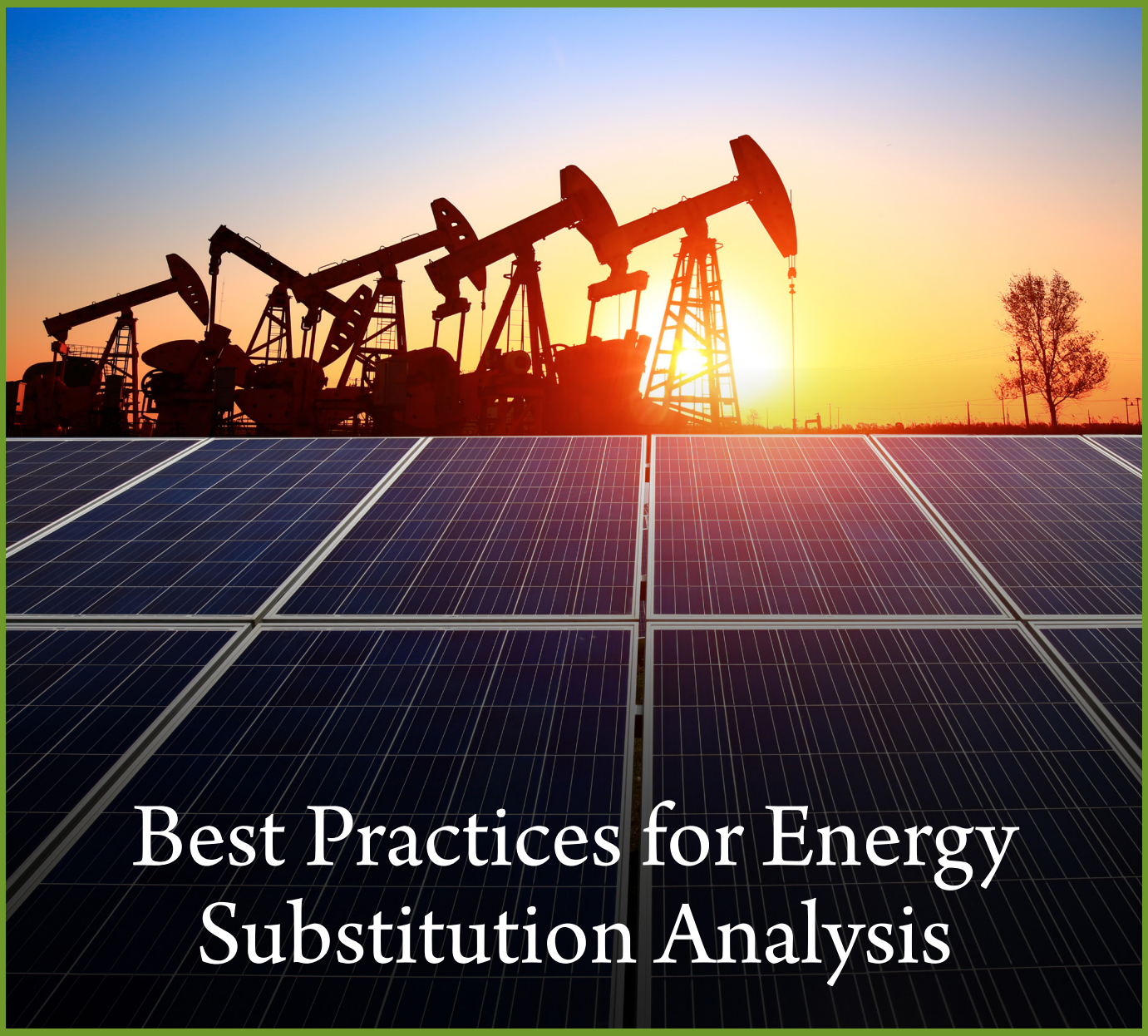
POLICY BRIEF



Best Practices for Energy Substitution Analysis

Institute *for* Policy Integrity
NEW YORK UNIVERSITY SCHOOL OF LAW

Peter H. Howard, Ph.D.
Max Sarinsky
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Institute for Policy Integrity
New York University School of Law
Wilf Hall, 139 MacDougal Street
New York, New York 10012

Peter H. Howard, Ph.D., is Economics Director at the Institute for Policy Integrity at NYU School of Law, where Max Sarinsky is a Senior Attorney.

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Executive Summary

In recent years, numerous federal agencies have made a controversial claim: that projects locking in fossil fuels over the long term will *decrease* aggregate greenhouse gas emissions, or that their effects on total emissions will be limited. In many of those cases, however, agencies have reached this counter-intuitive conclusion using a flawed consideration of energy substitution. This report identifies some of the recurring problems with agency analysis of energy substitution and offers best practices to apply moving forward.

