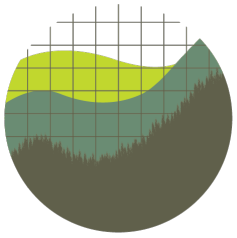

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November 4, 2022

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Re: Requests for Comments on Implementation Guidance for the Inflation Reduction Act (IRS Notices No. 2022–46 through –51 & 2022–56 through –58)

The Institute for Policy Integrity at New York University School of Law ("Policy Integrity")[1] respectfully submits the following comments in response to the Department of Treasury ("Treasury") and the Internal Revenue Service ("IRS")'s nine separate notices requesting comment on implementation of the recently passed Inflation Reduction Act ("IRA"). [2] Policy Integrity is a non-partisan think tank dedicated to improving the quality of government decisionmaking through advocacy and scholarship in the fields of administrative law, economics, and public policy.

Policy Integrity commends Treasury and the IRS for seeking public input early in the rulemaking and guidance process, and makes the following general recommendations to enhance public participation and consideration of racial equity and environmental justice in accordance with relevant Executive Orders during implementation of the IRA:

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[1] This document does not purport to represent the views, if any, of New York University School of Law.

[2] Policy Integrity files these comments in the docket for each currently open Request for Information on IRA Implementation under the following IRS Notices:

- 2022-46 (Request for Comments on Credits for Clean Vehicles);
- 2022-47 (Request for Comments on Energy Security Tax Credits for Manufacturing Under Sections 48C and 45X);
- 2022-48 (Request for Comments on Incentive Provisions for Improving the Energy Efficiency of Residential and Commercial Buildings);
- 2022-49 (Request for Comments on Certain Energy Generation Incentives);
- 2022-50 (Request for Comments on Elective Payment of Applicable Credits and Transfer of Certain Credits);
- 2022-51 (Request for Comments on Prevailing Wage, Apprenticeship, Domestic Content, and Energy Communities Requirements Under the Act Commonly Known as the Inflation Reduction Act of 2022);
- 2022-56 (Request for Comments on Section 45W Credit for Qualified Commercial Clean Vehicles and Section 30C Alternative Fuel Vehicle Refueling Property Credit);
- 2022-57 (Request for Comments on the Credit for Carbon Oxide Sequestration);
- 2022-58 (Request for Comments on Credits for Clean Hydrogen and Clean Fuel Production).

- **Treasury should coordinate with other federal agencies with experience incorporating environmental justice into their rulemaking process.** Treasury should consult with other federal agencies and interagency working groups on how best to incorporate equity and environmental justice into their rulemaking processes to fulfill the mandates of Executive Orders and other White House guidance on environmental justice, racial equity and modernizing regulatory review.
- **Treasury should conduct robust stakeholder outreach throughout the guidance and rulemaking process, especially in disadvantaged communities.** Meaningful public engagement will provide Treasury with the data needed to make informed decisions about IRA implementation, will result in greater public confidence in the resulting rules and guidance, and is supportive of—and consistent with—Treasury's first guiding principle in implementing these provisions with "[r]obust and broad public engagement.[3]

The below comments provide general recommendations for incorporating equity into Treasury's development of guidance and regulations to implement the IRA and are responsive to each of the nine Requests for Information. These recommendations are drawn from Policy Integrity's August 2021 report, *Making Regulations Fair: How Cost-Benefit Analysis Can Promote Equity and Advance Environmental Justice*,[4] attached to this comment. Although *Making Regulations Fair* focuses on the federal rulemaking process, the methodologies described in that report are applicable to a broad range of decisionmaking contexts, including grantmaking, investment, and procurement.

In addition, Policy Integrity makes two specific recommendations with respect to the calculation of carbon intensity for hydrogen production. These recommendations are discussed below in Section III, and are specifically directed to the docket for IRS Notice 2022-58 (Request for Comments on Credits for Clean Hydrogen and Clean Fuel Production). In particular, these recommendations respond to questions .01(1)(e) and .01(4)(f)-(g), which together seek information on how to verify the carbon intensity of energy inputs and how to treat indirect book factors that reduce a hydrogen producer's effective emissions.

I. Treasury Should Consult With Other Federal Regulators With Greater Expertise in Considering Environmental Justice

A. Executive Orders and Presidential Memorandums Require Treasury to Consider Racial Equity and Environmental Justice in Implementing the IRA

President Biden has issued two important Executive Orders and a Presidential Memorandum that require federal agencies to consider racial equity and environmental justice in all government actions, but specifically in climate-related actions.[5]

In the Presidential Memorandum on Modernizing Regulatory Review, the President directed the Office of Management and Budget to work with all federal agencies to propose procedures that

[3] *See* FACT SHEET: Treasury, IRS Open Public Comment on Implementing the Inflation Reduction Act's Clean Energy Tax Incentives, https://home.treasury.gov/system/files/136/FactSheet-Implementing-IRA-Climate-CleanEnergy-TaxIncentives.pdf.

[4] Lienke, et al., Making Regulations Fair: How Cost-Benefit Analysis Can Promote Equity and Advance Environmental Justice (August 2021), https://policyintegrity.org/publications/detail/making-regulations-fair.

[5] Exec. Order No. 13,985, 86 Fed. Reg. 7009 (Jan. 20, 2021); Exec. Order No. 14,008, 86 Fed. Reg. 7619 (Feb. 1, 2021) and Presidential Memorandum on Modernizing Regulatory Review, 86 Fed. Reg. 7223 (Jan. 26, 2021).

"take into account the distributional consequences of regulations, including as part of any quantitative or qualitative analysis of the costs and benefits of regulations, to ensure that regulatory initiatives appropriately benefit and do not inappropriately burden disadvantaged, vulnerable, or marginalized communities," with an emphasis on actions related to racial inequality and climate change.[6]

In Executive Order 13,985 on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government, the President directed all federal agencies to advance equity through a "systematic approach to embedding fairness in decision-making processes, executive departments and agencies" and to "work to redress inequities in their policies and programs that serve as barriers to equal opportunity."[7]

In Executive Order 14,008 on Tackling the Climate Crisis at Home and Abroad, the President made it a goal for at least 40 percent of most climate and clean energy federal investments to flow to disadvantaged communities under the Justice40 Initiative.[8] The President has also specifically called out the IRA as a crucial opportunity to advance the Administration's whole-of-government approach to directing investments toward disadvantaged communities.[9]

These Presidential Executive Orders and Memorandum are only the most recent directives directing agencies to consider racial equity and environmental justice in their rulemaking, and they build on a significant body of executive orders and regulatory guidance. For example, Executive Order 12,866 instructs agencies to incorporate environmental justice considerations into their cost-benefit analyses and regulatory decisions,[10] specifically recognizing that "distributional impacts" and equity" are relevant to assessing net benefits.[11] Circular A-4 instructs agencies to "provide a separate description of distributional effects (i.e., how both benefits and costs are distributed among sub-populations of particular concern) so that decision makers can properly consider them along with the effects on economic efficiency," and to describe distributional effects "quantitatively to the extent possible."[12] Distributional analysis helps decisionmakers understand how the impacts of an action affect different groups.

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[6] 86 Fed. Reg. at 7223.
[7] 86 Fed. Reg. at 7009.
[8] 86 Fed. Reg. at 7619.
[9] Fact Sheet, "Inflation Reduction Act Advances Environmental Justice," White House Briefing Room (Aug. 17, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/17/fact-sheet-inflation-reduction-act-advances-environmental-justice/ ("The Inflation Reduction Act builds on the historic investments in President Biden's Bipartisan Infrastructure Law and advances his Justice40 Initiative, which will deliver 40 percent of the overall benefits of climate and clean energy investments to disadvantaged communities. In total, hundreds of federal programs, including those established by the Inflation Reduction Act and Bipartisan Law, representing historic investments are being reimagined and transformed to meet the Justice40 goal and maximize benefits to disadvantaged communities.").
[10] Exec. Order No. 12,866 § 1(a), 58 Fed. Reg. 51,735 (Oct. 4, 1993) ("Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.").
[11] *Id.* § 1(b)(5).
[12] OFFICE OF MGMT. & BUDGET, CIRCULAR A-4: REGULATORY ANALYSIS 14 (2003).

Decisionmakers should be concerned if one or more groups face disproportionately adverse impacts from such an action.[13]

In 2011, President Obama issued Executive Order 13,563, which reaffirmed Executive Order 12,866 and stated that agencies conducting cost-benefit analysis "may consider (and discuss qualitatively) values that are difficult or impossible to quantify, including equity, human dignity, fairness, and distributional impacts."[14] Separate from these directives on cost-benefit analysis, federal agencies have been further instructed to consider environmental justice considerations in their decisionmaking.[15] And, as discussed above, President Biden has further reaffirmed commitments to prioritize environmental justice and the development of procedures to improve consideration of the distributional impacts of regulations.[16]

To the extent possible, Treasury should consider distributional effects as it develops guidance and regulations to implement the IRA in a way that meets the goals of the Justice40 Initiative. A key aspect of distributional analysis is the gathering of sufficiently detailed data and monetized estimates of effects—information that Treasury may be able to gather through interagency working groups dedicated to consistent consideration of environmental justice across the federal government. With this information in hand, Treasury can determine if the expected outcomes of its implementation guidance are distributionally desirable and weigh the distributional desirability of different options against one another. This distributional analysis should be underpinned by a robust stakeholder engagement process so that proposed regulations and guidance reflect accurate data and take into account community concerns. Detailed guidance on how to conduct an effective distributional analysis, including recommendations for granularity, disaggregation, and how to incorporate distributional effects into the decision-making process can be found in the attached Policy Integrity report, *Making Regulations Fair*.

B. Treasury Should Use Existing Expertise Within Other Federal Agencies to Understand and Account For the Distributional Effects of Its Rulemaking

Given that Treasury has not traditionally engaged in this type of analysis in its rulemaking, and has not established its own internal environmental justice office, Treasury should quickly seek external advice from other federal agencies who do have this expertise such as those discussed below. Treasury can best accomplish the goals set forth under the Executive Orders by engaging in meaningful discussion with other federal agencies and community stakeholders as early in the guidance and rulemaking process as possible.

To coordinate among federal agencies seeking to comply with the goals and policies set forth in Executive Order 14,008, President Biden created the White House Environmental Justice

[13] Executive Order 12,898 on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations directs agencies to address "disproportionately high and adverse human health or environmental effects" on certain populations, which is a useful lens to consider distributional effects more generally. Exec. Order 12,898 § 1, 59 Fed. Reg. 7629, 7629 (Feb. 16, 1994).
[14] Exec. Order No. 13,563 § 1(c), 76 Fed. Reg. 3821 (Jan, 21, 2011).
[15] Exec. Order No. 12,898 § 1-101, 59 Fed. Reg. 7,629 (Feb. 16, 1994) ("To the greatest extent practicable and permitted by law, . . . each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations . . . .").
[16] *See* Exec. Order 13,990, 86 Fed. Reg. 7037 (Jan. 25, 2021); Exec. Order No. 14,008 § 219, 86 Fed. Reg. 7619 (Feb. 1, 2021); Modernizing Regulatory Review: Memorandum for the Heads of Executive Departments and Agencies § 2(b)(ii), 86 Fed. Reg. 7223 (Jan. 26, 2021).

Interagency Council[17] and the White House Environmental Justice Advisory Council within the White House's Council on Environmental Quality.[18] These councils build on existing offices within federal agencies such as EPA's Office of Environmental Justice and Civil Rights and the Department of Energy's Office of Economic Impact and Diversity, which have worked to systematize consideration of environmental justice in agency rulemaking efforts. Rather than starting from scratch, Treasury should coordinate with these offices in order to ensure that its development of guidance and implementing regulations includes adequate consideration of equity and distributional effects.

II. Treasury Should Develop Robust Stakeholder Engagement Processes to Ensure Adequate and Meaningful Public Comment

Robust stakeholder engagement is a cornerstone of equity-promoting decisionmaking. Engagement of the public—and specifically environmental justice communities—can provide important benefits in Treasury's rulemaking process. Among other reasons, participation can help Treasury obtain more comprehensive information on relevant issues and build public confidence in the implementation of the IRA.

The actions of Treasury in issuing implementation guidance for the IRA do not exist in a vacuum. If Treasury is committed to considering equity in the distribution of tax benefits in the IRA as it must under Presidential guidance discussed above, it must also consider the other actions taken by federal, state, and local regulators that might contribute to—or conversely, hinder—its desired outcomes. For example, some of the IRA tax credits overlap with existing policies in some states who may have significant expertise on effectively distributing the funds. In addition, successful distribution of funds depends on other policies and regulations such as siting and permitting. Thus it is critical that Treasury engage with federal, state, and local regulators and other technical experts early in the process.[19] Importantly, such early engagement with state regulators could prevent costly litigation in the future.

Similarly, public participation by environmental justice communities can support Treasury's efforts to incorporate equity considerations by allowing the agency to obtain more comprehensive information for use in their decisions. Community members can provide novel information that can only be gleaned from lived experiences and a deeper understanding of these consequences than the literature might provide.[20] Additionally, communities might provide further information about public opinion that can help Treasury identify and analyze potential

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[17] Exec. Order 14,008 § 220, *supra* note 5.

[18] *Id.* § 221.

[19] Treasury's recent Stakeholder Roundtable with representatives from labor and environmental groups is a good example of the type of engagement that will be critical throughout the rulemaking and guidance process. *See* READOUT: Stakeholder Roundtable on Climate Impact, Equity, and the Inflation Reduction Act (Oct. 27, 2022), https://home.treasury.gov/news/press-releases/jy1055.

[20] Cynthia R. Farina et al., *Knowledge in the People: Rethinking "Value" in Public Rulemaking Participation*, 47 WAKE FOREST L. REV. 1185, 1197 (2012) (explaining that these communities have "situated knowledge" of the "impacts, ambiguities and gaps, enforceability, contributory causes, and unintended consequences that are based on the lived experience in the complex reality into which the proposed regulation would be introduced"); Eileen Gauna, *The Environmental Justice Misfit: Public Participation and the Paradigm Paradox*, 17 STAN. ENV'T. L.J. 3, 72 (1998) ("[F]ormal expertise cannot capture the knowledge that exists within affected communities."); MICHAEL SANT'AMBROGIO & GLEN STASZEWSKI, ADMIN. CONF. OF THE U.S., FINAL REPORT: PUBLIC ENGAGEMENT WITH AGENCY RULEMAKING 26 (2018).

areas of conflict.[21] With improved opportunities for communities to participate in the early stages of developing implementation guidance and regulations, members of such communities may be able to pass on information that Treasury might not otherwise obtain.

Moreover, community engagement in the rulemaking process can build public confidence in the implementation of the IRA. In general, stakeholders and the general public may be more supportive of agency action when they are given a meaningful opportunity to be heard.[22] Stakeholders may also have greater confidence in a process that brings community interests to the forefront of the discussion by engaging environmental justice communities and reducing emphasis on stakeholder politics.[23] Where the public is able to participate in the process and see that their concerns are heard and considered, they may be more inclined to accept, or even support, the outcome of the process.[24]

Public participation can also highlight areas for improvement in Treasury's decisionmaking processes. For example, in a recent proceeding of the Federal Energy Regulatory Commission (FERC) on its natural gas infrastructure certification policy, a broad array of commenters provided FERC with recommendations on how to improve various aspects of its environmental justice review for natural gas infrastructure projects. Treasury may be interested in reviewing comments submitted in this docket by a coalition of public interest organizations, including environmental justice organizations.[25] This specific set of comments provides detailed recommendations on how to improve the environmental justice assessment, a type of distributional analysis, including ways to enhance identification of environmental justice communities and the proper use of study areas and reference populations in assessment of impacts.[26] These organizations also highlight the importance of a clear and articulable policy for evaluating environmental justice impacts and mitigation measures, explaining that failing to have clear guidelines or "standards and best practices" can "diminish[] government accountability and make it more difficult for interested and affected parties to anticipate what [FERC] will do about

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[21] Marc Mihaly, *Citizen Participation in the Making of Environmental Decisions: Evolving Obstacles and Potential Solutions Through Partnership with Experts and Agents*, 27 PACE ENV'T L. REV. 151, 164–65 (2009) (discussing how citizen participation can provide information about "the nature and depth of public opinion" and "the substance, weight, significance and politics of stakeholder concerns").

[22] SANT'AMBROGIO & STASZEWSKI, *supra* note 20, at 17 ("[S]takeholders will be more supportive of agency rulemakings when their voices are heard by the agency, even when they do not get everything they want."); *id.* at 16 (citing CYNTHIA R. FARINA & CERI, IBM CTR. FOR THE BUS. OF GOV'T, RULEMAKING 2.0: UNDERSTANDING WHAT BETTER PUBLIC PARTICIPATION MEANS, AND DOING WHAT IT TAKES TO GET IT 12 (2013) as providing some evidence for this theory); *cf.* Michael Asimow, *Nonlegislative Rulemaking and Regulatory Reform*, 1985 DUKE L.J. 381, 402–03 (stating that public participation promotes democratic values because it allows agency staff to engage with groups or individuals that they may not regularly consult).

[23] Ian E. Cecala & A. Bryan Endres, *Damnesia: An Examination of Public Participation and Evolving Approaches to Hydropower Development in the US and Brazil*, 55 IDAHO L. REV. 115, 122 (2019).

[24] SANT'AMBROGIO & STASZEWSKI, *supra* note 20, at 3–4, 9–17.

[25] Supplemental Comments of Public Interest Organizations at 79–107, *Certification of New Interstate Natural Gas Facilities*, Docket No. PL18-1 (May 26, 2021) [hereinafter Public Interest Org. Natural Gas Comments] (comments of 54 environmental and other public interest organizations, including Natural Resources Defense Council, Sierra Club, WE ACT for Environmental Justice, Public Citizen, and Richmond Interfaith Climate Justice League, among others). Policy Integrity also submitted comments outlining recommendations on environmental justice analysis. Comments of the Inst. for Pol'y Integrity at New York University School of Law, *Certification of New Interstate Natural Gas Facilities*, Docket No. PL18-1 (May 26, 2021).

[26] *Id*. at 81–86.

environmental justice for any given project."[27] Treasury may find this proceeding useful not only for informing how it assesses equity and environmental justice in its implementation guidance, but also for how it engages with stakeholders.

For further details on this FERC proceeding and the importance of public participation in agency decisonmaking, see Policy Integrity's comments on FERC's Office of Public Participation,[28] comments to FERC on Certification of New Interstate Natural Gas Facilities,[29] and comments to the Nuclear Regulatory Commission on Providing for Meaningful Participation by Environmental Justice Communities.[30]

III. Treasury Should Adopt Rigorous Carbon-Accounting Principles When Calculating the Carbon Intensity of Hydrogen Production for the § 45V Clean-Hydrogen-Production Tax Credit

Another issue that Treasury should consider is how to measure the carbon intensity of hydrogen production using grid electricity for the purposes of implementing the § 45V clean-hydrogen-production tax credits. Under the IRA, the availability and value of tax credits for the production of hydrogen depends on the emissions intensity of the production process, including upstream emissions from electricity generation.[31] When hydrogen is produced using grid electricity, agencies should adhere to rigorous carbon-accounting principles that accurately count those emissions. Otherwise, agencies may undermine the environmental purposes of the statutes that they administer by inadvertently promoting carbon-intensive hydrogen.

A detailed explanation of these principles appears in attached comments to the Department of Energy that Policy Integrity submitted in response to the draft guidance on the Clean Hydrogen Production Standard. Those comments are equally applicable to calculating the carbon intensity of hydrogen production for the IRA's clean-hydrogen-production tax credits. Here, we summarize the two primary methodological points from our previous comments.

