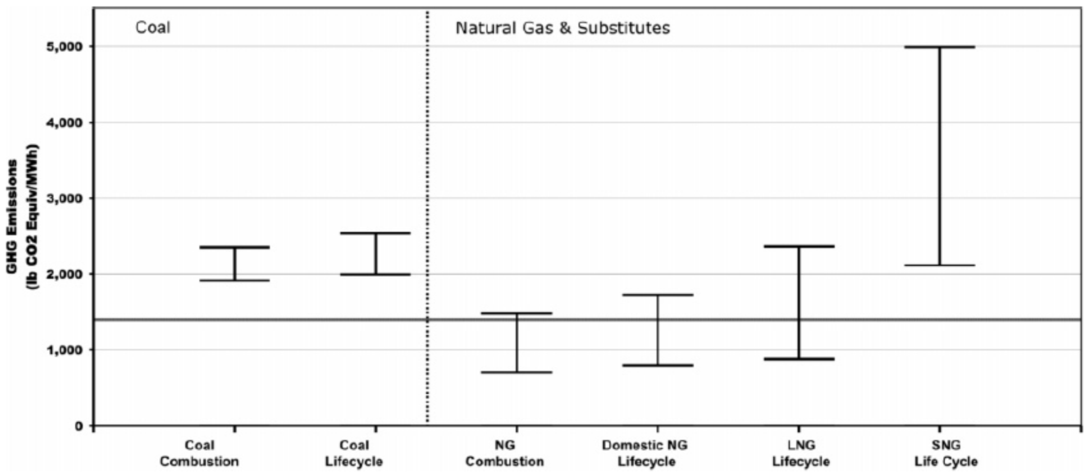
Second, even where importing countries do substitute gas for coal or fuel oil, this substitution is likely to cause little, if any, reduction in global greenhouse gas emissions. As noted above, recent research indicates that natural gas production has significant greenhouse gas emissions, which drastically narrow gas's combustion climate advantage over coal. Any remaining climate advantage is further narrowed, if not completely overcome, by the additional greenhouse gas emissions inherent in the LNG export process. Liquefying natural gas is an energy intensive process. Additional energy is then consumed in the transportation of the LNG, with attendant greenhouse gas emissions. Finally, the LNG must be regasified at the import terminal, often through the use of heat generated by the burning of yet more natural gas. Paulina Jaramillo *et al.* have estimated that these operations drastically increase the lifecycle greenhouse gas emissions of LNG relative to traditionally delivered natural gas, adding between 13.85 and 51.7 pounds of CO_2e per MMBtu on top of the emissions inherent in gas production and the 120 pounds of CO_2e per MMBtu emitted by gas combustion.[234] Jaramillo's more

[233] EWEA, *Wind in power: 2013 European statistics* (Feb. 2014), available at http://www.ewea.org/fileadmin/files/library/publications/statistics/EWEA_Annual_Statistics_2013.pdf and attached as Exhibit 113.

[234] Paulina Jaramillo, W. Michael Griffin, H. Scott Matthews, Comparative Life-Cycle Air Emissions of Coal, Domestic Natural Gas, LNG, and SNG for Electricity Generation, 41 Environ. Sci. Technol. 6,290 (2007) ("Jaramillo 2007"), *available at* http://www.ce.cmu.edu/~gdrg/readings/2007/09/13/Jaramillo_ComparativeLCACoalNG.pdf, attached as Exhibit 114. The cited estimate for the greenhouse gas emissions of liquefaction, transport, and regasification are derived by adding figures for these phases recorded in Figure 6S, p. 9 the supporting information for this article, which is available at http://pubs.acs.org/doi/suppl/10.1021/es063031o/suppl_file/ es063031osi20070516_042542.pdf, and is attached as Exhibit 115 ("Jaramillo Supporting Information"). An earlier, related report with some additional information is Paulina Jaramillo, W. Michael Griffin, H. Scott Matthews, *Comparative Life Cycle Carbon Emissions of LNG Versus Coal and Gas for Electricity Generation* (2005), available at http://www.ce.cmu.edu/~gdrg/readings/2005/10/12/Jaramillo_LifeCycleCarbonEmissionsFromLNG.pdf,

narrow estimates put CO_2e the emissions attributable to LNG at 19% to 23% higher than non-liquefied gas.[235] Even using what are now out-of-date estimates of traditional gas's lifecycle emissions, Jaramillo concluded LNG's lifecycle greenhouse gas emissions can bring LNG into parity with coal:

Figure 3: Life-Cycle Emissions of LNG, Natural Gas, and Coal in Electricity Generation[236]



Jaramillo's analysis understates LNG's lifecycle greenhouse gas emissions for at least two reasons. First, this analysis does not reflect recent studies that estimate greater methane leakage from gas production and greater warming impact for every pound of methane released. Jaramillo used pre-shale-gas-boom estimates both of gas's non-combustion, non-LNG-specific lifecycle emissions between 15.3 to 20.1 pounds CO_2e/ MMBtu.[237] As discussed above, the 2011 Worldwatch Report estimated this figure at 44 pounds CO_2e /MMBtu, and even that figure underestimates the likely volume of methane released and the global warming impact of that methane. Second, Jaramillo estimated lower transportation-related emissions than would result from US LNG exports. Jaramillo's study was concerned with the effects of imports of LNG to the US. As such, Jaramillo's estimates of transportation emissions assumed that the majority of imported LNG would come from Trinidad and Tobago, which are relatively nearby