Energy substitution analysis considers how the addition of a particular energy source affects the energy market as a whole, and how these various changes ultimately affect greenhouse gas emissions. The addition of one fossil-fuel source is likely to displace other energy sources that would have filled market demand in the absence of the new project—some of which could have been cleaner than the new source, others of which could have been dirtier. It is also likely to increase total fossil-fuel consumption. And these displacement effects may shift over the project's long timeframe as cleaner fuel sources become more prevalent throughout the energy system.

In theory, substitution analysis captures these various market dynamics and produces an output that, though uncertain, provides a reasonable estimate of the proposed project's effects on greenhouse gas emissions. A robust and balanced substitution analysis can therefore help an agency to assess whether to permit a certain project. In practice, however, agency substitution analysis often hides the substantial climate impacts of fossil-fuel projects, resting on implausible and unfounded inputs that minimize or altogether negate the project's likely climate impacts.

For instance, the Department of the Interior claimed for years and across multiple administrations that offshore oil-and-gas production would reduce total greenhouse gas emissions—a claim that multiple courts rejected and the agency has since disavowed.[1] More recently, other agencies including the Federal Energy Regulatory Commission (FERC),[2] Department of Energy,[3] and Department of Agriculture[4] have attempted to justify proposals for fossil-fuel infrastructure by concluding that those projects would also reduce climate pollution. But many of those analyses contain similar flaws. To avoid the problems that have plagued past substitution analyses, agencies should apply the best practices outlined in this report.

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[1] *See infra* Sec. I.

[2] *E.g.*, Iroquois Gas Transmission Sys., L.P., 178 FERC ¶ 61,200, at PP 50–56 (2022) [hereinafter Iroquois Certificate Order]; Kern River Gas Transmission Co., 179 FERC ¶ 61,121, at PP 31–34 (2022) [hereinafter Kern River Certificate Order].

[3] *E.g.*, Dep't of Energy, Draft Supplemental Environmental Impact Statement for the Alaska LNG Project 4.19-3 (2022) [hereinafter Alaska LNG Draft SEIS] (estimating that greenhouse gas emissions resulting from proposed license to export liquefied natural gas "would be no higher than [under] the No Action Alternative").

[4] *E.g.*, Dep't of Agriculture, Supplemental Environmental Assessment for the Nemadji Trail Energy Center Project 3-40 (2022) [hereinafter Nemadji Trail SEA] (concluding that not approving natural-gas turbine "will result in higher [greenhouse gas] emissions" relative to approving the proposal).

Best Practices for Substitution Analysis:

1. **The analysis must recognize that energy projects affect consumption, and not treat demand as fixed.** Numerous courts have rejected the notion of "perfect substitution"—that is, that one energy source will perfectly substitute for another at the same level of consumption. In reality, fossil-fuel projects affect the relative prices of different energy sources, increasing the total consumption of the targeted commodity while decreasing total consumption of other energy sources. Agency analyses must account for these supply-and-demand effects.

2. **The analysis must be sensitive to long-term trends and policies, and not assume continued fossil-fuel reliance into the distant future.** Agencies have typically assumed long-term reliance on fossil fuels near current levels, despite increasing policies and commitments worldwide to transition sharply away from fossil fuels. The result is analyses that conclude that fossil-fuel projects largely displace one another and barely decrease the long-term use of renewables (and thus have limited climate impacts on net). Substitution analyses must factor in long-term energy trends and not necessarily assume continued global reliance on fossil fuels.

3. **The analysis must be transparent and identify key sensitivities.** Agencies should make all modeling code and inputs publicly available, and conduct analysis disclosing how the results are sensitive to uncertain parameters. Different agencies should also apply consistent modeling practices as one another, to the extent practicable, and agencies that rely on applicant-provided analyses should develop clear and rigorous guidelines to govern those submissions.

4. **The analysis must be applied consistently to project costs and benefits.** Agencies frequently apply substitution analysis to offset the climate costs of a fossil-fuel project, yet rarely apply the results of that analysis when assessing the project's economic benefits. This produces an internal inconsistency that improperly tips the scales in the project's favor. When an agency engages in substitution analysis, it must apply that analysis consistently to both sides of the ledger.

1. Substitution Analysis Must Account for Resulting Consumption Increases

When the supply of a commodity increases, price declines and consumption rises, and consumption of other energy sources declines due to change in the relative price. Yet in numerous analyses for proposed fossil-fuel projects, agencies have erroneously assumed "perfect substitution"—that is, that the project will simply replace other sources of the same fossil fuel with no effect on total consumption.

