

# OVER-LEASED:

How Production Horizons of Already Leased Federal Fossil Fuels  
Outlast Global Carbon Budgets

EcoShift Consulting

Prepared for

The Center for Biological Diversity & Friends of the Earth

July 2016



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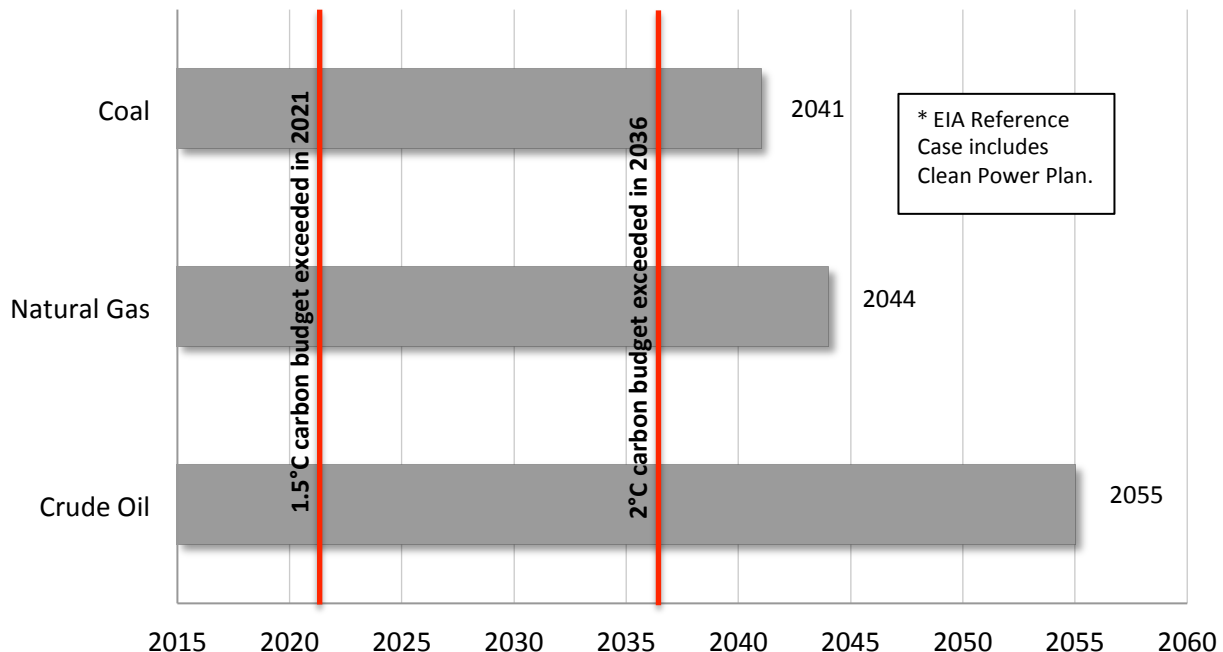
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## Overview

In this analysis we projected the “production horizons”- the number of years’ worth of remaining production - from currently leased federal fossil fuels based on the U.S. Energy Information Administration’s (EIA) 2016 “reference case” for fossil fuel production.<sup>1</sup> We then compared these production horizons to the dates by which the global carbon budgets the world can emit to have a “likely” (66 percent probability) chance of limiting global temperature increases to 1.5°C and 2°C would be exceeded under current global CO<sub>2</sub> emission rates. Our results suggest that:

- Crude oil under federal lease would last 39 years, through 2055;
- Coal under federal lease would last 25 years, through 2041;
- Natural gas under federal lease would last 28 years, through 2044; and
- The currently leased fossil fuels for all fuel types will last significantly beyond the thresholds for both 1.5°C and 2°C of global warming.

**Figure 1. Production horizons of leased federal fossil fuels under the EIA 2016 Reference Case and dates at which global carbon budgets are exceeded\***



<sup>1</sup> Energy Information Agency. 2016. Annual Energy Outlook. <https://www.eia.gov/forecasts/aeo/index.cfm>

Assuming current global CO<sub>2</sub> emissions continue at 2014 rates, and U.S. fossil fuel production continues as estimated by the EIA, we project that existing federal leases will still be producing fossil fuels long after global carbon budgets have been exhausted. Our analysis found that for all fossil fuels, production from lands and waters already leased to industry would outlast the 1.5°C carbon budget by several decades, and the 2°C budget by years to decades. Importantly, every new lease would extend production horizons even further into the future. As previous studies suggest, federal fossil fuel leasing policy should be aligned with U.S. climate policy goals. The analysis strongly suggests that staying within the global carbon budgets will likely require not only ending new federal leases, but also keeping significant amounts of *already leased* federal fossil fuels in the ground.

