

Review of an Industry Report on the Impacts of a Delay in Federal Offshore Oil and Gas Leasing

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Introduction

The Department of the Interior plans to release a draft federal offshore oil and gas leasing program by June 30, 2022, which will outline a proposed schedule of offshore lease sales over the next five years.ⁱ In that new program, Interior has the option to forego any new offshore oil and gas lease sales for the next five years. Earlier this year, fossil fuel industry groups -- The American Petroleum Institute and National Ocean Industries Association -- commissioned an analysis by Energy & Industrial Advisory Partners (EIAP) of the estimated impacts out to 2040 of a hypothetical five-year delay in offering new oil and gas leases in the Gulf of Mexico (GoM).ⁱⁱ The March 2022 report claims to find that a leasing delay would “significantly impact Gulf of Mexico oil and natural gas industry activity” and could subsequently lead to reduced oil and natural gas production, industry spending, jobs, contribution to GDP, and government revenue.ⁱⁱⁱ However, the EIAP analysis substantially overestimates any impacts and is unreliable for informing federal leasing policies for several reasons detailed in this review.

The EIAP study suffers from a number of fundamental methodological flaws and information gaps, including:

- EIAP provides very limited information about its methods and assumptions, undermining its accuracy and scientific rigor and making it difficult to assess and count on the reliability of the findings.
- EIAP finds greater production impacts due to a temporary pause in leasing compared to three other analyses, including two that assume a permanent end to new leasing, indicating that EIAP methods are unreliable and overestimate the impacts.
- The report falsely and misleadingly implies that a five-year delay in new leasing in the next OCS five-year program would result in significant price hikes on consumers. In fact, it would result in less than a penny per gallon difference in customer prices at the pump over the next 19 years. Furthermore, a permanent end to issuing new federal offshore oil and gas leases, would result in only 1 to 2 cents per gallon difference in price to consumers at the pump over the next 30 years.
- The input-output multipliers used by EIAP significantly overestimate employment and economic impacts of changes to the energy sector because they fail to account for how markets work.

¹ All judgements and conclusions of this review are entirely those of the author. I am grateful to Brian Prest from Resources for the Future for his related research and modeling insights and to Earthjustice for financial support to conduct this review. I am available for questions at Laura@apogeeep.com.

- EIAP does not report estimated net changes in production, jobs, or GDP, but rather the estimated change in the Gulf oil and gas industry's *contribution* to total US production, jobs, and GDP. This is a vitally important distinction. The EIAP model and reporting simply assume that every projected change in Gulf oil production is an unmitigated loss to each of these factors; an assumption that does not reflect the way energy and job markets work in real life, where adaptation and substitution play an important role. Drilling on existing leases (including on nearly 8 million acres of yet-to-be-developed leases) will continue for many years regardless of the number of new leases issued going forward and the impact to industry of a change in issuing new leases would be gradual over decades, giving plenty of time for the industry and for the workforce to adjust. In fact, accounting for substitution and expected shifts that would likely occur between energy sub-sectors and to other economic sectors that are more labor intensive could result in *more* net US jobs and GDP, not less.
- EIAP's report misleadingly describes impacts as substantial, yet the claimed impacts are strikingly small and well within the noise of annual change rates when put into context.
- EIAP's analysis completely ignores the benefits to society of avoided climate damages and of reduced environmental and health impacts. The dollar value of climate benefits alone out to 2040 from a five-year delay in leasing would come to between \$23 billion and \$365 billion dollars.

Analysis of EIAP Models, Claims, and Findings

EIAP's lack of methodological transparency makes it impossible to assess the reliability of its findings

EIAP's report is not substantiated. EIAP claims that its modeling is based on publicly available data, but fails to provide the input data, assumptions, and equations that it uses in the modules of its model. The report is vague about how the models work and readers are unable to reproduce or even evaluate EIAP's methods to validate the findings of the study. This fundamental flaw permeates nearly every aspect of the study.^{iv} As a result, EIAP's conclusions cannot be validated.

For example, EIAP's conclusion that annual oil and gas production will drop by 0.5 million barrels of oil equivalent by 2030 as a result of a five-year leasing delay is overblown. EIAP does not explain its modeling assumptions for the timing and activity levels for developing wells yet to be drilled. A substantial time lag would occur before a change in issuing new leases would have any substantial economic impact because operators would continue drilling on leases they already own. There are over 7.8 million acres of offshore GoM federal waters already under lease that have yet to be developed.^v Companies have currently only begun development on 2.6 million of the more than 10.4 million acres leased in the Gulf of Mexico. In other words, more than 3/4ths of the total existing leased offshore acres have yet to be developed. It will take oil and gas companies many years to develop the large inventory of existing undeveloped leases in the Gulf.

In fact, the federal government issued new federal oil and gas leases on over 2.8 million acres in the Gulf of Mexico in 2019 and 2020 (over 5.6 million acres of new GoM leases altogether between 2017 and 2020).^{vi} Companies typically have 10 years to start development on their lease, so companies holding those leases issued in 2019-2020 can start development on them as late as 2028-2029.^{vii} Research shows that companies typically wait until near the end of those 10-years to start development and that the majority of production from a federal offshore lease comes more than 10 years after a lease parcel is sold.^{viii} This means that oil produced from these leases would not reach the pump for years, and typically more than a decade down the road. As such, pausing or even ending leasing would not exert much effect on federal oil and gas production for at least a decade.