This assumption of perfect substitution comes in different varieties. Agencies sometimes apply its maximalist form—assuming no consumption change in any region or sector resulting from a major fossil-fuel project. Courts have rejected this version of perfect substitution on numerous occasions. For instance, in 2003, a federal appeals court rejected an analysis from the Surface Transportation Board assuming that a proposed coal railroad would not affect coal consumption (and thus not affect total greenhouse gas emissions), explaining that "the proposition that the demand for coal will be unaffected by an increase in availability . . . is illogical at best."[5] And in 2017, another federal appeals court rejected an analysis from the Bureau of Land Management (BLM) finding that fossil-fuel leasing would not affect oil and gas consumption (and thus also not affect total greenhouse gas emissions), finding the "perfect substitution assumption . . . irrational [and] contrary to basic supply and demand principles."[6]

Yet despite this judicial rebuke, some agencies continue to use the maximalist version of perfect substitution. For instance, the Department of Energy has routinely assumed perfect substitution to justify increasing fossil-fuel export.[7] In a recent analysis for a proposed export authorization in Alaska, the Department assumed that if the project were not constructed, then all of the natural gas that it would have exported would be exported anyway using existing terminals.[8] Yet this assumption both violates supply-and-demand principles and overlooks the facts that existing liquefied natural gas export terminals are already operating near capacity and that actual exports have consistently risen as export capacity has increased.[9] Notwithstanding these deficiencies, the Department relied on its analysis to conclude that the proposed export authorization would reduce greenhouse gas emissions.[10]

Even when not applying perfect substitution in its maximalist form, agencies frequently integrate perfect substitution into their analysis by implausibly holding consumption constant in a particular region or economic sector. In numerous analyses spanning years, for instance, the Department of the Interior recognized that oil and gas extraction on federal lands and waters produces an increase in domestic consumption—yet implausibly assumed that fossil-fuel consump-

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[5] Mid States Coal. for Progress v. Surface Transp. Bd., 345 F.3d 520, 549 (8th Cir. 2003).

[6] WildEarth Guardians v. Bureau of Land Mgmt., 870 F.3d 1222, 1236 (10th Cir. 2017).

[7] *See* Laura A. Figueroa & Sarah Ladin, Inst. for Pol'y Integrity, The Public Interest Review for LNG-Related Authorizations 32–34 (2022), https://perma.cc/8VBZ-WUEY.

[8] Alaska LNG Draft SEIS, *supra* note 3, at 4.19-3 ("To ensure consistency in modeling and comparison across the three scenarios, DOE modeled the [greenhouse gas] emissions associated with generating an equal amount of electricity (i.e., 1 megawatt hour) in each destination country. Under Scenarios 2 and 3, the LNG would be supplied by the proposed Project. Under Scenario 1, DOE modeled [greenhouse gas] emissions associated with LNG produced and supplied from the lower 48, since energy demand from foreign markets would remain and would need to be fulfilled from an alternate source under that scenario."); *see also id.* App. C (full lifecycle analysis).

[9] *The United States Became the World's Largest Exporter in the First Half of 2022*, U.S. Energy Info. Admin. (July 25, 2022), https://perma.cc/R6SJ-FEZM (showing chart comparing LNG export capacity with actual LNG exports from 2016 to June 2022).

[10] Alaska LNG Draft SEIS, *supra* note 3, at 4.19-5 ("Exporting LNG from the North Slope would not increase [greenhouse gas] emissions when providing the same services to society (through production of natural gas and oil) as the No Action Alternative."). The finding that the export license would decrease emissions was predicated on the reduction in transportation emissions in exporting natural gas to East Asia from Alaska (the proposed terminal location) versus the Gulf Coast (the site of most existing terminals). The Department did not consider other relevant and potentially confounding factors such as the effects on supply, demand, consumption, and the energy mix in the destination countries.

tion abroad would not change.[11] This assumption was illogical for two reasons. First, much of the natural gas produced domestically is shipped abroad.[12] And second, even if that were not the case, the fact that oil and natural gas are global commodities means that the effects of a supply increase in one region will not be limited to that region, but rather will lead to a net increase in global supply and consumption.[13] On this basis, three federal courts rejected Interior's analysis[14]—causing Interior to revisit its analysis and ultimately conclude that domestic extraction has far more severe climate effects than the agency had previously recognized.[15]

Other analyses assume that proposed fossil-fuel projects in a particular regional sector will not affect consumption beyond that sector. For instance, FERC recently adopted an applicant's analysis finding that a proposed natural gas pipeline that will serve the building sector in New York City would decrease total emissions.[16] But among its numerous flaws,[17] this analysis did not consider the project's effects on total consumption, instead assuming that the natural gas provided would perfectly substitute for other sources of natural gas to the local market. In essence, this analysis falsely assumed that the market for gas in New York City buildings is disconnected from the broader energy market.[18] By ignoring supply-and-demand effects and effectively assuming perfect substitution, this analysis minimized the potential for fossil-fuel lock-in and likely underestimated its climate impact.