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and attached as Exhibit 116. A more recent study reached a similar conclusion, suggesting that U.S. LNG may be about 15% more carbon-intensive than ordinary gas. Testimony of James Bradbury, World Resources Institute, Before the U.S. House of Representatives, Energy and Commerce Subcommittee on Energy and Power (May 7, 2013) at 15 (drawing on data from recent life cycle assessments), attached as Exhibit 117, available at http://docs.house.gov/meetings/IF/IF03/20130507/100793/HHRG-113-IF03-Wstate-BradburyJ-20130507.pdf

[235] *See, e.g.*, Jaramillo Supporting Info, *supra* n.234, at 9.

[236] From Jaramillo 2007, *supra* n.234, at 6,295. "SNG," in the figure, refers to synthetic natural gas made from coal.

[237] Jaramillo Supporting Information, *supra* n.234, at 8.

sources.[238] US LNG exports will almost exclusively go to more distant sources in Asia or Europe, entailing greater transportation emissions.

Whether by using Jaramillo's analysis as a template or by using some other methodology, FERC must take a hard look at emissions from the entire lifecycle of exported LNG. As we have explained, even if LNG exports displace coal in end use markets (an assumption that is uncertain at best), this is unlikely to reduce (and may increase) the lifecycle greenhouse gas emissions of those countries' energy use. Meanwhile, EIA modeling shows that exports are likely to increase US greenhouse gas emissions.

Finally, somewhat separate from the question of near-term responses to LNG exports, DOE must consider the longer-term impacts on global energy infrastructure. A course of action that leads other countries to build additional gas infrastructure to use imported LNG, which would likely entrench gas use for decades to come, is not the sort of action necessary to avoid serious climate impacts. Even if, contrary to IEA's predictions, imported LNG displaces other fossil fuels, the resulting emission reductions will be much less than those needed to stabilize atmospheric greenhouse gases below a catastrophic level.[239] DOE/FE must investigate policy options that would encourage the emissions reductions necessary to avert climate disaster, such as installation of infrastructure for renewables rather than fossil fuels. Merely slowing the rate of greenhouse gas emission growth, rather than causing emission reduction, will not avert the crisis.

5. Economic Impacts

Venture Global's arguments regarding the public interest analysis, and price and economic impacts in particular, rests on only two studies, both requested by or previously submitted to DOE/FE, which Sierra Club has discussed in comments incorporated here by reference. In general, Venture Global overstates these studies' conclusions or ignores important flaws therein.

a. Price and Supply Impacts

LNG exports will increase domestic gas prices, as Venture Global concedes. App. at 14-15. Price increases are contrary to the public interest because, as explained above, they will cause an increase in domestic coal consumption in the electricity sector, and because, as explained below, these price increase will harm the majority of the

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[238] Jaramillo 2007, *supra* n.234, at 6,291.

[239] Tom Wigley, *Coal to gas: the influence of methane leakage*, 108 Climatic Change 601, 602 (2011), Exhibit 118 http://www.usclimatenetwork.org/resource-database/report-coal-to-gas-the-influence-of-methane-leakage; Myhrvold & Caldeira, *Greenhouse gases, climate change and the transition from coal to low-carbon electricity*, 7 Environmental Research Letters (2012); Exhibit 119. http://iopscience.iop.org/1748-9326/7/1/014019/pdf/1748-9326_7_1_014019.pdf

American public by decreasing real wages and reducing employment in energy-intensive industries. Because these harms are correlated with the magnitude of price increases, informed forecasts of prices are important.

Yet no forecast considers any scenario in which the exports proposed here would be likely to occur. In reviewing prior export applications, DOE/FE's discussion of price increases has rested primarily on studies DOE requested from the EIA and NERA. EIA's 2012 LNG export study provides the foundation model for how domestic gas prices will increase in response to exports. EIA modeled prices and production over a 20 year period for a range of export scenarios, including scenarios involving 6 and 12 bcf/d of demand from exports.[240] In EIA's "reference" case for gas production recoveries, EIA predicts 10 to 13% increases in the 20-year average of Henry Hub prices for scenarios with 6 bcf/d of demand from exports. [241] For the 12 bcf/d scenarios, EIA's reference case predicts 14 to 26% increases in Henry Hub prices.[242] The NERA study DOE commissioned, and on which Venture Global relies, App. at 14-15, uses EIA's estimates for the price increases associated with given volumes of exports, but attempts to model the international market for exports under various scenarios.