EIAP states that industry needs to invest in new leases that are next to existing leases to diligently develop their existing leases. EIAP surmises that: “project development activity is projected to be reduced as soon as 2025, as projects would require tiebacks from adjacent unleased blocks to underpin their project economics are the first to be impacted.”^{ix} Yet EIAP presents no data or information on assumptions used in its model to assess how the geographic location and existence of the nearly 8 million acres of undeveloped exiting leases would be utilized (or conversely how those existing leased acres would be insufficient to enable this kind of development). Nor does EIAP project or even estimate how many millions of spare leased acres is enough for industry to develop existing leases.

EIAP also notes that the offshore oil and gas industry requires a steady stream of new leases to spread capital costs over a longer footprint.^x EIAP does not provide any evidence for its financing assumptions nor explain how these impacts are incorporated into its models. It is impossible to evaluate the reliability of EIAP’s findings without more information on the actual modeling assumptions and what existing data supports the necessity of such assumptions. The author reached out to the authors of the EIAP report to get more information on their models and assumptions, but at the time of this writing they have not responded.

EIAP overestimates production declines

As described above, EIAP presents very little information about the assumptions and methods used in its modeling, rendering a complete assessment of its results impossible.^{xi} But comparing the study’s findings with three other recent analyses modeling a pause or an end to offshore leasing demonstrates that EIAP’s estimated production impacts are inexplicably as much as two times higher than other analyses.

In January 2022, Rystad Energy estimated that if no new federal offshore leases were issued until 2028 (a five-year pause) then GoM oil production would be reduced by around 0.2 million barrels per day (mb/d) in 2030.^{xii} Another energy consulting firm, OnLocation, recently estimated that a permanent ban on issuing new federal offshore leases would result in less than a 0.2 million barrels per day reduction in GoM oil production in 2030.^{xiii} EIAP estimates double the production impacts, a 0.4 mb/d reduction in GoM oil production in 2030 from baseline, compared to what Rystad Energy or OnLocation estimate.^{xiv}

Economist Brian Prest, a fellow at the non-partisan economic think tank Resources for the Future (RFF), published a study in 2022 on the production impacts of ending new federal offshore oil and gas leases using his peer-reviewed model of the upstream oil and gas system.^{xv} Prest finds that a *permanent* end to issuing new federal offshore oil and gas leases beginning in 2020 would result in a nearly 2.5 million b/d reduction in cumulative offshore federal oil production by the end of 2030.^{xvi} In contrast, EIAP estimates that a *temporary* five-year pause to issuing new federal offshore leases beginning in 2023 would result in around 2.7 million b/d reduction in cumulative offshore federal oil production by 2033. In other words, EIAP's estimated reduction in offshore federal oil from a five-year pause is more than 200,000 b/d larger than those calculated by Prest from a permanent ban within the first 11 years.^{xvii}

Rather than larger, EIAP's estimates should be smaller than Prest's estimates. There are three reasons to expect EIAP's production estimates from a temporary pause to be smaller, not close to or larger, than Prest's estimates from a permanent end to offshore leasing. First, and most obviously, Prest evaluated a permanent ban on new leasing starting in 2020. EIAP's analysis covers only a pause from 2023-2028. Second, EIAP's forecasted price assumptions are smaller than Prest's high price scenario assumed prices.^{xviii} In general, the higher the price, the more production would occur. Using lower prices would be expected to shrink the difference between current and future production. Third, EIAP assumes that at least three more Gulf of Mexico lease sales occur and are in the inventory of existing leases to develop compared to what Prest assumed.^{xix} More leases equate to more acreage already in the hands of companies and available for development and production even during a leasing pause, resulting in greater baseline production than assumed in Prest's analysis. Yet, EIAP still estimates a reduction that exceed those in Prest's analysis.

In sum, EIAP finds greater production impacts due to a temporary pause in leasing compared to three other analyses that modeled equal or greater changes to future leasing in the Gulf. EIAP provides insufficient explanation for its methodology or justification for this incongruous result, rendering its findings unreliable.

Report insinuates large price impacts to consumers, yet would likely result in less than a penny per gallon increase at the pump

The first sentence in the EIAP executive summary implies that domestic oil and gas production (and presumably the impacts on production from the delayed GoM leasing that they analyze) would impact oil and natural gas prices for consumers.^{xx} Many critics of delaying or permanently suspending GoM lease sales also make the argument that new leases are critical to avoid price impacts on consumers already facing high energy prices. EIAP does not report price impacts estimated in its model, presumably because it takes the Energy Information Administration's Annual Energy Outlook (AEO) wholesale prices and treats them as fixed. Contrary to EIAP's statements, price calculations instead show that delayed or suspended leasing will only increase gas prices by pennies.

Although EIAP does not report estimated price impacts, a back of the envelope calculation applying Prest 2022 published leakage rates and demand elasticities to EIAP's estimated GoM

oil production impacts finds that a five-year delay in issuing new federal leases in the Gulf would result in **less than a penny per gallon difference** in customer prices at the pump over the next 19 years. Even if the federal government were to permanently stop issuing new federal offshore oil and gas leases, it would result in an estimated **1 to 2 cents per gallon difference** in price to customers at the pump over the next 30 years. Detailed explanations of the calculations are included below.

Calculating consumer price impacts

EIAP estimates that a five-year delay in offering new offshore leases would result in a 0.36 mb/d reduction in GoM crude oil production on average between 2022-2040 compared to if there was no delay to new leasing. Applying Prest 2022 federal leasing ban leakage rate of 72.4%, the estimated net impact on global oil supply due to a delay in issuing new GoM lease sales would be 0.1 mb/d over 19 years (27.6% of the 0.36 mb/d average annual GoM production decline estimated by EIAP).^{xxi} In the context of global oil demand of around 100 mb/d, this would represent around a -0.1% net loss in global oil supply. Dividing -0.1% by an oil demand elasticity of -0.2 yields a crude oil price impact of around +0.5% over 19 years.