As these various examples all illustrate, agencies should broadly consider the effects of proposed fossil-fuel projects on energy supply and demand rather than falsely assume perfect substitution. Various models are available to assess these effects, including the Energy Information Administration's (EIA) National Energy Modeling System (and its global companion, the World Energy Projection System) and the Integrated Planning Model used by the Environmental Protection Agency (EPA).[19] Other agencies should consider these models (or potentially others) and develop consistent modeling practices to look at the energy system broadly and recognize that individual projects affect supply and demand.

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[11] Bureau of Ocean Energy Mgmt., OCS Oil and Natural Gas: Potential Lifecycle Greenhouse Gas Emissions and Social Cost of Carbon 23 (2016), https://perma.cc/3NAC-YX4R [hereinafter BOEM Model] (explaining that "the reduction in foreign consumption of oil and gas in a no action analysis is not taken into account").

[12] U.S. natural gas exports have in fact risen dramatically over the past two decades. *Natural Gas Explained: Natural Gas Imports and Exports*, U.S. Energy Info. Admin. (last updated May 12, 2022), https://perma.cc/F3RT-FLKV.

[13] *See, e.g.*, Alex Juliana Ard et al., *Think U.S. Gas Prices Are High? Here's How Far $40 Goes Around the World*, Wash. Post (June 30, 2022), https://perma.cc/599W-PC5L (showing how oil and gas price increases are connected worldwide and quoting an economist at the U.S. Energy Information Administration for that proposition that "[o]il is a globally traded commodity").

[14] Ctr. for Biological Diversity v. Bernhardt, 982 F.3d 723, 736–40 (9th Cir. 2020) (agency's conclusion "that foreign oil consumption will remain static" from an increase in domestic supply violates "basic economics principles"); Sovereign Inupiat for a Living Arctic v. Bureau of Land Mgmt., 555 F. Supp. 3d 739, 762–67 (D. Alaska 2021); Friends of the Earth v. Haaland, No. CV 21-2317, 2022 WL 254526, at *12–15 (D.D.C. Jan. 27, 2022).

[15] *E.g.*, Bureau of Land Mgmt., Willow Master Development Plan Draft Supplemental Environmental Impact Statement 42 tbl.3.2.5 (2022) [hereinafter Willow DSEIS] (projecting downstream greenhouse gas emissions resulting from the change in foreign oil consumption that would result from domestic extraction project).

[16] Iroquois Certificate Order, *supra* note 2, at PP 50–56.

[17] For a fuller critique of this analysis, see Comments of the Institute for Policy Integrity at New York University School of Law, Docket No. CP20-48 (Apr. 25, 2022), https://perma.cc/E3ZS-B5NQ [hereinafter Inst. for Pol'y Integrity Iroquois Comments].

[18] *Id.* at 6–7.

[19] For a discussion of the advantages and drawbacks of these models, see Peter Howard, Inst. for Pol'y Integrity, The Bureau of Land Management's Modeling Choice for the Federal Coal Programmatic Review (2016), https://perma.cc/4ARJ-6YVH.

Best Practices:

- Agencies should assess changes in supply and demand resulting from the addition of an energy source.
- Agencies should apply energy models to analyze these market dynamics.
- Agencies should not assume "perfect substitution," including in a particular region or sector.

2. Substitution Analysis Must Consider Long-Term Changes in the Energy Sector

In the face of the climate crisis, the world is gradually transitioning away from fossil fuels. Yet substitution analyses normally assume that the world will remain reliant on fossil fuels for decades into the future and that the energy sector will not substantially change over time. This assumption frequently leads to the conclusion that a proposed fossil fuel project will mostly displace other fossil-fuel sources over its decades-long lifespan, and thus have a limited effect on climate change.[20]

Like perfect substitution, the assumption of long-term fossil fuel reliance takes various forms across numerous agency analyses. Often, agencies apply the assumption when they model the entire energy system for large production or transmission projects. In those substitution analyses, agencies often assume the EIA's "reference case" as their baseline,[21] which assumes near-constant demand for oil and gas for the next 70 years.[22] Agencies also typically assume that substitutability between different energy sources—such as oil and renewables—will follow historical patterns,[23] ignoring the presence of electric-powered cars and other emerging technologies that are likely to make renewables a far more viable alternative to existing fossil-fuel sources. Accordingly, these analyses project that oil and gas projects mostly displace other sources of oil and gas, thereby minimizing the net greenhouse gas emissions. Numerous analyses using this baseline have produced such results.[24]

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[20] Max Sarinsky & Peter Howard, *Yes, Curbing U.S. Fossil Fuel Extraction Does Reduce Climate Pollution*, The Regulatory Review (Nov. 29, 2021), https://perma.cc/2SFG-HC2Y.

