Making future U.S. offshore oil leasing more consistent with climate goals

Avoiding dangerous climate change requires a rapid transition away from fossil fuels. To keep warming within 2°C above pre-industrial levels – the goal reiterated in the Paris Agreement – fossil fuel use (and corresponding carbon dioxide emissions) must be phased out almost entirely within 50 years. However, the short time scale to phase out fossil fuels requires prompt and ambitious action. Many countries have taken measures to reduce fossil fuel combustion, such as pricing carbon and promoting low-carbon energy sources.

In the United States, the Obama administration adopted the Clean Power Plan to limit CO₂ emissions from coal and natural gas combustion for electricity generation, and implemented more-stringent vehicle efficiency standards to limit CO₂ from oil (gasoline and diesel).

President Obama also encouraged other world leaders to develop and pursue their own emission-reduction policies and commitments. While questions remain how President-elect Trump will engage with the international community when he takes office in 2017, global action to reduce emissions will continue.

It is widely acknowledged that to date, progress in reducing emissions has not been fast enough. Even with recent policies, global CO₂ emissions are still expected to rise at least through 2040. And even as nations work to reduce CO₂ emissions from fossil fuel consumption, investment in coal, oil and gas production remains high and is expected to hold steady or continue to grow.

That disconnect between nations’ climate goals and fossil fuel-sector investment has led to questions about whether fossil fuel production needs to be constrained along with consumption. For example, the U.S. Bureau of Land Management (BLM) announced an intention to analyze whether it might set a “budget” for how much coal to make available for production on federal lands based on a “declining schedule consistent with the United States’ climate goals and commitments and market demand.”

Oil is not as carbon-intensive as coal, nor is its production dominated quite as strongly by deposits on federal lands. Still, attaining climate goals will require transitioning away from oil as well, with global production needling to peak within the next 10 to 15 years and falling steadily thereafter.

This briefing paper explores what a “declining schedule” might look like for U.S. oil production from federal lands, and why it might be needed. In these last days of the Obama administration, there may be opportunities to use federal leadership to initiate such a transition for oil in addition to coal.

Our analysis focuses on leases for offshore oil production in federal waters. Offshore oil is especially relevant in the U.S.

because it is the dominant source of oil from federal lands, and the Bureau of Ocean Energy Management (BOEM) has been evaluating its upcoming lease schedule.

Investments in offshore oil infrastructure are also particularly susceptible to carbon lock-in, which arises when carbon-intensive investments become difficult to walk away from in the long term – for economic, institutional and/or political reasons. Since these investments resist being shut down, they continue to produce CO₂ (or carbon-rich fuels that lead to CO₂), making it more difficult to reach carbon reduction goals. (See box for this and other unique aspects of offshore oil drilling.)

U.S. offshore oil in context

Globally, offshore projects now account for about 30% of total oil production. Absent a change in policy, that share is expected to rise gradually over the coming decades, as onshore deposits are increasingly depleted. In the U.S., the vast majority of offshore oil produced to date has come from offshore deposits. Annual Gulf offshore oil production has averaged around half a billion barrels per year in recent years (between 1% and 2% of global oil production). Figure 1 puts the U.S. Energy Information Administration (EIA) reference case forecasts of offshore oil in the context of all U.S. oil production. Offshore projects represent a somewhat smaller fraction of U.S. supply – about 20% – than globally, due especially to the robust (and growing) production from (onshore) shale oil, a situation that is unique to the U.S.

For offshore U.S. oil to continue or expand its current production levels, new platforms will be required. Many of these, at least in the near term, will be constructed in waters already leased by BOEM, and where oil has already been discovered.
Over time, however, an increasing number would be built in waters that have not yet been leased, such as those to be offered in the agency’s proposed 2017–2022 leasing program. By 2040, new (not yet leased) offshore fields are expected to produce about 220 million barrels annually, 4% of U.S. supply (Figure 1), and greater amounts thereafter. (These 220 million barrels annually would emit about 90 million tons CO₂, once refined and combusted as fuel.)