## Introduction

Climate change is already affecting ecosystems, the food supply and public health, and further increases in warming will have even more significant impacts on human health and the environment. The 2015 Paris Agreement reached by 195 countries around the globe aims to hold global warming “well below 2°C above pre-industrial levels” and commits parties to “pursu[e] efforts to limit the temperature increase to 1.5°C above pre-industrial levels.”<sup>2</sup> Immediate and aggressive greenhouse gas emissions reductions are vital to achieving both of these goals.

According to the IPCC, to maintain just a “likely” (66 percent probability) of limiting global warming to 1.5°C requires adherence to a stringent carbon budget of only 400 GtCO<sub>2</sub> beginning in 2011, of which about 240 GtCO<sub>2</sub> remained at the start of 2015.<sup>3</sup> Further, to maintain a 66 percent chance of keeping global temperatures under 2°C, a threshold that countries agreed to stay “well below” in the Paris Agreement, the global carbon budget was 1,000 GtCO<sub>2</sub> in 2011, of which only 850 GtCO<sub>2</sub> remained as of 2015. With global annual emissions amounting to 36 GtCO<sub>2</sub> in 2015,<sup>4</sup> scientists predict that at current rates global emissions will exceed the carbon budgets necessary to stay under the 1.5°C target by 2021 and the 2°C target by 2036.<sup>5</sup>

Even considering the emissions reductions that can be accomplished under the Clean Power Plan and other federal and state climate policies, the EIA projects that U.S. energy production will continue to grow at a rate of 1 percent per year through 2040.<sup>6</sup> The U.S. was the top global oil and natural gas producer in 2014, and only China extracts more coal.<sup>7</sup> The EIA projections assume the U.S. continues to be a major fossil fuel exporter into the future in competition for an increasing share of overall global production. As a result, even as the U.S. commits to consume

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<sup>2</sup> Paris Agreement, article 2, § 1(a), at [http://unfccc.int/paris\\_agreement/items/9485.php](http://unfccc.int/paris_agreement/items/9485.php).

<sup>3</sup> Rogelj, J. et al. (2016) report that the global carbon budget was reduced by ~160 GtCO<sub>2</sub> between 2011 and 2015. See Table 2 in Rogelj, J. et al. (2016). Differences between carbon budget estimates unraveled. *Nature Climate Change* 6: 245-252.

<sup>4</sup> Oak Ridge National Laboratories. 2015. Carbon Dioxide Information Analysis Center. <http://cdiac.ornl.gov/GCP/>

<sup>5</sup> Carbon Brief. 2016. Data Dashboard: Climate, the IPCC’s carbon budgets. <http://www.carbonbrief.org/data-dashboard-climate-change>

<sup>6</sup> Energy Information Agency. 2016. Annual Energy Outlook, Total Energy Supply, Disposition, and Price Summary. [https://www.eia.gov/forecasts/aeo/data/browser/#/?id=1-AEO2016&region=0-0&cases=ref2016~ref\\_no\\_cpp&start=2013&end=2040&f=A&linechart=~ref2016-d032416a.12-1-AEO2016~ref\\_no\\_cpp-d032316a.12-1-AEO2016&ctype=linechart&sourcekey=0](https://www.eia.gov/forecasts/aeo/data/browser/#/?id=1-AEO2016&region=0-0&cases=ref2016~ref_no_cpp&start=2013&end=2040&f=A&linechart=~ref2016-d032416a.12-1-AEO2016~ref_no_cpp-d032316a.12-1-AEO2016&ctype=linechart&sourcekey=0)

<sup>7</sup> BP. 2015. BP Statistical Review of World Energy. 64<sup>th</sup> Edition. <http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2015/bp-statistical-review-of-world-energy-2015-coal-section.pdf>

less fossil fuels domestically, the EIA projects increased domestic fossil fuel production. Federal lands accounted for 23.7 percent of fossil fuel production in the U.S. 2014.<sup>8</sup>