First, to accurately quantify the emissions that result from grid electricity associated with hydrogen production, agencies should endorse the use of marginal emissions rates with appropriate spatial and temporal granularity. In other words, to calculate the emissions intensity of the additional load caused by an electrolyzer, agencies should focus on the carbon intensity of the power plant that increases its generation to match the new load. However, the IRA specifies that the emissions intensity of hydrogen production shall include only those emissions determined by (1) the most recent the Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies Model (GREET) or (2) a successor model determined by the Secretary of Treasury.[32] Because GREET does not currently adhere to a marginal-emissions approach, it is

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[27] *Id.*

[28] Comments of the Inst. for Pol'y Integrity at New York University School of Law, *The Office of Public Participation*, Docket No. AD21-9 (Apr. 23, 2021), https://policyintegrity.org/documents/Comments_on_FERC_Office_Public_Participation_04.23.21.pdf.

[29] Comments of the Inst. for Pol'y Integrity at New York University School of Law, *Certification of New Interstate Natural Gas Facilities*, Docket No. PL18-1 (May 26, 2021), https://policyintegrity.org/documents/Comments_on_FERC_NOI_05.26.21.pdf.

[30] Comments of the Inst. for Pol'y Integrity at New York University School of Law, *Providing for Meaningful Public Participation by Environmental Justice Communities,* Docket No. NRC-2021-0137 (Oct. 29, 2021), https://policyintegrity.org/documents/Policy_Integrity_Comments_on_NRC_EJ_Policy.pdf.

[31] Section 45V(b)(2).

[32] Section 45V(c)(1)(B).

critical that DOT and IRS cooperate with the Department of Energy to ensure that GREET is promptly updated. In the alternative, Treasury should use its discretion to develop a successor model that incorporates a marginal-emissions approach with appropriate spatial and temporal granularity. The attached comments include evidence that a marginal-emissions approach would be administrable based on the data that is available.

Second, if electrolyzers seek to use market instruments like renewable energy credits or power purchase agreements to effectively offset the carbon intensity of grid electricity used to produce hydrogen, agencies should enforce two requirements. The renewable generation associated with these instruments must be additional to the grid. If additionality is not satisfied, then offsets represent a mere reshuffling of the allocation electricity on paper, not a reduction in emissions that can be transferred to an electrolyzer. Further, agencies should use spatially and temporally specific marginal emissions rates to calculate the displaced emissions that these instruments represent. The avoided-emissions value of an offset depends on the emissions intensity of the marginal generator that ramped down to accommodate the clean generation.

For more details, please see our attached comments to the Department of Energy.

Respectfully,

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Attachments

1. Lienke, et al., Making Regulations Fair: How Cost-Benefit Analysis Can Promote Equity and Advance Environmental Justice (August 2021)

2. Institute for Policy Integrity, Comments to U.S. Department of Energy on Clean Hydrogen Production Standard (Nov. 4, 2022)

Attachment 1: Making Regulations Fair

Making Regulations Fair

How Cost-Benefit Analysis Can Promote Equity and Advance Environmental Justice

Institute *for* Policy Integrity

NEW YORK UNIVERSITY SCHOOL OF LAW

August 2021

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Attachment 1: Making Regulations Fair

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This report does not necessarily reflect the views of NYU School of Law, if any.

Executive Summary

Since taking office earlier this year, the Biden administration has made "[a]ffirmatively advancing equity" a centerpiece of its policy agenda.[1] As President Biden has recognized, however, the agencies that administer federal regulatory programs currently lack the toolkit necessary to consistently and robustly assess the distributional impacts of their actions.[2] Without understanding how the costs and benefits of different regulatory options are distributed among subpopulations of particular interest, agencies cannot reliably ensure that their programs do not "perpetuate systemic barriers to opportunities and benefits for people of color and other underserved groups."[3]

Accordingly, in his Presidential Memorandum titled *Modernizing Regulatory Review*, President Biden called on the Office of Management and Budget ("OMB") to "propose procedures that take into account the distributional consequences of regulations, including as part of any quantitative or qualitative analysis of the costs and benefits of regulations, to ensure that regulatory initiatives appropriately benefit and do not inappropriately burden disadvantaged, vulnerable, or marginalized communities."[4]

Offering agencies "concrete suggestions" on how to assess distributional impacts and how to use those assessments in decisionmaking will be key to ensuring that the Biden administration's equity initiatives yield meaningful and long-lasting reform.[5] Prior presidential administrations instructed agencies to incorporate distributional concerns into regulatory cost-benefit analyses. But agencies received practically no guidance on *how* to do this, even though they have long had detailed instructions for approaching other aspects of cost-benefit analysis. Absent standardized, cross-agency benchmarks for assessing the quality of agencies' distributional analyses, questions of equity have received little formal attention from the White House Office of Information and Regulatory Affairs ("OIRA"), the office within OMB that is responsible for reviewing all significant agency regulations prior to proposal and finalization. As a result, cost-benefit assessments for major rulemakings typically focus on aggregate cost and benefit estimates, with little analysis—quantitative or otherwise—of how those costs and benefits are distributed.

This report makes four recommendations to OMB regarding the establishment of standardized procedures for conducting and acting on distributional analyses.

First, OMB should advise agencies to assess regulatory impacts on a more granular scale when practicable. With regard to environmental impacts, for example, OMB should promote the use of detailed spatial modeling to assess how different zip codes and census blocks are affected by changes in pollution, accounting for baseline exposure levels along with existing vulnerabilities and risk factors. This more granular approach will both facilitate more accurate assessments of a rule's total mortality and morbidity impacts *and* provide an informational foundation for distributional analysis.

Second, OMB should provide comprehensive guidance to agencies on how to disaggregate their total cost and benefit estimates to illuminate whether any economic or demographic group can be expected to disproportionately bear the regulatory burdens or receive the regulatory benefits. Such guidance should, among other things, standardize the groups upon which agencies' analyses should focus, as this will enable comparison and aggregation of distributional impacts across rulemakings and agencies. We note that the Biden administration has not yet defined "disadvantaged,

vulnerable, or marginalized communities,"[6] and this report does not purport to identify which groups should be the focus of distributional analysis. However, we recommend that the administration undertake a robust stakeholder process to identify which groups merit particular consideration and what level of analytic granularity is needed to fully assess the impacts of federal action on those groups.

Third, OMB should provide more prescriptive guidance to agencies on incorporating the findings of their distributional analyses into decisionmaking. Currently, agencies are provided minimal guidance on how to weigh distributional effects against other regulatory impacts. Accordingly, agencies exhibit little consistency in their consideration of distributional impacts and frequently default to affording them little or no decisional weight. While precise recommendations on how agencies should balance distributional impacts are beyond the scope of this report, we survey the academic literature and identify approaches that OMB could consider.

Finally, we note that not all regulatory imbalances can or should be addressed on a rule-by-rule basis. The significance of some disparities may become clear only when viewed cumulatively across multiple rulemakings. And even where the distributional analysis of an individual rule reveals a significant disparity, changing the design of the rule may not always be possible or the most effective way to address that disparity; instead, compensatory action elsewhere in the executive branch may be warranted. Thus, our fourth recommendation is for OMB to develop coordinated, interagency strategies for identifying groups that are disproportionately burdened across the regulatory system and compensating those communities using agencies' regulatory and spending authorities. Regular reports from OMB on disparate impacts could help facilitate this process.

Attachment 1: Making Regulations Fair

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Background: The Limits of Existing Guidance and Precedent

While executive orders and guidance documents have, for decades, advised agencies to consider equity and fairness when promulgating regulations and setting policy, agencies have not consistently incorporated distributional analysis into their regulatory cost-benefit analyses. This section explores that contrast at a high level, largely faulting the lack of detailed guidance focused on the assessment of distributional impacts or the consideration of those impacts when weighing regulatory alternatives.

This section first provides an overview of executive precedents on distributional analysis, and then discusses the sporadic implementation by agencies.

The Importance of Equity Considerations in Regulation

A common argument against considering distributional consequences in regulatory decisionmaking is that regulations should focus on efficiency (i.e., maximizing aggregate welfare), whereas distributional equity should be left to the tax-and-transfer system.[7] While a full assessment of this argument is outside the scope of this report, the argument elicits several common rejoinders. Most notably, scholars point out that the tax-and-transfer system, while theoretically better suited to address distributional concerns, is not, as a practical matter, designed to compensate regulatory "losers," particularly for non-monetary harms such as health risks.[8] Richard Revesz explores the limitations of the tax-and-transfer system in his 2018 article *Regulation and Distribution*, arguing that "perhaps the most important benefit of environmental, health, and safety regulation is the prevention of premature mortality, and the income tax system is poorly suited to deal with such distributional consequences that are not income-based."[9]

Additionally, because our society values distributional equity—and because distributional baselines and impacts can inform an assessment of aggregate welfare gains and losses—regulatory analyses that omit distributional impacts do not fully capture welfare effects and thus may not accurately measure efficiency.[10] In an early 2021 article, Zachary Liscow argues that the United States tax code achieves only one-ninth of "the redistribution needed to maximize welfare."[11]

A. Legal Framework for Equity Considerations in Regulatory Cost-Benefit Analysis

Distributional concerns have traditionally played a backseat role in regulatory cost-benefit analysis. While relevant executive orders expressly instruct agencies to consider distributional equity, OMB guidance on cost-benefit analysis offers few insights regarding the appropriate form of such an analysis. Additionally, a separate executive order from President Clinton calls on agencies to assess environmental justice impacts, but agencies have rarely integrated that assessment into their broader cost-benefit analysis.

Executive Order 12,866, issued by President Clinton in 1994, requires agencies to conduct cost-benefit analysis for major rulemakings.[12] While a prior executive order issued by President Reagan did call for some assessment of distributional impacts in regulatory analysis,[13] President Clinton's order more explicitly recognized that equity considerations are relevant in regulatory decisionmaking. Specifically, Clinton's order explains that agencies should select regulatory "approaches that maximize net benefits"[14] and explicitly recognizes that "distributive impacts[] and equity" are relevant to assessing net benefits.[15] The order thus unambiguously recognizes that agencies should incorporate equity considerations into their cost-benefit analyses and regulatory decisions. It does not, however, provide agencies with any instructions on how to do so.

In 1996, OMB convened an interagency working group on cost-benefit analysis that resulted in the publication of a best practices guidance document.[16] This document contained just a brief and mostly non-prescriptive section on distributional effects and equity.[17] For instance, the guidance advised agencies to assess important distributional effects "quantitatively to the extent possible, including their magnitude, likelihood, and incidence of effects on particular groups," but offered no further advice to agencies on how to conduct that assessment.[18] On the question of how to incorporate distributional considerations into decisionmaking, the guidance simply advised regulators that "[t]here are no generally accepted principles for determining when one distribution of net benefits is more equitable than another" and thus warned them to "be careful to describe distributional effects without judging their fairness."[19]

Under the George W. Bush administration in 2003, OMB refined and replaced the Clinton-era guidance through the publication of *Circular A-4*, which remains OMB's principal guidance document on cost-benefit analysis. *Circular A-4* recognizes that "removing distributional unfairness" can be a basis for regulation.[20] Like the 1996 guidance, however it offers limited technical instruction on assessing distributional effects. While *Circular A-4* advises agencies to "provide a separate description of distributional effects (i.e., how both benefits and costs are distributed among sub-populations of particular concern) so that decision makers can properly consider them along with the effects on economic efficiency," it does not explain how to conduct such an analysis or what demographic subpopulations to consider.[21] And, while *Circular A-4* echoes the Clinton-era guidance by advising agencies to describe distributional effects "quantitatively to the extent possible," it too lacks further direction on this front.[22]

In 2011, President Obama published Executive Order 13,563, which reaffirms the centrality of cost-benefit analysis in regulatory decisionmaking.[23] While noting the continued applicability of Executive Order 12,866,[24] President Obama's Order puts additional emphasis on agencies' ability to cite distributional concerns as grounds for regulatory action. Specifically, the Order directs that "[w]here appropriate and permitted by law, each agency may consider (and discuss qualitatively) values that are difficult or impossible to quantify, including equity, human dignity, fairness, and distributive impacts."[25] But the Order does not elaborate on how agencies should consider these impacts, nor did the Obama administration publish any related guidance documents to supplement *Circular A-4*'s instructions on this topic.

In addition to these executive orders and guidance documents on cost-benefit analysis, there is a parallel and largely distinct line of authority on environmental justice considerations in agency decisionmaking. Executive Order 12,898, issued by President Clinton in 1994, requires agencies to identify and seek to address adverse environmental and human-health impacts of all federal administrative programs (including regulations) on minority and low-income populations.[26] Guidance documents—issued by the White House Council on Environmental Quality under the Clinton administration[27] and the Interagency Working Group on Environmental Justice under the Obama administration[28]—provide detailed instruction on identifying and assessing a broad range of potential disparate impacts in environmental justice analyses conducted under Executive Order 12,898. But these documents offer sparse direction on how environmental-justice analysis for rulemakings should interact, if at all, with regulatory cost-benefit analysis.

The Environmental Protection Agency ("EPA") has released its own guidance documents on considering equity and environmental justice in cost-benefit analysis. The agency's *Guidelines for Preparing Economic Analysis* contains a chapter focused on assessing distributional considerations and incorporating them into a cost-benefit analysis.[29] In 2016, EPA issued a document building off of this chapter that provides the most detailed guidance to date on "methods for analysts to use when assessing potential environmental-justice concerns in national rules."[30] This EPA guidance recommends that analysts "estimate[] health and environmental risks, exposures, outcomes, benefits and other relevant effects disaggregated by income and race/ethnicity" whenever possible.[31] Among other issues, the document addresses key analytical considerations and provides technical guidance on assessing the distribution of both regulatory costs and benefits.[32] Published in the final months of President Obama's second term, however, this guidance was largely ignored during the Trump administration, and its recommendations have not been extended to other agencies.

B. Lack of Routine or Consistent Practice Across Agencies

In the absence of detailed guidance from the White House on distributional analysis, individual agencies have mostly failed to develop a consistent set of best practices for assessing the distributional outcomes of their regulations. Studies show that agencies rarely provide quantitative analysis of distributional considerations and hardly ever cite fairness and environmental justice as a basis for rulemaking.

Lisa Robinson, James Hammitt, and Richard Zeckhauser conducted what is perhaps the most comprehensive evaluation to date of the role of distribution in regulatory impact analysis, analyzing dozens of major regulations promulgated during President Obama's first term.[33] In their study, Robinson et al. find few consistent practices across agencies and across analyses, a lack of quantification of distributional impacts, and a general inattention to equity. For instance, the authors note that agencies "rarely quantify the distribution of health-risk reductions across [demographic] groupings" and "[i]n most cases . . . they simply certify that the regulation . . . does not adversely affect the health of minorities, low-income groups, or children" without detailed analysis.[34] The authors find even less attention to the distribution of compliance costs, with agencies regularly failing to estimate how profits, price changes, or payroll and employment impacts fall on different demographic groups.[35] In sum, the authors conclude, "[n]et tallies of costs and benefits for different groups are simply not available" and thus "it is not possible to estimate the distribution of net benefits" using existing agency analyses.[36] This conclusion largely mirrors the findings of an analysis by Carl F. Cranor and Adam M. Finkel, which concludes that agencies often "anecdotally mention[] the subpopulations and individuals who may bear disproportionate costs or reap disproportionate benefits" without providing quantitative analysis. These scholars note that particularly little attention is paid to assessing whether "the costs of regulations might be distributed either regressively or progressively."[37]

Analyses of Executive Order 12,898's impact similarly find that the Order has neither resulted in robust analyses nor substantially affected policy outcomes. For instance, one study finds that agencies typically either ignore Executive Order 12,9898 or satisfy its demands through "boilerplate rhetoric" that is "devoid of detailed thought or analysis."[38] Another survey concludes that interest in environmental justice has waxed and waned across presidential administrations and that agencies have sometimes passed off environmental-protection measures that they would have taken anyway as "environmental justice."[39] Given the lack of guidance on how to integrate the findings of an environmental-justice analysis with those of a broader cost-benefit analysis, moreover, agency findings under Executive Order 12,898 are typically not integrated into agencies' broader assessments of rules' economic impacts.[40]

There are a handful of cases in which agencies explicitly relied upon distributional equity as a basis for rulemaking. For instance, in 2014 the National Highway Traffic Safety Administration ("NHTSA") relied on equity and justice concerns in promulgating a regulation mandating backup cameras on all new vehicles.[41] Despite acknowledging that the rule's costs exceed its monetized benefits,[42] the agency nonetheless concluded that justice considerations (along with nonmonetized benefits) justified the regulation, highlighting the rule's beneficial outcomes for children, people with disabilities, and the elderly, who collectively are disproportionately the victims of back-over crashes.[43] But NHTSA's analysis, though laudable in many respects, was incomplete in others. In particular, the agency ignored the distribution of regulatory costs and offered a somewhat opaque explanation of how it balanced quantified costs and benefits with equity effects.

There are many other examples of agencies disregarding key distributional impacts. Under the Trump administration, in particular, agencies routinely ignored (or minimally considered) regressive regulatory impacts with limited discussion or quantitative analysis. In one egregious example, the Department of Agriculture finalized a regulation tightening eligibility for the Supplemental Nutrition Assistance Program that, by the agency's estimates, would cause 688,000 individuals to lose their food-assistance benefits.[44] Although the rule would substantially and almost exclusively burden low-income individuals, the Department of Agriculture provided just a short section on distributional impacts that briefly estimated the racial breakdown of disenrollees without acknowledging the rule's regressive economic effect.[45] Moreover, these important distributional concerns did not appear to factor into the agency's determination.[46]

Various scholars have argued that disregarding distributional impacts in cost-benefit analyses has led agencies to fail to remediate—and sometimes even exacerbate—existing inequalities. In their article *Pricing the Priceless*, for instance, Frank Ackerman and Lisa Heinzerling claim that agency cost-benefit analysis "has the effect of reinforcing[] patterns of economic and social inequality."[47] Building upon this critique, Melissa J. Luttrell and Jorge Roman-Romero argue that agency use of cost-benefit analysis frequently "maintains and worsens . . . racially inequitable disparities . . . by ignoring—or dramatically undervaluing—equity concerns, even when the statute at issue is meant to reduce disparities."[48] And other scholars and advocates have observed that the use of cost-benefit analysis in federal spending and grant programs can lead to money being inequitably directed to wealthier communities.[49]

In short, agency cost-benefit analyses rarely integrate distributional impacts in a meaningful fashion, and agencies have not developed consistent practices for considering equity as part of regulatory decisionmaking.

C. Signals of a New Approach

After vowing as a candidate to focus on environmental justice and racial equity,[50] President Biden began a process hours after his inauguration to reform regulatory review with the hopes of better incorporating distributional impacts.

