Comments Submitted by State Attorneys General of the States of Washington, Delaware, Oregon, Maine, Maryland, Michigan, Minnesota, New Jersey, New York, North Carolina, Rhode Island, Vermont, the Commonwealths of Massachusetts, Pennsylvania, and Virginia, and the District of Columbia on the Draft Environmental Impact Statement for the Coastal Plain Oil and Gas Leasing Program, 83 Fed. Reg. 67337 (Dec. 28, 2018)

TABLE OF CONTENTS

ATTORNEYS GENERAL OF THE STATES OF WASHINGTON, DELAWARE, OREGON, MAINE, MARYLAND, MICHIGAN, MINNESOTA, NEW JERSEY, NEW YORK, NORTH CAROLINA, RHODE ISLAND, VERMONT, THE COMMONWEALTHS OF MASSACHUSETTS, PENNSYLVANIA, AND VIRGINIA, AND THE DISTRICT OF COLUMBIA

March 13, 2019

By U.S. Mail, E-Mail, and Electronically
Attn: Coastal Plain Oil and Gas Leasing Program EIS
Ms. Nicole Hayes
Project Coordinator
BLM Alaska State Office
222 West 7th Avenue, #13
Anchorage, AK 99513
Mnhayes@blm.gov

Re: Draft Environmental Impact Statement for the Coastal Plain Oil and Gas Leasing Program, 83 Fed. Reg. 67337 (Dec. 28, 2018):
Comments Submitted by State Attorneys General

Dear Ms. Hayes:

The undersigned Attorneys General submit these comments on the Coastal Plain Oil and Gas Leasing Program Draft Environmental Impact Statement (DEIS) prepared by the Bureau of Land Management (BLM or the Agency). As discussed below, we have significant concerns about the DEIS's incomplete review of the far-reaching environmental and climate impacts of the first proposed oil and gas leasing program (proposed Leasing Program) on the Coastal Plain of the Arctic National Wildlife Refuge (Arctic Refuge)—a region long protected and valued across the nation for its unparalleled wildness and beauty.

Before conducting any oil and gas leasing in the Coastal Plain region, the National Environmental Policy Act (NEPA) mandates that the BLM must assess—"to the fullest extent possible"—the environmental impacts of the proposed Leasing Program.[1] BLM must also fully apprise the public of the environmental impacts associated with this proposed major federal action.[2] At the time of

[1] 42 U.S.C. § 4332.

[2] 40 C.F.R. § 1500.1; *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1185 (9th Cir. 2008) (The purpose of NEPA is twofold: "ensure[ ] that the agency ... will have available, and will carefully consider, detailed information concerning significant environmental impacts[, and] guarantee [ ] that the relevant information will be made available to the larger [public] audience.") (citations omitted).

NEPA's passage, Congress expressly provided that the purpose of the statute was to "promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation …."[3]

The DEIS fails to satisfy NEPA's requirements in multiple respects. BLM's statement of program purpose and need is insufficient, and the DEIS fails to consider and analyze a reasonable range of alternatives—an error resulting, in part, from BLM's misinterpretation of the Tax Cuts and Jobs Act of 2017 and its failure to account for the fact that the proposed Leasing Program is unlikely to yield the anticipated $1.1 billion in federal revenues to offset the lost revenue associated with passage of the Tax Cuts and Jobs Act, because Arctic Refuge oil reserves currently are uneconomic to produce and likely will remain so. In addition, BLM's analysis of direct, indirect, and cumulative greenhouse gas emissions is fatally flawed and the DEIS arbitrarily fails to quantify the proposed Lease Program's climate impacts using the social cost of carbon or another metric despite quantifying and evaluating program benefits. The DEIS further fails to adequately analyze the proposed Leasing Program's substantial and potentially grave impacts to multiple migratory bird species or to identify and address mitigation measures to minimize migratory bird harm and habitat loss.

The potential impacts on climate change and migratory birds of the proposed Leasing Program are of vital interest to the states represented by the undersigned Attorneys General. Although our comments are focused on these impacts, oil and gas exploration and development in the Coastal Plain would have many other lasting, far-reaching, and devastating environmental and social impacts that the DEIS fails to adequately analyze. Due to its harsh climate, environmental impacts in the Arctic Refuge tend to be long-lived. These include impacts to caribou and polar bears, which were listed in 2008 as threatened under the federal Endangered Species Act (ESA), in part due to habitat loss from climate change, and impacts to communities that rely on the Coastal Plain for subsistence.

By failing to account for the serious and irreparable environmental harms that would occur if the proposed Leasing Program advances, and by failing to consider an adequate range of alternatives that allow for the minimum disturbance of the Coastal Plain, BLM's actions contravene both the statutory requirements and purpose of NEPA.

I. INTRODUCTION AND SUMMARY OF COMMENTS

The Arctic Refuge is often referred to as "America's Serengeti" due to "[t]he presence of caribou, polar bears, grizzly bears, wolves, migratory birds, and other species in this wild area."[4]

---

[3] 42 U.S.C. § 4321.

[4] Laura B. Comay et al., Cong. Research Serv., RL33872, Arctic National Wildlife Refuge (ANWR): An Overview, at 4 (Jan. 9, 2018).

The Coastal Plain region, located on the northwestern edge of the Arctic Refuge—and the site of the proposed Leasing Program—"is the most biologically productive part of the Arctic Refuge for wildlife and is the center of wildlife activity"[5] due in large part to its "relative compactness of habitats" in the area.[6] The coastal plain and Arctic foothills of the Coastal Plain region provide habitat for "an unusually diverse assemblage of large animals and smaller, less appreciated life forms, tied to their physical environments and to each other by natural, undisturbed ecological and evolutionary processes."[7] Species that are particularly reliant on the Coastal Plain's unique ecosystem include caribou, polar bears, and migratory birds. Alaska Native communities have since time immemorial relied on many of these species, particularly caribou, for subsistence.[8] Because of its rich biodiversity and the importance of key species to indigenous communities, numerous campaigns to open the Coastal Plain to oil and gas exploration, drilling, and production have been defeated over the years.[9] In 2015, after careful consideration, the U.S. Fish and Wildlife Service recommended designating the Coastal Plain region for federal wilderness protections to further protect this critical area.[10]

The Arctic ecosystem, including the Coastal Plain, is in a state of rapid transition due to climate change. Annual average near-surface air temperatures across Alaska and the Arctic have increased over the last 50 years at a rate more than twice as fast as the global average temperature. Especially strong warming has occurred over Alaska's North Slope during autumn. Rising Alaskan permafrost temperatures are causing permafrost to thaw and become more discontinuous; this process releases additional carbon dioxide and methane, resulting in an amplifying feedback and additional warming. Accelerated melting of multiyear sea ice, increased boreal wildfires, reduction of terrestrial snow cover, and permafrost degradation are stark examples of the rapid Arctic-wide response to global warming. Atmospheric circulation patterns connect the climates of the Arctic and the contiguous United States.[11]

---

[5] *Id.* at 18 (quoting U.S. Dept. of the Interior, Fish and Wildlife Serv., Geological Survey, and Bureau of Land Mgmt., Arctic National Wildlife Refuge, Alaska, Coastal Plain Resource Assessment, Report and Recommendation to the Congress of the United States and Final Legislative Environmental Impact Statement, 1987 [commonly referred to as the 1002 Report]).

[6] U.S. Fish & Wildlife Serv., *Ecological Regions with a focus on the Coastal Plain and Foothills*, https://www.fws.gov/refuge/arctic/ecoregions.html (last visited Feb. 13, 2019).

[7] *Id*.

[8] DEIS at 3-159–60; U.S. Fish & Wildlife Serv., Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final EIS, at 4.4.1 (Jan. 2015).

[9] Comay et al., *supra* note 4, at 4–7.

[10] U.S. Fish & Wildlife Serv., Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final EIS, Record of Decision (Jan. 2015).

[11] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Volume I, at 470 (Wuebbles, D.J., et al. eds. 2017) (*see* Chapter 11: Arctic Changes and their Effects on Alaska and the Rest of the United States).

As Congress and others have recognized, the Coastal Plain also likely contains areas of oil and gas reserves. The proposed action would create a leasing program to open the Coastal Plain for the first time to oil and gas development. Such development will forever change the fragile ecosystem of the Coastal Plain and the vast Arctic Refuge wilderness of which it is a part and threatens to increase greenhouse gas emissions at a time when many states are taking bold action to fight climate change by significantly reducing greenhouse gas emissions.

Emissions of greenhouse gases, like carbon dioxide, are causing an increase in the Earth's global average surface and ocean temperatures. The pre-industrial concentration of carbon dioxide in the atmosphere was about 280 parts per million (ppm); it reached 340 ppm in 1980, and, in 2017, it reached 409 ppm, with a yearly global average of 405 ppm—the highest concentration reached in three million years.[12] In early 2019, the National Oceanic and Atmospheric Administration (NOAA) announced that the last five years have been the hottest in NOAA's 139-year climate record, with the ten warmest years occurring since 2005.[13]

The Intergovernmental Panel on Climate Change (IPCC) has concluded that the warming of the climate system is unequivocal[14] and that emissions of carbon dioxide from fossil fuel combustion and industrial processes contributed about 78 percent of the total greenhouse gas emissions increase from 1970 to 2010.[15] The largest source of U.S. anthropogenic greenhouse gas emissions is fossil fuel combustion.[16] In 2016, fossil fuel combustion accounted for 76 percent of U.S. greenhouse gas emissions, and in 2017, nearly half of U.S. energy-related carbon dioxide emissions (by far the dominant contributor to overall greenhouse gas emissions) came from combustion of petroleum products.[17]

In 2012, the International Energy Agency's World Energy Outlook for the first time announced that *no more than one-third of proven reserves of fossil fuels could be consumed prior to 2050* if the world aimed to achieve the goal of limiting warming to a safer level of 2 degrees Celsius (3.6 degrees Fahrenheit)—in other words, two thirds of the world's proven reserves, in addition to all

---

[12] Rebecca Lindsey, Nat'l Oceanic & Atmospheric Admin, "Climate Change: Atmospheric Carbon Dioxide" (Aug. 1, 2018), https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide.

[13] NOAA, "*2018 was 4th hottest year on record for the globe*" (Feb. 6, 2019), https://www.noaa.gov/news/2018-was-4th-hottest-year-on-record-for-globe (last visited Mar. 5, 2019) (2016 was the hottest year on record, followed by 2015, 2017, and 2018).

[14] IPCC, Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, at 4 (Stocker, T.F. et al. eds. 2013), https://archive.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf.

[15] IPCC *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, at 5 (R.K. Pachauri and L.A. Meyer eds. 2014), https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf.

[16] U.S. Energy Information Administration, *Energy and the Environment Explained*: *Where Greenhouse Gases Come From* (last updated: July 20, 2018), https://www.eia.gov/energyexplained/index.php?page=environment_where_ghg_come_from.

[17] *Id*.

known other reserves, such as those located in the Coastal Plain, *must remain unburned*.[18] In 2013, the IPCC issued its own carbon budget, which determined that, to secure a likelihood of meeting the 2 degree Celsius target, the world could emit no more than 1000 gigatons of carbon from anthropogenic sources, of which 515 gigatons had already been emitted by 2011, again underscoring the fact that substantial portions of known reserves cannot be burned if humanity is to avert catastrophic climate change.[19]

In October 2018, the IPCC issued an unprecedented report that concluded, with a high degree of scientific confidence, that if the current pace of emissions continues, warming will reach 1.5 degrees Celsius (2.7 degrees Fahrenheit) above pre-industrial levels between 2030 and 2052.[20] The IPCC stressed that warming above that level brings significantly increased risk for human health, food security, global economies, water supply, national security, sea level rise, biodiversity, species loss and extinction, and ocean health, among others.[21]

The IPCC warned that the world must reduce global carbon dioxide emissions dramatically well before 2030 if we are to maintain temperature increase below 1.5 degrees Celsius (2.7 degrees Fahrenheit), and that to have a 50 percent chance of meeting the 1.5 degrees target, the world can emit no more than 580 gigatons of carbon dioxide, significantly reducing the portion of known "burnable" fossil fuel reserves.[22]

On November 23, 2018, the thirteen federal agencies that comprise the U.S. Global Change Research Program (USGCRP) issued the Fourth National Climate Assessment (Assessment).[23] Pursuant to the Global Change Research Act of 1990, the USGCRP must deliver to Congress and the President, no less than every four years, a report that evaluates the impacts of climate change.[24] The Assessment was produced by over 300 federal and non-federal experts, reviewed by the thirteen federal USGCRP member agencies, and peer reviewed by the National Academies of Sciences, Engineering, and Medicine. The Assessment concluded that:

> [T]he impacts of climate change are already being felt in communities across the country. More frequent and intense extreme weather and climate-related events, as well as changes in

---

[18] International Energy Agency, *World Energy Outlook 2012 Executive Summary*, at 3 (2012), https://www.iea.org/publications/freepublications/publication/English.pdf.

[19] *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis*, supra note 14, at 27.

[20] IPCC, *Summary for Policy Makers, In: Global Warming of 1.5° C*, § A.1, at 6 (Oct. 2018), *available at*: https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/. For greater detail, *see also*, *id.*, Ch. 1, at 66, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter1_Low_Res.pdf.

[21] *Id.*, § B, at 9.

[22] *Id*. § C, at 14.

[23] U.S. Global Change Research Program, *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II,* (D.R. Reidmiller et al. eds., 2018), https://nca2018.globalchange.gov/ [hereinafter Assessment].

[24] 15 U.S.C. § 2936.

> average climate conditions, are expected to continue to damage infrastructure, ecosystems, and social systems that provide essential benefits to communities. Future climate change is expected to further disrupt many areas of life, exacerbating existing challenges to prosperity posed by aging and deteriorating infrastructure, stressed ecosystems, and economic inequality. Impacts within and across regions will not be distributed equally. People who are already vulnerable, including lower-income and other marginalized communities, have lower capacity to prepare for and cope with extreme weather and climate-related events and are expected to experience greater impacts.[25]

The Assessment also concluded that "annual losses in some economic sectors are projected to reach hundreds of billions of dollars by the end of the century—more than the current gross domestic product (GDP) of many U.S. states."[26] Given these dire predictions, the proposed Leasing Program and the greenhouse gas emissions it would produce if developed could have significant impacts on public health and the environment nationally and globally. Just this month, Alaska Senator Lisa Murkowski, chair of the Senate Energy and Natural Resources Committee, discussed climate change impacts on Alaska, noting that "[i]t's impacting subsistence. It's impacting food security. It's certainly impacting our economy with our fisheries," and encouraging the integration of "cleaner energy technologies," particularly in remote communities, to "decrease reliance on diesel and provide greater reliability."[27]

The effects of the proposed Leasing Program will be felt in other states. Oil from the Coastal Plain will likely be processed at Washington State refineries, harming air quality, public health, and safety. And, as discussed in more detail below, the proposed Leasing Program could have grave consequences for migratory birds that travel to other states on their journey to and from the Coastal Plain. These impacts, together with the unacceptable ramifications of the proposed Leasing Program for the global climate and the consequent climate harms, implicate significant state interests of Washington, Massachusetts, Delaware, Maryland, Maine, Michigan, Minnesota, New York, New Jersey, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, and the District of Columbia (collectively, States).

The DEIS, however, fails to satisfy BLM's obligation to take a hard look at the environmental consequences of the proposed Leasing Program.[28] As detailed in these comments, the DEIS does not adequately comply with NEPA's requirements for the purpose and need statement, the range

---

[25] Assessment *supra* note 23, Summary Findings, § 1, https://nca2018.globalchange.gov/.

[26] *Id*., Summary Findings, § 2.

[27] Dorothy Mills Gregg, *Murkowski warns climate change 'directly impacting' Alaska*, The Hill, Mar. 5, 2019, https://thehill.com/policy/energy-environment/432717-murkowski-warns-climate-change-directly-impacting-alaska.

[28] *WildEarth Guardians v. Mont. Snowmobile Ass'n*, 790 F.3d 920, 924 (9th Cir. 2015).

of alternatives considered, the evaluation of greenhouse gas emissions and climate change impacts, and the evaluation of impacts to migratory birds.

In particular, the DEIS contains the following deficiencies:

- The DEIS statement of program purpose and need fails to sufficiently address the fiscal purpose of the Tax Cuts and Jobs Act directive that BLM establish a natural gas and oil leasing program in the Coastal Plain—a program that is not needed to meet U.S. demand for oil and natural gas, not needed for U.S. energy independence, and that is very unlikely to meet the Act's objective of generating $1.1 billion in federal revenue to meaningfully offset federal tax revenue losses resulting from passage of the Act.

- BLM fails to consider and analyze a reasonable range of project alternatives or evaluate certain alternatives necessary to satisfy NEPA. Specifically, the DEIS fails to:
    - adequately consider the no action alternative, thus failing to provide Congress, BLM, and the public with sufficient information about the extent and severity of the environmental harm that would result from any oil or gas development;
    - consider an alternative offering the minimum, 800,000-acre lease sale area specified by Congress;
    - properly interpret and apply the 2,000-aacre surface development limit imposed by Congress;
    - consider an alternative that would minimize environmental impacts;
    - analyze the Leasing Program's revenue generation potential and evaluate its benefits—in light of the fact that Coastal Plain oil and gas reserves are currently uneconomic and are likely to remain so—against the program's substantial and long-lasting environmental harm; and
    - consider a delayed lease sale alternative until such time as Coastal Plain oil reserves may become economic to develop.

- BLM's evaluation of greenhouse gas emissions and associated climate change impacts does not satisfy NEPA's requirement to take a hard look at the indirect and cumulative impacts of the proposed Leasing Program because it:
    - fails to adequately analyze the proposed Leasing Program's greenhouse gas emissions and resulting climate impacts;
    - arbitrarily refuses to consider the social cost of carbon or another metric to quantify the climate costs of the proposed Leasing Program; and
    - does not adequately analyze the cumulative impacts on greenhouse gas emissions and associated climate impacts of the proposed Leasing Program.

- Similarly, BLM's evaluation of the proposed Leasing Program's impacts on migratory birds fails to adequately analyze and address:
    - the direct and indirect impacts of the proposed Leasing Program on migratory birds;

- the cumulative impacts of the proposed Leasing Program and other projects in the region on migratory birds; and
- potential mitigation and monitoring measures to reduce impacts of the proposed Leasing Program on migratory birds.

Although not discussed in detail in these comments, the States are also concerned that the DEIS's evaluation of other environmental and social impacts, including impacts on polar bears, caribou, and subsistence populations, is not sufficient.

If not corrected, the deficiencies manifest in the DEIS will prevent BLM from fully understanding the environmental consequences of the proposed Leasing Program and from making an informed decision in violation of NEPA, which could have negative long-term consequences for our States.

Given the weighty and long-term consequences of the proposed Leasing Program, the undersigned Attorneys General on behalf of their States and their residents, demand that BLM's evaluation of the environmental consequences and climate impacts associated with Arctic Refuge development be sufficiently robust, thorough, and public—as mandated by NEPA—before moving forward with the proposed Leasing Program.[29]

II. DETAILED COMMENTS ON THE COASTAL PLAIN LEASING PROGRAM DEIS

A. BLM Fails to Sufficiently State Program Purpose and Need.

An environmental impact statement must "briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action."[30] Although an agency has considerable discretion to define a project's purpose and need,[31] it is unreasonable for an agency "to narrow the objective of its action artificially and thereby circumvent the requirement that relevant alternatives be considered."[32] In giving a "hard look" to the factors relevant to the definition of purpose, the agency "should always consider the views of Congress, expressed, to the extent that the agency can determine them, in the agency's statutory authorization to act, as well as in other congressional directives."[33]

In defining the purpose and need for the proposed action, BLM fails to fully account for Congress's directive in creating the Leasing Program. BLM's purpose and need statement

---

[29] 40 C.F.R. § 1500.1 ("Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA"); *WildEarth Guardians v. Mont. Snowmobile Ass'n*, 790 F.3d 920, 924 (9th Cir. 2015) (discussing NEPA's purpose and procedural requirements).

[30] 40 C.F.R. § 1502.13

[31] *Westlands Water Dist. v. U.S. Dep't of Interior,* 376 F.3d 853, 866 (9th Cir. 2004).

[32] *City of New York v. U.S. Dep't of Transp.,* 715 F.2d 732, 743 (2d Cir. 1983).

[33] *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 196 (D.C. Cir. 1991) (citing *City of New York v. Dep't of Transp.,* 715 F.2d at 743-45).

merely notes that the Tax Cuts and Jobs Act[34] requires it "to establish and administer a competitive oil and gas program for the leasing, development, production, and transportation of oil and gas in and from the Coastal Plain."[35]

BLM's sparse statement is insufficient because it arbitrarily fails to address the revenue generation purpose of Congress's lease program directive. The Congressional Budget Office (CBO) report accompanying the legislative proposal enacted as the Tax Cuts and Jobs Act estimated—erroneously—that the anticipated gross proceeds from the proposed Leasing Program would generate $2.2 billion in revenue over ten years, with half of that amount directed to the State of Alaska and the other half to the federal government.[36] A critical aspect of Congress's purpose in establishing the Leasing Program, therefore, is to offset the tax revenue loss resulting from passage of the Tax Cuts and Jobs Act.[37] But BLM does not mention that purpose or otherwise make an effort to evaluate the extent to which any action alternative would generate the amount of revenue intended by Congress. BLM also fails to mention or address other Congressional directives in its management of public lands to ensure a careful balance between resource extraction and environmental protection.[38] Given the significant, irreparable environmental harms that will result from oil and gas development in the Coastal Plain, BLM should fairly evaluate, consider, and present to the public both the benefits and the harms of the planned action, including the likelihood that the Leasing Program will not yield the economic results desired by Congress.[39] Only with this information will BLM "have a meaningful opportunity to *weigh* the benefits of the project versus the detrimental effects on the environment."[40]

---

[34] Section 20001 of Public Law (PL) 115-97.

[35] DEIS at 1-1.

[36] *See* Congressional Budget Office (CBO), *A Legislative Proposal Related to the Arctic National Wildlife Refuge* (Nov. 8, 2017), at 2–3, https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=3454269F-6DC5-4E6C-9F23-99D1E3E64698.

[37] *See* 163 Cong. Rec. S7394-01, 2017 WL 5892551 (November 29, 2017) (Wyoming Senator Mike Enzi, Senate Budget Committee chair, commenting that: "[o]n November 15 [2017], . . . the [Senate Energy and Natural Resources] committee approved . . . legislation authorizing responsible development in the 1002 area [of ANWR] and meeting the $1 billion reconciliation deficit reduction target.") *See also* Congressional Budget Office Cost Estimate, *Reconciliation Recommendations of the Senate Committee on Energy and Natural Resources* (November 21, 2017), https://www.cbo.gov/system/files/115th-congress-2017-2018/costestimate/senrreconciliationrecommendations.pdf, (finding, "CBO estimates that gross proceeds from bonus bids paid for the right to develop leases in ANWR would total $2.2 billion over the 2018-2027 period . . . leaving net federal receipts totaling $1.1 billion over the 2018-2027 period."); 163 Cong. Rec. S8088-02, 2017 WL 6513857 (December 19, 2017).

[38] *See e.g.*, 43 U.S.C. 1701(8), (12) (FLPMA); 16 U.S.C. § 3142 (ANILCA); 30 U.S.C. § 21a (MLA).

[39] *See Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1185 (9th Cir. 2008) (describing NEPA's purpose of informed decision making).

[40] *Marsh v. Or. Nat'l Res. Council*, 490 U.S. 360, 372 (1989) (*quoting TVA v. Hill*, 437 U.S. 153, 188 n.34 (1978)) (emphasis in original).

As discussed in detail below, BLM's unreasonably narrow purpose and need statement—by virtue of its failure to consider the revenue generation purpose of the Leasing Program—improperly frames and limits the Agency's alternatives analysis.[41]

B. The DEIS Fails to Consider an Adequate Range of Alternatives.

The alternatives section "is the heart of the environmental impact statement."[42] Agencies must rigorously explore and objectively evaluate all reasonable program alternatives, including no action, and must discuss the reasons for eliminating any alternatives which were rejected for detailed study.[43] An EIS is evaluated based on its "reasonably identified and defined objectives," and "an alternative is properly excluded from consideration in an environmental impact statement *only* if it would be reasonable for the agency to conclude that the alternative does not bring about the ends of the federal action."[44] To be effective, the alternatives analysis "should present the environmental impacts of the proposal and the alternatives in comparative form" to "sharply defin[e] the issues and provid[e] a clear basis for choice among options by the decisionmaker and the public."[45]

The DEIS fails to meet these requirements by unreasonably limiting the range of alternatives and failing to evaluate certain alternatives necessary to satisfy NEPA. These are fundamental flaws, especially here given the character of what is at stake and potentially lost forever—a vast, pristine wilderness with a complex ecosystem that is highly dependent on the precise area likely to be impacted by BLM's actions. First, BLM fails to thoroughly consider the no action alternative to better inform Congress, BLM, and the public about the extent and irreversible nature or the Leasing Program's environmental consequences. Second, BLM fails to analyze an alternative offering for lease sale the minimum 800,000-acre area specified in the Tax Cuts and Jobs Act. Third, BLM applies a flawed interpretation of surface development that greatly expands the scope of allowed surface disturbance contrary to Congress's imposed limits. Fourth, BLM fails to consider an alternative that properly applies both the 800,000-acre lease area minimum and the 2,000-acre surface development limit, thus failing to provide an action alternative that would minimize environmental impact. Fifth, BLM unreasonably fails to meaningfully evaluate the proposed action alternatives' potential to meet the revenue generation

---

[41] *See Alaska Survival v. Surface Transp. Bd.*, 705 F.3d 1073, 1084 (9th Cir. 2013) (A "purpose and need statement will fail if it unreasonably narrows the agency's consideration of alternatives so that the outcome is preordained.") (internal citation omitted).

[42] 40 C.F.R. § 1502.14.

[43] 40 C.F.R. § 1502.14(a) and (d). *See also Border Power Plant Working Grp. v. Dep't of Energy*, 260 F. Supp. 2d 997, 1030 (S.D. Cal. 2003) (*quoting Idaho Conservation League v. Mumma,* 956 F.2d 1508, 1520 (9th Cir. 1992) (an "agency must look at every reasonable alternative, with the range dictated by the nature and scope of the proposed action").

[44] *Anglers Conservation Network v. Pritzker*, 139 F. Supp. 3d 102, 118–19 (D.D.C. 2015) (emphasis in original, internal quotations excluded).

[45] *Id.*

purpose intended by Congress and, by so doing, fails to provide full and informed consideration of both the Leasing Program's benefits and costs. Finally, BLM fails to consider a delayed lease alternative to pause lease sales until such time that the Coastal Plain gas and oil reserves may become economically viable to develop.

1. Given the Significant Environmental Consequences at Stake, BLM Should More Thoroughly Consider the No-Action Alternative.

Although the States recognize that Congress has directed BLM to develop a Coastal Plain Leasing Program, that directive does not relieve BLM of its obligation to fairly consider the no action alterative. NEPA requires "analysis of the no action alternative even if the agency is under a court order or legislative command to act,"[46] or an alternative is "not within the jurisdiction of the lead agency."[47] The Council on Environmental Quality (CEQ) recognizes that "[e]ven alternatives outside the scope of what Congress has approved must still be evaluated because the EIS may serve as the basis for modifying the Congressional approval or funding in light of NEPA's goals and policies."[48] Thus, the DEIS and the Final EIS on the Coastal Plain Leasing Program serve the important purpose of informing Congress as well as BLM and the public of the true environmental consequences of oil and gas development in the Coastal Plain.

As discussed in detail below, these environmental consequences are significant and largely, irreversible. Before taking action that will forever change the ecosystem of the Coastal Plain, significantly impact the communities and species that rely on this area, and potentially contribute to greenhouse gas emissions and climate impacts, BLM should thoroughly analyze and meaningfully consider the no-action alternative—carefully weighed against the consequences of action—in reaching its final decision on the Leasing Program. As CEQ has observed, "NEPA's purpose is not to generate paperwork—even excellent paperwork—but to foster excellent action … that protect[s], restore[s], and enhance[s] the environment."[49] The States ask BLM to adhere to this fundamental NEPA purpose as it considers alternatives and reaches its ultimate decision.

An approach that seeks to ensure that development does not come at unnecessary environmental costs is consistent with other Congressional mandates, including section 1002 of the Alaska National Interest Lands Conservation Act (ANILCA), which directed that any exploratory activity in the Coastal Plain proceed "in a manner that avoids significant adverse effects on the fish and wildlife and other resources" of the region.[50] Similarly, the Federal Land and Policy

---

[46] *See* CEQ, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, question 3.

[47] 40 C.F.R. § 1502.14(c).

[48] *See* CEQ, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, question 2b (citing 40 C.F.R § 1500.1(a)).

[49] 40 C.F.R. § 1500.1.

[50] 16 U.S.C. § 3142.

Management Act (FLPMA) seeks to balance the protection of the quality of the ecological and environmental value of public lands with the need for the development of minerals, including oil and gas.[51] BLM should carefully consider whether the proposed Leasing Program, particularly under the alternatives considered in the DEIS, is consistent not only with NEPA's requirements and the Tax Cuts and Jobs Act's directives, but also with ANILCA and the FLPMA's mandates.

2. BLM's Failure to Consider an Alternative That Would Lease the Minimum Acreage Specified by Congress Violates NEPA.

In addition to meaningfully considering the no action alternative, BLM must comprehensively analyze action alternatives that will minimize the environmental harm of the Leasing Program. In particular, BLM must consider an alternative that would make available for lease sale the minimum acreage directed by Congress, 800,000 acres.[52] The Tax Cuts and Jobs Act directs BLM to offer a minimum of 800,000 acres in two separate lease sales of 400,000 acres each, comprised of "those areas that have the highest potential for the discovery of hydrocarbons."[53] Without considering this minimum lease acreage action alternative, BLM could not rationally determine which action alternative would "properly balance oil and gas development with protection of surface resources."[54]

BLM ostensibly explains its refusal to consider the minimum lease acreage alternative, as specified by Congress, simply by noting that there are only approximately 427,900 acres of high hydrocarbon potential (HCP), and thus, "low and medium HCP areas must be made available, in addition to the high HCP areas, for the two lease sales to meet the 800,000-acre minimum under PL 115-97."[55] Inexplicably, BLM fails to explain why this requires development of *more* than the minimum acreage directed by Congress. Indeed, lack of sufficient high HCP acreage to meet the Congressional minimum cuts against more expansive development, and instead supports focused development of the minimum required acreage with the highest potential. Thus, BLM utterly fails to provide a reasonable explanation to justify its elimination of the minimum acreage alternative in violation of NEPA.[56]

BLM's explanation that alternatives D1 and D2 are "similar in concept" to the minimum alternative is also unreasonable when each of those alternatives would lease approximately 237,000 acres more than the minimum acreage alternative—an increase of more than 25 percent. BLM's elimination of the minimum acreage alternative thus resulted in detailed analysis only of alternatives with greatly expanded acreage, which necessarily include greater areas of medium

[51] 43 U.S.C. 1701(8), (12).

[52] *See* Section 20001(c)(1) of Public Law (PL) 115-97. *See also* DEIS at 2-39.

[53] Section 20001(c)(1)(B) of Public Law (PL) 115-97.

[54] DEIS at 1-2.

[55] DEIS at 2-39.

[56] *See* 40 C.F.R. § 1502.14(a).

and low potential. In this way, elimination of the minimum acreage alternative improperly narrows the range of considered alternatives by failing to consider the minimum acreage allowed by Congress. BLM should consider this reasonable alternative in detail.

3. BLM's Flawed and Unreasonable Statutory Interpretation Greatly Expands the Scope of Allowed Surface Area Development Contrary to the Limits Imposed by Congress.

For each of the alternatives considered in the DEIS, BLM errs by misinterpreting and misapplying the surface facility development limit Congress established for lease areas.[57] Under the Tax Cuts and Jobs Act, BLM may authorize *at most* "2,000 surface acres of Federal land on the Coastal Plain to be covered by production and support facilities (including airstrips and any area covered by gravel berms or piers for support of pipelines) during the term of the leases[.]"[58] Here, BLM misinterprets and misapplies this legal mandate in two fundamentally flawed ways. First, it applies the surface development at any given moment in time, as opposed to the cumulative total of facilities that may ever exist during the life of the Leasing Program.[59] Second, it arbitrarily interprets "surface development" to exclude many types of development associated with leasing. By fundamentally misinterpreting the surface area development limit, BLM effectively developed an unlawful range of action alternatives under NEPA, none of which comply with the limit imposed by Congress.

BLM fails to provide a reasonable basis for its interpretation that Congress intended the 2,000-acre development limit to apply to surface development at any given moment in time, and not the cumulative total of facilities over the life of the Leasing Program. In effect, BLM's interpretation renders Congress's 2,000-acre limitation meaningless because the cumulative effects of BLM's approach will lead to far more than 2,000 acres of surface disturbance over time. As the U.S. Fish and Wildlife Service has recognized, human disturbances cause long-term damage to the Arctic tundra.[60] Scientists studying the long-term effects of winter seismic trails in the Arctic Refuge concluded that "vehicle traffic over snow-covered tundra can cause long-term changes to plant communities and permafrost stability."[61] Notably, this study contradicted predictions that impacts from exploration "would be mainly aesthetic" and would not create long-lasting damage.[62]

---

[57] Section 20001(c)(3) of Public Law (PL) 115-97.

[58] *Id.*, Section 20001(c)(3).

[59] DEIS at 1-6.

[60] *See*, U.S. Fish and Wildlife Serv., Arctic Seismic Trails, https://www.fws.gov/refuge/arctic/seismic.html.

[61] Janet C. Jorgenson, Jay M. Ver Hoef, and M.T. Jorgenson, "Long-term recovery patterns of arctic tundra after winter seismic exploration" at 219-20 (2010). Publications, Agencies and Staff of the U.S. Department of Commerce. 187. https://digitalcommons.unl.edu/usdeptcommercepub/187.

[62] *Id*. at 219–20.

BLM also fails to provide a reasonable basis for interpreting "surface development" to exclude: (1) any surface disturbance "indirectly related to or resulting from" the facilities; (2) ice roads because of their "fleeting existence;" and (3) gravel mines that supply raw materials for construction of oil and gas facilities but are not themselves oil and gas facilities.[63] Each of these structures and disturbances are the direct or indirect result of surface development required by or relating to the oil and gas program, and thus, BLM unreasonably and without adequate explanation excludes them from the 2,000-acre surface development limit.

To the extent that BLM provides any explanation, it is insufficient or irrational. For example, BLM's contention that ice roads are fleeting is contradicted by FWS and the main scientific study on the impact of winter development in the Arctic Refuge recognizing the long-term impacts of winter activities, including past seismic studies, in the Refuge.[64] And BLM's explanation that gravel mines do not constitute surface development because they "supply raw materials for construction of oil and gas facilities" and are thus akin to "mills that supply steel for construction of pipelines and other facilities"[65] is utterly illogical when, unlike a steel mill, that likely already exists, the gravel mines will be developed *within* the Coastal Plain and thus contribute to the overall environmental damage resulting from the proposed action. Indeed, the DEIS acknowledges that gravel mines could cause longer term adverse effects on terrestrial mammals such as habitat loss; habitat alteration from dust, water displacement and hydrological alteration; and displacement from gravel mines due to noise and activity.[66] BLM cannot logically exclude such long-term disruption and damage from its surface development acreage calculations.

Because of its unreasonable and flawed interpretation, BLM unlawfully expands the allowed surface facility development and resultant environmental impact for *all* action alternatives considered in the EIS. BLM must revise its action alternatives and corresponding analysis to reflect an accurate and rationale reading of the 2,000-acre surface disturbance limitation.

4. The Final EIS Should Develop and Adopt a Preferred Alternative that Minimizes Environmental Impacts.

Any oil and gas development in the Coastal Plain would have devastating, long-lasting, and in most instances, irreversible environmental impacts, including the climate and migratory bird impacts discussed *infra* in Sections II C. and D. None of the action alternatives in the DEIS avoid or adequately mitigate these grave impacts, strongly counseling that BLM *adopt* the no action alternative.[67] If BLM instead establishes a lease program, it should limit lease sales to the

[63] DEIS at 1-6; App. B-9.

[64] *See*, U.S. Fish and Wildlife Serv., Arctic Seismic Trails, *supra* note 60, and Janet C. Jorgenson, et al., "Long-term recovery patterns of arctic tundra after winter seismic exploration," *supra* note 61, at 219.

[65] DEIS at B-9.

[66] DEIS at 3-111.

[67] *See* discussion *supra* in Section II B.1.

minimum 800,000 acres specified in the Tax Cuts and Jobs Act and limit cumulative surface area development to 2,000 acres, *including* total acreage of ice roads, gravel mines that supply raw materials for construction of oil and gas facilities, any other surface disturbance indirectly related to or resulting from facility construction and use, as Congress intended.[68] None of the action alternatives in the DEIS satisfy these limits and as a result, any action alternative in the final EIS must be substantially revised before it would be a viable alternative for selection in the record of decision. Development, consideration, and adoption of an alternative that minimizes lease area and surface development, that also includes a full range of lease stipulations, restrictions, and mitigation requirements necessary to minimize environmental impacts, is particularly important here because BLM's NEPA review demonstrates that extensive irreversible environmental harm would result from oil and gas production in the Coastal Plain.[69]

5. The Alternatives Evaluated by BLM Are Unlikely to Fulfill the Federal Revenue Generation Purpose Intended by Congress.

As discussed *supra* in Section II A., BLM's unreasonably narrow purpose and need statement forecloses evaluation of the potential for the alternatives considered in the DEIS to accomplish Congress's intended purpose: to generate revenue to offset tax revenue losses from the Tax Cuts and Jobs Act. A thorough analysis that accounts for projected market conditions, the high cost of development in the Coastal Plain, and the convergence of multiple factors that will likely depress U.S. oil demand and price demonstrates, as discussed below, that lease sales very likely will generate less revenue than projected, and that leased areas may never become economically viable and generate royalty payments.[70]

A complete and robust NEPA review demands that BLM analyze these factors. By not analyzing the limited revenue potential of the program, BLM fails to allow public scrutiny of the need and economic benefits of the proposed Leasing Program balanced against the grave, long-lasting, and irremediable environmental harm it would cause to the fragile Coastal Plain ecosystem.[71]

a. The Lease Program most likely would not yield revenues sufficient to meaningfully offset federal revenue losses as Congress intended.

---

[68] *Id*. at Sections II B.2 and 3.

[69] *See* DEIS at 3-94–3-103, 3-111, and discussion *infra* in Section II D.1 (noting direct and indirect harm to migratory birds). *See also* DEIS at 3-110–3-122 (discussing direct, indirect, and cumulative impacts on Caribou), 3-124–3-129 (discussing polar bear impacts).

[70] *See* Energyzt Advisors, LLC, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain,* ES-1–ES-4, 58–72 (March 2019), attached hereto as Addendum A.

[71] CEQ, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, question 2b (citing 40 C.F.R 1500.1(a)) (proper review must provide full and accurate information and analysis to allow the "public scrutiny of a proposed program essential to implementing NEPA").

Congress intended the proposed Leasing Program to generate revenue from lease sales, bonus bids, land rental payments, and royalties on extracted oil or gas, established at 16.67 percent by the Tax Cuts and Jobs Act.[72]

The Congressional Budget Office (CBO) estimate that the Leasing Program will generate total revenues of $2.2 billion, with $1.1 billion for federal deposit, is based largely on an U.S. Energy Information Administration (U.S. EIA) analysis of how Coastal Plain oil production would impact the energy outlook projections.[73] But the U.S. EIA acknowledges that its projections are "highly uncertain because of several factors that affect the timing and cost of development, little direct knowledge of the resource size and quality that exists in ANWR, and inherent uncertainty about market dynamics."[74] BLM fails to analyze or account for these uncertainties or how they affect the Leasing Program's revenue generation potential.

i. The volume of technically recoverable oil is far from certain and Arctic Refuge oil reserves are not economic to develop under current conditions.

Estimates of the total volume of recoverable oil reserves are based on a 20-year-old, 1998 U.S. Geological Survey (USGS) study that used limited information from two seismic surveys performed about 35 years ago. A 2016 analysis of this old data determined that the total quantity of technically recoverable oil within Coastal Plain ranged from 4.3 billion (b) barrels (5 percent probability), to 11.8b barrels (95 percent probability), with a mean probability of 7.7b barrels.[75]

The CBO estimate that the project would generate $1.1 billion in federal revenue ($2.2 billion total) assumed production of 7.7b barrels and royalty payments based on U.S. EIA analysis of how Coastal Plain oil production would impact the energy outlook projections. This analysis projected that oil prices will hover around $80 per barrel through 2025, and, at the high end, would rise to over $100 per barrel by 2030.[76]

---

[72] Cong. Research Serv., ANWR Overview, *supra* note 4, at 10. The Tax Cuts and Jobs Act directs 50 percent of revenues (including royalties, rents, and bonus bids) to the State of Alaska, with the remaining 50 percent deposited into the U.S. Treasury as miscellaneous receipts. *Id*.