[21] *See, e.g.*, Bureau of Ocean Energy Mgmt., 2023–2028 National Outer Continental Shelf Oil and Gas Leasing Proposed Program 1-5 (2022) [hereinafter BOEM Proposed Five-Year Program]; *EIA Explores Effects of Not Building Future Interstate Natural Gas Pipelines*, U.S. Energy Info. Admin. (Apr. 4, 2022), https://perma.cc/EVY8-PAG2.

[22] BOEM Model, *supra* note 11, at 20 (explaining that BOEM's model "uses a projection of near constant demand [for oil and gas] over the next 40–70 years" and does not include expected "policy shifts that affect demand for oil and gas" and "alter the composition of energy supply").

[23] *See, e.g.*, Bureau of Ocean Energy Mgmt., Consumer Surplus and Energy Substitutes for OCS Oil and Gas Production: The 2021 Revised Market Simulation Model (MarketSim) 17–21 (2021), https://perma.cc/ZXA7-6WXM (explaining that MarketSim's supply and demand elasticities are based on various studies dating back to 1998 and relying on historical data going as far back as 1960).

[24] For instance, BOEM's recent analysis for the proposed five-year offshore leasing program projects that approximately 80% of proposed offshore production would be replaced by other sources of oil and gas if not produced. BOEM Proposed Five-Year Program, *supra* note 21, at 5-41 fig.5-13 (2022). The same analysis projects that 1% of the proposed offshore production would be replaced by coal, 9% would be replaced by other energy sources, and 10% would be replaced by reduced consumption. *Id.* Other analyses from the Department of the Interior applying similar modeling estimate comparably high levels of substitution. *E.g.*, Bureau of Land Mgmt., Willow Master Development Plan Final Environmental Impact Statement app. E-2 (2020) (finding nearly 97% leakage from project's emissions, with renewable energy making up for less than 0.4% of substituted demand); Bureau of Land Mgmt., Coastal Plain Oil and Gas Leasing Program Final Environmental Impact Statement app. R (2019) (finding roughly 96% leakage and virtually no displacement from renewable energy).

But there are strong reasons to doubt that the global energy system will remain so heavily reliant on fossil fuels. For one, the EIA "reference case" on which these analyses are based has historically missed out on emerging energy trends by underestimating the pace of renewable energy growth.[25] Global climate policies have also gotten much stronger over time,[26] and the wide gap between existing policies and international emission-reduction commitments indicates that global policies will continue to trend toward promoting decarbonization.[27] Additionally, as renewables become more integrated into the energy system with policy development, they will very likely become more substitutable with fossil-fuel energy sources. For instance, as noted above, the ongoing emergence of electric-powered vehicles means that renewable electricity will substitute more for oil in the future.[28] Analyses based exclusively on historical data do not capture these dynamics.

Agencies should thus incorporate a range of future trajectories into their analyses and not bias the results by assuming continued long-term reliance on fossil fuels and low levels of substitutability between fossil fuels and renewables. In fact, the Bureau of Ocean Energy Management (BOEM) recently recognized as much. In its proposed offshore leasing program from July 2022, the agency explained that "substitutions could vary dramatically based on the future energy scenario and pathway," and recognized that "a net-zero or similar pathway" could make "the impact of substitutions in the absence of [the proposed offshore] production . . . look very different."[29] Although BOEM did not integrate a decarbonization pathway into its quantitative analysis, it performed a qualitative analysis in which it recognized that such a pathway would likely decrease oil-to-oil substitution and increase oil-to-renewable substitution.[30] Thus, BOEM concluded, the prospect of future decarbonization meant that the proposed leasing would likely be more harmful to the climate than the agency's quantitative modeling projected.[31]

While BOEM's qualitative analysis is a laudable first step, agencies should seek to incorporate long-term decarbonization into their substitution modeling. Doing so would likely reveal that the climate impacts of fossil-fuel projects could be far more severe than existing agency analyses have concluded. In a recent report, we incorporated long-term decarbonization assumptions into BOEM's substitution modeling and found that under more aggressive decarbonization pathways (including revised elasticity assumptions that the economy of the future rather than simply incorporate historical data), offshore leasing would displace renewables much more, and other fossil-fuel sources much less, than BOEM projects — potentially tripling or quadrupling the agency's estimate of total net greenhouse gas emissions.[32] As this analysis demon-

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[25] Alexander Q. Gilbert & Benjamin K. Sovacool, *Looking the Wrong Way: Bias, Renewable Electricity, and Energy in the United States*, 94 Energy 533 (2015) ("The [Annual Energy Outlook] consistently under projects most types of non-hydro renewables," making "the reliability of the AEO . . . inherently low").

