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UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

IN THE MATTER OF	)	
	)	**FE DOCKET NO. 12-123-LNG**
CE FLNG, LLC	)	
	)	
	)	

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

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CE FLNG, LLC requests authorization to export approximately 1.07 billion cubic feet per day (bcf/d) of natural gas as liquefied natural gas (LNG) from a proposed LNG export terminal to be located in Plaquemines Parish, Louisiana. This proposal cannot move forward without extensive environmental and economic analyses that CE FLNG has not provided to the Department of Energy Office of Fossil Energy (DOE/FE). In any event, the available evidence demonstrates that this proposal is inconsistent with the public interest.

As CE FLNG concedes, its proposed terminal would induce additional natural gas production in the United States. App. at 12 (alluding to "higher demand [for gas] due to LNG exports"); *id*. at 14 ("The proposed export of LNG would allow natural gas that might otherwise be shut-in to be sold into the global LNG market, spurring the development of new natural gas resources."). DOE/FE cannot authorize exports without fairly weighing significant environmental and economic impacts of this production. *See Udall v. Federal Power Comm'n*, 387 U.S. 428, 450 (1967). Exports will also harm the public interest by increasing domestic gas prices and likely increasing global greenhouse gas emissions. Further, although CE FLNG asserts that the project will benefit local and regional economies, the company fails even to outline the project's local environmental impacts.

Because Sierra Club's members have a direct interest in ensuring that domestic natural gas production is conducted safely, and that any exports do not adversely affect domestic consumers, the Club moves to intervene in this proceeding and protests CE FLNG's application.

I. Sierra Club Should be Granted Intervention

Sierra Club members live and work throughout the area that will be affected by the CE FLNG export plan, including in the regions adjacent to the proposed facility and pipeline and associated 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 CE FLNG's. The Sierra Club currently has 2,755 members in Louisiana and 583,913 members overall.[1]

To protect our members' interests, Sierra Club moves to intervene in this proceeding, pursuant to 10 C.F.R. § 590.303. Consistent with that rule, Sierra Club states that its rights and interests in this matter include, but are not limited to, the following:

- The environmental consequences of any gas exports from the CE FLNG facility, including emissions and other pollution associated with the gasification and liquefaction processes, 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 CE FLNG facility, 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, 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 CE FLNG's proposal, and of all alternatives to the proposal.

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

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

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 this proceeding 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 this application.

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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. Accordingly, DOE/FE cannot proceed with CE FLNG's application without fully evaluating the environmental impacts of CE FLNG'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). Accordingly, DOE/FE should not proceed with CE FLNG's request for export authorization until the NEPA process is completed, including preparation of an Environmental Impact Statement.

CE FLNG's application largely fails to discuss the environmental impacts of its proposal, instead claiming that its proposal will provide environmental benefits abroad and deferring consideration of local environmental impacts pending review at FERC. App. at 16-17. Moreover, the application makes no mention of the many impacts associated with the increased production of natural gas that would result from a decision by DOE/FE to grant CE FLNG's request. For this and other reasons, CE FLNG fails to demonstrate that its proposal is in the public interest.

As we explain below, the proposal will cause three types of significant environmental harm. First, the construction and operation of the terminal, liquefaction facilities, and any other associated infrastructure 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 and conventional, and toxic air pollutants.

CE FLNG's economic arguments in support of its proposal are unpersuasive. Contrary to CE FLNG's contentions, LNG export will significantly increase domestic gas prices, harming domestic consumers and, as noted above, increased coal-fired electricity generation. Moreover, CE FLNG's predictions of job creation and other economic benefit are unsupported as well as potentially overstated. CE FLNG's economic benefits arguments also ignore the substantial distributional inequalities that exports would herald.

For these reasons 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 CE FLNG's export proposal. Here, we discuss some of these obligations created by the Natural Gas Act, National Environmental Policy Act, Endangered Species Act, and the National Historic Preservation Act before explaining why these obligations preclude CE FLNG's request for conditional authorization.

1. Natural Gas Act

Pursuant to the Natural Gas Act and subsequent delegation orders, DOE/FE must determine whether CE FLNG'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.[3] Courts, the Federal Energy Regulatory Commission (FERC), and DOE/FE, all agree that the "public interest" at issue in this provision includes environmental impacts. CE FLNG's contention that the public interest analysis should be limited to a determination whether "an export will . . . jeopardize supply to domestic needs" is at war with all of these sources. App. at 11.

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.

15 U.S.C. § 717b(a).[4]

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[3] 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). DOE/FE has previously authorized CE FLNG to export 1.25 bcf/d LNG to such nations. DOE/FE Order No. 3100 (May 31, 2012).

[4] 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). The Federal Energy Regulatory Commission has separately been delegated authority regarding the permitting, siting, construction and operation of export facilities. Department of Energy Delegation Order No. 00-004.00A.

Courts interpreting this provision have 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). In interpreting an analogous public interest provision applicable to hydroelectric power and dams, the 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). [5]

DOE has also acknowledged the breadth of the public interest inquiry and recognized that it encompasses environmental concerns. Deputy Assistant Secretary Smith recently testified that "[a] wide range of criteria are considered as part of DOE's public interest review process, including . . . U.S. energy security . . . [i]mpact on the U.S. economy . . . [e]nvironmental considerations . . . [and] [o]ther issues raised by commenters and/or interveners deemed relevant to the proceeding."[6] 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). In a previous LNG export proceeding, DOE determined that the public interest inquiry looks to "domestic need" as well as "other considerations" that included the environment. *Phillips Alaska Natural Gas Corporation and Marathon Oil Company*, 2 FE ¶ 70,317, DOE FE Order No. 1473, *22 (April 2, 1999); *accord* Opinion and Order Conditionally Granting Long-Term Authorization to Export

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See also Executive Orders 12038 & 10485 (vesting any executive authority to allow construction of export facility in the Federal Power Commission and its successors).

[5] 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).

[6] The Department of Energy's Role in Liquefied Natural Gas Export Applications: Hearing Before the S. Comm. on Energy and Natural Resources, 112th Cong. 4 (2011) (testimony of Christopher Smith, Deputy Assistant Secretary of Oil and Gas), attached as Exhibit 2.

[LNG] from Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations ("*Sabine Pass*"), DOE/FE Order 2961 at 29 (May 20, 2011) (acknowledging that the public interest inquiry extends beyond effects on domestic natural gas supplies); *see also Yukon Pacific Corp.*, ERA Dkt. No. 87-68-LNG (Nov. 16, 1989) ("Environmental concerns are an important element of DOE's public interest consideration."). Finally, DOE has applied its "policy guidelines" regarding the public interest to focus review "on the domestic need for the natural gas proposed to be exports; whether the proposed exports pose a threat to the security of natural gas supplies, *and any other issue determined to be appropriate*." *Sabine Pass* at 29 (citing 49 Fed. Reg. 6,684 (Feb. 22, 1984)) (emphasis added).[7]

FERC has agreed that environmental issues are included in the public interest calculus. 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. 139 FERC ¶ 61,039, PP 29-30 (Apr. 14, 2012).[8]

CE FLNG's contention that the public interest determination should be limited to preventing supply shortfalls is in conflict with all of these sources, with DOE practice, and with the approach of most other export applicants. In sum, it is quite clear that environmental impacts are a critical part of DOE/FE's public interest determination.

DOE's outdated *import* guidance document is not to the contrary. 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 in these guidelines was whether to directly regulate prices at which gas could be imported from Canada.[9] In the passages discussed by CE FLNG, App. at 8, 11, DOE/FE explained that rather than directly regulating prices for imported gas, it would seek to ensure that future imports were structured to be responsive to changes in market conditions, frowning upon "import arrangements with contract terms and conditions that restrict the competitiveness of the gas over time."[10] DOE/FE further 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 does not apply to exports,

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[7] Although germane here, these Policy Guidelines policy guidelines are merely guidelines: they "cannot create a norm binding the promulgating agency." *Panhandle Producers and Royalty Owners Ass'n v. Economic Regulatory Administration*, 822 F.2d 1105, 1110-1111 (D.C. Cir. 1987).

[8] 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.

[9] 49 Fed. Reg. at 6,684-85.

[10] 49 Fed. Reg. at 6,687.

[11] *Id.*

notwithstanding DOE/FE's reference to this guidance in the *Sabine Pass* and *Phillips Alaska* proceedings. It would be nonsensical to assume that a foreign purchaser's willingness to pay for gas exported from the United States provides a presumptive indication that there was not a domestic need for that gas. Similarly, a foreign purchaser's willingness to pay for U.S. exports is independent of the environmental impacts that will result from producing that gas: because DOE/FE must consider the latter as part of its public interest analysis, DOE/FE cannot simply presume that the market will reflect the public interest.

Further, although DOE/FE has adopted a general 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). This requirement is implemented via a set of procedures that "insure [sic] 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 "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)). The Council on Environmental Quality (CEQ) directs agencies to "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. DOE has adopted CEQ's NEPA regulations in full. *Id.* § 1021.103. The NEPA rules apply to "any DOE action affecting the quality of the environment of the United States, its territories or possessions." *Id.* § 1021.102.

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). Whether or not FERC takes a lead role, however, DOE's ultimate NEPA obligations are the same: It 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 FERC prepares in its capacity as lead agency is inadequate to fully inform DOE/FE's decision or discharge DOE/FE's NEPA obligations, DOE/FE must prepare a separate EIS.

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 in more detail below, a full 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,

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 the proposed 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.

Finally, while an EIS is being prepared "DOE shall take no action concerning the 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. During this time, DOE may take no action which would tend to "limit the choice of reasonable alternatives," or "tend[] to determine subsequent development." 40 C.F.R. § 1506.1.

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 the CE FLNG project "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 CE FLNG's export proposal will increase gas production activities nationwide. Thus, DOE/FE must consider not just species impacts at the proposed project site (although it must at least do that),[12] but the effects of increased gas production across the full region the plant 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 CE FLNG's proposal. 16 U.S.C. § 1536(a), (b).

4. National Historic Preservation Act

DOE/FE must also fulfill its obligations under the National Historic Preservation Act (NHPA) to "take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." 16 U.S.C. § 470f; *see also Pit River Tribe v. U.S. Forest Serv.*, 469 F.3d 768, 787 (9th Cir. 2006) (discussing the requirements of the NHPA). Because "the preservation of this irreplaceable heritage is in the public interest," 16 U.S.C. § 470(b)(4), it behooves DOE/FE to proceed with caution.

[12] According to the Fish and Wildlife Service's ECOS database, Plaquemines Parish contains five endangered species (West Indian manatee, Hawksbill sea turtle, Leatherback sea turtle, Kemp's ridley sea turtle, and pallid sturgeon), four threatened species (piping plover, Gulf sturgeon, Louisiana black bear, and Green sea turtle), one candidate species (Sprague's pipit), and one species in recovery (Brown pelican). U.S. Fish & Wildlife Serv., Species by County Reports, Plaquemines Parish, http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action?fips=22075 (last visited Jan. 29, 2013), attached as Exhibit 3. The 100 miles of new pipeline CE FLNG intends to build to support its proposed facility will likely impact other species as well.

DOE/FE must, therefore, initiate the NHPA section 106 consultation and analysis process in order to "identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties." 36 C.F.R. § 800.1(a). NHPA regulations make clear that the scope of a proper analysis is defined by the project's area of potential effects, *see* 36 C.F.R. § 800.4, which in turn is defined as "the geographic area . . . within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties," 36 C.F.R. § 800.16(d). This area is "influenced by the scale and nature of an undertaking." *Id.* The area of potential effects should sweep quite broadly here because, as in the ESA and NEPA contexts, the reach of CE FLNG's proposal extends to the entire area in which it will increase gas production. Thus, to approve CE FLNG's proposal, DOE/FE must first understand and mitigate its impacts on any historic properties which it may affect. *See also* DOE Policy P.141.1 (May 2001) (providing that DOE will fully comply with the NHPA and many other cultural resources preservation statutes).