In a Presidential Memorandum signed the afternoon of his inauguration titled *Modernizing Regulatory Review*, President Biden tapped OMB to lead an interagency process to identify "concrete suggestions on how the regulatory review process can promote public health and safety, economic growth, social welfare, racial justice, environmental stewardship, human dignity, equity, and the interests of future generations."[51] Among other directives, the Memorandum instructs OMB to develop practices to better "account [for] the distributional consequences of regulations" and "ensure that regulatory initiatives appropriately benefit and do not inappropriately burden disadvantaged, vulnerable, or marginalized communities."[52]

Also on the first day of his term, President Biden signed Executive Order 13,985, *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*.[53] The Order identifies how "[e]ntrenched disparities [have] denied . . . equal opportunity to individuals and communities," including those disparities created by public policy.[54] Accordingly, the Order calls on the federal government to "pursue a comprehensive approach to advancing equity for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality."[55] Among other things, the Order tasks OMB with "assessing whether agency policies and actions create or exacerbate barriers to full and equal participation by all eligible individuals," assisting agencies in "assess[ing] whether underserved communities and their members face systemic barriers in accessing benefits and opportunities available pursuant to [federal] policies and programs," and "identify[ing] opportunities to promote equity in the budget that the President submits to the Congress."[56]

This Order also instructs the White House Domestic Policy Council to "coordinate efforts to embed equity principles, policies, and approaches across the Federal Government," including by "identify[ing] communities the Federal Government has underserved, and develop[ing] policies designed to advance equity for those communities."[57] In addition, the Order establishes an Equitable Data Working Group, which includes an OMB designee among its membership and which is tasked with reviewing existing data collection practices and providing recommendations for "expand[ing] and refin[ing] the data available to the Federal Government to measure equity."[58]

A week after signing Executive Order 13,985, President Biden issued a separate, sweeping executive order calling for widespread action to combat climate change.[59] Most relevant for this report, Executive Order 14,008 reaffirms "that environmental and economic justice are key considerations" for agencies and creates a White House Environmental Justice Advisory Council to identify avenues to "increase the Federal Government's efforts to address current and historic environmental injustice, including recommendations for updating Executive Order 12898."[60] It also calls on the Council on Environmental Quality to "create a geospatial Climate and Economic Justice Screening Tool and . . . annually publish interactive maps highlighting disadvantaged communities,"[61] which will facilitate agencies' abilities to use appropriately granular data. In May 2021, three working groups of the White House Environmental Justice Advisory Council,[62] released initial recommendations for the new tool, including that it should "be integrated and/or supplemented with local community knowledge," "be continually updated and improved as new data becomes available," and "be leveraged to track progress on [environmental justice] goals."[63]

Other relevant agencies and councils have also begun their work to implement President Biden's executive orders. In late March, the Environmental Justice Advisory Council held its first public meeting, at which members signaled a broad openness to numerous reforms to emphasize environmental justice in federal policymaking. And in early May, OMB put out a request for information seeking to identify "effective methods for assessing whether agency policies and actions . . . equitably serve all eligible individuals and communities, particularly those that are currently and historically underserved."[64] Among other queries, the request seeks guidance on "new approaches" that agencies could take to "conduct effective equity assessments" of proposed policies or regulations.[65]

RECOMMENDATION 1:

OMB Should Instruct Agencies to Assess Regulatory Impacts at a Granular Scale, Taking into Account Community Demographics and Existing Risk Factors

A critical first step in addressing the distributional impacts of regulation is to identify which groups and communities are affected by a rule and to what degree. Measuring impacts at aggregate scales can hinder this objective, as group averages often mask disparate effects across communities and fail to accurately capture total regulatory impacts. Thus, in order to improve quantification of total regulatory impacts and enable better identification and analysis of disproportionate effects, regulators should measure effects as granularly as possible, considering different levels of exposure and risk factors of affected communities. These granular measurements could lay the foundation for regulatory analyses that better account for distributional impacts, as discussed in the next section of this report. As noted earlier, this report does not attempt to identify which subpopulations should be examined in a distributional analysis. That list should be the product of a robust stakeholder engagement process. Relevant subpopulations would likely include, however, at least some of those demographic groups identified in Executive Order 13,985.[66]

This section explains how granular measurements could unmask disparities in the intensity of regulatory impacts, account for different risk factors of affected groups, and generate more accurate analyses of both regulatory benefits and costs. The examples in this section are drawn from air-quality regulations, where impacts are heavily determined by geographical space, and hence geographically granular measurements are required to best assess regulatory effects. However, the advantages of granular analyses in the measurement of distributional outcomes extend beyond air or even environmental regulation. Indeed, they apply to any policy whose disproportionate effects on vulnerable individuals or communities are masked by population averages. The Equitable Data Working Group—established under Executive Order 13,985 to disaggregate federal data sets by "race, ethnicity, gender, disability, income, veteran status, or other key demographic variables"—is already collecting much of the data that could be useful for such analyses,[67] and OMB should recommend that agencies make use of this data (and other available disaggregated data) whenever possible.

A. Geographically Granular Analyses Are Key to Unveiling Environmental Injustices

Recent research in public health and economics that applies novel modeling techniques and disaggregated demographic data highlights how a granular analysis of impacts might better reveal environmental injustices in ways that a coarser analysis cannot. For instance, a team of researchers led by Andrew L. Goodkind measure $PM_{2.5}$-related health damages at a fine geographical scale (down to one kilometer).[68] They find that a large share of damages[69] is borne by populations living very close to emission sources: a third of total damages happen within five miles of the source of pollution. As a result, health damages associated with one more unit of emissions can vary by an order of magnitude within a single county. Likewise, Janet Currie, Lucas Davis, Michael Greenstone, and Reed Walker find that toxic emissions from industrial plants cause low infant birthweight only in narrow areas surrounding a plant.[70] In those cases, a county aggregate—

let alone a state or national estimate—would obscure the disproportionate effects of those populations more directly affected by pollution. And, depending on the number and demographics of the individuals living within the proximate range of the relevant plants, larger aggregates could significantly under- or over-estimate the total regulatory effect.

More granular analysis could also be used to better assess the scope and distribution of more distant pollution harms. This is particularly important in the case of diffuse pollutants, such as fine particulate matter or arsenic contamination of drinking water, whose adverse effects can propagate through narrow paths across large spatial areas.[71] Hence, Goodkind et al., in their fine-scale analysis of $PM_{2.5}$ pollution damages, find that a sizable share of pollution harm is borne by populations living more than 150 miles from a pollution source.[72] Recent research also shows that 99% of coal plant emissions leave the counties from which they are emitted after only six hours.[73] These findings reveal that limiting the exploration of environmental injustices to nearby, "frontline" communities—even in cases of pollutants that are often considered "local," such as primary particulate matter—might be overly simplistic in certain cases. In actuality, pollution can affect distant narrow areas (as determined by wind patterns and atmospheric conditions, or water bodies). Granular analysis of pollution impacts, unlike aggregate county- or state-level analyses, allows for identification of geographic communities near and far from pollution sources that stand to suffer disproportionate harms.

To best assess impacts at a granular scale, agencies should exhibit a preference for census block data as opposed to larger geographic units such as census tracts. Choosing a larger geographic unit of analysis could result in a disadvantaged community being outnumbered by a surrounding population, masking its presence in the analysis. EPA has long cautioned against this potential outcome, pointing out that "pockets of minority or low-income communities, including those that may be experiencing disproportionately high and adverse effects, may be missed in a traditional census tract-based analysis."[74]

B. Granular Analyses Should Incorporate Varying Levels of Vulnerability

Besides identifying different levels of exposure, granular measurements would also enable better integration of the risk factors associated with affected communities (and subpopulations within those communities), allowing analysts to better translate pollution levels into public-health impacts. Populations with different socioeconomic characteristics can differ in their vulnerability to changes induced by regulation, as an additional unit of pollution more severely affects a more vulnerable population than a less vulnerable one.[75] As a result, granular analysis is critical not only to identifying the affected communities, but ultimately to accurately estimating the public-health impacts of the regulation that are influenced by the profile of the communities affected. Due to differing levels of vulnerability, a regulation could result in disproportionate effects even if all communities are equally exposed to the same levels of pollution (although such uniform exposure rarely occurs).[76]

Granular-level analysis that considers socioeconomic risk factors could reveal regulatory impacts that a county- or region-wide analysis would likely miss. To provide just one example, a study by Tatyana Deryugina and a team of researchers finds that more vulnerable elderly populations (e.g., those more frequently suffering chronic health conditions) are more susceptible to pollution increases than other elderly communities, yet they tend to live in areas with *lower* average pollution levels.[77] Hence, reducing pollution in highly polluted areas may not always maximize public-health gains, as community demographic risk factors are equally important to the assessment. Because vulnerable populations tend to be concentrated in particular, sub-county geographic areas, regulatory impacts estimated at the county level would fail to capture the disparate vulnerability levels of different communities and thus would not fully capture public-health impacts.

Considering local-level demographic risk factors would improve our understanding of both the aggregate and distributional impacts of many regulations. For instance, the average dose-response function between particulate matter concentration and mortality identified in a 2009 study of the American Cancer Society is widely used in the quantification of costs related to pollution exposure,[78] including by EPA's Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool.[79] However, that same study also shows that mortality risk from pollution exposure is negatively correlated with educational attainment: for instance, lung-cancer mortality risk associated with a change of 10 $\mu g/m^3$ $PM_{2.5}$ concentration is approximately 20% higher for those without post-secondary education. The use of disaggregated risk estimates would thus enable a more accurate estimate of pollution mortality and morbidity.[80] By doing so, it could reveal both efficiency and distributional impacts that might be overlooked when using average population risks.

C. Regulatory Costs Should Also Be Measured Granularly

To more fully assess distributional impacts, regulators should seek to granularly estimate costs as well as benefits.[81] Even environmental regulations that bring health-related benefits to some affected communities could impose disproportionate costs on these same communities if, for instance, they are dependent on the pollution sources for jobs or would face higher prices for common consumer goods. These costs might offset health-related benefits in some cases.[82] Hence, regulatory analysis should seek to assess both benefits and costs on a granular scale.

Assessing who bears regulatory costs due to changing energy prices or wages at a granular scale could be more challenging than granularly evaluating health-related impacts. As described above, health impacts could be estimated using readily available air-transport models[83] and census demographic data. However, the distribution of regulatory costs would

usually depend on responses by firms and customers that are more complex to model (e.g., Would a firm pass costs incurred from a pollution-reducing policy to customers? Or would it rather decrease wages? How would customers/employees react to those changes?). For instance, regulations that cause a price increase in inferior goods (i.e., those for which demand decreases as consumer income rises) will tend to disproportionately burden low-income individuals and groups, whereas regulations that cause a price increase in normal goods (i.e., those for which demand increases as consumer income rises) will more heavily burden high-income individuals and groups.

Recent research has made advances in modeling these interactions. For instance, Dallas Burtraw, Maya Domeshek, and Amelia Keyes analyze how energy expenditures and income sources might change for populations with different income levels as a result of setting a federal carbon tax, showing that the details of implementation determine whether the policy is progressive or regressive.[84] When similar analytical models are not readily available, Lisa Robinson and her co-authors suggest performing a "bounding analysis" that assumes that costs are passed on "as changes in prices, wages, and/or returns to capital in both the short and long runs."[85] Comparing these different scenarios using disaggregated data on product purchases, wages by occupation, etc. would shed light on the potential distributional consequences of a policy, and consequently, allow a granular estimation of net benefits even when analysts are more data- or resource-constrained.

Case Study: Geographically granular analyses and environmental justice at EPA

EPA has long recognized the need to evaluate impacts at granular and disaggregated levels in order to address environmental justice, even if this recognition has not always been translated into policymaking. As early as 1995, and in response to Executive Order 12,898, EPA announced its goal that "no segment of the population, regardless of race, color, national origin, or income, as a result of EPA's policies, programs, and activities, suffers disproportionately from adverse human health or environmental effects."[86] However, in the decades following this statement, EPA's regulatory analyses were not typically carried out with a level of granularity to identify disproportionate impacts on different segments of the population. Indeed, most EPA analyses have incorporated environmental justice concerns only with "perfunctory, pro forma assertions," mostly stating that "a plan of environmental justice compliance was not needed because there would be no adverse impact."[87]

More recently, EPA has highlighted the importance of granular regulatory analysis in its detailed technical guidance issued during the last months of the Obama administration.[88] This guidance has the stated objective of assisting EPA's analysts in ensuring that "potential [environmental justice] concerns are appropriately considered and addressed in the development of regulatory actions."[89] Though it stresses that any analysis will be limited by the data available, the guidance highlights that a best practice is to "disaggregate data to reveal important spatial differences (e.g., demographic information for each facility/place) when feasible and appropriate."[90] In the case of air regulations, the guidance emphasizes that "finer-scale air quality, health, and socioeconomic data allow one to assess the distribution of air pollution impacts across key population groups of concern and to have greater confidence in the conclusions drawn from these data."[91] As noted in this section, such a granular analysis of pollution impacts should be feasible in most contexts using readily-available air transport models and census demographic data.

RECOMMENDATION 2:

OMB Should Provide Agencies with Detailed Guidance on Assessing the Distribution of a Proposed Regulation's Costs and Benefits Among Demographic Subgroups

Equipped with granular measurements of regulatory costs and benefits that consider different impact intensities and risk factors across subpopulations, a regulator could tally how those costs and benefits are distributed among discrete demographic groups. OMB should encourage agencies to provide such demographically disaggregated totals—in addition to aggregate calculations of costs and benefits—whenever possible. OMB should also publish guidance on conducting such an assessment, including a list of subpopulations to consider.

A. Disaggregated Totals Enable Agencies to More Rigorously Assess Disproportionate Impacts

As detailed in the Background section, executive orders and guidance on cost-benefit analysis have long called for agencies to quantify the distributional impacts of regulations, but these documents offer little direction on the form or contents of such an analysis.[92] To promote better and more consistent distributional analysis, OMB could provide more prescriptive and detailed guidance on this front. In particular, OMB could instruct agencies to provide disaggregated cost and benefit estimates, in addition to the population-wide estimates that agencies normally provide, that evaluate how both positive and adverse regulatory impacts are distributed across specified subpopulations.

Such analysis would enable regulators to assess not only how costs and benefits are dispersed among different subpopulations, but also whether the rule is more or less net-beneficial for those groups than it is for the remainder of the population. This would help regulators understand the magnitude of distributional consequences (including the distribution of benefits, costs, and net benefits) and potentially dispel false assumptions about their magnitude.[93] And by consistently disaggregating monetized cost-benefit totals along the same demographic lines, where possible, agencies (and OMB) could also assess whether subpopulations of particular concern are benefitted across the regulatory system, and consider whether disparate impacts of particular rules are offset or compounded by the effects of other rules. Such findings could be reported on a regular basis (e.g., yearly) as part of a suite of information that informs future actions.

Like good cost-benefit analysis itself, moreover, disaggregated estimates could also improve agency decisionmaking by "better inform[ing]" the public and decisionmakers on the regulation's distributional impacts and thereby "reduc[ing] interest group power over" the rulemaking process.[94] According to former OIRA administrator John Graham, advocates for low-income groups are underrepresented among lobbyists,[95] and so adding a "distributional test" to cost-benefit analysis would help ensure that "regulators . . . seriously consider the impact" of regulations on marginalized groups.[96] Clear, disaggregated data would also help engage stakeholders in the regulatory review process on distributional issues and facilitate dialogue between the public and the regulating agency on distributional impacts.

B. OMB Can Facilitate Consistent Disaggregated Analysis by Providing Guidance on Methodology and Approach

Despite not being widely implemented in regulatory analysis, the notion of disaggregating regulatory impacts along demographic lines is well-established in the academic literature.[97] But disaggregation can be very challenging. Without further guidance and standardization, agencies may continue struggling to assess distributional considerations in a rigorous and consistent fashion.

OMB should thus prepare guidance on methodologies for assessing distributional impacts. Such guidance should recommend methodologies for disaggregating and monetizing benefits, as well as methodologies for disaggregating and monetizing costs, and provide guidelines on the demographic subpopulations that agency analyses should consider. This section discusses those different elements, in that order.

For disaggregating benefits, EPA's 2016 technical guidance on incorporating environmental justice into cost-benefit analysis offers a useful starting point. In particular, that document provides detailed advice for analysts on disaggregating health impacts along geographic, and ultimately demographic, lines using mapping and data on exposure and baseline vulnerability.[98] As detailed in Recommendation 1, *supra*, regular usage of these state-of-the-art tools would enable agencies to better estimate both the scale and distribution of environmental benefits. As noted above, the Council on Environmental Quality is launching a new interactive mapping tool that would support the collection and consolidation of disaggregated data. Although OMB should broaden its guidance beyond environmental regulations, the core approach in EPA's guidance—incorporating scientific and demographic data to measure benefits at a granular scale—can be generalized and supplemented to facilitate disaggregated estimates of all benefits, both environmental and non-environmental.

As an example of using granular data to calculate benefits and costs on demographic subpopulations, Ronald J. Shadbegian, Wayne Gray, and Cynthia Morgan performed such an analysis in a paper looking at the impacts of EPA's sulfur dioxide trading program on various demographic subpopulations.[99] In their analysis, the authors began by looking at the distribution of sulfur-dioxide emission reductions by geographic area. They then looked at the demographic makeup of each geographic area to transpose geographic impacts into demographic effects. Specifically, the analysts assessed the rule's benefits and costs on five different demographic subpopulations based on race (Black and Hispanic), income (those below the poverty level), and age (children under 6 and the adults over 65).[100] While this analysis is from 2005 and does not make full use of high-resolution granularity now available, a more granular analysis would enable even more reliable translation of localized impacts into demographic assessments. In a 2014 assessment, for instance, a group of researchers from Resources for the Future performed a disaggregated cost-benefit analysis of several "smart growth" policies, analyzing their costs and benefits for numerous demographic subpopulations.[101]

As part of its guidance on disaggregating benefit estimates, OMB should provide particular guidance on how agencies should monetize health and welfare impacts that have been disaggregated along demographic lines. While some scholars have suggested using different willingness-to-pay values particular to each subpopulation,[102] one's willingness to pay is bounded by wealth and income and therefore does not fully reflect the value that one ascribes to a particular benefit. Especially if regulators assess benefits disaggregated by income groups, the use of particularized in-group willingness-to-pay values will thus undervalue benefits received by low-income groups and produce a skewed picture of regulatory impacts. Accordingly, the most defensible approach is to use the same monetized values for health and welfare benefits across all demographic groups.[103]

In addition to its normative advantages, using a constant value is also consistent with existing regulatory precedent, which could bolster its legal justification. For instance, EPA applies a constant value of a statistical life for all individuals, despite some empirical evidence suggesting that younger and healthier individuals may place a higher value on the avoidance of small mortality risks[104] (and the fact that ability to pay is higher among wealthier individuals[105]). And in the United Kingdom, cost-benefit analyses from the Department of Health apply demographic disaggregation while also using constant monetary valuations of health benefits across demographic groups.[106] OMB should provide clear guidance on the use of constant monetized values across demographic subpopulations to ensure consistent practices between agencies.

In addition to benefits, OMB should provide guidance on disaggregating regulatory *costs* along demographic lines, as "the distribution of health or environment effects alone," without disaggregated cost estimates, "might convey an incomplete—and potentially biased—picture of the overall burden faced by population groups of concern."[107] As detailed in Recommendation 1, frequently "data or methods may not exist for [a] full examination of the distributional implications of costs across population groups of concern."[108] Nonetheless, as noted therein, the distribution of costs could be assessed based on data such as the pass-through of compliance costs to consumers and the demographic makeup of the relevant consumer base and labor force.[109] Such cost data, to the extent available, could be disaggregated to estimate the breakdown of regulatory costs along different population subgroups. OMB could facilitate such analysis across the regulatory state by expanding on EPA's guidance to encompass cost considerations outside the environmental sphere.

OMB should also identify a manageable list of subpopulations for agencies' analyses to consider. Executive Order 12,898 targets the dimensions of income and race, with its focus on "minority populations and low-income populations."[110] Executive Order 13,985 lists a number of specific groups that have been historically underserved.[111] Other demographic characteristics such as age or health status may also be relevant, as illustrated by NHTSA's 2014 regulation involving backup cameras.[112] While all of these dimensions are important and merit consideration, disaggregating costs and benefits along demographic lines is challenging and time-consuming, and there is a risk that agencies may delay important regulations—or simply eschew recommended procedures for distributional analysis—if asked to perform quantitative analysis along numerous dimensions.

In providing guidance on the groups on which agency analyses should focus, OMB may wish to consider such factors as the prominence of different demographic indicators in concerns about distribution and equity, the availability of data, and the compatibility of different metrics with quantitative decisionmaking tools. Distributional breakdowns by income group fare especially well on the last criteria, as there is voluminous research translating income gains or losses into utility effects.[113] While disaggregated data based on race could also be highly informative regarding a regulation's racial or environmental justice impacts, agencies should exercise caution about factoring that data into regulatory decisionmaking since it could also implicate thorny constitutional issues.[114] As noted above, the federal government should engage stakeholders in identifying which groups to consider. Recommendations on which groups to choose are outside the scope of this report.

Whatever OMB recommends, it may wish to preserve flexibility for agencies to additionally consider a wide range of potential distributional considerations, either quantitatively or qualitatively, on a case-by-case basis (on top of the default analysis that OMB recommends). Important effects on particular communities—based on age or health status, for example[115]—could be considered in individual rulemakings even if it may not be feasible for agencies to quantitatively assess costs and benefits for that subpopulation in every rule.