The estimated impact on consumer prices at the pump would be even further diluted. Economists at the Federal Reserve Bank estimate that a \$10 increase in oil prices roughly translates to a 25-cent increase in retail gasoline prices at the pump over the long run.^{xxii} Assuming \$71/barrel for the average future price of global crude out to 2040,^{xxiii} a 0.5% rise would increase the global price of wholesale oil by around 36 cents/barrel.^{xxiv} As such, a delay in issuing new GoM leases would result in an estimated penny per gallon difference in price to customers at the pump over the next 19 years.^{xxv} The near term price impact would be even lower given that the majority of impacts to production would be around 10 years in the future due to the delay between when leasing occurs and when production from a lease would come online.

Assuming \$76/barrel for the average future price of global crude out to 2050,^{xxvi} the US federal government not offering new offshore leases going forward would result in between an estimated 0.78% and 1.03% rise in the global price of wholesale crude oil (or between 59 and 78 cents/barrel) over the next three decades.^{xxvii} In turn, not issuing new federal offshore oil and gas leases would result in an estimated 1 to 2 cents per gallon difference in price to customers at the pump over the next 30 years.^{xxviii} **Just looking at the next decade, not offering new federal offshore oil and gas leases would result in less than a penny per gallon of difference in customer prices at the pump.**^{xxix}

EIAP's chosen methods overestimate impacts and its misleading reporting does not reflect the way energy and job markets work in real life

EIAP uses multipliers that consistently overestimate impacts

To model both direct and indirect/induced economic and job impacts, EIAP uses input-output multipliers.^{xxx} Economists have found that EIAP's chosen methods significantly overestimate impacts because they fail to account for how markets work in reality by assuming fixed prices

and no substitution between factor inputs, often resulting in misleading and biased claims. For example:

- A 2015 review of research methods to estimate the socioeconomic impacts of the shale boom led by David Fleming reports that “although a very popular method employed by industry and governments to measure economic impacts, [input-output] models can easily provide misguided results, especially in the context of resource extraction activity.”^{xxxvi}
- Conducting statistical analysis based on historic data from after the 2010 production moratorium in the Gulf of Mexico, Joseph Aldy found that economic and employment projections made by industry, government, and academics during the moratorium that used regional employment multipliers overestimated the economic and employment impacts by many magnitudes.^{xxxvii} Aldy warns that multiplier analyses “may be uninformative and potentially biased for policy deliberations.”^{xxxviii}
- Economist Jeremy G. Weber found that input-output models overestimated the employment impacts of the shale gas boom in Pennsylvania by over 20 times the actual gain in employment.^{xxxix} Weber 2012 explains that when using input-output models to project how development and extraction will affect state economies, “the results of [input-output] models hinge on assumptions about economic multipliers and may deviate substantially from actual effects.”^{xl}
- An analysis of the projected impacts of an onshore federal leasing moratorium by Timothy Considine in 2020 admitted that the estimated economic impacts on employment and income were 60 to 75% lower when using multipliers based on historical data compared to input-output multipliers.^{xli}

EIAP neither acknowledges these well-known shortcomings, nor does it address how the use of different multipliers or methodologies may affect its estimates. It is standard practice to include a sensitivity analysis to test the validity of estimates using a different methodology and, at the very least, to include a disclaimer about the tendency for a chosen methodology to exaggerate impacts. EIAP did not do either of these. The result is that the report presents a biased overestimate of the impacts.

EIAP fails to estimate net impacts as employment shifts across job types, and misleadingly reports those shifts as lost jobs

EIAP concludes that a delay in issuing new federal offshore leases would lead to the loss of nearly 60,000 jobs.^{xlii} That takeaway is misleading because jobs (especially in the energy sector) are constantly shifting across industries and across states especially during energy transitions. EIAP’s analysis does not appear to account for this reality. To put EIAP’s estimated 60,000 job loss into perspective, pursuing US climate targets and transitioning to a net-zero economy could create around three million energy supply-side jobs (a **net increase of 300,000 to 600,000 jobs**) by 2030.^{xliiii}

It is critical to understand that EIAP does not report estimated net changes in US jobs or GDP, but rather the Gulf production’s “contribution to” jobs and GDP. This careful distinction is vitally important since energy production and work can fluidly shift between different economic sectors and between energy sub-sectors.^{xliiii} Workers in the oil industry are highly sought after, particularly right now when the industry is having major workforce shortages.^{xl} Most oil industry

workers not working on offshore wells in the Gulf will be able to find jobs elsewhere, meaning a different sector would claim the same “contributions to” GDP and jobs. In addition to high labor demand for work within the onshore oil and gas industry in the near term, going forward there is also high workforce transferability to adjacent energy sectors including in offshore wind, onshore renewables, and rig decommissioning.^{xli}

Given the gradual estimated impacts of not offering new leases occurring slowly over the next decade as development continues on the nearly 8-million-acre stockpile of existing yet-to-be-drilled leases, the economy and jobs will gradually shift over time to related fields (such as engineering and construction jobs in the expansion of renewable energy both onshore and offshore, the expansion of electric vehicle charging stations, etc.). Both onshore wind and utility-scale solar are competitive in counties with high levels of fossil fuel employment including along the gulf coast.^{xlii} DOI also plans to permit 30 gigawatts of offshore wind generating capacity by 2030 and is currently working on an environmental assessment to determine suitable areas in the Gulf of Mexico.^{xliii}