[26] *See* Nadja Popovich & Brad Plumer, *Yes, There Has Been Progress on Climate. No, It's Not Nearly Enough*, N.Y. Times (Oct. 25, 2021), https://www.nytimes.com/interactive/2021/10/25/climate/world-climate-pledges-cop26.html ("In 2014, Climate Action Tracker estimated that the world was on track for nearly 4 degrees Celsius of warming by 2100, compared with preindustrial levels. . . . This year, however, Climate Action Tracker painted a more optimistic picture, because countries have started doing more to restrain their emissions. Current policies put the world on pace for roughly 2.9 degrees Celsius of warming by 2100.").

[27] Minhal Pathak et al., Intergovernmental Panel on Climate Change, Working Group III Contribution to the IPCC Sixth Assessment Report (A6R): Technical Summary TS-28 (Nov. 29, 2021) [hereinafter "IPCC Working Group III Technical Summary"] (discussing "implementation gap . . . between [national] mitigation pledges[] and the expected outcome of existing policies"). According to analysis from Climate Action Tracker, nearly all countries are off track to meet Paris Accord targets and pledges. Climate Action Tracker, Climate Target Updates Slow as Science Ramps Up Need for Action ii–iii (2021), https://perma.cc/U89S-L4PZ.

[28] For instance, a recent economics paper uses a wide range of values for the price elasticity of demand for oil from -0.21 to -0.86 in recognition of the large uncertainty around this parameter. See Geoffrey Heal, *Economic Aspects of the Energy Transition*, Env't & Res. Econ. 1, 12 (2022).

[29] BOEM Proposed Five-Year Program, *supra* note 21, at 5-28.

[30] *Id.* at 5-52 to -56 (providing a "net-zero hypothetical analysis" and concluding that "it is likely that the incremental net benefits associated with [offshore] leasing would decrease given these alternative substitution assumptions").

[31] *See id.*

[32] Peter Howard, Max Sarinsky & Minhong Xu, The Real Costs of Offshore Oil and Gas Leasing, Inst. for Pol'y Integrity 15–22 (2022), https://perma.cc/7DSD-FH2U.

strates, agencies should not rely exclusively on the assumption of long-term fossil fuel reliance to conclude that a proposed project will have limited climate effects.

But it is not just large-scale energy modeling where the assumption of long-term fossil-fuel reliance has affected substitution analysis. When agencies conduct regional or sectoral analyses, they also often assume long-term reliance on fossil fuels—sometimes in the face of strong countervailing evidence or even legal obligations. In particular, agencies sometimes assume that proposed gas projects will displace dirtier sources and thus reduce long-term emissions,[33] while minimizing the potential that these projects may crowd out renewable sources over the long term. This assumption sometimes disregards existing state and local decarbonization laws. For instance, FERC recently adopted an applicant's analysis finding that a proposed pipeline to serve the New York City building market would reduce emissions in comparison to using oil for heating.[34] But that analysis ignored the fact that New York City has effectively banned the use of natural gas and most heating oil in new and renovated buildings starting in 2024.[35]

Many states and local governments have enacted legislation requiring substantial reductions in greenhouse gas emissions, either sectorally or economy-wide.[36] Substitution analyses focusing on projects in those jurisdictions should incorporate those policies into their long-term baselines and recognize that, by law, cleaner fuel sources will become substantially more prevalent in the coming years and decades. Where decarbonization and clean-energy requirements already exist, it is particularly problematic for an agency to assume long-term reliance on fossil.

Similarly, agencies should accurately project the retirement ages of existing energy infrastructure when conducting substitution analysis. If a coal or nuclear power plant is nearing retirement age, for instance, agencies should assume that the plant will retire within a reasonable timeframe and consider that retirement as part of the analytical baseline. In this circumstance, agencies should not attribute that retirement to the proposed project.

Best Practices:

- Agencies should consider long-term changes to the energy mix and not reflexively assume long-term reliance on fossil fuels.
- In system-wide analyses, agencies should develop baselines that incorporate decarbonization pathways and commitments, and not rely exclusively on a baseline that assumes long-term reliance on fossil fuels.
- In regional analyses, agencies should integrate state and local laws and the lifetime of existing sources.

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[33] *E.g.*, Nemadji Trail SEA, *supra* note 4, at 3-40; Kern River Certificate Order, *supra* note 2, at PP 31–34.

[34] Iroquois Certificate Order, *supra* note 2, at PP 50–56

[35] Inst. for Pol'y Integrity Iroquois Comments, *supra* note 17, at 7–8.