We summarize two flaws with these studies above: the studies do not consider the full volume of exports that are proposed (or even the volume of proposed exports constituted by applications ahead of the present one in DOE/FE's order of priority), and the NERA study understates the likelihood of any particular volume of exports occurring, by failing to account for the role of sunk costs in export agreements and by overstating the costs of LNG transport. Venture Global's application, which relies on the NERA study, fails to address these limitations. App. at 14-15.

An additional flaw in these studies is that they understate the rate at which exports may be phased in, using "rapid" scenarios under which export capacity comes online much more slowly than export proponents anticipate. The EIA's "rapid" scenario considered an increase in export demand of 3 bcf/d per year (i.e., 2.7 bcf/d of actual LNG exports). A review of easily-attainable information of projected facility start-up times indicates that export proponents claim that facilities will come on line more rapidly than this. A non-exhaustive search provided anticipated start-up times for 12 of the 32 proposed export terminals. Venture Global anticipates its first LNG deliveries in the summer of 2018.[243] Cameron LNG describes a three year phase-in period for its 1.7 bcf/d of

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[240] These scenarios assumed that the liquefaction process would consume gas as well, so the actual volume of exports would be closer to 5.5 or 10.9 bcf/d.
[241] EIA Export Study at table B1.
[242] *Id.*
[243] Venture Global LNG, *Conceptual Site Layout, supra* n.17.

exports.[244] Assuming that other facilities will also follow this three- to four-year on-ramp period, we see the following:

Table 3: Anticipated Commencment Dates for Proposed Exports

	New LNG Export Capacity Brought Online, in bcf/d			
	2016	2017	2018	2019
Sabine Pass[245]	1.38	1.38	1.38	
Cameron		0.57	0.57	0.57
Cove Point[246]		0.26	0.26	0.26
Oregon LNG[247]		0.42	0.42	0.42
Excelerate[248]		0.46	0.46	0.46
Delfin[249]		0.35	0.35	0.55
Magnolia LNG[250]			0.81	0.27
Cheniere/Corpus Christi[251]			0.7	0.7
CE FLNG[252]			0.36	0.36
Venture Global			0.36	0.36
Jordan Cove[253]				0.27
Lake Charles[254]				0.67
Totals:	1.38	3.44	5.67	4.89

[244] Japan's Kansai to buy U.S. Cameron LNG from Mitsui, Thompson Reuters (March 31, 2014), available at http://in.reuters.com/article/2014/04/01/lng-kansai-elec-p-idINL4N0MT0D020140401 and attached as Exhibit 120.

[245]Sabine Pass Monthly Progress Report February 2014, attached as Exhibit 121.

[246] DOE approves Dominion Cove Point LNG exports to non-FTA countries, Oil & Gas Journal (September 11, 2013), available at http://www.ogj.com/articles/2013/09/doe-approves-dominion-cove-point-lng-exports-to-non-fta-countries.html and attached as Exhibit 122.

[247] FACTBOX – North America natural gas export plans, Thompson Reuters (March 14, 2014), available at http://uk.reuters.com/article/2014/03/07/lng-export-north-america-idUKL1N0M418820140307 and attached as Exhibit 123.

[248] *Id.*

[249] App. at 7.

[250] Magnolia LNG fact sheet, available at http://www.magnolialng.com/IRM/Company/ShowPage.aspx?CategoryId=190&CPID=1980&EID=50440019 and attached as Exhibit 124.

[251] LNG World News, Endesa Buys More LNG from Cheniere (April 8, 2014), available at http://www.lngworldnews.com/endesa-buys-more-lng-from-cheniere/ and attached as Exhibit 125.

[252] FACTBOX, *supra* n.247.

[253]U.S. approves Veresen's LNG project in Oregon, The Globe and Mail (March 24, 2014), available at http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/us-approves-veresens-oregon-lng-project/article17652931/ and attached as Exhibit 126.

[254] Lake Charles LNG export project partners file FERC application, Oil & Gas Journal (March 26, 2014), available at http://www.ogj.com/articles/2014/03/lake-charles-lng-export-project-partners-file-ferc-application.html and attached as Exhibit 127.

The figures represent LNG export volumes, not new demand volumes. Using EIA's assumption that additional gas equal to 10% of the processed volume is generally used to drive liquefaction equipment, the facilities on this chart represent new demand of 3.78, 6.24, and 5.38 bcf/d in the years 2017, 2018, and 2019, significantly more than the 3 bcf/d in EIA's "high" scenarios. And these 12 facilities are only a fraction of the 32 different terminals (some with multiple applications) with applications before DOE.[255]

