

January 27, 2022

Honorable Joseph Manchin
Chairman, Committee on Energy and Natural Resources
U.S. Senate
Washington, DC 20515

Dear Mr. Chairman,

We would like to offer our services as academics and independent analysts to answer any questions that you or your staff may have about the potential impacts that existing research and modeling indicate for the reforms proposed in the Build Back Better Act (BBBA).^{i, ii, iii} **Research finds that the package of federal onshore oil and gas program reforms included in the BBBA would result in negligible impacts on US production and consumer prices. Furthermore, several of the provisions in BBBA would create incentives for production by discouraging speculation and encouraging diligent development of oil and gas deposits.**

(1) The biggest determinant of US consumer oil and gas prices are global wholesale market prices, and the biggest determinant of global prices is global supply. **Considering U.S. federal onshore oil and gas accounts for less than 2% of all global supply, the reforms will have a negligible impact on the global price of oil and natural gas and an even smaller impact on the prices paid by US consumers.**

(2) Onshore federal production is a small share (< 8%) of total US oil and gas production to begin with.^{iv} **Most of the reforms will apply to only a sliver of the ~8% of US oil and gas production that comes from the onshore federal mineral estate because most of the new fiscal terms only apply to newly issued leases** (See Table 1). The terms would not apply to the more than 25 million acres already leased onshore, including the more than 6 million acres leased within the past 5 years.^v Because existing leases last 10+ years and are not affected by provisions related to new leases, combined with the fact that most federal onshore production comes from leases that are 10+ years old,^{vi} the negligible change in US production expected to result from the proposed reforms would occur gradually over the course of more than a decade as industry develops the inventory of existing and yet-to-be-developed leases.

(3) **If passed, many of the reforms would make the terms applied to new federal leases be on par with, or remain less stringent than, the lease terms already applied to most production from the United States.** (See Table 2 for a comparison of new lease terms across jurisdictions in the US.) The Congressional Budget Office found in a 2016 report that any decrease in production due to increased rates on federal lands would be minimal if the federal term remained equal to or less stringent than the terms of nearby state and private lands.^{vii} For example, updating the 12.5% federal onshore oil and gas royalty to 16.67% or 18.75% would mean that industry would pay rates on production from future onshore federal leases that are equivalent to, and often less than, the rates currently charged by top producing Western states (19.1%),^{viii} private landowners (19%),^{ix} and for offshore waters (18.75%).^x

(4) **Compared to the costs of development, the new fiscal terms represent such a small increase to operators' costs that they are unlikely to change a producer's decision to explore or to develop.** For example, if the four diligent development reforms in the SENR proposal package became law, then the cost to producers would increase by around \$62 per acre compared to under the current system for a company to secure and explore a non-producing lease for 10 years.^{xi, xii} In comparison, average capital costs for an onshore oil and gas well in the US is more than \$5 million.^{xiii}

(5) **Four of the proposed reforms are expected to encourage diligent production on federal lands by reducing speculation and increasing the return taxpayers receive from the use of public lands.**

- **Eliminating non-competitive leasing, increasing the minimum lease bid to be in line with states, and implementing a per acre fee to nominate new leases will encourage companies to nominate acres that they are more likely to bid on and to eventually develop.** The current system encourages companies to nominate large amounts of acres to be included in BLM lease sales without considering how likely they are to bid on those parcels. According to a report by the US Government Accountability Office, only 16% of the federal onshore acres nominated were actually leased from 2009 through 2019.^{xiv} As explained in a 2021 DOI report: “the burden and expense then fall on BLM to process those parcels, triggering the dedication of BLM staff resources to analyze marginal lands that companies may not be interested in bidding on and that may never be leased, much less developed. At the same time, sales of large amounts of low-potential land often ignite local community concerns (particularly since low-potential lands are more likely to be in areas that are not accustomed to local oil and gas development) and result in protests that are time-consuming and resource-intensive to adjudicate.”^{xv}
- **Increasing rental rates (in line with terms on state and private leases) would encourage operators to develop leases in a timelier manner, in contrast to the current system where many leases are not developed until just prior to their expiration in year 10.**^{xvi} An analysis of lease data by the CBO found that under the current system production occurs on around 10% of competitively leased parcels and 3% of parcels leased noncompetitively.^{xvii} BLM data shows that by the end of FY20, industry had yet to pursue development on more than half of the acreage leased (or over 12 million onshore federal acres).^{xviii} The diligent development reforms will help to curb waste of government resources currently spent on administering lease sales and leases for the large number of parcels with low oil and gas potential that never go on to be developed and therefore never actually raise meaningful public revenues.^{xix} In addition, these reforms will serve to encourage diligent use of federal public lands and reduce holding on to federal lands for speculative reasons that tie up government resources that could otherwise go towards activities that generate public returns.