The regulations governing this process provide that "[c]ertain individuals and organizations with a demonstrated interest in the undertaking may participate as consulting parties" either "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties." 36 C.F.R. § 800.2(c)(5). Sierra Club meets that test, because the organization and its members are interested in preserving intact historic landscapes for their ecological and social value, and reside through the regions affected by the CE FLNG's proposal. Our members have worked for years to protect and preserve the rich human and natural fabric of these regions, and would be harmed by any damage to those resources. Sierra Club must therefore be given consulting party status under the NHPA for this application.

B. All Pending Export Applications, Pipelines, and Studies Must Be Incorporated Into DOE/FE's NEPA, NGA, and Other Analyses

As explained above, the NGA, NEPA, ESA and NHPA 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 application; DOE/FE must consider the broader constellation of indirect and cumulative effects. Here, to accurately analyze CE FLNG's application in context, DOE/FE's NEPA review must also take into account the other LNG export proposals pending before DOE/FE and FERC. Further, to ensure adequate consideration of the proposed project's impacts in conjunction with the impacts of other terminal proposals, DOE/FE must not act on CE FLNG's application until DOE/FE has fully evaluated comments on its recently released study on the economic impacts of exports and completed additional review necessary to address and respond to comments. In addition, the broader backdrop of related and similar projects, in turn, must inform the NEPA alternatives analysis. Finally, NEPA bars

DOE/FE from granting conditional authorization before it has discharged the NEPA, NGA, ESA, and other review obligations described above.[13]

1. DOE/FE Must Consider the Cumulative Effect of All Pending Export Proposals, and Should Do So Using a Programmatic EIS

CE FLNG's export proposal is only one of many before DOE/FE. Because the effects of these projects are cumulative, and because each approval alters the price and production effects of exports, DOE/FE must consider these projects' interactions. We note that in two similar proceedings EPA has requested consideration of this broader context. EPA, *Scoping Comments – The Jordan Cove Energy Project LP*, FERC Dkt. Nos. 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."),[14] EPA, *Scoping Comments – Cove Point Liquefaction Project*, FERC Dkt. No. 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.").[15]

DOE/FE can best conduct this analysis by preparing a programmatic EIS considering the impacts of *all* gas export proposals at once. DOE/FE has the discretion to prepare a programmatic EIS, even if it determines that it does not have the duty to do so. *See* 40 C.F.R. § 1508.18(b)(3); 10 C.F.R. § 1021.330. 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 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 should conduct an EIS that is adequate to inform this programmatic decision, rather than conducting piecemeal, application-by-application analysis.

[13] Similarly, Sierra Club protests any request for final, rather than conditional, authorization prior to completion of NEPA review.
[14] Attached as Exhibit 4.
[15] Attached as Exhibit 5.

2. DOE/FE Must Not Act Until It Has Thoroughly Reviewed Comments on its Recently Released Study of LNG Exports' Economic Impacts and Completed Necessary Additional Analysis

DOE/FE has commissioned two broad studies of exports' economic impacts. In the first, it requested that the Energy Information Administration ("EIA") analyze "the impacts of increased domestic natural gas demand, as exports."[16] The EIA Export Study predicts price increases from all gas export scenarios, economic impacts to residential and industrial users, and environmental harm as gas-fired electricity generators switch to coal power.[17] The study did not, however, consider the macroeconomic impacts of these effects.[18]

DOE also commissioned a second study considering the macroeconomic impacts of export, and has committed to withholding final authorization of any pending export application until review of these studies is complete.[19] The second study was recently released,[20] and the agency has received public comments and has committed to taking the comments into account in acting on pending applications.[21] Here, DOE/FE must honor this commitment to withhold authorization pending full review of the study and related comments. Indeed, to the extent DOE/FE relies on the study in completing the NEPA analysis that underpins the agency's decision to grant CE FLNG's application, DOE/FE is required to accept public comments on the study pursuant to ordinary NEPA principles. *See* 40 CFR § 1503.1.

Moreover, as explained in comments on the NERA study submitted by Sierra Club and its allies, DOE/FE is obligated to complete the additional analysis needed to fully

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[16] EIA, Effect of Increased Natural Gas Exports on Domestic Energy Markets 1 (2012) ("EIA Export Study"), attached as Exhibit 6.
[17] *Id.* at 6.
[18] *Id.* at 3.
[19] *See* Letter from Christopher Smith, DOE Deputy Assistant Secretary for Oil and Natural Gas, to Representative Edward J. Markey (February 24, 2012), *in* Democratic Staff, House Natural Resources Comm., *Drill Here, Sell There, Pay More: The Painful Price of Exporting Natural Gas*, App. 1 at 3-4 (2012) ("Drill Here, Sell There, Pay More"), attached as Exhibit 7.
[20] NERA Economic Consulting, Macroeconomic Impacts of LNG Exports from the United States (2012), *available at* http://www.fossil.energy.gov/programs/gasregulation/reports/nera_lng_report.pdf, attached as Exhibit 8.
[21] Energy Department Releases Study on Natural Gas Exports, Invites Public Comment, http://www.fe.doe.gov/programs/gasregulation/LNGStudy.html (last visited Dec. 5, 2012).

appreciate the environmental and economic consequences of export before granting CE FLNG's or any other export application. Among other things, DOE/FE must prepare a thorough description of 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.[22]

3. The Alternatives Analysis Must Consider This Broader Context

Both NEPA and the NGA require DOE/FE to fully consider alternatives to CE FLNG'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 CE FLNG'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 CE FLNG'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.

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[22] *See* Comments of Sierra Club et. al, Jan. 24, 2013, *available at* http://www.sierraclub.org/pressroom/downloads/NERA-Study-Comments-01-24-2013.pdf.

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 to condition 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 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.

4. A Full Environmental Impact Statement, Rather than an Environmental Assessment, Is Required Here

The proposed exports and terminal would have severe adverse environmental impacts, plainly surpassing the threshold of "significance" that mandates preparation of a full EIS. 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). As we have explained

elsewhere, LNG exports will induce additional gas production that, every year, will potentially emit massive amounts of air pollution and require millions of tons of fresh water.[23] 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 the quantity of liquefied natural gas imported or exported)" will "normally require [an] EIS." 10 C.F.R. Part 1021, Appendix D, D9. In addition, FERC's recent orders have consistently repeatedly determined that greenfield export facilities, such as the one CE FLNG proposes, require a full EIS.[24] In light of this precedent and the numerous impacts discussed below, an EIS is manifestly appropriate in this case.

5. DOE/FE Must Not Conditionally Approve CE FLNG's Proposal Prior to NEPA Review

DOE/FE must not conditionally approve CE FLNG's proposal before NEPA review of the proposal is completed. As we have discussed at length above, 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.

CE FLNG nonetheless argues that conditional authorization is appropriate, citing *Yukon Pacific Corp.*, ERA Dkt. No. 87-68-LNG (Nov. 16, 1989),[25] and *Rochester Gas & Elec. Corp.*, FE Dkt. No. 90-05-NG (May 16, 1991).[26] App. at 17 n.40. Neither decision supports CE FLNG's argument.

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[23] Sierra Club, *et al.*, comment on NERA Macroeconomic Study, *supra* n.22, at 32, 40.

[24] Notice of Intent To Prepare an Environmental Impact Statement for the Proposed Oregon LNG Export Project and Washington Expansion Project, 77 Fed. Reg. 59,603 (Sept. 28, 2012), Notice of Intent To Prepare an Environmental Impact Statement for the Planned Lake Charles Liquefaction Project, 77 Fed. Reg. 58,373 (Sept. 20, 2012), Notice of Intent To Prepare an Environmental Impact Statement for the Planned Jordan Cove Liquefaction and Pacific Connector Pipeline Projects, 77 Fed. Reg. 48,138 (Aug. 13, 2012), *but see* Notice of Intent To Prepare an Environmental Assessment for the Planned Corpus Christi LNG Terminal and Pipeline Project, 77 Fed. Reg. 34034 (June 8, 2012).

[25] The order is available at http://www.revenue.state.ak.us/gasline/ContractDocuments/Federal%20Agencies/DepartmentofEnergy/CDP_707224.pdf.

[26] The order is available at http://www.fossil.energy.gov/programs/gasregulation/authorizations/orders/ord503.pdf.

First, both decisions predate the adoption, in April 1992, of 10 C.F.R. § 1021.211, which bars DOE from taking any "action concerning [a] proposal" that is the subject of an EIS, 10 C.F.R. § 1021.211, if that action tends to "limit the choice of reasonable alternatives," or "determine subsequent development." 40 C.F.R. § 1506.1. In light of 10 C.F.R. § 1021.211, DOE cannot issue conditional authorizations for projects subject to an EIS, as CE FLNG's project should be, because conditional authorizations limit alternatives, and determine subsequent choices, in precisely the manner the regulations forbid.[27]

The NEPA analysis for the Sabine Pass export proposal, and the conditional approval that DOE/FE issued in that case, illustrate how conditional approval can constrain alternatives analysis. In *Sabine Pass*, DOE/FE expressed its "conditional" view that the project was in the public interest, conditioned on "the satisfactory completion of the environmental review process [by FERC] and on issuance by DOE/FE of a finding of no significant impact or a record of decision pursuant to NEPA." *Sabine Pass* at 41. DOE/FE's approval, even if nominally "conditional," plainly influenced the NEPA process. In the Sabine Pass EA, although FERC acknowledged that DOE/FE was making a broad public interest determination, FERC functionally treated DOE/FE's decision as already made. As such, in its alternatives analysis, FERC summarily rejected the "no-action" alternative because "the no-action alternative could not meet the purpose and need for the Project."[28] This statement reveals FERC's belief that DOE/FE had already made its decision, and thus that the EA was not truly designed to assist DOE/FE in deciding *whether* to allow gas exports. An analysis premised on the understanding that the decision had *not* been made after the conditional approval would not have summarily ruled out the no-action alternative. The fact that FERC felt that it was not free to give the no-action alternative serious consideration indicates that conditional approvals in fact tend to limit alternatives and influence decisionmaking.

Moreover, setting aside their conflict with section 1021.211, both decisions CE FLNG cites are factually distinguishable from CE FLNG's request. *Rochester Gas and Electric Corporation* concerned an import proposal, and thus does not demonstrate that conditional authorization is appropriate for export projects that facilitate environmentally damaging gas production. The *Rochester Gas* order approved a request to import natural gas from Canada for transportation, via pipeline, through New York; DOE conditioned approval on FERC's satisfactory completion of its environmental assessment for the new pipeline facilities needed to transport the imported gas. *Rochester Gas & Elec. Corp.*at 6. The relatively limited scope of environmental review

[27] We recognize that § 1021.211 refers to cases in which *DOE* is preparing an EIS. Under any reasonable interpretation of the regulation, however, the regulation applies when the EIS is completed by another agency – here, FERC – and is subject to DOE's review and adoption.

[28] FERC, *Environmental Assessment for the Sabine Pass Liquefaction Project*, Dkt. No. CP11-72-000, at 3-1 (2011) ("Sabine Pass EA").

contemplated in *Rochester* reflects the relatively narrow set of environmental impacts generally associated with imports, which introduce natural gas to U.S. markets and thus do not cause the widespread impacts to land, water, and air that result from export-induced drilling. Thus although it may have been possible, at least prior to the passage of 10 C.F.R § 1021.211, for DOE/FE to make a preliminary public interest determination regarding *imports* without the information provided by NEPA review, DOE/FE cannot make even a preliminary determination whether export proposals, which may subject the public to massive environmental harms, are in the public interest without balancing exports' benefits against environmental and other costs.

Yukon Pacific Corporation is also factually distinguishable. The order in *Yukon Pacific* granted an export license for a proposal (never realized) to ship North Slope gas as LNG from liquefaction facilities in Valdez, Alaska. DOE's authorization was issued *after* DOE participated in the Bureau of Land Management's preparation of, and adopted, an FEIS that "examined the environmental effects of constructing and operating the [proposed] pipeline, liquefaction facility, marine terminal, and related project components." *Yukon Pacific Corp.* at 35. Moreover, DOE conducted its own independent review to supplement the FEIS. *Id.* at 36. Thus, although DOE conditioned its approval on the satisfactory completion of FERC's review process, *id.* at 37-38, it did not complete its review process before any environmental analysis was done. On the contrary, DOE appears to have relied on extensive existing environmental review in issuing the *Yukon Pacific* order.