Lack of perspective is misleading

EIAP’s estimated impacts of a delay in issuing new offshore leases create scary sound bites for the fossil fuel industry to point to, but even the overestimates EIAP reports in its findings are strikingly small. EIAP estimates an annual average “loss in GDP contribution” of \$5 billion, but that represents only 0.02% of US GDP. US GDP typically fluctuates far more than that within any given year.^{xliv} EIAP also estimates job loss of 57,000, which amounts to only 0.03% of the US workforce of 164 million.^{xlv} Again, the workforce typically fluctuates far more than that from year to year.^{xlvi} In fact, EIAP’s estimated average job loss each year is less than the average job loss in the US for a single day.^{xlvii}

EIAP states that the jobs it claims will be lost due to a delay in issuing new offshore leases are “highly paid blue-collar jobs” but does not provide data on these wages, nor on the safety risks, job length and security, benefits, and other indications of job quality.^{xlviii} The fact is that overall, the availability of these jobs has been shrinking for years. Subject to volatile global prices for oil and with positions increasingly being replaced by machines, the oil and gas industry workforce faces a lot of instability.^{xlix} Offshore employment tracked by work hours dropped by more than 40% between 2011 and 2019.¹ Following massive layoffs in the oil and gas industry during the COVID-19 pandemic in 2020, many workers no longer want to return.^{li} Overall trends show oil and gas extraction jobs have been on the decline in the US since 2014^{lii} and machine automation is expected to decrease the number of human workers in the industry going forward.^{liii}

These jobs are also amongst the most dangerous in the US. A 2018 article by the Center for Public Integrity found that data shows oil and gas workers are five times more likely to die on the job than in other industries.^{liv} That is just what is officially counted. A 2021 investigation uncovered that fatalities of offshore workers in the Gulf of Mexico are twice as high as what is officially reported.^{lv}

EIAP fails to account for expected domestic production shifts that would further reduce job and economic impacts

Like its simplistic assumptions about the workforce, EIAP appears not to account for the shifts in domestic production in the near term that would be expected to partially offset a decline in offshore production. When modeling the impacts of a change in policy in one region such as a hypothetical five-year pause in issuing new federal offshore leases, it is basic practice to model the expected shifts in production across different regions. Prest estimates that around 30% of the eventual production decline from a federal leasing ban would be offset by a corresponding rise in domestic oil and gas production not subject to federal leasing decisions. Similarly, BOEM estimated that between 25 and 29% of offshore production that would not occur under the No Sale Option in its current five-year leasing program would be replaced by development from other sources of domestic oil and gas.^{lvi} That domestic production shift would in turn offset some of the expected impacts on GDP and on employment estimated by EIAP.

Although EIAP does not include production shifts in its modeling (a choice that makes impacts appear larger than when appropriately placed into the context of net impacts that account for the ways markets adjust in reality), it does allude to production shifts by repeating a common industry claim that GoM oil and gas is “cleaner” than that obtained elsewhere. EIAP incorrectly claims that GoM production has one of the lowest carbon footprints of oil and natural gas production globally and cites Motiwala et al. 2020 to support this statement.^{lvii} Motiwala et al. 2020 looks at carbon intensities between production from the Gulf of Mexico and the Permian Basin and finds that the Permian Basin has a higher carbon intensity than GoM production mainly because of flaring practices. That report does not mention how GoM carbon intensity compares to other producers globally. On the contrary, a study by the Carnegie Endowment finds that the differences in estimated lifecycle emissions of crude oil from the Gulf of Mexico compared to other major producing regions in the US and abroad are small and even finds that the emissions intensity of GoM oil production exceeds many other top producing regions.^{lviii} Although not central to modeling in the EIAP report, this incorrect use of a source is especially notable for a report that provides only a handful of sources and very little detail about the data and assumptions used in the study.

Chooses to ignore economic benefits to society of less leasing

As explained before, EIAP’s “contribution to GDP” accounting is likely to overstate the costs because it does not account for GDP gains outside of the Gulf region as workers and industry spending gradually move to other energy sectors and to other industries. But it is also important to note that GDP is not a measure of overall human welfare. The EIAP analysis completely ignores the benefits to society of delaying or permanently foregoing new oil and gas leasing. Benefits include avoided climate damages to people, agriculture, and infrastructure from reduced flooding, fires, and heat waves; avoided oil spills; avoided direct injuries and deaths to workers on the oil rigs; and the human health benefits of reduced air pollution.

Just focusing on the dollar value of climate benefits, and even accounting for the range of partial shifts in production to non-federal lands and waters, the climate benefits of net reductions in oil and gas out to 2040 due to a five-year delay in leasing would come to between \$23 billion and \$170 billion in 2020 dollars.^{lix} These estimates assume a moderate price on carbon starting at

around \$51/tCO₂e and rising around 2% per year. Using a higher social cost of carbon, such as New York State's 2020 central value starting at \$121/mt CO₂, leads to estimates that society would save between \$50 billion and \$365 billion in avoided climate damages expected to come from even a five-year delay in offering new offshore oil and gas leases between 2022-2040.^{lx}

Ironically, while EIAP chooses to simply ignore the estimated ecosystem, environmental, and climate benefits to society of a delay in offering new leases, it does report an estimated loss to the non-GOMESA Land and Water Conservation Fund contributions that “preserve ecosystem benefits for local communities” if there is a five-year delay in offering new offshore oil and gas leases.^{lxi} The decision to not even mention the value of the societal benefits listed above is surprising and indicates researcher bias.