None of the diligent development reforms would apply to existing leases, all are expected to have negligible net impact on production, and all are expected to raise public revenues.^{xx} CBO estimates that eliminating noncompetitive lease sales and increasing the minimum lease bid to be in line with terms on state and private leases would boost net federal income by an estimated \$50 million over 10 years^{xxi} GAO estimates that even if BLM had simply adjusted the rental rate for inflation, it would have generated an additional \$1.8 million for the first year for new leases issued in fiscal year 2018.^{xxii}

(6) Increasing the royalty rate to market rates already charged on most US production would have a negligible impact on production and on consumer costs, and yet would raise public revenue by between \$600 million and \$2 billion per year.^{xxiii} Even though the expected impacts of increasing the federal onshore royalty rate on US production are small and consumer impacts are negligible, royalty rate changes would have the most impact relative to the other reforms under consideration. Recent modeling by Brian Prest, an economist with the nonpartisan think tank Resources for the Future, estimates that increasing the royalty rate paid by industry on the oil and gas extracted from federal public lands to 16.67% would result in extremely small increases to wholesale prices (0.05% for oil and 0.08% for natural gas) over the next 30 years.^{xxiv} Given the relationship between a change in wholesale prices and a change in consumer prices, a 16.67% royalty rate is expected to change gasoline prices at the pump by around 1/10th of a penny per gallon and lead to around 1 cent of difference in average household monthly natural gas bills over the next three decades.^{xxv, xxvi} An 18.75% royalty rate would similarly have only a minimal impact on consumer prices (around 1/5th of a penny per gallon at the pump and 3 cents of difference in average household natural gas bills over 30 years).^{xxvii}

Contrary to claims that increasing the onshore federal royalty rate would mean a boon to foreign

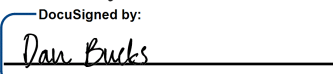
production, Dr. Prest estimates that the policy would result in a very small amount (less than 0.2%) of US oil and gas production going abroad over the next 30 years.^{xxviii} From a legal perspective, federal and state laws explicitly state that the public should receive “fair market value” for resources extracted from public lands, and there is substantial evidence that current federal rates are below market levels.^{xxix} Updating the royalty rate on future federal onshore leases to 16.67% is expected to raise an average of \$600 million per year in additional revenue over the next 30 years and updating to an 18.75% royalty rate would raise between \$900 million and \$2.1 billion in additional annual revenue.^{xxx} Because half of the royalties from federal onshore production are shared with the producing state, these revenues will also help support state and local budgets.

(7) The final group of reforms to strengthen public health and safety/ensure responsible development would likely have a negligible impact on near-term production.

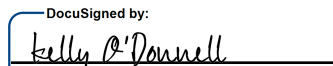
- Requiring bond amounts to ensure that companies properly restore public lands after development rather than the public footing the bill is not expected to impact production. The proposed bond amounts in BBBA would help to meet GAO recommendations.^{xxxi}
- Implementing a Severance Fee is both an insignificant cost compared to the cost of development, and it will slowly be phased in because it will only apply to new leases and not the 38 million acres of existing federal onshore and offshore oil and gas leases. For these reasons, this fee is not expected to impact US production or consumer prices.
- Repealing the Arctic National Wildlife Refuge Oil & Gas Program would not impact baseline US production or consumer prices because the amount of actual recoverable resources is highly uncertain and even if exploration occurred, production would not be expected to come online until around 2035.