[73] *See* CBO, *A Legislative Proposal Related to the Arctic National Wildlife Refuge, supra* note 36, at 2–3. *See also* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain, supra* note 70, at 11–13.

[74] U.S. EIA, ANNUAL ENERGY OUTLOOK 2019, WITH PROJECTIONS TO 2050, at 46 (Jan. 24, 2019), https://www.eia.gov/outlooks/aeo/pdf/aeo2019.pdf .

[75] USGS, ARCTIC NATIONAL WILDLIFE REFUGE, 1002 AREA, PETROLEUM ASSESSMENT, 1998, INCLUDING ECONOMIC ANALYSIS, FACT SHEET 0028–01: Online Report, https://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm (last updated Nov. 29, 2016). *See also* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain, supra* note 70, at 9–11.

[76] *See* CBO, *A Legislative Proposal Related to the Arctic National Wildlife Refuge, supra* note 36 at 2–3. *See also* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain, supra* note 70, at 11–13; U.S. EIA, ANNUAL ENERGY OUTLOOK 2018 (Feb. 6, 2018), https://www.eia.gov/outlooks/archive/aeo18/.

However, current oil prices and futures demonstrate flaws in CBO's assumptions. Oil and gas development in the Coastal Plain is particularly difficult and expensive because of its remote location, environmental conditions, and lack of existing pipelines, processing centers, and other infrastructure.[77] Indeed, Arctic Refuge oil is among the most expensive and uncertain of all undeveloped oil reserves and would be nearly the last resource to be developed.[78]

Recent analyses estimate that the price of oil must reach between $78 and $90 per barrel for drilling on the Coastal Plain to become economically viable.[79] But global oil prices for the past few years have ranged between $55 and $60 per barrel,[80] and crude oil futures are trading at $70 per barrel *or lower*—a far cry from the estimated $78 to $90 per barrel breakeven price needed to make Coastal Plain drilling projects viable.[81]

ii. Offering the Coastal Plain for lease would generate far less revenue than its intended purpose and the program's environmental harm would greatly outweigh any limited economic benefit.

Uncertainty about future oil prices and, thus, about the economic viability of Coastal Plain oil production would be reflected in the bonus bid and lease price bidders may be willing to pay.[82] The CBO in its $2.2 billion ($1.1 billion federal) revenue generation estimate acknowledges the uncertainty in its bonus bid and lease sale estimates, noting that "[p]otential bidders might make assumptions that are different from CBO's, including assumptions about long-term oil prices, production costs, the amount of oil and gas resources in ANWR, and alternative investment opportunities."[83]

Recent lease sales in the nearby National Petroleum Reserve in Alaska (NPRA)—where substantial deposit volumes of technically available oil have been confirmed—have ranged from roughly $5 to $18 per acre, with a weighted average of $8.81 per acre.[84] Based on recent NPRA

---

[77] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain, supra* note 70, at ES-2, 4–9. *See also* Cong. Research Serv., ANWR Overview, *supra* note 4, at 10.

[78] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain, supra* note 70, at ES-2.

[79] *See id*. at 17–19, 71.

[80] *Id.* at 17–19.

[81] *Id.* at 18–20. *See also* CME Group, OIL FUTURES QUOTES, https://www.cmegroup.com/trading/energy/crude-oil/brent-crude-oil.html (updated March 1, 2019).

[82] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 35–40, 63–64.

[83] *See* Congressional Budget Office, *Cost Estimate for Legislation to Provide for Reconciliation Pursuant to Title II of the Concurrent Resolution on the Budget for Fiscal Year 2018, As Ordered Reported to the Senate Committee on the Budget*, letter to the Honorable Mike Enzi, Chair, Senate Budget Committee (November 28, 2017) at 2–3, https://www.cbo.gov/system/files/115th-congress-2017-2018/costestimate/sbcreconciliation.pdf.

[84] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 66.

lease sale prices, analysts estimate that lease sales in the Coastal Plain would likely generate a total of anywhere from $37.5 million to $76 million.[85] But leases sale prices in the Coastal Plain would be lower than some high volume areas of the NPRA. Even with higher price expectations, Coastal Plain lease sale prices would most likely average roughly $25 to $30 per acre.[86] In this price range, successful leasing of the of the Coastal Plain would likely yield total lease revenues ranging from about $25 million for an auction offering the minimum or low-end lease sale acreage to $40 million at the high end of offered acreage.[87]

Beyond lease sale revenue, if oil prices fail to raise above the breakeven point over the next 20 years, as some current projections indicate, any Coastal Plain lease sale would not result in actual oil development and would thus provide no royalty payments to offset federal revenue losses from the Tax Cuts and Jobs Act.[88] Even if development does become economically viable with oil prices rising over $100 per barrel, as U.S. EIA's analysis assumes, potential royalty payments would not begin until 2031, and, together with lease sales and bonus bid revenue and rent payments, total revenue generation may still be well under the total intended $2.2 billion, with $1.1 billion for federal deposit.[89]

Given current and anticipated market conditions, potential revenues from Arctic Refuge oil are unlikely to generate the hoped-for federal revenue levels.[90] Indeed, even if BLM offered the entire program area for lease sale,[91] any resulting oil and gas development would not provide a meaningful benefit in light of the severe environmental consequences of developing the Coastal Plain.[92]

b. Any oil or gas developed from the Coastal Plain is not needed to meet U.S. demand

Oil use is undergoing a transformation tied to policy, economic, and technological developments. For the reasons discussed above, it is unlikely that the price of oil will rise to the estimated $78 -

---

[85] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 63–64, citing Matt Lee-Ashley, *The Energy Case Against Drilling in the Arctic National Wildlife Refuge,* Center for American Progress (Nov.13, 2017), https://www.americanprogress.org/issues/green/news/2017/11/13/442603/energy-case-drilling-arctic-national-wildlife-refuge/, and Jonathan Harsch, *GOP Dems Battle Over Drilling In Alaska Refuge,* Agri Pulse (Nov. 22, 2017), https://www.agri-pulse.com/articles/10261-gop-dems-battle-over-drilling-in-alaskan-refuge.

[86] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 66.

[87] *Id.*

[88] *Id*. at ES 1–4, 69–71.

[89] *Id*. at ES 1–4, 66–71.

[90] *Id*.; *See also* CBO Cost Estimate, *supra* note 37*,* at 3.

[91] *See* DEIS at 2-1–2-3, including description of Alternative B offering the entire program are for lease with the fewest restrictions.

[92] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at ES 1–4, 66–71.

$90 per barrel price necessary to make recovery viable.[93] Moreover, the cost of oil production in the Coastal Plain cannot compete with much cheaper North American shale oil production.[94] The U.S. is about to become a net exporter of oil and, given this net-exporter status, any oil developed in the Coastal Plain would most likely be exported.[95] Policy and technological developments are depressing U.S. demand for oil.[96] Because of the convergence of all these factors, any oil produced in the Coastal Plain is not needed to meet U.S. demand.[97]

i. North American shale is shifting global supply and the U.S. will soon be a net oil exporter.

The U.S. is now the leading global producer of petroleum products,[98] with oil production sharply increasing,[99] led by shale oil production.[100] The U.S. is projected to become a net exporter of crude oil by the fourth quarter of 2020 and remain so thorough 2050.[101] The volume of domestic oil production will approach the volume of consumption in the U.S. over the next five to ten years.[102] As a result, oil actually produced in the Coastal Plain, which would be far more expensive to produce than North American shale,[103] and would thus likely be exported.[104] Simply put, any oil produced from the Coastal Plain is not needed, either in the near- or long-terms, to meet U.S. demand or to respond to concerns about U.S. energy independence.[105]

---

[93] *Id*. at 17–19.

[94] *Id*. at 40–43, 47–49.

[95] *Id*. at 43–45.

[96] *Id*. at 49–63.

[97] *Id*. at ES 1–3, 47–48, 71.

[98] U.S. EIA, TOTAL PETROLEUM AND OTHER LIQUIDS PRODUCTION, 2017, https://www.eia.gov/beta/international/?view=consumption (updated Nov. 2018).

[99] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 40–43.

[100] *Id*. References to the cost and expansion of U.S. shale production are cited merely to illustrate one of many factors behind the fact that development of Coastal Plain oil is now and will likely remain economically unviable. Shale oil production results in a host of environmentally destructive impacts and these comments in no way endorse expanded shale production.

[101] *Id*. at 43–45. *See also* US EIA, SHORT-TERM ENERGY OUTLOOK (February 12, 2019), https://www.eia.gov/outlooks/steo/.

[102] *See* US EIA, Annual Energy Outlook 2019 (January 24, 2019), https://www.eia.gov/outlooks/aeo/. *See also* Energyzt*, Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain, supra* note 70, at 43–45.

[103] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 3, 47–49, 71.

[104] *Id.*

[105] *Id*. at ES 1–4, 47–49, 71.

ii. Policy and technology developments are depressing both U.S. and global oil demand.

Economics, technological advancements, and policies that incentivize greenhouse gas emissions reductions are driving a national transition to a clean energy future. Vehicle efficiency is increasing, materials technology is advancing, electric vehicles are gaining market share, and power needs are increasingly being met by low-carbon and renewable energy generation.[106] Global demand for oil is poised to peak and fall in the coming years.[107] The U.S. EIA projects that U.S. petroleum consumption will generally decrease through 2035, "mainly because of vehicle fuel efficiency gains."[108]

In particular, electrical vehicles (EV) have seen rapid, annual growth rates ranging from 30 to 60 percent in recent years as customer demand increases.[109] As the International Energy Agency states, "[n]ew registrations of electric hit a new record in 2016, with over 750 thousand sales worldwide."[110] The International Energy Agency projects that there is "a good chance that the electric car stock will range between 9 million and 20 million by 2020 and between 40 million and 70 million by 2025."[111] Annual EV sales are projected to exceed 100 million by 2035.[112]

The projected disruption of electric vehicles on oil demand is reflected in the trajectory of actual market announcements. Major auto-manufacturers have made aggressive commitments to electrify their products. In 2017, Volvo announced that all of its models will be hybrids or battery-powered starting in 2019.[113] Volkswagen and Mercedes-Benz announced that they will

---

[106] *Id.* at 49–50, 52–54, 71–72.

[107] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 40–60, 62–63, 71.

[108] *See* U.S. EIA, ANNUAL ENERGY OUTLOOK 2018 44, 56 (Feb. 6, 2018), https://www.eia.gov/outlooks/aeo/pdf/AEO2018.pdf.

[109] *See* Energyzt, "*Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 52–53. *See also* McKinsey Quarterly, *Mobility's second great inflection point*, February (Feb. 2019) (analyzing the looming widespread adoption of electric vehicles), https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/mobilitys-second-great-inflection-point.

[110] INT'L ENERGY AGENCY, GLOBAL EV OUTLOOK 2017 5 (2017), https://www.iea.org/publications/freepublications/publication/GlobalEVOutlook2017.pdf.

[111] *Id.* at 6.

[112] McKinsey, GLOBAL ENERGY PERSPECTIVE 2019: REFERENCE CASE, at 24 (January 2019), https://www.mckinsey.com/~/media/McKinsey/Industries/Oil%20and%20Gas/Our%20Insights/Global%20Energy%20Perspective%202019/McKinsey-Energy-Insights-Global-Energy-Perspective-2019_Reference-Case-Summary.ashx.

[113] *See* Press Release, Volvo Car Group, Volvo Cars to go all electric (July 5, 2017), https://www.media.volvocars.com/global/en-gb/media/pressreleases/210058/volvo-cars-to-go-all-electric.

offer an electric version of all of their vehicle models by 2030.[114] And General Motors outlined a pathway to an all-electric, emissions-free future for the company's vehicles.[115] In China, electric vehicles made up fully 7 percent of new vehicle sales in 2018, with a compound growth rate of *118 percent* since 2011.[116]

As discussed below, a majority of U.S. States have enacted programs, policy goals, and legislative mandates to decrease reliance on fossil fuels and transition to cleaner and more energy-efficient technologies.[117]

All told, the global demand for oil will likely soon begin to decline significantly.[118] As discussed in Section II. C. 2, *infra*, BLM's DEIS rests on the flawed assumption that oil demand will increase over the next 70 years. That is unlikely and would be inconsistent with current trends that are poised to greatly reduce demand. [119]

In sum, there is no need for any oil or gas produced by the proposed Leasing Program, and all of the alternatives considered in the DEIS are unlikely to generate revenue at a level approaching the CBO's projections to offset the cost of the Tax Cuts and Jobs Act. By failing to include in its alternatives analysis any assessment of potential revenue generation, including full and robust evaluation of all the relevant factors discussed above, BLM's alternatives analysis does not satisfy NEPA because it utterly fails to illuminate the real and significant tradeoff between the Leasing Program's illusory benefits and its substantial, long-lasting and irreversible environmental harms.

---

[114] *Volkswagen plans electric option for all models by 2030*, BBC NEWS (Sept. 11, 2017), http://www.bbc.com/news/business-41231766.

[115] *See* Press Release, General Motors, GM Outlines All-Electric Path to Zero Emissions (Oct. 2, 2017), http://www.gm.com/mol/m-2017-oct-1002-electric.html.

[116] *See* Nathaniel Bullard and Colin McKerracher, *Dispelling the Myths of China's EV Market: It's too soon to call a peak on traditional vehicles, but the potential for overall growth is in question. And just how much of that growth will be electric?*, Bloomberg Opinion (Feb 8, 2019), https://www.bloomberg.com/opinion/articles/2019-02-08/china-s-electric-vehicles-put-traditional-engines-on-notic.

[117] *See Energyzt, Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain, supra* note 70, at 32–35. *See also* Paul Dvorak, *Green America: Renewable standards, tax credits, and what's next,* map and chart 1 (depicting 34 States with renewable portfolio standards or goals), Windpower (Oct. 18, 2017), https://www.windpowerengineering.com/projects/policy/green-america-renewable-standards-tax-credits-whats-next/.

[118] *See id.* at 40–60, 62–63, 71.

[119] The current Administration's push for "energy dominance" stands in stark contrast to this trend toward decreasing demand and, if successful, the Administration's efforts to rollback fuel efficiency standards and other environmental protections could lead to increasing demand for fossil fuel production. *See e.g*. Executive Order 13783, *Promoting Energy Independence and Economic Growth* (March 28, 2017), https://www.govinfo.gov/content/pkg/FR-2017-03-31/pdf/2017-06576.pdf, Executive Order 13795, *Implementing an America-First Offshore Energy Strategy* (April 28, 2017), https://www.federalregister.gov/documents/2017/05/03/2017-09087/implementing-an-america-first-offshore-energy-strategy.

6. BLM Fails to Consider a Delayed Lease Sales Alternative.

In addition to analyzing the program's revenue generation potential, BLM should develop and consider an alternative that delays any lease sales until additional economic data make much more certain that leases sales will maximize revenue generation and oil prices will result in production and royalty payments. Offering lease sales when oil prices are well below the estimated $78 to $90 per barrel breakeven oil price could completely undermine the Leasing Program's revenue generation potential by suppressing lease sales price and diminishing the acreage successfully leased.[120]

A delayed leasing alternative would also allow BLM to obtain the information necessary to take NEPA's required hard look at the environmental impacts of its proposed Leasing Program. Just yesterday, PEER, an environmental organization, released several "Resource Assessments" in which U.S. Fish and Wildlife Service staff and technical experts from a number of other federal agencies, including BLM, identified "research gaps" in the data necessary to inform the EIS process.[121] These data gaps appear to include important baseline information for water resources, migratory bird populations, polar bears, and caribou.[122] Without this information, BLM cannot comply with NEPA's requirement to make an informed decision.[123]

As a result, BLM must seriously consider an alternative that delays leasing until BLM obtains the information necessary to take a hard look at the environmental consequences of its decision. At a minimum, BLM should delay lease sales until the latest time directed by the Tax Cuts and Jobs Act.[124]

---

[120] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 70, and discussion *supra* Section II. B. 5.

[121] *See* Public Employees for Environmental Responsibility (PEER), *Arctic Refuge Drilling Scientific Concerns Suppressed: Memos Outlining Major Environmental and Public Health Information Gaps Buried*, press release (March 12, 2019), https://www.peer.org/news/press-releases/arctic-refuge-drilling-scientific-concerns-suppressed.html.

[122] *See* Research Gaps Identified by Fish and Wildlife Service and other agency technical experts to inform Arctic Refuge Coastal Plain Oil and Gas Program Environmental Impact Statement, memorandum of Gregory Siekaniec, U. S. Fish and Wildlife Service Regional Director Alaska Region (Feb. 25, 2018) ("Research Gaps Identified by Fish and Wildlife Service and other agency technical experts to inform Arctic Refuge Coastal Plain Oil and Gas Program Environmental Impact Statement"), https://www.peer.org/assets/docs/ak/Priority%20Information%20Needs%20for%20the%20ANWR%201002%20Area.pdf.

[123] *N. Plains Res. Council, Inc.*, 668 F.3d at 1085.

[124] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 4, 70.

C. The DEIS Does Not Adequately Evaluate Greenhouse Gas Emissions and Climate Change Impacts.

As discussed above, development of the Coastal Plain will likely be uneconomic and thus may not occur even if BLM moves forward with the Leasing Program. However, the DEIS contemplates that potential "post-lease activities could include seismic and drilling exploration, development, and transportation of oil and gas in and from the Coastal Plain" and that these activities will have indirect and cumulative impacts on greenhouse gas emissions and climate change.[125] Accordingly, the potential impacts of greenhouse gas emissions on climate change from the proposed Leasing Program must be adequately considered as part of the indirect and cumulative effects analyses in an EIS.[126] To be adequate, these analyses "must be more than perfunctory" and must provide a "useful analysis of the cumulative impacts of past, present, and future projects."[127]

BLM's analysis of greenhouse gas emissions and associated climate change impacts in the DEIS, however, fails to meet BLM's obligation under NEPA. First, the DEIS's analysis of greenhouse gas emissions wrongly relies on a perfect replacement theory, assumes without question that demand for oil will increase over the next 70 years, unreasonably oscillates between U.S. and global comparisons to downplay impacts, and fails to adequately account for methane emissions. Second, the DEIS arbitrarily refuses to consider the social cost of carbon or any other metric to quantify the climate costs of the proposed Leasing Program. Third, the DEIS does not adequately analyze the cumulative impacts on greenhouse gas emissions and associated climate impacts of the proposed Leasing Program. For all these reasons, BLM's analysis of the indirect and cumulative impacts of greenhouse gas emissions on climate change from the proposed Leasing Program is fundamentally flawed.

1. The DEIS's Analysis of Greenhouse Gas Emissions Is Flawed.

BLM's analysis of greenhouse gas emissions impacts from oil development under the program is flawed in four respects.

---

[125] DEIS 3-5; *see also* App. B (discussing the reasonably foreseeable development scenario for oil and gas resources).

[126] *See e.g.*, *Sierra Club v. Fed. Energy Regulatory Comm'n*, 867 F.3d 1357, 1374 (D.C. Cir. 2017) (concluding that FERC violated NEPA by failing to consider "reasonably foreseeable" "indirect effects" of greenhouse gas emissions in authorizing pipeline project); *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008) ("The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct.").

[127] *Kern v. U.S. Bureau of Land Mgmt.*, 284 F.3d 1062, 1075 (9th Cir. 2002) (citation omitted); *Klamath-Siskiyou Wildlands Ctr. V. U.S. Bureau of Land Mgmt.*, 387 F.3d 989, 993–94 (9th Cir. 2004) (Proper considering of indirect and cumulative impacts requires "some quantified or detailed information"; general statements about possible effects "do not constitute a hard look absent a justification regarding why more definitive information could not be provided.").

First, the DEIS improperly relies on a perfect replacement theory in calculating greenhouse gas emissions. Although the DEIS states that total production for the Coastal Plain development "is estimated to range from 1.5 to 10 [billion barrels of oil]," and "0 to 7 trillion cubic feet of gas"[128] the DEIS projects that "over 96 percent of the Coastal Plain oil production is projected to replace other U.S. (and likely global) production that would not happen if development goes forward."[129] In other words, BLM projects that all but about 3.4 to 3.9 percent of Arctic Refuge oil and gas production will replace existing U.S. and global production and therefore will generate only an incidental increase in annual downstream greenhouse gas emissions—a mere 0.7 to 5.0 million metric tons.[130] For purposes of this analysis, BLM included production of both oil and natural gas expressed as barrels of oil equivalent.[131] Moreover, BLM assumes for purposes of its direct, indirect, and cumulative impacts analysis that "Coastal Plain oil production will not … significantly alter global demand and consumption of fossil fuels."[132]

This perfect replacement theory, *i.e.* the concept that 96 percent of Coastal Plain oil production will replace other production, is completely unsupported in this DEIS. BLM provides no meaningful evidence to support its assumption that the vast majority of oil produced in the Coastal Plain will displace other likely cheaper oil production in the United States,[133] let alone global supplies. Nor does BLM explain how it anticipates that Coastal Plain production will interact with other United States, again likely cheaper, production or global production. By assuming that nearly all of the oil generated from the proposed Leasing Program will replace other production, the DEIS may be significantly underestimating the true potential impact of the proposed Leasing Program on greenhouse gas emissions and associated climate change, running afoul of recent judicial rejections of reliance in perfect replacement theory.[134] In effect, BLM has wrongly cited certain economic assumptions to avoid taking a hard look at the extent to which Coastal Plain oil production will impact production and associated climate impacts. This NEPA does not permit.

Further, the DEIS's use of a perfect replacement theory for oil production contradicts BLM's analysis of the proposed Leasing Program's economic impacts. In calculating the direct and indirect impacts to the job market, the DEIS does not consider whether the jobs created in the

---

[128] DEIS 3-7.

[129] *Id*.

[130] DEIS 3-7, 3-8.

[131] DEIS 3-7.

[132] DEIS App. F-12.

[133] *See supra* Section II.B.5.

[134] *WildEarth Guardians v. U.S. Bureau of Land Mgmt.*, 870 F.3d 1222, 1236–37 (10th Cir. 2017) (concluding BLM irrationally relied on a perfect replacement theory in assessing the effects of increased coal consumption); *Mont. Envtl. Info. Ctr. v. U.S. Office of Surface Mining*, 274 F.Supp.3d 1074, 1098 (D. Mont. 2017) (rejecting BLM's reliance on perfect replacement theory).

Coastal Plain will displace jobs in oil production elsewhere in the United States.[135] Instead, the DEIS estimates that during the production phase, the proposed Leasing Program would generate an average of 730 direct jobs and over 3,000 indirect jobs. Given BLM's assumption that 96 percent of Coastal Plain production will replace other U.S. production, it follows that the vast majority of jobs created through the proposed Leasing Program would replace other oil production jobs within the United States. Yet, BLM does not consider or even acknowledge this possibility. BLM cannot rationally rely on a "perfect replacement theory" to downplay greenhouse gas emissions and climate change impacts but ignore this theory when calculating the number of jobs the project will create.[136]

Second, despite recognizing the inherent difficulties and uncertainties in economic projections, the DEIS's greenhouse gas emissions analysis assumes without reasonable explanation that oil production will increase over the next 70 years without acknowledging significant efforts to move toward cleaner energy sources.[137] As discussed above, movement toward cleaner energy has the potential to contribute toward lower oil prices, which would make Coastal Plain development uneconomic.[138] Clean energy policy and greenhouse gas reduction goals and state legislative mandates together with technological developments are depressing both the U.S. and global demand for oil, resulting in a projected 2 billion barrel per day decline from current levels over the next 5 to 15 years.[139]

States, businesses, and individuals are actively working to decrease reliance on fossil fuels and transition to cleaner technology. Many of our states have adopted ambitious greenhouse gas reduction goals and mandates that contradict BLM's prediction of increasing U.S. demand for petroleum. For example, Massachusetts' Global Warming Solutions Act requires the state to reduce economy-wide greenhouse gas emissions 25 percent below 1990 levels by 2020, and 80 percent by 2050.[140] In 2013, Massachusetts joined California, Connecticut, Maryland, New York, Oregon, Rhode Island, and Vermont in signing a memorandum of understanding that committed to a collective target of 3.3 million zero-emission vehicles on our roadways by

---

[135] DEIS 3-234–35.

[136] *See Ctr. For Biological Diversity*, 538 F.3d at 1198 (federal agency not "put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards"); *Mont. Envtl. Info. Ctr.*, 274 F.Supp.3d at 1098 (BLM acted irrationally "by inflating the benefits of the action while minimizing its impacts").

[137] DEIS 3-7 ("Given that global oil production continues to increase, the development that could occur with the Coastal Plain oil and gas leasing program would represent a smaller fraction of global production as the years pass.").

[138] *See supra* Section II.B.5.

[139] *See* Energyzt, *Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain*, *supra* note 70, at 49–60; *see also* U.S. EIA, ANNUAL ENERGY OUTLOOK 2019, WITH PROJECTIONS TO 2050, at 16 (Jan. 24, 2019), https://www.eia.gov/outlooks/aeo/pdf/aeo2019.pdf (projecting initial growth and then declines in U.S. crude oil production through 2050 in most cases).

[140] *See* MASS. GEN. LAWS. c. 21N, §§ 3(b) & 4(a); *see also* 310 MASS. CODE REGS §§ 7.72–7.75 & 60.05–60.06 (regulations directed at achieving reductions from multiple greenhouse gas emission source categories, including vehicles, to comply with GWSA mandates).

2025.[141] Massachusetts along with Connecticut, Delaware, Maine, Maryland, New Hampshire, New York, Rhode Island, and Vermont also participate in the Regional Greenhouse Gas Initiative—a mandatory, market-based program to reduce power-plant carbon dioxide emissions.[142] New York, by 2030, will achieve a 40 percent reduction in carbon emissions from 1990 levels; obtain 50 percent of its electricity generation from renewable energy sources, including distributed energy and large-scale renewables; and achieve 600 trillion British thermal units ("Btu") in energy efficiency gains.[143] Actions New York has taken to meet these targets have put New York on a path to achieve its longer-term goal of decreasing its carbon emissions 80 percent by 2050.[144] Similarly, Washington State adopted greenhouse gas reduction goals to reduce overall state emissions of greenhouse gasses to 1990 levels by 2020 and 50 percent below 1990 levels by 2050.[145]

Washington is also a national leader in electric vehicles. In 2015, Washington's Governor set a goal of 50,000 electric vehicles in Washington by 2020.[146] In addition, Executive Order 18-10 aimed to align the state's day-to-day operations with Washington's policy goals to reduce greenhouse gas emissions and other pollutants, including by directing state agencies to prioritize the purchase of battery-electric vehicle for the state vehicle fleet.[147] Washington now has over 42,000 electric vehicles on the road with 2400 charging points, and these numbers continue to grow.

Massachusetts also has seen tremendous growth in the use and ownership of electric vehicles (EVs) and EV infrastructure over the past five years, with EV registration increasing 732 percent from 2014 through June 2018.[148] EV sales trends in Massachusetts have been increasing sharply since 2015. Compared to a total of 4,631 EVs sold in Massachusetts from 2011 through 2014, more than 12,000 EVs were sold from January 2016 through June 2018. In 2010, there were no

---

[141] State Zero-Emission Vehicle Programs Memorandum of Understanding (Oct 24, 2013), http://www.nescaum.org/documents/zev-mou-8-governors-signed-20131024.pdf/.

[142] *See RGGI program overview and design*, THE REGIONAL GREENHOUSE GAS INITIATIVE (2019), https://www.rggi.org/program-overview-and-design/elements. New Jersey and Virginia are also taking steps to join RGGI.

[143] 2015 New York State Energy Plan, https://energyplan.ny.gov/Plans/2015.

[144] By Executive Order, it is a goal of New York to reduce carbon emissions from all sources within the State 80 percent below levels emitted in the year 1990 by the year 2050. 9 N.Y.C.R.R. §§ 7.24 & 8.2.

[145] Wash. Rev. Code § 70.235.020(1)(a).

[146] Leading the charge: Inslee promotes an electric transportation future (Jul. 11, 2018) https://medium.com/wagovernor/leading-the-charge-inslee-promotes-an-electric-transportation-future-7be79bbf2cde.

[147] Washington Exec. Order 18-01 (Jan. 16, 2018), https://www.governor.wa.gov/sites/default/files/exe_order/18-01%20SEEP%20Executive%20Order%20%28tmp%29.pdf.

[148] *See* Massachusetts Electric (EV) and Plug-in Hybrid Electric Vehicles (Increase Over Five Years, MassEVIP: Fleets, https://www.mass.gov/how-to/massevip-fleets.

publicly available EV charging stations in Massachusetts.[149] Including publicly-available and private charging infrastructure, there are currently 637 charging stations in Massachusetts, with a total of 1,742 charging outlets.[150] Electric vehicle growth in Massachusetts is supported by multiple state laws, policies, and rebate and incentive programs, including the Massachusetts ZEV Adoption Plan,[151] the Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) rebate program, and the Massachusetts Electric Vehicle Incentive Program (MassEVIP) grants program that promotes EV deployment and charging infrastructure expansion.[152] Massachusetts is committed to putting 300,000 EVs on the road by 2025. New York has set a goal of 800,000 EVs by 2025, representing nearly one out of every ten vehicles on the road in New York.[153] In furtherance of their emission-reduction goals, Massachusetts [and other states] joined California in adopting a Zero-Emission Vehicle Program to increase the sale of electric and other zero-emission vehicles.[154]

New Jersey is likewise committed to expanding renewable energy power and reducing greenhouse gas emissions in the state. Governor Murphy has directed that the state achieve one-hundred percent clean energy production by 2050.[155] To achieve this goal, Governor Murphy directed the development of clean energy sources, which includes offshore wind energy and community solar projects. [156] The development of clean energy programs is critical for New Jersey's economy and will create new job opportunities in the state's growing clean energy economy. New Jersey is also fostering clean transportation by using $10.8 million of the state's settlement funds from the Volkswagen Mitigation Trust for electric-vehicle charging stations across the state.[157] Additionally, $8 million of the settlement funds will be used for the purchase of eight electric transit buses that will operate in the City of Camden. These projects help reduce

---

[149] *See* Multi-state ZEV Task Force, Charging Station Locations, https://www.zevstates.us/charging-stations/#/analyze?region=US-MA&fuel=ELEC&show_map=true&ev_levels=all&status=P&status=E&access=private&access=public.

[150] *See* Multi-state ZEV Task Force, Charging Station Locations, https://www.zevstates.us/charging-stations/#/analyze?region=US-MA&fuel=ELEC&show_map=true&ev_levels=all&status=P&status=E&access=private&access=public.

[151] *Massachusetts Zero-Emission Vehicle Action Plan: A Roadmap to Reach 300,000 Zero Emissions Vehicles on Massachusetts Roads by 2025, Draft* (Aug. 2015), https://www.mass.gov/files/documents/2016/08/nk/massachusetts-zero-emission-vehicle-action-plan2015.pdf.

[152] *See* MassEVIP Fleets, https://www.mass.gov/how-to/massevip-fleets.

[153] *Govenor Cuomo Announces $31.6 Million in Funding Available to Dramatically Expand Electric Vehicle Usage* (Feb. 7, 2019), https://www.governor.ny.gov/news/governor-cuomo-announces-316-million-funding-available-dramatically-expand-electric-vehicle.

[154] *See* 310 MASS. CODE REGS § 7.40.

[155] 50 N.J. Reg. 1394(b) (June 18, 2018).

[156] *Id.*

[157] Department of Environmental Protection, Dep o Use First Round of Volkswagen Settlement Funds for Electric Vehicle Charging Stations, NJ Transit Electric Buses (Feb. 28, 2019), http://www.njintouch.state.nj.us/dep/newsrel/2019/19_0011.htm.

the disproportionate impacts of vehicle pollution on environmental justice communities in New Jersey.

In simply projecting increasing demand, BLM unreasonably ignores these state efforts and the significant policy and industry changes discussed above[158] to move towards clean energy and reduce consumption of and demand for fossil fuels. As a result, BLM ignores the potential future scenario where oil demand and production is decreasing over time and thus ignores the possibility that development of Coastal Plain oil and gas would form a larger percentage of overall global production over time, directly contradicting BLM's conclusion that over time Coastal Plain oil and gas "would represent a smaller fraction of global production as the years pass."[159] BLM also ignores the possibility that Coastal Plain development and production could drive demand that would not otherwise exist further contributing to greenhouse gas emissions and associated climate change.[160] To adequately account for the uncertainty in "any type of supply and demand projections" that BLM acknowledges in the DEIS,[161] BLM should consider that oil demand may decrease over the next 70 years and analyze the potential greenhouse gas emissions and climate impacts associated with that scenario. At the very least, BLM should explain its basis for assuming increasing demand over the next 70 years in light of the policy and industry changes discussed above.

Third, BLM downplays the proposed Leasing Program's climate impacts by misleadingly oscillating between U.S. and global comparisons. Although the DEIS acknowledges that petroleum is a "global commodity," the DEIS unreasonably narrows its greenhouse gas emission analysis to United States supply and demand for petroleum.[162] Then the DEIS looks to global petroleum liquids production to determine the percentage of global oil production that may result if the proposed Leasing Program reaches peak production.[163] Based on this comparison to the global market, the DEIS concludes that at peak production, "post-lease oil and gas activities could supply in the range of 0.1 to 0.5 percent of global oil production" and that this percentage is likely to decrease over time "[g]iven that global oil production continues to increase."[164] BLM cannot have it both ways. BLM cannot look to global production to minimize the proposed Leasing Program's contribution to overall production and then focus only on United States demand for purposes of estimating total greenhouse gas emissions with and without Coastal Plain development.[165] By shifting the bases of comparison, BLM's analysis unreasonably and

---

[158] *See supra* Section II.B.5.

[159] DEIS 3-7.

[160] *See* Erickson, et al., *Limiting fossil fuel production as they next big step in climate policy*, Nature Climate Change (Oct. 15, 2018) (discussing how limiting fossil fuel supply can drive down demand).

[161] DEIS 3-7.

[162] *Id*.

[163] *Id.*

[164] *Id.*

[165] *See Nat. Res. Def. Council v. U.S. Forest Serv.*, 421 F.3d 797, 813 (9th Cir. 2005) (Forest Service violated NEPA by presenting misleading economic effects in EIS).

artificially minimizes the potential impacts of greenhouse gas emissions and related climate impacts from the proposed Leasing Program.

Fourth, the DEIS fails to adequately address the greenhouse gas emission impacts associated with methane. The DEIS's brief paragraph discussing methane emissions fails to address or analyze the fact that methane is a potent greenhouse gas that is over 30 times more powerful than carbon dioxide in its ability to trap heat in the atmosphere over a 100-year time frame, and 86 times more potent over a 20-year timeframe.[166] In light of the urgent need for immediate reductions in greenhouse gases, and because of methane's significant near-term global-warming potential, reducing emissions of methane and other short-lived climate pollutants is a top priority. Although BLM cites EPA's inventory estimate that emissions from the oil and gas sector are the largest industrial source of methane emissions in the United States, accounting for about 30 percent of total U.S. methane emissions,[167] BLM ignores a recent study finding that methane emissions were *60 percent higher* than the EPA inventory estimate, likely because existing inventory methods miss emissions released during abnormal operating conditions.[168] BLM's incomplete and cursory summary fails to satisfy NEPA's requirement that BLM take a hard look at and robustly analyze greenhouse gas emission impacts from methane emissions associated with any natural gas and oil development under the proposed Leasing Program.

To remedy these deficiencies, BLM must revise its greenhouse gas emission and climate change analysis to accurately reflect the potential impact of the proposed Leasing Program on domestic and global greenhouse gas emissions and resulting climate change, including by properly accounting for efforts to reduce greenhouse gas emissions. Without an accurate estimation of greenhouse gas emissions, BLM will not be able to accurately assess the resulting climate change impacts of the proposed Leasing Program and thus will not be able to make an informed decision based on an understanding of the environmental consequences of the proposed action.[169]

2. The DEIS Arbitrarily Refuses to Analyze the Social Cost of Carbon or Otherwise Quantify the Climate Costs of the Proposed Leasing Program.

The DEIS also arbitrarily refuses to utilize the social cost of carbon—or any other meaningful metric—to accurately weigh the costs and benefits of the proposed project.[170] The social cost of carbon is a federally-developed tool to assist agencies in evaluating the social benefits of

---

[166] *See* Gunnar Myhre et al., *Anthropogenic and Natural Radiative Forcing*, 714 tbl. 8.7 (Daniel Jacob et al. eds., 2013).

[167] *See* DEIS at 3-8. *See also* EPA, *Greenhouse Gas Emissions*, (Last Updated Oct. 31, 2018) http://www3.epa.gov/climatechange/ghgemissions/gases/ch4.html.

[168] *See* Ramón A. Alvarez, et al., *Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain*, Science (June 21, 2018).

[169] *See WildEarth Guardians*, 870 F.3d at 1233–38.

[170] DEIS 3-9; and App. F-2–F-4.

reducing carbon dioxide (CO_2) emissions when analyzing the costs and benefits of agency action.[171] NEPA requires that where an agency quantifies the benefits of a proposed action, the agency must also quantify the costs, including the costs associated with greenhouse gas emissions, to ensure that the agency accurately analyzes the environmental consequences of its proposed action.[172]

BLM nevertheless contends that it is not obligated to calculate the social cost of carbon because it did not consider the "economic benefit" of the proposed project but only the "economic impact" of the project. As BLM explains, the "economic impact" of increased jobs and associated economic activity differs from an "economic benefit" because "[s]ome people may perceive increased economic activity as a 'positive' impact that they desire to have occur whereas another person may view increased economic activity as negative or undesirable due to potential increase in local population, competition for jobs, and concerns that changes in population will change the quality of the local community."[173] Thus, BLM attempts to distinguish economic *benefit* from economic *impact* calculations, asserting that the economic benefit metric accounts for changes in social welfare.[174] But both are metrics that *quantify* the economic result of a proposed action. And the case law makes clear that where BLM quantifies the economic results of a proposed action, it must also quantify the climate costs of that action so that the agency can accurately evaluate the consequences of its decision.[175] Accordingly, it is arbitrary and unlawful for BLM to quantify and compare other benefits or impacts of the proposed Leasing Program without taking a similar approach to quantifying the costs or impacts of greenhouse gas emissions.[176]

BLM's other reasons for rejecting the social cost of carbon protocol lack a reasonable basis. First, BLM implies that because the NEPA review process is not a rulemaking process for which the social cost of carbon tool was originally created and because federal policy has changed,

---

[171] DEIS App. F-2.

[172] 42 U.S.C. § 4332(2)(B); 40 C.F.R. § 1502.23; *Columbia Basin Land Prot. Ass'n v. Schlesinger*, 643 F.2d 585, 595 (9th Cir. 1981) (NEPA's "policy of full disclosure applies equally to the economic and technological benefits of a project as to its environmental costs. If full disclosure were applied only to the environmental costs, the purposes of mandating a balancing analysis would be defeated."); *Mont. Envtl. Info. Ctr*, 274 F.Supp.3d at 1095–99.

[173] DEIS App. F-3.

[174] DEIS App. F-3 (citing Watson et al. 2007); *See* Watson et al., *Determining Economic Contributions and Impacts: What is the difference and why do we care?* The Journal of Regional Analysis & Policy, JRAP 37(2):140–46 (2007); (defines "economic *impact*" as the "net changes in new economic activity associated with an industry …in an existing regional economy" and "economic *benefit*" as the "net increase in total social welfare" that includes "both market and nonmarket values." (emphasis added).

[175] *High Country Conservation Advocates v. U.S. Forest Serv.*, 52 F. Supp. 3d 1174, 1195 (D. Colo. 2014) ("It is arbitrary to offer detailed projections of a project's upside while omitting a feasible projection of the project's costs.").

[176] *See Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1198 (9th Cir. 2008) (agency "cannot put a thumb on the scale by undervaluing the benefits and overvaluing the costs" in failing to analyze the benefits of reducing greenhouse gas emissions).

