Institute *for* Policy Integrity

NEW YORK UNIVERSITY SCHOOL OF LAW

Testimony of Peter Howard, Ph.D., Economics Director, and Denise Grab, Western Regional Director, Institute for Policy Integrity, New York University School of Law[1]

Before the New Jersey Legislature
Senate Environment and Energy Committee
Assembly Environment and Solid Waste Committee

April 25, 2019

Thank you for inviting us to testify before these Joint Committees. Peter Howard, Ph.D., is the Economics Director at the Institute for Policy Integrity whose fields of expertise includes climate economics. He received his Ph.D. in Agricultural and Resource Economics from University of California–Davis. He has published in academic journals on the social cost of greenhouse gases, including in *Science*, *Nature*, *Environmental and Resource Economics*, *Harvard Environmental Law Review*, and the *Columbia Journal of Environmental Law*. His work has been cited by many prominent organizations, including the 2016 Interagency Working Group on the Social Cost of Greenhouse Gases and the National Academy of Sciences' Committee on the Social Cost of Carbon. Denise Grab is the Western Regional Director at the Institute for Policy Integrity, where she has written academic articles and reports and has advised regulators in multiple states on the use of the social cost of greenhouse gases in policy. She received a J.D. from Yale Law School and a Master of Environmental Management degree from the Yale School of Forestry and Environmental Studies.

The Institute for Policy Integrity at New York University School of Law ("Policy Integrity") is a nonpartisan 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 has particular expertise in the application of the social cost of greenhouse gases to state and federal decisionmaking, having written dozens of academic articles and reports and commented in hundreds of regulatory proceedings on the topic.

We applaud the New Jersey legislature's recognition of the importance of considering the costs of greenhouse gas emissions, both by holding this hearing and enacting legislation like

[1] No part of this document purports to present New York University School of Law's views, if any.

Senate Bill 2313 in the 2018 legislative session.[2] We encourage the legislature to extend application of the social cost of greenhouse gases into other types of proceedings.

This testimony will address: (1) why consideration of the social cost of greenhouse gases in state decisionmaking is important; (2) different ways in which states can and have applied a social cost of greenhouse gases; and (3) approaches to calculating the social cost of greenhouse gases.

I. Importance of Considering the Social Cost of Greenhouse Gases in State Policy

Climate change is already causing quantifiable and monetizable damages, such as increased extreme storm activity and coastal destruction. In both the near future and over the long term, unabated climate change will cause significant impacts to both market and nonmarket sectors, including agriculture, forestry, water, energy use, sea-level rise, human health, and ecosystem services.

New Jersey is also already experiencing these damages. Average annual temperature has already risen 2.2°C in New Jersey since 1900, along with the frequency and intensity of heavy rainfall, and these increases will continue at a higher rate than other U.S. regions. Because of rising sea levels and more extreme precipitation events, New Jersey will also experience damages from loss of wetlands, beach erosion, saltwater intrusion, flooding risk, and coastal home and infrastructure destruction. New Jersey will also experience a myriad of other impacts, including impacts to health from higher temperatures driving heat-related deaths, increased ozone formation, and expanded seasons and geographic extents of vector borne diseases; and ocean acidification and higher ocean temperatures negatively impacting fisheries.[3]

The social cost of greenhouse gas metrics—such as the Social Cost of Carbon and Social Cost of Methane—translate into dollars the amount of damage that will be caused by each ton of emissions of that pollutant.[4] Monetizing the impacts of emissions changes can help agencies and the public compare these emissions costs against other costs and benefits. Without such values, decisionmakers and the public are faced with imperfect information. When impacts are translated into the common metric of money, decisionmakers can more easily compare society's preferences for competing priorities, and the public can more readily understand the consequences of a regulatory choice.

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[2] *See* N.J. STAT. ANN. § 48:3-87.3 (b)(8) (determining that the "social cost of carbon, as calculated by the U.S. Interagency Working Group on the Social Cost of Carbon in its August 2016 Technical Update, is an accepted measure of the cost of carbon emissions").