In summary, applicable regulations, basic NEPA principles, and common sense require DOE/FE to fully weigh the project's environmental and economic consequences before authorizing CE FLNG's export proposal. To avoid placing premature and illegal restrictions on its decisionmaking, DOE/FE may not approve the CE FLNG export proposal, conditionally or not, until it has considered all alternatives to doing so through the NEPA and NGA processes.

C. CE FLNG's Proposal Will Have Numerous Harmful Environmental Effects and Is Contrary to The Public Interest

Although the full scope of the proposed facility's environmental impacts will be explored more fully during the environmental review process conducted by FERC, it is already apparent that the terminal is likely to harm the local environment. CE FLNG's proposed exports will also induce environmentally harmful gas production, increase prices domestic consumers and industry pay for natural gas, and increase domestic coal consumption, causing attendant harm to public health and the environment. CE FLNG's application does not address any of these economic and environmental costs. These environmental harms translate into economic damage. If pollution sickens people, or restricts their travel, economic productivity will suffer – as it will, more directly, if clean air and water and adequate waste disposal capacity are not available. Similarly, as

landscapes are industrialized, tourism, agricultural, forestry, hunting and angling, and other place-dependent industries will suffer. Thus, DOE/FE must both consider these environmental impacts and monetize them to weigh them against other economic harms in the public interest analysis. DOE/FE must also give little weight to CE FLNG's speculative claims of economic benefit.

We explain these deficiencies in the application below. In light of these costs and reduced benefits, if DOE/FE were to make a decision on the available record (rather than engaging in further study of these issues, as is warranted here), DOE/FE would have to conclude that these impacts outweigh any possible benefit of the project.

1. The Project Will Have Significant Adverse Impacts Not Discussed in CE FLNG's Application

CE FLNG's proposal will impose significant environmental costs. The environmental costs fall into three categories: direct effects of the terminal and associated infrastructure, indirect effects of the additional gas production the project will induce, and non-localized effects resulting from increased domestic gas prices and resulting increases in coal combustion. As we explain below, each of these categories of effects must be considered in DOE/FE's NEPA and NGA analyses, and each weighs against finding that the proposed project is consistent with the public interest. Together, the local, regional, and national environmental impacts plainly result in significant environmental effects which warrant preparation of an EIS. 42 U.S.C. § 4332(C).

a. Local Environmental Impacts

Although the full scope of the proposed project's local impacts is not yet known, it is already apparent that the proposed project is likely to cause various local environmental impacts. Construction and operation of the new facilities and enhancement of existing equipment will have significant impacts on air, water, landscapes, and wildlife. These impacts must be considered in both the NEPA analysis and in DOE/FE's public interest determination. The preliminary comments below merely identify a few impacts that are likely to occur based on experience with similar projects, although we recognize that the impacts associated with this project, which apparently will include floating liquefaction equipment, are likely to be different. Naturally, the project's full suite of impacts cannot be fully identified until additional information is presented in the NEPA process; the Sierra Club expects to provide fuller comments at that time.

i. Local Air Pollution

Construction and operation of the proposed terminal, pipeline, and other facilities will emit harmful carbon monoxide (CO), nitrogen oxides (NOx), volatile organic chemicals (VOC), greenhouse gases (GHGs), sulfur dioxides (SO_x), particulate matter (PM_{10} and $PM_{2.5}$), and hydrogen sulfide (H_2S) pollution. Below, we touch on some of the emissions

associated with operation of the project, although construction of the project will result in significant emissions in addition to those discussed below. All of these impacts must be explored in the NEPA process and weighed by DOE/FE in its public interest determination.

VOC and NO_x

Operation of LNG export terminals such as the proposed project causes significant emissions of volatile organic chemicals (VOCs) and NOx, emitted directly from project facilities, particularly liquefaction trains, and indirectly from tanker and other ship traffic and operations. For example, Oregon LNG, the proponent of a proposed terminal that would be located in Warrenton, Oregon, estimates that that facility would emit at least 736.1 tons per year (tpy) of NOx and 60.47 tpy of VOCs, excluding anticipated additional emissions from compression equipment.[29] The Sabine Pass LNG project, by contrast, has the potential to emit 2,670 tpy of NOx and 88 tpy of VOCs from the liquefaction component of the terminal.[30]

These emissions will harm the environment by increasing the formation of ground-level ozone. VOCs and NO_x 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.[31] Smog may also exacerbate existing respiratory illnesses, such as asthma and emphysema, or cause chest pain, coughing, throat irritation and congestion. Children,

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[29] FERC Dkt. No. PF12-18, Oregon LNG Resource Report ("RR") 9-16 to 9-19. Moreover, that facility would have also included installation of an additional 90,000 horsepower of compression, the emissions from which are not included in the above totals. *See* FERC Dkt. PF12-20 RR 1-1, 1-42 (Aug. 16, 2012). The documents submitted in connection with that project so far do not specify whether these compressors will be powered by electricity from the grid, natural gas, or some other power source. Because natural gas fired compressors have significant NOx and VOC emissions, total emissions resulting from the project could much higher than the above.

[30] FERC, *Environmental Assessment for the* Sabine Pass *Liquefaction Project*, Dkt. No. CP11-72-000,EA, *supra* n.28, at 2-56, t.2.7-7 (2011) ("Sabine Pass EA").

[31] 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 9; 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 10.

the elderly, and people with existing respiratory conditions are the most at risk from ozone pollution.[32] Significant ozone pollution also damages plants and ecosystems.[33]

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.[34]

CO

Operation of LNG export terminals such as the proposed project also causes emissions of CO; the Sabine Pass project has the potential to emit 4,759 tons per year of CO from liquefaction activities.[35] Even where more stringent pollution controls are proposed, as they are for the Oregon LNG project, anticipated direct emissions exceed 150 tpy of CO, with an additional 197.18 tpy of marine vessel emissions.[36]

CO can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues.[37] 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."[38]

GHGs

Operation of LNG export terminals such as the proposed project also results in emission of greenhouse gases. To again use the Oregon LNG terminal as an example, that facility – including the terminal, pipeline, and associated facilities – is estimated to directly emit over 2.6 million tpy of carbon dioxide equivalent in greenhouse gases (CO_2e), with an

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[32] *See* EPA, *Ground-Level Ozone, Health Effects*, *available at* http://www.epa.gov/glo/health.html attached as Exhibit 11. EPA, Nitrogen Dioxide, Health, available at http://www.epa.gov/air/nitrogenoxides/health.html, attached as Exhibit 12.

[33] O&G NSPS RIA, *supra* n.31, at 4-26.

[34] *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 13.

[35] Sabine Pass EA, *supra* n.28, at 2-56 t.2.7-7.

[36] Oregon LNG RR, *supra* n.29, at 9-16 to 9-18.

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

[38] *Id.*

additional 118,544.6 tpy emitted by marine vessel traffic.[39] The Sabine Pass proposal has the potential to emit 3.91 million tpy of CO_2e from liquefaction facilities.[40]

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."[41] 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.[42] 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.[43] Vulnerable populations—such as children, the elderly, and those with existing health problems—are the most at risk from these threats.

Sulfur Dioxide

Operation of LNG export terminals such as the proposed project also results in emission of sulfur dioxide. The Oregon LNG proposal, for example, would directly emit an estimated 72 tpy of SO_2, with an additional 80.88 tpy emitted by marine vessel traffic.[44]

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.[45] PM is discussed separately below.

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[39] Oregon LNG RR, *supra* n.29, at RR 9-16 to 9-19.
[40] Sabine Pass EA, *supra* n.28, at 2-57 t.2.7-8.
[41] Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 76 Fed. Reg. at 52,738, 52,791-22 (citing U.S. EPA, 2011 U.S. GREENHOUSE GAS INVENTORY REPORT EXECUTIVE SUMMARY (2011),)), attached as Exhibit 15.
[42] *Id.* at 66,532–33.
[43] EPA, *Climate Change, Health and Environmental Effects*, *available at* http://epa.gov/climatechange/effects/health.html, attached as Exhibit 16.
[44] Oregon LNG RR, *supra* n.29, at 9-16 to 9-19.
[45] EPA, Sulfur Dioxide, Health, *available at* http://www.epa.gov/air/sulfurdioxide/health.html, attached as Exhibit 17.

Particulate Matter/Fugitive Dust

Operation of LNG export terminals such as the proposed project also results in emission of particulate matter. For example, the proposed Oregon LNG terminal and compressor stations will directly emit an estimated 14.9 tpy of particulate matter, with an additional 51.2 tpy emitted by marine vessel traffic.[46]

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.[47]

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.[48] PM also reduces visibility,[49] and may damage important cultural resources.[50] 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.[51]

ii. Water Quality Impacts

The proposed project may impact water quality in numerous ways. Construction may require water withdrawals, and terminal operations could result in stormwater runoff and discharge and suspension or re-suspension of sediment as a result of dredging and ship transits. Stormwater from the terminal site could contain heavy metals, petroleum products and brake chemicals and compounds that are deleterious to fish and fish habitat. In addition, dredging, construction of in-water facilities, and ship transits all

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[46] Oregon LNG RR, *supra* n.29, at 9-16 to 9-19.

[47] *See* EPA, Particulate Matter, Health, *available at* http://www.epa.gov/pm/health.html, attached as Exhibit 18; 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.

[48] O&G NSPS RIA, *supra* n.31, at 4-19; EPA, Particulate Matter, Health

[49] EPA "Visibility – Basic Information" http://www.epa.gov/visibility/what.html, attached as Exhibit 19.

[50] *See* EPA, Particulate Matter, Health, *supra* n.47; West Tavaputs EIS, *supra* n.47, at 3-19; O&G NSPS RIA, *supra* n.31, at 4-24.

[51] UNEP Report at 6; IPCC (2007) at Section 2.4.4.3.

have the potential to suspend or re-suspend sediment in the affected waterbodies, adversely affecting water quality.

iii. Wildlife

The proposed project can be expected to impact wildlife and species habitat in numerous ways. As mentioned above, in Plaquemines Parish alone the Fish and Wildlife Service has identified five endangered species (West Indian manatee, Hawksbill sea turtle, Leatherback sea turtle, Kemp's ridley sea turtle, and pallid sturgeon), four threatened species (piping plover, Gulf sturgeon, Louisiana black bear, and Green sea turtle), one candidate species (Sprague's pipit), and one species in recovery (Brown pelican). The proposed terminal may impact these species, and the approximately 100-mile pipeline extension CE FLNG expects to build to support the proposed project may have additional impacts.

The Sierra Club intends to submit comments during the NEPA process that more fully explore species impacts in light of the project design. At this point, however, we note that increased ship traffic at the project site could harm manatees and other water-dependent species at the site. In addition, noise from construction and compressor operations may harass and displace species. Finally, water intake, which may be needed for numerous purposes, including ship operations, may disturb water-dependent species and risks fish entrainment.

b. Induced Gas Production

Further, and perhaps greater, environmental impacts will result from increased gas production induced by the development of the proposed project. The EIA; NERA, which recently reported to DOE/FE on the macroeconomic impacts of LNG exports; essentially every other LNG export applicant; and other informed commenters all agree that LNG exports will induce additional production in the United States.[52] The CE FLNG proposal is no exception; CE FLNG concedes that its proposal will induce production, and attempts to claim the alleged economic benefits of this induced production in arguing

[52] Although NERA certainly agrees that LNG exports will induce additional production if they occur, *see, e.g.*, NERA Report, *supra* n.20, at 35, one of NERA's core findings is that exports may *not* occur if baseline assumptions about U.S. reserves and global market dynamics hold true, *see id.* at 37. If this prediction proves true – that is, if economic conditions favoring export do not materialize – then, of course, all of the purported economic benefits of export touted by CE FLNG and described in the NERA study will prove illusory, although the adverse environmental impacts associated with construction of the terminal will nonetheless occur. If, on the other hand, exports do occur, they will plainly induce production, and the impacts of that additional production by be analyzed in NEPA by DOE/FE.

that its proposal is in the public interest. App. at 12 (alluding to "higher demand [for gas] due to LNG exports"); *id*. at 14 ("The proposed export of LNG would allow natural gas that might otherwise be shut-in to be sold into the global LNG market, spurring the development of new natural gas resources."); *id.* ("Exporting natural gas . . . provid[es] a much needed boost to local, regional, and national economies through resource development, an enhanced tax base, job creation and increased overall economic activity.").