BLM has no obligation to calculate the social cost of carbon.[177] That reasoning is inconsistent with legal precedent requiring agencies to quantify both the costs and benefits of a proposed action.[178] BLM cannot rely on a general change in policy to refuse to comply with legal precedent interpreting NEPA's requirements. Second, BLM's criticism that the social cost of carbon protocol does not allow for the "incremental impact" of a project on the environment or is not useful because it generates a range of dollar cost figures lacks support and contradicts BLM's previous statement that it sometimes "describes impacts using ranges of potential impacts."[179] If BLM uses ranges to describe impacts elsewhere in its analysis, then BLM should also be willing to use a range of dollar cost figures generated by the social cost of carbon. Moreover, NEPA does not allow federal agencies to simply refuse to quantify carbon costs based on such claims of uncertainty or incomplete information.[180]

In sum, to comply with NEPA, BLM must calculate the social cost of carbon or apply some other meaningful metric for calculating the costs of greenhouse gas emissions associated with the Leasing Project. BLM's failure to do so will render any leasing program decision unlawful.

3. The DEIS Fails to Adequately Consider the Cumulative Impacts of Other Development in the Arctic Region.

The DEIS's perfunctory cumulative impacts analysis of greenhouse gas emissions also violates NEPA.[181] Cumulative impacts are those impacts that result "from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions."[182] As the Ninth Circuit has observed, the "impact of greenhouse gas emissions on climate change is

[177] DEIS App. F-2.

[178] *Cf*. Office of Mgmt. & Budget, Circular A-4 at 29 (2003) (agencies should consider "any important ancillary benefits and countervailing risks," including those "secondary to the statutory purpose of the rulemaking"); Exec. Order No. 13,563 § 1, 76 Fed. Reg. 3821, 3821 (Jan. 21, 2011) (affirming Exec. Order No. 12,866) (directing agencies to assess the "actual results of regulatory requirements" and explicitly require analysis of both direct and indirect costs and benefits); Exec. Order No. 12,866 § 1, 58 Fed. Reg. 51,735, 51,741 (Oct. 4, 1993) ("Costs and benefits shall be understood to include both quantifiable measures . . . and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider."); U.S. EPA, Guidelines for Preparing Economic Analyses, 11-2 (2010) (directing the agency to assess "all identifiable costs and benefits," including both direct effects "as well as ancillary benefits and costs").

[179] DEIS App. F-2–F-4.

[180] *See Sierra Club*, 867 F.3d at 1374 (NEPA "necessarily involves some reasonable forecasting" and "agencies may sometimes need to make educated assumptions about an uncertain future."); *Ctr. for Biological Diversity*, 538 F.3d at 1200 (even where "there is a range of values, the value of carbon emissions reduction is certainly not zero."); *High Country Conservation Advocates*, 52 F. Supp. 3d at 1192 (explaining that even with "a wide range of estimates about the social cost of GHG emissions," federal agencies acted arbitrarily in not quantifying the costs); *cf. Mid States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 549 (8th Cir. 2003) ("[W]hen the *nature* of the effect is reasonably foreseeable but its *extent* is not, we think that the agency may not simply ignore the effect.").

[181] *See* DEIS 3-9; App. Part F.3.

[182] *Id*. at § 1508.7.

precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct."[183] Despite this obligation, BLM's analysis of the cumulative climate impacts of the proposed Leasing Program comprises a single paragraph in the DEIS that does not provide an adequate review of other past, present, and reasonably foreseeable greenhouse gas emission and climate impacts when combined with the proposed Leasing Program.[184]

Most notably, BLM's cumulative impacts analysis fails to consider the reasonably foreseeable cumulative impacts of the proposed Leasing Program's greenhouse gas emissions when combined with other regional oil and gas development. Although Appendix F identifies ten other "reasonably foreseeable future onshore oil and gas projects" and claims that these projects were included in its cumulative effects analysis, BLM's cumulative impacts analysis of greenhouse gas emissions does not include consideration of these other projects.[185] For example, although Appendix F identifies the Willow Oil and Gas Project within the National Petroleum Reserve in Alaska (NPR-A) as a reasonably foreseeable project subject to its cumulative impacts analysis, BLM's discussion of cumulative impacts from greenhouse gas emissions does not discuss the Willow Project.[186] BLM does, however, discuss the Willow Project in its analysis of cumulative economic impacts, along with the Point Thomson project on the eastern North Slope, the Greater Mooses Tooth One and Two Projects.[187] Similarly, although BLM identifies the Alaska LNG Project, which would include a gas treatment plant at Prudhoe Bay and an 800-mile pipeline, BLM does not assess the cumulative climate impacts of that project and gas development in the proposed Leasing Area.[188] It is arbitrary for BLM to identify these other projects as part of its cumulative impacts analysis and then fail to conduct that analysis with respect to greenhouse gas emissions and resulting climate change impacts.[189]

Moreover, the projects identified by BLM in the DEIS exclude consideration of important offshore oil and gas activity in the Chukchi and Beaufort Seas, including the Bureau of Ocean Energy Management's (BOEM) plan for a 2019 lease sale in the Beaufort Sea.[190] This project is reasonably foreseeable and should be considered in the cumulative impacts analysis.[191]

---

[183] *Center for Biological Diversity*, 538 F.3d at 1217.

[184] DEIS 3-9.

[185] App. F-7–F-10; DEIS 3-9.

[186] DEIS 3-9.

[187] DEIS 3-238–39.

[188] DEIS 3-9; App. F-8–F-9.

[189] *Indigenous Envtl. Network v. U.S. Dep't of State*, 347 F. Supp. 3d 561, 578 (D. Mont. 2018) ("The cumulative impacts analysis must do more than merely catalogue relevant projects in the area.").

[190] Notice of Intent to Prepare an Environmental Impact Statement for the Proposed 2019 Beaufort Sea Oil and Gas Lease Sale, 83 Fed. Reg. 222 (Nov. 16, 2018).

[191] *Ctr. For Envtl. Law & Policy v. U.S. Bureau of Reclamation*, 655 F.3d 1000, 1010 (9th Cir. 2011) (notice of intent makes a project reasonably foreseeable under NEPA).

BLM cannot rely on incorporation of its analysis of cumulative impacts in the Greater Mooses Tooth Two Final Supplemental EIS to remedy these deficiencies because that analysis too is flawed. The Greater Mooses Tooth Two EIS contains an inadequate assessment of the cumulative impacts of greenhouse gas emissions and climate change,[192] does not consider the social cost of carbon,[193] and does not account for the impacts of the proposed Leasing Program,[194] which BLM projects to be significantly larger than the Greater Mooses Tooth Two project.[195] Accordingly, BLM cannot rely on the Greater Mooses Tooth Two to satisfy its obligation to consider the cumulative impacts of greenhouse gas emissions on climate change.[196]

By failing to conduct an adequate cumulative impacts analysis, BLM has not taken a hard look at the proposed Leasing Program's foreseeable effects.[197] To remedy these deficiencies, BLM must reconsider its cumulative impacts analysis to fully account for the cumulative impacts of greenhouse gas emissions and associated climate impacts from the proposed Leasing Program and past, present, and reasonably foreseeable actions.

D. The DEIS Does Not Adequately Evaluate Impacts on Migratory Birds.

The DEIS's analysis of the proposed Leasing Program's impacts on migratory birds that frequent the Coastal Plain is also deficient. As the DEIS recognizes, hundreds of thousands of waterbirds, shorebirds, larids, raptors, landbirds, and seabirds including at least 156 bird species utilize the Coastal Plain annually, depending on the unique habitat of the coastal plains, lagoons, and Arctic foothills for breeding, molting, and staging.[198]

Thousands of these birds fly 3,000 miles or more every spring and fall from breeding, molting, and resting areas in the Coastal Plain to all 50 states, including undersigned States. As they migrate along the Pacific, Central, Mississippi, and Atlantic Flyways, many of these birds stopover or winter in our States, where they form a valuable part of our States' ecosystems and are prized for birdwatching and hunting. In 2016, the U.S. Fish and Wildlife Service estimated that nationwide migratory bird hunting generated $2.3 billion dollars with 2.4 million hunters

[192] *See* U.S. Dep't of the Interior, Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth 2 Development Project, Final Supplemental EIS, Vol. 1, Section 4.2.4 (Aug 2018).

[193] *Id.* at 311–12.

[194] *Id*. at 491 (stating that Coastal Plain leasing plan was considered in the evaluation of cumulative impacts).

[195] DEIS 3-6 (predicting that the total production potential for the proposed Leasing Program is between 9 and 59 times as much as for the Greater Mooses Tooth 2 project).

[196] *Kern*, 284 F.3d at 1074 (agency may not tier to legally deficient NEPA document); *Indigenous Envtl. Network*, 347 F. Supp. 3d at 579 (rejecting federal government's argument that its cumulative impacts analysis in the Alberta Clipper EIS satisfied the government's obligation to review the cumulative impacts of greenhouse gas emissions associated with the Keystone Pipeline).

[197] 40 C.F.R. § 1508.7; *Indigenous Envtl. Network*, 347 F. Supp. 3d 561, 577–79 ("The cumulative impacts analysis must do more than merely catalogue relevant projects in the area.").

[198] DEIS 3-84–91.

participating in the sport.[199] Wildlife watching generating over $79 billion, with wild bird watching attracting over 45 million people and forming the largest percentage of overall wildlife watching.[200]

Species that migrate along the Pacific Flyway to Washington include snow geese, long-tailed ducks, red-throated loons, pacific loons, western sandpipers, and golden plovers.[201] Washington has designated long-tailed ducks a species of significant concern, given its declining population.[202] Hunting and wildlife watching contributes almost 2 billion dollars annually to Washington's economy, with migratory bird watching and hunting forming an essential part of that economic impact.[203]

Scientists have also tracked flight paths from the U.S. East Coast into eastern Canada and then across northern Canada to the north slope of Alaska and the Arctic National Wildlife Refuge.[204] The American Golden-Plover, Whimbrel, Semipalmated Sandpiper, and Blackpoll Warbler are among the species that frequent the Coastal Plain and have been confirmed to feed and rest in Massachusetts while migrating further south,[205] and dozens of other species stop or overwinter in our States along the East Coast during migration to and from the Coastal Plain.[206] Massachusetts is home to world-class birding destinations, including Cape Cod and the Great Meadows

---

[199] U.S. Fish and Wildlife Serv., 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 24–26 (2016), available at https://wsfrprograms.fws.gov/subpages/nationalsurvey/nat_survey2016.pdf.

[200] *Id.* at 38–39.

[201] DEIS 3-87–3-88 (discussing observations of long-tailed duck); DEIS App. A, Map 3-18; App. J, Table J-9.USFWS, Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan and Final EIS, App. F.1 (Jan. 2015); Wash. Dep't of Fish and Wildlife, State Action Plan Update, App. *A Species of Greatest Conservation Need Fact Sheets*, (2015), at A2-10 https://wdfw.wa.gov/publications/01742/11_A2_Birds.pdf; Wash Dep't of Fish and Wildlife, *Management Recommendations for Washington's Priority Species* – Birds Vol. IV: (May 2004), https://wdfw.wa.gov/publications/00026/wdfw00026.pdf.

[202] Wash. Dep't of Fish and Wildlife, State Action Plan Update, App. *A Species of Greatest Conservation Need Fact Sheets*, (2015), at A2-10, https://wdfw.wa.gov/publications/01742/11_A2_Birds.pdf.

[203] Wash. Dep't of Fish and Wildlife, *Fish, Wildlife, and Washington's Economy* (2010), https://wdfw.wa.gov/publications/00728/wdfw00728.pdf.

[204] Harris, M.C., Miles, A.K., Pearce, J.M., Prosser, D.J., Sleeman, J.M., and Whalen, M.E., 2015, USGS highly pathogenic avian influenza research strategy: U.S. Geological Survey Fact Sheet 2015-3060, at 4, https://dx.doi.org/10.3133/fs20153060; Humberg, D.D. Understanding Waterfowl: The Flyways. Ducks Unlimited Magazine online, https://www.ducks.org/conservation/waterfowl-research-science/understanding-waterfowl-the-flyways.

[205] Methods of species confirmation include observations, electronic and banding tracking, and stable isotope analysis of feathers collected in coastal Massachusetts locations. *See e.g.* Rebecca Holberton, et al., *Isotopic (δ 2 H f) evidence of "loop migration" and use of the Gulf of Maine Flyway by both western and eastern breeding populations of Blackpoll Warblers*, Journal of Field Ornithology (May 2015).

[206] Email correspondence from Trevor Lloyd-Evans, Director of Land Bird Conservation Programs, and Brad Winn, Director of Shorebird Habitat Management, Manomet, Inc. (March 1, 2019). A science-based non-profit organization headquartered in Massachusetts, Manomet is a nationally-recognized leader in conservation research and programs for several migratory bird species.

National Wildlife Refuge. In 2011 alone, birdwatchers and other wildlife watchers spent nearly $1.3 billion in Massachusetts, generating approximately $2.3 billion in economic impact.[207] Also in 2011, four million bird and wildlife watchers spent more than $4 billion in New York, ranking New York first among all states by economic output.[208]

New Jersey beaches and wetlands provide vital resting and feeding grounds for shorebirds migrating to their summer breeding grounds in the Arctic. The Delaware Bay is a critical stop for at least six arctic-nesting shorebirds including the federally-threatened red knot.[209] The Nature Conservancy's South Cape May Meadows, Gandy's Beach Preserve, and Sunray Beach Preserve are examples of important habitats in the Delaware Bay ecosystem upon which migratory shorebirds depend to refuel and rest.[210] Shorebirds migrate great distances—from South American wintering areas, through U.S. stopovers and ultimately to Arctic breeding areas—to complete their annual life cycle. Their continued existence relies on habitats throughout the Western Hemisphere. Migrant shorebirds are an integral part of the State's ecosystem and are a world-renowned bird-watching phenomenon.

Given the significance of migratory birds to our states' ecosystems and economies and BLM's obligation to comply with the Migratory Bird Treaty Act (MBTA), which makes it unlawful "at any time, by an means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, [or] possess" migratory birds unless permitted by regulation,[211] the States are particularly concerned by the DEIS's failure to adequately consider the impacts of the proposed Leasing Program on migratory bird populations.

As an initial matter, the DEIS identifies a lack of information about migratory birds in the Coastal Plain.[212] The Ninth Circuit has explained that where such baseline data is deficient NEPA requires an agency "to gather information before it can make an informed decision."[213] To remedy its information deficiency, BLM should engage in robust multiple year and multiple

---

[207] *See* U.S. Fish & Wildlife Serv., Wildlife Watching in the U.S.: The Economic Impacts on National and State Economies in 2011, Addendum to the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, at 9, table 6, Economic Impact of Wildlife Watching by State in 2011, https://digitalmedia.fws.gov/digital/collection/document/id/1906.

[208] *Id.*

[209] N.J. Dep't of Envtl. Prot. Div. of Fish & Wildlife, Wildlife Action Plan, at 11 (Mar. 2018), https://www.state.nj.us/dep/fgw/ensp/waphome.htm.

[210] The Nature Conservancy, Must-See Migration, https://www.nature.org/en-us/about-us/where-we-work/united-states/new-jersey/stories-in-new-jersey/top-must-see-migrations-in-new-jersey-the-red-knot/ (last visited Mar. 8, 2019).

[211] 16 U.S.C. § 703.

[212] *See e.g.*, DEIS 3-85 ("Although there are historical survey data for the ARCP … detailed distribution and abundance data for the program area are lacking for many, and contemporary data are lacking for most bird species."); *Id.* (noting that "much of the contemporary data were collected for only 1 or 2 years, cover only a small portion of the program area, or were collected at low survey intensity").

[213] *N. Plains Res. Council, Inc.*, 668 F.3d at 1085.

season migratory bird surveys to better understand the status of bird species and the potential impacts of development and provide an adequate baseline for its analysis of the proposed Leasing Program's impacts.[214] To the extent possible, BLM should conduct such bird surveys and obtain better information on abundance, distribution, habitat use, and phenology of breeding and non-breeding birds in the Coastal Plain before conducting a lease sale and hold the initial lease sale at the end of 2021 and the second lease sale at the end of 2024 as allowed by the Tax Cuts and Jobs Act.[215] Collection of this data is not only required by NEPA, but it is consistent with ANILCA's requirement for an 18-month baseline study of the Coastal Plain region to, among other things "assess the size, range, and distribution of the populations of the fish and wildlife," and thus guide any potential exploratory activities in the area.[216] This baseline data will also be essential for ensuring the Leasing Program's compliance with the MBTA.[217] This demand is also consistent with a recently obtained expert memorandum with input from ten scientists from four different federal agencies identifying significant information gaps for analyzing potential impacts to birds from oil and gas development and disturbance.[218]

In addition to lacking adequate baseline information, the DEIS fails to adequately analyze the direct and indirect impacts on migratory birds, fails to adequately consider the cumulative impacts of the proposed Leasing Program and other projects on migratory birds, and fails to incorporate any mitigation measures or ongoing monitoring to protect migratory birds.

1. The DEIS Fails to Adequately Analyze the Direct and Indirect Impacts of the Proposed Leasing Program on Migratory Birds.

Birds are among the species most sensitive to environmental change. The proposed Leasing Program threatens to adversely impact migratory birds through habitat loss and alteration, disturbance and displacement, mortality and injury, and attraction to human activities and facilities.[219] These threats include road construction, oil spills, water drawdown in lagoons and

---

[214] *Id.* at 1083–85. At the very least, BLM must satisfy its obligation to identify incomplete or unavailable information under 40 C.F.R. R. § 1502.22. BLM should also more thoroughly consider the analysis of migratory birds conducted by the U.S. Fish and Wildlife Service as part of its Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final EIS.

[215] PL 115-97, § 20001(c)(2)(1)(B)(ii) (allowing initial lease sale to be held as late as December 2021 and second lease sale to be held as late as December 2024).

[216] 16 U.S.C. § 3142.

[217] 16 U.S.C. § 703. *See also* Research Gaps Identified by Fish and Wildlife Service and other agency technical experts to inform Arctic Refuge Coastal Plain Oil and Gas Program Environmental Impact Statement, memorandum of Gregory Siekaniec, U. S. Fish and Wildlife Service Regional Director Alaska Region (Feb. 25, 2018). https://www.peer.org/assets/docs/ak/Priority%20Information%20Needs%20for%20the%20ANWR%201002%20Area.pdf.

[218] *See* Research Gaps Identified by Fish and Wildlife Service and other agency technical experts to inform Arctic Refuge Coastal Plain Oil and Gas Program Environmental Impact Statement, memorandum of Gregory Siekaniec, U. S. Fish and Wildlife Service Regional Director Alaska Region (Feb. 25, 2018).

[219] DEIS at 3-94–3-103.

lakes important for nesting and molting, climate change, vegetation damage, transportation, construction, air traffic, and many other threats that will reduce or alter previously untouched migratory bird habitat, impact prey, and contribute to bird injury and mortality.[220] Oil spills in particular could lead to high mortality, the loss of habitat, and long-term impacts on the health of migratory bird populations.

Despite these potentially devastating impacts, the DEIS contains mostly generic, broad, and unsupported statements about the impacts of action alternatives on migratory birds.[221] For example, in discussing habitat loss and alteration impacts, the DEIS makes the unsupported statement that in response to habitat alterations caused by screeding for barge access that "would create a sediment plume that could disport feeding by non-breeding, post-breeding, and staging birds" the high number of birds using the area "are highly mobile and likely would be able to move to adjacent similar areas if necessary."[222] The DEIS does not provide support for any of these statements or otherwise explain the availability and quality of other adjacent similar areas, how the disruption may impact birds at different life-cycle stages, or whether birds are expected to return to the disrupted habitat after disruption ceases. Similarly, the DEIS notes that "[p]otential impacts of disturbance and displacement by summertime construction and operations would be long term and may affect nesting success for some birds near facilities; however, they are unlikely to affect regional or global population sizes or nesting densities of breeding birds."[223] But, the DEIS provides no support for this conclusion.[224] Common sense suggests the opposite: that long-term disruption of nesting success for bird species likely would contribute to declines in nesting densities and/or population sizes. As with other topics in the DEIS, BLM addresses this issue not with data, science, or even common sense, but instead assumes that no problem exists.

Where the DEIS does provide bird-specific information, it merely notes the impact without drawing any meaningful conclusions about the significance of the impact to bird populations and long-term health. For example, the DEIS notes that lower water levels from drawdowns "could eliminate important nesting sites on islands and peninsulas and may reduce fish prey, with particular impacts on breeding Pacific and red-throated loons" that would include "potential population consequences for Pacific, red-throated, and yellow-billed loons."[225] But, despite recognizing that the impact from drawdowns could be significant, the DEIS provides no

---

[220] *Id.*

[221] *Id.* To the extent the DEIS relies on data, much of it is more than ten years old, including studies that are more than 30-years old. *See* DEIS 3-92 (citing Eberhardt et al. 1982); DEIS 3-94 (citing Derksen et al. 1981). BLM cannot rely on outdated data to support its conclusions. *See N. Plains Res. Council, Inc.*, 668 F.3d at 1086–87 (agency may not rely on state data to support environmental impact analysis).

[222] DEIS 3-95–3-96.

[223] DEIS at 3-97.

[224] *Id.*

[225] DEIS at 3-94.

additional analysis of the extent of these population consequences or how they may impact regional or global population sizes. Similarly, although the DEIS recognizes that long-tailed ducks "make up about 80 percent of the birds in the nearshore waters of the Beaufort Sea" and are "the predominant bird in the lagoon system," the DEIS does not meaningfully analyze how this concentration of the long-tailed duck population might intensify impacts from disturbance and displacement or how these impacts in combination with habitat loss, mortality, injury, and a changing climate may impact population health.[226] Given that the decline of long-tailed duck populations in Washington in recent years, this inadequate analysis is of particular concern.

The DEIS also fails to meaningfully analyze the impacts on migratory birds of oil spills, which could have grave consequences for migratory bird populations. Although the DEIS acknowledges that oil spills "pose risks of injury or death to birds," the DEIS largely dismisses this threat without meaningfully analyzing the impacts of spills or providing any evidence to support its conclusions.[227] Large spills are of particular concern because of the potentially catastrophic and long-lasting impacts to migratory bird population.[228] As both the *Exxon Valdez* and *Deepwater Horizon* disasters have demonstrated, a large-scale oil spill, even if rare, will have significant, long-term, and far reaching impacts to migratory bird populations beyond the immediate mortality and injury caused by the spill.[229] Small and medium-sized spills are also of concern, given that at least one recent study of crude oil impacts on the western sandpiper concluded that "small amounts of crude oil on feathers can have dramatic effects on the energy costs of flight and migration ability of birds, with potentially substantial repercussions for energy budgets, reproduction, and survival."[230] Despite studies showing the long-term nature of impacts from even small spills, the DEIS does not acknowledge the long-term impacts of oil spills, provide any scientific support for its analysis, or otherwise analyze how any oil spill would impact bird populations. The DEIS also ignores the Fish and Wildlife Service's 2015 observation that an offshore oil spill "could have direct effects by oiling birds aggregated in coastal areas and

---

[226] DEIS 3-95–98.

[227] DEIS at 3-99.

[228] *Id.* (stating that "many species would be vulnerable" if oil is not contained and flows into lagoons); *id.* ("Large spills … could pose contamination risk to large numbers of molting, feeding, or migrating birds.").

[229] Henkel, et al., *Large-Scale Impacts of the* Deepwater Horizon *Oil Spill: Can Local Disturbance Affect Distant Ecosystems through Migratory Shorebirds?*, *BioScience*, Vol. 62, Issue 7 (July 2012), at 676–85 (concluding that impacts from the Deepwater Horizon spill will likely extend to other ecosystems, including the Arctic, used by migratory birds and other highly mobile species), https://doi.org/10.1525/bio.2012.62.7.10; Esler, et al., *Cytochrome P4501a Biomarker Indication of Oil Exposure In Harlequin Ducks up to 20 Years after the Exxon Valdez Oil Spill*, Envtl. Toxicology and Chemistry, Vol. 29, No. 5, pp. 1138–1145, 1144 (2010) (find strong evidence of oil exposure in harlequin ducks 20 years after Exxon Valdez oil spill), https://doi.org/10.1002/etc.129.

[230] Maggini et al., *Light oiling of feathers increases flight energy expenditure in a migratory shorebird,* Journal of Experimental Biology, at 2200, 2372–79 (2017), http://jeb.biologists.org/content/jexbio/220/13/2372.full.pdf.

indirect effects by impacting the food resources used by birds."[231] In short, the DEIS's analysis is wholly inadequate.

Finally, the DEIS does not meaningfully evaluate the different environmental consequences associated with each action alternative. Although the DEIS contains a brief description of the different impacts associated with each action alternative, the analysis is again cursory, general, and unsupported. For example, the analysis of Alternative D repeatedly notes the potential benefits to birds from non-surface occupancy restrictions or timing limitations, but there is no analysis of the extent of the potential benefits or how these benefits would interact with other impacts.[232] In addition, the DEIS misleadingly calculates the level of long-term loss and alteration of habitat and extent of disturbance and displacement as a percentage total of the overall area being leased. As a result, even though Alternative D is the most protective alternative considered in the DEIS, the DEIS misleadingly states that its percentage of long-term loss and alteration of habitat will be approximately 1.6 percent, compared with 1 percent for Alternatives B and C, even though Alternatives B and C will result in larger acreage impacts. Similarly, the DEIS calculates that disturbance and displacement under Alternative D could total 3 percent of the area available for leasing as compared to 2 percent under Alternatives B and C.[233] These misleading calculations erroneously suggest that Alternatives B and C may be more protective than Alternative D, when the reverse is true.

In sum, the DEIS's analysis of direct and indirect impacts on migratory birds falls short of BLM's obligation to carefully consider the environmental consequences of its proposed action under NEPA.[234]

2. The DEIS Fails to Meaningfully Analyze Cumulative Impacts on Migratory Birds.

The DEIS's analysis of cumulative impacts on migratory birds is also deficient. Although the DEIS identifies seismic exploration surveys as a reasonably foreseeable action,[235] it does not meaningfully address the impacts of this testing on migratory birds in its cumulative impacts analysis.[236] The cumulative impacts analysis also fails to discuss other past, present, and reasonably foreseeable future oil and gas development projects in the area and how those other projects would contribute to impacts on migratory birds.[237] Instead, the DEIS merely states that

[231] U.S. Fish & Wildlife Serv., Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final EIS, at 4-88 (Jan. 2015).

[232] DEIS 3-102.

[233] DEIS 3-100–103.

[234] 40 C.F.R. § 1500.1; 40 C.F.R. § 1502.14; 40 C.F.R. § 1502.16.

[235] DEIS App. F-8.

[236] DEIS 3-102–103.

[237] *Id.*; *see also* App. F, Table F-1.

"[p]ast, present, and reasonably foreseeable oil and gas development impacts would be common to the impacts described for development pursuant to the program area lease sales" and that these impacts would likely increase in occurrence and intensity and affect birds in both terrestrial and marine environments.[238]

NEPA demands more than this cursory analysis.[239] BLM must engage in a meaningful analysis that identifies the past, present, and reasonably foreseeable actions and the specific cumulative impacts on migratory birds. To the extent possible, BLM should engage in species-specific analysis to determine whether certain bird species will be more heavily impacted by the cumulative effects of oil and gas projects in the region. Only with this information can BLM make a meaningful and informed decision about the proposed Leasing Program.

3. The DEIS Fails to Incorporate Mitigation Measures for Migratory Birds.

The DEIS also fails to incorporate any meaningful mitigation measures to protect migratory birds from the acknowledged threats of the proposed Leasing Program. A DEIS should include a discussion of "[m]eans to mitigate adverse environmental impacts."[240] "Mitigation must be discussed in sufficient detail to ensure that environmental consequences have been fairly evaluated."[241]

Here, however, the DEIS recognizes potential methods for minimizing impacts but fails to identify any of these as mitigation measures. For example, although the DEIS notes that impacts from gravel and dust fallout "would be minimized by using the shortest road routes and smallest pads and by placing gravel in uplands and well-drained habitats," the DEIS does not identify these measures for mitigation.[242] Similarly, although the DEIS recognizes that future disturbance and displacement could affect nesting within 0.8 miles of active roads and 3.1 miles of oilfield facilities, the DEIS does not require any mitigation to reduce this disturbance and displacement.[243] Further, the DEIS notes that reduced speed limits and driver awareness of seasonal birds could reduce bird-vehicle collisions, but again the DEIS does not require this as a mitigation measure. In addition, the DEIS notes the importance of "[s]pill containment at strategic points on waterways," but does not include any specific mitigation measures to ensure that the spill prevention and response contingency plans under the proposed Leasing Program incorporate measures to ensure protections for migratory birds. At the very least, BLM should incorporate these and other meaningful mitigation measures into the Leasing Program Record of

---

[238] DEIS 3-102.

[239] *Lands Council v. Powell*, 395 F.3d 1019, 1027–28 (9th Cir. 2005) (holding Forest Service failed to adequately explain cumulative environmental impacts of other projects).

[240] 40 C.F.R. § 150.16; *see also* 40 C.F.R. § 1502.14.

[241] *Neighbors of Cuddy Mountain v. U.S. Forest Serv.,* 137 F.3d 1372, 1380 (9th Cir. 1998).

[242] DEIS 3-95.

[243] DEIS 3-97.

Decision to ensure the least possible impacts on migratory birds. BLM should also require ongoing monitoring to analyze the ongoing impacts of the Leasing Program on migratory birds.

III. CONCLUSION

For the above reasons, the undersigned States strongly urge BLM to reconsider its purpose and need statement, its range of alternatives considered, its analysis of greenhouse gas emissions and related climate impacts, and its analysis of the proposed Leasing Program's impact on migratory birds.

We appreciate your consideration of this important matter.

Respectfully submitted,

FOR THE STATE OF WASHINGTON

ROBERT W. FERGUSON
Attorney General

By: /s/ *Aurora Janke*

WILLIAM R. SHERMAN
Assistant Attorney General
AURORA JANKE
Special Assistant Attorney General
Counsel for Environmental Protection
800 5th Ave Suite 2000, TB-14
Seattle, WA 98104-3188
(206) 442-4485
(206) 233-3391

FOR THE COMMONWEALTH OF MASSACHUSETTS

MAURA HEALEY
Attorney General

By: /s/ *Matthew Ireland*
MATTHEW IRELAND
Assistant Attorney General
MIRANDA COVER
Assistant Attorney General
Office of the Attorney General
Environmental Protection Div.
One Ashburton Place, 18th Floor
Boston, MA 02108
(617) 727-2200

FOR THE COMMONWEALTH OF PENNSYLVANIA

JOSH SHAPIRO
Attorney General

By: /s/ *Josh Shapiro*
JOSH SHAPIRO
Attorney General
Commonwealth of Pennsylvania
Strawberry Square
Harrisburg, PA 17120
(717) 787-3391

FOR THE COMMONWEALTH OF VIRGINIA

MARK R. HERRING
Attorney General

By: /s/ *Matthew L. Gooch*
MATTHEW L. GOOCH
Assistant Attorney General
Office of the Attorney General
202 North 9th Street
Richmond, Virginia 23219
(804) 225-3193

FOR THE DISTRICT OF COLUMBIA

KARL A. RACINE
Attorney General

By: /s/ *David S. Hoffmann*
DAVID S. HOFFMANN
Assistant Attorney General
Office of the Attorney General
441 Fourth Street, NW
Suite 650 North
Washington, DC 20001
(202) 442-9889

FOR THE STATE OF DELAWARE

KATHLEEN JENNINGS
Attorney General

By: /s/ *Kathleen Jennings*
KATHLEEN JENNINGS
Attorney General of Delaware
Department of Justice
Carvel State Building, 6th Floor
820 North French Street
Wilmington, DE 19801
(302) 577-8400

FOR THE STATE OF MAINE

AARON M. FREY
Attorney General

By: /s/ *Margaret A. Bensinger*
MARGARET A. BENSINGER
Assistant Attorney General
Office of the Attorney General
6 State House Station
Augusta, Maine 04333-0006
(207) 626-8578

FOR THE STATE OF MARYLAND

BRIAN E. FROSH
Attorney General

By: /s/ *John B. Howard, Jr.*

JOHN B. HOWARD, JR.
Assistant Attorney General
JOSHUA M. SEGAL
Assistant Attorney General
Office of the Attorney General
200 St. Paul Place
Baltimore, MD 21202
(410) 576-6300

FOR THE STATE OF MICHIGAN

DANA NESSEL
Attorney General

By: /s/ *Dana Nessel*
DANA NESSEL
Attorney General
Michigan Department of Attorney General
P.O. Box 30212
Lansing, MI 48909
(517) 335-7622
P51346

FOR THE STATE OF MINNESOTA

KEITH ELLISON
Attorney General

By: /s/ *Max Kieley*
MAX KIELEY
Assistant Attorney General
445 Minnesota Street, Suite 900
St. Paul, Minnesota 55101-2127
(651) 757-1244 (Voice)
(651) 297-4139 (Fax)

FOR THE STATE OF NEW YORK

LETITIA JAMES
Attorney General

By: /s/ *Mihir A. Desai*
MIHIR A. DESAI
Assistant Attorney General
ALAN BELENSZ
Chief Scientist
New York State Office of the Attorney General
28 Liberty Street, 19th Floor
New York, NY 10005

FOR THE STATE OF NEW JERSEY

GURBIR S. GREWAL
Attorney General

By: /s/ *Dianna Shinn*
DIANNA SHINN
Deputy Attorney General
Environmental Enforcement & Environmental Justice Section
New Jersey Division of Law
25 Market Street
P.O. Box 093
Trenton, NJ 08625-093
(609) 376-2789

FOR THE STATE OF NORTH CAROLINA

JOSHUA H. STEIN
Attorney General

By: /s/ *Asher Spiller*
Asher Spiller
Assistant Attorney General
North Carolina Department of Justice
P.O. Box 629
Raleigh, NC 27602-0629
(919) 716-6000

FOR THE STATE OF OREGON

ELLEN F. ROSENBLUM
Attorney General

By: /s/ *Paul Garrahan*
PAUL GARRAHAN
Attorney-in-Charge
STEVE NOVICK
Special Assistant Attorney General
Natural Resources Section
Oregon Department of Justice
1162 Court Street NE
Salem, OR 97301-4096
(503) 947-4593

FOR THE STATE OF RHODE ISLAND

PETER F. NERONHA
Attorney General

By: /s/ *Gregory S. Schultz*
GREGORY S. SCHULTZ
Special Assistant Attorney General
Rhode Island Office of Attorney General
150 South Main Street
Providence, RI 02903
(401) 274-4400

FOR THE STATE OF VERMONT

THOMAS J. DONOVAN JR.
Attorney General

By: /s/ *Nicholas F. Persampieri*
NICHOLAS F. PERSAMPIERI
Assistant Attorney General
Office of the Attorney General
109 State Street
Montpelier, VT 05609
(802) 828-3186

CC:

Ted Murphy, Acting State Director, BLM, t75murph@blm.gov
Greg Siekaniec, Regional Director, U.S. FWS, greg_siekaniec@fws.gov
Joe Balash, Assistant Secretary of Land and Minerals Management, U.S. Department of the Interior, joseph_balash@ios.doi.gov
Steve Wackowski, Senior Advisor for Alaska Affairs, U.S. Department of the Interior, stephen_wackowski@ios.doi.gov

ADDENDUM A

Energyzt Advisors, LLC

Economic Assessment of Proposed Oil and Gas Lease Sales in the Arctic National Wildlife Refuge Coastal Plain

March 2019

Comments Submitted by State Attorneys General on the Draft Environmental Impact Statement for the Coastal Plain Oil and Gas Leasing Program, 83 Fed. Reg. 67337 (Dec. 28, 2018)

ENERGYZT

REPORT

Economic Assessment of Proposed Oil and Gas Lease Sales In the Arctic National Wildlife Refuge Coastal Plain

Prepared by: Energyzt Advisors, LLC

Prepared in Support of:
Comments filed on the Draft Environmental Impact Statement for the Coastal Plain Oil and Gas Leasing Program, 83 Fed. Reg. 67337 (Dec. 28, 2018) by the Attorneys General of States of Washington, Delaware, Oregon, Maine, Maryland, Michigan, Minnesota, New Jersey, New York, North Carolina, Rhode Island, Vermont, the Commonwealths of Massachusetts, Pennsylvania, and Virginia, and the District of Columbia

March 2019

DISCLAIMER

Energyzt Advisors, LLC ("Energyzt") is a global collaboration of energy experts who create value for our clients through actionable insights. Combining deep industry expertise with analytical capabilities, we help companies make informed business decisions.

This report is an independent assessment that was prepared by Energyzt and is based, in part, on publicly-available information which was not originated by or within the control of Energyzt. As such, Energyzt has made reasonable efforts to apply standard industry practice in assessing the applicability of the information for its proposed use, and has checked the veracity and completeness of such information to the best of its ability, but makes no claims as to its accuracy and has not performed an independent audit of data procured from the public domain. Where such information is relied upon, the source or sources are referenced.

In conducting the analysis, Energyzt has made certain assumptions with respect to conditions, events, and circumstances that may occur in the future. Where applicable, these assumptions and source materials are stated and described in the report. The methodologies used in performing the analysis are based on public projections and follow generally accepted industry practices. While we believe that such methodologies as summarized in this report are reasonable and appropriate for the purpose for which they are used, depending upon conditions, events, and circumstances that occur but are unknown at this time, actual results may differ materially from those embedded in the public projections and Energyzt scenarios that use those projections. Accordingly, Energyzt makes no assurances that the projections or forecasts will be consistent with actual results or performance.

Neither this report, nor any information contained herein or otherwise supplied by Energyzt in connection with this report, shall be used in connection with any proxy, proxy statement, and proxy soliciting material, prospectus, Securities Registration Statement, or similar document.

TABLE OF CONTENTS

LIST OF FIGURES

EXECUTIVE SUMMARY

Economic Assessment of Proposed Oil and Gas Lease Sales In the Arctic National Wildlife Refuge Coastal Plain

In December 2017, Congress passed the Tax Cuts and Jobs Act ("Act"),[1] which included a provision requiring the Bureau of Land Management ("BLM") to administer a competitive program for the leasing, development, production, and transportation of oil and gas in the Coastal Plain (i.e., the "1002 Area") within the Arctic National Wildlife Refuge ("ANWR"). Mandating the sale of two leases of no less than 400,000 acres each, within a set period of time following the passage of the Act (the first lease within four years, and the second within seven years), the goal is to raise $2.2 billion in total revenues, of which half would be allocated to federal revenues and the other half to Alaska. The $1.1 billion in federal revenues is intended to offset the loss of tax revenues to the federal government resulting from passage of the Act. Current and projected market conditions, however, do not support the stated objectives:

1) **Uneconomic:** Oil from the 1002 Area is not economic to develop under current conditions and cannot compete with other domestic and international resources;

2) **Not Needed:** Oil from the 1002 Area is not needed for domestic demand and is likely to be sold to international markets; and

3) **Unlikely to Generate Sufficient Benefits:** Given current and anticipated market conditions, potential revenues from ANWR oil are unlikely to generate the hoped-for revenue levels.

Each of these points is summarized below.

---

[1] Tax Cuts and Jobs Act of 2017, Pub. L. No. 115-97, 131 Stat. 2054 (2017).

OIL FROM THE 1002 AREA IS NOT ECONOMIC TO DEVELOP

Current prices for oil, as well as futures prices, are below the breakeven cost estimates required to produce oil from the 1002 Area, making the asset uneconomic to develop.

Over the long-term, increased supply from U.S. and global shale plays as well as decreases in demand due to carbon reduction policies and the convergence of multiple disruptive technologies regarding passenger vehicles is projected to maintain prices at current levels and may even result in lower prices.

Although some long-term projections may imply higher oil prices in the 2030s and beyond, those projections have lower prices in the near-term when the leases would be bid. They also understate the rate of electric vehicle adoption expected to occur by the mid-2020s. If such projections are to be believed, however, the lease auctions should be delayed until oil prices recover (by no means a certainty), so as to maximize potential revenues that could be generated should market conditions eventually support drilling in the 1002 Area.

OIL FROM THE 1002 AREA IS NOT REQUIRED TO MEET DOMESTIC NEEDS

ANWR oil is among the most expensive and uncertain of all undeveloped oil reserves and would be nearly the last resource to be developed. Other domestic resources are less costly and better positioned for development compared to the 1002 Area.

As a result of significant oil reserves associated with shale and unconventional oil in the lower-48 states, the U.S. will soon be a net exporter of oil. The U.S. Energy Information Administration ("EIA") projects that the U.S. will be a net exporter of oil and oil products by 2020, extending through 2050 under the reference case.

As a net exporter, with marginal costs of shale production well below the breakeven price for developing ANWR oil, any oil that would be produced from the 1002 Area is unlikely to displace U.S. oil. Instead, it would be sold into international markets.