RECOMMENDATION 3:

In Addition to Providing Guidance on How to Conduct Distributional Analysis, OMB Should Offer Suggestions for Incorporating the Results of Such Analysis into Regulatory Decisionmaking

Even if agencies gather detailed data on how costs and benefits are distributed among discrete demographic groups as described above, current authorities offer little guidance on what they should do with that data. For instance, *Circular A-4* instructs agencies to perform a distributional analysis but then says nothing about how to incorporate that analysis into the ultimate decision of which regulatory alternative to select. In other words, agencies have no guidance on how to weigh the desirability of a potential rule's distributional effects against other attributes of that rule, such as its total net benefits.

This section discusses three possible approaches to factoring distributional consequences into regulatory decisionmaking:

1. Qualitatively assessing the desirability of distributional outcomes from a disaggregated cost-benefit analysis.
2. Using quantitative tools that enable regulators to assess the desirability of distributional outcomes.
3. Using weighted cost-benefit analysis that directly incorporates distributional outcomes into aggregated cost and benefit totals.

The first option is premised on the status quo, where OMB grants agencies broad discretion to determine whether and how distributional desirability should affect their decisions.

The second is to recommend standardized metrics for scoring policies' distributional outcomes, which agencies could use to supplement a traditional cost-benefit analysis.[116] These approaches include inequality metrics and social welfare functions that enable agencies to "score," or assess the desirability of, different distributional outcomes. While this approach leaves agencies discretion as to how to use those scores when selecting among regulatory options, OMB could recommend that agencies treat these scores similarly to other nonmonetized effects.

The third option is to fully integrate distributional effects into the bottom line of a cost-benefit analysis by using distributional weights that reflect the diminishing marginal utility of income (recognizing that a dollar is worth more to a poor person than a rich one) or the diminishing marginal utility of well-being more broadly understood,[117] based on a utilitarian social welfare function. Alternately, OMB could recommend that agencies use weights that reflect an ethical choice to prioritize net benefits for worst-off individuals or groups, based on a prioritarian social welfare function. Rather than supplementing a traditional cost-benefit analysis, these metrics would effectively replace that traditional analysis.

OMB should use a consultative process to determine which of these approaches, if any, best meets the goals of stakeholders. Public input should also inform how the results of distributional analyses—and the data underlying those analyses—are presented, as not only agencies, but also community groups and other organizations may benefit from access. Whichever approach it chooses, we urge OMB to provide agencies with step-by-step guidance on how to implement that approach and assess—whether quantitatively or not—the magnitude or significance of distributional consequences relative to a proposed action's other effects (including aggregate monetized costs and benefits). We note that any approach to distributional analysis, including the status quo approach, requires a regulator to make explicit value judgments.[118] Transparency regarding such judgments is key to ensuring consistent and robust distributional analysis.

A. OMB Could Recommend that Agencies Qualitatively Assess the Results of a Disaggregated Cost-Benefit Analysis

Regulators could treat the findings of a disaggregated cost-benefit analysis the way they would treat a nonmonetized cost or benefit. Under this approach, an agency could use its discretion when evaluating the significance of a proposal's distributional effects and incorporating that evaluation into its regulatory decision. While this qualitative assessment resembles how agencies currently treat distributional impacts, agencies would now have quantitative support for their decisions from their disaggregated cost-benefit totals.

This would not be such a departure from current practice, as agencies are already making judgments like this when faced with important but nonmonetized risk reduction or health effects. Indeed, rules have been justified on the significance of their unquantified benefits in the past. For example, EPA promulgated a rule in 2015 on phosphoric acid manufacturing and phosphate fertilizer production despite finding that rule to be net-costly based on monetized impacts alone.[119] Though the agency relied on the nonmonetized benefits of mercury emissions reductions, EPA concluded that the rule was net-beneficial on the whole and therefore justified. Specifically, EPA explained that the rule "will mitigate future

[mercury] emissions … by requiring compliance with numeric emission limits,"[120] thereby "result[ing] in improvements in air quality and reduced negative health effects associated with exposure to air pollution of these emissions."[121] However, EPA did not monetize the benefits of reducing mercury emissions because it lacked adequate data to do so.[122] Similarly, the Bureau of Land Management justified its 2015 hydraulic fracturing rule despite an absence of monetized benefits by concluding that not being able to put a number on the risk reduction associated with the rule "does not mean that the rule is without benefits."[123]

Circular A-4 also broadly endorses the consideration of nonmonetized benefits (and costs), explaining that "[w]hen there are important non-monetary values at stake," a regulator should "also identify them in [the] analysis so policymakers can compare them with the monetary benefits and costs."[124] Accordingly, regulators should "exercise professional judgment in determining how important the non-quantified benefits or costs may be in the context of the overall analysis."[125]

Agencies could treat the findings of their distributional analysis in the same manner. For instance, if a proposal has desirable enough distributional effects, those effects could allow a regulator to justify choosing this option even if it has lower net benefits than the other alternatives examined. Similarly, an agency could choose not to pursue the most net-beneficial option (according to aggregated, traditional cost-benefit estimates) if its distributional outcomes are undesirable. This ranking could be done by looking at the results of a disaggregated cost-benefit analysis and making normative judgments about the desirability of distributional outcomes—much like how regulators often consider other nonmonetized effects.

B. OMB Could Recommend that Agencies Use Quantitative Tools to Evaluate Distributional Outcomes

If a regulator is treating the results of a disaggregated cost-benefit analysis like a nonmonetized effect, it is important that those effects "be categorized or ranked in terms of their importance within the decision-making context."[126] Like with nonmonetized effects, the more underlying data to guide such an analysis, the better.[127] While distributional impacts could be ranked without further quantitative analysis, as discussed above, various quantitative methodologies to assess the results of a disaggregated cost-benefit analysis would greatly aid in the process of assessing and contextualizing different distributional outcomes.

If it pursues this approach, OMB should recommend standardized metrics for assessing distributional outcomes that regulators could then weigh against monetized costs and benefits. These metrics could be inequality metrics that are commonly used in the literature or they could be based on social welfare functions. The decisionmaker could also use this information to determine if some other quantitative analytical tool, like a breakeven analysis, would be useful. In breakeven analysis, if faced with a net-costly rule with nonmonetized benefits, the regulator tries to determine "[h]ow small … the value of the non-quantified benefits [would] be … before the rule would yield zero net benefits."[128]

The following subsections describe several analytical tools that could be used to more easily rank and compare policy proposals based on distributional outcomes or distributional desirability. As noted above, policymakers could treat their findings from these methodologies as they would a nonmonetized effect: the findings could factor into their decision, even to justify choosing a less net-beneficial alternative, but to what extent this information plays a role would be at the policymaker's discretion. In other words, these quantitative metrics could be presented alongside traditional cost-benefit analysis, with the regulator choosing how much weight to give each analysis in the decisionmaking process.

Quantitative Tools for Incorporating Distributional Considerations into Decisionmaking

Tool	Numerical Output	Possible Information[129]
Gini Coefficient	A number between 0 and 1. A higher value denotes greater inequality.	A ratio representing the projected distribution of an impact (e.g., cost or benefit) in a given policy scenario compared to an equal distribution of said impact.
Atkinson Index	A number between 0 and 1. A higher value denotes greater inequality.	A ratio representing the projected distribution of an impact in a given policy scenario compared to an equal distribution of said impact, reflecting societal preferences about inequality. The greater the societal aversion to inequality, the more sensitive the ratio is to unequal distribution of outcomes.
Theil Index	A number between 0 and infinity. A higher number denotes greater inequality.	A number representing how far the projected distribution of an impacts from a scenario where said impact is distributed equally.
Utilitarian Weighted Cost-Benefit Analysis	A dollar value for net benefits.	Aggregate costs and benefits of a rule if willingness to pay for a specific impact of the rule is weighted to reflect the diminishing marginal utility of income.
Prioritarian Weighted Cost-Benefit Analysis	A dollar value for net benefits.	Aggregate costs and benefits of a rule if willingness to pay for a specific impact of the rule is weighted so that improvements to the worst off are prioritized above other welfare impacts.

1. Inequality metrics

One option is for regulators to assess policy outcomes using inequality metrics. Inequality metrics take a range of inputs, like individual-, household-, or group-level characteristics (e.g., income, health status, or exposure to a particular pollutant), apply a formula that reflects certain assumptions about the regulator's priorities, and produce values that represent the level of inequality in a given scenario. Inequality metrics can be used to compare the status quo with the distributional outcomes of a specific policy scenario or to compare distributional outcomes across alternatives. The values produced by these metrics could allow regulators to rank different policy options based on distributional effects, enabling them to evaluate distributional outcomes alongside cost-benefit analysis to aid in decisionmaking process. Using these metrics requires a regulator to have already assessed the impacts of a rule on certain groups, so gathering and sorting the data by subpopulations of interest per Recommendation 1 and Recommendation 2 of this report are prerequisites for implementing inequality metrics.

Below are some examples of inequality metrics that OMB could suggest that agencies use. The Gini coefficient and Atkinson index have been used by researchers to measure health inequality and also "to evaluate changes in inequality resulting from environmental policy measures."[130] The Theil index is also widely used by researchers in the health context[131] and has been used to measure racial segregation.[132] The United States Census Bureau uses all three to assess income inequality.[133]

a. Gini Coefficient

The Gini coefficient was originally designed to measure inequality in distribution of income.[134] In the income context, the Gini coefficient takes the area between a given Lorenz curve, which shows income distribution, and an ideal Lorenz curve where income distribution is equal, and expresses that area as a proportion of the total area under the given Lorenz

curve.[135] Gini himself proposed that the metric measured "the variability of any statistic distribution or probability distribution."[136] The result is a number between zero and one, "with higher values denoting greater inequality."[137]

The Gini coefficient can be deployed in other contexts by substituting other characteristics, like exposure to pollutants, for income. Thus, the Gini coefficient could be used to compare the effects of a proposed regulation with the status quo or the effects of a preferred regulatory alternative with other policy options.[138] If the Gini coefficient is near one for a proposed action but near 0.5 for a possible alternative, for instance, the regulator would know that the proposal would result in a more unequal outcome than the alternative.

b. Atkinson Index

The Atkinson index was also originally designed to measure inequality in the distribution of income. In the income context, the Atkinson index "is derived by calculating the equity-sensitive average income," which is "the level of per capita income which, if uniformly possessed, would make total welfare exactly equal to the total welfare generated by the actual income distribution."[139] The Atkinson index takes the status of an individual and the number of individuals in the population, and applies an inequality-aversion parameter.[140] The Atkinson index "explicitly incorporate[s] normative judgments about social welfare" by applying an aversion-to-inequality factor that is chosen by the analyst or regulator.[141] The inequality-aversion parameter reflects "societal preferences for equality."[142] Like the Gini coefficient, the Atkinson index could be used to compare the distributional effects of a regulatory proposal with those of the status quo or other regulatory alternatives.

c. Theil Index

The Theil index effectively measures how far away the population in a given scenario is from a state of equality.[143] The output is a number between zero and infinity, with higher numbers representing greater levels of inequality.[144] For example, a regulatory option with a Theil index of 5 would have a more equal distribution of impacts than one with a Theil index of 50. Some experts recommend that the Theil index only be used with other inequality metrics because certain aspects of its calculation lack intuitive appeal.[145]

Two research teams—one led by Jonathan Levy,[146] the other by Sam Harper[147]—provide useful overviews of these and other inequality metrics, which OMB may wish to consider. Levy et al. include a stylized example of how these three inequality metrics can be used in the context of an air pollution control policy.[148]

Inequality Metrics in the Literature

There are various notable papers that explore how to use inequality metrics for health and environmental justice considerations. Although this report does not endorse any particular metric (or the use of inequality metrics in general), this discussion highlights the rigor of these approaches and their prevalence in the literature.

In one paper, a team of researchers led by Sam Harper considers explicitly applying inequality metrics to regulatory decisionmaking.[149] The authors discuss twenty indicators of health inequality, including "quantification of the distribution of inequalities in health outcomes across social groups of concern, considering both within-group and between-group comparisons."[150] The authors note that regulators conducting distributional analyses using measures of well-being must make certain choices, including with respect to: reference groups or points for comparisons; whether they will look at relative or absolute dimensions of inequality; whether to consider ordinal groups (e.g., income quartiles or educational attainment) or nominal groups (e.g., ethnic or geographic groups) or both; and finally, any value judgments that belie possible weighting choices.[151] Finally, the authors caution that these measures "will…be interpretable only when they take account of baseline inequality and are evaluated in conjunction with [other] benefits."[152]

In another example of the application of inequality metrics, a team of researchers led by James Boyce uses different indicators of inequality—such as the Gini Coefficient, Theil Index/Generalized Entropy Measure, ratios of medians, and ratios of 90th percentiles—and census tract-level data to generate inter-state rankings according to inequality in exposure to air pollution. The authors look at both vertical inequality, which is inequality of exposure to air pollutants, and horizonal inequality, which is based on other characteristics like minority status and income.[153]

In the context of measuring inequality of health benefits derived from regulation, Levy et al.[154] compare different metrics, such as the Gini index, Atkinson index, and the Theil's entropy index. They analyze how these metrics behave with respect to what they consider an ideal set of criteria ("axioms").[155] They conclude that the Atkinson Index, an indicator originally developed to characterize income inequality, is the metric that best satisfies these axioms. In another paper, Neal Fann and his co-authors, for instance, use the Atkinson Index to assess distributional impacts of different air quality management approaches in the city of Detroit.[156]

In recent work, Erin T. Mansur and Glenn Sheriff[157] propose an alternative metric to the measures of inequality used by many other authors, wherein they draw from the Rawlsian veil of ignorance theory to rank emissions distributions resulting from different policy scenarios.[158] The authors use the premise that one policy is preferable for a specific subpopulation if that policy would be "chosen by an impartial agent who had an equal probability of receiving the exposure of any individual in that group." The authors caution that their approach allows the selection of a globally optimal policy only if there were consensus within groups about preferences. Specifically, they claim that their approach "informs a policy maker about how different policy options affect each group but leaves to her the decision of how to balance competing interests."[159]

* * *

Pending stakeholder input, OMB should consider inequality metrics as one set of available tools for agencies to incorporate distributional analysis into regulatory decisionmaking. Using inequality metrics alongside costs and benefits that have been disaggregated by demographic groups may give regulators important information about how evenly costs and benefits are distributed, which could help them contextualize a rule's distributional effects alongside other regulatory impacts.

2. *Weights based on social welfare functions*

Agencies could also assess the desirability of distributional outcomes by applying weights to costs and benefits that are based on a Social Welfare Function ("SWF") framework. SWFs are used to understand how social welfare changes as a function of the distribution of "utilities," or units of well-being,[160] in a given population.[161] Weights based on SWFs could be applied to disaggregated costs and benefits to rank policy options based on distributional desirability. Although SWFs typically are based on income or consumption, we note that it is also possible to define well-being using characteristics like health status or leisure.[162] **OMB should consult with stakeholders when evaluating whether an income-focused approach is appropriate and, if not, whether and how other attributes of well-being could be used to generate weights.**

Here we describe two types of distributional weights that could be applied to costs and benefits to proxy different SWFs: utilitarian and prioritarian. Utilitarian weights are typically constructed to reflect the fact that one dollar is more valuable for a low-income individual than a high-income one. They could also be constructed to reflect the diminishing marginal utility of well-being more broadly understood (e.g., an increase in environmental quality is more valuable to individuals with a lower baseline of environmental quality).[163] But using dimensions other than income requires additional analytical steps (e.g., determining how to measure environmental quality, including how a unit of environmental quality improvement or degradation can be compared). Under the prioritarian approach, weights go beyond incorporating the diminishing marginal utility of income (or other characteristics) and are constructed instead to integrate particular ethical and moral considerations of equity and fairness. Prioritarian weights assign "higher value to well-being increments that accrue to the worse-off than to identical well-being impacts that accrue to the better-off."[164] Under either approach, regulators could look at weighted cost-benefit assessments as another data point to inform their consideration of distributional concerns.

The economics literature underpinning social welfare functions is well-established. Proponents like Duke University law and economics professor Matthew Adler advocate for the use of social welfare functions in regulatory decisionmaking[165] by using analysis that applies weights in assessing costs and benefits.[166]

a. Utilitarian Weights

As currently conducted, traditional regulatory cost-benefit analysis monetizes regulatory impacts based on individuals' willingness-to-pay (which is largely based on ability to pay), and thus, does not account for the distribution of willingness-to-pay among individuals. Because those with higher income are able and willing to pay more for goods and services than those with lower incomes, a willingness-to-pay approach inherently favors those who are richer.

Diminishing marginal utility of income, however, considers that as income increases, the marginal benefit of each additional dollar to an individual's well-being decreases. Therefore, adjusting for diminishing marginal utility using income-based utilitarian weights could alleviate the inherent bias in the analysis. Such utilitarian weights translate income changes into well-being, or utility, changes. As a result, a certain monetized benefit for a low-income group is given greater value than the same monetized benefit for a high-income group, even when the monetization is based on a willingness-to-pay estimate. A regulatory analysis using this methodology would, in theory, show decisionmakers what regulatory option generates the greatest utility for society overall, offering policymakers a rigorous methodology to prioritize different distributional alternatives.

Utilitarian weights can be extended to reflect more complex definitions of well-being, rather than just equating well-being with income. For instance, well-being might be defined to include attributes like health status. In that case, utilitarian weights would reflect that the same health benefit increases the well-being of a sick person more than that of a healthier one.[167] However, constructing this type of utilitarian function would require that decisionmakers determine which attributes contribute to well-being. Relying on income rather than more complex definitions of well-being would be simpler, particularly given that the concept of diminishing marginal utility of income already underpins standard practices of cost-benefit analysis such as discounting.[168] Moreover, some attributes of affected communities that might be of interest to the regulator (such as race, gender, or labor occupation) cannot be incorporated into a utilitarian SWF. Hence, using utilitarian weights will not help in the analysis of distributional impacts along these dimensions.

Using income-based utilitarian weights is recommended by the British government for regulatory impact assessment.[169] The UK Green Book, which sets specific guidance on how to carry out cost-benefit analysis in the United Kingdom, even establishes precise values. Specifically, it states that a dollar to a person in the lowest income quartile is worth roughly twice as much as a dollar to a person in the highest income quartile in the British context.[170] Again, if a utilitarian-based analysis is presented alongside the results of a traditional cost-benefit analysis, regulators will have flexibility to assess what policy outcome is preferable considering different aggregate and distributional outcomes. In this context, the utilitarian analysis provides helpful perspective for the regulator but need not be the deciding factor.

In the context of a rule that controls air pollution, for example, utilitarian weighing might make the adjusted willingness to pay for health benefits of avoided exposure equal across income groups, even if the empirical willingness to pay differs between these groups (which it likely does because it depends on *ability* to pay). Or, such weighting might make such health benefits to low-income groups *even more* valuable than the same health benefits to groups with greater resources. Assuming that willingness to pay for health effects is uniform across social groups is not actually a deviation from standard practice, as we discuss in Recommendation 2. Alternately, using utilitarian weights might take identical costs to two groups and increase the magnitude of those costs to the lower income group, reflecting the fact that the same monetary cost has greater disutility to an individual with less ability to pay that cost.

b. Prioritarian Weights

A regulator could go one step further by applying prioritarian weights to inform an assessment of distributional outcomes. These weights can be used to proxy a prioritarian social welfare function—that is, a welfare function that recognizes a higher societal benefit to improving the utility of the worst-off than improving the utility of the best-off.[171] In essence, prioritarian social welfare functions assign larger weights to the welfare gains of the worst-off than weights based solely on marginal utility of income or other measures of well-being.[172] In giving priority to the worst-off, prioritarian weights reflect one possible (albeit common) idea of fairness. In the context described above, when considering a rule with air pollution effects, prioritarian weighting would necessarily give greater value to health benefits of the groups who are most vulnerable to those adverse effects (e.g., due to preexisting health conditions or lack of access to healthcare). Prioritarian weighting also means that if weights were applied to all effects of a proposed action (costs as well as benefits), costs to better-off groups would be weighted less heavily than the same costs to worst-off individuals, even after those costs were income-adjusted to reflect the declining marginal utility of consumption.