Available tools 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 recently refused to consider induced production in the *Sabine Pass* proceeding, that order is based on factual and legal errors and should not be followed here.

i. CE FLNG's Proposal Will Induce Additional U.S. Gas Production

As CE FLNG itself concedes, its export proposal will increase U.S. gas production. App. at 12, 14. Although CE FLNG states that its "primary source of natural gas" will be offshore Gulf production rather than shale gas plays, App. at 6, the project will still increase demand for natural gas and will thus cause gas production to expand in response, even if CE FLNG does not physically obtain its supply from shale plays. The analysis commissioned by DOE/FE itself predicts that much of this new production will come from shale.

The Energy Information Administration, in its study of the effects of U.S. exports commissioned by DOE/FE, estimated that, overall, the majority of exported gas will come from increased production, primarily from shale gas.[53] Specifically, EIA predicts that "about 60 to 70 percent" of the volume of LNG exported would be supplied by increases in domestic production, with the remainder supplied via reductions in domestic consumption of current production. EIA also estimates that "about three quarters of this increased production is from shale sources."[54] DOE/FE is required to consider the impacts of this induced production in making a decision on CE FLNG's application.

EIA and DOE have precise tools enabling them to estimate how U.S. production will change in response to CE FLNG's proposed exports. These tools enable DOE/FE to predict, if necessary, how and when production will increase in individual gas plays. 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

[53] EIA Export Study, *supra* n.16, at 6, 11.
[54] *Id.* at 6.

a series of interlocking modules that represent different energy sectors on geographic levels.[55] Notably, the "Natural Gas Transmission and Distribution" module already models the relationship between U.S. and Canadian gas production, consumption, and trade, specifically projecting U.S. production, Canadian production, imports from Canada, etc.[56] 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.[57] 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.[58] 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.[59]

Similarly, the "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.[60] 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."[61] The module distinguishes coalbed methane, shale gas, and tight gas from other resources, allowing for specific predictions distinguishing unconventional gas supplies from conventional supplies.[62] The module further projects the number of wells drilled each year, and their likely production – which are important figures for estimating environmental impacts.[63] 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

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[55] Energy Information Administration ("EIA"), *The National Energy Modeling System: An Overview*, 1-2 (2009), attached as Exhibit 20, available at http://www.eia.gov/oiaf/aeo/overview/pdf/0581(2009).pdf.
[56] *Id.* at 59.
[57] EIA, *Model Documentation: Natural Gas Transmission and Distribution Module of the National Energy Modeling System*, 15-16 (2012), attached as Exhibit 21, *available at* http://www.eia.gov/FTPROOT/modeldoc/m062(2011).pdf.
[58] *See id.* at 22-32.
[59] *See id.* at 30-31.
[60] EIA, *Documentation of the Oil and Gas Supply Module*, 2-2 (2011), attached as Exhibit 22, *available at* http://www.eia.gov/FTPROOT/modeldoc/m063(2011).pdf.
[61] *Id.* at 2-3.
[62] *Id.* at 2-7.
[63] *See id.* at 2-25 to 2-26.

investment decision."[64] 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."[65]

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.

EIA is not alone in its ability to predict localized effects of LNG exports. In a study cited by CE FLNG and numerous other export terminal proponents, Deloitte Marketpoint describes a model that can, it claims, make localized predictions about production impacts.[66] According to Deloitte, its "North American Gas Model" and "World Gas Model" allow it to predict how gas production, infrastructure construction, and storage will respond to changing demand conditions, including those resulting from LNG export. According to Deloitte, the model connects to a database that contains "field size and depth distributions for every play," allowing the company to model dynamics between these plays and demand centers. "The end result," Deloitte maintains, "is that valuing storage investments, identifying maximally effectual storage field operation, positioning, optimizing cycle times, demand following modeling, pipeline sizing and location, and analyzing the impacts of LNG has become easier and generally more accurate."[67]

ii. 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, 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 –

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[64] *Id.* at 2-3.
[65] *Id.*
[66] Deloitte Marketpoint, *Made in America: The Economic Impact of LNG Exports from the United States* (2011) (hereinafter "*Deloitte Report*"), available at http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/Energy_us_er/us_er_MadeinAmerica_LNGPaper_122011.pdf and attached as Exhibit 23.
[67] Deloitte, *Natural Gas Models*, http://www.deloitte.com/view/en_US/us/Industries/power-utilities/deloitte-center-for-energy-solutions-power-utilities/marketpoint-home/marketpoint-data-models/b2964d1814549210VgnVCM200000bb42f00aRCRD.htm (last visited Dec. 20, 2012), attached as Exhibit 24.

which is part of the proffered justification for the proposed project, App. at 14 – is 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. For example, 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 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*. *Accord Mid States Coalition for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 548-550 (8th Cir. 2003).

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 was required to consider the environmental effects of upstream electricity generation induced by the new infrastructure, rejecting DOE's decision to exclude these upstream impacts from analysis.[68] *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 CE FLNG's proposal, regardless of DOE's regulatory authority over that production.

EPA has also argued, in scoping comments it submitted regarding two other LNG export proposals, that induced production should be included in NEPA review. In scoping comments for the Jordan Cove project, EPA opined that in light of the regulatory definition of indirect effects and the EIA Export Study's prediction of induced production, "it is appropriate to consider available information about the extent to which drilling activity might be stimulated by the construction of an LNG export facility on the west coast, and any potential environmental effects associated with that drilling

[68] 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.

expansion."[69] 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 should "thoroughly consider the indirect and cumulative *environmental* impacts" of export.[70]

Although DOE/FE recently "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 the *Sabine Pass* proceeding, that ruling contains factual and legal errors, and DOE/FE should therefore not follow *Sabine Pass* here.[71]

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)).[72] 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, if exports occur, an aggregate production increase is unarguably "reasonably foreseeable."

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

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[69] EPA Jordan Cove Scoping Comments, *supra* n.14, at 14.
[70] EPA Cove Point Scoping Comments, *supra* n.15, at 2-3.
[71] 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)).
[72] In this proceeding, FERC endorses this formulation of "reasonable foreseeability." FERC "Order Granting Section 3 Authorization" 139 FERC ¶ 61,039, FERC Docket CP11-72-001 ¶ 95(April 16, 2012) (hereinafter "FERC April Order").

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.

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 many 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 would 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).

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 CE FLNG'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.

iii. Environmental Harm Resulting from Induced Production

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. EIA 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.[73] 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. DOE, Secretary of Energy's Advisory Board, *Shale Gas Production Subcommittee Second 90-Day Report* (2011) at 10.[74] 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. Although some states and federal agencies are taking steps to limit these harms, these efforts are uncertain and, even if fully implemented, will not eliminate the environmental harms.

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

Below, we briefly describe some of the primary air pollution problems caused by the industry. These issues include direct emissions from production equipment and indirect emissions caused by natural gas replacing cleaner energy sources. EPA has moved to correct some of these problems with new air regulations finalized this year, but, as we later discuss, these standards do not fully address the problem. FERC must therefore consider the air pollution impacts of increased natural gas production even if EPA's rules are finalized.

Air Pollution Problems from Natural Gas

Oil and gas operations emit 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 $PM_{2.5}$). Oil and natural gas 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.[75] 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.

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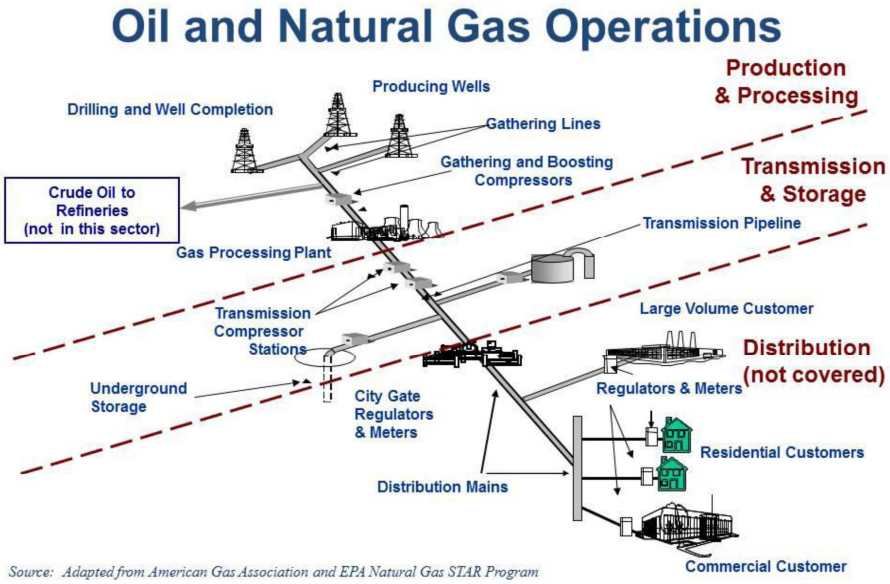
[73] EIA Export Study, *supra* n. 16, at 11.

[74] Attached as Exhibit 25. *See also* DOE, Shale Gas Production Subcommittee First 90-Day Report, attached as Exhibit 26.

[75] 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 ("TSD") at 2-4 (July 2011), attached as Exhibit 27.

Figure 1: The Oil and Natural Gas Sector



There is strong evidence that emissions from natural gas production are higher than have been commonly understood. In particular, a recent study by a consortium of researchers led by the National Ocean and Atmospheric Administration (NOAA) Earth System Research Laboratory recorded pollution concentrations near gas fields substantially greater than EPA estimates would have predicted. That study monitored air quality around oil and gas fields.[76] The researchers observed high levels of methane, propane, benzene, and other volatile organic compounds in the air around the fields. According to the study authors, their "analysis suggests that the emissions of the species we measured" – that is, the cancer-causing, smog-forming, and climate-disrupting pollutants released from these operations – "are most likely underestimated in current inventories," perhaps by as much as a factor of two.[77]

These emissions have dire practical consequences. A second research team, led by the Colorado School of Public Health, measured benzene and other pollutants released from unconventional well completions.[78] Elevated levels of these pollutants correspond to

[76] G. Petron *et al.*, *Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study*, 117 J. of Geophysical Research 4304, DOI 10.1029/2011JD016360 (2012), attached as Exhibit 28.
[77] *Id.* at 4304.
[78] 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 29.

increased cancer risks for people living within half of a mile from a well[79] – a very large population which will increase as drilling expands.

We discuss the harmful effects of many of these pollutants in part III.C.1.a, above. Below, we detail the sources of emissions within the gas production industry and provide further information regarding the serious global, regional, and local impacts these exploration and production emissions entail:

Methane: Methane is the dominant pollutant from the oil and gas sector. 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. EPA has identified natural gas systems as the "single largest contributor to United States anthropogenic methane emissions."[80] The industry is responsible for over 40% of total U.S. methane emissions.[81] Methane causes harm both because of its contributions to climate change and as an ozone precursor.

Methane is a potent greenhouse gas that contributes substantially to global climate change. Methane has at least 25 times the global warming potential of carbon dioxide over a 100 year time frame and at least 72 times the global warming potential of carbon dioxide over a 20-year time frame.[82] Because of methane's effects on climate, EPA has found that methane, along with five other well-mixed greenhouse gases, endangers public health and welfare within the meaning of the Clean Air Act.[83] The oil and gas production industry is a significant emitter of this dangerous pollutant; its methane emissions amount to 5% of all carbon dioxide equivalent (CO_2e) emissions in the country.[84]

Methane also reacts in the atmosphere to form ozone.[85] As we discuss elsewhere, ozone is a major public health threat, linked to a wide range of maladies. In addition to

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[79] *Id.* at 2.
[80] 76 Fed. Reg. 52,738, *supra* n.41, at 52,792.
[81] *Id.* at 52,791–92.
[82] *IPCC 2007—The Physical Science Basi*s, Section 2.10.2, and *IPCC 2007- Summary for Policymakers*, attached as Exhibit 30. We note that these global warming potential figures may be revised upward in the next IPCC report. A more recent study by Shindell *et al.* estimates methane's 100-year GWP at 33; this same source estimates methane's 20-year GWP at 105.
[83] EPA, Endangerment and Cause or Contribute Findings for Greenhouse Gases, 74 Fed. Reg. 66,496, 66,516 (Dec. 15, 2009) ("Endangerment Finding"), attached as Exhibit 31.
[84] 76 Fed. Reg. 52,738, *supra* n.8041, at 52,791–92.
[85] *Id.* at 52,791.

these public health harms, ozone can damage vegetation, agricultural productivity, and cultural resources. Ozone is also a greenhouse gas, meaning that methane is doubly damaging to climate – first in its own right, and then as an ozone precursor.