Although such sales would reduce the balance of trade, oil sales from the 1002 Area would not be used for domestic purposes. Indeed, limits on tankers that meet the requirements of the Jones Act could make such deliveries into the lower-48 states cost-prohibitive. Similarly, any natural gas that could be produced from the 1002 Area would only be sold into other markets if it were converted into Liquified Natural Gas ("LNG"), increasing production costs significantly given the need for an on-site liquefaction facility and for which no active Jones Act LNG vessel currently is operational. Therefore, shipping limits are likely to be another constraint to bringing energy commodities from the 1002 Area to market.

In the unlikely event that ANWR oil is produced, it would not be used to meet domestic needs or to displace existing or undeveloped energy resources in the U.S.; oil from the 1002 Area would be exported.

REVENUES FROM THE 1002 AREA LEASES ARE NOT LIKELY TO MEET REVENUES ORIGINALLY PROJECTED BY THE CBO

The original federal revenue estimate by the Congressional Budget Office ("CBO") is unsupported. As a result of competitive alternatives, current market conditions, and projected market conditions under current trends, the 1002 Area leases are not likely to generate significant lease revenues. If anything, the price paid would reflect a heavily discounted estimate of the extrinsic value associated with an asset that currently is "out-of-the-money" (i.e., more expensive than market prices would support). Under current and projected conditions, revenues would be far less than the $2.2 billion originally projected by the CBO.

For example, a review of land leases awarded during the past few years in the

nearby National Petroleum Reserve in Alaska ("NPRA") indicate that land with a high potential for oil sold for an average of $40 per acre in 2016. In 2017, land with a low probability of oil sold for less than $10 per acre. The estimated revenues of $2.2 billion, even under the assumption that all of the potential acreage is leased results in an implied price of $1,400 per acre.[2] This value is unrealistic and unsupported by comparable sales in the region, especially given uncertainty surrounding volumes and cost to develop reserves in the 1002 Area, as well as current market conditions for oil that do not support development.

If leases are awarded, the lessee also would be required to make rental payments between acquisition of the lease and production. The CBO estimates that these would amount to only $2 million in total from 2022 to 2027. This is less than the estimated $10 million in costs anticipated to be incurred between 2018 and 2022 to administer the leases and perform requisite environmental reviews.

Under current and anticipated market conditions, it would be uneconomic to produce oil from the 1002 Area. Therefore, there would be no royalty payments. To the extent there are royalty payments, such payments would simply add to the cost of drilling, making the asset even less economic than alternatives that do not have an equivalent royalty payment.

In conclusion, the 1002 Area leases would not be economic assets. Any revenues would be well below what was originally projected and may barely (if at all) cover the costs of administering the program. The economic feasibility of these assets relies on a rising oil price projection. To maximize revenues under these leases, therefore, auctions should be delayed to a point where it is clear such oil is economic and needed for domestic purposes.

[2] There are an estimated 427,900 acres of high potential, 658,400 acres of medium potential and 477,200 acres of low potential, (BLM Draft EIS, p. 2-39) for a total of 1,563,500 acres (BLM Draft EIS, p. B-1).

ENERGYZT

Economic Assessment of Proposed Oil and Gas Lease Sales In the Arctic National Wildlife Refuge Coastal Plain

1. INTRODUCTION

Under the Act, Congress required that two lease sales be made in the 1002 Area for at least 400,000 acres each (out of a total area acreage of 1.5635 million acres). Legislation required that the two lease sales occur over a seven-year period following enactment (the first auction by 2021 and the second by 2024).

Drilling in the ANWR is forecasted to bring $2.2 billion in new lease bid revenues by 2027 which would be split evenly between the U.S. government and Alaska. For each lease awarded, the lessees will have to pay the federal government bonus bids to acquire the leases, annual rent to retain the leases through production, and a royalty based on the value of any oil and gas production from the leases. Rental payments would be due between the purchase of the lease and when production begins, estimated by the CBO at around $2 million in total between 2022 to 2027.[1] The legislation establishes a 16.67% royalty on oil and gas produced from the 1002 Area leases.

Energyzt was asked to examine the stated objectives of the proposed leases for the 1002 Area within ANWR given the context of current and anticipated market conditions. Specifically:

1) How do the economics of the 1002 Area oil production compare to current market conditions?

2) Is oil that would be produced from the 1002 Area anticipated to offset domestic demand?

---

[1] Congressional Budget Office (CBO), "A Legislative Proposal Related to the Arctic National Wildlife Refuge," November 8, 2017, https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=3454269F-6DC5-4E6C-9F23-99D1E3E64698

3) Is production from the 1002 Area anticipated to decrease global oil prices?

4) Is it likely that $1.1 billion in federal revenues will be generated to offset the loss of federal revenue resulting from passage of the Act?

This report addresses each of these questions in the context of current and anticipated market conditions, including a market assessment of the supply and demand for oil.

The research and analysis described in this report concludes the following:

- Under publicly-available breakeven price projections, the anticipated cost to produce oil from the 1002 Area is higher than current market prices for oil.
- Futures prices indicate a similar result, indicating that oil from the 1002 Area currently is an uneconomic resource.
- Although short-term pricing can change, longer-term trends in global supply and demand for oil indicate that oil that could be produced from the 1002 Area is not likely to be economic.
- It would therefore be prudent to delay the lease auctions until such time that the oil may become economic to develop in order to preserve an opportunity to maximize revenues.
- Production would not be required for domestic needs; if produced, oil from the 1002 Area likely would be sold into global markets. For this reason, oil from the 1002 Area would not have any material impact on U.S. energy independence.
- The relatively small amount of oil production compared to global supply and demand would have negligible impact on prices, especially if technological trends come to fruition by 2030, as projected.
- Based on economic conditions and recent auctions for leasing rights on the North Slope, federal revenues that can be anticipated to be generated by the 1002 Area leases are not likely to meet the stated objective of raising $1.1 billion, rental payments are minimal, and future royalties would be zero under anticipated conditions where the 1002 Area remains uneconomic.

This report provides the basis for these conclusions in more detail.

- **Section 2** provides a brief summary of the 1002 Area within ANWR, including its projected reserves and breakeven costs compared to short-term market price projections.
- **Section 3** provides the broader context of global oil markets in which oil from the 1002 Area would be sold.
- **Section 4** describes technological changes occurring on the supply side of oil, specifically the shale revolution in the U.S. and how that would impact the domestic need for and competitiveness of oil from the 1002 Area within ANWR, concluding that sales of such oil are likely to be international versus domestic.
- **Section 5** summarizes technological changes happening today and anticipated tipping points expected to converge in the 2020s that would diminish domestic and potentially international demand for oil, rendering the 1002 Area even more uneconomic and unlikely to produce oil.
- **Section 6** uses information from the previous sections as well as third party assessments to estimate what the potential revenues from the 1002 Area oil production would be to the U.S. and concludes that $1.1 billion is highly unlikely to be generated by the leases and rental payments through 2031.
- **Section 7** summarizes the conclusions of this report.
- **Appendix A** lists the documents, data and resources relied upon in developing this report.

2. ABOUT THE ARCTIC NATIONAL WILDLIFE REFUGE

Established in 1960, ANWR is 19.64 million acres of contiguous land in Northern Alaska originally established as a refuge to protect wildlife and the environment.

In 1980, the Alaska National Interest Lands Conservation Act ("ANILCA") enacted by Congress designated ANWR as part of the conservation lands, for purposes of:[2]

[2] Alaska National Interest Lands Conservation Act, Pub. L. No. 96–487, December 2, 1980, 94 Stat. 2371 (1980).

- Conserving animals and plants in their natural diversity;
- Protecting water quality and quantity;
- Ensuring a place for hunting and gathering activities; and
- Fulfilling the international fish and wildlife treaty obligations.

However, Section 1002 of the ANILCA provided that decisions about usage, management and protection of around 1.5 million acres in the coastal plain parcel, subsequently known as the "1002 Area," would be deferred.

A limited number of studies on the 1002 Area began after the Act was passed, with updates to Congress. In 1987, the U.S. Department of Interior issued a report to Congress on the 1002 Area, finding that there was a mean average of 13.8 billion barrels of in-place oil resources estimated in the reserve.[3] The U.S. Geological Survey ("USGS") has provided some updated information to inform decisions on land management, environmental issues, and strategy. Private companies also have performed their own studies on limited areas. These assessments offer a wide range of conclusions regarding the amount of recoverable oil and the estimated costs of extracting those reserves.

There is significant uncertainty surrounding the volumes of oil reserves actually available, the distribution of those reserves, and the breakeven cost of recovering those reserves. Most estimates indicate that the breakeven costs of oil from ANWR could be amongst the most expensive of identified undeveloped crude resources in the industry.[4]

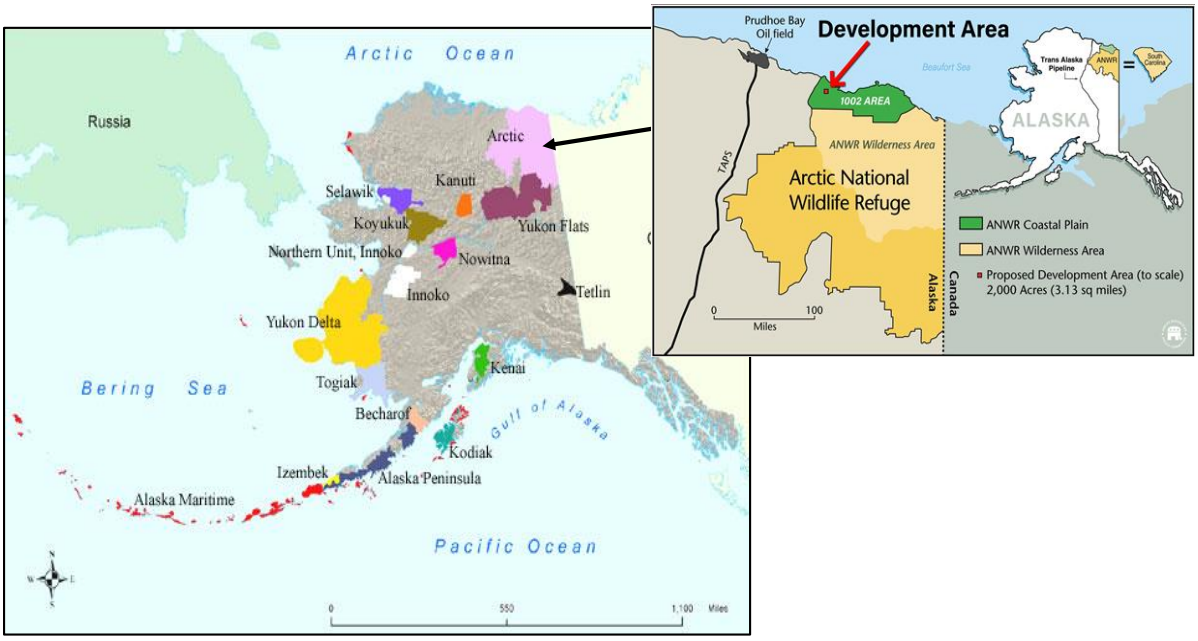
2.1. ANWR is not ideally located

ANWR is one of 16 national wildlife refuges in Alaska, located in the far Northeast corner of the state. The refuge runs nearly 200 miles along the border of Canada and has approximately 125 miles of coastline along the Arctic Ocean.[5] The 1002

[3] U.S. Fish and Wildlife Service, "Arctic National Wildlife Refuge, Alaska, Coastal Plain Resource Assessment," April 1987, https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/1987leis.pdf
[4] Shell, "Energy Transition Report," 2018.
[5] U.S. Fish and Wildlife Service, "Management of the 1002 Area within the Arctic Refuge Coastal Plain," February 14, 2014, https://www.fws.gov/refuge/arctic/1002man.html

Area, located on the coastal plain, takes up around two-thirds of the ANWR coastline in the northern-most reaches of the refuge (**Figure 1**).

Figure 1: Location of ANWR and 1002 Area[6]



2.2. Additional transportation infrastructure is required

The 1002 Area is located less than 85 miles east of the Trans-Alaska Pipeline System ("TAPS").[7] TAPS was built between 1974 to 1978 in response to the first energy crisis to bring oil from the Prudhoe Bay Oil Field on the North Slope to the warm-water

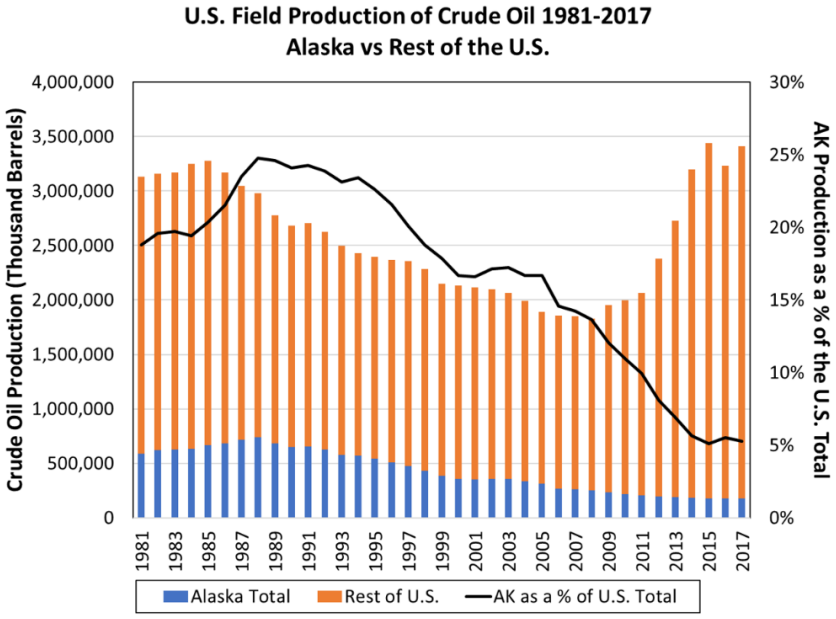
[6] USGS, https://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm;
US Forest Service, https://www.fws.gov/alaska/nwr/map.htm

[7] Attanasi, E. D., USGS, "Undiscovered oil resources in the Federal portion of the 1002 Area of the Arctic National Wildlife Refuge: An economic update," 2005, p. 8,
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.405.6106&rep=rep1&type=pdf
Lisa Murkowski indicates that it is less than 60 miles away from TAPS in a Natural Gas Intel article,
https://www.naturalgasintel.com/articles/108979-bill-would-allow-limited-development-of-alaskas-1002-area
A fact sheet issued by the Institute for Energy Research suggests that TAPS is 70 miles away,
https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/anwr-fact-sheet-pipeline-starved-potential-untapped/#_edn13

port at Valdez on the state's southern coast.[8] Roughly 800 miles long, TAPS is the longest pipeline system in the world. It takes nearly 12 days for oil injected into the pipeline from the North Slope to reach the Port of Valdez where crude oil tankers can then deliver the oil to refineries in the U.S. and abroad.[9]

TAPS throughput peaked on January 14, 1988, at around 2.145 million barrels per day.[10] Since then, reserves in Prudhoe Bay have declined, and oil transported across TAPS has declined to current flow rates of around 0.5 million barrels per day, or less than 200 million barrels per year. Oil delivered from the North Slope via TAPS is now around 5 percent of total U.S. production while shale oil production in the lower-48 states has more than made up the difference (**Figure 2**).

Figure 2: Alaskan Oil Production versus the Rest of the U.S.[11]



[8] Valdez was site of the famous Exxon Valdez oil spill that released over 11 million gallons of crude oil and cost upwards of $7 billion, History.com, "Exxon Valdez Oil Spill," March 4, 2019, https://www.history.com/topics/1980s/exxon-valdez-oil-spill

[9] Alyeska Pipeline, "The Facts," 2007, p. 19, http://large.stanford.edu/courses/2011/ph240/mina1/docs/FINALfacts-2007.pdf

[10] American Oil & Gas Historical Society, https://aoghs.org/transportation/trans-alaska-pipeline/

[11] USGS, https://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm;

Once pipeline oil throughput falls below a certain level, oil flows can slow to a point where icing and wax buildup necessitate more frequent cleaning of the pipeline. If TAPS cannot be used to transport oil, it would have to be shut down and, by contract, dismantled.[12] Indeed, one of the stated values of drilling in the 1002 Area is to provide throughput at a level that supports TAPS and maintains the option value for future drilling.[13] This value assumes, however, that oil reserves from the Arctic have the potential to be acquired and a probability of being economic in the future, which is far from certain.

Although TAPS is a potential transportation solution to bring ANWR oil to market, there currently are no pipelines in the 1002 Area that could be used to transport oil to market. Therefore, new pipelines would have to be built to transport oil from the wellhead to TAPS. Given current levels of throughput from Prudhoe Bay that are around 1.5 million barrels per day less than its peak,[14] there should be enough incremental capacity available on TAPS to deliver the entirety of production from the 1002 Area assuming it can be gathered and delivered to the pipeline. If production were to exceed this amount, or more competitive options from the nearby National Petroleum Reserve of Alaska were to contract for the TAPS capacity first, alternative means of transportation would be required, effectively increasing the break-even cost of production. Therefore, maximum potential production from the 1002 Area can be capped at around 1.5 million barrels per day or 11 billion barrels over a 20-year period, similar to the maximum reserves originally estimated by the USGS in 1998 (see **Section 2.3**).

US Forest Service, https://www.fws.gov/alaska/nwr/map.htm

[12] In 2012, the EIA projected that TAPS would be shut down by 2025 in the event that oil prices generated less than $5 billion per year and flow rates were below 350,000 barrels per day, https://www.eia.gov/todayinenergy/detail.php?id=7970

[13] Bradley, Robert, "ANWR: Make Alaska Great Again," Forbes, January 12, 2018, https://www.forbes.com/sites/robertbradley/2018/01/12/anwr-make-alaska-great-again/#7f68bf09782f See also Yale Environment 360, https://e360.yale.edu/features/trans-alaska-pipeline-is-fueling-the-push-to-drill-arctic-refuge and "Making the case for ANWR," http://anwr.org/2013/08/making-the-case-for-anwr/

[14] Alyeska Pipeline, "Pipeline Operations: Throughput," https://www.alyeska-pipe.com/TAPS/PipelineOperations/Throughput

The bigger constraint, however, could come in the form of vessels needed to ship the oil from Valdez to the lower-48 states in the U.S. Once oil is delivered to Valdez, it must be shipped another 2,500 to 5,000 miles via specialized crude oil tankers.[15] Depending on market conditions, and congestion at U.S. ports, oil can be processed in Alaska (around 15 percent), shipped to Hawaii or internationally (around 5 percent) or to California and Washington (80 percent).[16] Shipping oil from Alaska to U.S. ports of call requires large Jones Act tankers at shipping costs of about $5.50 per barrel.[17]

Under the Jones Act, vessels transferring commodity from one U.S. port to another U.S. port are required to be U.S. flagships, built in the U.S., and operated by a majority of American crew.[18] However, there are a limited number of Jones Act oil tankers large enough to deliver oil from Valdez to the state of Washington.[19] As production from Prudhoe Bay slowed, a number of tankers retired to the point where only 11 remain.[20] Each vessel can make around 2 round trips per month. With carrying capacity of 0.5 to 1 million barrels per vessel, the existing fleet can only transport 265

---

[15] Conoco Phillips, http://alaska.conocophillips.com/who-we-are/alaska-operations/polar-tankers-us-west-coast/

[16] "Analysis of Projected Crude Oil Production in the Arctic National Wildlife Refuge: Issue in Focus from the Annual Energy Outlook, 2018," May 2018, p. 3, https://www.eia.gov/outlooks/aeo/pdf/ANWR.pdf

[17] *Ibid*.

[18] United States Code: Merchant Marine Act, 1920, 46 U.S.C. §§ 861-889 (1958).

[19] Buzy, Mark, U.S. Department of Transportation, "The State of the U.S. Flag Maritime Industry," January 17, 2018, https://www.transportation.gov/content/state-us-flag-maritime-industry
In the Jones Act tanker category, there are 43 tankers, of which 11 were Aframax or Suezmax vessels that carry 800 to 1,500 MBbt. Those 11 larger vessels were dedicated to the Alaska North Slope or moving crude from the Port of Valdez. The medium or "Handysize" ships can then transport along the West Coast.

[20] Fielden, Sandy, "Ship to Wreck – Can the Jones Act Tanker Market Keep Growing?" October 25, 2015, https://rbnenergy.com/ship-to-wreck-can-the-jones-act-tanker-market-keep-growing See also an updated list of Jones Act vessels with the 11 crude oil tankers identified as "Crude Oil Tanker," Appendix A, National Cooperative Freight Research Program, "Marine Highway Transport of Toxic Inhalation Hazard Materials," National Academies Press, Transportation Research Board, 2012, https://www.nap.edu/read/22737/chapter/13#54 as confirmed in an updated list as of February 4, 2019 published by the U.S. Department of Transportation, Maritime Administration, https://www.maritime.dot.gov/sites/marad.dot.gov/files/oictures/DS_USFlag-Fleet_20190204_0.pdf

million barrels per year or 0.75 million barrels per day.[21] Therefore, the constraint on transporting oil from the 1002 Area to domestic markets is less likely to be pipeline infrastructure and more likely to be shipping constraints.

Addressing the constraints associated with the need for large, double-hulled oil tankers that can transport long distances could require new ships and long-term contracts at prices and commitments high enough to cover the costs. This would add the risk of another long-term obligation in addition to the standard shipping costs required to bring ANWR oil to market from Alaska via the TAPS pipeline costs.[22]

2.3. The amount of oil in the 1002 Area is limited

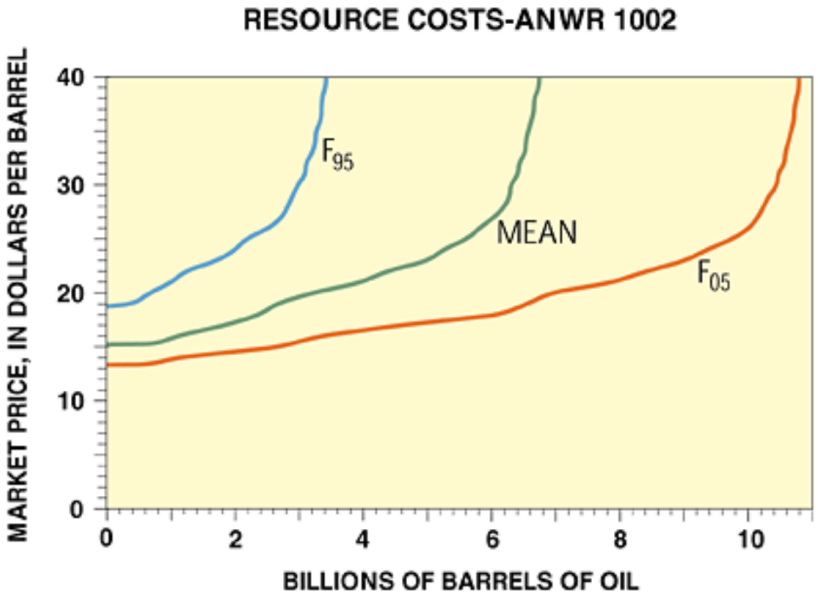
Following an initial 1987 report, a group of 40 scientists from the USGS performed an update in 1998 regarding the potential amount of oil and economic cost of extraction.[23] In that year, oil prices were trading between $18 to $27 per barrel, the nadir before what began a decade-long increase that would track to over $100 per barrel by 2008 (see **Section 3.3**). At that time, the USGS estimated that the amount of technically recoverable oil within the Coastal Plain ranged from 4.3 billion to 11.8 billion barrels in total (95% and 5% probability). A subset of those reserves, between 3 to 10 billion barrels of oil, with a mean of 7.7 billion barrels, would be economically recoverable at prices ranging from $13 to $40 per barrel (1996 dollars) (**Figure 3**).

[21] Assumes 80,000 to 160,000 DWT (averaging 0.75 million barrels) for an Aframax; and 120,000 to 200,000 DWT (1 million barrels) for a Suezmax, http://maritime-connector.com/wiki/aframax/ and https://itstillruns.com/average-capacity-oil-tanker-7486538.html

[22] Holodny, Elena, "This map shows how much it costs to transport oil across the US," *Business Insider*, June 10, 2016, https://www.businessinsider.com/map-oil-cost-shipping-2016-6

[23] USGS, "The Oil and Gas Resource Potential of the Arctic National Wildlife Refuge 1002 Area, Alaska," 1998, https://pubs.usgs.gov/of/1998/ofr-98-0034/ANWR1002.pdf https://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm

Figure 3: USGS 1998 Projection of ANWR Economically Recoverable Reserves[24]



Anticipated reserves were expected in the western section of the 1002 Area, occurring in multiple accumulations around 10 different plays. Further research was required. In addition, this economic estimate would have to be updated to reflect inflation for construction cost, materials and labor to reflect current dollars. Other than a private exploration that has been kept confidential, there are no updates to the 1998 study regarding potential volumes.

Since the initial estimates in the 1980s and 1990s, additional research and drilling has been performed to estimate the location of potential reserves. The findings conclude that there is not likely to be a single large pool, but smaller gatherings of oil scattered throughout as many as 35 small traps in the area,[25] increasing the cost to extract as well as transportation infrastructure. The most recent EIA study assumes that the number of traps could be as low as 37 and as high as 64, with a mean ANWR

[24] USGS, https://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm
[25] Bourne, Joel, "Arctic Refuge Has Lots of Wildlife – Oil, Maybe Not So Much," National Geographic, December 19, 2017, https://news.nationalgeographic.com/2017/12/arctic-wildlife-refuge-tax-bill-oil-drilling-environment/

production assumption of 53 traps.[26]

In addition, there have been disappointing results. For example, in 2015, Shell spent $7 billion drilling offshore in Alaska nearby the 1002 Area, finding very little oil and gas.[27] With much lower output than originally projected, Shell ended its project after drilling only one well and cut any funding for further drilling plans in the Arctic citing the poor results, along with high costs of operating in the Arctic, and a tough local and regulatory climate as reasons for doing so.[28]

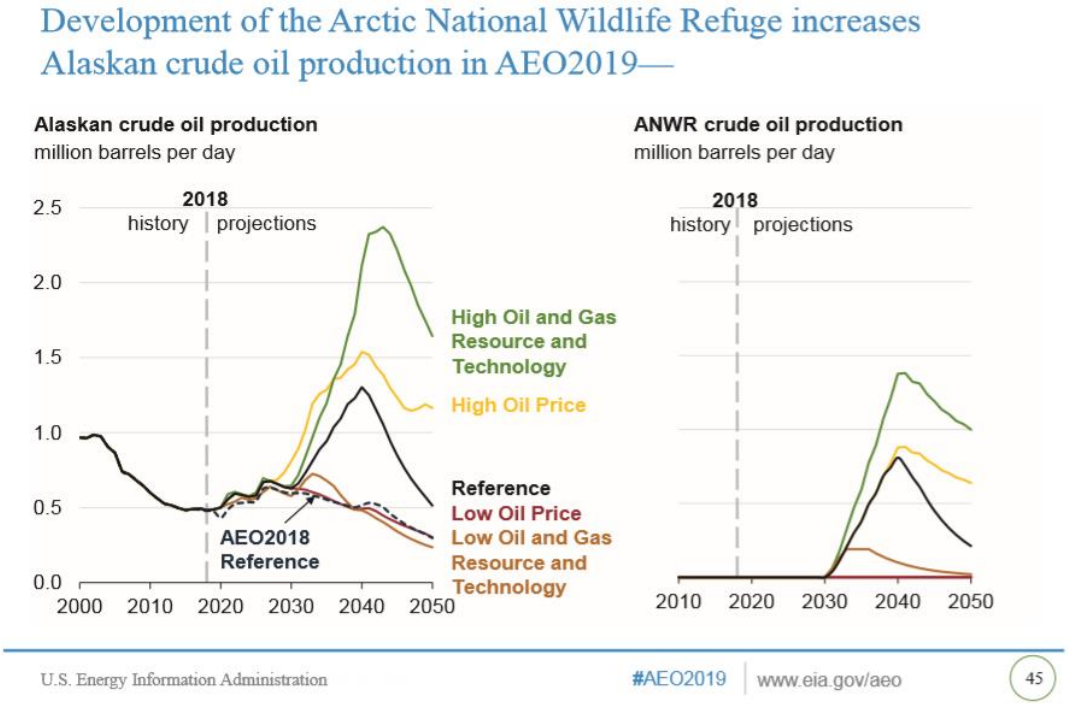
The EIA recently studied how ANWR would impact the 2018 Annual Energy Outlook ("AEO 2018") projections and incorporated these findings into the 2019 Annual Energy Outlook ("AEO 2019"). Under the "Mean ANWR" case for the AEO 2018 Update, the EIA estimated an increase in production from 2031 to 2050.[29]

AEO 2019 included different scenarios, based on assumed oil prices, with production starting in 2031 and peaking in 2041 under the "Reference Case" and "High Oil Case" (**Figure 4**). In the "Low Oil Price" case, there is no incremental Alaskan crude oil production from ANWR because it is not economic to develop under projected oil prices that remain below $50 per barrel ($2018) through 2050.[30] The EIA also includes a "Low Oil and Gas Resource Technology" case where only 0.7 billion barrels is produced between 2031 and 2050.[31]

---

[26] Wagener, Dana, U.S. Energy Information Administration, "Analysis of Projected Crude Oil Production in the Arctic National Wildlife Refuge," May 23, 2018, https://www.eia.gov/outlooks/aeo/anwr.php
[27] Macalister, Terry, "Shell ceases Alaska Arctic Drilling; exploratory well oil gas disappoints," The Guardian, September 28, 2015, https://www.theguardian.com/business/2015/sep/28/shell-ceases-alaska-arctic-drilling-exploratory-well-oil-gas-disappoints
[28] Koch, Wendy, "3 Reasons Why Shell Halted Drilling in the Arctic," National Geographic, September 28, 2015, https://news.nationalgeographic.com/energy/2015/09/150928-3-reasons-shell-halted-drilling-in-the-arctic/
[29] Wagener, Dana, U.S. Energy Information Administration, "Analysis of Projected Crude Oil Production in the Arctic National Wildlife Refuge," May 23, 2018,
[30] AEO 2019, pp. 33, 45 – 46.
[31] *Ibid*., p. 46.

Figure 4: U.S. Production in EIA Reference Case with ANWR Production Scenarios[32]



In other words, the total amount of reserves in the 1002 Area is unknown and uncertain. As the EIA readily admits:

> The ANWR projections are highly uncertain because of several factors that affect the timing and cost of development, little direct knowledge of the resource size and quality that exists in ANWR, and inherent uncertainty about market dynamics.[33]

In the "Reference Case," AEO 2019 assumes crude oil production of 6.8 billion barrels between 2031 and 2050, effectively adopting the USGS mean case from the 1998 estimates. This scenario, however, assumes Brent oil prices of around $75 per barrel (2018$) through 2022, rising to $100 per barrel ($2018) by 2035.[34] Although this is lower

[32] *Ibid.*, p. 45
[33] *Ibid.*, p. 46.
[34] *Ibid.*, p. 33.

than AEO 2018 price projections,[35] it is still high enough under the EIA assumptions to support drilling in the 1002 Area, in contrast to current prices or the EIA "Low Oil Price" scenario of around $50 per barrel ($2018).

That said, the AEO 2019 Reference Case is unrealistic for a number of reasons:

1) The EIA projection is limited to inclusion only of existing policies,[36] and therefore does not reflect additional anticipated efforts to reduce carbon emissions or application of a carbon tax;

2) The EIA consistently underestimates price trends (illustrated in **Section 3.3**); and

3) AEO 2019 oil price projections reflect a fairly low view of electric vehicle adoption rates and assumes linear adoption over time rising to only 1.5 million in sales per year by 2030 (discussed in **Section 5.1**).[37]

AEO projections can only be based on existing policy; the moratorium on drilling was lifted after the modeling for AEO 2018 was complete. Therefore, until the 2017 Tax Cuts and Jobs Act, ANWR production was not included in recent AEO projections. Once legislation required leases to be issued for drilling in ANWR, the EIA included the potential impact in its report.

Whether or not 1002 Area reserves can even be extracted economically under realistic price projections in a timely manner is another matter. The next section discusses the potential for natural gas in ANWR followed by a discussion on the estimated amount of time between lease purchase and production and estimates of the all-in cost to produce oil from the 1002 Area and how that compares to other options

---

[35] U.S. EIA, "Annual Energy Outlook 2018," February 6, 2018, oil price projections begin at around $80 per barrel and were projected to rise to $100 per barrel by 2030.
[36] U.S. Energy Information Administration, "EIA's Annual Energy Outlook is a projection, not a prediction," May 17, 2016, https://www.eia.gov/todayinenergy/detail.php?id=26272
https://www.eia.gov/outlooks/aeo/assumptions/
https://www.eia.gov/outlooks/aeo/retrospective/
[37] *Ibid.*

domestically and globally.

2.4. The value of natural gas reserves is negligible

The 1002 Area leases will be for oil and natural gas. Natural gas often is produced as a byproduct of oil extraction. In locations such as Texas where a natural gas pipeline system already exists, that natural gas can be transported to market and monetized. In areas such as North Dakota, natural gas has no way to be shipped to market and is flared, releasing significant carbon emissions into the atmosphere.[38]

Other oil fields on the North Slope produce natural gas, but only for limited purposes. There are no pipelines that can be used to ship natural gas to large load centers. Instead, the natural gas is reinjected into the oil fields to assist with oil extraction or otherwise consumed as part of the natural gas and crude oil production process.[39]

Although proposals for construction of a new natural gas pipeline linking Alaska with the lower-48 states have been contemplated, a pipeline of that distance and size currently is not economic, especially with the availability of inexpensive shale gas production co-located near the existing pipeline system. The alternative of a new LNG export terminal near Anchorage also has been proposed, which would be fed by a new 800-mile long pipeline. Although the Federal Energy Regulatory Commission is scheduled to review the proposal for approval by 2020, economic realities may prevail. Lack of potential buyers and increasing competition from LNG exports to Asian markets has prompted the new CEO of Alaska's state gas corporation to inform legislators that the project – estimated to cost $43 billion – would be shut-down if

[38] The amount flared in 2018 alone – 527 million cubic feet per day -- was enough to meet all of the natural gas needs for North Dakota and South Dakota. Dalrymple, Amy, "North Dakota natural gas flaring hits records, improvement expected in 2019," *Bismark Tribune*, December 25, 2018, https://bismarcktribune.com/bakken/north-dakota-natural-gas-flaring-hits-records-improvement-expected-in/article_201e38f4-54db-5b96-a03a-31af0fd077e0.html

[39] US EIA, "Alaska: State Profile and Energy Estimates," https://www.eia.gov/state/analysis.php?sid=AK#49

investors or customers do not appear in early 2019.[40]

Therefore, any revenues associated with the 1002 Area is assumed to be associated exclusively with oil market conditions; natural gas currently has no way to reach market.

2.5. Production requires at least 10 years of lead-time

Uncertainty surrounding information on 1002 Area reserves, location and economics has another uncertainty in the form of time and commitment. The EIA addendum does not assume any production begins until 2031, around 10 years after the first lease is legislatively required to be signed. This time period is required for further exploration, appraisal, permitting and development, and could be extended even further with the potential of an extensive litigation battle.

The timeframe required from lease signing to output is important for three reasons:

1. **Research Required:** There are a significant number of additional studies required along with investment in testing and planning before drilling can begin, requiring significant expenditures by the lease holder.

2. **Capital Investment and Construction Time Required:** In addition to the upfront lease costs and studies, there would be significant capital investment and construction time required to be able to establish wells and transportation infrastructure to bring the oil to market.

3. **Dynamic Market Conditions:** Oil prices are incredibly volatile, yet are key to determining economic reserves as well as potential return on investment. Current as well as projected conditions are important to understanding potential value to be obtained from the proposed leases and whether or not any production could be realized if those leases are purchased. Even

[40] Bradner, Tim, "Alaska might give up on North Slope gas pipeline, LNG export terminal: Official," S&P Global, February 28, 2019, https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/022819-alaska-might-give-up-on-north-slope-gas-pipeline-lng-export-terminal-official

assuming current market conditions appeared to be favorable (which they are not), those conditions could change dramatically in the future due to a number of supply and demand trends,[41] resulting in stranded assets following the upfront investment phase.[42]

These timing constraints and long-term commitment are important to consider when examining how market conditions are expected to change and how potential bidders will incorporate this uncertainty into their lease bids. Oil companies are moving away from long-term commitments that limit their flexibility to shorter-term plays that require less upfront fixed costs, especially given other, more flexible opportunities with quicker pay-outs in the U.S.[43] Committing to a long-term exploration and development timeframe in an expensive and controversial part of the world in the face of potential disruption and climate policy impacts does not seem to be a wise focus of capital investment dollars. As a result, recent investment by the large oil companies is being directed to shale plays in the lower-48 states.[44]

2.6. The 1002 Area is an expensive source of oil

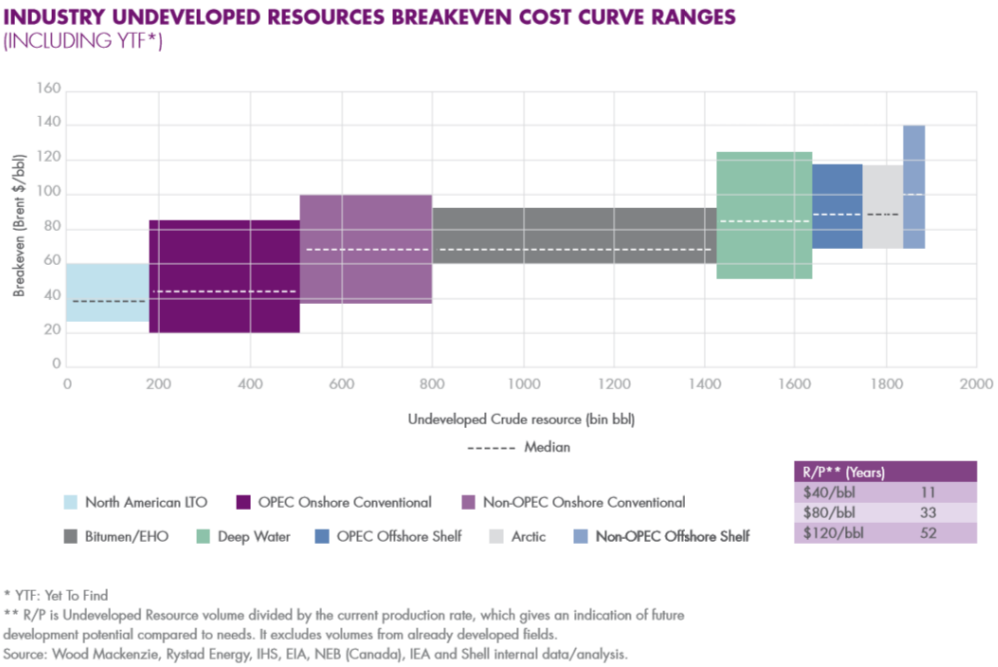
Estimated costs to extract oil from the 1002 Area have increased since the 1998 USGS study, which estimated that an average of 5.2 billion barrels could be recovered for around $24 per barrel ($1998). The USGS updated the estimates in its most recent assessment, conducted in 2005 when it was estimated that 7.1 billion barrels could be economically recoverable at a price of $67.65 per barrel ($2017), suggesting that much of the oil in the 1002 Area would be developed with little to no profit at today's prices.[45]

---

[41] Supply trends are discussed in **Section 4**; demand trends are discussed in **Section 5**.
[42] As an example, the major oil companies all had to take write-offs for their investment in Canadian oil sands once oil prices fell at the end of 2014.
[43] Denning, Liam, "Chevron-Exxon Texas Showdown Spells Trouble for Frackers," Bloomberg Opinion, March 5, 2019, https://www.bloomberg.com/opinion/articles/2019-03-05/chevron-exxon-texas-showdown-spells-trouble-for-frackers
[44] Blum, Jordon, "Exxon, Chevron plan to dominate Permian, grow as others cut back," *Houston Chronical*, March 5, 2019, https://www.chron.com/business/energy/article/Exxon-Chevron-plan-to-dominate-Permian-grow-as-13663733.php
[45] Congressional Research Service, "Arctic National Wildlife Refuge (ANWR): An Overview," January 9, 2018, https://fas.org/sgp/crs/misc/RL33872.pdf

Another estimate establishes break-even oil prices for the 1002 Area higher than the USGS estimate at about $78 per barrel.[46] A study conducted by Rystad Energy looked at recent cost trends and provided an estimate for the cost of drilling in the Arctic; high costs of construction and development of the oil, along with its transportation, would result in an average breakeven price of $75 to $80 per barrel. However, even this estimate may not include other costs associated with long-term commitments tied to new Jones Act ships. Regardless, a mean breakeven price of $78 per barrel makes oil from the 1002 Area significantly more expensive and riskier than U.S. shale development opportunities that have costs at around half of that level.[47]

Figure 5: Shell Oil Assessment of Relative Costs of ANWR versus Other Resources[48]



* YTF: Yet To Find
** R/P is Undeveloped Resource volume divided by the current production rate, which gives an indication of future development potential compared to needs. It excludes volumes from already developed fields.
Source: Wood Mackenzie, Rystad Energy, IHS, EIA, NEB (Canada), IEA and Shell internal data/analysis.