Venture Global also relies on a study by Deloitte Marketpoint LLC, which concludes that exporting 6 bcf/d of LNG would average increase citygate prices by 1.7%.[256] Deloitte MarketPoint LLC and the Deloitte Center for Energy Solutions, *Made in America: The Economic Impact of LNG Exports from The United States*, (2011) ("Deloitte Study").The Deloitte Study's estimates are drastically lower than those provided by EIA; they are even lower than those provided by other export applicants. As noted above, EIA estimates that exporting 6 bcf/d will increase wellhead prices by 10 to 20%. *EIA Study* at 8. Another export applicant recently estimated that exporting 2.2 bcf/d would increase prices by 5-6%. Dominion Cove Point LNG, LP, *Application for Long-Term Authorization to Export Liquefied Natural Gas to Non-Free Trade Agreement Countries*, DOE/FE Docket 11-128-LNG, Ex. C at 42 (Oct. 3, 2011).[257] Venture Global offers no support for or explanation of why the Deloitte Study's estimate is lower than the estimates provided by EIA or other export applicants. Absent a strong showing that the Deloitte Study estimates are superior to those prepared by EIA (and by other members of industry), it would be arbitrary and capricious for DOE/FE to use industry estimates instead of the estimates produced by the impartial federal agency DOE/FE specifically tasked with examining this particular issue. 5 U.S.C. § 706, *Motor Vehicle Mfrs. Ass'n of the United States v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

b. Venture Global's Project Will Harm U.S. Workers and the U.S. Economy

To determine consistency with the public interest, DOE cannot look at price impacts in isolation: DOE must look at the effect given price increases will have on the public (together with the other aspects of the public interest inquiry). Available evidence, including the NERA study DOE commissioned, indicates that the exports Venture Global proposes will decrease wages and make most US families worse off. Venture Global's pending application provides minimal discussion of these issues. As we have explained in comments on the NERA study, the project will likely cause net economic harm even if environmental impacts are excluded from consideration. When environmental impacts

[255] Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of June 11, 2014), *supra* n.18.

[256] This study appears to draw heavily from, and restate many of the conclusions of, the Altos Management Partners study submitted as Appendix B to Freeport LNG's export application in DOE/FE Docket No. 10-161. *See id.* at 21 (explaining Deloitte's acquisition of Altos in 2011).

[257] Attached as Exhibit 128 and available at http://www.fossil.energy.gov/programs/gasregulation/authorizations/2011_applications/11-128-LNG.pdf

(and their economic effects) are considered in addition to these purely economic harms, as they must be, it is clear that the project is contrary to the public interest.

Venture Global does not acknowledge, much less discuss, the economic harms exports will cause. Domestic gas price increases that will result from exports will have far-reaching effects on the U.S. economy. Consumers will face higher total gas bills despite reducing their consumption of gas. Employment and wages in energy-intensive industries such as manufacturing will decline because of reduced gas prices. Even in regions where export spurs additional gas production, temporary growth in jobs will likely lead to long-term economic decline, as these regions suffer from the "resource curse" and boom-bust cycle that plagues extractive economies. The result will be decreases in real wage growth for the overwhelming majority of Americans who do not own (directly or indirectly) stock in gas producing companies, as well as decreases in nationwide employment.[258] As with environmental effects, DOE/FE cannot approve the pending application without thoroughly considering these impacts. If DOE/FE were to make a decision on the available evidence, DOE/FE would have to conclude that these impacts render exports contrary to the public interest.

Perhaps the most immediate and dramatic economic effect of exports will be job losses in energy intensive industries, such as manufacturing. Although the NERA Study was not designed to capture this effect, NERA predicts declines in wage income for each of its export scenarios, and changes in wage growth can be translated into losses of job equivalents (as NERA has done using the same model elsewhere). According to NERA, exports will cause these industries to suffer job losses in the tens to hundreds of thousands.[259] This is true even if Venture Global's exports are considered in isolation. The proposed 0.67 bcf/d project, with the gas required to run liquefaction equipment, will represent 243.6 bcf/y of new demand. Many of NERA's scenarios considered export-created demand of only 370 bcf/y by 2015.[260] NERA predicts that even this minimal level of export would cause a net decrease in wage income equivalent to between 15,000 and 31,000 jobs during the same timeframe.[261] Notably, NERA's forecast concerns changes in *net* wage income, and therefore attempts to include the offsetting effects of job creation in gas production, terminal construction, and other industries. For reasons we detail in our comments on the NERA Study, the actual consequences are likely to be even worse. Moreover, as we explain in part III.B above, DOE/FE cannot consider Venture Global's proposal in isolation. Research on the effects of LNG export in Australia, which has already accumulated experience with gas exports, demonstrates the adverse effects exports can have on domestic industry.[262]

[258] EIA Export Study, *supra* n.3, at 6, 14; NERA Study, *supra* n.3, at 8-9.
[259] Sierra Club Initial NERA Comments, *supra* n.3, at 8, Ex. 5 (Synapse Report) at 5.
[260] NERA Study, *supra* n.3, at 38.
[261] Synapse Report at 5.
[262] National Institute of Economic and Industry Research, "Large scale export of East Coast Australia natural gas: Unintended consequences." A report to the Australian Industry Group and the Plastics and

Even gas producing regions will likely be worse off in the long term, despite short-term job growth as a result of increases in gas production. "Resource curse" effects are well documented in the economic literature. One of the most comprehensive surveys, by Professors Freudenburg and Wilson, of economic studies of "mining" communities (including oil and gas communities) concludes that the long-term economic outcomes are "consistently and significantly negative."[263] Headwaters Economics performed a similar study in 2009, documenting this trend in western U.S counties which focused on resource extraction rather than more durable economic growth strategies. The Headwaters study looked at the performance of "energy-focusing" regions compared to comparable counties over the decades since 1970.[264] It concludes that "counties that have focused on energy development are underperforming economically compared to peer counties that have little or no energy development."[265] A third study, by Amanda Weinstein and Professor Mark Partridge of Ohio State University, found this general trend to apply specifically to communities where shale gas extraction is occurring.[266] Using Bureau of Economics Analysis statistics, the Ohio study directly compared employment and income in counties in Pennsylvania with significant Marcellus drilling and without significant drilling, and before after the boom started.