## Objective

In order to evaluate how federal mineral leasing policy aligns with U.S. climate change goals and global carbon budgets, this research estimated the production horizons — how long federal fossil fuels that have already been leased to industry will last — for crude oil, natural gas and coal. Our objectives are twofold: 1) Model how long already leased federal fossil fuel deposits will produce into the future under the EIA reference scenario;<sup>9</sup> and 2) Compare those production horizons with dates by which global CO<sub>2</sub> emissions (if they continue at 2014 levels) will exceed global carbon budgets for maintaining a “likely” (66 percent) chance of limiting global warming to 1.5°C and 2°C above pre-industrial levels.

## Methodology

We analyzed federal fossil fuels— coal, oil and natural gas— that are currently under lease for production on federal lands and offshore areas (hereafter, “federal lands”). To estimate the production horizons for already leased federal fossil fuels, we calculated an annual rate of energy production on federal lands. Our methodology is as follows:

*Step 1:* We compiled U.S. energy production data reported in quads (quadrillion British thermal units or Btu) of energy from the EIA’s 2016 *Annual Energy Outlook* that reports on 2014 production and makes projections for every year through 2040 for each of coal, natural gas and oil. We used the overall growth rate for each fossil fuel from 2014-2040 to extrapolate annual production for 2041 and each year beyond. To calculate annual federal production from existing leases, we assumed annual federal coal, oil (combined with condensate), and natural gas extraction will be a function of overall U.S. production multiplied by the proportions of production that occur on federal lands.

To calculate the rate of annual federal production from existing leases, we assumed the rate of federal coal, oil (combined with condensate), and natural gas extraction will be a function of overall U.S. production multiplied by the proportions of production that occur on federal lands. The proportion of federal coal, oil, and natural gas production is based on data collected by the Department of Interior and published by the EIA.<sup>10</sup> These data show that federal lands supplied 21.4 percent of oil, 14.1 percent of natural gas, and 40.7 percent of coal produced in the U.S. in 2014. We assumed these proportions would stay consistent throughout the production horizon. Multiplying overall U.S. coal, oil, and natural gas production projected by the EIA by these percentages gave us the annual rates of federal coal, oil, and natural gas production.

*Step 2:* The total energy content of already leased federal crude oil, coal, and natural gas was estimated using energy inventories from the Energy Policy and Conservation Act (EPCA Phase 3) and leasing data from the Office of Natural Resource Revenue (ONRR), Bureau of Land

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<sup>8</sup> Energy Information Agency. 2015. Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014. <http://www.eia.gov/analysis/requests/federallands/pdf/eia-federallandsales.pdf>

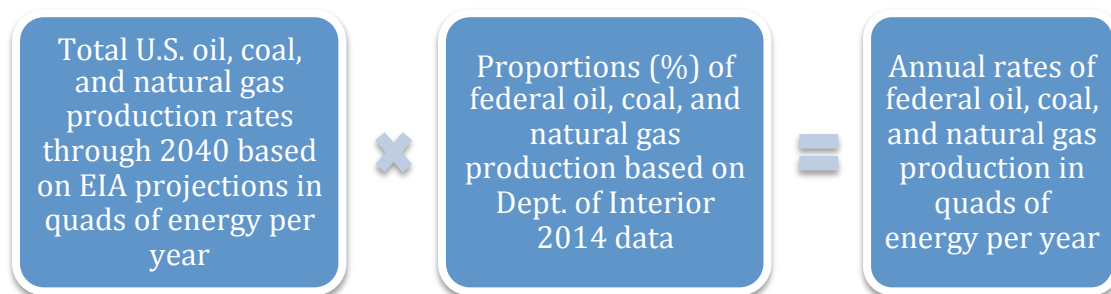
<sup>9</sup> EIA “reference case” for U.S. fossil fuel production reflects production under current federal, state and local laws and regulations and includes implementation of the Clean Power Plan (CPP) rules and regulations.