The parameters of a prioritarian social welfare function depend on the decisionmaker's normative determinations, including the evaluation of society's aversion to inequality. As a result, calculating prioritarian weights can be challenging. However, there are empirical estimates that a regulator could use to support such a calculation. For instance, society's

distributional preferences and aversion to inequality, though nuanced,[173] can be measured empirically. One recent paper concludes that from a prioritarian standpoint, an improvement in air quality is eight times more advantageous when that improvement benefits someone with a lower baseline environmental quality, versus another individual whose environmental-quality baseline is twice as high.[174] However, this empirical measurement of inequality aversion depends, among other things, on the type of environmental good that is being considered (e.g., air quality versus soil quality). Calculating an aversion to inequality factor or coefficient can be a complex undertaking that is context-specific. Though OMB could provide guidance on the process for making such a calculation, agencies would potentially need to derive the aversion to inequality factor for each policy proposal.

Other studies of inequality aversion further demonstrate how an individual's well-being relative to others in a given population affects preferences for certain distributional outcomes.[175] In order to apply prioritarian weights practically, a regulator must make normative judgments and other decisions in order to select a methodology for determining the inequality aversion factor.[176] Once again, policymakers could consider an analysis using prioritarian weights alongside a traditional cost-benefit analysis, rather than assign it dispositive preference.

C. OMB Could Recommend that Agencies Calculate Net Welfare Using Weighted Cost-Benefit Analysis

Finally, in the biggest departure from common practice, a regulator could prioritize distributional outcomes by *replacing* traditional cost-benefit analysis with a weighted cost-benefit analysis. Under this approach, the results of a weighted cost-benefit analysis would be presented not alongside those results of a disaggregated cost-benefit analysis, but rather as the main or only result.

If it takes this approach, OMB should give explicit guidance on whether income will be the default measure of utility, and so the basis for weights, and if not, provide guidance on how regulators could use other measures of well-being in the place of income for generating weights. Also, as noted above, a utilitarian weighted cost-benefit analysis will not shed light on distributional impacts along some attributes that could be of interest to a regulator, such as race, while prioritarian weights could.[177] We note that though adopting SWF-based weights as the main decisionmaking tool has some theoretical and academic support,[178] it could pose a challenge from a practical and legal perspective (in addition to the limitations mentioned above).

First, weighting may be an unnecessary step to achieve more equitable outcomes. Some argue that using traditional cost-benefit analysis could lead to progressive (greater benefits to the worse off) rather than regressive (greater benefits to the better off) policies. In a forthcoming paper, Daniel Hemel argues that using traditional weighted cost-benefit analysis is particularly appropriate when assessing policies that are designed to save lives.[179] Hemel is not alone in concluding that regulators should stick with traditional cost-benefit analysis. David Weisbach draws the same conclusion in a 2015 paper, though for different reasons. Essentially, Weisbach argues that agencies exist to "perform specialized tasks," and that within that narrow scope of responsibility, agencies cannot achieve "desirable distributive policies." Therefore, he argues that regulatory decisionmakers should continue to use traditional cost-benefit analysis, with redistribution occurring primarily through the tax-and-transfer system.[180]

If OMB determines that weighting is the appropriate approach for agencies to meet both efficiency and distributional goals, there are a number of considerations that OMB would have to take into account before choosing this route. For example, employing a social welfare function requires regulators to make political decisions that they may not be empowered to make.[181] This may be particularly true when using prioritarian weights, as designating the "worst-off" group in any given scenario is an inherently value-laden judgment that may not fully capture all determinants of fairness. Although regulators have long purported to consider distributional concerns,[182] they may be ill-equipped to determine policy so explicitly and fundamentally based on distributional considerations. And insofar as regulations are justified primarily based on distributional benefits rather than more traditional benefits, courts may be concerned that agencies are relying too heavily on factors outside their core statutory mandate.

There are other possible practical and legal hurdles to adopting weighted cost-benefit analysis as the primary basis for regulatory decisions. For example, traditional cost-benefit analysis is widely applied across the federal government and well understood by courts. While agencies are given broad deference by courts and surely have latitude to make methodological choices, fundamental changes to cost-benefit analysis of this sort may draw judicial ire (justified or not).[183] It is certainly possible that case law could come to embrace the use of social welfare functions in cost-benefit analysis just as it has traditional cost-benefit analysis.[184] Indeed, agencies are generally empowered by sufficiently open-ended statutory frameworks to choose their preferred methodology and balance different regulatory priorities.[185] However, this may be a risk that the federal government does not wish to take. Indeed, even Adler, one of the biggest proponents of social welfare functions, argues that because applying distributional weights (both utilitarian and prioritarian) is "value-laden," agencies should "undertake standard [cost-benefit analysis] alongside distributionally weighted [cost-benefit analysis] with some range of weights," as we have discussed in the previous subsection.[186]

* * *

Addressing distributional concerns in regulation involves more than showing how the costs and benefits of a particular regulatory option accrue to different groups. It also requires taking this information into account when deciding whether and how to regulate. Agencies have a range of methodological options for considering distributional impacts alongside other regulatory effects. Clear guidance from OMB on how agencies can contextualize the magnitude or significance of distributional consequences will be critical to ensure robust and consistent consideration of distributional impacts across agencies.

RECOMMENDATION 4:

OMB Should Lead a Whole-of-Government Approach to Implement Measures to Mitigate Adverse Distributional Impacts Through Interagency Coordination

Regardless of how agencies account for distributional outcomes in regulatory decisionmaking, there will likely be some undesirable distributional outcomes resulting from otherwise desirable rules. Executive Order 13,985 has already tasked the Domestic Policy Council ("DPC") with "coordinat[ing] efforts to embed equity principles, policies, and approaches across the Federal Government."[187] OMB could join forces with the DPC and specifically coordinate among agencies to provide guidance on how agencies can mitigate potential adverse distributional outcomes.[188]

As noted in the previous sections, OMB could give agencies guidance to help them to identify adverse distributional outcomes during the rulemaking process. Agencies could then consider other avenues within their statutory authority to address or minimize undesirable distributional outcomes. For example, the Department of the Interior could prioritize fossil-fuel-dependent communities for the siting of renewable energy projects to redress potential lost revenue in those places due to more stringent leasing and production policies.[189] This type of policy accounts for lost income to some groups, an adverse distributional consequence, by providing new income-generating opportunities for those same groups. OMB could consult with agencies on a rule-by-rule basis to identify avenues to mitigate adverse distributional impacts.

If mitigating the adverse distributional effects of an otherwise cost-benefit-justified rule is outside the statutory authority of the rulemaking agency, then the lead agency could work with other agencies to create remediation plans. The DPC or OMB could act as a liaison between agencies. Additionally, OMB (or specifically OIRA) could provide oversight over distributional issues in decisionmaking, including by regularly reviewing distributional analyses across rules and across agencies to assess cumulative distributional effects. As part of such oversight, OIRA, along with the DPC, could convene an interagency working group to provide coordination across the federal government aimed at addressing adverse distributional outcomes. As a first step, **the administration should solicit public input and establish a robust stakeholder process to inform how it implements a whole-of-government approach to improving equity.**

A. OMB and the Domestic Policy Council Should Coordinate Between the Lead Agency and Other Agencies to Address Inequitable Effects

Many adverse distributional outcomes cannot be efficiently solved within the lead agency's authority, nor can any one agency alone work to solve longstanding distributional disparities suffered by certain groups. In this event, it may be appropriate for two or more agencies to work together to correct distributional imbalances. OMB and/or the DPC should provide coordination in this regard.

In a law review article on this topic, Richard Revesz discusses when it may be desirable for a second agency (other than the rulemaking agency) or multiple other agencies to design the redistributive mechanism.[190] Revesz goes into detail about a real-life example, the Partnerships for Opportunity and Workforce and Economic Revitalization (sometimes known as POWER) Initiative, which was designed to compensate displaced coal industry workers.[191] This initiative was in part a way of addressing the disproportionate effect of environmental regulations like the Clean Power Plan on coal communities.[192] Although EPA was responsible for the regulations in question, the Economic Development Administration, Department of Labor, Appalachian Regional Commission, Department of Commerce, and Department of Agriculture all worked with EPA on the POWER Initiative.[193]

Similar to the multiagency cooperation in the POWER Initiative, Executive Order 13,990 establishes the Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization.[194] This tasks numerous agencies and offices with "coordinat[ing] the identification and delivery of Federal resources to revitalize the economies of coal, oil and gas, and power plant communities," among other things.[195] A similar group of agency heads could come together to direct resources towards compensating groups adversely affected by a specific regulation or set of regulations.

Such cooperation could be a model for future efforts. OMB oversight and coordination could facilitate these types of joint ventures across the federal government.

OMB and the DPC Could Initiate a Pilot Program to Study Compensatory Mechanisms

Agencies have limited resources, including limited capacity for cross-agency engagement, but such coordination is essential to identify and implement compensatory mechanisms for groups and communities that have faced disproportionate adverse effects from federal action (and inaction). In fact, the Biden administration has already created one interagency working group aimed specifically at remediating inequitable harms against a particular community, and could create other interagency working groups to benefit other discrete, disadvantaged populations.

Executive Order 14,008 established an interagency working group on Coal and Power Plant Communities and Economic Revitalization.[196] This working group is tasked with addressing the economic costs that these communities have faced due in part to rules aimed at protecting public health and the environment by limiting the use of fossil fuels. In April, the group released a report,[197] per the executive order, that identifies the "mechanisms, consistent with applicable law, to prioritize grantmaking, federal loan programs, technical assistance, financing, procurement, or other existing programs"[198] to support these communities that may have suffered localized adverse impacts from federal actions. The report was informed by stakeholders and advocacy groups, and is but the first step of the working group.

A similar group could be established that addresses the cumulative adverse environmental harms faced by the communities living in Cancer Alley. Cancer Alley is not only in great need of remediation but is also a useful counterpart to coal and power plant communities because it has been affected by the regulatory status quo in very different ways. Whereas coal and energy communities have disproportionately felt the economic burdens of environmental and public health regulations, the communities of Cancer Alley have disproportionately suffered the costs of insufficient or altogether absent health and safety regulations.

Like the coal and power plant communities working group, the Cancer Alley working group could begin by gathering information on how those communities could be compensated (through grantmaking, financing, technical assistance, procurement, and other programs) to address the harms they have suffered due to government action and inaction.

B. OMB and the DPC Should Provide Systemwide Oversight

Beyond addressing the adverse distributional impacts of individual rules, OMB and/or the DPC could also facilitate assessment, and potentially remediation, of distributional inequities across the regulatory system. For instance, regulatory actions—or inactions—may routinely impose disparate impacts on the same groups. Conversely, some groups may experience disproportionate costs under some policies but enjoy offsetting disproportionate benefits under others. In order to identify these cumulative effects, the federal government would benefit from an approach that considers the whole universe of agencies and their actions, rather than looking at each agency or action in a vacuum. This will require systemwide oversight and data collection, which OMB (and OIRA in particular) could lead.[199]

As noted above, President Biden has already charged the DPC with leading an interagency process on improving equity across the federal government. Similarly, President Biden has given OMB a number of interagency coordination duties with respect to the climate crisis that the Office could carry out with careful attention to regulatory equity. For instance, President Biden's executive order *Tackling the Climate Crisis at Home and Abroad* (Executive Order 14,008) directs the Director of OMB to work with the National Climate Advisor to first identify fossil fuel subsidies provided by various agencies and to then take the necessary steps to ensure that "[f]ederal funding is not directly subsidizing fossil fuels."[200] As part of this role, OMB could help identify the nature and magnitude of disparate impacts resulting from fossil-fuel subsidies, and work with agencies to ensure that federal funding does not contribute to adverse distributional impacts. This same executive order also tasks OMB with reviewing and assessing agencies' Climate Action Plans to ensure these plans are consistent with policy established by the Order. OMB could similarly request plans from agencies that detail how the agencies intend to address equity in their upcoming actions.

OIRA, an office within OMB, is already responsible for carrying out some tasks that could be translated into the context of distributional analysis. For example, since agencies already provide regulatory impact analyses to OIRA for review, OIRA would be the perfect candidate to oversee a systemic review of agencies' distributional analyses.[201] First, it could collect data from agencies on their distributional analyses. This might include setting up an online database that is accessible to agencies and interested stakeholders alike that includes distributional effects for specific rules. This information could be aggregated in the database and organized by rule or action, year, agency, subpopulation, etc. Then, OIRA could look at the net effects on specific groups across agencies and across rules.

Using its expertise in assessing the consequences of regulation, OIRA could work with agencies to formulate an appropriate response to distributional consequences of proposed rules.[202] Given its understanding of the regulatory landscape, OIRA would also be well suited to advise agencies on when the distributional impacts of their regulations are significant and merit corrective action, similar to the agency's function in assessing whether a regulation is "significant" under Executive Order 12,866 triggering a detailed regulatory impact analysis. In the event that OIRA identifies a number of actions with potentially adverse distributional impacts affecting the same group, it could establish an interagency working group to address these impacts.

Finally, again due to its unique position overseeing the significant actions of all agencies, OIRA would be well positioned to assess cumulative distributional issues resulting from many actions. This could be done in partnership with or under the advisement of the DPC and the White House Environmental Justice Advisory Council. OIRA could, for example, incorporate other distributional issues into the environmental justice scorecard prescribed by Executive Order 14,008,[203] or generate separate scorecards to capture how well agencies are addressing equity in their decisionmaking.

OIRA could also use the unified agenda process to facilitate review of distributional analyses. Under this approach, agencies would flag potential adverse distributional outcomes early in the regulatory process. If possible, agencies could include preliminary distributional findings as part of their semi-annual submission to the unified agenda.[204] With this information, OIRA would be able to better guide agencies through the rulemaking process to address distributional concerns from the early stages, rather than waiting for notice and comment on each action. Similarly, OIRA, along with the DPC, could connect agencies to address distributional inequities. Moreover, providing this information early allows for further stakeholder engagement and input into the upcoming year's rulemaking process across agencies.

In its annual review and report to Congress, OIRA could assess distributional outcomes (both of key rules and across rules) and report whether any particular groups were adversely impacted by the year's regulatory actions.[205] Understanding the effects on specific groups from the entire universe of regulations in a given period of time is key to addressing longer-term inequities. Such information could also provide a baseline from which to consider the distributional effects of the following year's regulatory agenda.

OMB generally, or OIRA in particular, along with the DPC, could also convene an interagency working group to address the distributional outcomes of regulatory actions. This group could be tasked with "facilitat[ing] the organization and deployment of a Government-wide approach" to equity, the way the newly formed National Climate Task Force is tasked with taking such an approach to addressing climate change.[206] This could be housed within the existing Interagency Working Group on Environmental Justice or it could subsume the Equitable Data Working Group to minimize duplication of efforts, or could operate as a distinct body. Among other important tasks, such an interagency working group on distributional impacts could help OIRA assess the collective distributional impacts across regulations and across agencies to include in OIRA's annual report to Congress.[207]

The interagency working group could also be responsible for taking stock of methodological shortcomings of existing distributional analyses, such as identifying unquantified effects that have important equity implications for further research,[208] in partnership with the Equitable Data Working Group established by Executive Order 13,985. In this regard, it would have similar responsibilities to the Interagency Working Group on the Social Cost of Greenhouse Gases. Because interoperable, systematic distributional analysis would be new, there would inevitably be room for continuous improvement within and across agencies. An interagency working group could lead research efforts and contribute to OIRA's methodological guidance on established best practices. As Jason Schwartz has recognized, "[o]nce a set of best practices is established by the interagency working group, it will become less costly for agencies to conduct their distributional analyses, because they can refer back to established practices rather than trying to reinvent a new methodology each time."[209]

Wicked Problems, Systems Thinking, and Distributional Analysis

Social policy problems, like environmental injustice and other issues of inequity, can be seen as "wicked problems":[210] they are not lone problems in and of themselves, but in fact the product of a constellation of issues involving many stakeholders.[211] Wicked problems are defined by ambiguity, so there can be disagreement not only about the nature of the problem and its solutions, but also more abstract concerns about what constitutes a public good or how to define key elements like equity and justice.[212] There is also not necessarily a clear end point at which a wicked problem can be considered resolved, which is perhaps the most important characteristic for the purposes of this report.[213] Rather, wicked problems need to be looked at from multiple perspectives and each element of the problem must be considered along with all the others. This is why it may not be sufficient for a federal agency to act alone, or even in partnership with other individual agencies, to address distributional concerns that are the product of regulatory actions. Instead, distributional concerns should be considered across the entire regulatory system.

The existing siloed structure of the executive branch dampers our ability to see federal agencies—and their actions—as components of a broader system.[214] Specialized agencies operate exclusively within statutorily prescribed policy silos and only rarely undertake joint rulemakings and analyses.[215] Moreover, while OIRA's review of significant rules constitutes a form of systemic oversight, it is limited to furthering efficiency objectives. OIRA does not take this same type of bird's-eye-view with respect to other aspects of regulatory actions. Systems thinking, which has established methodologies and tool kits, can help policymakers "to identify and understand critical linkages, synergies and trade-offs between issues generally treated separately and thus to reduce unintended consequences."[216]

Using a systems thinking approach to distributional effects could be particularly effective for several reasons. First, some groups face historic and systemic inequities that are the product of decisions made across policy arenas. Second, the same groups may be losers (i.e., suffer net harms) from a given set of contemporary regulations. Third, decisionmakers may 'speak a different language' (i.e., operate from a different point of view) than affected individuals/communities or regulated industry, and so miscommunication between decisionmakers and stakeholders can be prevalent; systems thinking takes the perspectives of the various stakeholders into account.[217] Fourth, as noted above, there are often tradeoffs—but also unidentified synergies—in trying to address distributional concerns that agencies cannot address on their own. Fifth and finally, because social problems like environmental justice are often wicked problems, there is no single solution, but rather many solutions must be assessed and implemented.

Conclusion

The federal regulatory system could play an important role in addressing inequality and promoting fairness and environmental justice. Greater oversight and clearer guidance from OMB will be critical to creating long-lasting change on this front. As this report has outlined, OMB should provide detailed guidance to agencies on conducting granular analysis, assessing costs and benefits for a manageable number of demographic subgroups, and weighing distributional concerns alongside other regulatory impacts. Additionally, OMB and the DPC should facilitate coordination between agencies to promote equity throughout the regulatory system.

Endnotes

1 Exec. Order No. 13,985 § 1, 86 Fed. Reg. 7009 (Jan. 20, 2021).

2 *Id.* § 4(a) (requiring study of "best methods . . . to assist agencies in assessing equity").

3 *Id.* § 1.

4 Modernizing Regulatory Review § 2(b)(ii), 86 Fed. Reg. 7223 (Jan. 20, 2021). Notably, the memorandum does not define "disadvantaged," "vulnerable," or "marginalized" communities. Executive Order 13,985 does, however, provide a non-exhaustive list of "underserved communities that have been denied [consistent and systematic fair, just, and impartial] treatment," which includes "Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality." Exec. Order No. 13,985 § 2.

5 *Id.* § 2(a).

6 *See id.*

7 Richard L. Revesz, *Regulation and Distribution*, 93 N.Y.U. L. Rev. 1489, 1500–11 (2018) (presenting, but then criticizing, this "orthodox view").

8 *Id.* at 1512–18; *see also* H. Spencer Banzhaf, *Regulatory Impact Analyses of Environmental Justice Effects*, 27 J. Land Use & Env't L. 1, 14 (2011) ("[A]ctual compensations for the distributional effects of government projects and regulations are exceedingly rare, if not an outright fiction.").

9 Revesz, *supra* note 7, at 1511–12.

10 *See* Banzhaf, *supra* note 8, at 14 (stating that "if redistribution is a national objective, then any regulatory action that promotes this objective, ceteris paribus, is obviously preferable to one that does not").