Volatile Organic Compounds (VOCs) and NO_x: The gas industry is also a major source of two other ozone precursors: VOCs and NO_x.[86] VOCs are emitted from well drilling and completions, compressors, pneumatic devices, storage tanks, processing plants, and as fugitives from production and transmission.[87] The primary sources of NO_x are compressor engines, turbines, and other engines used in drilling and hydraulic fracturing.[88] NO_x is also produced when gas is flared or used for heating.[89]

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.[90] 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.[91] 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.[92]

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[86] *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 32.

[87] *See, e.g.,* TSD, *supra* n.75, at 4-7, 5-6, 6-5, 7-9, 8-1; *see also* Barnett Shale Report, *supra* n.86, at 24.

[88] *See, e.g.*, TSD, *supra* n.75, at 3-6; Barnett Shale Report, *supra* n.86, 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 33.

[89] TSD, *supra* n.75, 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, attached as Exhibit 34.

[90] Texas Railroad Commission history of Barnett Shale, attached as Exhibit 35.

[91] Barnett Shale Report, *supra* n.86, at 1, 3.

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

Oil and gas development has also brought serious ozone pollution problems to rural areas, such as western Wyoming.[93] On March 12, 2009, the governor of Wyoming recommended that the state designate Wyoming's Upper Green River Basin as an ozone nonattainment area.[94] The Wyoming Department of Environmental Quality conducted an extended assessment of the ozone pollution problem and found that it was "primarily due to local emissions from oil and gas . . . development activities: drilling, production, storage, transport, and treating."[95] Last winter alone, the residents of Sublette County suffered thirteen days with ozone concentrations considered "unhealthy" under EPA's current air-quality index, including days when the ozone pollution levels exceeded the worst days of smog pollution in Los Angeles.[96] Residents have faced repeated warnings regarding elevated ozone levels and the resulting risks of going outside.[97]

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[93] 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 36.

[94] *See* Letter from Wyoming Governor Dave Freudenthal to Carol Rushin, Acting Regional Administrator, USEPA Region 8, (Mar. 12, 2009) ("Wyoming 8-Hour Ozone Designation Recommendations"), *available at* http://deq.state.wy.us/out/downloads/Rushin%20Ozone.pdf, attached as Exhibit 37; Wyoming Department of Environmental Quality, Technical Support Document I for Recommended 8-hour Ozone Designation of the Upper Green River Basin (March 26, 2009) ("Wyoming Nonattainment Analysis"), at vi-viii, 23-26, 94-05, *available at* http://deq.state.wy.us/out/downloads/Ozone%20TSD_final_rev%203-30-09_jl.pdf, attached as Exhibit 38.

[95] Wyoming Nonattainment Analysis, *supra* n.94, at viii.

[96] 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 39; *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 40.

[97] *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 41; 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 42.

Ozone problems are mounting in other Rocky Mountain states as well. Northeastern Utah recorded unprecedented ozone levels in the Uintah Basin in 2010 and 2011. In the first three months of 2010—which was the first time that winter ozone was monitored in the region—air quality monitors measured more than 68 exceedances of the federal health standard. On three of these days, the levels were almost twice the federal standard.[98] Between January and March 2011, there were 24 days where the National Ambient Air Quality Standard (NAAQS) for ozone were exceeded in the area. Again, ozone pollution levels climbed to nearly twice the federal standard.[99] The Bureau of Land Management (BLM) has identified the multitude of oil and gas wells in the region as the primary cause of the ozone pollution.[100]

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 Environment concluded that the smog-forming emissions from oil and gas operations exceed vehicle emissions for the entire state.[101] Moreover, significant additional drilling has occurred since 2008. Colorado is now home to more than 46,000 wells.[102] 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.[103] This pollution is taking a toll on residents of San Juan

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[98] Scott Streater, *Air Quality Concerns May Dictate Uintah Basin's Natural Gas Drilling Future*, N.Y. TIMES, Oct. 1, 2010, *available at* http://www.nytimes.com/gwire/2010/10/01/01greenwire-air-quality-concerns-may-dictate-uintah-basins-30342.html, attached as Exhibit 43.

[99] *See* EPA, AirExplorer, Query Concentrations (Ozone, Uintah County, 2011), available through the http://www.epa.gov/airexplorer/ website and attached as Exhibit 44.

[100] 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 45.

[101] 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 46.

[102] Colorado Oil & Gas Conservation Commission, *Colorado Weekly & Monthly Oil and Gas Statistics*, at 12 (Nov. 7, 2011), available at http://cogcc.state.co.us/ (library—statistics—weekly/monthly well activity), attached as Exhibit 47.

[103] *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 48.

County. The New Mexico Department of Public Health has documented increased emergency room visits associated with high ozone levels in the County.[104]

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[105] – 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.[106] These areas are all near concentrated oil and gas development in the San Juan Basin.[107]

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.[108]

Sulfur dioxide: Oil and gas production also emits sulfur dioxide, primarily from natural gas processing plants.[109] Sulfur dioxide is released as part of the sweetening process, which removes hydrogen sulfide from the gas.[110] Sulfur dioxide is also created when gas containing hydrogen sulfide (discussed below) is combusted in boilers or heaters.[111]

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[104] 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 49.

[105] *See* 42 U.S.C. § 7472(a).

[106] 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 50.

[107] *Id.* at 1112.

[108] *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 51.

[109] 76 Fed. Reg., *supra* n.80, at 52,756.

[110] TSD, *supra* n.75, at 3-3 to 3-5.

[111] 76 Fed. Reg. , *supra* n.80, at 52,756.

Hydrogen sulfide: Some natural gas contains hydrogen sulfide. Gas containing hydrogen sulfide above a specific threshold is classified as "sour gas."[112] According to EPA, there are 14 major areas in the U.S., found in 20 different states, where natural gas tends to be sour.[113] All told, between 15 and 20% of the natural gas in the U.S. may contain hydrogen sulfide.[114]

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."[115] Hydrogen sulfide may be emitted during all stages of development, including exploration, extraction, treatment and storage, transportation, and refining.[116] For example, hydrogen sulfide is emitted as a result of leaks from processing systems and from wellheads in sour gas fields.[117]

Hydrogen sulfide emissions from the oil and gas industry are concerning because this pollutant may be harmful even at low concentrations.[118] 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, and headaches.[119] Although hydrogen sulfide was originally included in the Clean Air Act's list of hazardous air pollutants, it was removed with industry support.[120]

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[112] *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.*

[113] 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 52.

[114] 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 53.

[115] EPA Hydrogen Sulfide Report, *supra* n. 113, at III-35.

[116] *Id.* at ii.

[117] TSD, *supra* n.75, at 2-3.

[118] *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 54.

[119] EPA Hydrogen Sulfide Report, *supra* n. 110, at ii.

[120] *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.

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.[121] 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.[122] 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.[123]

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.[124] 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 $PM_{2.5}$.[125]

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.[126] These elevated levels of $PM_{2.5}$ have been linked to oil and gas activities in the Uinta Basin.[127] Modeling also shows that road traffic associated with energy development is pushing PM_{10} levels very close to violating NAAQS standards.[128]

EPA's Air Rules Will Not Fully Address These Air Pollution Problems

Although EPA's recently finalized new source performance standards and standards for hazardous air pollutants[129] do reduce some of these pollution problems, they will not

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[121] EPA Hydrogen Sulfide Report, *supra* n. 113, at III-35.
[122] See Global Community Monitor, *Gassed! Citizen Investigation of Toxic Air Pollution from Natural Gas Development*, at 11-14 (2011), attached as Exhibit 55.
[123] *Id.* at 21.
[124] *See* BLM, GASCO Energy Inc. Uinta Basin Natural Gas Development Project Draft Environmental Impact Statement, at App. J at 2 (Oct. 2010) ("GASCO DEIS").
[125] O&G NSPS RIA, *supra* n.31, at 4-18.
[126] GASCO DEIS, *supra* n.124, at 3-12.
[127] West Tavaputs FEIS, *supra* n.47, at 3-20.
[128] *See* GASCO DEIS, *supra* n.124, at 4-27.
[129] *See* EPA, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants, 77 Fed. Reg. 49,490 (Aug. 16, 2012), *available at* http://www.gpo.gov/fdsys/pkg/FR-2012-08-16/pdf/2012-16806.pdfl.

solve them. The rules, first, do not even address some pollutants, including NO_x, methane, and hydrogen sulfide, so any reductions of these pollutants occur only as co-benefits of the VOC reductions that the rules require.[130] Second, the rules do not control emissions from most transmission infrastructure.[131] Third, existing sources of air pollution are not controlled for any pollutant, meaning that increased use of existing infrastructure will produce emissions uncontrolled by the rules. Fourth, without full enforcement, the rules will not reduce emissions completely. Fifth, the rules will not address important emissions effects of LNG in particular, including LNG exports' tendency to increase the use of coal power. Thus, though DOE/FE might work with EPA to fully understand the emissions levels likely after the rules are fully implemented, it may not rely upon the EPA rules to avoid weighing and disclosing these impacts.

Emissions from CE FLNG's Exports Alone Will Be Significant

As we have discussed, CE FLNG proposes to export about 1.07 Bcf/d, or 390.55 Bcf/year, of natural gas, and about 60 to 70 percent of this natural gas will come from new production.

EPA conversion factors allow us to estimate the emissions impacts of this new production. EPA's current greenhouse gas inventory implies that about 2.4% of gross gas production leaks to the atmosphere in one way or another.[132] More recent work by National Oceanic and Atmospheric Administration ("NOAA") scientists based on direct measurement at gas fields, again suggests that this leak rate may be actually between 4.8% and 9%, at least in some fields.[133] These leak rates, and EPA conversion factors between the typical volumes of methane, VOC, and HAP in natural gas,[134] make it

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[130] *See id.* at 49,513-14.

[131] *See, e.g.*, *id.* at 49,523.

[132] 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 **56**.

[133] *See* Petron, *supra* n.76; Tollefson, *Methane leaks erode green credentials of natural gas*, Nature (2013).

[134] *See* 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 ("TSD") at t.4.2 (July 2011) ("2011 TSD"), attached as Exhibit **58**. 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.

possible to calculate the potential impact of increasing gas production in the way that LNG export would require.

The table below uses these conversion factors to generate a rough, preliminary calculation of the emissions associated with exporting 390.55 Bcf/year of gas. The table assumes, based on EIA estimates and estimates submitted by other export applicants,[135] that 63% of gas exported by CE FLNG will come from new production, and that CE FLNG's proposal will thus induce 246.05 Bcf/year of additional production. We calculate for a 1% leak rate (which is below the current value, but is included as a conservative case to reflect successful air pollution controls more extensive than those which EPA has promulgated), the current EPA estimated rate of 2.4%, and the higher leak rates the NOAA studies suggest, generating results for methane, VOC, and HAP. [136]

Table 1: Emissions Associated with Producing 246.05 Bcf/year of Natural Gas

Leak Rate	Methane (tpy)	VOC (tpy)	HAP (tpy)
1%	51,178	7,467	542
2.40%	122,828	17,921	1,302
4.80%	245,656	35,841	2,604
9%	460,606	67,202	4,882

Thus, CE FLNG alone would be responsible for tens 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. CE FLNG would thus greatly increase air pollution in the regions from which it draws its gas, imperiling public health and the global climate.