Communities where resource extraction occurs will suffer further harms not captured by these examinations of job statistics. Raw numbers of jobs or job-equivalents failure to capture the continuity or quality of jobs, but as we explain elsewhere, the gas production jobs that exports will create are typically short-term jobs, whereas the manufacturing and energy-intensive industry jobs it will eliminate are typically stable and long-term.[267]

DOE/FE gave short shrift to these concerns in the Freeport Conditional Authorization. Although DOE/FE acknowledged that regional impacts should be considered in DOE/FE's review of individual LNG export applications, Order 3282 at 77, DOE/FE dismissed the evidence of a resource curse that Sierra Club and other commenters had provided, including the three studies cited above, with the superficial statement that "DOE/FE . . . finds that authorizing the Liquefaction Project is likely to have positive local and regional impacts. As explained above, the comments submitted in response to the LNG Export

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Chemicals Industries Association, October 2012, attached as Exhibit 129 (full document), Exhibit 130 (summary).

[263] W.R. Freudenburg & L.J. Wilson, *Mining the Data: Analyzing the Economic Implications of Mining for Nonmetropolitan Regions*, 72 Sociological Inquiry 549 (2002) at 549, attached as Exhibit 131.

[264] Headwaters Economics, *Fossil Fuel Extraction as a County Economic Development Strategy: Are Energy-Focusing Counties Benefiting?* (revised. July 2009), attached as Exhibit 132.

[265] *Id.* at 2.

[266] Amanda Weinstein and Mark D. Partridge, *The Economic Value of Shale Natural Gas in Ohio*, OHIO STATE UNIVERSITY, Swank Program in Rural-Urban Policy Summary and Report (December 2010) ("Ohio Study"), attached as Exhibit 133.

[267] Sierra Club Initial NERA Comment at 20-21.

Study do not support a different conclusion," *id.* at 78. Despite DOE/FE's use of "as explained above," DOE/FE provided no examination of this evidence or reason for disagreeing with it. Thus, DOE/FE's rejection of this argument was arbitrary and capricious, and as it would be for DOE/FE to similarly disregard the resource-curse effect here.

These adverse effects on rate payers, employees in energy intensive industries, and communities where production occurs mean that exports will have grave distributional effects, as they harm wage-earning households and reduce employment while providing benefit to the relatively few shareholders in gas industries.[268] The NERA study attempts to downplay this fact by arguing that benefits realized by gas production companies are realized by "consumers" generally, because "[c]onsumers own all production processes and industries by virtue of owning stock in them."[269] As Sierra Club explained, however, only about half of American families own any stock at all, and only a small subset of stock owners own stocks in the gas production companies that will benefit from exports.[270] Moreover, the NERA study wrongly assumes that gas production and liquefaction service companies are American owned, but as Sierra Club explained in its comments on the NERA study, this assumption is incorrect.[271] Thus, in describing who will economically benefit from exports, NERA overstates both the extent to which benefits will accrue to most Americans and the extent to which benefits will accrue to Americans at all. In the Freeport Conditional Authorization, DOE/FE refused to examine this issue, assuming that foreign investment in gas production would cause a dollar-for-dollar displacement of domestic investment in other industries. Order 3282 at 93. DOE/FE did not identify any evidence of this, nor any analysis of its implications. Of course, as the NERA study indicates, exports will have winners and losers. It may be that, because foreign investors already own shares of gas companies, this has freed up American investment money for other industries, but the NERA study provides no indication that those other industries will receive the same benefits the foreign owners of gas companies will receive as a result of exports. For all these reasons, most Americans will not share in the benefits of LNG exports.

Because LNG exports will cause all Americans to pay higher energy rates, they will cause many Americans to lose their jobs, and they will benefit only a few Americans, who are generally already wealthy, who own shares of companies in a few industries, it is clear that most Americans will be worse off with LNG exports than they would be without them. DOE/FE's Freeport Conditional Authorization refused to acknowledge this evidence, concluding that this evidence was not "sufficiently compelling" to demonstrate that the harmful distributional effects of exports outweigh the minimal

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[268] *See, e.g.,* Sierra Club Initial NERA Comments, *supra* n.3, at 10.
[269] NERA Study, *supra* n.3 at 55 n.22.
[270] Sierra Club Initial NERA Comment, *supra* n.3, Ex. 5, 9-10.
[271] Foreign investment in wells. http://bridgemi.com/2013/06/canadian-firm-plans-fracking-campaign-that-could-require-4-billion-gallons-of-michigan-water/, attached as Exhibit 134.