Most of the potential offshore production in 2040 is still expected to come from the Gulf of Mexico. But in the longer term, the location of new investments may shift. Shell’s recent efforts in Alaska’s Chukchi Sea have been put on hold, but exploration in the U.S. Arctic could resume in the long term if federal policy permits it and, over time, overtake that in the U.S. Gulf. Rystad Energy, for example, expects exploration investments in Alaska’s Chukchi and Beaufort seas to surpass Gulf exploration within the next two decades.⁸

Therefore, absent a fundamental policy change, the longer-term future of U.S. offshore oil may lie in the Arctic, suggesting that debates about Arctic drilling and its environmental and safety risks may well continue. Of course, the U.S. is not alone in exploring the Arctic. Norway (the world’s third leading investor in offshore oil, after Brazil and the U.S.) is focusing most of its exploration activity in the Barents Sea and the northern portion of the Norwegian Sea. Like the U.S., Norway is in the midst of major debates about the future of Arctic drilling.

Offshore oil drilling is much more complex – and costly – than onshore drilling. Drilling must be performed, via a pipe, from a platform that is either floating above or firmly anchored to the sea floor. Once drilled, the well is constructed by pumping cement down the drill pipe to line the walls of the well, which is then attached to the surface with a reinforced tube called a “riser”, through which oil can flow.

There are several different types of offshore oil drilling rigs, and their use varies depending on water depth, weather, and climate. Jack-ups have legs that attach to the sea floor, and to which a platform is attached and raised above the ocean surface (out of the waves). These are used in shallow water. Semi-submersibles, by contrast, sit partially in the water (stabilized by pontoons) and can be used in deeper and rougher water. Heavy-duty semi-submersibles (such as the Deepwater Horizon that caught fire and sank in 2010) are used in particularly severe conditions and water depths down to 3,000 meters (about 10,000 feet). Similar depths can be attained by drill ships, though these are less common than semi-submersibles.

As a result of these capital-intensive and complicated offshore platforms and systems, offshore drilling projects have very long lead times (many years, even a decade or more) and may cost several hundred million dollars per well, instead of a few million for an onshore well. Once constructed, however, the operating costs of offshore drilling may be as low as – or, in some cases, even lower than – the cost of producing onshore oil (e.g. from oil sands). This gap between the capital and operating cost of offshore platforms leads investors in offshore resources to take a long-term view – requiring confidence in a high eventual price for oil, even as prices in any given year or month may fluctuate widely. It also means that, once constructed, offshore oil production can be relatively resistant to price fluctuation, remaining cash-flow positive and continuing operation even with sustained lower oil prices, as might arise if future oil demand declines as the result of climate policy. From the perspective of investors, those assets could be “stranded”, since they are no longer yielding adequate returns. However, they are not physically stranded, as they continue production. Thus, from a climate perspective, offshore oil investments can contribute to carbon lock-in. This is because new fossil fuel infrastructure may yield more fuels in the long term than would be consistent with a 2°C pathway, leading to over-production and the undermining of climate goals, since increasing the supply of oil, coal, or gas tends to limit price increases and, in turn, increase consumption relative to a more constrained supply.
Figure 1 shows how U.S. oil production may rise in the U.S. Energy Information Administration (EIA) reference scenario, which assumes no further steps to address CO₂ emissions beyond those already adopted. This raises a question, however: How would U.S. oil production instead proceed in a world committed to a safer climate, where global oil (and other fossil fuel) demand falls continuously, renewable power and electric vehicles soar, and countries move along an energy pathway that preserves a 50% or (ideally) greater chance of limiting warming to 2°C?

To assess this question, we turn to two modelling exercises that have analyzed which world regions would produce the oil consumed during a low-carbon transition. These studies – one by the International Energy Agency (IEA) and another by the researchers Christophe McGlade and Paul Ekins at University College London (UCL) – both plot cost-efficient pathways for fossil fuel production, under the principle that fossil fuel markets would decide which countries produce how much of each fuel. In these studies, countries with lower-cost resources produce more of the global oil consumed, and higher-cost resources are not developed (or become “stranded”), in a 2°C scenario.

Each study has strengths and limitations for answering our question. The UCL study uses a more stringent definition of a 2°C scenario – one that maintains a 60% chance of limiting warming to this level. However, it underestimates U.S. oil production, since it uses a data set starting in 2010 that misses much of the subsequent boom in U.S. oil and gas production capacity. (It also does not reflect global equity considerations that might suggest less-developed countries should be allowed to produce a greater share of the total.)

The IEA study starts with 2013 data, and thus better captures the U.S. oil production boom, but it uses a scenario with only a 50% chance of keeping warming below 2°C. It also does not reflect global equity considerations.