11 Zachary Liscow, *Redistribution for Realists* 6 (2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3792122.

12 Exec. Order No. 12,866, 58 Fed. Reg. 51,735 (Oct. 4, 1993).

13 Exec. Order No. 12,291 § 3(d)(1)–(2), 46 Fed. Reg. 13,193 (Feb. 17, 1981) (calling on agencies to "identif[y] . . . those likely to receive the benefits" and "those likely to bear the costs" of each regulation"). However, this Order does not advise regulators on how to incorporate such a distributional analysis into its assessment of net benefits. Instead, the Order advises agencies that "[r]egulatory objectives shall be chosen to maximize the net benefits to society," suggesting that distributional and justice considerations merit scant consideration. *Id.* § 2(c).

14 *Id.* § 2(c).

15 Exec. Order No. 12,866 § 1(b)(5).

16 Office of Mgmt. & Budget, Economic Analysis of Federal Regulations Under Executive Order 12,866 (Jan. 11, 1996), https://georgewbush-whitehouse.archives.gov/omb/inforeg/riaguide.html.

17 *Id.* § III(A)(8).

18 *Id.*

19 *Id.*

20 Office of Mgmt. & Budget, Circular A-4, Regulatory Impact Analysis 3 (2003) [hereinafter "Circular A-4"].

21 *Id.* at 14.

22 *Id.*

23 Exec. Order No. 13,563, 76 Fed. Reg. 3821 (Jan. 18, 2011).

24 *Id.* § 1(b).

25 *Id.* § 1(c).

26 Exec. Order No. 12,898 § 1-101, 59 Fed. Reg. 7629 (Feb. 11, 1994) ("To the greatest extent practicable and permitted by law, . . . each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations . . . ."); *accord id.* § 3-302(a). Executive Order 12,898 does not define "minority populations" or "low-income populations. "

27 Council on Env't Quality, *Environmental Justice: Guidance Under the National Environmental Policy Act* (Dec. 10, 1997), https://www.epa.gov/sites/production/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf.

28 Fed. Interagency Working Grp. on Env't Just., *Promising Practices for EJ Methodologies in NEPA Reviews* (2016), https://www.epa.gov/sites/production/files/2016-08/documents/nepa_promising_practices_document_2016.pdf.

29 EPA, Guidelines for Preparing Economic Analyses 10-1 to 10-23 (last updated 2014) [hereinafter "EPA Guidelines"].

30 EPA, Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (2016), https://www.epa.gov/sites/production/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf [hereinafter "EPA Technical Guidance"].

[31] *Id.* at 13.

[32] *See, e.g., id.* at 11–14 (describing key analytical considerations); *id.* at 41–59 (offering guidance on assessing distribution of benefits and costs in regulatory impact analysis).

[33] Lisa A. Robinson, James K. Hammitt & Richard Zeckhauser, *The Role of Distribution in Regulatory Analysis and Decision Making* (Mossavar-Rahmani Ctr. for Bus. and Gov't, Harvard Kennedy Sch., Working Paper No. 2014-02, 2014), https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/files/Zeckhauser_final.pdf.

[34] *Id.* at 9.

[35] *Id.* at 10–12.

[36] *Id.* at 12.

[37] Carl F. Cranor & Adam M. Finkel, *Toward the Usable Recognition of Individual Benefits and Costs in Regulatory Analysis and Governance*, 12 Reg. & Governance 131, 131 (2018) (emphasis added).

[38] Elizabeth Ann Glass Geltman, Gunwant Gil, & Miriam Jovanic, *Beyond Baby Steps: An Empirical Study of the Impact of Environmental Justice Executive Order 12898*, 39 Family and Cmty. Health 143, 143 (2016); *see also* Revesz, *supra* note 7, at 1540 ("[O]f the nearly 4,000 rules the EPA promulgated during the Obama administration, the agency referred to only seven as ones taking environmental justice concerns into account.").

[39] Denis Binder et al., *A Survey of Federal Agency Response to President Clinton's Executive Order No. 12898 on Environmental Justice*, 31 Env't. L. Rep. News & Analysis 11133 (2001).

[40] *See* Banzhaf, *supra* note 8, at 5–6 ("[W]hen it has incorporated even these limited environmental justice objectives into its [cost-benefit analyses], EPA has tended to stop at perfunctory, pro forma assertions that it is not creating or exacerbating an environmental injustice.").

[41] Federal Motor Vehicle Safety Standards; Rear Visibility, 79 Fed. Reg. 19,178 (Apr. 7, 2014).

[42] *Id.* at 19,184.

[43] *Id.* at 19,236.

[44] USDA, Regulatory Impact Analysis: Supplemental Nutrition Assistance Program: Requirements for Able-Bodied Adults Without Dependents 2 (2019), https://www.regulations.gov/document?D=FNS-2018-0004-19016. This analysis was conducted in support of Supplemental Nutrition Assistance Program: Requirements for Able-Bodied Adults Without Dependents, 84 Fed. Reg. 66,782 (Dec. 5, 2019).

[45] *Id.* at 49–51.

[46] The U.S. District Court for the District of Columbia found this regulation to be arbitrary and capricious, citing, among other reasons, the agency's failure to meaningfully evaluate distributional impacts. *D.C. v. United States Dep't of Agric.*, 496 F. Supp. 3d 213, 256–57 (D.D.C. 2020). This case represents a rare judicial rebuke of an agency's distributional analysis.

[47] Frank Ackerman & Lisa Heinzerling, *Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection*, 150 U. Pa. L. Rev. 1553, 1573 (2002).

[48] Melissa J. Luttrell & Jorge Roman-Romero, *Regulatory (In) Justice: Racism and CBA Review*, Yale J. on Reg. (Oct. 27, 2020), https://www.yalejreg.com/nc/regulatory-injustice-racism-and-cba-review-by-melissa-j-luttrell-and-jorge-roman-romero/.

[49] *See, e.g.,* Anne N. Junod, Carlos Martín, Rebecca Marx, & Amy Rogin, *Equitable Investments in Resilience: A Review of Benefit-Cost Analysis in Federal Flood Mitigation Infastructure*, The Urban Institute (2021) (explaining how use of cost-benefit analysis often directs federal flood mitigation funding to wealthier communities by focusing on home values). Although this report focuses on the use of cost-benefit analysis in federal regulation, its recommendations on how to improve upon those analyses are also applicable for cost-benefit analyses performed for other purposes, such as federal grantmaking.

[50] *See generally* Joe's Vision, Joe Biden, https://joebiden.com/joes-vision/.

[51] Modernizing Regulatory Review, *supra* note 4, § 2(a).

[52] *Id.* § 2(b)(ii).

[53] Exec. Order No. 13,985.

[54] *Id.* § 1.

[55] *Id.* The Order defines two terms: "equity" and "underserved communities." It defines "equity" as "the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bixsexual, transgender, and queer [] persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality." It defines "underserved communities" as "populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life, as exemplified by the list in the preceding definition of 'equity.'" *Id.* § 2.

[56] *Id.* §§ 4(a), 5, 6(a).

[57] *Id.* § 3.

[58] *Id.* § 9(c)(ii).

[59] Exec. Order No. 14,008, 86 Fed. Reg 7619 (Jan. 27, 2021).

[60] *Id.* §§ 219, 221(b).

[61] *Id.* § 222(a).

[62] These working groups are: The Justice40 initiative working group, the Climate and Economic Justice Screening Tool working group, and the Executive Order 12,898 Revisions working group.

[63] White House Environmental Justice Advisory Council, *Interim Final Recommendations for Justice40, Climate and Economic Justice Screening Tool, & Executive Order 12898 Revisions* 65 (May 13, 2021), https://www.epa.gov/sites/default/files/2021-05/documents/whejac_interim_final_recommendations_0.pdf.

[64] Methods and Leading Practices for Advancing Equity and Support for Underserved Communities Through Government, 86 Fed. Reg. 24,029, 24,029 (May 5, 2021).

[65] *Id.* at 24,030.

[66] Exec. Order 13,985 § 2(a).

[67] *Id.* § 9.

[68] Andrew L. Goodkind et al., *Fine-Scale Damage Estimates of Particulate Matter Air Pollution Reveal Opportunities for Location-Specific Mitigation of Emissions*, 116 Procs. Nat'l Acad. Scis. 8775 (2019).

[69] Here, damages are defined as the monetary valuation of premature mortality attributable to exposure to fine particulate matter.

[70] Janet Currie et al., *Environmental Health Risks and Housing Values: Evidence from 1,600 Toxic Plant Openings and Closings*, 105 Am. Econ. Rev. 678 (2015).

[71] Banzhaf, *supra* note 8; *see also* Ellen S. Post, Anna Belova & Jin Huang, *Distributional Benefit Analysis of a National Air Quality Rule*, 8 Internat'l J. Env't Res. & Pub. Health 1872 (2011).

[72] Goodkind et al., *supra* note 68.

[73] John M. Morehouse & Edward Rubin, *Downwind and Out: The Strategic Dispersion of Power Plants and Their Pollution* 47 (Ctr. for Growth & Opportunity at Utah State U. Working Paper, 2021).

[74] EPA, *Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses* 16 (1998).

[75] Qian Di et al., *Air Pollution and Mortality in the Medicare Population*, 26 New Eng. J. Med. 2513 (2017).

[76] Solomon Hsiang, Paulina Oliva & Reed Walker, *The Distribution of Environmental Damages*, 13 Rev. Env't Econ. & Pol'y 83 (2019); *see also* Banzhaf, *supra* note 8.

[77] Tatyana Deryugina et al., *Geographic and Socioeconomic Heterogeneity in the Benefits of Reducing Air Pollution in the United States* (Nat'l Bur. of Econ. Res. Working Paper Series, 2020).

[78] Daniel Krewski et al., *Extended Follow-up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality* (Health Effects Inst. Rsch. Rep., 2009).

[79] CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool, Data and Tools, EPA, https://www.epa.gov/statelocalenergy/co-benefits-risk-assessment-cobra-health-impacts-screening-and-mapping-tool (last updated June 26, 2017).

[80] Neal Fann et al., *Maximizing Health Benefits and Minimizing Inequality: Incorporating Local-Scale Data in the Design and Evaluation of Air Quality Policies*, 31 Risk Analysis 908 (2011).

[81] Banzhaf, *supra* note 8.

[82] Jonathan I. Levy, *Accounting for Health Risk Inequality in Regulatory Impact Analysis: Barriers and Opportunities*, 41 Risk Analysis 610 (2021); *see also* EPA, Final Guidance For Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses (1998).

[83] Goodkind et al., *supra* note 68.

[84] Dallas Burtraw, Maya Domeshek & Amelia Keyes, *Carbon Pricing 104: Economic Effects Across Income Groups*, Resources for the Future (May 4, 2020), https://www.rff.org/publications/explainers/carbon-pricing-104-economic-effects-across-income-groups/.

[85] Lisa A. Robinson, James K. Hammitt & Richard J. Zeckhauser, *Attention to Distribution in U.S. Regulatory Analyses*, 10 Rev. Env't Econ. & Pol'y 308 (2016).

[86] EPA, EPA Environmental Justice Strategy 3 (Apr. 3, 1995), https://www.epa.gov/environmentaljustice/epa-environmental-justice-strategy-1995.

[87] Elizabeth Glass Geltman, Gunwant Gill & Miriam Jovanovic, *Beyond Baby Steps: An Empirical Study of the Impact of Environmental Justice Executive Order 12898*, 39 Fam. & Cmty. Health 144 (2016).

[88] EPA Technical Guidance, *supra* note 30.

[89] *Id.* at 1.

[90] *Id.* at 14.

[91] *Id.* at 47.

[92] *See supra* notes 12–46 and accompanying text.

[93] *See* Robinson et al., *supra* note 33, at 21.

[94] Cass R. Sunstein, *The Cost-Benefit State* 22–23 (Coase-Sandor Institute for Law & Economics Working Paper No. 39, 1996).

[95] John Graham, *Savings Lives Through Administrative Law and Economics*, 157 U. Pa. Law. Rev. 395, 520 (2008).

[96] *Id.*

[97] As discussed above, a 2016 EPA guidance document recommends that analysts quantify the distribution of costs and benefits as part of their regulatory analysis. Many legal and economic scholars also support the practice. *See supra* notes 30–32 and accompanying text. Many legal and economic scholars also support the practice. *See, e.g.*, Banzhaf, *supra* note 8, at 9 n.35 (collecting sources).

98 *See* EPA Technical Guidance, *supra* note 30, at 41–57.

99 Ronald J. Shadbegian, Wayne Gray & Cynthia Morgan, *Benefits and Costs from Sulfur Dioxide Trading: A Distributional Analysis,* (Nat'l Ctr. for Env't Econ. Working Paper 05-09, 2005).

100 *Id.* at 15–18.

101 Winston Harrington et al., Resources for the Future, *Distributional Consequences of Public Policies: An Example from the Management of Urban Vehicular Travel* (Resources for the Future Discussion Paper 14-04, 2014).

102 *See, e.g.,* Daniel Hemel, *Regulation and Redistribution with Lives in the Balance,* U. Chi. L. Rev., at 2 (forthcoming, manuscript available at March 2, 2021), https://papers.ssrn.com/abstract=3796235) ("Incorporating distributive objectives into cost-benefit analysis of lifesaving regulations while maintaining equal dollar [values of a statistical life] for rich and poor will potentially produce perverse outcomes that—according to standard economic thinking—actually redistribute from poor to rich.").

103 Applying uniform benefit estimates across demographic groups is effectively a form of utilitarian weighting, which is described further in Recommendation III, *infra*.

104 EPA Guidelines, *supra* note 29, at B-4 to B-6. *But cf.* Richard L. Revesz & Michael A. Livermore, Retaking Rationality: How Cost-Benefit Analysis Can Better Protect the Environment and our Health 80–81 (2008) (discussing evidence that older individuals place a higher value on each remaining life-year).

105 EPA Guidelines, *supra* note 29, at B-4 ("[T]he income elasticity of [willingness to pay] to reduce mortality risk is positive . . . .").

106 David Glover & John Henderson, *Quantifying Health Impacts of Government Policies: A How-To Guide to Quantifying the Health Impacts of Government Policies,* UK Dep't of Health 12 (2010) (advising that "the health gains to any two individuals should be valued the same regardless of their income"); *see also id.* at 10–12 (endorsing disaggregating assessment of regulatory impacts).

107 EPA Technical Guidance, *supra* note 30, at 57.

108 *Id.* at 58.

109 *Id.* at 57–59; EPA Guidelines, *supra* note 29, at 10-8 to 10-9.

110 Exec. Order No. 12,898 § 1-101.

111 This includes "Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bixsexual, transgender, and queer . . . persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality." Exec. Order 13,985 § 1.

112 *See supra* note 43 and accompanying text.

113 *See, e.g.,* Matthew Adler, Measuring Social Welfare: An Introduction 16 (2019) [hereinafter Measuring Social Welfare] ("If income indeed has declining marginal well-being impact, then an equal distribution of a fixed total 'pie' of income among otherwise identical individuals generates a bigger sum total of well-being, as compared to an unequal distribution of the same 'pie.'"). Social welfare functions are discussed in further detail in Recommendation 3.

114 Earlier this year, for instance, a divided panel of the U.S. Court of Appeals for the Sixth Circuit enjoined the Small Business Administration from prioritizing applications for relief funding based upon the race or sex of the applicant. *Vitolo v. Guzman,* 999 F.3d 353 , 366 (6th Cir. May 27, 2021). Two weeks after that decision, a federal judge in the Eastern District of Wisconsin issued a temporary restraining order blocking the Department of Agriculture from administering a loan-forgiveness program based on the applicant's race. *Faust v. Vilsack,* 2021 WL 2409729 (E.D. Wis. June 10, 2021).) A federal judge in the Middle District of Florida also enjoined the same program less than two weeks later, on similar grounds. *Wynn v. Vilsack,* 2021 WL 2580678 (M.D. Fla. June 23, 2021).In general, federal courts are skeptical of mathematical analyses involving "suspect classifications" such as race. *See, e.g., Gratz v. Bollinger,* 539 U.S. 244, 279 (O'Connor, J., concurring) (concluding that university-admission process relying on racial "point allocations" violates the Equal Protection Clause because it "ensures that the diversity contributions of applicants cannot be individually assessed"). *But see Grutter v. Bollinger,* 539 U.S. 306 (permitting university-admission process that considers racial diversity as a "soft variable[]" in a holistic analysis).

115 *See, e.g., supra* note 43 and accompanying text.

116 We refer to traditional cost-benefit analysis to differentiate the status quo from cost-benefit analysis where utilitarian or prioritarian weights are applied to the costs and benefits of different groups before aggregation, as described below.

117 *See* below in the discussion of utilitarian and prioritarian weights that income is the default, but not necessarily the only, basis for weights. Weights could also consider attributes like health status. *See infra* p. 31–32.

118 *See* e.g., Marc Fleurbaey & Rossi Abi-Rafeh, *The Use of Distributional Weights in Benefit-Cost Analysis: Insights from Welfare Economics,* 10 Rev. Env't Econ. & Pol'y 286, 289 ("Interpersonal comparisons have long been considered problematic because they are associated with difficult value judgments. Although the Pareto principle, which is so popular in economics, is itself a value judgment, it seems easy to defend. In contrast, dealing with the conflicting interests of winners and losers involves defining who is worse off, or more deserving, and this is clearly no simple task.").

[119] Phosphoric Acid Manufacturing and Phosphate Fertilizer Production RTR and Standards of Performance for Phosphate Processing, 80 Fed. Reg. 50,386 (Aug. 19, 2015).

[120] *Id.* at 50,430.

[121] *Id.*

[122] EPA determined this rule to not be significant under Executive Order 12,866. *Id.* at 50,431.

[123] Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands, 80 Fed. Reg. 16,188 (Mar. 26, 2015).

[124] Circular A-4, *supra* note 20, at 3.

[125] *Id.* at 2. The Circular uses nonmonetized and unquantified somewhat interchangeably, noting that "[a] non-quantified outcome is a benefit or cost that has not been quantified or monetized in the analysis." *Id.* at 3.

[126] Lisa A. Robinson et al., *Reference Case Guidelines for Benefit-Cost Analysis in Global Health and Development* xviii (2019), https://cdn1.sph.harvard.edu/wp-content/uploads/sites/2447/2019/05/BCA-Guidelines-May-2019.pdf.

[127] *See* Circular A-4, *supra* note 20, at 27 (encouraging agencies to assess "detailed information on the nature, timing, likelihood, location, and distribution of the unquantified benefits and costs").

[128] *Id.* at 2.

[129] The inequality metrics discussed in this section can be applied in a variety of ways. This table merely illustrates the type of information each metric could provide that would be useful to a policymaker.

[130] Sam Harper et al., *Using Inequality Measures to Incorporate Environmental Justice into Regulatory Analyses*, 10 Int'l J. Env't Res. Pub. Health 4039, 4042 (citing Jonathan Levy et al., *Quantifying the Efficiency and Equity Implications of Power Plant Air Pollution Control Strategies in the United States*, 115 Env't Health Perspect. 743 (2007)); Jonathan Levy et al., *Evaluating Efficiency-Equality Tradeoffs for Mobile Source Control Strategies in an Urban Area*, 29 Risk Analysis 34 (2009); Neal Fann et al., *Maximizing Health Benefits and Minimizing Inequality: Incorporating Local-Scale Data in the Design and Evaluation of Air Quality Policies*, 31 Risk Analysis 908 (2011).

[131] Harper et al., *supra* note 130, at 4041.

[132] E.g., Urban Inst., *Segregation Measures*, https://www.urban.org/research/data-methods/data-analysis/quantitative-data-analysis/segregation-measures (last visited June 28, 2021).

[133] U.S. Census Bureau, *Income Inequality Metrics*, https://www.census.gov/topics/income-poverty/income-inequality/about/metrics.html (last visited June 28, 2021).

[134] *See* Robert Dorfman, *A Formula for the Gini Coefficient*, 61 Rev. Econ. Stat. 146 (1979); Frank Cowell, Measuring Inequality (1995).

[135] *Id.* at 147.

[136] *Id.* (citing Corrado Gini, *Variabilità e Mutabilità*, J. Econ. Ineq. (1912)).