[3] *See* U.S. GLOBAL CLIMATE RESEARCH PROGRAM, CLIMATE SCIENCE SPECIAL REPORT 10, 195, 218, 352 (2017), *available at* https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf; U.S. EPA, WHAT CLIMATE CHANGE MEANS FOR NEW JERSEY (2016), https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-nj.pdf; N.J. Dep't of Envtl. Prot., NEW JERSEY CLIMATE DATA, https://www.nj.gov/dep/climatechange/data.html (last visited Apr. 24, 2019).

[4] Each ton of methane and nitrous oxide warms the climate substantially more than each ton of carbon dioxide. In addition, the pollutants persist in the atmosphere for different lengths of time, resulting in different social cost metrics for each.

If an analysis discusses the externalities of emissions only qualitatively, decisionmakers and the public will both tend to minimize the significance of the effects. In general, non-monetized effects are often irrationally treated as worthless.[5] This may be especially true when some effects (like compliance costs and fuel savings) are monetized, while other effects (like climate and health benefits) are discussed only quantitatively or qualitatively.

It also may be especially difficult for the public and decisionmakers to give appropriate consideration to climate effects that are only presented through estimates of emissions volumes.[6] After all, New Jersey's 101 million metric tons of greenhouse gases (measured in carbon dioxide equivalent) emitted per year[7] may seem like a small fraction of global emissions,[8] and reducing that figure down to, for example, 99 million metric tons per year may seem like an insignificant difference. Specifically, while decisionmakers and the public certainly can tell that 99 million metric tons per year of carbon dioxide is less than 101 million metric tons, without any context it may be difficult to weigh the climate consequences of that 2-million-ton reduction.[9] Yet the monetized expected benefits of avoiding the climate damages from those 2 million metric tons of carbon dioxide—about $100 million per year[10]—is less easily overlooked. Monetization makes clear the significance of the emissions reduction.

Such context would be helpful to New Jersey agencies in analyzing their regulatory choices as well as in explaining the climate benefits of the decision to New Jersey citizens. New Jersey should monetize environmental and health benefits, as it is useful to decisionmakers and the public.

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[5] Richard L. Revesz, *Quantifying Regulatory Benefits,* 102 CAL. L. REV. 1424, 1434-35, 1442 (2014).

[6] As the U.S. Environmental Protection Agency's website explains, "abstract measurements" of so many tons of greenhouse gases can be rather inscrutable for the public, unless "translat[ed] . . . into concrete terms you can understand." EPA, GREENHOUSE GAS EQUIVALENCIES CALCULATOR, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last updated Sept. 2017).

[7] N.J. Dep't of Envtl. Prot., NEW JERSEY CLIMATE DATA, https://www.nj.gov/dep/climatechange/data.html (last visited Apr. 24, 2019).

[8] Ctr. for Climate Change & Energy Solutions, GLOBAL EMISSIONS, https://www.c2es.org/content/ international-emissions/ (last visited Jan. 31, 2018) (estimating global carbon dioxide emissions as approaching 35 billion metric tons per year by 2020).

[9] *See* Cass R. Sunstein, *Probability Neglect: Emotions, Worst Cases, and Law*, 112 YALE L.J. 61, 63, 72 (2002); Daniel Kahneman et al., *Economic Preferences or Attitude Expressions? An Analysis of Dollar Responses to Public Issues*, 19 J. RISK & UNCERTAINTY 203, 212-213 (1999) (describing mental heuristics called "probability neglect" and "scope neglect" that can cause people to underestimate climate risks).

[10] The Interagency Working Group's central estimate of the social cost of carbon for year 2020 emissions is $42 in 2007$. INTERAGENCY WORKING GRP. ON SOCIAL COST OF GREENHOUSE GASES, TECHNICAL SUPPORT DOCUMENT: TECHNICAL UPDATE OF THE SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12,866, at 4 (2016), *available at* https://www.obamawhitehouse.gov/sites/default/files/omb/inforeg/scc_tsd_final_clean_8_26_16.pdf [hereinafter IWG 2016]. Using the CPI Inflation Calculator, that equals about $50 in 2017$. A reduction of 2 million metric tons per year multiplied by $50/ton equals $100 million (undiscounted). As the social cost of carbon increases over time, the benefit of an annual reduction of 2 million tons per will increase, as well.