<sup>10</sup> Energy Information Agency. 2015. Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014. <http://www.eia.gov/analysis/requests/federallands/pdf/eia-federallandsales.pdf>



Management (BLM), Bureau of Ocean Energy Management (BOEM), and Government Accountability Office (GAO). The equations and steps used to calculate “already leased” federal resources are described in Appendix 1 of *the Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels*.<sup>11</sup> The EPCA Phase 3 inventory estimates the total energy in federal crude oil and natural gas.<sup>12</sup> The portion of onshore crude oil and natural gas already leased is calculated using BLM data.<sup>13</sup> Offshore crude oil and natural gas already leased is based on statistics from BOEM for the Gulf of Mexico, Southern California, and Alaska.<sup>14</sup> The amount of federal coal under lease is not available, so the calculation is based on data from GAO,<sup>15</sup> BLM,<sup>16</sup> and the percentage of leased and unmined federal coal reserves remaining in the Powder River Basin.<sup>17</sup> This total amount of energy in leases for federal crude oil, coal, and natural gas was divided by the 2014 rates of federal crude oil, coal, and natural gas production. The result is the production horizon for federal coal, oil and natural gas leases.

**Figure 2a. Step 1 calculated the annual rate of federal oil, coal, and natural gas production**



**Figure 2b. Step 2 compiled the total inventory of federal oil, coal, and natural gas leases and divided this by the annual rates of federal production to get the production horizons**

<sup>11</sup> Appendix 1, pages 26–28, EcoShift Consulting. 2015. *The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels*. Report for the Center for Biological Diversity and Friends of the Earth. <http://www.ecoshiftconsulting.com/wp-content/uploads/Potential-Greenhouse-Gas-Emissions-U-S-Federal-Fossil-Fuels.pdf>

<sup>12</sup> Bureau of Land Management. 2008. *Energy Policy and Conservation Act. Phase 3 Inventory*. [http://www.blm.gov/wo/st/en/prog/energy/oil\\_and\\_gas/EPCA\\_III.html](http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/EPCA_III.html)

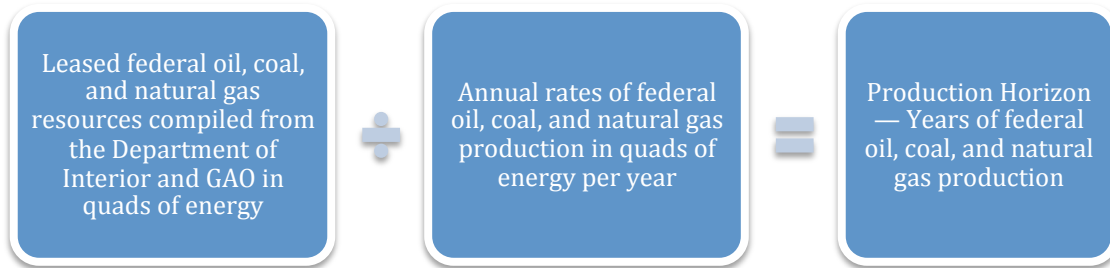
<sup>13</sup> BLM 2014a. United States Department of the Interior, Bureau of Land Management. “Oil and Gas Statistics.” [http://www.blm.gov/wo/st/en/prog/energy/oil\\_and\\_gas/statistics.html](http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/statistics.html)

<sup>14</sup> BOEM 2015. United States Bureau of Ocean Energy Management. “Combined Leasing Report as of February 2, 2015.” <http://www.boem.gov/Combined-Leasing-Report-February-2015/>

<sup>15</sup> GAO 2013. “Coal Leasing - BLM Could Enhance Appraisal Process, More Explicitly Consider Coal Exports, and Provide More Public Information.” <http://www.gao.gov/assets/660/659801.pdf>

<sup>16</sup> BLM 2014b. United States Department of the Interior, Bureau of Land Management. “Total Federal Coal Leases in Effect, Total Acres Under Lease, and Lease Sales by Fiscal Year Since 1990.” [http://www.blm.gov/wo/st/en/prog/energy/coal\\_and\\_non-energy/coal\\_lease\\_table.html](http://www.blm.gov/wo/st/en/prog/energy/coal_and_non-energy/coal_lease_table.html)

<sup>17</sup> Wright, S. 2015. Electronic mail correspondence with Steven S. Wright, P.E., MBA, Assistant District Manager, Solid Minerals, BLM Wyoming High Plains District dated Friday May 15, 2015.