Together, the scenarios indicate that U.S. oil production would be 40% to 50% lower in 2040 than current levels. To be consistent with a 2°C pathway under these scenarios, U.S. oil production will need to decline at rates averaging 2–3% per year, leaving little room for new sources of production. Scenarios with a “likely” (66%) chance of keeping warming below 2°C would further constrain production.

Figure 1 also shows one other element of a transition to a 2°C scenario – U.S. oil consumption. The U.S. now uses at least a billion barrels more than it produces each year. In transitioning to a 2°C pathway (50% chance), however, U.S. oil consumption would fall faster than production, shrinking that gap.

**Does new offshore oil pass a ‘climate test’?**

Figure 1 shows how, in simplified terms, there is already more than enough domestic oil from other sources to meet U.S. oil production needs consistent with a 2°C pathway without expanding federal offshore oil production. These other sources include oil from private and state lands (and waters) – plus oil from already-producing federal sources.

The U.S. could thus adopt a 2°C oil production pathway within a range such as the one shown, using it as a budget or “declining schedule” for oil. On this basis alone, the BOEM could stop issuing new leases for offshore oil development in federal waters, as a contribution towards aligning national energy development with a 2°C pathway. Such action would send a strong signal to other nations that are similarly committed to the Paris Agreement but still exploring for offshore oil, such as Norway.

There is also another way to look at the role of offshore oil under a 2°C pathway, based on economic efficiency. Under this lens, production would adjust based on the relative cost of each resource, effectively leaving market forces to decide which resources would be extracted.

---

**References:**

1. Rystad Energy (2016); IEA (2015, 2016)
Since a 2°C transition would imply lower levels of global oil demand than in a reference case, oil prices would likely be lower than otherwise. New projects that could not cover their costs in this lower-price environment—with higher “break-even” oil prices—would not proceed.

Figure 2 applies this economic efficiency lens to the global oil market. It shows that in the IEA’s 2°C (450) scenario, about 930 billion barrels of oil would be consumed between now and 2050. More stringent carbon budgets—those that use a 66% or higher chance of meeting the goal—would allow for less oil. The vast majority—perhaps nearly all—of yet-to-be-leased offshore oil in the U.S. (small, dark blue, labeled blocks in Figure 2) is expected to have break-even costs well above this range. By contrast, oil fields that are already producing (those on the left side of Figure 2) can produce at lower costs and may “fit” within the IEA’s 2°C carbon budget.

To get an even clearer sense of the costs and potential quantities of U.S. offshore oil, Figure 3 shows just U.S. offshore oil and relaxes the 2050 production constraint that was used in Figure 2 (which was necessary to align with IEA’s assumed carbon budget). Figure 3 therefore shows Rystad’s assessment of the entire oil resource of the U.S. offshore, to help understand the full quantities that may be in play due to U.S. leasing decisions.

As seen in Figure 3, projects dependent on new leases in the Gulf of Mexico, Atlantic, Pacific and Arctic are expected to require, on average, break-even oil prices of at least $140 per barrel. This makes them at least $50 per barrel too expensive (in the Arctic, up to $150 per barrel too expensive) to be consistent with oil demand (and associated price) under a 2°C pathway.

By contrast, and depending on the costs of production, some offshore oil in the Gulf of Mexico could still be produced in a 2°C scenario—especially from rigs that are already producing (those in light blue on the left side of the chart). This helps illustrate how, as noted in the box, offshore oil is particularly susceptible to carbon lock-in, because once the upfront investment is made, the cost of operating an oil platform can be relatively low (blocks on left side of Figure 2). As a result, oil production may continue even in a low oil price environment (such as the near-$50/bbl prices seen currently) or even with the prices, e.g. around $80/bbl, that could be expected under a 2°C scenario.

The oil industry itself talks about “resilience” when it discusses how offshore oil can be relatively insulated from oil price swings. Whichever term is used, it is clear that investing in new offshore oil infrastructure may yield more oil being produced than is consistent with a 2°C pathway, potentially undermining climate goals, since increasing the supply of oil tends to limit price increases and, in turn, increase consumption relative to scenarios in which supply is more constrained. It could also lead to stranded assets and even create new environmental risks and taxpayer liabilities—for example, if reclamation activities for offshore platforms and rigs are underfunded.

When would new offshore oil make sense?
The concept of a climate test, as applied above, is based on a 2°C limit. But a similar test could be performed for other limits on temperature increase. For example, a test could also be applied using a 1.5°C trajectory, which would almost certainly involve even more stringent limits on oil production.
We can also explore the implications of scenarios with greater oil production and use. The current forecast of U.S. oil production under “business as usual”, for instance, as in Figure 1, suggests a global energy system that would lead to warming well above 2°C.