Other estimates place the median break-even price even higher with a wide

[46] Rystad Energy, "Global Liquids Cost Curve: Shale is pushing out oil sands and Arctic, Offshore is still in the race," June 12, 2014, https://www.rystadenergy.com/newsevents/news/press-releases/global-liquids-cost-curve
[47] See **Section 4**.
[48] Shell, "Energy Transition Report," p. 35.

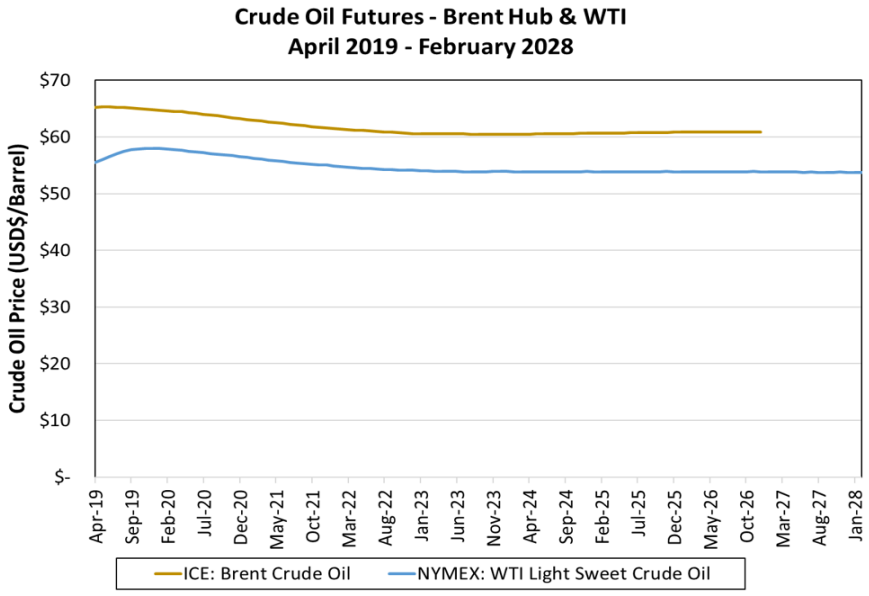
range reflecting the uncertainty of the extraction and transportation costs. For example, Shell Oil estimates the median breakeven price of undeveloped Arctic oil at almost $90 per barrel (i.e., the Arctic region represented by the light gray box, second from the end) (**Figure 5**). Of the industry's undeveloped resources, ANWR is anticipated to be one of the most expensive oil reserves to develop.

There are many other undeveloped resources both domestically and globally that would be more economic to develop first. If new oil reserves are needed, ANWR would be almost the last location that should be leased and developed compared to alternatives based on breakeven costs.

2.7. Oil from the 1002 Area currently is not economic

A comparison of potential breakeven cost curves for the 1002 Area to futures prices indicate that market prices do not support drilling in ANWR. Futures prices for Brent Crude have settled in at $60 per barrel through the mid-2020s; Western Texas Intermediate ("WTI") reflecting domestic oil prices is trading lower at around $53 per barrel (**Figure 6**).

Figure 6: Futures Prices for Oil[49]



[49] CME Group, "Oil Futures Quotes," February 27, 2019,

A number of large oil producers similarly report prices consistent with futures. Shell expects oil to remain around $60 per barrel through 2021.[50] BP has stated that it sees oil prices in 2025 as being similar to the 2017 level of $55 per barrel.[51]

The EIA also projects near-term prices at around $75 per barrel ($2018) through the mid-2020s, with a low oil price estimate below $50 per barrel.[52] In February 2019, the EIA revised its Short-Term Energy Outlook (STEO) to be lower than its January STEO due to expectation of slower growth in demand, forecasting 2020 prices of $62 per barrel for Brent and $58 per barrel for WTI.[53] Consensus among multiple forecasts through the early 2020s would indicate that the reserves are not expected to be economic when the leases are bid.

With a breakeven price of around $78 to $90 per barrel – well above where oil currently is trading -- the 1002 Area oil is not economically recoverable. Projections indicate that 1002 Area reserves would not be economic when the first set of leases is bid. As discussed in more detail in **Section 4,** the cost of extracting and delivering oil from the ANWR Coastal Plain is well above the cost of bringing shale oil in the lower-48 states to market.

The ANWR reserves therefore are "out-of-the-money" – reflecting a total cost to extract that cannot be recovered from market prices. As a result, no drilling would occur under current prices. In addition, any leases that might be sold would be at very low prices reflecting only the extrinsic value of the site associated with optionality, heavily discounted to reflect uncertainty and risk of long-term commitments, as

---

https://www.cmegroup.com/trading/energy/crude-oil/brent-crude-oil.html

[50] Royal Dutch Shell plc., Fourth Quarter 2018 Results, January 31, 2019, https://www.shell.com/investors/news-and-media-releases/investor-presentations.html

[51] British Petroleum (BP), "Oman 2018: Upstream Investor Day & Fieldtrip," December 2018, https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/investors/oman-2018-investor-day-bernard-looney-plenary.pdf

[52] U.S. EIA AEO 2019, p. 34.

[53] U.S. EIA, "Short-Term Energy Outlook," February 2019, https://www.eia.gov/outlooks/steo/
See also, OGJ Editors, "EIA revised down its oil price forecast," *Oil & Gas Journal*, February 12, 2019, https://www.ogj.com/articles/2019/02/eia-revised-down-its-2020-oil-price-forecasts.html

opposed to any intrinsic value related to the reserves that might be technically recoverable.

2.8. Rising oil prices would support delaying lease sales

To the extent long-term oil prices are expected to recover, a possibility that runs counter to longer-term trends in lower-cost supply and softening demand, the auctions should be delayed. Moving forward with leasing the 1002 Area while market prices are below the estimated breakeven price will not generate the anticipated revenues. Instead, selling American energy assets at depressed prices will lock-up the ownership and opportunities associated with those assets for the term of the lease.

In effect, the U.S. federal government would be giving up optionality associated with the 1002 Area reserves. Given where market prices for oil currently are, therefore, it would make economic sense to delay the auctions until such time—if indeed that time ever comes—when global oil prices at least cover the estimated breakeven price of extracting oil from the 1002 Area. Moving forward at current prices would minimize potential revenue gains and effectively give away development rights to the 1002 Area oil assets.

2.9. Key points about ANWR

The estimated cost to extract oil from the 1002 Area is highly uncertain. That said, the following is known:

- **"Out-of-the-money":** Oil reserves in the 1002 Area that are technically recoverable are more expensive to develop than current market prices; projected prices indicate that market prices are likely to continue to be lower than the breakeven price through the early 2020s.
- **Uncompetitive Resources:** ANWR oil reserves are among the most expensive opportunities in the industry, and will be much more expensive to develop than shale oil which is being produced in the lower-48 states.
- **Low Bids with High Discounts:** Any bids tied to leasing the sites may reflect only the option value of the site with significant discounts reflecting uncertainty surrounding volumes and costs to extract and bring to market.

- **Delay Optimizes Revenues:** Given that current market prices are lower than the cost to develop the 1002 Area reserves, it would make economic sense to delay the auctions.

Therefore, proceeding with the lease auctions under current market conditions is not likely to optimize lease revenues, and could simply serve to lock up assets with no potential production and associated revenue in the future.

3. GLOBAL OIL MARKET

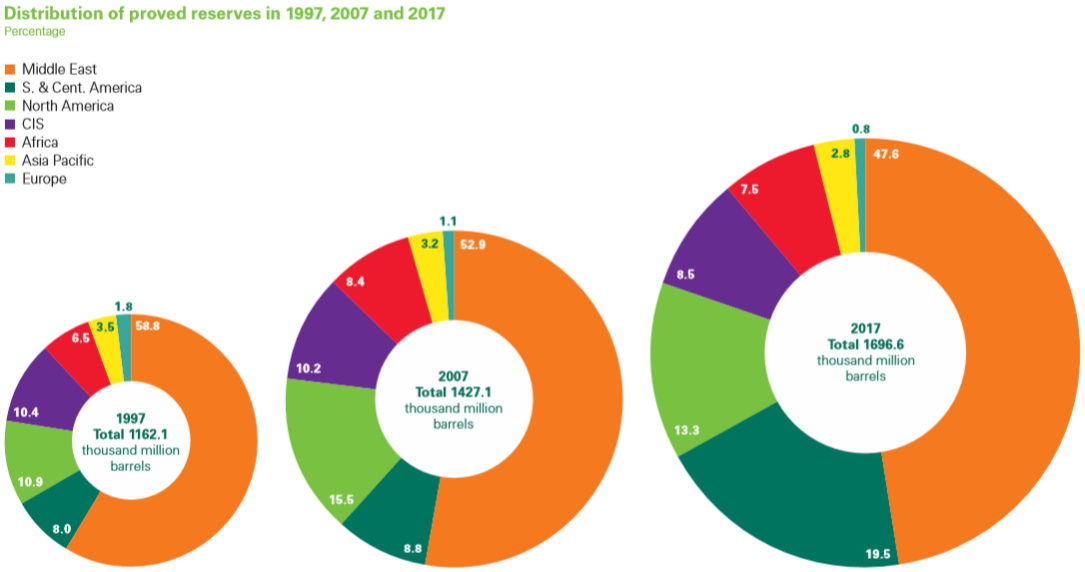
Oil is a global commodity that is shipped from oil-producing states to purchasers around the world. In accordance with basic economics, prices are driven by supply and demand. A critical part of price drivers are geo-political events that can dramatically impact supply, including decisions to withhold or produce oil by the Organization of the Petroleum Exporting Countries ("OPEC"). OPEC countries control 82 percent of all oil reserves,[54] giving this block of countries the opportunity to exercise monopoly power through coordinated efforts to establish production quotas to control prices. This section describes the factors that drive oil prices in order to explain the context behind recent impacts of shale technology on supply (**Section 4**) and projected impacts of automobile technology and business models on demand (**Section 5**).

3.1. Supply is concentrated

Proven reserves span the world with a substantial amount of conventional oil reserves located in the Middle East, although the relative share has been declining over the past two decades (**Figure 7**).

[54] Organization of the Petroleum Exporting Countries (OPEC), "OPEC share of world crude oil reserves, 2017," 2019, https://www.opec.org/opec_web/en/data_graphs/330.htm

Figure 7: Location and Size of Proved Oil Reserves Over Time[55]



Proved reserves in both North America (primarily Canada due to oil sands) and South America (primarily Venezuela) have increased the total amount of proved reserves along with the market share of the Americas. Although each country's value reflects estimation methods and system charges that may make direct comparisons to each other inconsistent, a relative comparison of oil reserves as by region indicates that the source of supply is growing and diversifying.[56]

Total proved oil reserves only tell a limited snapshot of the story and are a limited measure of total potential volumes. The estimated amount of proved oil reserves a country may have at any given time can change. Key factors that impact estimated reserves include changes in technology, market conditions and production. For purposes of calculating proved reserves, current prices, as measured by the past twelve months, for example, tend to be used.

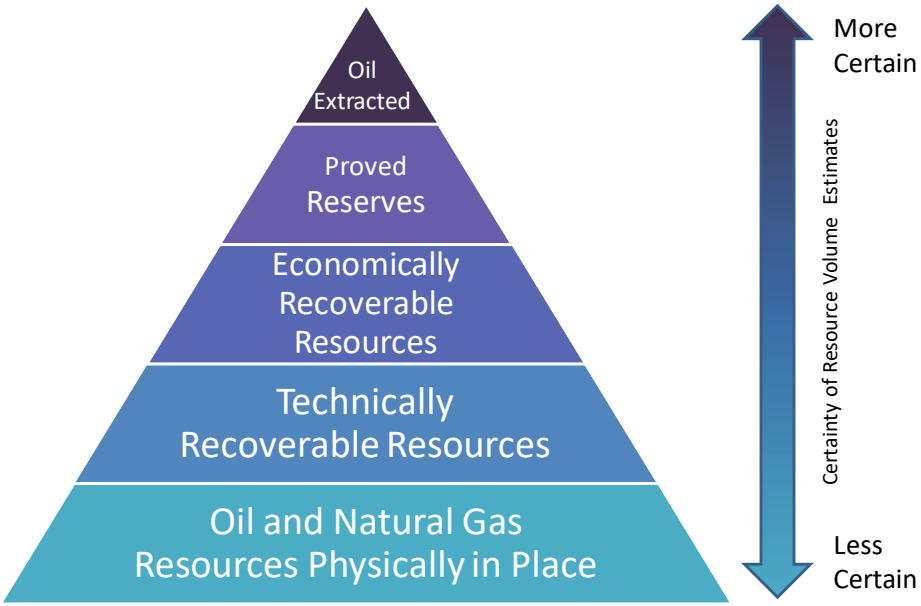
---

[55] BP, "Statistical Review of World Energy 2018," June 2018, 67th Edition, p. 13, https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf

[56] U.S. Energy Information Administration, "International Energy Statistics," 2019, https://www.eia.gov/beta/international/data/browser/

Most other measures of reserves reflect an estimate of oil and natural gas volumes that might be produced in the future, with future conditions being key. Other types of reserves estimates are therefore based on both facts and projections. As a result, reserves generally are grouped into categories based on the degree of their certainty and likelihood of extraction in the future (**Figure 8**).

Figure 8: Relationship of Different Measures of Oil Reserves[57]



Each of these four categories are described below[58]

1) **Proved Reserves:** This category is the most restrictive and reflects the most factual estimate of oil and gas that is available to a country under current economic conditions and technology given the geological formations already known and measured. In addition to changes in market and technological conditions, the amount of proved reserves is reduced by the volumes

[57] Energyzt representation of different measures of reserve volumes.
[58] U.S. EIA, https://www.eia.gov/todayinenergy/detail.php?id=17151 See also:
2011 guidelines issued by the Society of Petroleum Engineers,
https://www.spe.org/industry/docs/PRMS_Guidelines_Nov2011.pdf
The United Nations guidance on measuring energy reserves,
http://www.unece.org/fileadmin/DAM/ie/se/pdfs/UNFC/UNFCemr.pdf

extracted. There is reasonable certainty that the energy resources will be recoverable in future years. In the U.S., company estimates of reserves provided by publicly-traded companies are defined and regulated; estimates by other countries may not match the same definitions or level of certainty.

2) **Economically Recoverable Resources:** This category expands proven reserves to include additional plays that may not be currently producing, but are economically recoverable. The volume of economically recoverable oil rises and falls with prices. There is an inverse relationship with capital and operating costs whereby higher costs reduce economically recoverable resources.

3) **Technically Recoverable Reserves:** This broader category of oil and gas resources reflects the amounts that can be extracted based on current technology, processes, and geological knowledge, regardless of oil prices and costs. As innovation and information expands, so too can the measure of technically recoverable resources. U.S. government agencies tend to report technically recoverable resources instead of economically recoverable resources because it is easier to compare to estimates made by other countries versus economically recoverable resources which may be based on fluctuating estimates of price and costs.

4) **Remaining Oil and Gas in Place:** The broadest category reflects the total volume of oil and gas in place before the start of production less what already has been extracted. This is the most uncertain of the categories in that it could include stranded assets that may never be recovered unless technology and prices reach a level that makes these reserves technically and economically feasible.

It is important to reiterate the impact of changing prices on estimates of measurable reserves. Although a change in price would not impact the actual physical oil in the ground (i.e., the remaining oil in place or technically recoverable resources), a sustained reduction in prices could result in stranded assets. Furthermore, the economically recoverable resources and proved reserves would have to be reduced,

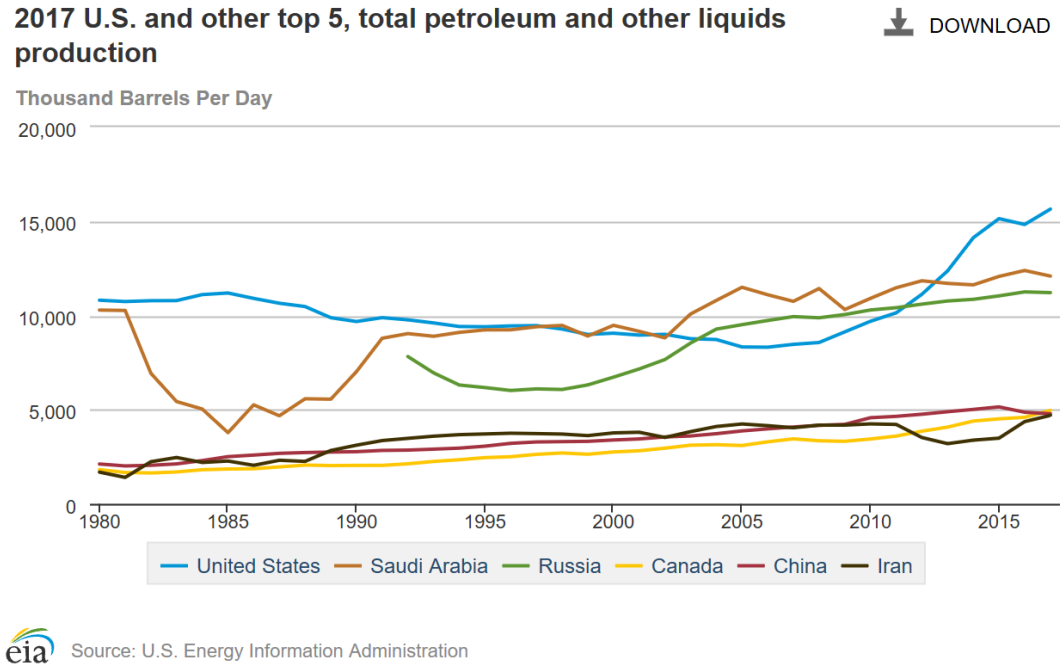
potentially with an impairment value calculated using SEC regulated formulas.[59] Therefore, actual and projected prices are an important input to company and country calculations of proved reserves and economically recoverable resources, making comparison across estimates potentially misleading without proper understanding of what those values represent. It also is critical to understand which metric is being used when estimated volumes of reserves are presented.

Furthermore, the physical amount of oil is constantly changing as new pools and plays are discovered. For the past thirty years, total oil reserves have been increasing as new volumes were discovered, prices increased, and technology costs fell. Canada became a top player of proved reserves once oil sands were incorporated into the estimate, followed by Venezuela's Orinoco discovery. At this point, U.S. reserves of unconventional oil have not been fully incorporated into country-wide estimates of proved reserves. Once they are, however, there will be a complete reconfiguration of where proved reserves are located (see **Section 4.1**).

Another way to examine the location of supply is through production, which presents a more factual basis for understanding what different countries can and are producing. Although the U.S. may not be among the top ten for proven reserves of conventional oil, the U.S. has been one of the top three producers of oil over the past forty years (**Figure 9**).

[59] For example, a number of oil companies had to take impairment charges for their Canadian oil sands investments in 2015 and 2016 when lower prices from the 2014 price crash were sustained for more than a year.

Figure 9: Annual Oil Production by Major Countries[60]

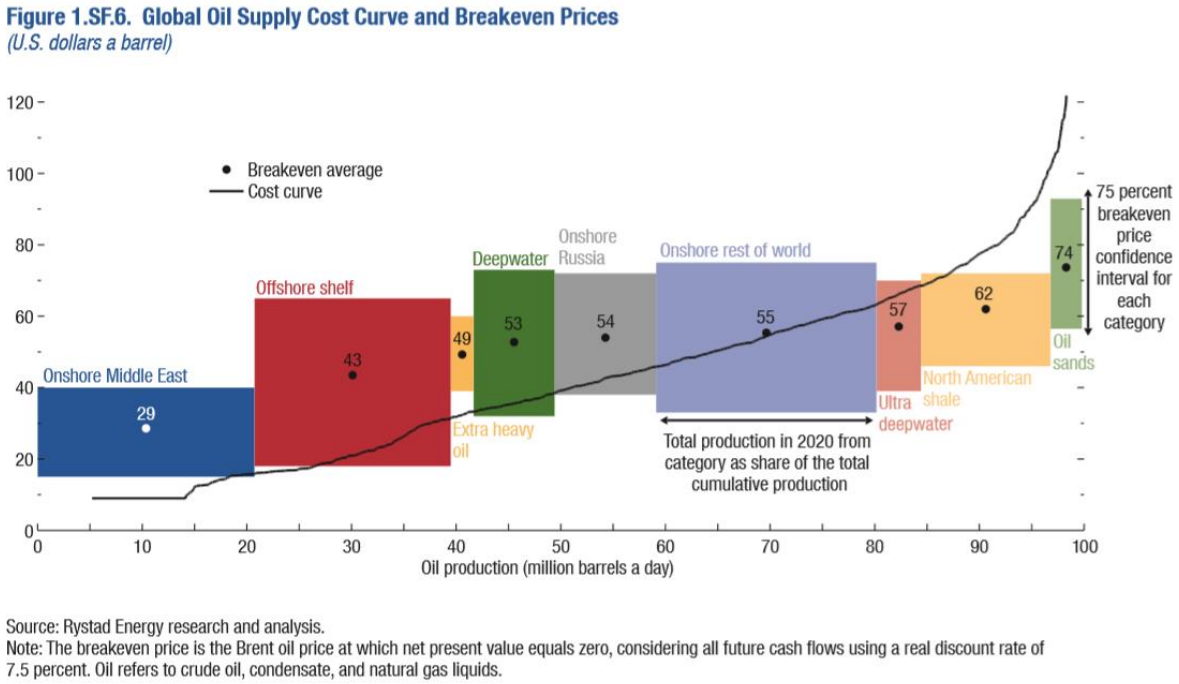


Global oil supply curves that can be used to derive prices also use actual production levels, as opposed to reserves. Combined with marginal costs of production, such supply curves provide insight into potential impacts of new supply or demand on prices.

Figure 10 plots production levels from key regions against estimates of their marginal cost of production. The height of the block represents a 75 percent confidence interval for the breakeven cost of production in each region; the width represents actual oil production on a daily basis (measured in million barrels per day). The large set of blocks in the middle ranging from 40 to 95 million barrels per day indicate a relatively large expanse of production with prices ranging from $40 to $80 per barrel. Global demand for oil in 2017 reached 98.5 million barrels of oil per day, which is projected to rise to above 100 million barrels per day in 2019.[61]

[60] US EIA, https://www.eia.gov/beta/international/?view=consumption
[61] U.S. Energy Information Administration, "Short-Term Energy Outlook," February 12, 2019, https://www.eia.gov/outlooks/steo/report/global_oil.php

Figure 10: Global Oil Supply Curve[62]



Source: Rystad Energy research and analysis.
Note: The breakeven price is the Brent oil price at which net present value equals zero, considering all future cash flows using a real discount rate of 7.5 percent. Oil refers to crude oil, condensate, and natural gas liquids.

Rising demand for oil in 2018 prompted multiple pundits to call for price spikes above $100 per barrel by the end of 2018.[63] Instead, global economic growth softened, and prices for Brent Crude fell to almost $50 per barrel, corresponding to onshore production.[64] In addition, North American shale has been gaining market share and serving as swing supply to set the price for oil.

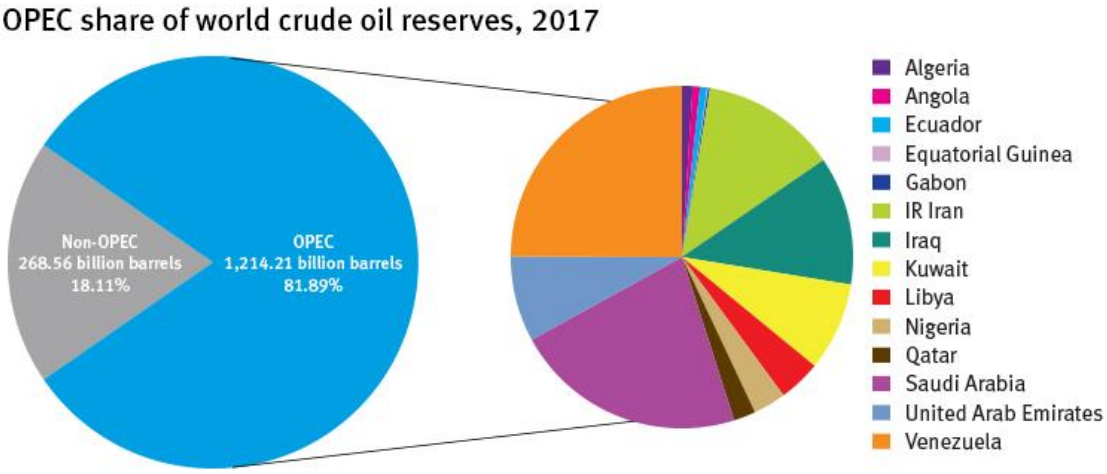
The combination of the supply curve and recent price experience illustrates that oil markets currently are operating on the steep part of the supply curve. Small changes can have a big impact (e.g., price projections ranging from $100 per barrel to $50 per barrel within a few months). As shale supply increases, and demand is impacted by new technologies, supply and demand could settle in at the flatter part of the supply

[40] International Monetary Fund, "World Energy Outlook," Chapter 1, 2017, p. 60, https://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017#Chapter 1
[63] Ashton, Gary, "Crude Oil Price Forecast: $100 All the Rage," Investopedia, September 30, 2018, https://www.investopedia.com/investing/crude-oil-price-forecast-100-all-rage/
[64] NASDAQ, https://www.nasdaq.com/markets/crude-oil-brent.aspx

curve, which would minimize the price impact of small changes in supply.

For the time being, OPEC continues to play a key role in setting oil prices. Representing more than 80 percent of oil reserves, the majority of OPEC member countries are located in the Middle East (**Figure 11**). The addition of Venezuela has only strengthened OPEC's price-setting capabilities; recent alliances with Russia make it even stronger.

Figure 11: OPEC Share of Oil Reserves as of 2017[65]



OPEC proven crude oil reserves , at end 2017 *(billion barrels, OPEC share)*

Venezuela	302,81	24,9%	Kuwait	101,50	8,4%	Qatar	25,24	2,1%	Gabon	2,00	0,2%
Saudi Arabia	266,26	21,9%	UAE	97,80	8,1%	Algeria	12,20	1,0%	Equat. Guinea	1,10	0,1%
IR Iran	155,60	12,8%	Libya	48,36	4,0%	Angola	8,38	0,7%			
Iraq	147,22	12,1%	Nigeria	37,45	3,1%	Ecuador	8,27	0,7%			

Source: OPEC Annual Statistical Bulletin 2018.

Representing such a significant block of supply, combined with the dominance of Saudi Arabia who single-handedly can serve as swing supply to punish defectors,[66] has allowed OPEC to set the price of oil at levels it targets since the 1970s. That said, there are a number of factors that have raised increasing challenges to OPEC's control over the past decade, including escalating demand from Asian countries and the increase in

[40] OPEC, https://www.opec.org/opec_web/en/data_graphs/330.htm

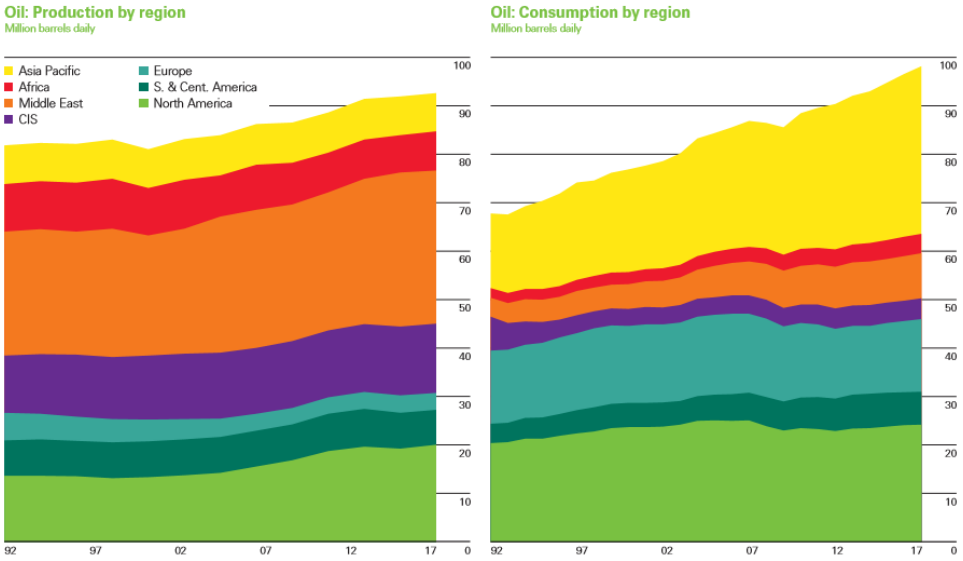
[66] The ability to punish defectors is a critical aspect of OPEC's success along with repeated cooperation opportunities. Without these two factors, game theory would predict that the alliance would fall apart as individual countries choose to "cheat" and produce higher output than their quotas allow.

shale oil supply from non-OPEC countries.

3.2. Demand growth faces policy challenges

In contrast to supply for conventional oil which is concentrated in Venezuela and the OPEC countries in the Middle East, demand for oil and oil products is heavily concentrated among developed countries. The largest consumers of oil and oil products are the developed countries, led by the United States and Europe (**Figure 12**).

Figure 12: Oil Consumption by Region (Million Barrels per Day)[67]



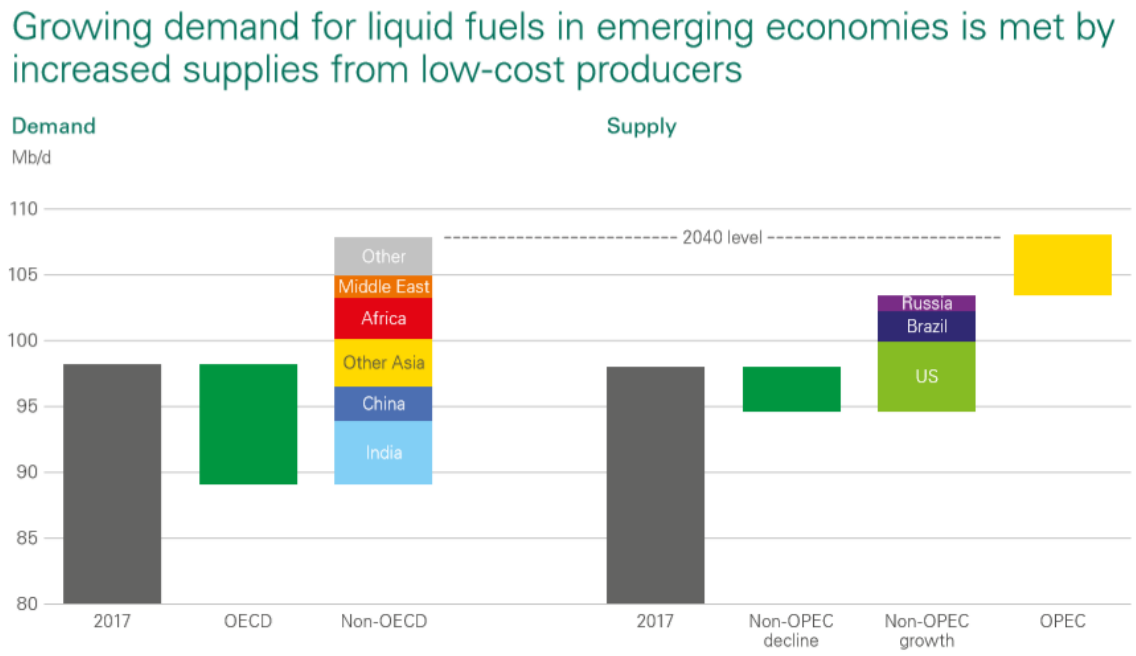
World oil production rose by only 0.6 million b/d in 2017, below average for the second consecutive year. Production fell in the Middle East (-250,000 b/d) and South & Central America (-240,000 Kb/d) but this was outweighed by growth from North America (820,000 b/d) and Africa (390,000 b/d). Global oil consumption growth averaged 1.7 million b/d, above its 10-year average of 1.1 million b/d for the third consecutive year. China (500,000 b/d) and the US (190,000 b/d) were the single largest contributors to growth.

The largest driver of growth in demand, however, is projected to come from developing countries, including China and India.[68] For example, BP projects that demand for liquid fuels (e.g., fuel oil, diesel, petrol and kerosene) will decline in developed countries while demand in developing countries is projected to grow; supply is expected to be met by increased production from the U.S. and OPEC countries (**Figure 13**).

---

[67] BP, "Statistical Review of World Energy 2018," p. 18.
[68] International Energy Agency, "Oil 2018," March 5, 2018, https://www.iea.org/oil2018/

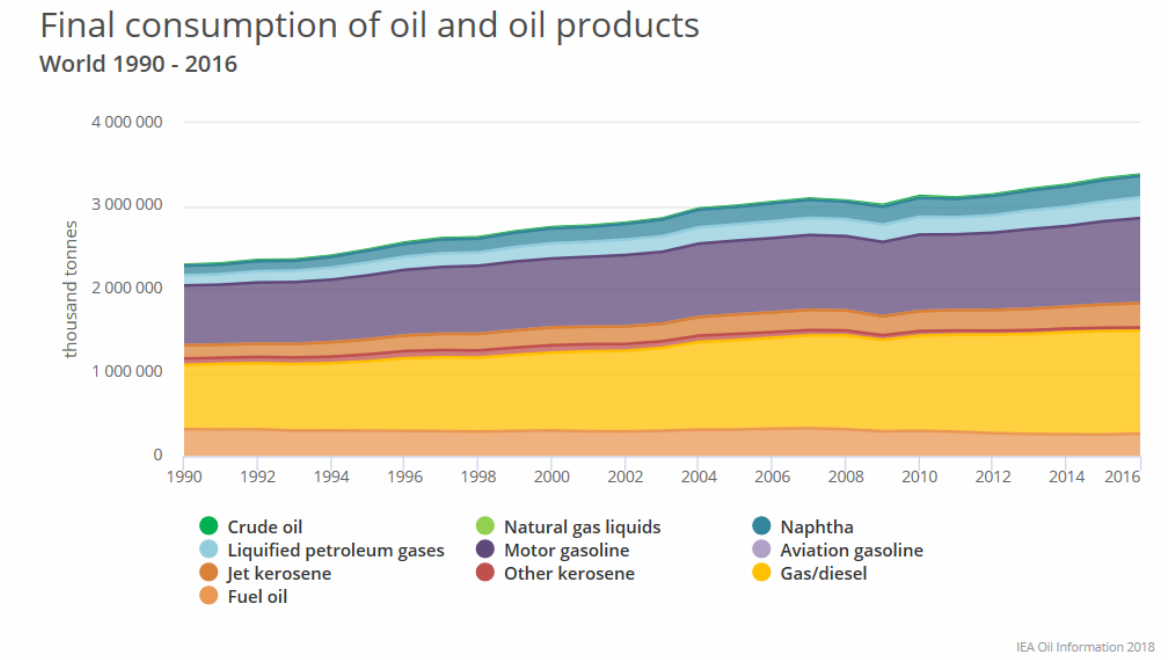
Figure 13: Projected Growth in Demand for Liquid Fuels[69]



Oil and oil products are consumed for a number of purposes. The largest component is for gasoline or diesel transportation, followed by aviation fuel. In 2016, roughly two-thirds of consumption was for transportation; the second largest use is for non-energy purposes such as feedstock and other manufacturing inputs (**Figure 14**).

[69] BP Energy Outlook, 2019 edition, p. 81, https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf

Figure 14: Final Consumption of Petroleum Products[70]



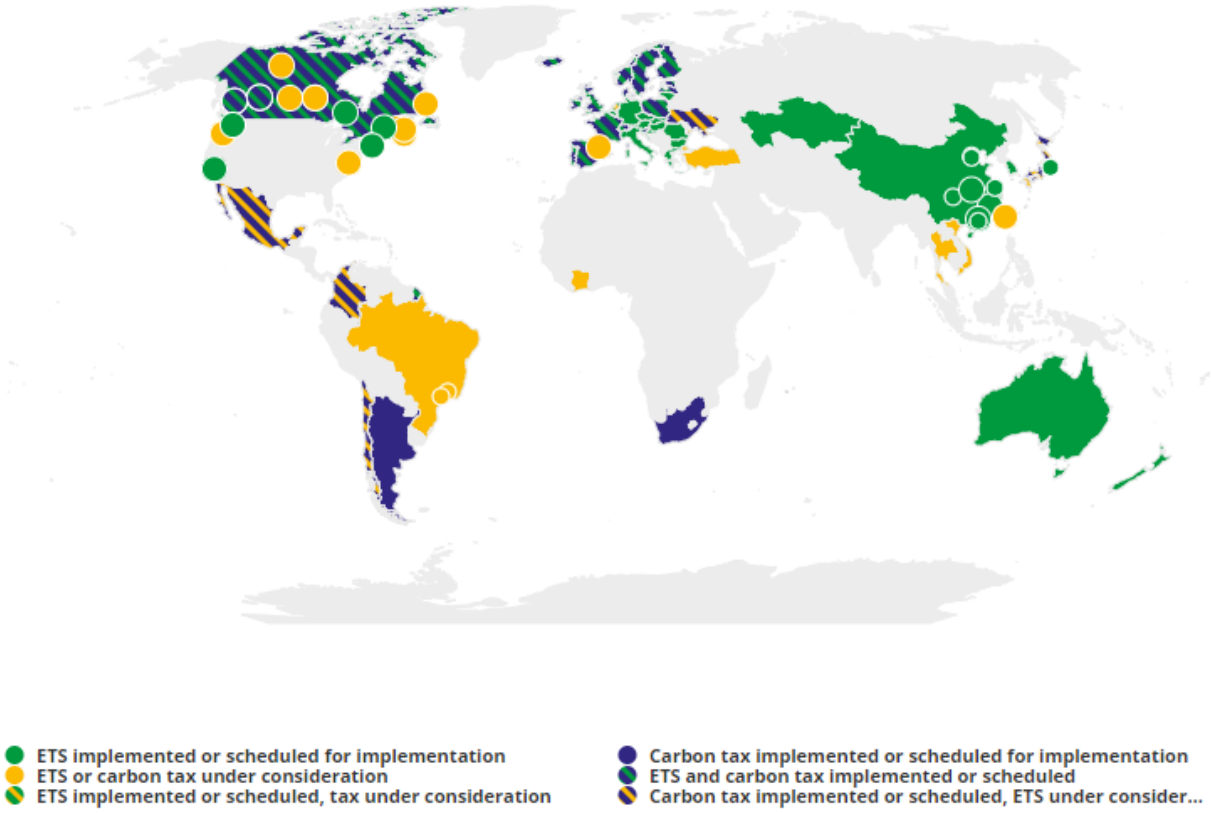
One of the limiting growth factors in developed, as well as developing, countries is the focus on decarbonization. Policies, laws and economic support are being provided on the local levels as well as by countries. According to the World Bank,[71] over 40 countries and 20 cities have implemented some form of carbon pricing (**Figure 15**). These policy initiatives cover roughly half of their carbon emissions – about 13 percent of annual global greenhouse gas emissions.[72]

[70] International Energy Agency, "Statistics: Global Energy Data at your Fingertips," https://www.iea.org/statistics/?country=WORLD&year=2016&category=Oil&indicator=OilProductsCons&mode=chart&dataTable=OIL

[71] World Bank, "Pricing Carbon," http://www.worldbank.org/en/programs/pricing-carbon

[72] *Ibid.*

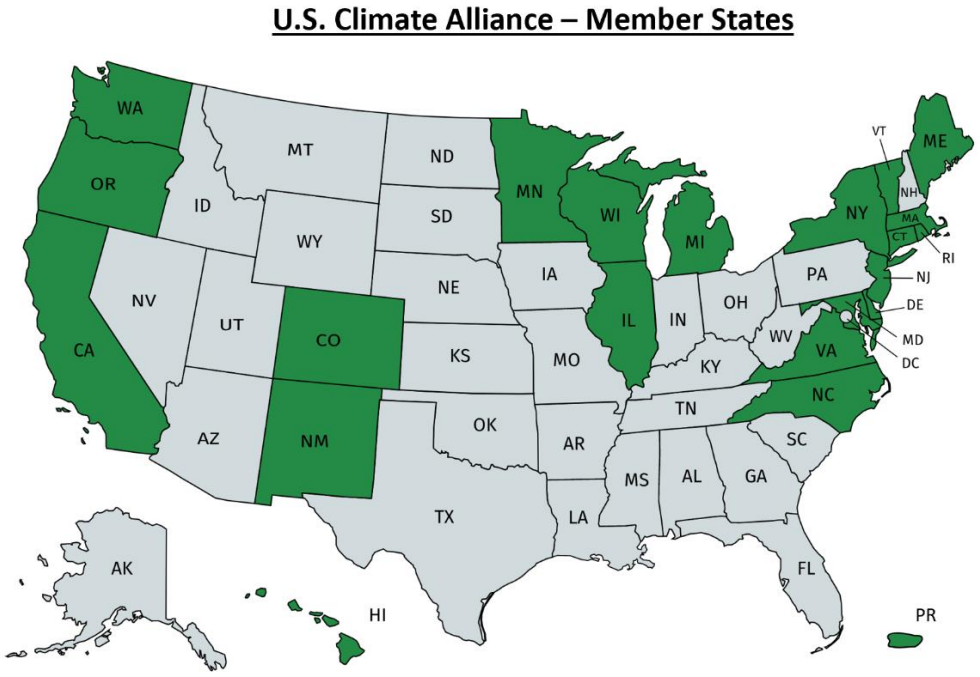
Figure 15: Map of Regional, National and Subnational Carbon Pricing Initiatives[73]



Individual states in the U.S. are included in this count. Following the Trump Administration's withdrawal from the Paris Agreement, a number of states vowed to uphold the agreement.[74] The United States Climate Alliance ("Alliance") member states agree to implement policies that advance the Paris Agreement, and aim to reduce greenhouse gas emissions by at least 26 to 28 percent below 2005 levels by 2025.[75] Currently, 21 states plus Puerto Rico are members of the Alliance (**Figure 16**).