The EIAP report fails to address the 1.5°C elephant in the room

According to the IPCC, to avoid more than a 1.5°C rise in global temperatures, global greenhouse gas emissions must peak by 2025 and be cut by 43% by 2030.^{lxii} The International Energy Agency's 1.5°C-consistent pathway requires “no investment in new fossil fuel supply projects” starting immediately.^{lxiii} A 2021 paper published in Nature calculates that avoiding a 1.5°C rise would require leaving 60% of existing oil and gas reserves and 90% of coal reserves in the ground.^{lxiv} Going even further, a 2022 paper published in the journal of Environmental Research Letters, finds that nearly 40% of already producing reserves need to stay in the ground to meet the 1.5°C target.^{lxv} Given the need to rapidly transition away from fossil fuels for a chance to avoid global temperatures from rising more than 1.5°C and to avoid the worst impacts of a changing climate, it is also reasonable to simulate (or at least to qualitatively address) the expected impacts of a delay in leasing under a scenario consistent with meeting climate targets. Arguably pursuing additional leases to construct infrastructure that enables even more long-term extraction from offshore reserves will increase the expense to firms in the long run as they fail to recover investments from stranded assets.

As the US and the global economy transition to a low-emissions energy future, the demand for oil and gas (especially from areas not yet leased) are likely to decline considerably. Global demand for oil is around 100 million barrels/day. Climate scenarios compatible with keeping temperatures from rising more than 1.5°C or 2°C project that global oil demand will decline by between 20 to 75 mb/d by 2040.^{lxvi} To put things into perspective, EIAP estimates that a delay in offering new offshore federal leases would result in 0.5 mb/d lower oil production coming from the Gulf of Mexico in 2040. In other words, it is likely that demand for oil from the Gulf of Mexico in 2040 will be reduced by a lot more than 0.5 mb/d and there will not be a need for production that would come from areas not yet leased in the Gulf of Mexico.

Conclusion

The EIAP projections rely on several vague assumptions and methodological choices that make it difficult to assess and count on the reliability of its findings. And there is evidence that EIAP's models overestimate the likely impacts of a change to future leasing in the Gulf of Mexico. For example, EIAP finds as much as twice the production impacts due to a temporary pause in

leasing compared to three other recent analyses, including two that assume a permanent end to new leasing.

Even before picking apart the ways that EIAP's methodological and reporting choices overestimate and misrepresent impacts on production, jobs, consumer prices and the economy due to a delay in future offshore leasing, the report's own findings are quite small when put into context. Putting all these points together, EIAP's report does not reliably indicate the effects from a change in future offshore oil and gas leasing policies on the energy industry and workers in the Gulf nor on the nation.

ⁱ US Department of the Interior (DOI). "Secretary Haaland Provides Updates on Offshore Leasing Program During Senate Testimony." (19 May 2022). <https://www.doi.gov/pressreleases/secretary-haaland-provides-updates-offshore-leasing-program-during-senate-testimony>

ⁱⁱ Energy & Industrial Advisory Partners. 2022. *The Economic Impacts of a five-year Leasing Program Delay for the Gulf of Mexico Oil and Natural Gas Industry*. https://cdn.baseplatform.io/files/base/ebm/ogj/document/2022/03/220329_offshore_5_year_plan_rpt.624374e57ca43.pdf [hereinafter EIAP 2022].

ⁱⁱⁱ EIAP 2022, p.2

^{iv} For example, EIAP does not state what prices it ultimately assumed for its analysis. For near term price assumptions EIAP claims to assume prices from the EIA's Short Term Energy Outlook (STEO) from April 2020 (p.42), yet elsewhere the authors state that they assume prices from the STEO in January 2022 (p.41). EIAP also states that it made modifications to near-term pricing and production levels based on current market conditions (p.18) but does not state what its modifications and assumptions are. For long-term price projections, EIAP claims to use EIA's AEO 2021 (p.18 and p.41) and yet on other pages it claims to assume prices from AEO 2020 (p.42 and p.44).

^v Bureau of Ocean Energy Management (BOEM). June 2022. *Combined Leasing Status Report*. https://www.boem.gov/sites/default/files/documents/Lease%20stats%206-1-22_0.pdf

^{vi} US BOEM. All Lease Offerings. Outer Continental Shelf Lease Sale Statistics. Updated 24 February 2021. <https://www.boem.gov/sites/default/files/documents/about-boem/Table%201%20SwilerTable%204FEB2021.pdf>

^{vii} 10 years is the standard initial lease length of deepwater offshore leases (CBO 2016). Although some offshore leases in shallow water have shorter lease terms (such as 8 years), these account for relatively little of offshore oil and gas development.

Congressional Budget Office (CBO). 2016. *Options for Increasing Federal Income from Crude Oil and Natural Gas on Federal Land*. https://www.cbo.gov/default/files/114th-congress-2015-2016/reports/51421-oil_and_gas_options.pdf [hereinafter CBO 2016].

^{viii} CBO 2016

^{ix} EIAP 2022, p.30

^x For example, EIAP 2022 says on page 3: "A key requirement for continued Gulf of Mexico oil and natural gas production is continued lease sales, which enable operators to...underpin existing and planned projects by allowing operators to backfill production into facilities with declining production." They go on to state: "In most cases, additional leases are required to produce an existing field fully or to underpin the economics of processing and transportation infrastructure."