The EIA’s “business-as-usual” scenario assumes cumulative global oil demand of at least 1.2 trillion barrels, on par with (or greater than) the IEA’s New Policies Scenario (Figure 1). Demand at that level would only be reached with less-than-ambitious climate policies, leading to a continued rise in emissions from oil and other fuels, and warming of about 4°C. At that level of demand, oil prices would be high enough to yield some new offshore oil, as in Figure 3.

These findings suggest that BOEM, by continuing to lease new offshore oil resources that would cost about $140/bbl (or more) to produce, would be implicitly counting on warming of at least 4°C (7°F). At this level, the Intergovernmental Panel on Climate Change (IPCC) warns of “very high” risks of severe and widespread impacts on natural systems, species extinctions, large risks to food security, and compromised human activities due to high heat, among other concerns.15

As a result, decisions to allow continued offshore exploration effectively count on the Paris Agreement to fail or, in the words of the economist Nicholas Stern, ask us “to bet against the world … telling us that we won’t do what we’ve set out to do and that it is a safe bet to bet that we won’t”.16

Policy implications
A global response to keep warming within 2°C demands a rapid and near-complete phase-out of fossil fuels over the next several decades. To date, most nations – including the U.S. – have focused almost entirely on policies to reduce demand for fossil fuels, especially coal and oil.

But clearly that has not been enough. Measures to constrain supply directly (complementing efforts to reduce demand) can also play an important role in reaching emission reduction targets. In that context, efforts such as the BLM’s review of whether fossil fuel production should be purposefully constrained – e.g., a “declining leasing schedule consistent with U.S. climate commitments” – were a welcome development and can serve as a model for other countries (and U.S. states).

Here, we have shown:

- The leasing and development of new U.S. offshore oil implicitly assumes that the world is on a pathway for at least 4°C of warming, a level that the IPCC finds would bring substantial new risks to ecosystems, water supply, food security and human health.

- Investment in new, capital-intensive offshore oil expands supply and creates carbon lock-in that makes it ever harder to limit warming, owing to the resilience of offshore oil supply to subsequent drops in oil demand and prices and the strengthening of the political, institutional and technical structures that sustain it.

These findings suggest that continuing to issue new leases for offshore oil risks stranding assets and communities, making little sense for regional economies or the climate. Were the concept of a “climate test” to be applied to offshore oil, our findings suggest it would not pass, and that the world’s (and U.S.) limited carbon budget would be better spent elsewhere.

Endnotes


Rystad Energy’s forecasts in the UCube model show a similar pattern for oil and gas.


5 See, for example, IEA (2015), World Energy Outlook 2015, Table 2.1 (450 scenario) or the review of IPCC scenarios in Figure 3a of: McGlade, C. and Ekins, P. (2015). The geographical distribution of fossil fuels unused when limiting global warming to 2°C. Nature, 517(7533). 187–90. DOI:10.1038/nature14016.


8 As of November 2016, Rystad’s UCube forecasts exploration capex off the North Slope of Alaska to reach $4 billion in 2031, overtaking investment in Gulf deepwater exploration in that year.


10 Estimates from Rystad Energy’s UCube database indicate that at demand and price outlooks like those in IEA’s New Policies scenario, already-producing U.S. fields would decline about 8% (in aggregate) on average between now and 2040.


12 The chart shows the average break-even price within each basin and lease status, so individual project costs may vary. Furthermore, Rystad believes its early estimates of break-even costs for new areas to be conservative, noting that “best in class” operators would typically be able to produce at lower costs.


14 The IEA’s New Policies Scenario (see endnote 2) and analogous 4DS scenario (see IEA 2016 in endnote 11) correspond to warming of about 4°C.


16 For video of Nicholas Stern making these remarks, see https://www.theguardian.com/environment/video/2015/may/27/shell-wrong-on-climate-change-nick-stern-video/.

This discussion brief was written by Peter Erickson, Adrian Down and Michael Lazarus of SEI, with contributions from Andrew Grant, James Leaton and Mark Fulton of the Carbon Tracker Initiative. The authors would like to thank NextGen Climate America and Natural Resources Defense Council, which provided funding for this research, and Friends of the Earth US, which provided funding for the original analysis on which this brief builds. We also thank Harro van Asselt for helpful review and input. Responsibility for the content lies solely with the authors.