[73] World Bank, "Carbon Pricing Dashboard," https://carbonpricingdashboard.worldbank.org/
[74] Garfield, Leanna and Gould, Skye, "This map shows which states are vowing to defy Trump and uphold the US' Paris Agreement goals," *Business Insider*, June 9, 2017, https://www.businessinsider.com/us-states-uphold-paris-agreement-2017-6
[75] United States Climate Alliance, https://www.usclimatealliance.org/alliance-principles

Figure 16: Member States of the U.S. Climate Alliance (Green States)[76]



Many states are going beyond the Alliance goals. For example, the six New England states currently participate in the Regional Greenhouse Gas Initiative and have targeted an 80 percent reduction in 1990 levels of carbon emissions by 2050.[77] In December 2018, Massachusetts and eight other Northeast and Mid-Atlantic states, plus the District of Columbia, released an agreement to develop a framework for a regional program to reduce transportation sector greenhouse gas emissions.[78] The New York Green New Deal announced by Andrew Cuomo in January 2019 targets a net zero carbon emissions economy,[79] as do similar plans in California and Hawaii.[80] The

[76] World Bank, "Carbon Pricing Dashboard."
[77] RGGI, Inc., https://www.rggi.org/; ISO-NE, 2018 Regional Energy Outlook, February 2018, p. 28, https://www.iso-ne.com/static-assets/documents/2018/02/2018_reo.pdf
[78] Massachusetts Executive Office of Energy and Environmental Affairs, December 18, 2018, https://www.mass.gov/news/commonwealth-joins-regional-states-to-reduce-transportation-emissions
[79] Cuomo, Andrew M., "2019 Justice Agenda: The Time is Now," https://votesolar.org/files/7415/4758/4798/SoS_Briefing_Book_2019.pdf
[80] Penn, Ivan, "California Lawmakers Set Goal for Carbon-Free Energy by 2045," *The New York Times*, August 28, 2018, https://www.nytimes.com/2018/08/28/business/energy-environment/california-clean-energy.html

Governor of Minnesota also has presented a plan for 100 percent carbon-free electricity by 2050.[81]

In addition, large investors, led by many of the proactive state pension funds, are calling for utilities to go zero carbon by 2050.[82] The effort by investors to understand company and investment risks tied to carbon emissions has increased over the past decade. Oil companies such as Exxon increasingly are facing investor proposals to set targets for carbon emissions and increase disclosure of environmental risks.[83]

Placing a price on carbon is an efficient way to accomplish the objective of reducing the environmental impact associated with carbon emissions. In the fall of 2018, a United Nations scientific panel stated that pricing carbon dioxide emissions is key to reducing carbon emissions and controlling global warming.[84] In January 2019, a number of Nobel Prize winning economists, former Chairs of the Federal Reserve, former Chairs of the Council of Economic Advisors, Secretaries of the U.S. Department of Treasury and other illustrious signatories signed the "Economists' Statement on Carbon Dividends," advocating for putting a tax on carbon and distributing the dividends back to tax payers for investment in the form of equal lump-sum rebates.[85]

Such policy programs that target carbon are expected to continue to expand and will have to target transportation emissions if meaningful reductions are to be realized. In the U.S., transportation accounts for around one-third of total carbon emissions (**Figure 17**). A carbon tax can help to incentivize the transition away from high carbon

---

[81] Austin, Paul, "Press Release: One Minnesota Path to 100% Clean Energy is Bold and Pragmatic," *Conservation Minnesota*, https://www.conservationminnesota.org/news/interests/energy-climate-and-transportation/press-release-one-minnesota-path-to-100-clean-energy-is-bold-and-pragmatic/

[82] Kerber, Ross, "Big U.S. Pension Funds Ask Electric Utilities for Decarbonization Plans," US News, February 28, 2019, https://www.usnews.com/news/top-news/articles/2019-02-28/big-us-pension-funds-ask-electric-utilities-for-decarbonization-plans

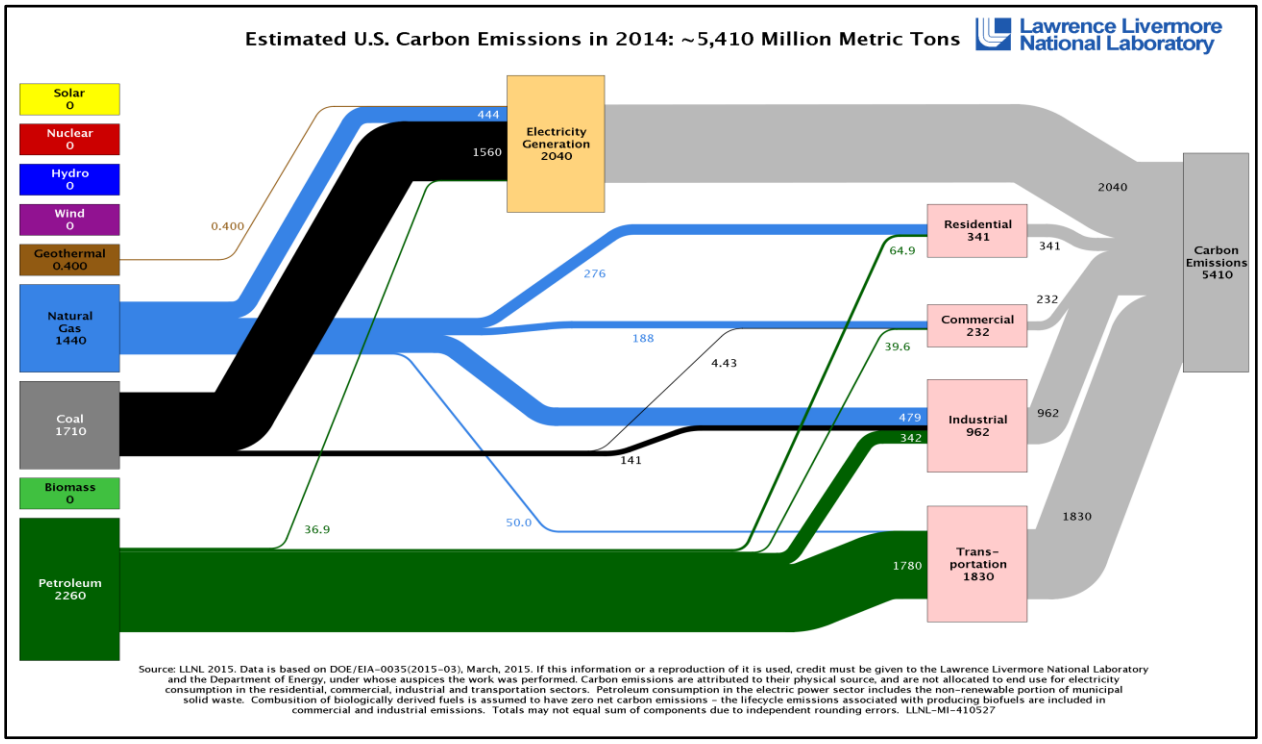
[83] Crooks, Ed, "Exxon seeks to block vote on investor proposal on emissions," *Financial Times*, February 24, 2019, https://www.ft.com/content/800fb008-3853-11e9-b72b-2c7f526ca5d0

[84] Plumer, Brad, "New U.N. Climate Report Says Put a High Price on Carbon," *The New York Times*, October 8, 2018, https://www.nytimes.com/2018/10/08/climate/carbon-tax-united-nations-report-nordhaus.html

[85] "Economist's Statement on Carbon Dividends," https://www.econstatement.org/

emitting transportation resources by making internal combustion engines less competitive than electric vehicles, motivating higher energy efficiency transportation technology, and shifting travel decisions away from high carbon intensity modes of travel. The price signal also would allow the market to find and/or create the most cost-effective alternatives.

Figure 17: Source of Carbon Emissions in the U.S.[86]



3.3. Oil prices are low but volatile

Although there are roughly 160 different types of oil that vary in terms of weight, viscosity and chemical composition (e.g., sulfur content), markets generally trade around two price indices for futures (i.e., Brent Crude oil and Western Texas Intermediate ("WTI")).[87] Both indices are traded on the New York Mercantile Exchange (NYMEX) and the Intercontinental Exchange (ICE), and reported by the Chicago

[86] Lawrence Livermore National Laboratory, https://flowcharts.llnl.gov/commodities/carbon
[87] Other important oil price indices include the Dubai Crude, Oman Crude, Urals oil and the OPEC Reference Basket.

Mercantile Exchange. Prices reflect global and domestic supply and demand conditions, described in more detail below. Wellhead prices also are available, with the most relevant for ANWR being the North Slope First Purchase Price, which is highly correlated with both Brent and WTI, differing by the transportation cost required to bring the oil to market.

With a large market in Western Europe, Brent Crude is an international index for oil prices. Brent Crude is sourced from the North Sea and oil production coming from Europe, Africa and western flows from the Middle East are priced relative to this oil. Brent Crude is ideal for making gasoline and middle distillates and is used to price about two-thirds of the internationally-traded crude oil supplies in the world. As of early March 2019, Brent Crude was trading over the counter at around $65 per barrel. Prices have traded as low as $2.23 per barrel in 1970 to a high of $145.61 per barrel in 2008.[88]

The U.S. tends to rely predominantly on WTI, although the U.S. also requires heavier crude for certain applications. WTI is known as "Texas light sweet," a grade of crude oil described as "light" because of it relatively low density and "sweet" because of low sulfur content. Prices have ranged from $1.42 per barrel in 1946 to $145.31 in 2008. Although WTI and Brent Crude tend to track each other, discrepancies can occur due to chemical content, physical constraints such as limitations on refinery capacity and global supply or transportation disruptions. Most recently, WTI has been trading lower then Brent Crude and is currently at around $55 per barrel.

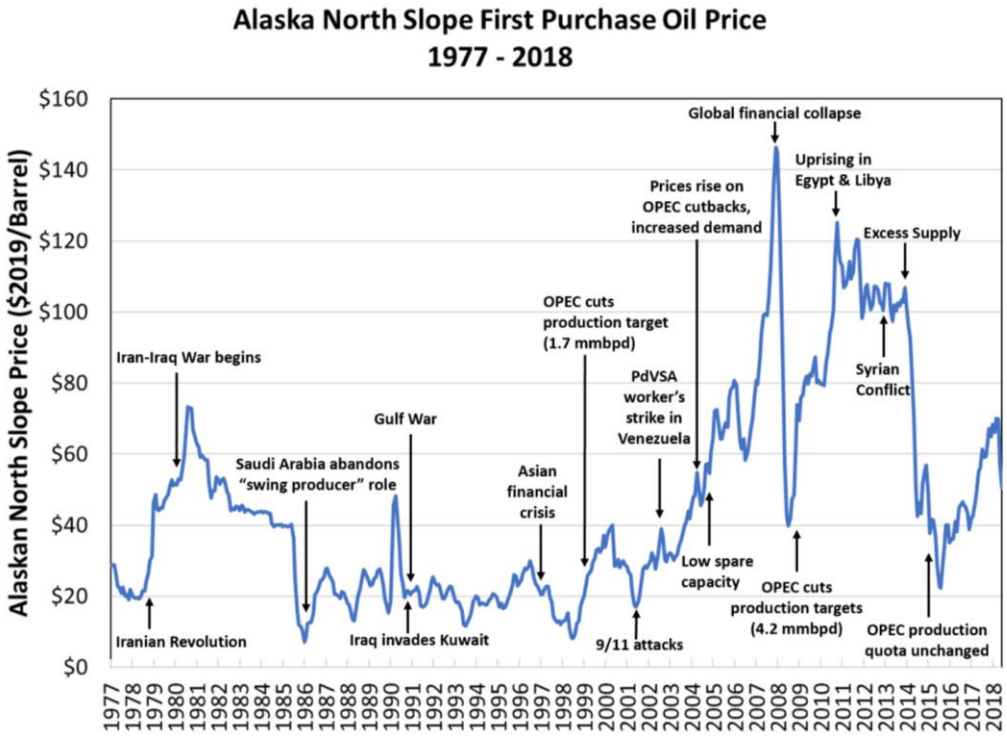
The relationship between North Slope wellhead prices and the international and domestic indices tends to reflect the transportation cost required to bring North Slope prices to market. Therefore, a breakeven price at the wellhead in ANWR needs to be adjusted by at least $5 per barrel for comparison to Brent Crude, and by around $8 to $10 per barrel for comparison to WTI.[89]

Oil prices tend to be very responsive to geo-political events due to their

[88] Trading Economics, https://tradingeconomics.com/commodity/brent-crude-oil
[89] Based on Energyzt analysis of historical North Slope prices to Brent and WTI.

anticipated impact on supply and demand. When political conflict breaks out in the Middle East or other oil-producing regions, oil prices can spike. Similar, softening of global projections for demand due to economic recessions or financial crises tend to cause oil prices to fall. The correlation between Brent Crude prices and the North Slope means that global events impact prices at which oil from Alaska can be sold. **Figure 18** illustrates how historical oil prices at the North Slope in Alaska, adjusted for inflation, have been impacted by events over the past fifty years.

Figure 18: Relationship of North Slope Oil Prices to Geo-political Events[90]



After hitting a high approaching $150 per barrel in 2008, oil prices fell to around $40 per barrel as a result of the global financial collapse and then rose to above $100 per barrel as a result of OPEC production cuts. Prices crashed at the end of 2014 to below $30 per barrel due to excess supply and softening demand. Although oil prices are

[90] Energyzt Analysis of US EIA, North Slope First Purchase Price adjusted for inflation using the Consumer Price Index to $2019; events identified by the U.S. EIA and historical review, "North Slope First Purchase Price," https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=F005071__3&f=M

recovering, they remain well below peak prices.

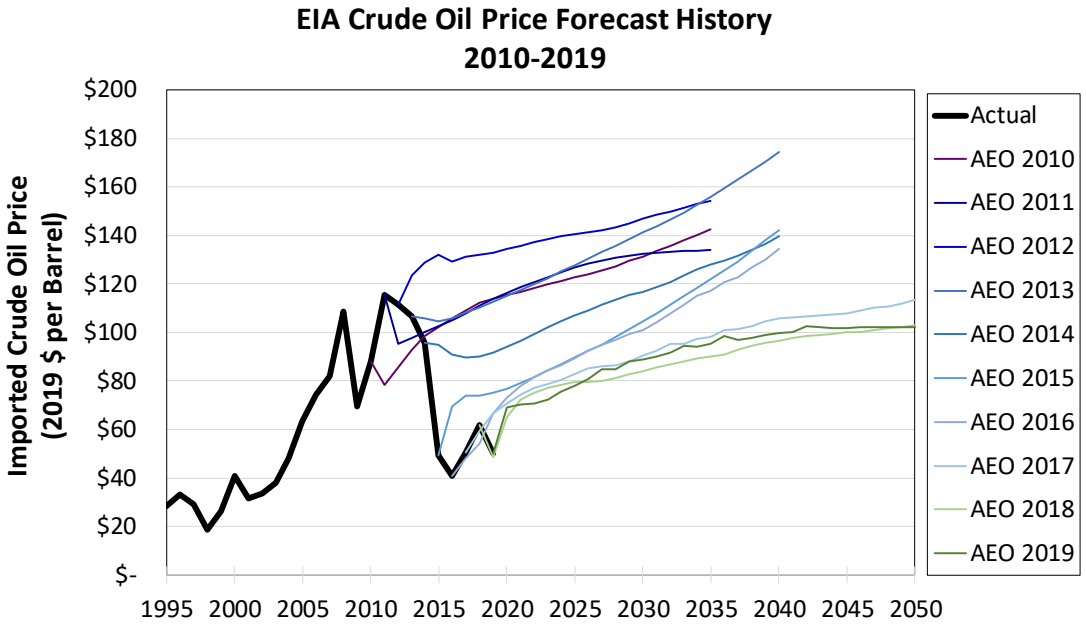
Short-term forecasts by the EIA and others anticipate that these low oil price trends will continue through the mid-2020s. Thereafter, under the assumption of increasing global demand for oil, the EIA projection in its AEO 2019 Reference Case increases to above $100 ($2018) per barrel by 2040.[91] It is clear, however, that the EIA projections are tied to conservative projections of the adoption of electric vehicles with minimal incorporation of how other technologies will contribute to electric vehicle adoption rates (**Section 5.1**).

Furthermore, there are inherent limitations to the EIA price projections that have resulted in a history of underestimating the impact of extant trends, especially in light of new technology such as horizontal drilling and shale production (**Figure 19**).[92] Therefore, such long-term forecasts, should be considered in context and compared to other projections and anticipated policies and events.

[91] In the High Oil Price case, the price of Brent crude oil, in 2018 dollars, is projected to reach $212 per barrel by 2050 compared with $108 per barrel in the Reference Case and $50 per barrel in the Low Oil Price case. U.S. EIA, AEO 2019, p. 33.

[92] As already mentioned, EIA price forecasts are required to assume current legislation as passed and are not able to incorporate anticipated policy changes.

Figure 19: Actual Imported Crude Oil Prices vs. EIA Forecasts (2010 – 2019)[93]



As will be discussed in the next two sections, other forecasts that provide a high technology adoption rate project that oil prices will continue at current rates, with some anticipating a significant impact on the world oil regime. Even if a major disruption does not occur, incremental technological improvements in shale oil recovery costs will continue to put downward pressure on global oil prices. As a result, ANWR is not projected to be economic in the near-term and, under realistic expectations concerning incremental technological improvements, would not have economically recoverable reserves over the long-term.

3.4. Key Points about global oil markets

Global oil markets are volatile and subject to geopolitical events as well as monopolistic whims that drive supply and demand conditions. OPEC, representing 80 percent of total proved oil reserves, has the ability to set the price based on supply production or cuts in response to demand. Keeping prices high, however, is only recently

[93] Energyzt analysis of U.S. EIA, Historical AEO Projections 1980 – 2019 oil price data versus EIA AEO price projections.

being held in check by the ability of non-OPEC countries such as the U.S. to produce shale oil at competitive prices. OPEC thus faces a dilemma of maintaining high oil prices at the risk of losing market share. Although Saudi Arabia, the country with the largest proved reserves of conventional oil, has been able to keep OPEC members in check historically, the increasing diversity of reserves and flexibility of U.S. shale to operate as swing supply by responding to price signals may be eroding OPEC's monopoly power.

Demand is a key part of oil prices. With many developed countries moving towards reducing their carbon footprint, addressing carbon emissions from transportation will be key. As a result, demand from developed countries is projected to decline while global demand only increases due to higher consumption by developing countries such as China, India, Africa and the Middle East. This increasing demand is likely to be met by U.S. shale oil production, followed by increases in OPEC production, as described further in the next section. The mid-term challenge to the global oil regime ties to changes in energy consumption patterns and demand, described further in **Section 5**.

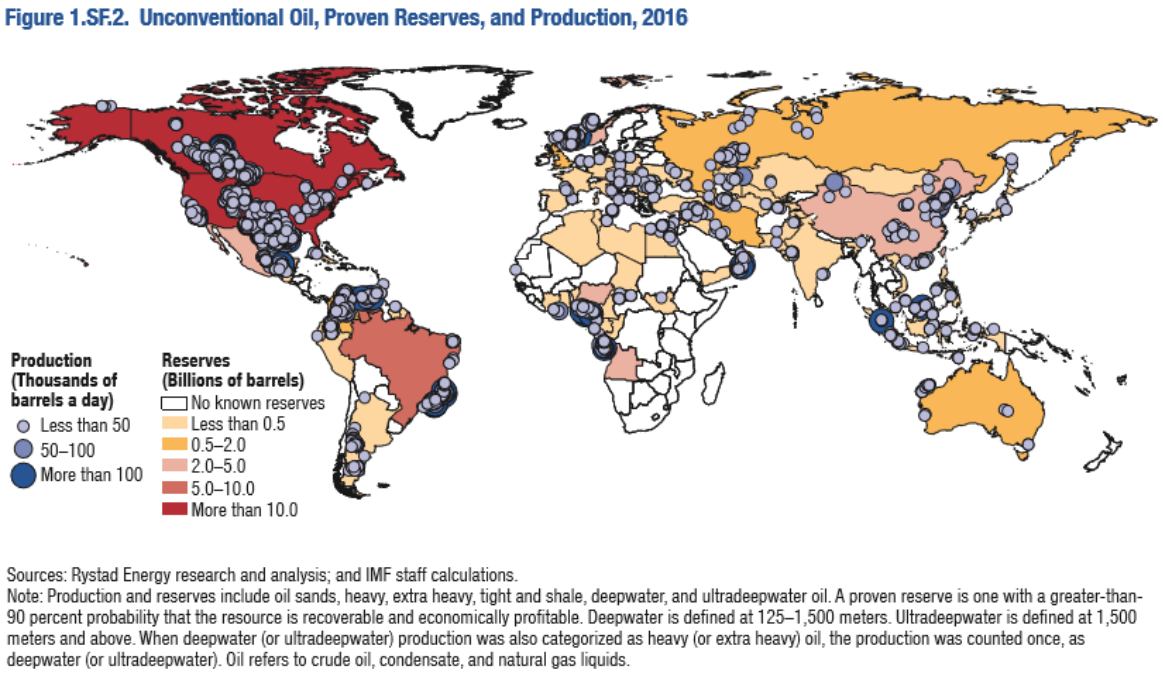
4. IMPACT OF NEW TECHNOLOGIES ON SUPPLY

Technological improvements can increase both the amount of technically feasible reserves and lower the price at which those reserves are economic to extract. The past decade has experienced a significant change in the way oil is extracted in the U.S. and elsewhere. Unconventional oil drilling (i.e., technology used to extract shale oil) now dominates production in the U.S. The increase in reserves and production has served to mitigate OPEC's market power. In addition, lowering the costs of extraction make shale plays increasingly competitive against global supply, as well as ANWR. The net impact is an anticipation that the U.S. will be a net exporter of oil by 2020. Indeed, the EIA is using this as its reference case in its most recent projections.

4.1. U.S. oil reserves are significantly higher due to shale

Although unconventional oil plays exist around the world, they are most significant in North America (**Figure 20**). In Canada, unconventional oil is predominantly associated with oil sands. In the U.S., unconventional oil tends to refer to tight and shale oil which generally is obtained via horizontal drilling.

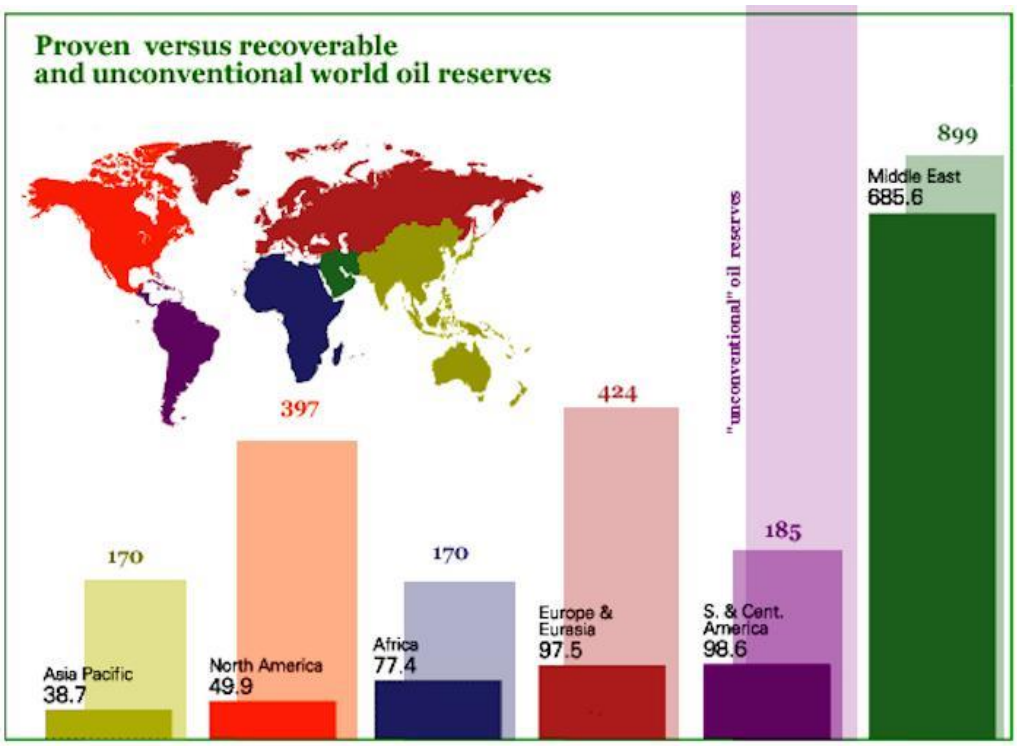
Figure 20: Location of Unconventional Oil Reserves and Production[94]



Estimated reserves tied to unconventional shale plays effectively turns the current oil regime on its head. Whereas supply currently is located in areas with relatively low demand for oil, unconventional reserves balance supply and demand geographically so that supply is located in the developed countries such as North America and Europe. Countries that had been net importers of oil, have the opportunity to become net exporters. North American reserves alone increase from 25 years of supply to 200 years when recoverable reserves using unconventional oil are taken into consideration (**Figure 21**).

[94] International Monetary Fund, "World Economic Outlook, April 2017: Gaining Momentum?" April 2017, p. 56, https://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017#Chapter 1

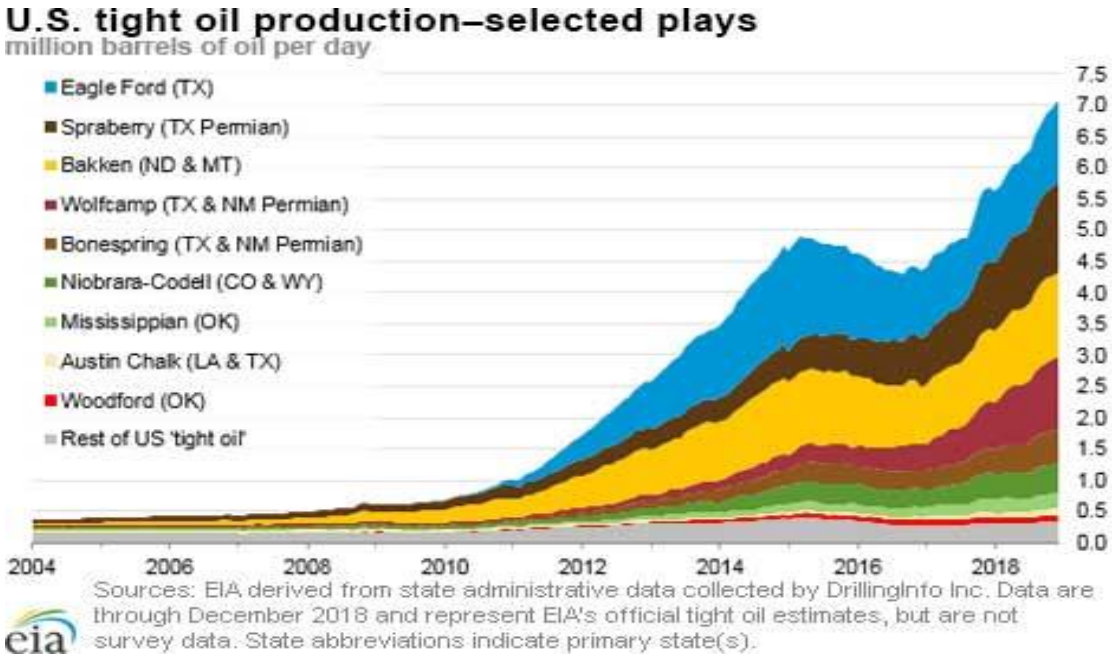
Figure 21: Oil Reserves by Region Adjusted for Unconventional Oil[95]



The impact already is being seen in U.S. oil production where horizontal rigs are replacing traditional vertical rigs.[96] Although the 2014 price crash initially caused a production decline, cost cuts and technological improvements quickly allowed volumes to recover. Whereas shale prices had been estimated at between $65 to $80 per barrel, current estimates range from $35 and $65 per barrel.[97] As a result, production continues to increase, despite lower oil prices (**Figure 22**).

[95] Conca, James, "US Winning Oil War Against Saudi Arabia," Forbes.com, 2015, https://www.forbes.com/sites/jamesconca/2015/07/22/u-s-winning-oil-war-against-saudi-arabia/#6cb08b911678
See also, Institute for Energy Research, https://www.instituteforenergyresearch.org/wp-content/uploads/2015/05/U.S.-Oil-Shale-Foreign-Oil-Reserve-Estimates-Mar-15.png
[96] Energyzt Analysis of Baker Hughes, "North America Rotary Rig Count," http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsothe r
[97] Bloomberg NEF, "Economics of U.S. Shale Oil Production," June 1, 2018, https://about.bnef.com/blog/economics-u-s-shale-oil-production

Figure 22: Production from U.S. Shale Plays[98]



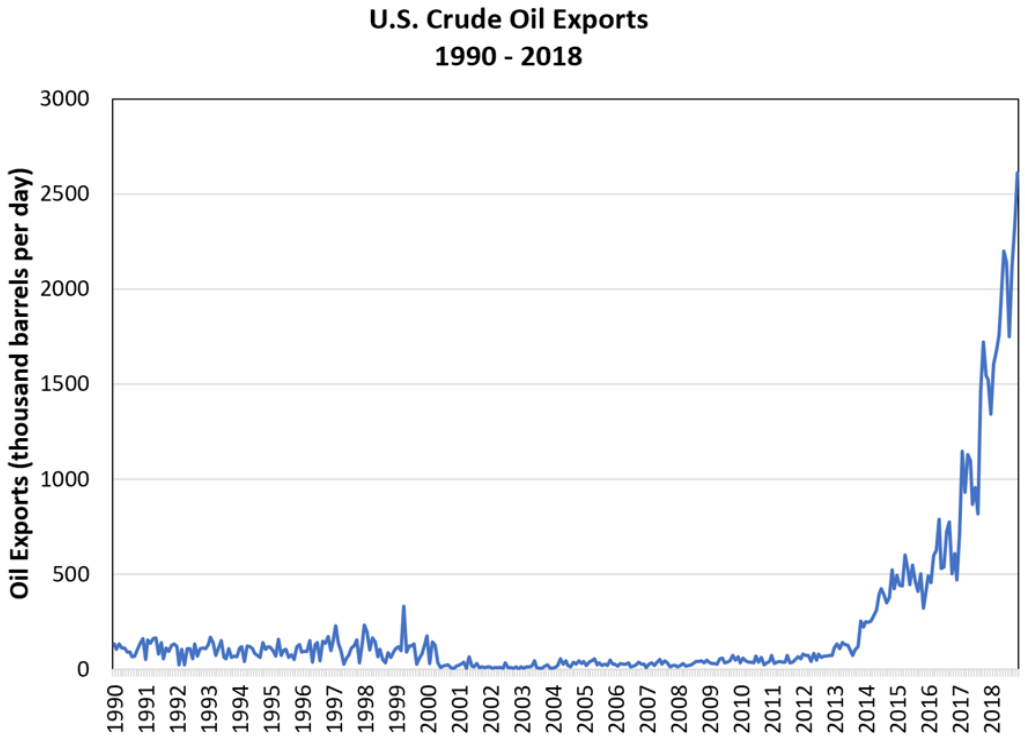
Increased output in the face of softening demand already is modifying the balance of trade between the U.S. and global markets, reversing a downward trend in U.S. oil production and decreasing reliance on foreign oil. As a result of growing exports, the role of the U.S. in global oil markets is changing.

4.2. U.S. is projected to be a net exporter

With rising oil production domestically, the need for oil imports declines. Although the U.S. will continue to import at least some of the heavier crude from international markets, increased production from shale already has increased exports from the U.S. into other markets (**Figure 23**).

[98] US EIA, https://www.eia.gov/energyexplained/index.php?page=oil_where#tab2

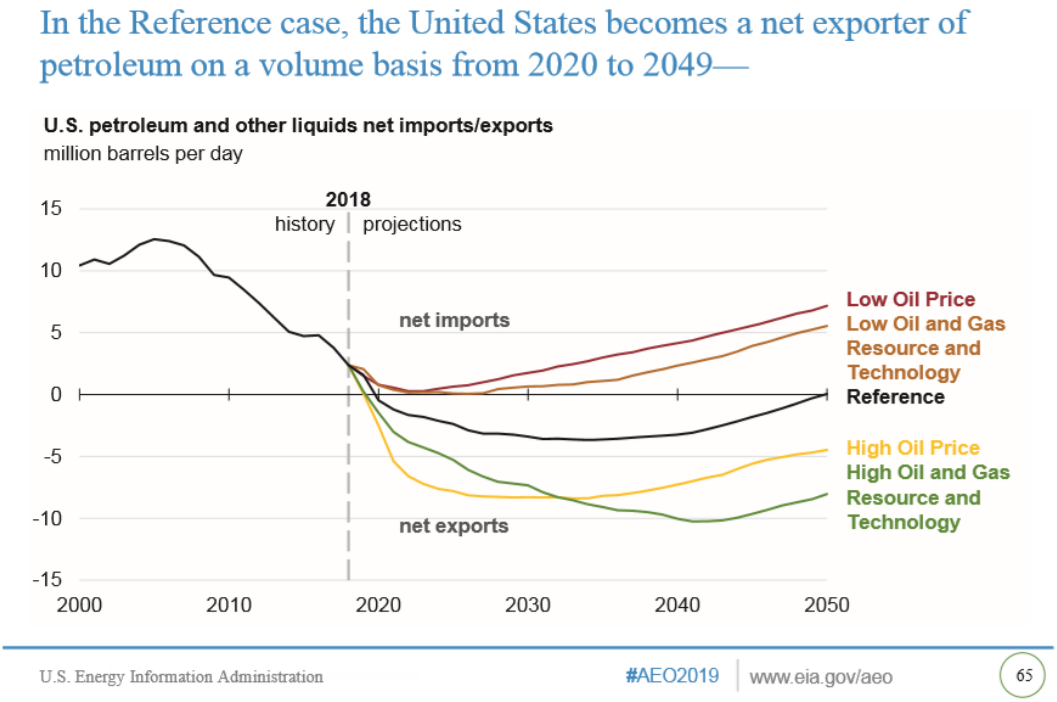
Figure 23: U.S. Oil Exports [99]



Production of unconventional oil in the lower-48 states is projected to continue. As a result, the EIA has estimated that the U.S. will become a net exporter of oil by 2020 under the Reference Case and remain so through 2050 (**Figure 24**). If oil and gas prices increase, U.S. oil production also would increase and the U.S. would export even more oil, resulting in net exports of potentially 10 million barrels per day by 2040. In contrast, under low oil prices (i.e., Brent prices at around $50 per barrel),[100] domestic oil production could decline and demand increase,[101] maintaining the country's current position as a net importer of oil.

[99] U.S. EIA, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCREXUS2&f=M
[100] U.S. EIA, AEO 2019, p. 34.
[101] U.S. EIA, AEO 2019, p. 16.

Figure 24: U.S. EIA Projection that the U.S. is a Net Exporter of Oil[102]



When oil prices are high enough to support development of the 1002 Area, the oil is not needed for domestic use because the U.S. is a net exporter of oil at those prices. When oil prices are low enough that the U.S. is a net importer, oil production from the 1002 Area is more expensive than market prices as well as the less costly shale oil resources in the lower-48 states. Therefore, any oil that could be produced economically from the 1002 Area would be sold into international markets.

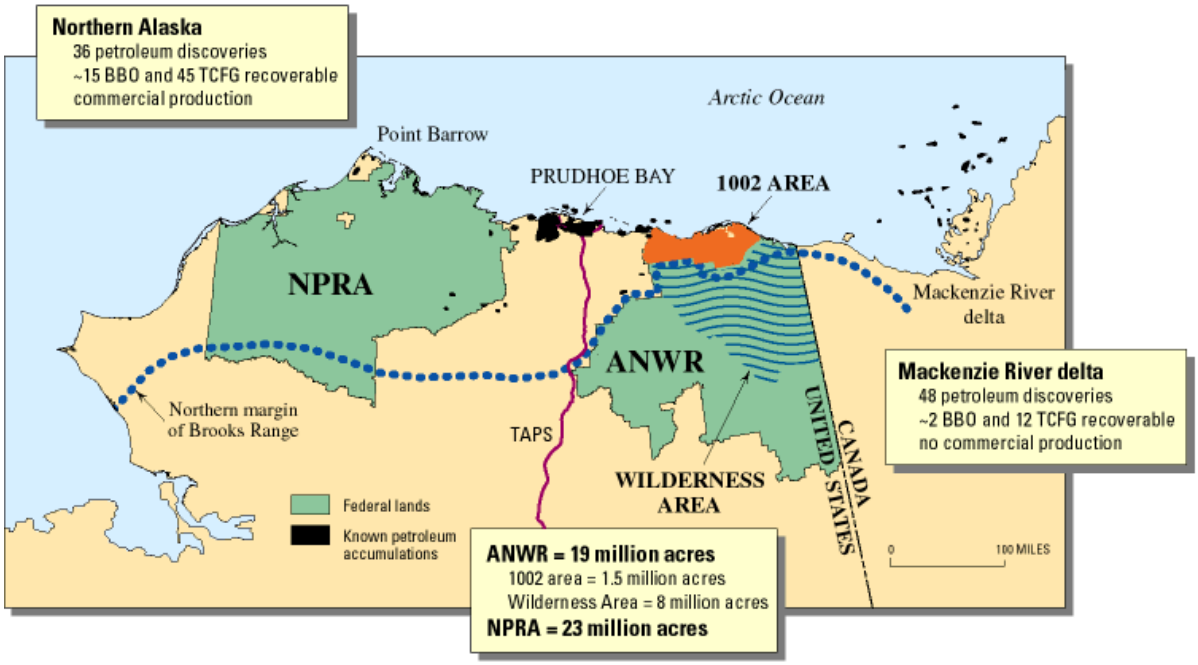
4.3. The 1002 Area faces competition from the North Slope

A recent announcement from the Department of Interior ("DOI") indicates that ANWR oil also faces increased competition from other resources on the North Slope of Alaska. Although production from Prudhoe Bay has declined over the years, recent studies have confirmed a significant amount of oil still is available in the National Petroleum Reserves in Alaska ("NPRA"). Located to the west of ANWR on the North Slope, NPRA already has a significant amount of drilling and testing (**Figure 25**). The

[102] U.S. EIA, AEO 2019, p. 65.

DOI recently confirmed recoverable oil reserves totaling 8.7 billion barrels onshore in the NPRA compared to previous 2010 estimates of only 1.5 billion barrels.[103]

Figure 25: Location of National Petroleum Reserve in Alaska versus ANWR[104]



Resources in or near the NPRA could be more competitive than potential production from ANWR for the following reasons:

1) **Proved Reserves:** Reserves already have been tested and proven whereas ANWR does not have any recent data and would require expensive test drilling.