Given our topical range of research expertise, we hope to provide you with non-biased assessments of what research indicates for the proposed reforms to the federal onshore oil and gas program. Please feel free to contact us with any questions.

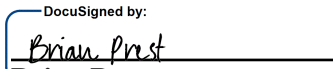
Sincerely,

DocuSigned by:

Dan Bucks

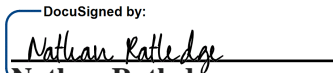
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Kelly O'Donnell

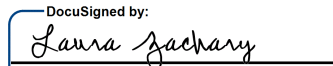
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Table 1. Existing Terms vs Proposed Changes to the Federal Energy Program

	Existing Law	Terms in BBBA passed by the House	Would changes apply to existing leases?	Terms in SENR Dec 2021 proposed draft
ENCOURAGE DILIGENT PRODUCTION & DISCOURAGE HOLDING ON TO LEASES FOR SPECULATIVE REASONS				
Minimum Lease Bid	\$2/acre	\$10/acre; adjust for inflation every 4 years	No	\$10/acre; no adjustment for inflation
Rental Rates	\$1.50/acre – first 5 years \$2/acre (or more) – years 6-10	\$3/acre – first 2 years; \$5/acre (or more) – next 8 years; adjust for inflation every 4yrs	No	\$3/acre – first 2 years; \$5/acre – next 6 years; \$15/acre thereafter
Noncompetitive Leasing	Authorized; all parcels not sold competitively available for 2 years noncompetitively	Eliminated; all parcels must be sold competitively	No	Eliminated; all parcels must be sold competitively
Initial Lease Length	10 years	5 years	No	No change - remains 10-year primary term
Lease Nomination (expression of interest) Fee	None	\$15/acre (or more); adjust for inflation every 4 years	No	\$5/acre; adjust for inflation every 4 years
Speculative Leasing Fee (on and offshore)	None	\$6/acre for non-producing leases; adjust for inflation every 4 years	No	None

	Existing Law	Terms in BBBA passed by the House	Would changes apply to existing leases?	Terms in SENR Dec 2021 proposed draft
UPDATING ROYALTY TO MARKET RATES				
Royalty Rate	12.5%	18.75%	No	16.67% for all leases commencing after 1/1/2024. Charge royalties on “extracted methane”
Royalty Relief	Permitted “in the interest of conservation” and “to promote development or . . . [if] leases cannot successfully be operated under the terms provided”	Repealed	Yes	No change to the existing system of granting royalty relief.
REQUIREMENTS TO STRENGTHEN PUBLIC HEALTH & ENVIRONMENTAL SAFETY				
Bonding	Bonding minimums: \$10,000 per lease; \$25,000 statewide; \$150,000 nationwide. DOI must “establish standards” that “ensure the complete and timely restoration and reclamation of any land, water, range, or other environmental resources adversely affected by lease activities or operations after the abandonment or cessation of oil and gas operations on the lease”	“Full cost” bonding requirement. Bonds are inadequate if they are for less than the complete and timely reclamation of the least tract, the restoration of any lands or surface waters adversely affected by lease operations, and, in the case of an idled well, the total plugging and reclamation costs for each idled well controlled by the same operator.	Subject to rulemaking	Adjust bonding minimums to: \$150,000/ lease; \$500,000 statewide; and \$2 million nationwide. Adjust for inflation every 4 years.