II. How States Can Incorporate a Social Cost of Greenhouse Gases into Decisionmaking

States can use a social cost of greenhouse gases in a wide variety of energy and environmental decisionmaking. Our report, *The Social Cost of Greenhouse Gases and State Policy: A Frequently Asked Questions Guide*, is attached as an exhibit to this testimony, and provides additional detail on how states can use the social cost of greenhouse gases in policymaking.[11] Our *Cost of Carbon Pollution* website, https://costofcarbon.org, includes an updated list of ways in which state agencies are currently using the social cost of greenhouse gases. We summarize our analysis and highlight particular examples here.

- <u>Rulemakings that address greenhouse gas emissions directly</u>

States can use the social cost of greenhouse gases to value the benefits and costs of proposed regulatory actions that would change the quantity of greenhouse gas emissions. Such analysis can be used in formal cost-benefit analyses or informally to evaluate options throughout the regulatory process.[12] The social cost of greenhouse gases can be used to set the stringency of a greenhouse-gas reduction target or to evaluate different proposed regulatory alternatives to determine which is most beneficial to the public.

New Jersey's agencies could use the social costs of greenhouse gases in many types of proceedings. For example, agencies could use the Social Cost of Carbon to set the stringency of an emissions reduction target for the electricity, transportation, industrial, or agricultural sector. Agencies could use the Social Cost of Methane to assess the impacts of a regulation to require the recapture of fugitive methane emissions at landfills.

Other leading state agencies have already begun applying the social cost of greenhouse gas emissions in rulemakings. For example, the California Air Resources Board applies the Social Cost of Carbon in its 2030 Climate Scoping Plan to evaluate the proposed alternative reduction approaches.[13] CalRecycle (a state agency) has used the Social Cost of Methane values to assess its regulation to reduce of methane emissions from landfills,[14] and the California Air Resources Board and the California Public Utilities Commission have discussed the potential for using the Social Cost of Methane in rulemakings involving

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[11] ILIANA PAUL, ET AL., THE SOCIAL COST OF GREENHOUSE GASES AND STATE POLICY: A FREQUENTLY ASKED QUESTIONS GUIDE (2017), available at https://policyintegrity.org/files/publications/SCC_State_Guidance.pdf. For New Jersey-specific analysis, see Zach Froio et al., *At What Co$t?: Incorporating the Social Cost of Carbon into State-Level Policies in New Jersey* (2018).

[12] Note that cost-benefit analysis is most useful when applied consistently across different policies. To the extent that resource capacity limits agencies' ability to do so, *see id.* at 17, 34–36, New Jersey might consider expanding that capacity.

[13] *See* CALIFORNIA AIR RESOURCES BOARD, CALIFORNIA'S 2017 CLIMATE CHANGE SCOPING PLAN 39–46 (2017), *available at* https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf. Note that AB 197 instructs the agency to "consider the social costs of the emissions of greenhouse gases" when developing rules, regulations, and plans to achieve greenhouse gas emissions reductions.

[14] CALRECYCLE, PROPOSED REGULATION FOR SHORT-LIVED CLIMATE POLLUTANTS: ORGANIC WASTE METHANE EMISSIONS, STANDARDIZED REGULATORY IMPACT ASSESSMENT 37-38 (2019), *available at* https://www.calrecycle.ca.gov/docs/cr/laws/rulemaking/slcp/impactassessment.pdf.

emissions standards for crude oil and natural gas facilities and methane leakage from natural gas pipeline facilities.[15]

- <u>Electricity ratemaking and regulation</u>

State electricity regulators can use the social cost of greenhouse gases to account for the climate effects associated with different types of proposed generation resources. So far, ten states, including New Jersey, have begun using monetary estimates of climate damages in electricity proceedings. These state regulators have used the social cost of greenhouse gases in three main ways: utility resource planning, compensation for low- or zero-emissions resources, and cost-benefit analysis frameworks. As a state with a deregulated electricity market, the first category (utility resource planning) does not apply to New Jersey.

With respect to the second category, resource compensation programs, state utility regulators use these programs to compensate low-carbon generators for their emissions reduction benefits. These programs go by different names for different types of generation resources and in different states: for example, zero emission credit (ZEC) programs that compensate nuclear generators, and value of distributed energy resources (VDER) proceedings that compensate distributed energy resources (DERs). These programs share the common thread of paying money to electricity sources that reduce carbon dioxide pollution based on the value of the emissions they reduce.