^{xi} EIAP 2022, p.14-18

^{xii} Rystad Energy UCube, Rystad Energy research and analysis. Cited in Offshore Magazine. 27 Jan. 2021. "Biden administration suspends federal oil and gas leasing." <https://www.offshore-mag.com/regional-reports/us-gulf-of-mexico/article/14196352/biden-administration-suspends-federal-oil-and-gas-leasing>

^{xiii} OnLocation, NRDC-NEMS Analysis of a Moratorium on New Offshore Leasing in the Gulf of Mexico, 4 March 2022. https://355898.fs1.hubspotusercontent-na1.net/hubfs/355898/NRDC-GOM%20Final%20Offshore%20Moratorium%20Scenario%20Results_0511.pdf

^{xiv} EIAP 2022. Calculated difference of EIAP reported 2030 oil base case and oil delayed 5-year leasing program case, Table 14. p.57.

^{xv} Prest, B. *Supply-side reforms to oil and gas production on federal lands: modeling the implications for CO2 Emissions, Federal Revenues, and Leakage.*, Journal of the Association of Environmental and Resource Economists. Available online April 2022.

<https://www.journals.uchicago.edu/doi/suppl/10.1086/718963> [hereinafter Prest 2022].

^{xvi} Analysis of supplemental annual results from Prest 2022. I focus comparisons here on Prest's high price scenario based on International Energy Agency's 2019 projections to compare to the EIAP results because it is closer than Prest's reference price scenario to the US Energy Information Administration's (EIA's) Annual Energy Outlook (AEO) 2021 price projections that were likely assumed by EIAP.

^{xvii} EIAP estimates a 9% greater reduction in baseline federal offshore oil production by year 11 due to a five year pause in leasing than the reduction that Prest estimated for a permanent leasing ban. This is compared to Prest's high price scenario. Compared to Prest's baseline scenario, EIAP estimated a 63% greater reduction in offshore federal oil production in the first 11 years.

^{xviii} Based on statements in the paper, it is unclear exactly what price assumptions EIAP makes.

Assuming EIAP used AEO 2021 price forecasts (as stated on p.18 and p.41 of EIAP 2022), then they assume in their reference scenario that the WTI price of oil reaches around \$63/bbl in 2021 dollars in 2025, \$75/bbl by 2030, close to \$84/bbl by 2035 and \$92/bbl by 2040. Prest's high oil and gas price assumptions (all in \$2021) assumes the WTI average oil price goes from around \$68 per barrel in 2020, to around \$79/barrel by 2025, \$84/b by 2030, \$93/b by 2035, and \$100/b by 2040.

^{xix} Prest conducted his modeling of a federal lease ban in the summer of 2020 and from the perspective of no new leases being issued as of mid-2020. The federal government leased an additional 477,413 acres in lease sale 256 in November 2020. EIAP explicitly states in the report (p.5) that the Delayed five-year Leasing Program Case assumes that lease sales 259 and 261 occur in 2022 and that after that no new lease sales occur until 2028. At a minimum, EIAP assumes an additional 477 thousand acres in the GOM stockpile of leases than what Prest 2022 assumed in its modeling of the production impacts of permanent ban to new leases.

^{xx} EIAP 2022, p.3.

^{xxi} Prest 2022 base oil and gas price scenario for a leasing ban, calculates a leakage rate of 72.4% and a demand elasticity of -.2 (see Prest 2022 Table 1, p. 706).

^{xxii} See Owyang, M.T., and Vermann, E.K., 2014. *Rockets and Feathers: Why Don't Gasoline Prices Always Move in Sync with Oil Prices?*. 01 October 2014. Federal Reserve Bank of St. Louis.

<https://www.stlouisfed.org/publications/regional-economist/october-2014/rockets-and-feathers-why-dont-gasoline-prices-always-move-in-sync-with-oil-prices>

^{xxiii} AEO 2022 reference case average price of oil at the wellhead is \$71/b between 2021 and 2040 in 2021 dollars per barrel.

^{xxiv} A 0.5% rise would increase the global price of oil by around 36 cents/barrel ($\$71 \times 1.005 = \71.36)

^{xxv} The expected impact on prices at the pump would be less than a penny ($10/0.25 = 0.36/X$, then $X = \$0.009$)

^{xxvi} AEO 2022 reference case average price of oil at the wellhead is \$76/barrel between 2021 and 2050 in 2021 dollars.

^{xxvii} Prest supplemental annual modeling results for a high price scenario finds that a permanent ban on issuing new federal leases would result in an estimated annual average reduction of 0.84 mb/d in federal offshore oil production through 2050. Applying Prest 2022 base demand elasticity for oil of -0.2 and the high price scenario leakage rate of 75.5%, would mean a -0.2 mb/d net global supply production impact due to no new federal offshore leasing ($-0.84 / [1 - 0.755] = -0.21$). To test the sensitivity of this result, I also calculate applying a leakage rate of 52.4% for the high demand elasticity scenario which results in an annual average of -0.40 mb/d net global supply production impact due to no new offshore leasing ($-0.84 / [1 - 0.524] = -0.40$). Compared to the global demand for oil of 100 mb/d, these estimated net reductions due to not issuing new offshore leases would represent between -0.21% and -0.40% of net global oil supply ($-0.21/100 = -0.21\%$) and ($-0.40/100 = -0.40\%$). Assuming \$76/barrel for the average price of global crude out to 2050 and applying a base demand elasticity for oil of -0.2 from Prest 2022, would result in an estimated 1.03% rise ($-0.21\% / -0.2 = 1.03\%$) or a 78 cents per barrel increase in the global price of wholesale oil due to not offering new federal offshore leases ($\$76 \times 1.0103 = \76.78). For the sensitivity case I apply a high elasticity oil demand of -0.51 from Prest 2022 and estimate a 0.78% rise ($-0.40\% / -$

0.51=0.78%) or a 59 cents per barrel increase in the global price of wholesale oil due to not offering new federal offshore leases ($\$76 \times 1.0078 = \76.59).