[36] *See generally* U.S. State Climate Action Plans, *Center for Climate & Energy Solutions*, https://perma.cc/2ZPT-3JVM ("33 states have released a climate action plan or are in the process of revising or developing one.").

3. Substitution Analysis Must Be Transparent and Disclose Key Sensitivities

A good substitution analysis is often complex, and its results can vary depending on the inputs and assumptions. As with any government analysis, agencies should be transparent with their substitution analyses to facilitate public input.

Transparency is a hallmark of good government analysis. Circular A-4, the guidance document on economic analysis from the Office of Management and Budget, explains that a "good analysis is transparent," meaning that it "should be possible for a qualified third party reading the report to see clearly how you arrived at your estimates and conclusions."[37] Circular A-4 further recommends that agencies post all supporting documentation to enable public review,[38] and conduct sensitivity analysis "to reveal whether, and to what extent, the results of the analysis are sensitive to plausible changes in the main assumptions and numeric inputs."[39]

On the transparency scorecard, agency substitution analyses are mixed.[40] Sometimes, agencies provide documentation detailing the analytical assumptions and results of the substitution analysis, facilitating meaningful public review. But agencies typically do not make the modeling code itself publicly available, limiting the public's ability to reproduce the analysis and test its sensitivity to key parameters.[41] This lack of reproducibility is particularly problematic for analyses that rely on proprietary models, such as certain analyses submitted by project applicants. Agencies should make all model codes and inputs publicly available and require applicants for federal authorizations to do the same.

Another challenge is that numerous agencies perform substitution analyses that rely on different models, inputs, and assumptions.[42] This not only creates inconsistency across agencies but places an additional burden on the public to evaluate many different models. This practice is especially problematic for agencies like FERC that do not perform substitution analysis themselves, but rather accept analyses from applicants that frequently use different models and parameters. Agencies should collaborate with one another to ensure government-wide consistency between analyses. While agencies should ideally perform substitution analysis themselves to maximize consistency and neutrality, agencies that rely on applicant-submitted analyses should provide robust standards for applicants to follow (and reject analyses that do not meet those standards). This standardization is particularly important to counteract the incentive that applicants have to deploy models and parameters that are favorable to the project.

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[37] Off. of Mgmt. & Budget, Circular A-4: Regulatory Analysis 3 (2003). While Circular A-4 does not formally apply to environmental analyses conducted under the National Environmental Policy Act, its recommendations may still be viewed in that context as best practices.

[38] *Id.* at 17.

[39] *Id.* at 3.

[40] *See generally* Howard, *supra* note 19, at 12–13 (evaluating transparency of three agency models).

[41] *Compare id.* at 6, 9, *with id.* at 11 (noting that some substitution models are publicly available while others are not). Sometimes, agencies publicly release detailed documentation explaining the modeling but do not publicly release the model itself—for instance, this is the case with Interior's MarketSim.

[42] Of the main models in usage by the federal government, the Department of the Interior uses MarketSim, the EPA uses the Integrated Planning Model, and the EIA uses the National Energy Modeling System. *Id.* at 6, 10. Some agencies that engage in substitution analysis use none of these models.

Finally, agencies should assess the sensitivity of their results to key parameters. Substitution analysis is an uncertain enterprise, as it can be highly sensitive to uncertain assumptions and inputs.[43] For instance, as discussed in the prior section, the choice of the baseline is both uncertain and highly consequential.

Best Practices:

- Agencies should make all modeling code and inputs publicly available.
- To the extent feasible, different agencies should apply consistent modeling practices. Agencies that rely on applicant-provided analyses should develop rigorous guidelines for those analyses consistent with the principles set forth in this document.
- Agencies should conduct sensitivity analysis around key uncertainties, such as the long-term energy baseline.

4. Substitution Analysis Must Be Applied Consistently to Costs and Benefits

While agencies normally use substitution analysis to assess the climate impacts of a proposed project, they rarely apply the same analysis when assessing economic benefits. This discrepancy creates an obvious inconsistency. If an energy project's greenhouse gas emissions would be largely replaced by substitute energy sources if the project were not completed, then many of the project's economic benefits—such as revenues, royalties, and jobs—would also be largely replaced by those same substitutes. Agencies should apply substitution analysis consistently to all impacts, and not place their thumb on the scale by offsetting only climate costs.[44]

Two recent analyses from the Department of the Interior offer, respectively, a deficient and exemplary example of how agencies should apply substitution effects to economic benefits. The deficient example comes from the BLM environmental analysis of the Willow Master Development Plan—a fossil-fuel extraction plan in Alaska currently under review. In numerous environmental analyses, the agency has concluded that a large share of the greenhouse gas emissions resulting from the project is simply displacing emissions that would have occurred from alternative oil-and-gas production should the project not proceed.[45] Yet there is no mention of this displacement effect when the agency calculates royalties and revenues.[46]

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[43] Federal guidance supports the consideration of uncertain impacts in agency analysis. Circular A-4, *supra* note 37, at 38–42. Under the National Environmental Policy Act, courts have recognized the importance of assessing uncertain environmental effects. *See, e.g.*, Mont. Wilderness Ass'n v. McAllister, 666 F.3d 549, 559 (9th Cir. 2011); Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n, 481 F.2d 1079, 1092 (D.C. Cir. 1973).