	Existing Law	Terms in BBBA passed by the House	Would changes apply to existing leases?	Terms in SENR Dec 2021 proposed draft
Resource Conservation Fee (on and offshore)	None	\$4/acre for producing leases; adjust for inflation every 4 years	No	None
Severance Fees (on and offshore)	None	Not less than \$0.50/barrel (or barrel equivalent) and \$2 per metric ton of coal	No	\$0.50/barrel of oil and \$0.025 per thousand cubic feet of natural gas. Revenue goes to a new energy community revitalization fund for DOI to address abandoned hardrock mines and orphaned wells and infrastructure.
Inspection Fees (on and offshore)	None	Onshore: \$1,000/ lease each year and secretarial discretion to increase. Offshore: \$11,725/ facility with processing equipment or gathering lines; \$18,984/ facility with 1-10 wells; \$35,176/ facility with 10+ wells	Yes	None
Idled Well Fees	None	\$500/well – idled 1-5 years	Yes	None

		\$1,500/well – idled 5-10 years \$3,500/well – idled 10-15 years \$7,500/well – idled 15+ years; adjust all idled well fees for inflation every 4 years		
ANWR Oil & Gas Program	Establishes the ANWR oil & gas program; requires 2 (or more) lease sales w/in 10 years	Repealed; All existing/issued ANWR leases cancelled	Yes	Repealed; All existing/issued ANWR leases cancelled

Table 2. Lease terms applied to new leases across jurisdictions^{xxxii}

<u>Jurisdiction</u>	<u>Top Royalty Rate</u>	<u>Primary Term (years)</u>	<u>Minimum Bonus Bid (per acre)</u>	<u>Rental Rate on non-producing leases (per acre)</u>
Texas	25%	3	\$10 ^{xxxiii}	\$10
Colorado	20%	5	None	\$2.50
New Mexico	20%	5	Varies; ~\$45 lowest observed ^{xxxiv}	\$0.25 to \$1
North Dakota	18.75%	5	\$1	\$1
Oklahoma	18.75%	3	\$5	\$1
Montana	16.67%	10	None	\$1.50 to \$4 ^{xxxv}
Utah	16.67%	5	\$2	\$2
Wyoming	16.67%	5	\$1	\$1
Avg. Western State	19.1%	5.13		~\$2.8
Avg. Private Lands	19% ^{xxxvi}			
Federal Offshore ^{xxxvii}	18.75%	5-10	\$100 ^{xxxviii}	\$11 (yr1-5); \$16 (yr6+) ^{xxxix}
Federal Onshore	12.5%	10	\$2	\$1.50 (yr1-5); \$2 (yr 6-10)

[†]The topline points in our assessment apply to both the package of proposed changes to the federal oil and gas program in the version of H.R. 5376 that was passed by the House of Representatives in November 2021 and the proposed reforms in Title VII Senate Energy and Natural Resources (SENR) Committee amendment to H.R. 5376. To avoid confusion, we primarily focus on the reforms and terms in the SENR version within the text of our letter and use endnotes to include additional analysis or points that are specific to related reforms in the House version. See Table 1 for a comparison of terms in the two packages and those in existing law.

^{††} H.R. 5376. Build Back Better Act. Passed by the House of Representatives on 19 November 2021.

<https://www.congress.gov/bill/117th-congress/house-bill/5376/actions>

^{†††} Title VII, Senate Committee on Energy and Natural Resources, Amendment to H.R. 5376. Posted on the Website of the Senate Democratic Leadership on 17 December 2021.

<https://www.democrats.senate.gov/imo/media/doc/Title%20VII%20Committee%20on%20Energy%20and%20Natural%20Resources.pdf>

^{††††} Eight of the nine relevant SENR proposed BBBA reforms (or ten of the 14 reforms in the House version) apply solely to the federal onshore oil and gas estate, totaling 7.7% of oil and 8% of natural gas produced in the United States in 2020. Total % derived by taking the 5.106 quad Btu federal oil and gas production volume reported by [ONRR calendar year](#) for 2020 (convert units from bbl to Quad Btu to compare to EIA total production #s) and divided by the combined 65.03 Quad Btu for total US crude oil, dry natural gas, and natural gas plant liquids production for 2020 reported by EIA Monthly Energy Review (EIA 2021 [p.5](#)). Of the four remaining reforms, four would also apply to federal offshore leases. In 2020 6.8% of total US oil and gas production came from federal offshore waters. Three of the four reforms that apply to offshore would only apply to new leases and none are expected to change development decisions in the next decade.