^{xxviii} Given that a \$10 increase in wholesale oil roughly translates to a 25-cent increase in retail gasoline prices, the expected impact on prices at the pump would be less than 2 cents per gallon ($10/0.25=0.78/X$, then $X = \$0.0195$) and ($10/0.25=0.59/X$, then $X = \$0.01475$).

^{xxix} Prest 2022 supplemental annual modeling results for the high price scenario shows that a permanent ban on issuing new federal leases would result in an estimated annual average reduction of 0.25 mb/d in federal offshore oil production through 2030. Applying a leakage rate of 75.5% from the Prest 2022 high price, base elasticity scenario would mean a -0.06 mb/d net global supply production impact out to 2030 due to no new federal offshore leasing ($-0.25/[1-0.755] = -0.06$). To test the sensitivity of my calculations to the assumptions about leakage rates and elasticity of oil demand, I also calculated using a leakage rate of 52.4% from the Prest 2022 high demand elasticity scenario. The sensitivity case results in an annual average of -0.12 mb/d net global supply production impact due to no new offshore leasing ($-0.25/[1-0.524] = -0.12$). Compared to the global demand for oil of 100 mb/d, the net reduction due to not issuing new offshore leases would represent between -0.06% and -0.12% of net global oil supply ($-0.06/100 = -0.06\%$) and ($-0.12/100 = -0.12\%$). Assuming \$90/barrel for the average price of global crude out to 2030 and applying a base demand elasticity for oil of -0.2 from Prest 2022, would result in an estimated 0.31% rise in the global price of oil due to not offering new federal offshore leases and increase the global price of oil by an estimated 28 cents/barrel ($\$90 \times 1.0031 = \90.28). For the sensitivity case, assuming a high demand elasticity for oil of -0.51 from Prest 2022 would result in an estimated 0.23% rise in the global price of wholesale oil (or an estimated 21 cents per barrel increase) over 10 years due to not offering new federal offshore leases ($\$90 \times 1.0023 = \90.21). In turn, the expected impact on prices at the pump would be less than 1 cent per gallon ($10/0.25=0.28/X$, then $X = \$0.007$) and ($10/0.25=0.21/X$, then $X = \$0.005$).

^{xxx} EIAP 2022, p.43

^{xxxi} Fleming, D., Komarek, K., Partridge, M., Measham, T. The Booming Socioeconomic Impacts of Shale: A Review of Findings and Methods in the Empirical Literature, MPRA Paper No. 68487, at 16 (Dec. 2015), <https://mpra.ub.uni-muenchen.de/68487/>

^{xxxii} Aldy J. The Labor Market Impacts of the 2010 Deepwater Horizon Oil Spill and Offshore Oil Drilling Moratorium, Resources for the Future DP 14-27, at 26 (Aug. 2014), <https://bit.ly/3c0QXuQ>

^{xxxiii} Aldy 2014, p.26

^{xxxiv} Weber, J.G. The Effects of a Natural Gas Boom on Employment and Income in Colorado, Texas, and Wyoming. Energy Economics, 34(5), 1580–1588, (2012). at 1587.

<https://doi.org/10.1016/j.eneco.2011.11.013> [hereinafter Weber 2012]

Considine, T., Watson, R., Entler, R., Sparks, J. The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update. Penn State University Department of Energy and Mineral Engineering. (2010). [hereinafter Considine et al 2010]

Weber reviewed a study led by Timothy Considine in 2010 estimated 20 times greater employment impacts when using input-output models compared to historic-based estimates.

When using empirical estimates based on historic employment data, Weber 2012 estimated that the shale gas boom in Pennsylvania led to 2,183 new jobs in 2009 (Weber 2012 p.1587). In contrast, when using an input-output model Considine 2010 estimated that the boom led to 44,098 new jobs in Pennsylvania in 2009.

^{xxxv} Weber 2012, p.1580.

^{xxxvi} Considine 2020, p.46

^{xxxvii} EIAP 2022, p.2

^{xxxviii} Princeton University, “Net-Zero America Project,” December 2020, <https://acee.princeton.edu/rapidswitch/projects/net-zero-america-project/>

^{xxxix} Nguyen, T. “Labor shortage remains a major challenge for oil and gas: Spring 2022 outlook.” Real Economy. (7 Feb. 2022) <https://realeconomy.rsmus.com/labor-shortage-remains-a-major-challenge-for-oil-and-gas-spring-2022-outlook/>

^{xl} Hampton, L., Kelly, S., Williams, N. “North American oil companies scramble to find workers despite boom. Reuters. (29 April 2022). <https://www.reuters.com/business/energy/n-american-oil-companies-scramble-find-workers-despite-boom-2022-04-29/>

^{xii} Energy Transition Institute. 2021. Robert Gordon University. “UK Offshore Energy Workforce Transferability Review.” <https://www.rgu.ac.uk/wp-content/uploads/2021/05/workforce-transferability-report.pdf>

A 2021 analysis of BLS data by the Center for Economic and Policy Research (CEPR) estimates that around 40% of those employed in the US fossil fuel industry have skills that directly transfer to find work in other industries without the need for additional training. Furthermore, of the workers with skills deemed “non-transferable,” nearly half are in construction and extraction occupations with skills that can very likely be transferred to other industries with some training. Source: Baker, D., Lee, A. “The Employment Impact of Curtailing Fossil Fuel Use.” Center for Economic and Policy Research. (26 May 2021).

<https://cepr.net/report/the-employment-impact-of-curtailling-fossil-fuel-use/>

^{xiii} Brookings analysis of Emsi and UT Austin Energy Institute Levelized Cost of Electricity data.