New Jersey has begun developing a zero emission credit (ZEC) program that compensates nuclear generators for their emission reduction benefits.[16] In enacting that program, the legislature recognized that the "social cost of carbon, as calculated by the U.S. Interagency Working Group on the Social Cost of Carbon in its August 2016 Technical Update, is an accepted measure of the cost of carbon emissions."[17] Nonetheless, New Jersey designed its ZEC program "such that its costs are guaranteed to be significantly less than the social cost of carbon emissions avoided by the continued operation of selected nuclear power plants."[18] In order to fairly compensate all clean energy resources for their emissions reduction benefits, New Jersey should extend the ZEC compensation program to all non-emitting generation resources. The state could also increase the value of its credit to account for the

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[15] *See* CALIFORNIA AIR RESOURCES BOARD, FINAL STATEMENT OF REASONS FOR THE REGULATION FOR GREENHOUSE GAS EMISSION STANDARDS FOR CRUDE OIL AND NATURAL GAS FACILITIES 110 (2017), *available at* https://www.arb.ca.gov/regact/2016/oilandgas2016/ogfsor.pdf; Cal. Pub. Util. Comm'n, Proposed Decision Approving Natural Gas Leak Abatement Program Consistent with Senate Bill 1371, Rulemaking No. 15-01-008 at 135 (May 17, 2017) (noting that incorporation of the social cost of methane is a "long term objective" in the proceeding), *available at* http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M186/K437/186437714.PDF.

[16] *See* N.J. STAT. ANN. §§ 48:3-87.3 to 48:3-87.7.

[17] *See* N.J. Stat. Ann. §§ 48:3-87.3 (b)(8).

[18] *See id.*

full social cost of carbon (adjusted downward by the Regional Greenhouse Gas Initiative ("RGGI") allowance price).[19]

The third type of proceeding where states have valued climate damages is in developing cost-benefit tests, which have then been used to decide which distributed energy resources to permit utilities to develop.[20] In the past, these cost-benefit analysis frameworks had focused primarily on direct expenditures by the utilities and ratepayers, without considering broader costs to the public. Recently, utilities commissions have begun adopting societal cost test frameworks that consider effects on the public, including climate damages as reflected by the Social Cost of Carbon.[21]

As a neighboring deregulated state, New York offers a good model for how New Jersey might apply the social cost of greenhouse gases in its electricity proceedings. New York has begun using the Social Cost of Carbon to value climate damages in three different proceedings: (1) benefit-cost analysis for distributed energy resources under the state's Reforming the Energy Vision proceeding;[22] (2) resource compensation paid to nuclear generators via the Zero-Emissions Credit Program;[23] and (3) resource compensation paid to distributed energy resources to reflect the environmental value they provide to the grid as part of the Valuing Distributed Energy Resources program.[24]

For more detail on how states can apply a social cost of greenhouse gases in electricity proceedings, see our report, *Opportunities for Valuing Climate Impacts in U.S. State Electricity Policy*,[25] attached as an exhibit.

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[19] The most recent RGGI auction priced an allowance at about $5 per ton of carbon dioxide, while the Social Cost of Carbon is about $50 per ton. See Reg'l Greenhouse Gas Initiative, ALLOWANCE PRICES AND VOLUMES, https://www.rggi.org/auctions/auction-results/prices-volumes (last visited Apr. 24, 2019).

[20] *See* Denise A. Grab, *Balancing on the Grid Edge: Regulating for Economic Efficiency in the Wake of* FERC v. EPSA, 40 HARV. ENVTL. L. REV. F. 32, 35–37 (2016).

[21] *See, e.g.*, Cal. Pub. Util. Comm'n, Order Instituting Rulemaking to Create a Consistent Regulatory Framework for the Guidance, Planning, and Evaluation of Integrated Distributed Energy Resources, Rulemaking 14-10-003, Proposed Decision Adopting Cost-Effectiveness Analysis Framework Policies for All Distributed Energy Resources (Mar. 25, 2019), http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M274/K960/274960797.PDF.; N.Y. Pub. Serv. Comm'n, Order Establishing the Benefit Cost Analysis Framework, Case 14-M-0101 (Jan. 21, 2016) http://documents.dps.ny.gov/public/Common/ViewDoc.aspx? DocRef Id=%7bF8C835E1-EDB5-47FF-BD78-73EB5B3B177A%7d.