[137] James Boyce et al., Measuring Environmental Inequality, 124 Ecol. Econ. 114, 118 (2016).

[138] *See, e.g.,* Daniel L. Millimet & Daniel Slottje, *Environmental Compliance Costs and the Distribution of Emissions*, 42 J. Regul. Sci. 105 (2002) (using Gini coefficient to assess how uniform increases in federal environmental standards impact the distribution of environmental hazards).

[139] Jonathan Levy et al., *Incorporating Concepts of Inequality and Inequity into Health Benefits Analysis*, 5 Int'l J. Equity Health 1, 10 (2006).

[140] *See* Harper et al., *supra* note 130, at 4052 for a detailed discussion on the Atkinson Index.

[141] Levy et al., *supra* note 139, at 10. We note that other tools discussed in this section incorporate those judgments implicitly (e.g., by excluding a factor that represents societal preferences about inequality).

[142] *Id.*

[143] *See* U.S. Census Bureau, *Theil Index*, https://www.census.gov/topics/income-poverty/income-inequality/about/metrics/theil-index.html (last visited June 28, 2021) ("The Theil index measures an entropic 'distance' the population is away from the 'ideal' egalitarian state of everyone having the same income.").

[144] *Id.*

[145] *Id.*

[146] Levy et al., *supra* note 139.

[147] Harper et al., *supra* note 130.

[148] Levy et al., *supra* note 139, at 10–12.

[149] Harper et al., *supra* note 130, at 4041 (2013) ("We are primarily concerned with characterizing the degree of inequality across social groups in defined health outcomes and how that inequality changes as a function of regulatory measures targeting environmental exposures.").

[150] *Id.* at 4039.

[151] *Id.* at 4043–46.

[152] *Id.*

[153] Boyce et al., *supra* note 137, at 115.

[154] Levy et al, *supra* note 139.

[155] According to these axioms, the metric should: "avoid value judgments about the relative importance of transfers at different percentiles of the risk distribution; incorporate health risk with evidence about differential susceptibility; include baseline distributions of risk; use appropriate geographic resolution and scope; consider multiple competing policy alternatives"; and satisfy the Pigou-Dalton transfer

principle (that an indicator "should not decrease when risk is transferred from a low-risk to high-risk person, and it should decrease when risk is transferred from a high-risk to low-risk person") and subgroup decomposability (an indicator "should be able to have total inequality divided into its constituent parts").

156 Neal Fann et al., *Maximizing Health Benefits and Minimizing Inequality: Incorporating Local-Scale Data in the Design and Evaluation of Air Quality Policies*, 31 Risk Analysis 908 (2011).

157 Erin T. Mansur and Glenn Sheriff, *On the Measurement of Environmental Inequality: Ranking Emissions Distributions Generated by Different Policy Instruments*, 8 J. Assoc. Env't & Res. Economists 721 (2021).

158 *Id.* at 1.

159 *Id.*

160 In his 2019 book, Matthew Adler dedicates a chapter on how to define/measure a unit of well-being. Measuring Social Welfare, *supra* note 113, ch. 2.

161 Fleurbaey & Abi-Rafeh, *supra* note 118.

162 *See, e.g.,* Matthew Adler & Koen Decancq, *Measuring Well-Being and Respect for Preferences*, in Prioritarianism in Practice (Matthew Adler and Ole Frithjof Norheim, eds., forthcoming).

163 *Id.*

164 Maddalena Ferranna et al., *Addressing the COVID-19 Pandemic: Comparing Alternative Value Frameworks* 19, (National Bureau of Economic Research, Mar. 29, 2021).

165 Measuring Social Welfare, *supra* note 113.

166 Matthew D. Adler, *Factoring Equity into Benefit-Cost Analysis*, Regul. Rev. (Apr. 26, 2021), https://www.theregreview.org/2021/04/26/adler-factoring-equity-benefit-cost-analysis/ [hereinafter Factoring Equity].

167 *See, e.g.,* Ferranna et al., *supra* note 163, at 6 (constructing weights considering that well-being depends on "consumption/income, longevity, and health status").

168 *See, e.g.,* Tamma Carleton & Michael Greenstone, *Updating the United States Government's Social Cost of Carbon* 25 (2021); Circular A-4, *supra* note 20, at 35 (explaining that one rationale for discounting is that "if consumption continues to increase over time, as it has for most of U.S. history, an increment of consumption will be less valuable in the future than it would be today, because the principle of diminishing marginal utility implies that as total consumption increases, the value of a marginal unit of consumption tends to decline").

169 Her Majesty's Treasury, T*he Green Book: Central Government Guidance on Appraisal and Evaluation* (2020), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938046/The_Green_Book_2020.pdf [hereinafter UK Greenbook].

170 *Id.* at 97.

171 *See* Matthew D. Adler, *Benefit-Cost Analysis and Distributional Weights: An Overview*, 10 Rev. Env't Econ. & Pol'y 264 (2016) [hereinafter BCA and Distributional Weights]; Factoring Equity, *supra* note 165.

172 Adler explains the family of prioritarian social welfare functions at length, but very simply, they are tools that can be used when a decisionmaker places value on improving the well-being of the worst-off, even if that leads to larger decreases in well-being to the best-off. Measuring Social Welfare, *supra* note 113, at 88.

173 *See, e.g.,* Raymond Fisman, Ilyana Kuziemko & Silvia Vannutelli, *Distributional Preferences in Larger Groups: Keeping up with the Joneses and Keeping Track of the Tails*, 19 J. Euro. Econ. Assoc. 1407 (2021).

174 Frank Venmans & Ben Groom, S*ocial Discounting, Inequality Aversion, and the Environment*, 109 J. Env't Econ. & Mgmt. 1 (2021).

175 For instance, Fisman et al., *supra* note 172, use different models to understand what value an individual may place on greater equality. The authors also discuss aversion-to-inequality models more generally. This study in particular looks at "the role of others' payoffs in choosing distributional outcomes." *Id.* at 1409. In other words, the authors can "distinguish, for example, whether individuals put more weight on reducing inequality at extreme income levels such as the top and bottom, or focus on inequality nearer to the subject's own income." *Id.* Their findings explain some anecdotal evidence regarding society's aversion to inequality, like why the top one percent of earners are an easier target than those who are extremely well-off but lower down on the income scale for higher tax rates. *Id.* at 1408.

176 *See* BCA and Distributional Weights, *supra* note 170, at 271 (explaining that defining the inequality aversion parameter can also reflect "the moral preferences" of a decisionmaker).

177 As we note above, using race as a factor in decisionmaking may raise constitutional issues. *See supra* note 114 and accompanying text.

178 *See, e.g.,* Fleurbaey & Abi-Rafeh, *supra* note 118, for a brief overview of this literature.

179 Hemel, *supra* note 102.

180 David A. Weisbach, *Distributionally Weighted Cost-Benefit Analysis: Welfare Economics Meets Organizational Design*, 7 J. Legal Analysis 151 (2015).

181 *See, e.g.,* BCA and Distributional Weights, *supra* note 170, at 278 ("The use of distributional weights does raise questions of institutional role. An unelected bureaucrat might feel that it would be legally problematic, or democratically illegitimate, for her to specify weights."); *see also* Fleurbaey & Abi-Rafeh, *supra* note 118, at 289.

182 *See, e.g.,* Robinson et al., *supra* note 33.

183 In a new working paper, Harvard Professor and former OIRA administrator Cass Sunstein argues that "courts . . . should tread lightly" when making determinations about whether the use of a social welfare function-based approach to regulatory analysis is arbitrary. Cass R. Sunstein, *Arbitrariness Review (With Special Reference to the Social Cost of Carbon)* (Harvard Kennedy School working paper, June 26, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3874312.

184 Measuring Social Welfare, *supra* note 113, at 213.

185 *Id.* at 214 (arguing that the law likely enables agencies to choose between a social welfarist approach and a traditional cost-benefit analysis approach).

186 Factoring Equity, *supra* note 165.

187 Exec. Order 13,985 § 3.

188 This section draws significantly from Revesz, *supra* note 7, and Jason Schwartz, Inst. for Pol'y Integrity, *Enhancing the Social Benefits of Regulatory Review* 11–12 (2020), https://policyintegrity.org/files/publications/Enhancing_the_Social_Benefits_of_Regulatory_Review.pdf.

189 *See* Jayni Hein, Inst. for Pol'y Integrity, *A New Way Forward on Climate Change and Energy Development for Public Lands and Waters* 12 (Sept. 2020) (proposing that Interior "identify renewable resource generation potential in areas that have experienced or are expected to experience a decline in fossil fuel production" and potentially prioritize those areas for such renewable development).

190 Revesz, *supra* note 7, at 1573.

191 *See Investing in Coal Communities, Workers, and Technology: The POWER+ Plan* 2–3 (2015), The President's Budget, https://obamawhitehouse.archives.gov/sites/default/files/omb/budget/fy2016/assets/fact_sheets/investing-in-coal-communities-workers-and-technology-the-power-plan.pdf.

192 Revesz, *supra* note 7, at 1550.

193 *Id.* at 1551.

194 Exec. Order No. 14,008 § 218.

195 *Id.* Membership in this interagency working group is comprised of the Secretaries of the Treasury, Interior, Agriculture, Commerce, Labor, Health and Human Services, Transportation, Energy, Education, the Administrator of the EPA, the Director of OMB, the Assistant to the President for Domestic Policy and the Director of the Domestic Policy Council, and the federal co-Chair of the Appalachian Regional Commission.

196 Exec. Order No. 14,008 § 218.

197 Interagency Working Group on Coal and Power Plan Communities and Economic Revitalization, *Initial Report to the President on Empowering Workers Through Revitalizing Energy Communities* (April 2021), https://netl.doe.gov/sites/default/files/2021-04/Initial%20Report%20on%20Energy%20Communities_Apr2021.pdf.

198 Exec. Order No. 14,008 § 218 (B)(ii).

199 *See* Revesz, *supra* note 7, at 1556–68 for a detailed argument for why the Office of the President is an appropriate conduit for these considerations.

200 Exec. Order 14,008 § 209.

201 *See* Revesz, *supra* note 7, at 1570–72 for a discussion of why OIRA is a suitable candidate to oversee federal government-wide distributional issues.

202 *Id.*

203 Exec. Order No. 14,008 § 220 (d),

204 Schwartz, *supra* note 187.

205 *Id.*

206 *See* Exec. Order No. 14,008 § 203.

207 Schwartz, *supra* note 187, at 12.

208 *Id.*

209 *Id.*

210 *See* Horst Rittel & Melvin Webber, *Dilemmas in a General Theory of Planning*, 4 Pol'y. Sci. 155, 160–61 (1973).

211 *See* Kreuter et al., *Understanding Wicked Problems: A Key to Advancing Environmental Health Promotion*, 31 Health Ed. Behavior 441, 443 tbl.1 (2004) (providing a breakdown of what makes a problem "wicked").

212 *Id.*

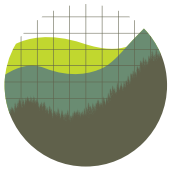
213 *Id.*

214 *See* OECD, *Systemic Thinking for Policy Making – The Potential of Systems Analysis for Addressing Global Policy Challenges in the 21st Century* at 3 (Gabriela Ramo & William Hynes eds., 2019), https://www.oecd.org/naec/averting-systemic-collapse/SG-NAEC(2019)4_IIASA-OECD_Systems_Thinking_Report.pdf ("[O]ur established approaches to analysis and policy are heavily based on the Western scientific tradition of reductionism—where we separate complex realities into specialized disciplines, fields of research, agencies and ministries, each focused on a part of the overall truth. We are then confronted by the need to pull all these disparate views together in order to organize an effective policy response.").

215 There are, of course, exceptions. For instance, EPA and NHTSA have jointly promulgated fuel-efficiency and greenhouse gas emission standards for motor vehicles in recent years.

216 Ramo & Hynes, *supra* note 213, at 3.

217 *See, e.g.,* Jeroen van der Heijen, *Systems Thinking and Regulatory Governance: A Review of the International Academic Literature* 15–16, (State of the Art in Regul. Governance Rsch. Paper 2020).



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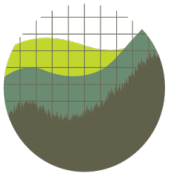
Attachment 2: DOE Comments



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

November 4, 2022

To: Hydrogen and Fuel Cell Technologies Office, Department of Energy

Subject: Clean Hydrogen Production Standard Draft Guidance

The Institute for Policy Integrity (Policy Integrity) at New York University School of Law and WattTime respectfully submit the following comments to the Department of Energy (DOE) regarding the draft guidance on the Clean Hydrogen Production Standard (CHPS). Policy Integrity is a non-partisan think tank dedicated to improving the quality of government decisionmaking through advocacy and scholarship in the fields of administrative law, economics, and public policy.[1] WattTime is a non-profit entity that aims to provide research, education, and assistance on the environmental benefits of electricity use timing, and advocates for a data-driven approach to solving environmental problems.

As DOE explained in the draft guidance, the Infrastructure Investment and Jobs Act (IIJA) requires DOE to establish the CHPS.[2] Then the Secretary of Energy must establish a program to support the development of at least four regional clean hydrogen hubs that demonstrably aid the achievement of the CHPS.[3] The Secretary shall also conduct activities to advance and support the establishment of a series of technology-cost goals oriented toward achieving the CHPS.[4] In the draft guidance, DOE proposed a CHPS of 4.0 kg CO_2e/kg H_2 from well to gate, which DOE arrived at in part by using the Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies Model (GREET) to analyze the target's feasibility.

These comments focus on two methodological points that DOE should consider when calculating the carbon intensity of hydrogen production. The proper resolution of these questions is critical for the implementation of the CHPS and the selection of the clean hydrogen hubs. DOE's decisions on these points may also be critical for the upcoming Department of Treasury rulemaking(s) for clean-hydrogen production tax credits, as DOE's final guidance may influence how the Department of Treasury resolves the same methodological issues in the implementation of the Inflation Reduction Act.[5]

First, to ensure accurate accounting of the emissions that result from producing hydrogen with grid electricity, DOE's final guidance should endorse the use of marginal emissions

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[1] These comments do not purport to represent the views, if any, of New York University School of Law.
[2] 42 U.S.C. § 16166(a).
[3] *Id.* § 16161a(b)(1).
[4] *Id.* § 16154(e)(1).
[5] *See* 26 U.S.C. § 45V.

rates with appropriate spatial and temporal granularity. While the default emissions assumptions of GREET may be reasonable for selecting the CHPS, assessing the performance of a given facility requires different data. Marginal emissions rates with appropriate granularity reflect the true emissions consequences of using grid electricity to produce hydrogen. Additionally, a marginal-emissions approach would promote the efficient allocation of resources by incentivizing clean hydrogen production when and where renewable generation would otherwise be curtailed. **An annual-average approach to estimating emissions, as used in GREET, could significantly miscalculate emissions from some hydrogen production, potentially undermining the goals of the CHPS by leading to the selection of deployments that do not demonstrably aid achievement of the target.**

Second, DOE's final guidance should state that renewable energy credits (RECs), power purchase agreements (PPAs), and other market structures may be used to characterize the carbon intensity of hydrogen production only when those instruments represent true avoided emissions. Thus, DOE should specify that these instruments may be used to reduce the carbon intensity of hydrogen production (1) only when there is additionality and (2) by an amount that is calculated by using a marginal-emissions approach.

I. Assessment of Whether a Deployment Demonstrably Aids Achievement of the CHPS

Question 3a: How should the GHG emissions of hydrogen commercial-scale deployments be verified in practice? What data and/or analysis tools should be used to assess whether a deployment demonstrably aids achievement of the CHPS?

Response: DOE should endorse the use of a temporally and spatially granular marginal-emissions approach for assessing whether a deployment demonstrably aids achievement of the CHPS, rather than the current default assumptions in GREET, which use an annual-average approach to estimating emissions.

DOE's final guidance should make clear that emissions from the use of grid electricity should be calculated based on a temporally and spatially granular marginal-emissions approach, rather than the annual average-emissions approach. **Accordingly, the final guidance should state that GREET, which uses an annual-average approach, should not be used to assess whether a deployment demonstrably aids the achievement of the CHPS unless and until any GREET successor model is updated to adhere to a marginal-emissions approach.** A marginal-emissions methodology is superior to the current GREET methodology for two main reasons. First, a marginal-emissions approach provides a more accurate estimate of the true emissions impact of additional hydrogen production using grid electricity. Second, using marginal emissions rates better incentivizes hydrogen production when and where renewable energy production would otherwise be curtailed.

A. Compared to the current GREET methodology, a marginal-emissions approach that is temporally and spatially granular would provide a more accurate estimate of the true emissions impact of using grid electricity to produce hydrogen.

A new electrolyzer creates additional electricity demand. The emissions related to this additional demand depend on the emissions intensities of the additional generating resources that are used to meet this demand. Marginal emissions rates show exactly this: the increase in emissions when electricity demand increases by an incremental amount at a given time and location.

Average Estimates Misrepresent the Actual Emissions Impact of Additional Load. A simple example demonstrates the necessity of a marginal-emissions approach for emissions accounting. Imagine that a new electrolyzer were located in the Pacific Northwest, where hydroelectric generation is abundant. If the emissions intensity of the hydrogen produced by that electrolyzer were calculated by looking at the average carbon intensity of the grid, the emissions intensity would be relatively low. But the real effect of the new load from the electrolyzer would be significantly different: Because there is not enough hydropower to meet the full regional demand for electricity, adding load in the Pacific Northwest from an electrolyzer would require more electricity generation from some other resource to meet total demand, likely a coal or natural gas plant. That plant would be the marginal plant in the region, and its emissions intensity would dictate the true emissions intensity of the electrolyzer. Thus, despite a low average emissions intensity of the regional grid, the actual carbon intensity of the hydrogen would be high because the additional generation needed for the electrolysis would come from fossil-fuel resources. GREET estimates electricity-use emissions by looking at the average grid mix, not the emissions of the marginal plant.[6] As the GREET documentation acknowledges, "the bulk average cannot be used within a marginal analysis, which seeks to identify the electrical facility on the margin that would be used if a new electrical load were added to the grid."[7]

Temporal Resolution Must Be Sufficiently Granular to Be Meaningful. Although any averaging approach would obscure the variability in emissions from electricity use, GREET's particular approach to averaging would lead to especially inaccurate estimates of carbon emissions because the model uses *annual* averages of the grid's carbon intensity.[8] Indeed, the GREET documentation recognizes that the timing of electricity use determines actual emissions and that the model "may not fully capture some time-of-use features" for flexible loads such as an electrolyzer that can intentionally time when it produces hydrogen.[9]

Hourly or sub-hourly marginal emissions rates change as frequently as the grid dispatch changes. Figures 1 and 2 show sample periods of marginal emissions for California Independent System Operator (CAISO) and Southwest Power Pool (SPP), and each figure depicts how the marginal emissions often oscillate between zero and either approximately 800 lbs CO_2/MWh in CAISO or

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[6] J. KELLY ET AL., ARGONNE NAT'L LAB'Y, UPDATING ELECTRIC GRID EMISSIONS FACTORS 1 (2016).
[7] *Id.*
[8] *See id.*
[9] *Id.*

1,400 lbs CO_2/MWh in SPP.[10] These variations indicate how dramatic the misestimation could be if an annual-average approach were used instead of an hourly or sub-hourly marginal-emissions approach. **For that reason, DOE's final guidance should endorse using temporally granular marginal emissions rates.**