Timer, A., Kane, J., and George, C. 2021. How renewable energy jobs can uplift fossil fuel communities and remake climate politics. Brookings. <https://www.brookings.edu/research/how-renewable-energy-jobs-can-uplift-fossil-fuel-communities-and-remake-climate-politics/>

^{xiii} BOEM. January 2022. BOEM Initiates Environmental Assessment for Offshore Wind in the Gulf of Mexico.

<https://www.boem.gov/newsroom/press-releases/boem-initiates-environmental-assessment-offshore-wind-gulf-mexico>

^{xliv} US Bureau of Economic Analysis. Real Gross Domestic Product [A191RO1Q156NBEA], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/A191RO1Q156NBEA> , June 15, 2022.

^{xlv} US Bureau of Labor Statistics. Table A-1. Employment status of the civilian population.

<https://www.bls.gov/news.release/empsit.t01.htm>

^{xlvi} US Bureau of Labor Statistics, Civilian Labor Force Level [CLF16OV], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CLF16OV>, June 15, 2022.

^{xlvii} Center for Economic and Policy Research (CEPR) calculates a daily average job loss rate of 60,000 in the US in 2019 based on 2019 data from the Job Opening and Labor Turnover Survey from US Bureau of Labor Statistics. <https://cepr.net/report/the-employment-impact-of-curtailling-fossil-fuel-use/>

^{xlviii} EIAP 2022, p. 24

^{xlix} US Bureau of Labor Statistics, All Employees, Oil and Gas Extraction [CES1021100001], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CES1021100001>, June 17, 2022.

ⁱ US Bureau of Safety and Environmental Enforcement. 2019. Safety and Environmental Performance Data for Industry Benchmarking. <https://www.bsee.gov/sites/bsee.gov/files/safety-and-environmental-performance-data-for-industry-benchmarking-cy-2019-12-26-20.pdf>

ⁱⁱ Nguyen 2022.

ⁱⁱⁱ US Bureau of Labor Statistics, All Employees, Oil and Gas Extraction [CES1021100001], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CES1021100001>, June 17, 2022.

ⁱⁱⁱⁱ De Luna, Marcy. 2021. “Robots could replace hundreds of thousands of oil and gas jobs by 2030.” Houston Chronicle. 29 March 2021. <https://www.houstonchronicle.com/business/energy/article/Robots-could-replace-hundreds-of-thousands-of-oil-16061352.php>

^{lv} Morris, Jim. 2018. The Center for Public Integrity. “Death in the oilfields.”

<https://apps.publicintegrity.org/blowout/us-oil-worker-safety/> Cites US Bureau of Labor Statistics. <https://www.bls.gov/iag/tgs/iag211.htm>

^{lv} Sneath, Sara. 2021. WWNO. New Orleans Public Radio. “Offshore oil and gas worker fatalities are underreported by federal safety agency.” <https://www.wwno.org/coastal-desk/2021-08-18/offshore-oil-and-gas-worker-fatalities-are-underreported-by-federal-safety-agency>

^{lvi} BOEM 2016. p. 1-15

^{lvii} On p.3 and p.11 EIAP makes this claim and cites Motiwala, Ama; Ismail, Dr. Huzeifa (2020): Statistical Study of Carbon Intensities in the GOM and PB. ChemRxiv <https://chemrxiv.org/engage/api-gateway/chemrxiv/assets/orp/resource/item/60c749d20f50db4b6c39696c/original/statistical-study-of-carbon-intensities-in-the-GoM-and-pb.pdf>

^{lviii} Carnegie Endowment. Oil-Climate Index. <https://oci.carnegieendowment.org/#supply-chain>

^{lix} The low-end calculation combines EIAP estimated reduction for each year between 2022 and 2040 in b/d of oil and boe/d of natural gas from the Gulf, with a base demand assumption from Prest 2022 that

75.5% of reduced production in the Gulf would still be produced on net due to expected shifts in production from other lands and waters, an emission factor for crude oil of 0.43 tCO₂e/barrel and for natural gas of 0.066 tCO₂e/mcf, assuming 6 mcf of natural gas = 1 BOE, and applying the US IWG 2021 SC-CO₂e values for a 3% discount rate in 2020 dollars for the 2022-2040 studied window. The high-end calculation does the same as the first calculation except it assumes Prest 2022 high demand elasticity leakage rate of 52.4%.

^{ix} Used the same method to calculate the low and high-end climate damage assessment costs each year but uses New York State's Dec. 2020 Social cost values for carbon dioxide, assuming a 2% discount rate. All reported in 2020\$.

Appendix: NYS Social Cost Values. 2020. New York State Department of Environmental Conservation.

https://www.dec.ny.gov/docs/administration_pdf/vocapp22.pdf

^{lxi} EIAP 2022, p.28

^{lxii} <https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/>

^{lxiii} International Energy Agency (IEA). "Net Zero by 2050: A Roadmap for the Global Energy Sector". May 2021. <https://www.iea.org/reports/net-zero-by-2050>

^{lxiv} Welsby, Dan, James Price, Steve Pye, and Paul Ekins. "Unextractable fossil fuels in a 1.5 C world." *Nature* 597, no. 7875 (2021): 230-234.

^{lxv} Trout et al. 2022. 'Existing fossil fuel extraction would warm the world beyond 1.5°C'. *Environmental Research Letters*. 17. no. 6. <https://iopscience.iop.org/article/10.1088/1748-9326/ac6228>

^{lxvi} Resources for the Future. 2022. Global Energy Outlook. <https://www.rff.org/publications/reports/global-energy-outlook-2022/>