Finally, we used an analysis conducted by Carbon Brief that estimates the number of years until global carbon budgets for 1.5°C and 2°C temperature thresholds are exceeded. Carbon Brief used the remaining quota of global CO<sub>2</sub> emissions that can be emitted to maintain a “likely” chance (66 percent) of limiting global temperature increases to 1.5°C or 2°C above pre-industrial levels (the remaining “carbon budget”) and divided this by annual global CO<sub>2</sub> emissions as of 2014. These results projected what year the carbon budgets for 1.5°C and 2°C would be exceeded if 2014 emissions levels continue. The global quota used by Carbon Brief is based on climate science compiled by the Intergovernmental Panel on Climate Change (IPCC).<sup>18</sup>

Since the IPCC produced this budget in 2011, Carbon Brief updated the carbon budget to reflect the remaining quota in 2016 by subtracting annual CO<sub>2</sub> emissions that have occurred since 2011. Oak Ridge National Laboratories compiled the annual emissions data underlying Carbon Brief’s analysis, which used annual CO<sub>2</sub> emissions from 2011–2014, and applied 2014 emissions rates for each year into the future.<sup>19</sup> The results of Carbon Brief’s analysis show that global emissions will exceed the global carbon budget to likely stay below 1.5°C by 2021, and the global carbon budget to likely stay below 2°C by 2036, if the 2014 pace of emissions continues.

## Results

The production horizon for leased crude oil extends the furthest into the future, lasting 39 years until 2055. Natural gas production on federal lands will last 28 years, through 2044. The production horizon for coal extends 25 years to 2041. In the EIA’s reference scenario, the CPP lowers demand for coal-powered electricity, creating lower domestic demand for coal.

Comparing these production horizons to dates at which carbon budgets would be exceeded if current emissions level continue:

- Federal crude oil already leased will continue producing 34 years beyond the 1.5°C threshold and 19 years beyond 2°C;
- Federal natural gas already leased will continue producing 23 years beyond the 1.5°C threshold and 8 years beyond 2°C;
- Federal coal already leased will continue producing 20 years beyond the 1.5°C threshold and 5 years beyond 2°C.

<sup>18</sup> Intergovernmental Panel on Climate Change. 2014: 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 [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland. [http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR\\_AR5\\_FINAL\\_full\\_wcover.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf)

<sup>19</sup> Oak Ridge National Laboratories. 2015. Carbon Dioxide Information Analysis Center. <http://cdiac.ornl.gov/GCP/>

## Conclusion

Production horizons from already leased federal fossil fuels calculated in this report will last for decades into the future and extend beyond projected dates by which the global carbon budgets necessary to maintain a likely chance of limiting global warming to 1.5°C (2021) and 2°C (2036) will be exceeded if current global emission levels continue. Further, the federal government continues to offer new leases that will extend production horizons even further into the future.<sup>20</sup>

These findings add to prior research estimating that ceasing federal fossil fuel leasing would remove up to 450 GtCO<sub>2</sub>e from the threat of development and prevent 100 million tons in annual CO<sub>2</sub> emissions through 2030.<sup>21, 22</sup>

Our analysis is not meant to suggest that current emissions rates must or will continue into the foreseeable future or that carbon budgets will be exceeded in a fixed number of years. Indeed, if we are to avoid the worst effects of climate change, emissions rates must decline steeply, and immediately. Success in significantly lowering emissions rates would also extend production horizons. Changes in emissions rates, either upward or downward, would necessarily affect the dates by which the 1.5°C and 2°C carbon budgets are exhausted. Nor do we intend to suggest that if all federal fossil fuels remain in the ground, no further climate action would be necessary. Preserving a likely chance of meeting the goals of the Paris Agreement will require additional, concerted efforts in the U.S. and around the world.

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<sup>20</sup> The Department of the Interior has put in place a moratorium on most new coal leasing while it conducts a Programmatic Environmental Impact Statement of the federal coal-leasing program.

<sup>21</sup> EcoShift Consulting. 2015. The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels. Report for the Center for Biological Diversity and Friends of the Earth. <http://www.ecoshiftconsulting.com/wp-content/uploads/Potential-Greenhouse-Gas-Emissions-U-S-Federal-Fossil-Fuels.pdf>

<sup>22</sup> Stockholm Environment Institute. 2016. How would phasing out U.S. federal leases for fossil fuel extraction affect CO<sub>2</sub> emissions and 2°C goals? Working Paper No. 2016-02.