2. 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 and significantly affecting ecosystems, plants, and animals. These impacts are large and difficult to manage.

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[135] *See* Golden Pass DOE/FE Application, DOE/FE Dkt. No. 12-156-LNG, Deloitte Report at 15.

[136] 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.

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."[137] New York's Department of Environmental Conservation reached similar estimates.[138] After initial drilling is completed the well pad is partially restored, but 1 to 3 acres of the well pad will remain disturbed through the life of the wells, estimated to be 20 to 40 years.[139] 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.[140]

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."[141] "Research has shown measureable impacts often extend at least 330 feet (100 meters) into forest adjacent to an edge."[142]

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;

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[137] TNC, Pennsylvania Energy Impacts Assessment, Report 1: Marcellus Shale Natural Gas and Wind 10, 18 (2010), attached as Exhibit 57.
[138] 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.
[139] Id. at 6-13.
[140] *Id.* at 6-68.
[141] Pennsylvania Energy Impacts Assessment, *supra* n.137, at 10.
[142] NY RDSGEIS, *supra* n.138, at 6-75.

- 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;

- 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.[143]

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,[144] 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.[145]

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 harm endangered species in regions where production would increase in response to CE FLNG'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.

3. Gas Production Poses Risks to Ground and Surface Water

As noted above, most of the increased production that would result from CE FLNG's proposal will likely be from shale and other unconventional gas sources, and producing gas from these sources requires hydraulic fracturing, or fracking.[146] Hydraulic fracturing involves injecting a base fluid (typically water),[147] 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 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.

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[143] Pennsylvania Energy Impacts Assessment, *supra* n.137, at 29.
[144] *See id.*
[145] Penn. Dep't of Conservation and Natural Resources, Impacts of Leasing Additional State Forest for Natural Gas Development (2011), attached as Exhibit 59.
[146] *See* DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.74, at 8.
[147] 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.

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.[148] 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.[149] 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.[150] 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.[151] Even when flow reductions are not themselves problematic, the intake structures can harm aquatic organisms.[152] 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

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[148] TNC, Pennsylvania Energy Impacts Assessment, *supra* n.137, at 10, 18; *accord* NY RDSGEIS, *supra* n.138, 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 **60** ("Comment on NY RDSGEIS").

[149] 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 61; 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 62. 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.74, at 19.

[150] NY RDSGEIS, *supra* n.138, at 6-13; *accord* Nicot 2012, *supra* n.149, at 54.

[151] NY RDSGEIS, *supra* n.138, 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 63.

[152] NY RDSGEIS, *supra* n.138, at 6-4.

fracking process is (barring accident) deposited below freshwater aquifers and into sealed formations.[153] 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 occur through several methods, including where the well casing fails or where the fractures created through drilling intersect an existing, poorly sealed well. 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.[154] Chemicals are added as solvents, surfactants, friction reducers, gelling agents, bactericides, and for other purposes.[155] New York recently identified 322 unique ingredients used in fluid additives, recognizing that this constituted a partial list.[156] 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.[157] 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.[158] 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."[159]

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[153] *Id.* at 6-5; First 90-Day Report, *supra* n.74, at 19 ("[I]n some regions and localities there are significant concerns about consumptive water use for shale gas development.").
[154] NY RDSGEIS, *supra* n.138, at 5-40.
[155] *Id.* at 5-49.
[156] *Id.* at 5-41.
[157] *Id.* at 5-75 to 5-78.
[158] DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.74, at 25.
[159] 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 64.

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."[160] 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.[161]

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.[162] 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.[163]

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.[164] 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.[165]

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."[166] By tracking

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[160] Shale Gas Production Subcommittee First 90-Day Report, *supra* n.74, at 21; *see also* Comment on NY RDSGEIS, *supra* n.148, attachment 3, Report of Glen Miller, at 2.
[161] Comment on NY RDSGEIS, *supra* n.148, attachment 1, Report of Susan Harvey, at 92.
[162] DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.74, at 20.
[163] Comment on Diesel Guidance, *supra* n.159, at 5-9.
[164] Comment on NY RDSGEIS, *supra* n.148, attachment 3, Report of Tom Myers, at 12-15.
[165] Tom Myers, *Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers* (Apr. 17, 2012), attached as Exhibit 65.
[166] 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*

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.[167] Two other reports "have documented or suggested the movement of fracking fluid from the target formation to water wells linked to fracking in wells."[168] "Thyne (2008)[[169]] had found bromide in wells 100s of feet above the fracked zone. The EPA (1987)[[170]] 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."[171]

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."[172] 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.[173] At shallower levels, EPA detected "high concentrations of benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons."[174] EPA determined that surface pits previously used for storage of drilling wastes and produced/flowback waters were a

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fracturing, Proceedings of the National Academy of Science, 108, 8172-8176, (2011), attached as Exhibit 66).

[167] *Id.*

[168] Comment on NY RDSGEIS, *supra* n.148, attachment 3, Report of Tom Myers, at 13.

[169] 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.

[170] 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 67.

[171] Comment on NY RDSGEIS, *supra* n.148, attachment 3, Report of Tom Myers, at 13.

[172] 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 68. 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).

[173] *Id.* at xii.

[174] *Id.* at xi.

likely source of contamination for the shallower waters, and that fracturing likely explained the deeper contamination.[175] The U.S. Geological Survey, in cooperation with the Wyoming Department of Environmental Quality, also provided data regarding chemicals found in wells surrounding Pavillion.[176] 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.[177]

EPA also identified elevated levels of hazardous substances in home water supplies near Dimock, Pennsylvania.[178] 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.[179] Arsenic, barium, and manganese were present in five home wells "at levels that could present a health concern."[180] 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."[181] The PADEP information provided reason to believe that drilling activities in the area led to contamination of these water supplies. Drilling in the area

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

[176] 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 69.

[177] Tom Myers, *Assessment of Groundwater Sampling Results Completed by the U.S. Geological Survey* (Sept. 30, 2012), attached as Exhibit 70. Another independent expert, Rob Jackson of Duke University, has 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 71. *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 72.

[178] 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 73; EPA, *EPA Completes Drinking Water Sampling in Dimock, Pa.* (Jul. 25, 2012), attached as Exhibit 74.

[179] EPA Region III Action Memorandum, *supra* n.178 , at 1, 3-4.

[180] *EPA Completes Drinking Water Sampling in Dimock, Pa.*, *supra* n.178.

[181] EPA Region III Action Memorandum, *supra* n.178 , at 1.

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, [182] 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 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.[183] 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

[182] *EPA Completes Drinking Water Sampling in Dimock, Pa.*, *supra* n.178.
[183] *See, e.g.,* NY RDSGEIS, *supra* n.148, at 1-12.

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.[184]

Additionally, underground injection of fracking wastes appears to have induced earthquakes in several regions. For example, underground injection of fracking waste in Ohio has been correlated with earthquakes as high as 4.0 on the Richter scale.[185] 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."[186] 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."[187] 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.[188] In light of these effects, Ohio and Arkansas have placed moratoriums on injection in the affected areas.[189] The recently released abstract of a forthcoming United States Geological Survey study affirms the connection between disposal wells and earthquakes.[190]

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[184] *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 75.

[185] 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 76.

[186] *Id.*

[187] *Id.*

[188] *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 77.

[189] 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 78.

[190] 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 79.

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 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.[191]

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.[192]

[191] Comment on NY RDSGEIS, *supra* n.148, attachment 3, Report of Glen Miller, at 13.
[192] *Id.* at 4.

c. Other Nationwide and Global Impacts

i. Price Increases

Natural gas exports will increase domestic gas prices. There is a broad consensus on this issue, which CE FLNG does not dispute. CE FLNG does, however, make several arguments related to price that DOE/FE must reject. First, DOE/FE must use (and improve upon, and refine) the price impacts analysis prepared by its own consultants rather than the lower projections offered in the Deloitte Marketpoint study CE FLNG cites. Second, DOE/FE must reject Deloitte's reliance on outdated projections of U.S. gas demand, just as it must reject NERA's reliance on these figures. Third, DOE/FE must consider the cumulative price impacts of all pending export proposals, rejecting CE FLNG's suggestion that its exports be considered in isolation.

First, as a general matter, DOE/FE must reject the low price impact projections CE FLNG offers in favor of the higher price projections prepared by the consultants DOE/FE hired to analyze exports' impact. CE FLNG points to the Deloitte Marketpoint study, which projects a weighted-average price impact of $0.12/MMBtu on US prices from 2016 to 2025 as a result of a 6 bcf/d increase in exports, representing a 1.7% increase in the projected average US citygate price . . . [from] 2016 to 2035." App. at 12. By contrast, the NERA scenarios that modeled a 6 bcf/d increase generally projected higher impacts; NERA projects that, if phased in rapidly, a 6 bcf/d increase could cause a wellhead price impact of $0.27 to $0.33 by 2015, with additional increases from 2020 through 2035.[193] In its study of exports' price impacts, EIA predicted even greater price increases in scenarios modeling a 6 bcf/d increase; it predicted price increases between 5 and 30% in 2016, though these levels decline over time and depend on assumptions about the size of the U.S. resource base.[194]

Further, as explained by the Sierra Club and other commenters, even NERA's price projections are likely too low, for a variety of reasons.[195] DOE/FE must correct these deficiencies if it is to fully understand the price impacts of export, and in any event it must reject the much lower price impact figures that CE FLNG offers.

Second, DOE/FE must also avoid relying on a study – like Deloitte Marketpoint's – based on outdated projections of U.S. natural gas demand. Like the NERA study, the Deloitte report assumes "U.S. gas demand growth rates . . . consistent with the U.S. Energy Information Administration's (EIA) Annual Energy Outlook ("AEO") 2011 projection" to estimate gas demand for sectors other than for power generation, although it used its

[193] NERA Study, *supra* n. 20, at 51 fig.29.
[194] EIA Export Study, *supra* n. 16, at 9 fig. 4.
[195] Comments of Sierra Club et al., *supra* n.22.

own model (with higher demand estimates) for power generation predictions.[196] Use of the older AEO 2011 data for sectors other than power generation likely caused Deloitte to understate price impacts. As explained by the Sierra Club and others in comments on the NERA study, projections of domestic consumption of natural gas in a variety of sectors have risen considerably above previously predicted levels since AEO 2011. As Representative Markey pointed out in a letter to DOE, "[h]eavy industrial users – already consumers of 40 percent of total U.S. natural gas supplies – are making tens of billions of dollars of additional capital investments in energy-intensive manufacturing equipment that will create huge amounts of new natural gas demand."[197] Because it fails to account for such developments, the 2011 Deloitte Marketpoint study significantly underestimates domestic demand for gas. Using the more recent, higher predictions of demand would decrease the amount of natural gas available for export, thus increasing export-related price impacts.

Third, DOE must consider the cumulative effects of all pending proposals, rather than looking solely at the impact attributable to CE FLNG's proposed exports. App. at 12 ("extrapolating" from the Deloitte Marketpoint study that CE FLNG's exports will have a small price impacts). 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.[198] Because prices increase non-linearly with exports, effects of individual proposals cannot be considered in isolation. That is, going from 4 to 6 bcf/d in exports impacts domestic prices more than going from 0 to 2 bcf/d.[199] One reason for this is that

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[196] Deloitte Marketpoint, *supra* n.66, at 4.

[197] Letter from Rep. Markey to Sec. Chu, Dec. 14, 2012, *available at* http://democrats.naturalresources.house.gov/sites/democrats.naturalresources.house.gov/files/documents/2012-12-14_Chu_NERA.pdf, and included in the record in DOE's public comment process for the NERA study. In particular, the latest EIA projections indicate that industrial demand will grow by 47 percent more than previously predicted in AEO 2011. *Id.*

[198] Nonetheless, even if DOE/FE were to unlawfully look solely to effects attributable to CE FLNG, DOE/FE would have to conclude that these impacts were significant. CE FLNG, relying on a report from Navigant Consulting, concludes that its proposed 0.5 bcf/d of exports would increase hub prices by 11 cents per mmbtu in 2016, rising to 21 cents by 2035 (2.9% and 3.3% higher than Navigant's "baseline" scenarios, respectively). App. at appx. A p. 3. Similarly, NERA concluded that the price impacts of only 0.5 bcf/d (0.18 tcf/year) will adversely impact employment in manufacturing and energy intensive industries. NERA, *supra* n.20, at 38, 60-61. *See also* part III.C.2, below.