[44] *See generally* Bus. Roundtable v. Secs. & Exch. Comm'n, 647 F.3d 1144, 1148–49 (D.C. Cir. 2011) (criticizing defendant agency for "inconsistently and opportunistically fram[ing] the costs and benefits" of a regulation); Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1198 (9th Cir. 2008) (agency cannot "put a thumb on the scale" through inconstant treatment of costs and benefits).

[45] The agency's most recent environmental analysis of this project, from June 2022, explains that if the project does not proceed, "[e]nergy demand would potentially be satisfied by non-Project sources." Bureau of Land Mgmt., Willow Master Development Plan Supplemental Environmental Impact Statement 39 (2022). BLM then conducts a formal substitution analysis and offsets greenhouse gas emissions resulting from the project by the emissions from substitute production that it finds the project would displace. *Id.* at 41 tbl.3.2.2.

[46] *See id.* at 254.

Of course, if BLM is correct that much of the plan's oil and gas production displaces production that would otherwise occur elsewhere, many of the claimed economic benefits of the plan would also substitute for benefits that would result from this displaced production elsewhere. Yet, under the agency's logic, the plan is responsible for all of its positive economic impacts but few of its climate harms. And BLM is hardly alone in its disregard for substitution effects when assessing project benefits. Agencies routinely present a lopsided analysis by applying substitution analysis only to greenhouse gas emissions while failing to consider how it may also affect project benefits.[47]

A better example of how agencies can consistently apply substitution impacts to both sides of the ledger comes from BOEM's recent proposed five-year leasing plan. In that proposal, BOEM conducted an analysis identifying likely energy market substitutes.[48] BOEM then integrated the results of that substitution analysis to inform its assessment of both the proposal's climate costs and its economic benefits.[49] Specifically, BOEM evaluated the alleged incremental benefits of the proposed leasing program by subtracting the benefits that would be generated by energy substitutes from the gross benefits of the proposal.[50]

Though BOEM's analysis in this regard is the exception rather than the norm, it provides a model that other agencies should follow.

Best Practices:

- If an agency conducts a substitution analysis, it should consistently apply the findings of that analysis when assessing economic benefits.
- To evaluate incremental economic benefits under this scenario, agencies should subtract the benefits that would be generated by energy substitutes from the gross benefits of the proposal.

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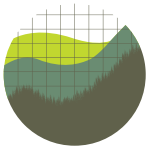
[47] For example, the U.S. State Department's analysis of the proposed Keystone XL Pipeline contained a detailed discussion of substitution effects with respect to greenhouse gas emissions, but no similar discussion with respect to economic benefits. *See* Inst. for Pol'y Integrity, Comment Letter on Failure to Consistently Apply Substitution Analysis in the Draft Supplemental Environmental Impact Statement for the Proposed Keystone XL Pipeline, Docket No. DOS-2019-0033, at 1–3 (Nov. 18, 2019), https://perma.cc/4BDH-2VZP. Other than BOEM's recently proposed five-year proposal, past Interior analyses have routinely disregarded substitution effects when assessing economic impacts. *See* Rachel Rothschild & Max Sarinsky, Toward Rationality in Oil and Gas Leasing 19 (2021), https://perma.cc/F7NF-AL4U.

[48] BOEM Proposed Five-Year Program, *supra* note 21, at 5-41 fig.5-13 (reporting results of substitution analysis).

[49] *Id.* at 5-42 ("All domestic substitutes would provide [net economic value] under the No Sale Option and only the Draft Proposal [net economic value] over and above this amount is an incremental benefit to the Nation."). *See also id.* at 5-42 tbl.5-11 (reporting economic benefits from energy substitutes under no-sale option); *id.* at 5-46 (reporting "incremental net benefits" as the difference between the net benefits of the proposal and the net benefits of energy substitutes).

[50] *Id.* at 5-46 to -48.



Institute *for*
Policy Integrity
NEW YORK UNIVERSITY SCHOOL OF LAW

Institute for Policy Integrity
New York University School of Law
Wilf Hall, 139 MacDougal Street, New York, New York 10012
policyintegrity.org