GDP growth forecast by NERA. Order 3282 at 75. DOE/FE's only explanation as to the purported deficiency in this evidence was that "None of the commenters [making distributional arguments] has performed a quantitative analysis of the distributional consequences of authorizing LNG exports at the household level." *Id.* In light of the aggregate job data, ratepayer effects, and shareholder data provided by the Sierra Club, there is no apparent reason why a household-level study is necessary.

The Obama Administration has repeatedly emphasized the need to avoid regressive policies that transfer wealth from the middle classes to the wealthy.[272] The President recently explained that "Our economic success has never come from the top down; it comes from the middle out. It comes from the bottom up."[273] Similarly, the President has warned against short-sighted management of wealth. As he explained in the 2009 State of the Union address, the nation erred when "too often short-term gains were prized over long-term prosperity, where we failed to look beyond the next payment, the next quarter, or the next election."[274] DOE/FE must not allow a "surplus [to] bec[o]me an excuse to transfer wealth to the wealthy instead of an opportunity to invest in our future."[275] Thus, LNG exports are at odds with fundamental aspects of executive policy.

Before granting Venture Global's or any other would-be exporter's application, DOE/FE must analyze exports' implications for the economy not just on a macroeconomic scale, but also at local and regional levels; it must consider the effects of increasing U.S. dependence on resource exports on gasfield communities, domestic industry, and the environment; and it must consider counterfactuals, allowing it to evaluate whether the national would be better off without LNG export, or with lower export volumes.[276]

In summary, the NGA's "public interest" test requires DOE/FE to determine whether the country would be better off with Venture Global's proposal than without it. Information in the record demonstrates that exports will transfer wealth from the many to the few.

c. GDP Impacts

The NERA Study's broad conclusion that the US would be better off with exports, or that the net effect of exports is positive, rests almost entirely on a forecast of net GDP growth as a result of exports. DOE/FE rested on this conclusion in refusing to consider

[272] *See, e.g.,* State of the Union Address (January 24, 2012), attached as Exhibit 135, available at http://www.whitehouse.gov/the-press-office/2012/01/24/remarks-president-state-union-address
[273] Remarks by the President at the Daimler Detroit Diesel Plant, Redford, MI (Dec. 10, 2012), attached as Exhibit 136 and available at http://www.whitehouse.gov/the-press-office/2012/12/10/remarks-president-daimler-detroit-diesel-plant-redford-mi
[274] State of the Union Address (Feb. 24, 2009), attached as Exhibit 137, available at http://www.whitehouse.gov/the_press_office/Remarks-of-President-Barack-Obama-Address-to-Joint-Session-of-Congress
[275] *Id.*
[276] *See* Sierra Club Initial NERA Comments; *see also* Sierra Club Reply NERA Comment.

distributional effects in the Freeport Conditional Authorization. Order 3282 at 75. Even on this narrow issue, however, the NERA Study's conclusion is contradicted by other available studies, such as the comprehensive model of LNG exports' impacts conducted recently by Purdue University economists Kemal Sarica and Wallace E. Tyner.[277] The Tyner study found that exports would cause a net reduction in GDP, and acknowledged that its methodology, like NERA's, excluded numerous other factors that would further drive down GDP.

Among these excluded factors are the environmental impacts of gas production, and of the failure to regulate it. These impacts must be factored into assessment of exports' net and distributional impacts. In terms of net impacts, the economic cost of environmental harm, such as the cost of increased air emissions, erodes (if not entirely erases) the net benefit NERA purports to find. Although DOE/FE cannot limit its consideration of environmental impacts to those that are easily monetizable, DOE/FE must, at a minimum, apply available tools to estimate the economic impacts of environmental harms. For example, under the USREF_SD_LR scenario, NERA predicts 2.19 tcf/y of exports in 2035, with a $2 billion GDP increase relative to the baseline.[278] Consideration of just one environmental impact of that level of exports—the contribution to global warming from methane leakage associated with induced gas production and transportation to export terminals (ignoring contributions to global warming from the rest of the LNG lifecycle, and further ignoring non-climate environmental impacts)—erodes a significant fraction of that value. Using EIA estimates of the share of exports that will result from induced production (63%) and a modest estimate of the leak rate for gas production (1.5%), the Sierra Club estimated that 2.19 tcf/y of exports will release an additional 431,000 tons of methane into the atmosphere each year.[279] The present value of the social cost of a ton of methane emissions in 2035 can be roughly estimated as $2,016.[280] Thus, a rough estimate of the social cost of the

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[277] *See* Kemal Sarica & Wallace E. Tyner, *Economic and Environmental Impacts of Increased US Exports of Natural Gas* (Purdue Univ., Working Paper, 2013) (available from the authors) [hereinafter Purdue Study].

[278] *Compare* NERA Study, *supra* n.3, at 179 *with* Sierra Club Initial NERA Comment, *supra* n.3, at 186.

[279] *See supra* part III.C.2.c.i.3 and Sierra Club Initial NERA Comment, *supra* n.3,, at 31-32, for methodology.