[199] 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 80.

domestic gas consumers differ in their ability to reduce gas consumption.[200] 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, even small price increases will lead price-sensitive domestic consumers to reduce their consumption, freeing gas supplies for exports and limiting price impacts.[201]

Given these dynamics, it is crucial that DOE/FE consider the impact of the full volume of proposed exports. Presently, proposals for 28.63 bcf/d of exports are pending before DOE/FE.[202] For perspective, note that this figure is over 34% of current domestic gas production.[203] The Deloitte Marketpoint study CE FLNG cites analyzes only a 6 bcf/d increase in exports – a small fraction of the pending proposals. App. at 12. The *EIA Export Study* also considers less than half of the total volume of proposed export, considering scenarios in which 6 or 12 bcf/d of gas are exported, with exports phased in either slowly or quickly.[204] Similarly, although the recent NERA report considered higher volumes of exports in certain limited scenarios,[205] this report did not consider the effect of the full volume of proposed exports, and as explained below, NERA's unwarranted assumptions about the cost of liquefying and transporting natural gas led it to understate the possibility of exports in low production scenarios. Adjusting these reports to account for the full volume of export proposals will significantly increase the predicted price impact.

Consideration of the full volume of proposed exports is not only the prudent means of fully evaluating the decisions before DOE/FE, but is also a required component of

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[200] *Id.* at 7.

[201] Estimates of exports' price impacts differ in their assumption of price sensitivity of domestic consumers. One study that estimates low price-sensitivity predicts significantly higher price increases than either Navigant or the EIA study. *Id.* at 5, 7.

[202] Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of January 11, 2013), available at http://fossil.energy.gov/programs/gasregulation/reports/summary_lng_applications.pdf and attached as Exhibit 81. This figure combines all pending applications, including FTA and nFTA applications.

[203] EIA, Monthly Natural Gas Gross Production Report (November 2, 2012), available at http://www.eia.gov/oil_gas/natural_gas/data_publications/eia914/eia914.html, attached as Exhibit 82. This report states that, for the month of August 2012, gross U.S. withdrawals (not limited to the lower 48) were 76.60 bcf/d. The highest monthly production in the past 12 months was 83.06 bcf/d in January 2012; the currently pending proposed exports amount to over 34% of this total.

[204] *EIA Export Study*, *supra* n.16, at 1.

[205] NERA report, *supra* n.20, at 40 ("no constraint" scenarios). Aside from considering different volumes of exports, NERA's predictions of price impacts are designed to track EIA's. *Id.* at 200.

DOE/FE's NEPA and public interest analyses. DOE/FE cannot authorize a proposed project on the assumption that the project will never be placed into operation. 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.

Although the NERA report concluded that only a portion of the proposed exports were likely to occur, several assumptions underlying the NERA report lead it to understate the likelihood of exports. For example, NERA assumes that only the optimal number of export terminals will be built, and incorporates the capital costs of these terminals into its predictions of the per-MMbtu price of providing liquefaction services.[206] Thus, NERA ignores the possibility that excess domestic liquefaction capacity will be built. NERA also ignores the alternative possibility that long-term contracts at export terminals will lock in exports regardless of subsequent domestic price increases. Under the "take or pay" liquefaction services arrangements that many LNG export terminals will likely adopt, would-be exporters will be required to pay a fee to reserve terminal capacity, regardless of whether that capacity is actually used to liquefy and export gas.[207] This arrangement may cause exporters to continue to export US gas even if prices increase, because the required liquefaction services charges will discourage them from switching to alternative energy sources. Similarly, NERA may overstate the transportation cost associated with export of US gas by assuming that all US gas will be exported from the Gulf Coast.[208] Exports from the Gulf Coast to Asia have high transportation costs, raising prices paid by the importer and thus disincentivizing exports. Several export terminals are proposed for the West Coast, however, and these terminals will have lower transportation costs to Asia. As such, completion of these terminals may lead to higher volumes of exports than NERA predicts.

In summary, to determine whether any one 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. Obviously, the most efficient way to consider this question is through programmatic studies, including a programmatic EIS as we recommend above and

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[206] NERA, *supra* n.20, at 57, 85.

[207] *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.

[208] NERA, *supra* n.20, at 88-89, 210.

similar to the reports DOE/FE has already commissioned from EIA and NERA. For the reasons explained above, however, the existing EIA and NERA studies fail to examine the full amount of proposed exports and the full potential of exports' price impacts. Before DOE/FE approves any of the pending flood of export proposals, DOE/FE must develop a clear picture of what the ultimate price impacts may be, and a justification as to why, if these price impacts will cause the harms described below, approval is nonetheless in the public interest.

ii. Changes in Domestic Power Production

CE FLNG's export proposal will further increase air pollution by increasing the amount of coal used for domestic electricity production. The EIA Export Study predicts that exports, by causing natural gas prices to rise, will drive more electricity generation to coal than to renewable energy. According to the EIA, the power sector will "primarily" respond to higher natural gas prices by shifting to coal-fired generation, and only secondarily to renewable sources.[209] Specifically, EIA predicts that 72 percent of the decrease in gas-fired electricity production will be replaced by coal-fired production, with increased liquid fuel consumption, increased renewable generation, and decreases in total consumption making up the remainder (8, 9, and 11 percent, respectively).[210]

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.[211] Thus, the EIA Export Study demonstrates that exports will harm the local environment by causing the opposite shift here.[212]

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[209] EIA Export Study, *supra* n.16, at 6; *see also id.* at 17 ("[H]igher natural gas prices lead electric generators to burn more coal and less natural gas.").

[210] *Id.* at 18.

[211] EPA, Air Emissions, http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html (last visited Dec. 12, 2012), attached as Exhibit 83.

[212] The macroeconomic study DOE/FE recently commissioned from NERA Economic Consulting did not examine shifts within the domestic power sector in detail. Moreover, although the NERA study found that exports prompted a lower change in demand for natural gas in the electricity sector than the change the EIA study predicted, the NERA study authors admitted that their model, unlike EIA's NEMS model, is ill suited to modeling changes in electricity sector demand for gas relative to other fuels. The NERA study states: "[T]he NERA results show much greater demand response in the industrial sector [than the EIA results] while at the same time much less demand response in the electricity sector. These differences appear to be consistent across all baseline cases. The main reason for the variations in the electricity sector comes from the different way that the sector is modeled. 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

Coal-fired plants also release roughly twice the carbon dioxide combustion emissions as gas-fired plants, although, as discussed in the following section, some of this combustion advantage is offset by the greenhouse gas emissions resulting from gas production. Accordingly, the price increase and corresponding shift to coal-fired power generation risks increasing greenhouse gas pollution. The *EIA Export Study* examined the effects of 6 or 12 bcf/d of exports, phased in slowly or quickly, together with various estimates for the extent of shale gas reserves and the pace of US economic development. EIA concluded that under every scenario exports would produce a significant increase in domestic greenhouse gas emissions, as illustrated by the table below.

Table 2: Cumulative CO_2 Emissions from 2015 to 2035 With Various Export Scenarios[213]

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.

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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.20, at 207 (appx. D, figs. 176-78 and accompanying text). Because the EIA model is better suited to predicting domestic power impacts, DOE/FE should accord greatest weight to the EIA results related to fuel-switching.

[213] From the *EIA Export Study*, *supra* n.16, at 19.

The fact that gas exports will tend to favor coal as a fuel for domestic electrical generation has particularly important implications for national emissions control efforts. EPA has just released proposed carbon pollution standards for electricity generating units which set emissions levels based upon the performance of natural gas combined-cycle plants.[214] EPA anticipates no notable compliance costs for the rule because it expects utilities to react to low gas prices, among other factors, by avoiding constructing expensive coal-fired plants.[215] If LNG exports move forward, however, gas prices will increase, making it more difficult and expensive to capture combustion-side carbon pollution reductions from fossil-fuel fired power plants. This interference with national efforts to control global warming, which endangers public health and welfare,[216] is not in the public interest.

iii. Effects on Global Greenhouse Gas Emissions

CE FLNG argues that LNG exports will benefit the environment by allowing importing countries to burn natural gas in place of coal, fuel oil, or other fuels with higher carbon intensities, and that LNG exports will thereby reduce global greenhouse gas emissions. App. at 16. This argument is wrong for two reasons.

First, looking at importing countries' response to exports, a recent study by the International Energy Agency 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.[217] In the United States alone, the IEA expects the gas boom to result in a 10% reduction in renewables relative to a baseline world without increased gas use and trade.[218] 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."[219]

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[214] Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 Fed. Reg. 22,392 (Apr. 13, 2012).
[215] *See id.* at 22,430.
[216] *See* Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).
[217] 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 84.
[218] *Id.* at 80.
[219] *Id.*

Another recent study, prepared by the Joint Institute for Strategic Energy Analysis (JISEA), modeled U.S. power sector futures resulting from increasing reliance on natural gas.[220] That study likewise found that, under baseline assumptions for future electricity demand and policy measures, increasing reliance on natural gas results in wind energy growing at a rate that represents "a significant reduction from deployment in recent years;" as a result, CO2 emissions "do not begin to transition to a trajectory that many scientists believe is necessary to avoid dangerous impacts from climate change."[221] These studies suggest that in many instances natural gas will replace cleaner fuels rather than dirtier ones.

Second, even where importing countries do substitute gas for coal or fuel oil, the available evidence indicates that this substitution is likely to cause little, if any, reduction in global greenhouse gas emissions. LNG production imposes significant environmental and energy costs beyond those associated with the production of non-liquefied gas. Liquefying natural gas is an energy intensive process. Additional energy is then consumed in the transportation of the gas, 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. These operations drastically increase the lifecycle greenhouse gas emissions of LNG, adding between 13.85 and 51.7 pounds of CO_2e per MMBtu.[222]

Emissions from liquefaction, transportation and gasification mean that the greenhouse gas emissions associated with LNG are significantly higher than those associated with domestic natural gas. For perspective, natural gas *combustion* emits roughly 120 pounds

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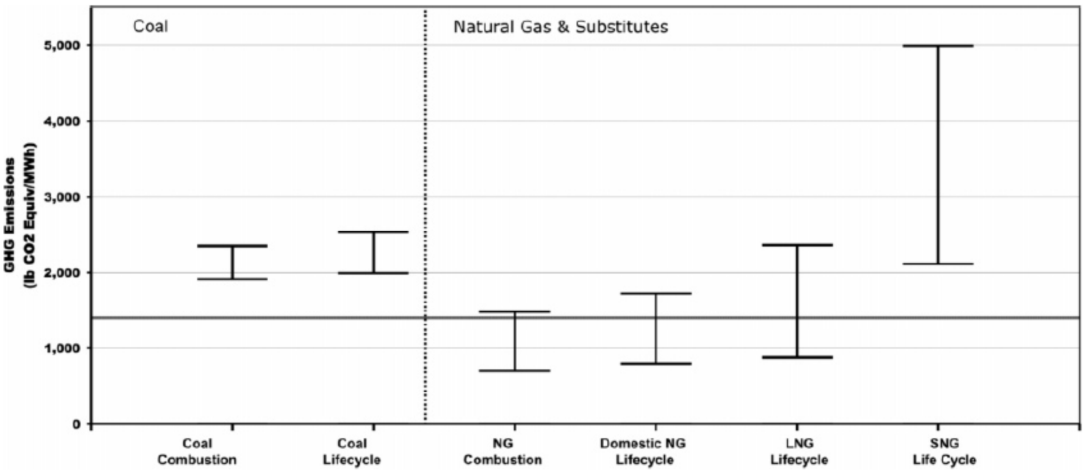
[220] Jeffrey Logan et al., Joint Inst. for Strategic Analysis, Natural Gas and the Transformation of the U.S. Energy Sector (2012), *available at* http://www.nrel.gov/docs/fy13osti/55538.pdf, attached as Exhibit 85.