^{†††††} BLM Oil and Gas Statistics. Table 2. Acreage in Effect. <https://www.blm.gov/programs-energy-and-minerals-oil-and-gas-oil-and-gas-statistics#>

^{††††††} Congressional Budget Office (CBO). 2016. *Options for Increasing Federal Income from Crude Oil and Natural Gas on Federal Lands*. April 2016. CBO survey of production by age of lease in 2013 found that over half of federal onshore oil and gas production comes from leases over 50 years old and only one-sixteenth of federal onshore production comes from leases during the first decade of their existence.

^{†††††††} [CBO 2016](#). Although not included in the SENR proposed list of oil and gas reforms released in December 2021, a shorter primary lease term is a noteworthy example of a reform that would not harm production because terms on new leases would become in line with or even remain less stringent than terms on neighboring lands. If the change to lease lengths as included in the BBBA package passed by the House became law, then decreasing the 10-year federal onshore oil and gas primary term length to 5 years would mean that industry would need to start development on future leases within the same time frame provided to producers on state public lands across the West.

^{††††††††} State lease terms compiled by GAO for testimony in front of Congress. US Government Accountability Office. 24 Sept. 2019. Table 1. Federal and State Lease Terms and Practices for Onshore Oil and Gas Leases, as of September 2019. From GAO-19-718T. <https://www.gao.gov/products/gao-19-718t> [hereinafter GAO-19-718T].

^{†††††††††} Brown et al. 2019 reports an average royalty rate on private lands of 19% (p.1059). Dataset from Drillinginfo accounted for 90% of onshore oil and gas production from private leases in 2014 (including leases from 575 counties across 17 major oil- and gas-producing states (p.1045). Brown, JP., Fitzgerald, T., and Weber, JG. 2019. Does Resource Ownership Matter? Oil and Gas Royalties and the Income Effect of Extraction. *Journal of the Association of Environmental and Resource Economists*. Vol 6. No 6. November 2019.

<https://www.journals.uchicago.edu/doi/pdf/10.1086/705505>

^{††††††††††} In 2008, the royalty rate for new offshore leases at all depths was increased to 18.75% where it remains today

^{†††††††††††} Calculation: \$13 per acre (or (\$10+\$5)-\$2) difference in the one-time costs for increased minimum lease bid and the new lease nomination fee compared to the \$2/acre current minimum lease bid. Then the slight increase to rental rates would mean: \$3 (or (\$3-\$1.50)*2) difference for the first two years together; \$10.50 (or (\$5-\$1.50)*3) difference across years 3,4, and 5; \$9 (or (\$5-\$2)*3) across years 6,7, and 8; \$26 (or (\$15-\$2)*2) for years 9 and 10. Altogether, if a lease is non-producing for all 10 years of its primary lease length, then the additional cost to the producer would be \$61.50 per acre (or \$13+\$3+\$10.50+\$9+\$26) total compared to the current system.

^{††††††††††††} Similarly, if all six of the diligent development reforms in the House BBBA package become law, then the cost to producers for government fees would increase by around \$66.50 per acre compared to under the current system for a company to secure and explore a non-producing lease for 5 years.

Calculation: \$23 per acre (or \$10+\$15-\$2) difference in the one-time costs for increased minimum lease bid and the new lease nomination fee. Then the slight increase to rental rates and the new \$6/acre speculative leasing fee would mean: \$15/acre (or (\$3+\$6-\$1.50)*2) difference across the first two years, and \$28.50/acre (or, (\$5+\$6-\$1.50)*3) for years 3-5. Altogether, if a new lease is non-producing for all 5 years of the primary lease length, then the additional

cost to the producer would be \$66.50 per acre (or \$23+\$15+\$28.50) extra in fees paid to the government compared to the current system.

^{xiii} Total capital costs per onshore oil and gas well in the US averages between \$4.9 million to \$8.3 million. A \$62 per acre added cost to producers would represent less than 0.001% of the capital costs to develop a well. See: US EIA. 2016. "Trends in U.S. Oil and Natural Gas Upstream Costs."