2) **Single Pool versus Multiple Traps:** It appears that the new NPRA reserves may reside in large pools, making it more economic to develop whereas ANWR appears to be located in multiple traps, creating more uncertainty and more expensive extraction.

---

[103] Department of Interior, "New Interior Department Survey Shows HUGE Increase in Recoverable Energy Resources in Federal, State and Native Lands and Waters in Alaska," December 22, 2017, https://www.doi.gov/pressreleases/new-interior-department-survey-shows-huge-increase-recoverable-energy-resources

[104] USGS, https://pubs.usgs.gov/fs/fs-0028-01/image1.gif

3) **Operations:** Extraction already has been occurring in the NPRA, creating certainty and potentially existing infrastructure that can be levered.

4) **Timing:** Leases already are being sold, primarily on contiguous parcels to existing production, allowing for faster time to market.

5) **More Certainty:** Given the long history of drilling in the NPRA, there is less uncertainty around key issues that have yet to be surmounted as compared to ANWR.

As a result, NPRA creates potentially formidable competition that could be first to utilize the available TAPS capacity and contract with existing Jones Act vessels, leaving oil from the 1002 Area without access to market and requiring an even larger commitment to procure transportation for uncertain volumes.

4.4. The 1002 Area production is not competitive

Shale technology dramatically impacts the "need" for oil from the 1002 Area. With shale oil production continuing to rise, and the U.S. projected to be a net exporter of oil by 2020, ANWR oil is not needed to meet domestic needs.[105]

A comparison of the marginal cost of supply from ANWR to shale costs of production indicate that oil supply from ANWR would not be able to compete with most other domestic sources. Estimated breakeven costs of production from ANWR currently are expected to be well above those of shale plays in the lower-48 states. Even if ANWR achieves cost reductions over time similar to the downward trajectory of the cost curve realized by shale, the transportation costs from Valdez to the U.S. in addition to new pipeline costs would make ANWR the more expensive option. As a result, ANWR oil is not likely to displace U.S. domestic production of oil.

Instead, if oil prices do rise to high enough levels to support production (an unlikely situation given technological changes on both the supply and demand side),

[105] This conclusion is supported by the U.S. EIA projections where ANWR crude oil production from 2031 to 2050 is zero in the Low Oil Price case. AEO 2019, p. 46.

ANWR oil is likely to be sold on the global market. Although international sales would serve to decrease the U.S. trade balance, making the U.S. even more of a net exporter, ANWR oil is not likely to displace existing or anticipated U.S. production. It simply cannot compete.

4.5. Key points about impact of technology on global supply

Conventional oil reserves are heavily concentrated in the Middle East and Russia. Unconventional reserves have added Canada, Venezuela and the United States to the mix. As technology continues to evolve, new sources of supply are found. For example, China recently declared that it had discovered a massive source of shale supply in the north.[106] The discovery of shale fields increases reserves for those countries that have the resource, potentially upending the world order of oil under conventional plays.

The U.S. has confirmed significant volumes of oil in a number of shale plays. These reserves have increased domestic production dramatically, and at lower costs over time as the shale equipment and drilling achieve incremental improvements. As a result, the EIA projects that the U.S. will be a net exporter of oil by 2020. The increase in reserves also puts the U.S. into the position of being the swing producer. As a result, market prices are likely to hover around the marginal cost to produce shale oil as the U.S. responds to upward pressure on prices wrought by OPEC quotas with increased supply.

The net result is that the 1002 Area leases are likely to remain uncompetitive against other domestic resources and uneconomic globally. More expensive than shale in the lower-48 states, ANWR oil will not be able to compete with domestic alternatives. Limitations tied to Jones Act tankers also may prevent ANWR oil from physically being delivered into the lower-48 states. Instead, any oil from ANWR that possibly could be developed economically, is likely to be sold into international markets. Although these

[106] Paraskova, Tsvetana, "China says massive shale oil supply found in North," Oilprice.com, March 1, 2019, https://oilprice.com/Energy/Crude-Oil/China-Says-Massive-Shale-Oil-Reserves-Found-In-North.html

oil exports would offset the U.S. trade balance, they would not be physically delivered to or consumed by domestic end-users.

5. IMPACT OF NEW TECHNOLOGIES ON DEMAND FOR OIL

The demand-side also is facing significant changes to technology that can disrupt oil markets. A number of technological innovations are reaching a tipping point and marching towards convergence, promising to reduce demand for oil, potentially resulting in a precipitous decline in oil prices before 2030. As the 2014 oil price crash showed, even a small surplus of 2 million barrels per day can unsettle markets and drop prices by more than 70 percent. Even 1.2 million barrels per day – an amount that OPEC recently announced would be the intended reduction in output – is expected to cause oil prices to rise.[107] In the event technology prompts lower demand of around these same levels, prices are likely to fall causing oil from the 1002 Area to continue to be uneconomic and undeveloped.

5.1. Transportation technologies are converging

As already mentioned, transportation is a key contributor to oil consumption. Worldwide, 40 percent of petroleum products fuel cars and trucks.[108] In the U.S., roughly 47 percent of petroleum products sold in the U.S. went to finished motor gasoline (which is used in personal vehicles); diesel and heating oil composed 20 percent.[109] Of the 14 million barrels per day sold for transportation in the United States, around 9.3 million barrels per day was considered finished motor gasoline. Therefore, less than 25 percent of consumption from the U.S. automobile sector is required to achieve market pressures similar to those experienced during the 2014 crash. A lower

---

[107] Reid, David, "Saudi Arabia's oil deal with Russia is now 'more fragile than ever,' analyst says," CNBC, February 19, 2019,
https://www.cnbc.com/2019/02/19/saudi-arabias-opec-oil-deal-with-russia-could-fail.html

[108] International Energy Agency indicates global oil demand in 2017 was cars (23%) and trucks (17%), p. 140, "World Energy Outlook 2018," IEA Publications, November 13, 2018, https://www.iea.org/weo2018/

[109] U.S. EIA, "In 2017, consumption of finished motor gasoline averaged about 9.33 million b/d (392 million gallons per day), which was equal to about 47% of total U.S. petroleum consumption," Independent Statistics & Analysis, Use of Oil,
https://www.eia.gov/energyexplained/index.php?page=oil_use

level of adoption is required globally – only around 10 percent conversion from gasoline-miles to electric.

Four factors related to the transportation sector are converging that could lead to a dramatic decline in oil prices:

- **Batteries:** Improvements to lithium ion batteries giving them a faster charge, longer life, longer range, and lower replacement cost;
- **Electric Vehicles:** Cost improvements to electric vehicles, in addition to lower battery costs, are making them more cost effective than the traditional internal combustion engine vehicles;
- **Autonomous Vehicles:** Sensing, data-driven technology as well as a familiarity and consumer comfort with the concept of self-driving autos and optimized operations will reduce average miles per gallon consumed; and
- **Ride sharing:** Growing familiarity with using smart phones and other personal communications devices to hail cars instead of only using a self-provided private vehicle for transportation will make for a smoother transition to more effective transportation options.

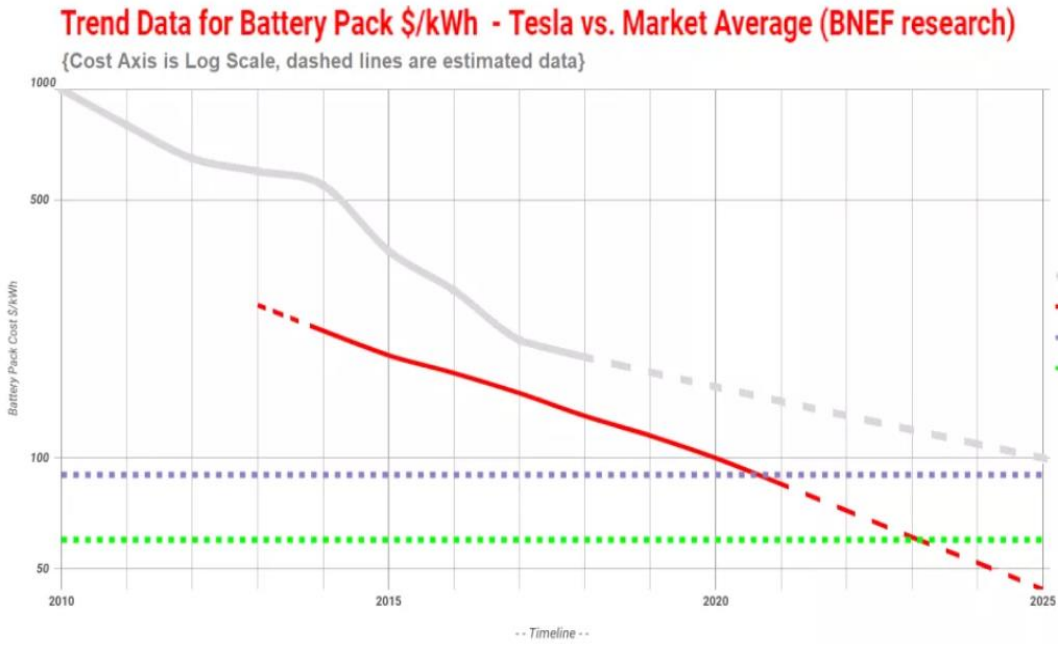
Each of these factors on their own would create a major shift in demand for petroleum-based automobile ownership and miles driven. Together, they converge to create an accelerated adoption of "Transportation as a Service" (TaaS), creating sizable shifts in demand for oil. Additional detail of how these factors promise to decrease demand for oil are described in more detail below.

Batteries

Lithium-ion battery prices are arguably the largest component driving growth in electric vehicles. The lower the cost of the battery and the better batteries perform, the closer electric vehicles come to parity with internal combustion engine vehicles fueled by gasoline. Between 2010 and 2017, battery prices fell by nearly 79 percent from $1,000/ kWh to $209/kWh, rapidly approaching the $100/kWh price point required for

electric vehicles to compete directly with traditional vehicles (**Figure 26**).[110]

Figure 26: Projected Cost of Lithium-ion Batteries[111]



With continued development and improvements, Bloomberg projects that batteries will cost only $70/kWh by 2030.[112] Tesla's more optimistic forecasts support a $90/kWh price point by 2021 and $60/kWh by 2023.[113] By the mid-2020s, if not sooner, electric vehicles are projected to be able to compete with traditional vehicles directly based on capital

[110] The measure of the cost of a battery in $/kWh reflects the total cost of the battery divided by the number of kWh it can discharge. The $100/kWh parity with internal combustion engines converts the cost per mile into a cost per kWh with a conversion of miles per kWh. Therefore, the lower the cost of the battery and the more efficient the charge in miles per kWh, the better the battery. Lambert, Fred, "Electric vehicle battery cost dropped 80% in 6 years down to $227/kWh – Tesla claims to be below $190/kWh," *Electrek*, January 30, 2017, https://electrek.co/2017/01/30/electric-vehicle-battery-cost-dropped-80-6-years-227kwh-tesla-190kwh/

[111] Holland, M., "$100/kWh Tesla Battery Cells This Year, $100/kWh Tesla Battery Packs in 2020," *Clean Technica*, June 9, 2018, https://frontera.net/news/global-macro/the-5-biggest-electric-vehicle-manufacturers-in-brics-nations/

[112] Morsy, Salim, Bloomberg New Energy Finance Group, *Electric Vehicles*, 2018, https://bnef.turtl.co/story/evo2018?src=TW

[113] Holland, M., (2018).

cost alone.[114]

Electric Vehicles

Spurred by better, faster and cheaper batteries, electric vehicle sales (which have been growing by 30 to 60 percent per year) are projected to accelerate during the 2020s. Accelerated sales will be fed by the current decisions already made by a number of mass market automobile companies to focus on production of electric vehicles. For example,

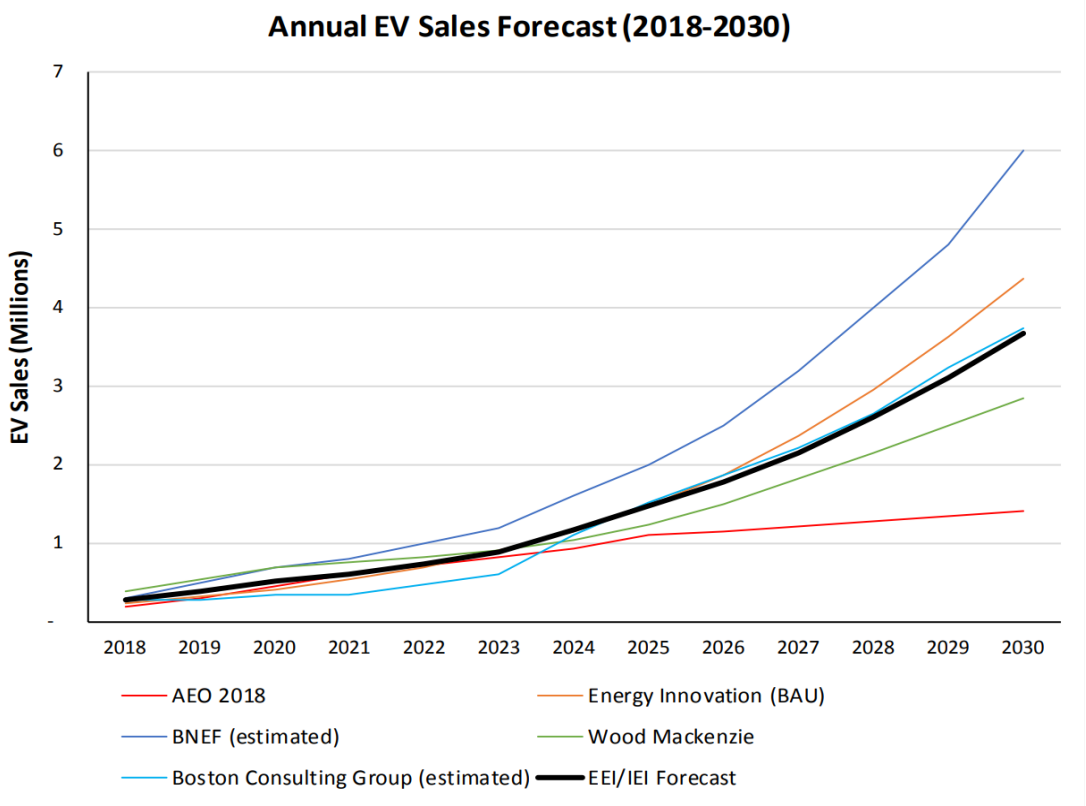
- GM plans on introducing 20 electric vehicle models by 2023.[115]
- BMW plans on selling 25 electric vehicle models by 2025, of which 12 will be pure electric.[116]
- Audi's 2019 Superbowl commercial promises that one-third of its vehicles will be electric by 2025.[117]
- Most other major automobile manufacturers are adding electric vehicles to their passenger car and light duty truck fleets.

Compared to global sales of around 80 million internal combustion engine cars per year, of which almost 20 million are sold in the U.S., electric vehicles promise to become mainstream. Bloomberg projects global sales of 6 million electric vehicles per year by 2030, for a total of nearly 30 million electric vehicles on the road worldwide, lead by China.[118] By 2035, according to McKinsey's 2019 projections, electric vehicle

[114] Electric vehicles already are less costly based on operating costs tied to fewer moving parts and lower fuel costs in the form of electricity versus gasoline.
[115] Evans, Brian, "GM Could be Shifting Toward Electric Sooner Than Expected," *The Drive*, October 31, 2018, http://www.thedrive.com/tech/24595/gm-could-be-shifting-toward-electric-sooner-than-expected
[116] Brzozowski, Aaron, "BMW Electric Vehicle Plan Looks A Lot Like GM's, Others'," GM Authority, October 1, 2018, http://gmauthority.com/blog/2018/10/bmw-electric-vehicle-plan-looks-a-lot-like-gms-others/
[117] Audi, "'Cashew' - 2019 Super Bowl Commercial," https://www.youtube.com/watch?v=7x58qVzUz0U
[118] Bloomberg NEF, "Electric Vehicle Outlook 2018," https://about.bnef.com/electric-vehicle-outlook/

sales to exceed 100 million in the reference case.[119] In contrast, AEO 2018 and 2019 projections assume only 1.5 million electric vehicles are sold per year by 2030.[120] A number of other projections fall in between (**Figure 27**).

Figure 27: EEI Comparison of Projected Sales of Electric Vehicles[121]



Depending on how quickly batteries, electric vehicles and other factors converge, all of these projections could significantly understate conversion to electric vehicles. For example, BP projects that electric vehicles could total 350 million by 2040, of which 300

[119] McKinsey,"Global Energy Perspective 2019: Reference Case," January 2019, p. 24, https://www.mckinsey.com/industries/oil-and-gas/our-insights/global-energy-perspective-2019
[120] U.S. EIA, AEO 2019, p. 128.
[121] Edison Electric Institute (EEI). "Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030," November 2018.
Rissman, J., "The Future Of Electric Vehicles In The U.S., Part 1: 65%-75% New Light-Duty Vehicle Sales By 2050," Forbes, September 14, 2017, https://www.forbes.com/sites/energyinnovation/2017/09/14/the-future-of-electric-vehicles-in-the-u-s-part-1-65-75-new-light-duty-vehicle-sales-by-2050/#7f656e08e289

million would be passenger cars. Although at that level of adoption only 15 percent of cars would be electrified, BP projects that autonomous vehicles and ride sharing could result in electric vehicles providing nearly one-quarter of total passenger vehicle miles.[122]

Autonomous Vehicles

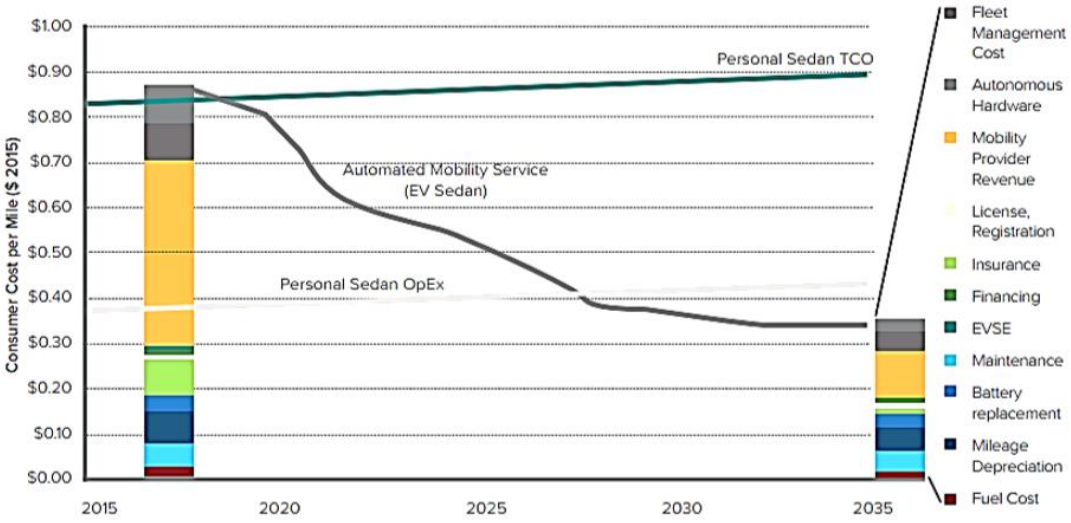
Driverless cars already exist and are beta testing the streets of selected cities and towns. In particular, sensors, automated response, and LIDAR (Light Detection and Ranging) have been combined in existing models as well as in the prototypes for autonomous vehicles to mimic what a driver actually does while driving, but with greater accuracy. The cost of these technologies, as well as their application in vehicles, continues to come down the cost curve.

Although autonomous capability will make such vehicles more costly than human-operated vehicles, the combination with shared electric vehicles will be less expensive than owning a personal vehicle or even ride-hailing and human-operated taxi-services. The cost of using an electric sedan could decline from $0.64 per mile in 2018 to about $0.26 by 2035 (U.S. dollars)[123] (**Figure 28**).

[122] British Petroleum, "BP Energy Outlook: 2019 Edition," February 2019. See also:
Bousso, R., "BP Sees Self-Driving Electric Vehicles Crimpling Oil Demand by 2040," Reuters, February 20, 2018, https://www.reuters.com/article/us-oil-bp/bp-sees-self-driving-electric-vehicles-crimping-oil-demand-by-2040-idUSKCN1G41XK

[123] The assumed exchange rate from Canadian dollars to US dollars is CAN$1 to US$0.75.

Figure 28: Automated versus Personal Car Costs (Canadian Dollars)[124]



Autonomous vehicles are expected to play a significant role in personal transportation. IHS Market recently released its projections for the Autonomous Vehicle Market and concluded that more than 33 million autonomous vehicles will be on the road with 7.4 million sold annually by 2040.[125] The most significant growth is projected to occur in the Asia Pacific region followed by the Americas.[126] Primary purchasers will include ride sharing services and taxi companies where human drivers can be displaced, saving costs and creating fewer opportunities for human error.

Significant volume growth in autonomous vehicles is expected to begin in 2021. Although the U.S. will take the lead in adoption, China will soon take over. Aging societies such as Japan also will adopt autonomous vehicles as a transportation service readily embraced by the technology-oriented culture. Autonomous electric vehicles will go global, displacing demand for gasoline and petroleum-based motor fuels.

---

[124] Litman, T., "Autonomous Vehicle Implementation Predictions: Implications for Transport Planning," Victoria Transport Policy Institute (VTPI), November 26, 2018, p. 8, https://www.vtpi.org/avip.pdf
[125] Culver, Michelle, "Autonomous Vehicle Sales to Surpass 33 Million Annually in 2040, Enabling New Autonomous Mobility in More Than 26 Percent of New Car Sales, HIS Markit Says," IHS Markit, January 2, 2018, https://news.ihsmarkit.com/press-release/automotive/autonomous-vehicle-sales-surpass-33-million-annually-2040-enabling-new-auto
[126] *Ibid*.

Ride Sharing

Ride sharing is the final piece of the puzzle, reducing the cost per mile to well below the price of a human-operated internal combustion engine vehicle that runs on petroleum-based motor fuels. Many people already are becoming acclimated to using smart phones to electronically hail rides, share rides with other people, and make economic decisions based on differential pricing that reflects timing of service and type of vehicle. ZipCar established car sharing without associated ownership. Uber and Lyft services are the precursors to ride-sharing with autonomous electric vehicles; their stated strategies are to develop TaaS.

The transportation market has seen a shift in the growing demand for ride sharing services and a decline in car ownership. Goldman Sachs recently estimated that the ride hailing industry will grow to $285 billion by 2030, displacing the taxi market.[127] Ride hailing is expected to increase from 15 million trips per day to 97 million by 2030.[128] The lower cost of autonomous electric vehicles will drive electric vehicle fleet adoption.

5.2. Oil demand growth is offset by electric vehicles

The combination of technological changes described in the prior section will converge to decrease demand for oil. As already mentioned, dramatic price impacts can occur with changes of 1 to 2 million barrels per day.

A number of industry projections anticipate at least this level of impact.

- **Bloomberg:** Expects electrified buses and cars will displace a combined 7.3 mbpd of fuel by 2040; current growth rates put a projected oil-crash

[127] Huston, C., "Ride-hailing industry expected to grow eightfold to $285 billion by 2030," Market Watch, May 27, 2017, https://www.marketwatch.com/story/ride-hailing-industry-expected-to-grow-eightfold-to-285-billion-by-2030-2017-05-24

[128] Research and Markets, "$218 Billion Ride Sharing Market – Global Forecast to 2025," Globe Newswire, January 17, 2019, https://globenewswire.com/news-release/2019/01/17/1701096/0/en/218-Billion-Ride-Sharing-Market-Global-Forecast-to-2025.html

benchmark of 2 million barrels per day by 2028.[129]

- **Forbes:** Issued a report on a study by Carbon Tracker that shows that electric vehicles will displace 2 million barrels per day in the mid-2020s with an alternative case scenario showing a reduction of 8 million barrels per day by 2030.[130]

- **International Energy Agency:** The World Energy Outlook projects that oil use in cars will peak in the mid-2020's; improvements in fuel efficiency for conventional cars will displace 3 times more oil demand than electric vehicles (i.e., 3 million barrels per day due to electric vehicles plus another 9 million barrels per day from fuel efficiency improvements in internal combustion engine vehicles by 2040).[131]

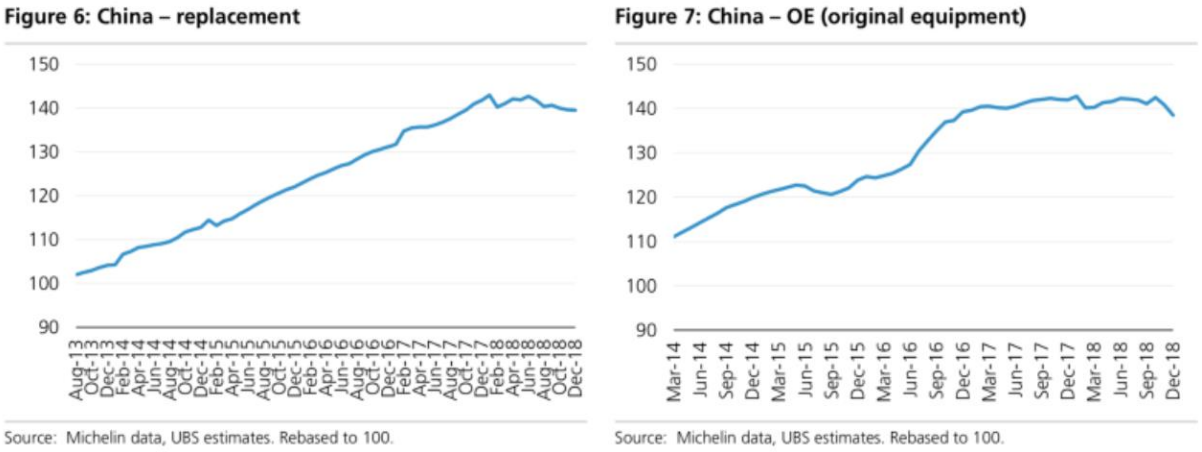
These trends, combined with policy efforts to address carbon emissions, are likely to cause declines in demand for oil and oil products by developed countries. These declines could completely offset any potential growth in demand from developing countries.

Indeed, a number of indicators already appear to show softening in automobile ownership and usage. For example, tire sales in China – on original cars and replacement – have both experienced a decline over the past year or two (**Figure 29**). Although the slow down can be blamed on a slower growth, economic contraction is exactly when oil prices tend to fall.

---

[129] Bullard, N., "Oil Demand for Cars Is Already Falling," Bloomberg, November 16, 2018, https://www.bloomberg.com/opinion/articles/2018-11-16/oil-demand-for-cars-and-transportation-is-already-falling
Randall, T., "Here's How Electric Cars Will Cause The Next Oil Crisis," Bloomberg, February 25, 2016, https://www.bloomberg.com/features/2016-ev-oil-crisis/
[130] Jackson, F., "EVs Alone Could Peak Oil Demand In The Late 2020s, Forbes, July 2, 2018, https://www.forbes.com/sites/feliciajackson/2018/07/02/evs-alone-could-peak-oil-demand-in-the-late-2020s/#569161645ce5
[131] International Energy Agency, "Executive Summary," World Energy Outlook (2018).

Figure 29: Automobile Tire Sales in China[132]



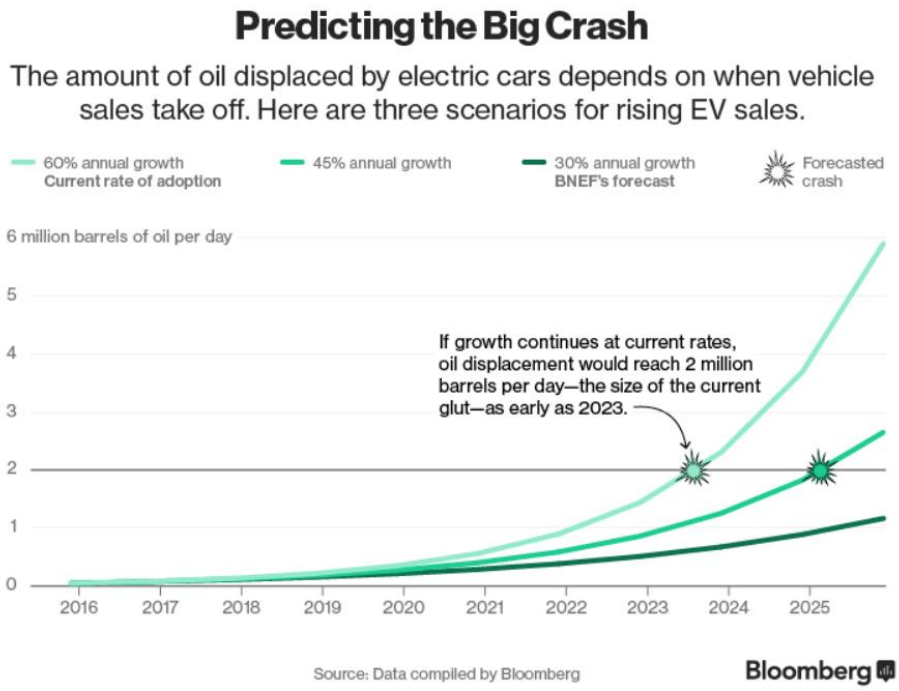
Therefore, even though developing countries may take the lead in shifting towards electric vehicles for purposes of reducing carbon emissions, countries with lower per capita income such as China, India and Brazil may not be far behind due to economics. As a result, potential growth in international demand could be flat or more than offset by reductions in developed countries whose large urban centers and low per capita income makes ride sharing the more economic solution to transportation than car ownership.

5.3. Lower demand should lower oil prices

A number of industry pundits are projecting a crash in oil prices tied to when the amount of oil displaced by electric vehicles reaches a tipping point. Working off the 2014 crash when supply exceeded demand by only 2 million barrels per day, Bloomberg projects the displacement of internal combustion engine vehicles by electric vehicles to reach a tipping point by as early as 2023 under an assumed growth in the rate of adoption of 60 percent per year. A growth rate of 30 percent per year results in a crash in 2028 (**Figure 30**).

[132] Edwards, Jim, "Carpocalypse now: Lyft's founders are right — we're already in the endgame for cars," March 3, 2019, https://www.msn.com/en-us/money/markets/carpocalypse-now-lyfts-founders-are-right—-were-already-in-the-endgame-for-cars/ar-BBUjimn?ocid=spartanntp

Figure 30: Bloomberg's Predicted Timing of an Oil Price Crash[133]



As already noted, there are a number of projections that show similar reductions in demand occurring during the 2020's (see **Section 2.5**). Stanford's Tony Seba originally equated the anticipated decline in demand for oil to a decrease in oil prices down to $25 per barrel by 2030,[134] but more recently indicated that the crash can occur by the early 2020's.[135] McKinsey projects peak demand for oil by 2035, with most of the growth in demand for oil from industry offset by reductions in demand for oil due to less demand from transportation.[136] McKinsey's accelerated case has peak oil demand occurring before 2025 with total demand for oil in 2050 falling to half of today's

[133] Randall, T., "Here's How Electric Cars Will Cause The Next Oil Crisis," (2016).
[134] Arbib, James and Seba, Tony, "Rethinking Transportation 2020 – 2030: The Disruption of Transportation and the Collapse of the Internal-Combustion Vehicle and Oil Industries," May 2017, p. 41, https://static1.squarespace.com/static/585c3439be65942f022bbf9b/t/59f279b3652deaab9520fba6/1509063126843/RethinkX+Report_102517.pdf
[135] Seba, Tony, "Clean Disruption of Energy and Transportation," Presented at the 70th Conference on World Affairs, Boulder, Colorado, April 9, 2018., starting at 56:50, https://www.youtube.com/watch?v=duWFnukFJhQ
[136] McKinsey, "Global Energy Perspective 2019: Reference Case," p. 25.

levels.[137]

The pace of change is faster than ever, with cost curves steeper and adoption rates quicker. The convergence of vehicle transportation technology could be faster and more disruptive than consensus indicates. If that is the case, oil prices would fall before drilling in the 1002 Area begins, indefinitely postponing development. As one of the most expensive undeveloped resources, the 1002 Area would not be developed given anticipated changes in supply and demand for oil.

5.4. Impact of 1002 Area production on oil prices is negligible

As the market evolves, OPEC will attempt to maintain prices and market share. Although OPEC can respond with reduced production to maintain prices, market share will suffer. If higher prices are maintained, U.S. shale will invest and produce even more product at prices ranging from $35 to $65 per barrel or lower. The net result will be an industry operating on the flatter part of the supply curve, where OPEC sets quotas that are quickly countered by shale supply response from the U.S.

Studies performed in 2008 on the impact of production from the 1002 Area concluded that these dynamics would mitigate any potential impact of new supply on global oil prices. For example, a working paper prepared for the Reg-Markets Center in 2008 found that drilling would have only a modest impact on world oil prices—on the order of one percent.[138] Similarly, Kotchen and Burger (2007) concluded, "Domestic oil prices are determined in a world market and would be unaffected by the relatively small annual flows from ANWR."[139] These studies were performed when oil prices were at their highest, and the supply curve was reaching equilibrium at its steepest. Under current conditions, the impact should be even smaller. In the anticipated scenarios where 1002 Area leases are sold, but never developed due to market prices and competition, there would be no impact on global prices for oil.

In contrast, the response of market prices to lower demand could be dramatic.

---

[137] McKinsey, "Global Energy Perspective 2019: Reference Case," p. 24.
[138] Hahn, Robert and Passell, Peter, (2008), p. 18.
[139] Kotchen, Matthew and Burger, Nicholas E., (2007), p. 4723.

Depending on the volatility around market price adjustments, OPEC members may quickly defect from OPEC quotas, preferring to sell their oil assets at any price but zero or suffer stranded assets that remain in the ground. Should OPEC cooperation fail in those circumstances, oil prices could quickly crash as the effective marginal cost of production approaches an opportunity cost of zero. This death spiral would shut-down the most expensive areas of production and prevent undeveloped areas from receiving investment while the market finds a new equilibrium based on new sources of supply and decreased demand for oil.

Saudi Aramco's CEO has slammed this theory, claiming that projections of peak demand are hype and illogical. Although automobiles compose more than 20 percent of global demand for oil, other transportation options such as shipping, aviation, and trucks do not currently have non-petroleum based fuel alternatives.[140] Over time, however, this could change, especially with respect to trucks, which would benefit most from autonomous electric vehicles that have significantly lower fuel and maintenance costs than current modes of transportation. Greater efficiency in jet engines and shipping also could reduce demand for oil. Economic incentive combined with the convergence of existing technologies will motivate innovation.

Despite Aramco's dismissiveness, almost every major oil company includes a projection of declining demand under increases in sustainability initiatives. For example, BP includes a "Rapid Transition" scenario where demand for oil starts to fall off by mid-2025. BP's four other scenarios generally keep global demand for oil at current levels.[141] Shell's annual outlook also includes a scenario where prices fall and/or stay low due to fundamental changes in market conditions tied to new technologies.[142] Only Exxon seems to ignore a potential scenario in which new technology dramatically

---

[140] Reuters, "Aramco CEO says oil industry facing a crisis of perception," February 26, 2019, https://www.reuters.com/article/us-saudi-aramco-oil/aramco-ceo-says-oil-industry-facing-a-crisis-of-perception-idUSKCN1QF0YN

[141] British Petroleum (BP). "BP Energy Outlook: 2019 Edition," February 2019, https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf

[142] Shell, "Energy Transition Report," 2018, https://www.shell.com/energy-and-innovation/the-energy-future/shell-energy-transition-report.html

disrupts global oil markets.[143]

Even the International Energy Agency includes such a scenario in its World Energy Outlook for 2018.[144] One of the three scenarios reflects a "Sustainable Development" scenario where world oil demand falls to well below current levels by 2030 and even further to around 70 million barrels per day by 2040. Correspondingly, oil prices fall to below the breakeven cost to produce from ANWR,[145] rendering oil from the 1002 Area uneconomic.

A dramatic decline in prices below current levels is not required to make the ANWR leases uneconomic. At current oil prices, including those trading on the futures markets, oil from the 1002 Area already is uneconomic to extract. Therefore, all that is required to preclude economically recoverable oil from the 1002 Area is to maintain the status quo. Given the introduction of U.S. shale as a new source of swing supply that serves as a counter to price impacts on OPEC quotas, it is not difficult to envision the current state of play continuing through the leases, especially if there is an economic slowdown.

Even if global demand for oil from developing countries increases dramatically, there will continue to be incentives for increased production from low-cost shale plays to capture higher margins, bringing prices back down to the flat part of the supply curve following short-term responses to temporary shocks.

5.5. Key points on impact of technology on global demand

Demand for oil is facing a number of disruptive technologies that, when combined, could crash oil prices as early as the mid-2020s, and keep them low enough through the 2030s to preclude economic development of 1002 Area oil reserves. Such an event would generate a "peak demand" scenario where demand for oil in developed countries declines faster than growth in developing countries, eventually leading to

[143] Exxon, "2018 Outlook for Energy: A View to 2040," February 2, 2018.
[144] International Energy Agency, "World Energy Outlook 2018," (2018).
[145] *Ibid.*

global adoption of cleaner, more cost-effective substitutes for oil.

The risk of such an event is not theoretical. Large industry players such as BP and Shell, as well as government agencies such as the International Energy Agency and others, have modeled this scenario and identified conditions where oil prices stay in the $50 to $75 per barrel range indefinitely. In such scenarios, ANWR reserves would never become economically viable and oil production from the 1002 Area is zero. In such a scenario, there would be no rent or royalty payments. At most, lease payments might reflect a minimal amount of option value tied to the extrinsic value of an asset that is "out-of-the-money" facing a high probability of becoming stranded.

6. ANWR LEASE PAYMENTS AND INCOME

This section provides an independent assessment of total revenues that would be generated by the proposed ANWR lease under alternative scenarios.

6.1. Alternative estimates

The CBO estimates that the sale of ANWR leases would generate $2.2 billion; this claim is unrealistic and has been challenged on a number of fronts.

- **Backward-looking Estimates are Inappropriate:** The CBO has made a number of assumptions based on historical information on oil/gas leasing in the US and information from DOI, EIA, and individuals in the oil/gas industry about the factors that affect company willingness to pay to acquire oil and gas leases. This backward-looking approach is not appropriate for today's oil industry that faces fundamental changes to both supply and demand. As the CBO states in its estimate:

  > Estimates of bonus bids for leases in ANWR are uncertain. Potential bidders might make assumptions that are different from CBO's, including assumptions about long-term oil prices, production costs, the amount of oil and gas resources in ANWR, and alternative investment opportunities. In particular, oil companies have other domestic and overseas investment

options that they would evaluate and compare with potential investments in ANWR.

- **Opposition Estimates:** Opposing the bill, Democrat Maria Cantwell has claimed recent lease sales in Alaska's North Slope suggest ANWR would bring in $76 million at most.[146]

- **Center for American Progress:** An analysis by the Center for American Progress found that based on recent oil and gas lease sales in the Alaska North Slope, ANWR would only generate $37.5 million over the next 10 years.[147]

An independent analysis of the potential value of leases using recent lease sales supports the lower end of these estimates.

6.2. Lease payments

As already mentioned, the 1002 Area leases are out-of-the-money, with all measures of breakeven prices above current market prices. The value of these leases in terms of volumes of oil and breakeven costs of producing that oil and transporting it to market also are very uncertain. Therefore, the only value that would be paid for the leases on top of the land value, if anything, would be an extrinsic value associated with the opportunity, but not the obligation, to drill.