[221] *Id.* at 98.

[222] 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 86. 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 87 ("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, and attached as Exhibit 88.

of CO_2e per MMBtu.[223] Using the above conservative figures, the process of liquefying, transporting, and regasifying LNG accordingly emits 19% to 23% of the CO_2e emitted by natural gas combustion itself—a substantial increase. Jaramillo 2007 concluded that this increase could bring LNG's lifecycle greenhouse gas emissions into parity with coal:

Figure 1: Life-Cycle Emissions of LNG, Natural Gas, and Coal in Electricity Generation[224]



Jaramillo's analysis also likely understates LNG's lifecycle greenhouse gas emissions, because it does not reflect recent studies that have raised estimates for emissions associated with natural gas production. The Jaramillo studies were conducted prior to the shale gas boom. Some studies have found shale gas production's methane emissions to be drastically higher than those of conventional gas production. Moreover, in April 2011 (well after the Jaramillo studies were published), EPA released improved methodologies for estimating fugitive methane emissions from all natural gas systems (unconventional and otherwise), which lead to higher estimates.[225]

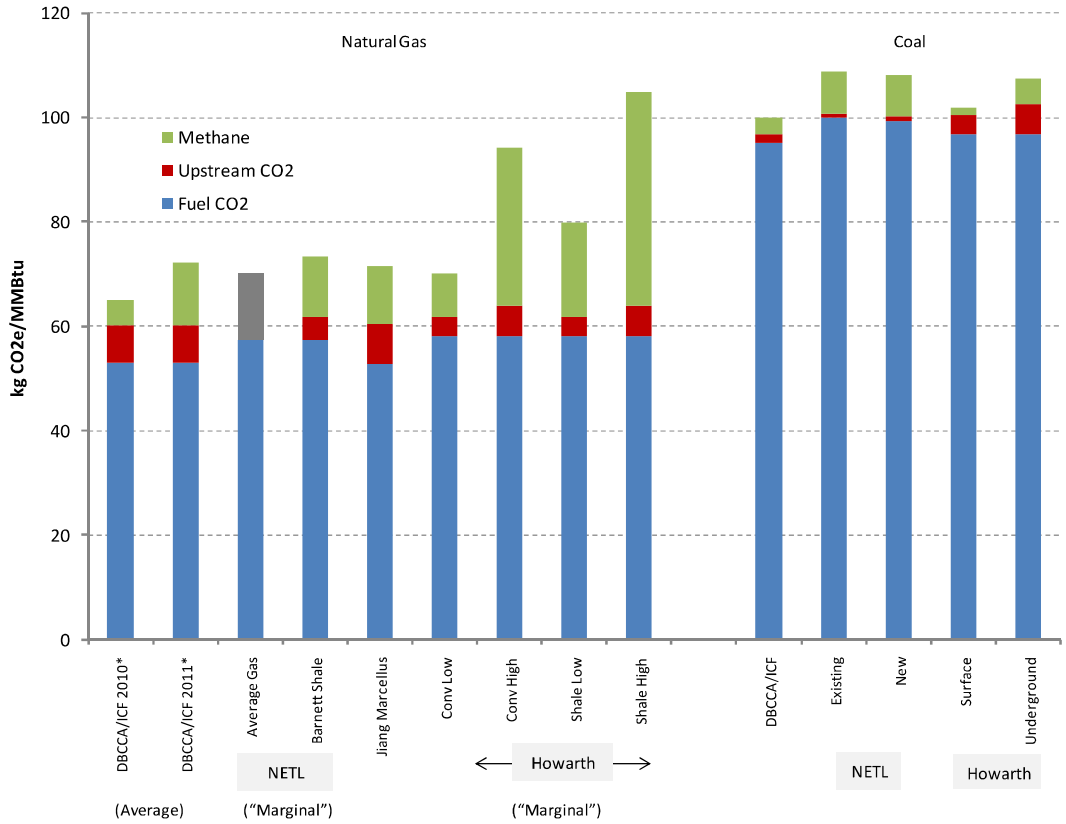
These recent studies estimate that aggregate domestic natural gas production releases at least 44 pounds of CO_2e per MMBtu. A report from the Worldwatch Institute and Deutsche Bank summarizes much of the recent work.[226] Specifically, the Worldwatch

[223] *See, e.g.*, Jaramillo Supporting Info, *supra* n.222, at 9.
[224] From Jaramillo 2007, *supra* n.222, at 6,295. "SNG," in the figure, refers to synthetic natural gas made from coal.
[225] EPA, *Inventory of U.S. Greenhouse Gas Emissions And Sinks: 1990 – 2009,* U.S. EPA, EPA 430-R-11-005, attached as Exhibit 89. The executive summary to this document is attached as Exhibit 90.
[226] Mark Fulton *et al.*, *Comparing Life-Cycle Greenhouse Gas Emissions from Natural Gas and Coal* (Aug. 25, 2011) ("Worldwatch Report"), attached as Exhibit 91.

Report synthesizes three other reports that used "bottom-up" methodologies to estimate natural gas production emissions, prepared by Dr. Robert Howarth et al., of Cornell,[227] Mohan Jiang et al. of Carnegie-Mellon,[228] and Timothy Skone of NETL.[229] The Worldwatch Report separately derived a "top-down" estimate, which produced a result similar to the NETL estimate.[230] These various assessments are summarized in the following chart.

[227] Robert W. Howarth *et al*., *Methane and the greenhouse-gas footprint of natural gas from shale formations*, Climactic Change (Mar. 2011), attached as Exhibit 92.
[228] Mohan Jiang *et al.*, *Life cycle greenhouse gas emissions of Marcellus shale gas*, Environ. Res. Letters 6 (Aug. 2011), attached as Exhibit 93.
[229] 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 94. NETL has also published a fuller version of this analysis. *See also* Timothy J. Skone, *Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production* (Oct. 24, 2011), attached as Exhibit 95.
[230] Worldwatch Report, *supra* n.226, at 9.

Figure 2: Comparison of Recent Life-Cycle Assessments[231]



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 normalized life-cycle GHG emissions from domestic natural gas production (i.e., excluding liquefaction, transport, and gasification of LNG) at approximately 20.1 kilograms, or over 44 pounds, of CO_2e/MMBtu,[232] although, as the above figure shows, some studies estimate that production emissions are significantly higher. The JISEA study generated a similar estimate of production greenhouse gas emissions: 78g CO2e/kWh, or approximately 23kg, of CO_2e/MMbtu.

Jaramillo used production emission estimates that are much lower than those produced by the more recent studies, and using the recent and higher figures appears to erode what little climate advantage Jaramillo found LNG to have over coal. Jaramillo used estimates of 15.3 to 20.1 pounds CO_2e/ MMBtu, *i.e.*, estimates that were at least 24

[231] *Id.* at 3.
[232] *Id.* at 15 Ex. 8.

pounds lower than the 2011 studies'.[233] Jamarillo estimated total life-cycle emissions for LNG at 149.6 to 192.3 lbs CO_2e/MMBtu.[234] Simply increasing these life-cycle estimates by 24 lbs CO_2e represents a 12% to 16% increase in total emissions. This increase substantially erodes any climate advantage LNG-fired electricity generation may have over coal-fired generation.

Finally, LNG exports will likely have life cycle emissions that are even higher than the above estimates. The studies synthesized in the Worldwatch report generally estimate gas production emissions in aggregate, mixing conventional gas extraction with unconventional sources such as shale gas. As noted above, the EIA Export Study predicts that extraction induced by exports will overwhelmingly be from shale gas sources,[235] and at least some sources have found that shale gas has higher production emissions than conventional sources.[236] 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.[237] Further, the possibility that unconventional production induced by exports could release substantial quantities of greenhouse gases highlights the need for a thorough study regarding the indirect and cumulative impacts of export prior to any DOE/FE authorization. Further study is similarly needed to combine the analysis of export on fuel switching domestically with

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[233] Jaramillo Supporting Information, *supra* n.222, at 8.

[234] *Id.*

[235] EIA Export Study, *supra* n.16, at 11.

[236] 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.220, 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.220, at 29 (citing Terri Shires & Miriam Lev-On, Characterizing Pivotal Sources of Methane Emissions from Unconventional Natural Gas Production 11-14 (2012), available at http://anga.us/media/press/CA5CDCEE-F69C-9B96-36DBAEC2E203BEDE/files/task%202%20api%20anga%20survey%20report%2019%20july%20final.pdf, attached as Exhibit 96).

[237] *See* O&G NSPS TSD at 4-7 (Table 4-2).

life-cycle emissions of LNG exports. In light of the evidence presented above, it is unlikely that LNG export will reduce global greenhouse gas emissions.

2. Exports' Price Increases Will Harm U.S. Workers and the US Economy

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. This will reduce effective household income and lead to job losses in gas-dependent industries. Although exports will create some jobs in gas production, CE FLNG makes no attempt to demonstrate that effect, and does not even mention jobs lost in other sectors as a result of price increases. Considering all of these effects, exports will merely transfer wealth from wage-earners and middle-class households to shareholders in gas production companies, a regressive redistribution of wealth contrary to the public interest.

The Sierra Club's extensive critique of the proposition that exports' economic benefits outweigh their costs are presented in our comments on the NERA Study.[238] Because DOE/FE already intends to place those comments into the administrative record for this proceeding,[239] we refer DOE/FE to our comments, and subsequent reply comments, for an extensive discussion of the many ways in which exports will harm U.S. workers and the economy.

3. DOE/FE Cannot Rationally Approve CE FLNG'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*

[238] *See* Sierra Club comments, *supra* n.22.

[239] *See* Dep't of Energy, Energy Department Releases Study on Natural Gas Exports, Invites Public Comment (last visited Jan. 30, 2013) ("The report and resulting comments will be taken into consideration as the Department makes its public interest determinations in each case. . . . All comments received need only be submitted once as they will be placed in the administrative record for . . . currently pending export application dockets.").

Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983) (emphasis supplied). DOE/FE cannot rationally find for CE FLNG on the record in this case.

As we have demonstrated, record support for CE FLNG's claimed benefits is extraordinarily thin. CE FLNG has not submitted modeling showing that exports will promote economic growth, and information available from other sources, including the NERA study, fails to demonstrate that the economy would improve *more* with export proposals such as CE FLNG's than it would without them.

Sierra Club, on the other hand, has shown, both here and in our comments on the NERA study, that the gas and electricity price increases associated with exports will add billions of dollars in costs to consumers. 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 CE FLNG 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).

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

If DOE/FE nonetheless approves CE FLNG's application, it must recognize its continuing duty to protect the public interest, as it explained in its *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.[240]

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 CE FLNG 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.

IV. Conclusion

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

Respectfully submitted,

Ellen Medlin
Sierra Club Environmental Law Program
85 2nd St., Second Floor
San Francisco, CA 94105

[240] Providing a clear monitoring plan of this sort will also benefit CE FLNG, 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.

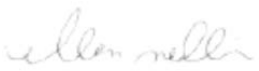
UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

IN THE MATTER OF	**)**	
	)	**FE DOCKET NO. 12-123-LNG**
CE FLNG, LLC	**)**	
	)	

CERTIFIED STATEMENT OF AUTHORIZED REPRESENTATIVE

Pursuant to C.F.R. § 590.103(b), I, Ellen Medlin, 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 4th day of February, 2013.



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UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

IN THE MATTER OF	**)**	
	)	**FE DOCKET NO. 12-123-LNG**
CE FLNG, LLC	**)**	
	)	

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 February 4, 2013.

Dated at San Francisco, CA, this 4th day of February, 2013.

_____

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UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

IN THE MATTER OF	)	
	)	**FE DOCKET NO. 12-123-LNG**
CE FLNG, LLC	)	
	)	

VERIFICATION

SAN FRANCISCO	§
	§
CALIFORNIA	§

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

Ellen Medlin
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Subscribed and sworn to before me this 4th day of February, 2013.

Notary Public

NICHOLAS JAMES LIFE
Commission # 1951418
Notary Public - California
San Francisco County
My Comm. Expires Sep 9, 2015

My commission expires: 09/09/2015