<https://www.eia.gov/analysis/studies/drilling/pdf/upstream.pdf>

^{xiv} GAO-22-103968. Oil and Gas Leasing: BLM Should Update Its Guidance and Review its Fees. 9 Dec. 2021

<https://www.gao.gov/products/gao-22-103968>

^{xv} DOI. 2021. REPORT ON THE FEDERAL OIL AND GAS LEASING PROGRAM: Prepared in Response to Executive Order 14008. November 2021. <https://www.doi.gov/sites/doi.gov/files/report-on-the-federal-oil-and-gas-leasing-program-doi-eo-14008.pdf> p.13

^{xvi} CBO 2016. Figure 1-7.

^{xvii} CBO 2016

^{xviii} BLM Oil and Gas Statistics. Table 6. Producing Acres and Table 2. Acreage in Effect.

^{xix} Royalties on production from developed leases make up around 90% of revenues for the federal oil and gas program.

^{xx} Two additional diligent development reforms (implementing an annual \$6 per acre fee on nonproducing leases and shortening the initial length of leases from 10 years to 5 years) were included in the version of the BBBA passed by the House but were not included in the package of oil and gas reforms proposed by SENR in December 2021. It is worth noting that if passed, all six of the diligent development reforms included in the House version of the BBBA are expected to have negligible net impact on production and all are expected to raise public revenues. According to CBO, charging an annual \$6 per acre speculative leasing fee would increase net federal income by \$200 million over 10 years for onshore and \$500 million for offshore. CBO 2016 explains that a \$6 speculative leasing fee's net effect on production would likely be limited because such a fee would represent less than 0.1% of the typical costs of development.

^{xxi} CBO 2016. p.31-32

^{xxii} GAO-19-718T

^{xxiii} Updating the royalty rate on future federal onshore leases to 16.67% is expected to raise an average of \$600 million per year in additional revenue over the next 30 years and updating to an 18.75% royalty rate would raise between \$900 million and \$2.1 billion in additional annual revenue. Estimated impacts of a 16.67% royalty rate come from supplemental modeling results supplied by Dr. Brian Prest for this letter using his model detailed in [RFF WP 20-16](#) and publication forthcoming at JAERE. Prest's paper includes modeling results expected for increasing the royalty rate to 18.75%. See Table 1 and Table A.7 Prest, B. *Supply-Side Reforms to Oil and Gas Production on Federal Lands: Modeling the Implications for Climate Emissions, Revenues, and Production Shifts*, Resources for the Future, Working paper 20-16 (updated December 2021). https://www.rff.org/documents/3229/WP_20-16_Dec_2021.pdf [hereinafter Prest 2021].

^{xxiv} Prest 2021 estimates that increasing the royalty rate paid by industry on the oil and gas extracted from federal public lands to 18.75% (the rate proposed in the version of the BBBA passed by the House) would also result in extremely small increases to wholesale prices (0.1% for oil and between 0.1 to 0.2% for natural gas) over the next 30 years.

^{xxv} 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. [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>].

Assuming \$80/barrel for the average future price of global crude, a 0.05% rise would increase the global price of oil by around 4 cents/barrel ($\$80 \times 1.0005 = \80.04). As such, the updated 16.67% royalty rates charged to producers will lead to an estimated 1/10th of a penny difference in price to customers at the pump over the next 30 years. ($10/0.25 = 0.04/X$, then $X = \$0.001$)

^{xxvi} At \$4/mmBtu of natural gas, a 0.08% rise would increase the price of wholesale gas by around 0.3 cents/mmBtu ($\$4 \times 1.0008 = \4.003). Assuming higher wholesale prices are directly passed on to consumers, then for the average US household that consumed 36 therms per month in 2019 [EPA 2021] (or 3.6 mmBtu because 10 therms equal one mmBtu), a 0.3 cent increase per mmBtu of gas would mean the household's monthly bill would change by ~ 1 cent on average over the next 30 years. $41,712 \text{ cubic feet of natural gas} = 2019 \text{ avg household per year natural gas consumption}$. Convert to therms, $/96.7 = 431 \text{ therm per year}$. $431/12 \text{ months} = 35.9 \text{ therms per month}$.