[280] Although EPA has not yet prepared an estimate of the social cost of methane, a best available approximation can be derived from the estimate of the current federal Interagency Working Group on Social Cost of Carbon estimates. Interagency Working Group on Social Cost of Carbon, United States Government, *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866*, 3 (Nov. 2013), *available at* http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf and attached as Exhibit 138. The current federal estimate is that present value of the social cost of a short ton of carbon dioxide emitted in 2035 (roughly the midway of the life of the Project) is $56. Although the working group cautions that there are limits to the ability to apply the social cost of carbon dioxide to other greenhouse gases on the basis of their global warming potentials, this comparison can provide a rough estimate of the social cost of methane. As explained *supra* n.86 and in accompanying text, the Intergovernmental Panel on Climate Change estimates methane's 100 year global warming potential as 36. Multiplying this GWP by the cost of a ton of carbon

production-side methane leaks alone is $ 869 million,[281] displacing more than 43% of the GDP increase NERA predicts under this scenario. Liquefaction, processing, transportation, regasification, and combustion of natural gas further adds to greenhouse gas emissions. Other environmental impacts also impose monetizable costs, which must be added to any calculation of net impacts and thus further erase the claimed benefit.

Thus, there is significant doubt as to whether, when all things are considered, the net effect of export would be positive. Thus, even putting aside the serious distributional concerns identified in the previous section, and the the environmental and other effects that can be difficult to monetize, exports' costs are likely to outweigh their benefits. DOE/FE therefore cannot use the NERA Study's prediction of an increase in GDP as evidence that exports will in fact be consistent with the public interest.

d. Venture Global Argues That It Will Provide LNG to Haiti and Similar Nations Without Commiting to Actually Do So

As noted above, an inordinate amount of Venture Global's application is dedicated to the argument that Venture Global's project is "unique," App. at 14, because Venture Global will "enhanc[e] natural gas availability in markets like Haiti," App. at 16, where Venture Global asserts that LNG imports will displace heavy fuel oil and diesel in electricity generation and provide development and humanitarian benefits.

Venture Global's application provides no credible assurance that it will in fact supply LNG to Haiti or other "Caribbean island economies." App. at 16. Venture Global, like every other export applicant, seeks authorization to export "to *any country* which has, or in the future develops, the capacity to import LNG via ocean-going carriers (either directly or by use of LNG containers transported on ocean-going carriers)." App. at 2 (emphasis added). Thus, nothing in Venture Global's application indicates an enforceable commitment to deliver LNG to the countries that Venture Global premises its public interest arguments on. To use Haiti as an example (per Venture Global's lead): unless Venture Global commits to delivering gas to Haiti, DOE/FE's public interest analysis cannot rest on purported benefits specific to delivery of gas to Haiti.

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produces the result of $2,016. Admittedly, estimating the social cost of methane by multiplying the social cost of carbon by methane's global warming potential is imperfect, because the social cost of carbon incorporates some effects which methane will not have until it degrades to carbon dioxide (such as effects on ocean acidification), and methane imposes other social costs beyond its contribution to global warming (such as increasing ozone formation). Nonetheless, using an imperfect estimate such as this is more accurate than disregarding the cost of methane entirely.

[281] *I.e.,* (36)($56/ton)(431,000 tons). For more background on these estimates, *see* Sierra Club Initial NERA Comment, *supra* n.3, at 33-34. Note that this comparison uses the present value, at a 3% discount rate, for environmental harms caused by methane emissions, but does not estimate present value for 2035 GDP increases.

Even if DOE/FE were to look beyond enforceable commitments, the Application itself casts serious doubt on whether Venture Global will actually deliver gas to Haiti or similar nations. Venture Global does not describe any contracts for delivery of such gas. Instead, the Application merely states that Venture Global is in "discussions" regarding possible delivery only of 4 to 7 percent of the project's output to Haiti.

Absent an enforceable commitment to deliver gas to Haiti, DOE/FE must assume that Venture Global will sell gas to the highest bidder. Venture Global provides no evidence indicating that Haitian buyers will outbid Asian and European LNG buyers for Venture Global's proposed capacity. On the other hand, if Haiti were able to purchase LNG in a competitive market, then it would likely be able to win bids for gas from any of the other proposed Gulf Coast LNG export projects, defeating Venture Global's argument that it is somehow "unique" in providing gas to the Carribean.

D. DOE/FE Cannot Rationally Approve Venture Global's Export Plan On the Record Before It

The NGA, and subsequent DOE delegation orders and regulations, charge DOE/FE with determining whether or not a gas export application is in the public interest. *See, e.g.* 15 U.S.C. § 717b(a). DOE/FE must make this decision on the record before it. This means that, regardless of DOE/FE's decision to presume, initially, that an application should be granted, this presumption does not, and cannot, absolve DOE/FE of its duty to make its *own* determination. *Panhandle Producers and Royalty Owners Ass'n*, 822 F.2d at 1110-11. Simply put, "the *agency* must examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made." *Motor Vehicle Mfrs. Ass'n of the United States v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) (emphasis supplied). DOE/FE cannot rationally find for Venture Global on the record in this case.