[22] *Id.*

[23] N.Y. Pub. Serv. Comm'n, Order Adopting a Clean Energy Standard 134, Case 15-E-0302 (Aug. 1, 2016), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRef Id={44C5D5B8-14C3-4F32-8399-F5487D6D8FE8}. Unlike New Jersey, New York has directly based its Zero Emissions Credit value on the Social Cost of Carbon. New York's program was recently upheld by the U.S. Court of Appeals for the Second Circuit, based in part on the fact that the credit value is tied to the Interagency Working Group's estimates of the social cost of carbon. Coalition for Competitive Elec. v. Zibelman, 906 F.3d 41, 51 (2d Cir. 2018), *cert. denied* (Apr. 15, 2019).

[24] N.Y. Pub. Serv. Comm'n, Order on Net Energy Metering Transition, Phase One of Value of Distributed Energy Resources, and Related Matters 15–16, Case 15-E-0751 (Mar. 9, 2017), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRef Id={5B69628E-2928-44A9-B83E-65CEA7326428}.

[25] DENISE A. GRAB ET AL., OPPORTUNITIES FOR VALUING CLIMATE IMPACTS IN U.S. STATE ELECTRICITY POLICY (2019), *available at* https://policyintegrity.org/files/publications/Pricing_Climate_Impacts.pdf.

- Environmental Impact Statements and Permitting

Another type of proceeding in which the social cost of greenhouse gases can help improve decisionmaking is evaluating environmental impact statements in conjunction with permitting for a proposed construction project. Application of the social cost of greenhouse gases can help New Jersey's Department of Environmental Protection to better understand the full scope of the impact of the proposed project.[26] Using the social cost of greenhouse gases is especially important when the environmental impact statement monetizes some impacts, such as projected revenue from the project, but not the greenhouse gas impacts.

The project reviewers can tailor the analysis to the particular type of project involved. For instance, the analysis for an intrastate gas pipeline could use the social cost of methane to assess the impact of potential leakage, while the analysis for a new highway project could use the social cost of carbon to assess the impact of emissions from additional vehicle miles traveled. For guidance on applying the social cost of greenhouse gases in an environmental impact statement in the analogous context of federal National Environmental Policy Act review, see Policy Integrity's report *Pipeline Approvals and Greenhouse Gas Emissions*.[27]

Other states have already begun incorporating the social cost of carbon into their assessments of proposed state projects. For example, the California Department of Transportation uses the social cost of carbon in its lifecycle and benefit-cost analyses for proposed highway and transit projects.[28]

- State agency procurement

State entities can use the social cost of greenhouse gases to evaluate purchasing options for state procurement. In deciding, for example, whether to renovate state buildings to be more energy efficient or whether to buy more low- or zero-emission state vehicles, agencies could include the social cost of greenhouse gases in the financial analysis of which options to select.

As an example, Washington State has developed guidance on using the social cost of greenhouse gases to evaluate energy efficiency and transportation options for state procurement. With Executive Order 14-04, Governor Inslee directed the state Department of Commerce to develop "a new statewide program to significantly improve the energy performance of both our public and private buildings," which, among other measures, would "[e]nsure that the cost-benefit tests for energy-efficiency improvements include full

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[26] Froio et al., *supra* note 11, at 28–30.

[27] Jayni Hein, Jason Schwartz, & Avi Zevin, *Pipeline Approvals and Greenhouse Gas Emissions* (2019), *available at* https://policyintegrity.org/files/publications/Pipeline_Approvals_and_GHG_Emissions.pdf; *see also, e.g.*, Inst. for Policy Integrity, Comments on Arctic Coastal Plain Draft EIS to U.S. Bureau of Land Management (Mar. 13, 2019) (describing how the social cost of carbon should be used in an environmental impact statement for a proposed oil and gas leasing plan), *available at* https://policyintegrity.org/documents/Arctic_Coastal_Plain_DEIS_Comments_2019.3.13-final.pdf.