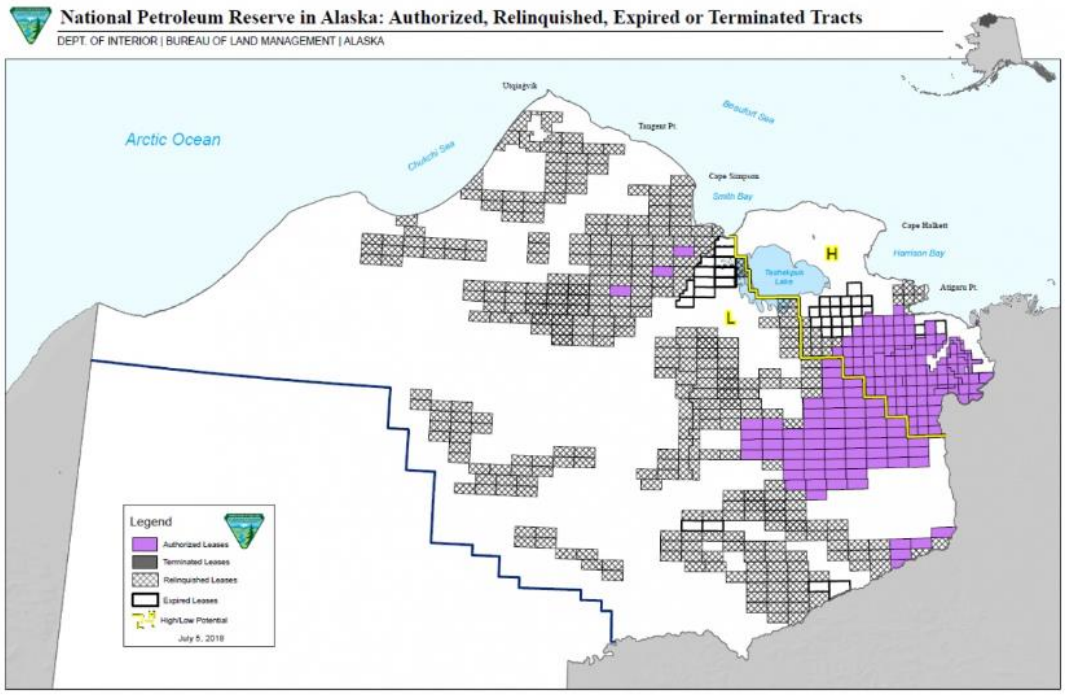
Lease auctions recently held for the NPRA provides a set of comparable prices for what 1002 Area leases might command. **Figure 31** shows where NPRA leases have been authorized (purple), expired (white), or were relinquished (hatch mark).

---

[146] Harsch, J., "GOP Dems Battle Over Drilling In Alaska Refuge," *Agri Pulse*, November 22, 2017, https://www.agri-pulse.com/articles/10261-gop-dems-battle-over-drilling-in-alaskan-refuge

[147] Ashley, M., "The Energy Case Against Drilling in the Arctic National Wildlife Refuge," Center for American Progress, November 13, 2017, https://www.americanprogress.org/issues/green/news/2017/11/13/442603/energy-case-drilling-arctic-national-wildlife-refuge/

Figure 31: Leases in the National Petroleum Reserve in Alaska[148]



As illustrated by the number of leases relinquished, a successful lease sale does not guarantee production. The location of authorized leases also is telling; it is important to be closer to transportation (i.e., the TAPS pipeline to the east). The new findings in the Colville River Delta to the east of the NPRA are likely to be very competitive to ANWR.

The value of land leases auctioned by BLM in the nearby NPRA likely provide a maximum price that lease sales from the 1002 Area might be able to generate.[149] Auction results indicate two insights:

[148] BLM, Oil & Gas Leases updated 11/2018, https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/about/alaska/NPR-A

[149] Acreage also is leased directly by the state of Alaska, but provides much fewer data points and was not included in the analysis. State lease data is provided by the State of Alaska, Department of Natural Resources, Division of Oil & Gas, http://dog.dnr.alaska.gov/Information/Data

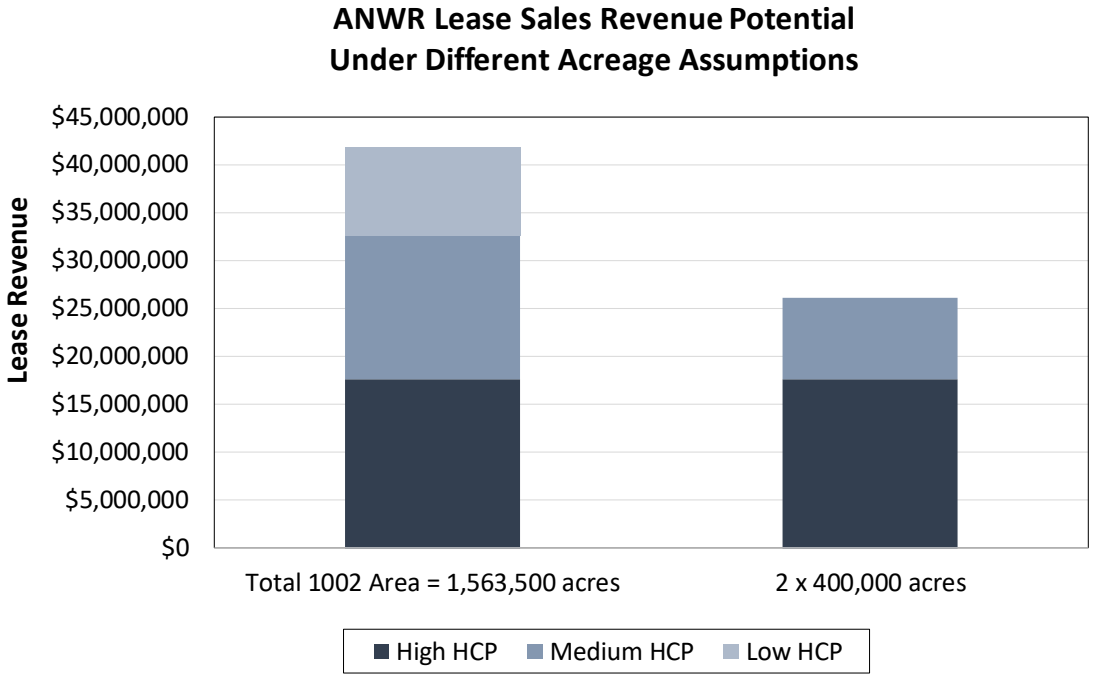
1) **Limited Demand:** Although 2.8 million acres were put up to bid in 2018, only 174,044 acres were sold; none of the 22,412 acres considered "high potential" were purchased. In 2017, only around 80,000 acres of the approximately 10 million acres put to auction were sold. The lack of uptake could be indicative of the response that the market would have to ANWR leases which have even more uncertainty with respect to reserves and breakeven costs.

2) **Low Price per Acre:** Leases sold in 2018 ranged from $5.05 per acre to $19.01 per acre, with a weighted average of $8.81 per acre. In 2017, the weighted average price was slightly lower at around $14.49 per acre. Granted, these lease sales were for low potential acreage. However, even the high potential parcels sold in 2016 were priced at around $40 per acre on average versus the low potential lease prices of $27 per acre (all dollars in nominal terms). The clear implication is that raising $2.2 billion for 800,000 acres is an unrealistic expectation.

Using lease sales prior to the 2014 oil price crash does not provide a much better prognostication. **Figure 32** provides an estimate of the total revenues that could be expected under average conditions from 2013 through 2018 under both a minimum and maximum lease auction acreage of two 400,000 acre parcels versus the entire area. In this analysis, average prices per acre were allocated based on low, medium and high potential according to the prices that cleared in prior auctions for each of these categories to provide an upper bound of what the 1002 Area parcels might command. Assuming the lots in the 1002 Area would be sold, they are likely to go for less than the price paid in the more certain, high volume area of the NPRA.

Even with a higher price expectation, total revenues from the lease sales would not be expected to exceed $40 million. At most, one could expect to see an average price of $25 to $30 per acre, implying total revenues of less than $25 million for the minimum auction acreage to be sold. Half of these potential revenues would be shared with Alaska, leaving less than $13 million in federal revenues generated by the two 400,000 acre parcels.

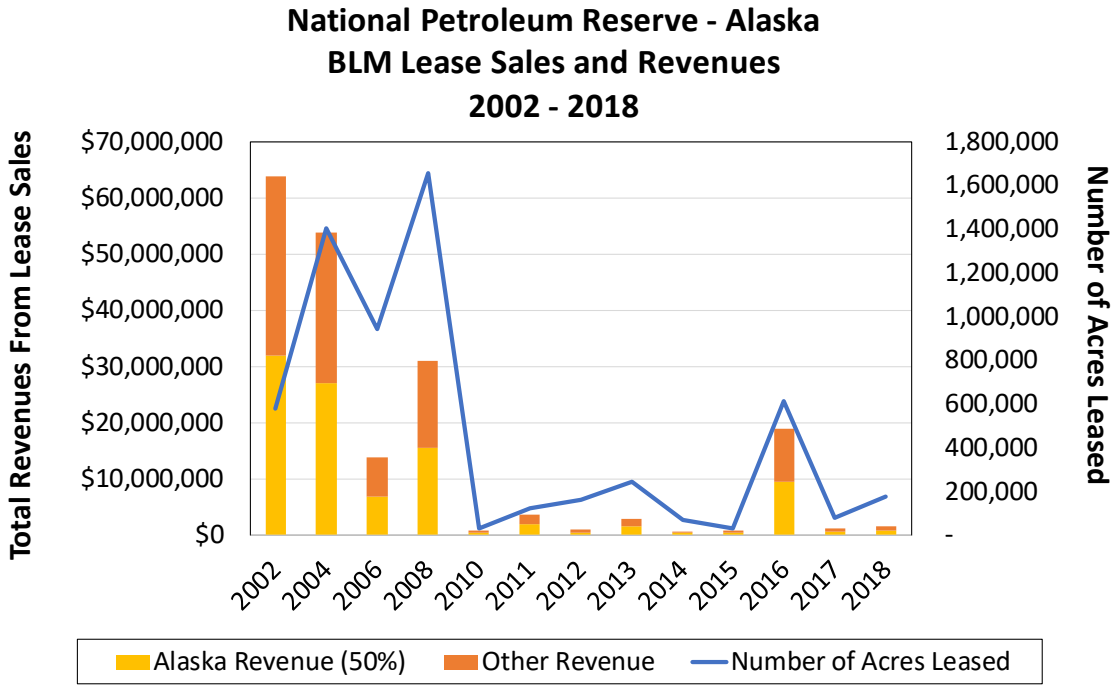
Figure 32: Potential Revenues from Lease Sales of 1002 Area Acreage[150]



An analysis of the total revenues generated by historical NPRA lease sale revenues supports this conclusion. For example, the sale of 615,000 acres in 2016 generated only $19 million in total revenues for a combination of low and high value parcels; in 2008, the sale of leases for 1.6 million acres generated only $30 million (**Figure 33**).

[150] Energyzt analysis of the BLM, Oil & Gas Leases (2018).

Figure 33: Historical NPRA Lease Sale Revenues[151]



6.3. Rental payments

If the leases are sold, rental payments would occur between acquisition of the lease and production. If market prices do not recover during that time or are anticipated to collapse, lessees could choose to relinquish the lease. Whether or not a buyer continues paying the rental payment will depend on the potential prospects of developing the 1002 Area, which will be highly dependent on market prices for oil.

The CBO estimated that rental payments would total $2 million over the period from 2022 to 2027. This is less than the estimated cost over the 2018 to 2022 period for environmental reviews and administrative costs of around $10 million. Combined revenues from bonus payments and rents to the federal government would barely cover

[151] Energyzt analysis based on Alaska Oil and Gas Lease Sales in the National Petroleum Reserve - Reported by the BLM, "Annual NPR-A Lease Sale Bid Recap (2002-2018)," https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/regional-lease-sales/alaska

(and could even be less) than the administrative costs.

Even if rental payments extended to 2031, the receipts would make a negligible contribution to the target of $1.1 billion. More likely, however, the lessee would be prepared to abandon the leases in the event that oil prices remained low or crashed before 2030, in which case rental income would be even lower.

6.4. Royalties

If ANWR production is zero, as projected by the EIA in the "Low Oil" scenario where prices remain below $50 per barrel, oil production and royalties would be zero.

Assuming a technological convergence in which supply and demand for oil maintains at current levels, ANWR would remain uneconomic and royalties would be zero.

Under the scenarios where demand and prices crash during the 2020s, as projected by Bloomberg, there would be no royalties.

Only in the case where one projects prices rising above the breakeven price for the 1002 Area production, plus a premium for uncertainty, would royalties be generated. This scenario is not likely to occur before 2031, creating significant uncertainty around any potential for royalties, especially under current conditions.

The risk of a price collapse in the 2020s or even the 2030s, as posited by Bloomberg, McKinsey and the International Energy Agency, would prevent development of the 1002 Area from ever occurring. If the leases are sold, however, and investment is made to identify potential resources in the 1002 Area, an actual or anticipated price crash in the 2030s could lead to cessation of any further investment and preclude production and associated revenues.

6.5. Key points about potential ANWR revenues

The value of the ANWR leases are subject to a significant amount of uncertainty:

- There is no existing infrastructure in place.
- The volume of technically recoverable reserves is not confirmed.
- Breakeven costs are uncertain.
- Market prices for oil currently are below the estimated breakeven costs.
- Transportation costs to ship product to market are expensive, including both pipeline costs and shipping fees.
- Competition from both the nearby NPRA and shale production in the lower 48 states make ANWR production more expensive than domestic production alternatives.
- Additional costs to develop the project, including collection pipeline system and investment in new Jones Act tankers, create a potential for even higher costs.
- Production from ANWR requires an expensive, long-term commitment of more than 10 years versus more flexible investment options in the U.S. and other parts of the world.

Although, estimated lease payments using historical prices can provide a range of anticipated value under current conditions, a potential bidder may choose not to bid at all or apply a significant discount to the valuation in light of the myriad uncertainties facing the project.

Instead of offering the leases to bid while oil prices are below the anticipated breakeven price, it may be prudent to wait to put the leases out to bid. Adopting this strategy will ensure that national assets are not given away during a low-priced period, especially since the objective of the leases is to raise money and create jobs, neither of which would occur at any significant level under current conditions.

7. CONCLUSION

The oil industry is undergoing a fundamental transformation as a result of technological changes on both the supply and demand side. As a result, oil from the 1002 Area currently is not economic to produce and is unlikely to be economic to produce over the longer term. Under current conditions, federal revenues generated by the 1002 Area through 2027 are likely to be much lower than the $1.1 billion target and may not even cover the administrative costs.

ANWR is not economic under current market conditions. Futures markets and near-term projections by oil companies and governmental agencies are in consensus that projected oil prices are expected to continue at around current levels – that is between $55 to $75 per barrel for Brent Crude. This price reflects the marginal cost of production of shale oil, which currently is the marginal resource and is expected to be swing supply for the near future. In contrast, ANWR's breakeven price of around $78 to $90 per barrel make oil from the 1002 Area uneconomic to produce.

Supply-side technology improvements have converted the U.S. from a net importer of oil to a net exporter by 2020 and for the foreseeable future. As a result, ANWR is not needed for domestic demand. Under conditions where the U.S. could be a net importer, the breakeven cost of ANWR would make it even more uncompetitive than market prices. Therefore, the 1002 Area is unlikely to displace any domestic production of oil. To the extent it does produce under conditions of high prices, it would be more expensive than shale plays, and therefore more likely to be sold into international markets.

Technological changes on the demand-side also work against the potential for 1002 Area to become economic. A convergence of existing technologies is projected to reach a tipping point in the early 2020s which would decrease demand for oil. In addition to policy efforts by developing countries to reduce their carbon footprint and demand for oil, market-based economics could have the same impact on international demand. In particular, those very markets that oil companies project as driving increased demand for oil are ideal candidates for ride sharing through autonomous electric vehicles instead of private ownership of cars internal combustion engine vehicles.

A softening in car ownership already is taking place, which could be a harbinger of the technological convergence that would offset global growth in demand for oil. The net result could be a dramatic decrease in global oil prices, followed by a death spiral tied to uncooperative behavior by OPEC nations desperate to realize value from their otherwise stranded assets of oil reserves. In this environment, the reserves from the 1002 Area would be even more uneconomic and among the first to be stranded.

Given the relative cost of ANWR compared to market price, any revenues generated by sale of 1002 Area leases are likely to reflect nothing more than land value and perhaps a small extrinsic value. The asset itself is "out-of-the-money" – more expensive than domestic and international alternatives. Therefore, any revenues generated in early 2020, under current market price projections, would generate significantly less than the projected $1.1 billion. Furthermore, uncertainty surrounding these costs and the potential magnitude of reserves is likely to create an even bigger discount on potential bid prices. As technology progresses, and ANWR oil becomes even more expensive compared to alternatives, potential rental payments and royalties would be zero. Oil reserves from the 1002 Area are among the most expensive of the undeveloped reserves, making them the first to be stranded in the face of technological changes.

As a result of market conditions and the economics of the oil industry, ANWR is not likely to be economic in the near-term and is unlikely to produce oil in the long-term except under the unlikely condition of sustained long-term growth in demand without a price-responsive change in supply.

APPENDIX A
Bibliography

Articles

- Ashley, M., "The Energy Case Against Drilling in the Arctic National Wildlife Refuge," Center for American Progress, November 13, 2017, https://www.americanprogress.org/issues/green/news/2017/11/13/442603/energy-case-drilling-arctic-national-wildlife-refuge/

- Ashton, Gary, "Crude Oil Price Forecast: $100 All the Rage," Investopedia, September 30, 2018, https://www.investopedia.com/investing/crude-oil-price-forecast-100-all-rage/

- Austin, Paul, "Press Release: One Minnesota Path to 100% Clean Energy is Bold and Pragmatic," *Conservation Minnesota*, https://www.conservationminnesota.org/news/interests/energy-climate-and-transportation/press-release-one-minnesota-path-to-100-clean-energy-is-bold-and-pragmatic/

- Blum, Jordon, "Exxon, Chevron plan to dominate Permian, grow as others cut back," *Houston Chronical*, March 5, 2019, https://www.chron.com/business/energy/article/Exxon-Chevron-plan-to-dominate-Permian-grow-as-13663733.php

- Bourne, Joel, "Arctic Refuge Has Lots of Wildlife – Oil, Maybe Not So Much," National Geographic, December 19, 2017, https://news.nationalgeographic.com/2017/12/arctic-wildlife-refuge-tax-bill-oil-drilling-environment/

- Bradley, Robert, "ANWR: Make Alaska Great Again," Forbes, January 12, 2018, https://www.forbes.com/sites/robertbradley/2018/01/12/anwr-make-alaska-great-again/#7f68bf09782f

- Bradner, Tim, "Alaska might give up on North Slope gas pipeline, LNG export terminal: Official," S&P Global, February 28, 2019, https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/022819-alaska-might-give-up-on-north-slope-gas-pipeline-lng-export-terminal-official

- Bousso, R., "BP Sees Self-Driving Electric Vehicles Crimpling Oil Demand by 2040," Reuters, February 20, 2018, https://www.reuters.com/article/us-oil-bp/bp-sees-self-driving-electric-vehicles-crimping-oil-demand-by-2040-idUSKCN1G41XK

- Brzozowski, Aaron, "BMW Electric Vehicle Plan Looks A Lot Like GM's, Others'," GM Authority, October 1, 2018, http://gmauthority.com/blog/2018/10/bmw-electric-vehicle-plan-looks-a-lot-like-gms-others/

- Bullard, N., "Oil Demand for Cars Is Already Falling," Bloomberg, November 16, 2018, https://www.bloomberg.com/opinion/articles/2018-11-16/oil-demand-for-cars-and-transportation-is-already-falling

- Conca, James, "US Winning Oil War Against Saudi Arabia," Forbes.com, 2015, https://www.forbes.com/sites/jamesconca/2015/07/22/u-s-winning-oil-war-against-saudi-arabia/#6cb08b911678

- Crooks, Ed, "Exxon seeks to block vote on investor proposal on emissions," *Financial Times*, February 24, 2019, https://www.ft.com/content/800fb008-3853-11e9-b72b-2c7f526ca5d0

- Culver, Michelle, "Autonomous Vehicle Sales to Surpass 33 Million Annually in 2040, Enabling New Autonomous Mobility in More Than 26 Percent of New Car Sales, HIS Markit Says," IHS Markit, January 2, 2018, https://news.ihsmarkit.com/press-release/automotive/autonomous-vehicle-sales-surpass-33-million-annually-2040-enabling-new-auto

- Dalrymple, Amy, "North Dakota natural gas flaring hits records, improvement expected in 2019," *Bismark Tribune,* December 25, 2018, https://bismarcktribune.com/bakken/north-dakota-natural-gas-flaring-hits-records-improvement-expected-in/article_201e38f4-54db-5b96-a03a-31af0fd077e0.html

- Denning, Liam, "Chevron-Exxon Texas Showdown Spells Trouble for Frackers," Bloomberg Opinion, March 5, 2019, https://www.bloomberg.com/opinion/articles/2019-03-05/chevron-exxon-texas-showdown-spells-trouble-for-frackers

- Edwards, Jim, "Carpocalypse now: Lyft's founders are right — we're already in the endgame for cars," March 3, 2019, https://www.msn.com/en-us/money/markets/carpocalypse-now-lyfts-founders-are-right-—-were-already-in-the-endgame-for-cars/ar-BBUjimn?ocid=spartanntp

- Evans, Brian, "GM Could be Shifting Toward Electric Sooner Than Expected," *The Drive*, October 31, 2018, http://www.thedrive.com/tech/24595/gm-could-be-shifting-toward-electric-sooner-than-expected

- Fielden, Sandy, "Ship to Wreck – Can the Jones Act Tanker Market Keep Growing?" October 25, 2015, https://rbnenergy.com/ship-to-wreck-can-the-jones-act-tanker-market-keep-growing

- Garfield, Leanna and Gould, Skye, "This map shows which states are vowing to defy Trump and uphold the US' Paris Agreement goals," *Business Insider*, June 9, 2017, https://www.businessinsider.com/us-states-uphold-paris-agreement-2017-6

- Harsch, J., "GOP Dems Battle Over Drilling In Alaska Refuge," *Agri Pulse*, November 22, 2017, https://www.agri-pulse.com/articles/10261-gop-dems-battle-over-drilling-in-alaskan-refuge

- Holland, M., "$100/kWh Tesla Battery Cells This Year, $100/kWh Tesla Battery Packs in 2020," *Clean Technica*, June 9, 2018, https://frontera.net/news/global-macro/the-5-biggest-electric-vehicle-manufacturers-in-brics-nations/

- Holodny, Elena, "This map shows how much it costs to transport oil across the US," *Business Insider*, June 10, 2016, https://www.businessinsider.com/map-oil-cost-shipping-2016-6

- Huston, C., "Ride-hailing industry expected to grow eightfold to $285 billion by 2030," Market Watch, May 27, 2017, https://www.marketwatch.com/story/ride-hailing-industry-expected-to-grow-eightfold-to-285-billion-by-2030-2017-05-24

- Jackson, F., "EVs Alone Could Peak Oil Demand In The Late 2020s, Forbes, July 2, 2018, https://www.forbes.com/sites/feliciajackson/2018/07/02/evs-alone-could-peak-oil-demand-in-the-late-2020s/#569161645ce5

- Kerber, Ross, "Big U.S. Pension Funds Ask Electric Utilities for Decarbonization Plans," US News, February 28, 2019, https://www.usnews.com/news/top-news/articles/2019-02-28/big-us-pension-funds-ask-electric-utilities-for-decarbonization-plans

- Koch, Wendy, National Geographic, "3 Reasons Why Shell Halted Drilling in the Arctic," September 28, 2015, https://news.nationalgeographic.com/energy/2015/09/150928-3-reasons-shell-halted-drilling-in-the-arctic/

- Lambert, Fred, "Electric vehicle battery cost dropped 80% in 6 years down to $227/kWh – Tesla claims to be below $190/kWh," Electrek, January 30, 2017, https://electrek.co/2017/01/30/electric-vehicle-battery-cost-dropped-80-6-years-227kwh-tesla-190kwh/

- Litman, T., "Autonomous Vehicle Implementation Predictions: Implications for Transport Planning," Victoria Transport Policy Institute (VTPI), November 26, 2018, p. 8, https://www.vtpi.org/avip.pdf

- Macalister, Terry, "Shell ceases Alaska Arctic Drilling; exploratory well oil gas disappoints," The Guardian, September 28, 2015, https://www.theguardian.com/business/2015/sep/28/shell-ceases-alaska-arctic-drilling-exploratory-well-oil-gas-disappoints

- Massachusetts Executive Office of Energy and Environmental Affairs, "Commonwealth Joins Regional States to Reduce Transportation Emissions," Press Release, December 18, 2018, https://www.mass.gov/news/commonwealth-joins-regional-states-to-reduce-transportation-emissions

- OGJ Editors, "EIA revised down its oil price forecast," *Oil & Gas Journal*, February 12, 2019, https://www.ogj.com/articles/2019/02/eia-revised-down-its-2020-oil-price-forecasts.html

- Paraskova, Tsvetana ,"China says massive shale oil supply found in North," *Oilprice.com*, March 1, 2019, https://oilprice.com/Energy/Crude-Oil/China-Says-Massive-Shale-Oil-Reserves-Found-In-North.html

- Passut, Charlie, "Bill Would Allow Limited Development of Alaska's 1002 Area," *Natural Gas Intel*, January 9, 2017, https://www.naturalgasintel.com/articles/108979-bill-would-allow-limited-development-of-alaskas-1002-area

- Penn, Ivan, "California Lawmakers Set Goal for Carbon-Free Energy by 2045," *The New York Times*, August 28, 2018, https://www.nytimes.com/2018/08/28/business/energy-environment/california-clean-energy.html

- Plumer, Brad, "New U.N. Climate Report Says Put a High Price on Carbon," *The New York Times*, October 8, 2018, https://www.nytimes.com/2018/10/08/climate/carbon-tax-united-nations-report-nordhaus.html

- Randall, T., "Here's How Electric Cars Will Cause The Next Oil Crisis," Bloomberg, February 25, 2016, https://www.bloomberg.com/features/2016-ev-oil-crisis/

- Reid, David, "Saudi Arabia's oil deal with Russia is now 'more fragile than ever,' analyst says," *CNBC*, February 19, 2019, https://www.cnbc.com/2019/02/19/saudi-arabias-opec-oil-deal-with-russia-could-fail.html

- Research and Markets, "$218 Billion Ride Sharing Market – Global Forecast to 2025," *Globe Newswire*, January 17, 2019, https://globenewswire.com/news-release/2019/01/17/1701096/0/en/218-Billion-Ride-Sharing-Market-Global-Forecast-to-2025.html

- Reuters, "Aramco CEO says oil industry facing a crisis of perception," February 26, 2019, https://www.reuters.com/article/us-saudi-aramco-oil/aramco-ceo-says-oil-industry-facing-a-crisis-of-perception-idUSKCN1QF0YN

- Rissman, J., "The Future Of Electric Vehicles In The U.S., Part 1: 65%-75% New Light-Duty Vehicle Sales By 2050," *Forbes*, September 14, 2017, https://www.forbes.com/sites/energyinnovation/2017/09/14/the-future-of-electric-vehicles-in-the-u-s-part-1-65-75-new-light-duty-vehicle-sales-by-2050/#7f656e08e289

- Rystad Energy, "Global Liquids Cost Curve: Shale is pushing out oil sands and Arctic, Offshore is still in the race," Press Release, June 12, 2014, https://www.rystadenergy.com/newsevents/news/press-releases/global-liquids-cost-curve

- Yale Environment 360, "How the Alaska Pipeline Is Fueling the Push to Drill in the Arctic Refuge," November 16, 2017, https://e360.yale.edu/features/trans-alaska-pipeline-is-fueling-the-push-to-drill-arctic-refuge

Bloomberg

- Bloomberg NEF, "Electric Vehicle Outlook 2018," https://about.bnef.com/electric-vehicle-outlook/

- Bloomberg NEF, "Economics of U.S. Shale Oil Production," June 1, 2018, https://about.bnef.com/blog/economics-u-s-shale-oil-production

- Morsy, Salim, *Electric Vehicles*, Bloomberg New Energy Finance Group, 2018, https://bnef.turtl.co/story/evo2018?src=TW

British Petroleum (BP)

- "Statistical Review of World Energy 2018," June 2018, 67th Edition, p. 13, https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf

- "BP Energy Outlook, 2019 edition," https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf

- "Oman 2018: Upstream Investor Day & Fieldtrip," December 2018, https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/investors/oman-2018-investor-day-bernard-looney-plenary.pdf

Congressional Budget Office

- Congressional Budget Office, "A Legislative Proposal Related to the Arctic National Wildlife Refuge," November 8, 2017, https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=3454269F-6DC5-4E6C-9F23-99D1E3E64698

Congressional Research Service

- Congressional Research Service, "Arctic National Wildlife Refuge (ANWR): An Overview," January 9, 2018, https://fas.org/sgp/crs/misc/RL33872.pdf

- Lazzari, S. 2008. "Possible Federal Revenue from Oil Development of ANWR and Nearby Areas." Congressional Research Service Report for Congress. June. Order Code RL34547

International Energy Agency

- "Oil 2018," March 5, 2018, https://www.iea.org/oil2018/

- "Statistics: Global Energy Data at your Fingertips," https://www.iea.org/statistics/?country=WORLD&year=2016&category=Oil&indicator=OilProductsCons&mode=chart&dataTable=OIL

- "World Energy Outlook 2018," IEA Publications, November 13, 2018, https://www.iea.org/weo2018/ Supporting data obtained as part of purchase from https://webstore.iea.org/world-energy-outlook-2018

International Monetary Fund

- International Monetary Fund, "World Economic Outlook, April 2017: Gaining Momentum?" April 2017, https://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017#Chapter 1

Legislation

- United States Code: Merchant Marine Act, 1920, 46 U.S.C. §§ 861-889 (1958), https://www.loc.gov/item/uscode1958-009046024/

- Tax Cuts and Jobs Act of 2017, Pub. L. No. 115-97, 131 Stat. 2054 (2017).

- Alaska National Interest Lands Conservation Act, Pub. L. 96–487, December 2, 1980, 94 STAT. 2371 (1980).

Organization of the Petroleum Exporting Countries (OPEC)

- "OPEC share of world crude oil reserves, 2017," 2019, https://www.opec.org/opec_web/en/data_graphs/330.htm

Reports

- Arbib, James and Seba, Tony, "Rethinking Transportation 2020 – 2030: The Disruption of Transportation and the Collapse of the Internal-Combustion Vehicle and Oil Industries," May 2017, p. 41, https://static1.squarespace.com/static/585c3439be65942f022bbf9b/t/59f279b3652deaab9520fba6/1509063126843/RethinkX+Report_102517.pdf

- Cuomo, Andrew M., "2019 Justice Agenda: The Time is Now," https://votesolar.org/files/7415/4758/4798/SoS_Briefing_Book_2019.pdf

- Edison Electric Institute (EEI). "Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030," November 2018, http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20EV%20Forecast%20Report_Nov2018.pdf

- Exxon, "2018 Outlook for Energy: A View to 2040," February 2, 2018, https://corporate.exxonmobil.com/energy-and-environment/energy-resources/outlook-for-energy/2018-outlook-for-energy-a-view-to-2040

- Hahn, Robert and Passell, Peter, "The Economics of Allowing More Domestic Oil Drilling," Working Paper 08-21, Revised: September 2008, Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1265728

- Kotchen, Matthew and Burger, Nicholas E., "Should we drill in the Arctic National Wildlife Refuge? An economic perspective," Energy Policy 35, 4720-4729, May 24, 2007.

- McKinsey,"Global Energy Perspective 2019: Reference Case," January 2019, https://www.mckinsey.com/industries/oil-and-gas/our-insights/global-energy-perspective-2019

- National Cooperative Freight Research Program, "Marine Highway Transport of Toxic Inhalation Hazard Materials," National Academies Press, Transportation Research Board, 2012, https://www.nap.edu/read/22737/chapter/13#54

Presentations

- Seba, Tony, "Clean Disruption of Energy and Transportation," Presented at the 70th Conference on World Affairs, Boulder, Colorado, April 9, 2018, starting at 56:50, https://www.youtube.com/watch?v=duWFnukFJhQ

Shell Oil

- Shell, "Energy Transition Report," 2018, https://www.shell.com/energy-and-innovation/the-energy-future/shell-energy-transition-report/_jcr_content/par/toptasks.stream/1524757699226/f51e17dbe7de5b0eddac2ce19275dc946db0e407ae60451e74acc7c4c0acdbf1/web-shell-energy-transition-report.pdf

- Royal Dutch Shell plc., Fourth Quarter 2018 Results, January 31, 2019, https://www.shell.com/investors/news-and-media-releases/investor-presentations.html

U.S. Bureau of Land Management

- Environmental Impact Statement, DOI-BLM-AK-0000-2018-0002-EIS (Coastal Plain Oil and Gas Leasing EIS), https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=152110

- "Oil & Gas Leases updated 11/2018," https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/about/alaska/NPR-A

- "Annual NPR-A Lease Sale Bid Recap (2002-2018)," https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/regional-lease-sales/alaska

U.S. Department of Interior

- Press Release, "New Interior Department Survey Shows HUGE Increase in Recoverable Energy Resources in Federal, State and Native Lands and Waters in Alaska," December 22, 2017, https://www.doi.gov/pressreleases/new-interior-department-survey-shows-huge-increase-recoverable-energy-resources

U.S. Department of Transportation

- Buzy, Mark, "The State of the U.S. Flag Maritime Industry," U.S. Department of Transportation, January 17, 2018, https://www.transportation.gov/content/state-us-flag-maritime-industry

- Maritime Administration, United States Flag Privately-Owned Merchant Fleet Report Oceangoing, Self-Propelled Vessels of 1,000 Gross Tons and Above that Carry Cargo from Port to Port, As of: February 4, 2019, https://www.maritime.dot.gov/sites/marad.dot.gov/files/oictures/DS_USFlag-Fleet_20190204_0.pdf

U.S. Energy Information Administration

- "Alaska: State Profile and Energy Estimates," https://www.eia.gov/state/analysis.php?sid=AK#49

- Annual Energy Outlook 2019 data and supporting spreadsheets:
  - https://www.eia.gov/outlooks/aeo/assumptions/
  - https://www.eia.gov/outlooks/aeo/retrospective/

- Annual Energy Outlook 2019, https://www.eia.gov/outlooks/aeo/pdf/aeo2019.pdf
- Annual Energy Outlook 2018, https://www.eia.gov/outlooks/archive/aeo18/
- Annual Energy Outlook 2019, https://www.eia.gov/outlooks/aeo/
- Annual Energy Outlook 2018, https://www.eia.gov/outlooks/archive/aeo18/
- Annual Energy Outlook 2017, https://www.eia.gov/outlooks/archive/aeo17/
- Annual Energy Outlook 2016, https://www.eia.gov/outlooks/archive/aeo16/
- Annual Energy Outlook 2015, https://www.eia.gov/outlooks/archive/aeo15/
- Annual Energy Outlook 2014, https://www.eia.gov/outlooks/archive/aeo14/
- Annual Energy Outlook 2013, https://www.eia.gov/outlooks/archive/aeo13/
- Annual Energy Outlook 2012, https://www.eia.gov/outlooks/archive/aeo12/
- Annual Energy Outlook 2011, https://www.eia.gov/outlooks/archive/aeo11/
- Annual Energy Outlook 2010, https://www.eia.gov/outlooks/archive/aeo10/index.html
- Annual Energy Outlook 2009, https://www.eia.gov/outlooks/archive/aeo09/index.html
- Annual Energy Outlook 2008, https://www.eia.gov/outlooks/archive/aeo08/index.html
- Annual Energy Outlook 2007, https://www.eia.gov/outlooks/archive/aeo07/index.html
- Annual Energy Outlook 2006, https://www.eia.gov/outlooks/archive/aeo06/index.html

- Independent Statistics & Analysis, "Use of Oil," https://www.eia.gov/energyexplained/index.php?page=oil_use

- "International Energy Statistics," 2019,
    - https://www.eia.gov/beta/international/data/browser/
    - https://www.eia.gov/beta/international/?view=consumption

- North Slope First Purchase Price, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=F005071__3&f=M

- "Short-Term Energy Outlook," February 2019,
    - https://www.eia.gov/outlooks/steo/
    - https://www.eia.gov/outlooks/steo/report/global_oil.php

- Today in Energy, "EIA's Annual Energy Outlook is a projection, not a prediction," May 17, 2016, https://www.eia.gov/todayinenergy/detail.php?id=26272

- Today in Energy, "Oil and natural gas resource categories reflect varying degrees of certainty," July 17, 2014, , https://www.eia.gov/todayinenergy/detail.php?id=17151

- Today in Energy, "Projected Alaska North Slope oil production at risk beyond 2025 if oil prices drop sharply," September 14, 2012, https://www.eia.gov/todayinenergy/detail.php?id=7970

- "Analysis of Projected Crude Oil Production in the Arctic National Wildlife Refuge: Issue in Focus from the Annual Energy Outlook, 2018," May 2018, https://www.eia.gov/outlooks/aeo/pdf/ANWR.pdf

- Wagner, Dana, U.S. Energy Information Administration, "Analysis of Projected Crude Oil Production in the Arctic National Wildlife Refuge," Report Summary, May 23, 2018, https://www.eia.gov/outlooks/aeo/anwr.php

- "Where our oil comes from," https://www.eia.gov/energyexplained/index.php?page=oil_where#tab2

U.S. Fish and Wildlife Service

- U.S. Fish and Wildlife Service, *Arctic National Wildlife Refuge, Alaska, Coastal Plain Resource Assessment*, April 1987, https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/1987leis.pdf

- U.S. Fish and Wildlife Service, "Management of the 1002 Area within the Arctic Refuge Coastal Plain," February 14, 2014, https://www.fws.gov/refuge/arctic/1002man.html

U.S. Forest Service

- US Forest Service, https://www.fws.gov/alaska/nwr/map.htm

U.S. Geological Service

- Attanasi, E. D., USGS, "Undiscovered oil resources in the Federal portion of the 1002 Area of the Arctic National Wildlife Refuge: An economic update," 2005, p. 8, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.405.6106&rep=rep1&type=pdf

- USGS, "The Oil and Gas Resource Potential of the Arctic National Wildlife Refuge 1002 Area, Alaska," 1998, https://pubs.usgs.gov/of/1998/ofr-98-0034/ANWR1002.pdf

- USGS, "Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998, Including Economic Analysis," Fact Sheet 0028-01: Online Report, page last modified November 29, 2016, https://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm

Websites

- Alyeska Pipeline, "The Facts," 2007, p. 19, http://large.stanford.edu/courses/2011/ph240/mina1/docs/FINALfacts-2007.pdf
- Alyeska Pipeline, "Pipeline Operations: Throughput," https://www.alyeska-pipe.com/TAPS/PipelineOperations/Throughput
- Alex Fitzsimmons, Institute for Energy Research, Fact Sheet, "ANWR Fact Sheet: Pipeline Starved, Potential Untapped," January 29, 2015. https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/anwr-fact-sheet-pipeline-starved-potential-untapped/#_edn13
- American Oil & Gas Historical Society, https://aoghs.org/transportation/trans-alaska-pipeline/
- ANWR.org, "Making the case for ANWR," August 15, 2013, http://anwr.org/2013/08/making-the-case-for-anwr/
- Audi, "'Cashew' - 2019 Super Bowl Commercial," https://www.youtube.com/watch?v=7x58qVzUz0U
- Baker Hughes, "North America Rotary Rig Count," phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsother
- CME Group, "Oil Futures Quotes," February 27, 2019, https://www.cmegroup.com/trading/energy/crude-oil/brent-crude-oil.html
- Conoco Phillips, http://alaska.conocophillips.com/who-we-are/alaska-operations/polar-tankers-us-west-coast/
- "Economist's Statement on Carbon Dividends," https://www.econstatement.org/
- History.com, "Exxon Valdez Oil Spill," March 4, 2019, https://www.history.com/topics/1980s/exxon-valdez-oil-spill
- Institute for Energy Research, https://www.instituteforenergyresearch.org/wp-content/uploads/2015/05/U.S.-Oil-Shale-Foreign-Oil-Reserve-Estimates-Mar-15.png
- ISO-NE, 2018 Regional Energy Outlook, February 2018, https://www.iso-ne.com/static-assets/documents/2018/02/2018_reo.pdf

- It Still Runs. "What is the Average Capacity of an Oil Tanker?" https://itstillruns.com/average-capacity-oil-tanker-7486538.html
- Lawrence Livermore National Laboratory, https://flowcharts.llnl.gov/commodities/carbon
- Maritime Connector, "Aframax," http://maritime-connector.com/wiki/aframax/
- NASDAQ, https://www.nasdaq.com/markets/crude-oil-brent.aspx
- RGGI, Inc., https://www.rggi.org/
- Society of Petroleum Engineers, "Guidelines for Application of the Petroleum Resources Management System," November 2011, https://www.spe.org/industry/docs/PRMS_Guidelines_Nov2011.pdf
- State of Alaska, Department of Natural Resources, Division of Oil & Gas, http://dog.dnr.alaska.gov/Information/Data
- Trading Economics, https://tradingeconomics.com/commodity/brent-crude-oil
- United Nations, http://www.unece.org/fileadmin/DAM/ie/se/pdfs/UNFC/UNFCemr.pdf
- United States Climate Alliance, https://www.usclimatealliance.org/alliance-principles

World Bank

- "Pricing Carbon," http://www.worldbank.org/en/programs/pricing-carbon
- "Carbon Pricing Dashboard," https://carbonpricingdashboard.worldbank.org/