^{xxvii} The estimated impact on consumer prices if the royalty rate paid by industry on the oil and gas extracted from federal public lands increased to 18.75% (the rate proposed in the version of the BBBA passed by the House) would also be negligible. Given the relationship between a change in crude oil prices and a change in consumer prices, a 0.1% change in the price of crude oil is expected to change gasoline prices at the pump by around 0.2 cents (1/5th of a penny) per gallon over the next three decades. A 0.2% change in the price of wholesale gas is expected to lead to around 3 cents of difference in average household monthly natural gas bills over 30 years.

Assuming \$80/barrel for the price of global crude, a 0.1% rise would increase the global price of oil by around 8 cents/barrel ($\$80 \times 1.001 = \80.08). As such, the updated royalty rates charged to producers will lead to an estimated 1/5th of a penny difference in price to customers at the pump over the next 30 years. ($10/0.25 = 0.08/X$, then $X = \$0.002$).

At \$4/mmBtu of natural gas, a 0.2% rise would increase the price of wholesale gas by around 0.8 cents/mmBtu ($\$4 \times 1.002 = \4.008). Assuming higher wholesale prices are directly passed on to consumers, then for the average US household that consumed 36 therms per month in 2019 [EPA 2021] (or 3.6 mmBtu because 10 therms equal one mmBtu), a 0.8 cent increase per mmBtu of gas would mean the household's monthly bill would change by less than 3 cents on average over the next 30 years. 41,712 cubic feet of natural gas = 2019 avg household per year natural gas consumption. Convert to therms, $41,712 / 96.7 = 431$ therm per year. $431 / 12$ months = 35.9 therms per month.

^{xxxviii} This estimate is for 18.75% and the amount is expected to be even lower if the increase to the onshore federal royalty rate is limited to 16.67%.

^{xxxix} See GAO-19-718T. And Covert, T. and Kellogg, R.. 2021. *Ensuring Americans Receive Fair Value for U.S. Oil and Gas Resources*. University of Chicago. <https://epic.uchicago.edu/area-of-focus/ensuring-americans-receive-fair-value-for-us-oil-and-gas-resources/>

^{xxx} Estimated impacts of a increasing the royalty rate to 16.67% are annual averages over 30 years and come from supplemental modeling run results conducted by Brian Prest for this analysis. Results for increasing the royalty rate to 18.75% come from Table 1 and Table A.7 in Prest 2021.

^{xxxi} See GAO-19-615. 2019. Oil and Gas: Bureau of Land Management Should Address Risks from Insufficient Bonds to Reclaim Wells. <https://www.gao.gov/products/gao-19-615>

^{xxxii} Unless otherwise noted, new lease terms for Western states come from Table 1 in GAO-19-718T.

^{xxxiii} Noted in GAO-19-718T: Minimum bonus bids for state lease sales in Texas vary "based on location, geology, and comparable lease bonuses in the vicinity and range as high as \$20,000 an acre."

^{xxxiv} Covert and Kellogg 2021 report that according to New Mexico State Land Office data, the lowest reserve price observed in New Mexico's state auctions was around \$45/acre.

^{xxxv} \$1.50(yr1-5)/\$2.75 (yr6)/\$4 (yrs7-10)

^{xxxvi} Brown et al. 2019

^{xxxvii} Terms vary by water depth. Given that most current federal offshore leases have blocks with maximum water depths greater than 400 m deep, the terms listed here apply to leases located in water deeper than 400 meters. Latest terms for royalty rate and initial lease length come from US Department of the Interior's BOEM [Gulf of Mexico Lease Terms and Royalty Relief Summary](#). BOEM explains that 5-year initial lease lengths are granted for leases in water between 400 and 799m and 10 years for leases in water deeper than 800m.

^{xxxviii} See BOEM [Gulf of Mexico Rental Rate, Minimum Bid, and Royalty Rate History](#). Retrieved 3 January 2022.

^{xxxix} US Department of the Interior. Natural Resources Revenue Data. <https://revenue.data.doi.gov/how-revenue-works/revenues>