[28] *See* Cal. Dep't of Transp., CALIFORNIA LIFE-CYCLE BENEFIT/COST ANALYSIS MODEL VOL. 4 at II-64 (2017), http://www.dot.ca.gov/hq/tpp/offices/eab/benefit_files/Cal-BCTechSupplementVol4v3.pdf; Cal. Senate Office of Research, *Social Cost of Carbon: Federal and California Activity*, POLICY MATTERS 6 (2018), https://sor.senate.ca.gov/sites/sor.senate.ca.gov/files/Policy%20Matters%20SCC%20Final.pdf.

accounting for the external costs of greenhouse gas emissions."[29] The order also instructed "[t]he Department of Commerce, in collaboration with the Departments of Enterprise Services and Ecology" to "evaluate incentives and life-cycle costs for the purchase of electric vehicles and other clean-fuel cars" and to "move forward with state procurement of these vehicles where the life-cycle costs and benefits are comparable, including consideration of the benefits of emission reductions."[30] The state Department of Commerce developed guidance to implement the governor's executive order, "recommend[ing] that all Washington State agencies use the most recent estimates produced by the federal interagency working group for the SCC," specifically the estimates using the 2.5% discount rate.[31]

- Setting carbon emissions caps or taxes

Environmental regulators or the legislature could also use the social cost of greenhouse gases to set a carbon emission cap or tax. New Jersey plans to rejoin the Regional Greenhouse Gas Initiative ("RGGI"), which will add an allowance price to electricity transactions in the state of about $5 per ton of carbon dioxide (in the most recent auction),[32] which is substantially lower than the Social Cost of Carbon (currently about $50). Optimally, the price of a carbon allowance or tax should be as high as the social cost of greenhouse gases, in order to make sure that the harms from emissions are fully internalized in the market. Therefore, a state-level effort to price carbon for electricity transactions should take into account the Social Cost of Carbon minus the RGGI price of carbon. No such modification would be necessary for putting a price on emissions from small generators, transportation, or other sectors that are not covered by RGGI.

III. Approaches for Calculating the Social Cost of Greenhouse Gases

Economists can estimate and monetize climate damages by linking together global climate models with global economic models, producing what are called integrated assessment models. These integrated assessment models can take a single additional unit of greenhouse gas emissions (whether emitted from driving a car or burning coal at a power plant) and calculate the change in atmospheric greenhouse concentrations, translate that change in concentration into a change in temperature, and model how that temperature change and associated weather changes will cause economic damages to agriculture, forestry, fisheries, energy, buildings and infrastructure, water, ecosystems, and human health. The resulting monetary estimate of how each additional unit of greenhouse gases will impact our health,

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[29] Exec. Order 14-04, Washington Carbon Pollution Reduction and Clean Energy Action 6 (Apr. 29, 2014), *available at* https://www.governor.wa.gov/sites/default/files/exe_order/eo_14-04.pdf.

[30] *Id.* at 7. *See also* WASH. ADMIN. CODE §§ 194-29-020 & 194-29-070 (requiring consideration of "the social cost of carbon emissions" in a lifecycle cost analysis to determine the extent to which a local government must meet its goal under REV. CODE WASH. § 43.19.648 of transitioning 100% of its vehicle fleet to electric or biofuel vehicles).

[31] Wash. Dep't of Commerce, THE SOCIAL COST OF CARBON 2–3 (2014), http://www.commerce.wa.gov/wp-content/uploads/2015/11/Energy-EV-Planning-Social-Cost-of-Carbon-Sept-2014.pdf.

[32] Reg'l Greenhouse Gas Initiative, ALLOWANCE PRICES AND VOLUMES, https://www.rggi.org/auctions/auction-results/prices-volumes (last visited Apr. 24, 2019).

our economic activity, our quality of life, and our overall well-being is called the social cost of greenhouse gases.