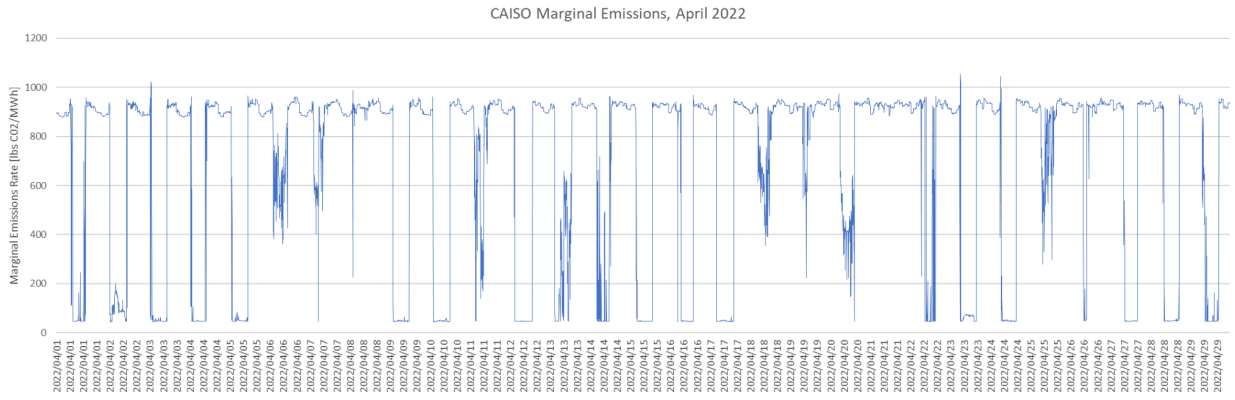

Figure 1: variability in CAISO marginal emissions

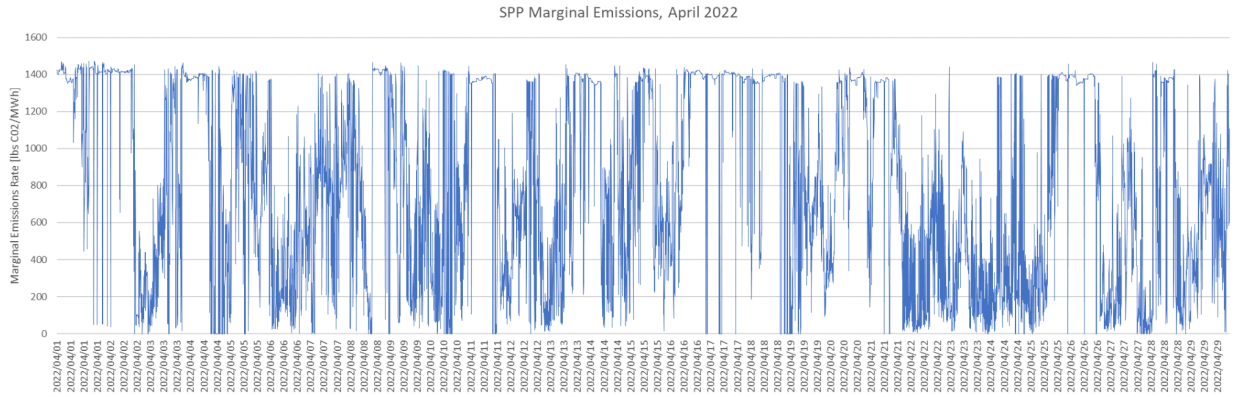

Figure 2: variability in SPP marginal emissions

Additionally, GREET's annual-average emissions rates reflect the grid mix from 2017,[11] even though the 2016 GREET update states that emissions data should be updated annually.[12] Using GREET to assess whether a deployment demonstrably aids the achievement of the CHPS would mean using data that does not fully reflect the rapidly evolving mix of generation resources. In contrast, many of the currently available marginal emissions rates use real-time data. **The age of the GREET data is a further reason why employing GREET's annual averages would lead to inaccurate estimates of carbon intensity of hydrogen production.**

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[10] Each figure reflects marginal emissions rates as modeled by WattTime. *See Methodology: How Does WattTime Calculate Marginal Emissions?*, WATTTIME, https://perma.cc/NTD8-F88L; WATTTIME, MARGINAL EMISSIONS MODELING: WATTTIME'S APPROACH TO MODELING AND VALIDATION (2022), https://perma.cc/6DMQ-NX7P.

[11] LONGWEN OU & HAO CAI, ARGONNE NAT'L LAB'Y, UPDATE OF EMISSION FACTORS OF GREENHOUSE GASES AND CRITERIA AIR POLLUTANTS, AND GENERATION EFFICIENCIES OF THE U.S. ELECTRICITY GENERATION SECTOR 2 (2020).

[12] KELLY, *supra* note 6, at 1.

Spatial Resolution Should Reflect Grid-Management Realities. Marginal emissions rates vary not only with time but also with geography. GREET divides the United States into large regions with different average carbon intensities, and these regions generally do not align with grid-operation boundaries.[13] In practice, for any given change in load, a balancing authority (of which there are 66) manages the grid by turning on or off the power plants within its area to meet the changes in load.[14] These decisions happen on the balancing-authority level, or on a smaller spatial scale because of operational constraints (most notably, limitations in transmission). As a result, when an electrolyzer draws electricity from the grid to produce hydrogen, the carbon intensity will depend on where that electrolyzer is located. Figure 3 depicts the spatial variation in marginal emissions rates at a representative moment in time, as modeled by WattTime.[15] **Given this variability, DOE should endorse the use of marginal emissions rates that align with the footprints of balancing authorities, or with even smaller areas when available, to better reflect the actual emissions caused by generating hydrogen with electricity.**

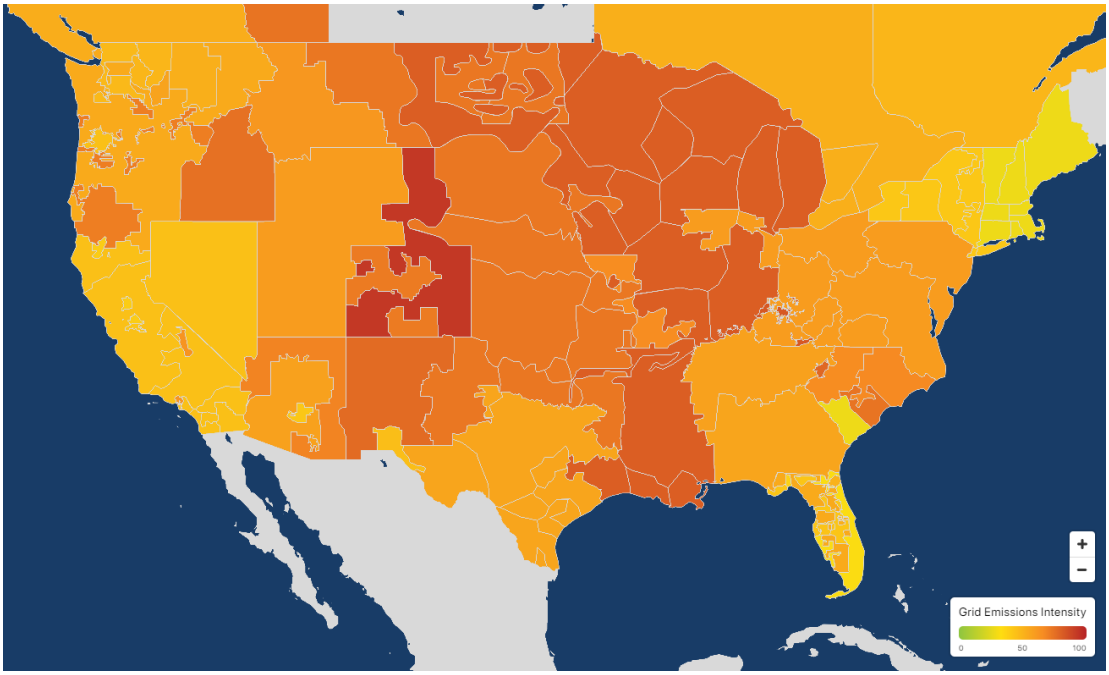

Figure 3: spatial variability in marginal emissions rates

B. <u>Using marginal emissions rates would better incentivize hydrogen production when and where there is more renewable energy curtailment.</u>

When clean resources are being curtailed, the marginal emissions rate is zero for that region because any additional demand would be met by clean resources that would have otherwise been curtailed. Many regions of the US grid have an oversupply of renewable generation during

[13] *See id.* at 2–3.
[14] *See U.S. Electric System Is Made Up of Interconnections and Balancing Authorities*, U.S. ENERGY INFO. ADMIN. (July 20, 2016), https://perma.cc/5XWJ-WT8X.
[15] *See supra* note 10; *see also Grid Emissions Intensity by Electric Grid*, WATTTIME, https://www.watttime.org/explorer/#3.89/43.6/-111.64 (last visited Oct. 25, 2022).

certain periods. But the periods when consuming electricity causes no emissions are intermittent and determined by the specific generating resources in a region.

If DOE were to measure the carbon intensity of grid electricity based on temporally and spatially granular marginal emissions rates, electrolyzers would be incentivized to locate in regions that experience curtailment and to produce during periods of curtailment. That outcome would reduce total costs to society by aligning hydrogen production with available clean electricity that would have otherwise gone to waste.

Figure 4 illustrates the growing magnitude of curtailment and thus the potential to intentionally pair electrolysis with excess clean generation under a marginal-emissions approach.

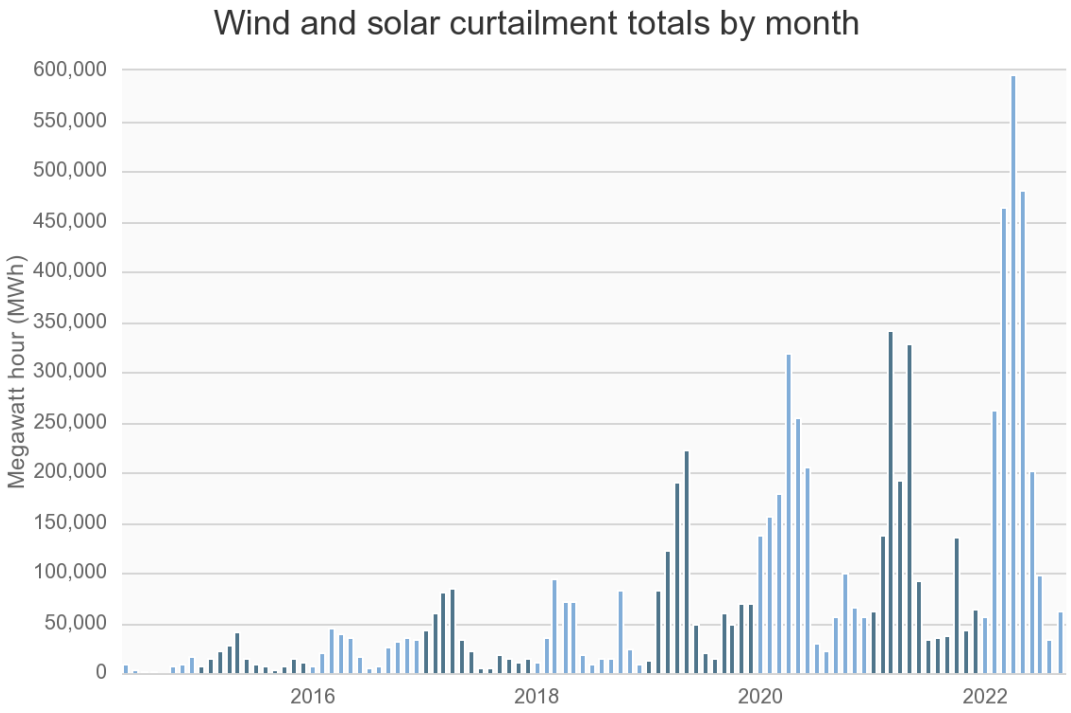

Figure 4: CAISO Curtailment[16]

C. A marginal-emissions approach would be administrable.

A marginal-emissions approach would be administrable because marginal emissions rates are available from a variety of sources. PJM Interconnection publishes granular marginal-emissions rates through its data platform,[17] and other balancing authorities are also beginning to provide similar data.[18] Granular and real-time marginal estimates are also available from other research

[16] *Managing Oversupply*, CAISO, https://perma.cc/LG6T-U2SK (select "all" from the menu under "view").
[17] *Five Minute Marginal Emission Rates*, PJM Interconnection, https://dataminer2.pjm.com/feed/fivemin_marginal_emissions/definition (last visited Oct. 25, 2022).
[18] Karen Palmer et al., RESOURCES FOR THE FUTURE, OPTIONS FOR EIA TO PUBLISH CO_2 EMISSIONS RATES FOR ELECTRICITY 21–22 (2022), https://perma.cc/6VAA-JEQX; *Dispatch Fuel Mix*, ISO New England, https://www.iso-ne.com/isoexpress/web/reports/operations/-/tree/gen-fuel-mix (last visited Oct. 25, 2022) (marginal fuel; see "marginal flag string"); *Fuel on Margin*, SPP, https://marketplace.spp.org/pages/fuel-on-margin (last visited Oct. 25,

and academic sources like WattTime, as evidenced by Figures 1, 2, and 3.[19] The Energy Information Administration is also in the process of releasing real-time or near-real-time marginal emissions data.[20]

II. Characterization of Emissions Intensity Using RECs and Other Market Structures

Question 3c: Should renewable energy credits, power purchase agreements, or other market structures be allowable in characterizing the intensity of electricity emissions for hydrogen production? Should any requirements be placed on these instruments if they are allowed to be accounted for as a source of clean electricity (e.g. restrictions on time of generation, time of use, or regional considerations)? What are the pros and cons of allowing different schemes? How should these instruments be structured (e.g. time of generation, time of use, or regional considerations) if they are allowed for use?

Response: When calculating the carbon intensity of hydrogen in light of RECs, PPAs, and other market structures, DOE should accurately account for the net emissions associated with hydrogen production in light of those instruments.

If electrolyzers seek to use RECs, PPAs, or other market structures to characterize the carbon intensity of hydrogen produced with grid electricity, DOE should rely on rigorous carbon accounting principles to ensure accurate estimates of the hydrogen's true carbon intensity in light of those instruments. First, these instruments must satisfy the principle of additionality by representing the production of energy that would not have otherwise happened. Second, the avoided-emissions value of any instrument should reflect the true quantity of displaced carbon emissions that is attributable to the energy represented by the instrument, which will depend on the timing and location of the clean generation.

Renewable Generation Should Be Additional. If an electrolyzer purchases a REC to effectively offset the carbon intensity of the electricity that was used to produce hydrogen, the electrolyzer must show that the clean production associated with the REC is additional to the grid, not simply electricity that was always going to be generated and used by some other consumer.[21] Without this requirement, the use of a REC could merely reshuffle the allocation of electricity on paper and fail to genuinely offset any emissions resulting from the hydrogen

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2022) (real-time marginal fuel); *Real-Time Fuel on the Margin*, Midcontinent Independent System Operator, https://www.misoenergy.org/markets-and-operations/real-time--market-data/market-reports/#nt=%2FMarketReportType%3AReal-Time%2FMarketReportName%3AReal-Time%20Fuel%20on%20the%20Margin%20(xls)&t=10&p=0&s=MarketReportPublished&sd=desc (last visited Oct. 25, 2022) (real-time marginal fuel).

[19] Palmer, *supra* note 18, at 22–25; Kyle Siler-Evans, Inês Lima Azevedo & M. Granger Morgan, *Marginal Emissions Factors for the U.S. Electricity System*, 46 ENV'T SCI. & TECH. 4742 (2012).

[20] *See* 42 U.S.C. § 18772(a)(2)(B) (requiring the Energy Information Administration to establish an online database that includes, where available, the estimated marginal greenhouse gas emissions per megawatt hour of electricity generated); Palmer, *supra* note 18.

[21] *See* Michael Gillenwater, *Redefining RECs—Part 1: Untangling attributes and offsets*, 36 ENERGY POL'Y, 2109, 2112-2113 (2008).

production.[22] Because the electrolyzer is actually adding load to the grid, which may be met with fossil-fuel resources, allowing RECs to offset electric load on a 1:1 basis regardless of additionality might lead to misclassifying high-emission hydrogen production as demonstrably aiding achievement of the CHPS. The same additionality principles apply to PPAs. If a clean generation resource has already been built, then its power was always going to be sold to some consumer. A PPA for this energy would represent the mere reallocation of energy on paper without doing anything to offset the electrolyzer's new load.

Accordingly, DOE's final guidance should make clear that, before an electrolyzer can use market structures to characterize the carbon intensity of hydrogen, the electrolyzer should be required to demonstrate that the associated clean generation would not have been built but for the prospect that the clean generator could sell the RECs to or enter into a PPA with the electrolyzer.[23] Additionality is not necessarily satisfied by contracting with a clean generator that has yet to be built. In the context of RECs, if the associated generation would have happened irrespective of any REC sales, the RECs sold by that generator would not represent avoided emissions that could be claimed by an electrolyzer. Thus, no offset purchased under these circumstances should be recognized vis-à-vis the CHPS. In these comments, we do not take a stance on which of the multiple tests for assessing additionality is most appropriate for implementing the CHPS.[24]

Offset Rules Should Attend to Marginal Emissions Rates. Assuming additionality has been satisfied, there are further accounting principles that DOE should adopt in the final guidance to ensure that offsets purchased by electrolyzers are counted in accordance with the actual emissions reductions that they represent. As explained above, because marginal emissions rates vary by time and location, the emissions displaced by clean energy generation also vary widely depending on the generation mix at a given time and place.[25] The emissions reduction associated with a renewable generator for a given period is the product of (a) the amount of power generated and (b) the marginal emissions rate when and where the renewable generator was operating.[26]

If a clean generator sells RECs (or other offsets) based on energy produced when the marginal generator was coal or natural gas, those RECs would be associated with a high amount of avoided emissions because that same quantity of energy would have been supplied by fossil fuels if the clean generator had not been operating. Thus, an electrolyzer could purchase those RECs

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[22] *See* GOV'T ACCOUNTABILITY OFF., GAO-11-345, OPTIONS FOR ADDRESSING CHALLENGES TO CARBON OFFSET QUALITY 8 (2011), https://perma.cc/6FUU-ZEG6.

[23] *See id.* at 3 ("An offset is additional if it would not have occurred without the incentives provided by the offset program.").

[24] *See id.* at 18–21 (comparing different approaches for testing additionality).

[25] *See, e.g.,* Duncan S. Callaway, Meredith Fowlie & Gavin McCormick, *Location, Location, Location: The Variable Value of Renewable Energy and Demand-Side Efficiency Resources,* 5 J. ASS'N ENV'T & RES. ECONS. 39 (2018).

[26] WATTTIME, ACCOUNTING FOR IMPACT: REFOCUSING GHG PROTOCOL SCOPE 2 METHODOLOGY ON 'IMPACT ACCOUNTING' 8 (2022), https://perma.cc/9B6W-BJFQ; Aleksandr Rudkevich & Pablo A. Ruiz, *Locational Carbon Footprint of the Power Industry: Implications for Operations, Planning and Policy Making, in* HANDBOOK OF CO_2 IN POWER SYSTEMS 131 (Qipeng P. Zheng et al., eds. 2012).

and use them to lower the carbon intensity of hydrogen produced with grid electricity. In contrast, when a clean generator produces electricity when renewable resources are being curtailed, the clean generator is displacing no emissions, and an electrolyzer cannot claim any emissions offset based on a REC associated with that energy production. As discussed above, granular marginal estimates are available that would facilitate the calculation of the true avoided-emissions value of RECs based on time and geography. The same accounting principles would apply if an electrolyzer has a financial/virtual PPA involving the purchase of clean energy.[27]

For physical PPAs, assuming additionality has been met, clean power that is physically delivered and used by the electrolyzer within a single region at the time of hydrogen production would have an emissions intensity of zero.[28] But if a clean generator cannot itself source all the power contracted for under a physical PPA, the carbon intensity of the electricity procured from third parties would depend on the resources called upon to fill the deficit.[29] For additional energy purchased on the wholesale market, the carbon intensity would be that of the marginal plant for the region at the moment of generation.

Respectfully Submitted,

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[27] *See Financial PPA*, EPA (Feb. 25, 2022), https://perma.cc/67XS-ZQBL.
[28] *See Physical PPA*, EPA (Feb. 25, 2022), https://perma.cc/8YA3-F9GE.
[29] *See* AM. COUNCIL ON RENEWABLE ENERGY, *Renewable Energy PPA Guidebook for Corporate and Industrial Purchasers* 11-12 (2016), https://perma.cc/LJ3K-GZDY.