As we have demonstrated, record support for Venture Global's claimed benefits is extraordinarily thin. Venture Global has submitted no detailed studies or information demonstrating the specific benefits expected from its proposed LNG exports, instead relying on the EIA and NERA studies.

Sierra Club, on the other hand, has shown that the gas and electricity price increases associated with exports will add billions of dollars in costs to consumers. These costs will propagate through the economy, retarding growth. We have also shown that the economic benefits, if any, associated with gas production increases may actually do long-term damage to the U.S. economy by plunging large regions of the country into a boom-and-bust extractive cycle. Further, we have shown that gas extraction and export have major environmental (and, hence, additional economic) costs, which Venture Global has failed to even acknowledge.

On this record, DOE/FE cannot approve export. Were it do so, it would be violating basic norms of agency record rulemaking, as well as its own rules. *See, e.g.*, 5 U.S.C. § 706; 10 C.F.R. § 590.404 (requiring DOE/FE to base its final opinion "solely on the official record of the proceeding" and to impose terms "as may be required by the public interest" after record review).

E. If DOE/FE Does Move Forward, It Must Impose Rigorous Monitoring Conditions

If DOE/FE nonetheless approves Venture Global's application, it must recognize its continuing duty to protect the public interest, as it explained in its earlier *Sabine Pass* decision. This duty is of crucial importance in the context of LNG export, where circumstances are rapidly changing. DOE/FE therefore announced its intention to monitor environmental, economic, and other relevant considerations. *Sabine Pass* at 31-33. Such a monitoring provision must be imposed here, as well, but must be significantly expanded.

Specifically, although *Sabine Pass* announces an intention to monitor many different considerations, it most clearly states that the agency will act if there is a "reduction in the supply of natural gas needed to meet essential domestic needs." *Id.* at 32. This consideration is undoubtedly of great importance, but it is not the only way in which changing circumstances could imperil the public interest.

On the contrary, as we have demonstrated at length in these comments, there is strong evidence that the public interest will be impaired by gas exports. These impairments include (1) regional and national economic dislocations and disruptions caused by natural gas extraction, including by the industry's boom-and-bust cycle, (2) national increases in gas and electricity prices and resulting shifts to more polluting fuels, (3) and environmental impacts of many sorts. Any one of these categories of interests could be impaired by gas export. DOE/FE must therefore state that it will monitor each of these areas, providing specific monitoring terms and thresholds which will trigger agency actions of various types, ranging from further study through reductions in export volume or changes in timing to a revocation of DOE/FE's approval.[282]

If DOE/FE fails to include such provisions in any final approval, it will fail to fulfill its "continuing duty to protect the public interest," *id.* at 31, and so violate the Natural Gas Act. Because neither Venture Global nor DOE/FE have described or proposed such terms, Sierra Club protests this application to the extent that DOE/FE fails to develop adequate monitoring terms of the sort we have described.

[282] Providing a clear monitoring plan of this sort will also benefit Venture Global, which will be better able to determine when and how DOE/FE may act, improving the company's ability to plan its actions and investments.

IV. Conclusion

Sierra Club therefore moves to intervene, offers the above comments, and protests Venture Global's export proposal for the reasons described above. Venture Global's application is not consistent with the public interest and must be denied.

Respectfully submitted,

Nathan Matthews
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UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

IN THE MATTER OF	)	
	)	
VENTURE GLOBAL LNG, LLC	)	**FE DOCKET NO. 13-69-LNG**
	)	

CERTIFIED STATEMENT OF AUTHORIZED REPRESENTATIVE

Pursuant to C.F.R. § 590.103(b), I, Nathan Matthews, hereby certify that I am a duly authorized representative of the Sierra Club, and that I am authorized to sign and file with the Department of Energy, Office of Fossil Energy, on behalf of the Sierra Club, the foregoing documents and in the above captioned proceeding.

Dated at San Francisco, CA, this 26th day of June, 2014.

____
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UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

IN THE MATTER OF	**)**	
	)	
VENTURE GLOBAL LNG, LLC	**)**	**FE DOCKET NO. 13-69-LNG**
	)	

CERTIFICATE OF SERVICE

I hereby certify that I caused the above documents to be served on the applicant and all others parties in this docket, in accordance with 10 C.F.R. § 590.017, on June 26, 2014.

Dated at San Francisco, CA, this 26th day of June, 2014.

____

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UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
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	)	

VERIFICATION

SAN FRANCISCO	§
	§
CALIFORNIA	§

Pursuant to 10 C.F.R. §590.103(b), Nathan Matthews, being duly sworn, affirms that he is authorized to execute this verification, that he has read the foregoing document, and that facts stated herein are true and correct to the best of his knowledge, information, and belief.

Nathan Matthews

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Subscribed and sworn to before me this 25th day of June, 2014.

Rathod
Notary Public

ZARINA RATHOD
Commission # 1992347
Notary Public - California
Alameda County
My Comm. Expires Sep 27, 2016

My commission expires: 09-27-2016