In 2009, a federal Interagency Working Group (IWG) was convened to develop consistent estimates of the social cost of greenhouse gases for agencies to use in their analyses, based on "a defensible set of input assumptions that are grounded in the existing scientific and economic literature."[33] Using the three leading IAMs—DICE, FUND, and PAGE—combined with other reasonable assumptions and the best available data transparently drawn from the peer-reviewed literature, the IWG began first estimating the social cost of carbon dioxide.[34] By 2016, the IWG added separate estimates for the social cost of methane and the social cost of nitrous oxide as well, since different greenhouse gases have different climate impacts based on their individual capacity to absorb the sun's energy and their lifespans in the earth's atmosphere.[35]

For each greenhouse gas, the IWG issued a central estimate of social costs per metric ton of emissions per year based on a 3% discount rate, as well as additional estimates that explore the calculation's sensitivity to a lower (2.5%) or higher (5%) discount rate.[36] Discount rates determine how future costs and benefits are weighed compared to present-day costs and benefits. Because of the long lifespan of greenhouse gases and the long-term or irreversible consequences of climate change, the effects of today's greenhouse emissions will stretch out over the next several centuries. Recognizing the importance of selecting a discount rate that reflected the economic consensus and was grounded in the literature, the IWG chose a 3% rate (based on the average rate of return on Treasury notes) to drive its central estimate of the social cost of greenhouse gas. The IWG specifically rejected any discount rate higher than 5% as "not considered appropriate,"[37] and three recent, independent surveys indicate a strong consensus among economists and climate experts for using a discount rate below 3% for climate analyses, with little to no support for a rate above 5%.[38]

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[33] INTERAGENCY WORKING GRP. ON SOCIAL COST OF GREENHOUSE GASES, TECHNICAL SUPPORT DOCUMENT: TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12,866 (2010), *available at* https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/foragencies/Social-Cost-of-Carbon-for-RIA.pdf [hereinafter IWG 2010].

[34] *See id.*

[35] INTERAGENCY WORKING GRP. ON SOCIAL COST OF GREENHOUSE GASES, APPLICATION OF THE METHODOLOGY TO ESTIMATE THE SOCIAL COST OF METHANE AND THE SOCIAL COST OF NITROUS OXIDE (2016), *available at* https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/august_2016_sc_ch4_sc_n2o_addendum_final_8_26_16.pdf.

[36] *See generally* IWG 2010, *supra* note 33. A fourth estimate, based on the 95th percentile value of the distribution of estimates at a 3% discount rate, is also included, as a proxy for omitted catastrophic damages, risk aversion, and other uncertainties.

[37] INTERAGENCY WORKING GRP. ON SOCIAL COST OF GREENHOUSE GASES, RESPONSE TO COMMENTS 36 (2015), *available at* https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/scc-response-to-comments-final-july-2015.pdf.

[38] Moritz Drupp et al., *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (Ctr. for Climate Change Econ & Pol'y, Working Paper No. 195, 2015); PETER HOWARD & DEREK SYLVAN, EXPERT CONSENSUS ON THE ECONOMICS OF CLIMATE CHANGE (2015), available at https://policyintegrity.org/files/publications/ExpertConsensusReport.pdf; Council of Econ. Advisers, DISCOUNTING FOR PUBLIC POLICY: THEORY AND RECENT EVIDENCE ON THE MERITS OF UPDATING THE DISCOUNT RATE

Importantly, even the central estimate omits key categories of climate damages—like the risk of catastrophic, irreversible consequences—and so should be treated as a conservative underestimate of total climate damages from combustion. For more details on what impacts are included and excluded from the IWG estimates, see Policy Integrity's issue brief *A Lower Bound: Why the Social Cost of Carbon Does Not Capture Critical Climate Damages and What That Means for Policymakers*[39] and report *Omitted Damages: What's Missing from the Social Cost of Carbon*.[40]

The Interagency Working Group on the Social Cost of Greenhouse Gases included, along with its range of three estimates across different discount rates, a fourth estimate. That fourth and highest estimate, calculated as the 95th percentile of the distribution of damages estimates at a 3% discount rate, was intended to serve as an imperfect proxy for, among other things, omitted catastrophic damages.[41] In any given year, this high 95th percentile estimate is about three times the central estimate of the social cost of greenhouse gases.[42] Like the other estimates, this estimate increases over time because each additional ton of emissions will become much more damaging as GHG emissions accumulate in the atmosphere.

The IWG's estimates have been repeatedly endorsed by reviewers. In 2014, the U.S. Government Accountability Office reviewed the IWG's methodology and concluded that it had followed a "consensus-based" approach, relied on peer-reviewed academic literature, disclosed relevant limitations, and adequately planned to incorporate new information via public comments and updated research.[43] In 2016, the U.S. Court of Appeals for the Seventh Circuit held that it was reasonable for agencies to use the IWG's estimates.[44] In 2016 and 2017, the National Academies of Sciences issued two reports that, while recommending future improvements to the methodology, supported the continued use of the existing IWG

(2017), https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf.

[39] Inst. for Policy Integrity, A LOWER BOUND: WHY THE SOCIAL COST OF CARBON DOES NOT CAPTURE CRITICAL CLIMATE DAMAGES AND WHAT THAT MEANS FOR POLICYMAKERS (2019), https://policyintegrity.org/files/publications/Lower_Bound_Issue_Brief.pdf.

[40] PETER HOWARD, OMITTED DAMAGES: WHAT'S MISSING FROM THE SOCIAL COST OF CARBON (2014), *available at* https://costofcarbon.org/files/Omitted_Damages_Whats_Missing_From_the_Social_Cost_of_Carbon.pdf.

[41] IWG 2010 TSD, *supra* note 33.

[42] IWG 2016, *supra* note 10. For example, for year 2020 emissions, the central estimate of the social cost of carbon (in 2007$) is $42, while the 95th percentile estimate is $123. Similarly, for year 2020 emissions, the central estimate of the social cost of methane (in 2007$) is $1200, while the 95th percentile estimate is $3200. For nitrous oxide, the social cost for year 2020 emissions increases from $15,000 at the central estimate to $39,000 at the 95th percentile value.

[43] GOV'T ACCOUNTABILITY OFFICE, REGULATORY IMPACT ANALYSIS: DEVELOPMENT OF SOCIAL COST OF CARBON ESTIMATES 12–19 (2014), *available at* https://www.gao.gov/assets/670/665016.pdf.

[44] Zero Zone, Inc. v. Dep't of Energy, 832 F.3d 654, 679 (7th Cir. 2016).

estimates.[45] It is, therefore, unsurprising that scores of economists and climate policy experts have endorsed the IWG's values as the best available estimates.[46]

In March 2017, President Trump's Executive Order 13,783 disbanded the IWG.[47] Since then, in an attempt to justify the repeals of beneficial rules, some federal agencies have relied on faulty economic theory to propose "interim" estimates of the social cost of greenhouse gases that drop the social cost of carbon from $50 per ton in year 2020 down to as little as $1 per ton, and drop the social cost of methane from $1420 per ton in year 2020 down to $58.[48] These "interim" estimates from the Trump administration rely on two manipulations of the social cost of greenhouse gases: a spurious "domestic-only" calculation and an inappropriately high 7% discount rate, which experts agree are inconsistent with accepted science and economics.[49]

For more detail on why the Trump administration's "interim" estimates are based on faulty science and economics, and should not be used by New Jersey, see Policy Integrity's Issue Brief, *How the Trump Administration is Obscuring the Costs of Climate Change*.[50]

Recognizing that the IWG's 2016 estimates remain the best available estimates of the social cost of carbon, a growing list of states have continued to adopt these estimates, even after the IWG was disbanded. The states that have continued to incorporate the IWG's estimates or methodologies into their own decisionmaking include California, Colorado, Illinois, Maine, Maryland, Minnesota, Nevada, New York, and Washington state.[51]

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[45] NAT'L ACAD. SCI., ENG. & MEDICINE, VALUING CLIMATE DAMAGES: UPDATING ESTIMATES OF THE SOCIAL COST OF CARBON DIOXIDE 3 (2017); NAT'L ACAD. SCI., ENG. & MEDICINE, ASSESSMENT OF APPROACHES TO UPDATING THE SOCIAL COST OF CARBON: PHASE 1 REPORT ON A NEAR-TERM UPDATE 1 (2016).

[46] *See, e.g.*, Richard Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 SCIENCE 655 (2017); Michael Greenstone et al., *Developing a Social Cost of Carbon for U.S. Regulatory Analysis: A Methodology and Interpretation*, 7 REV. ENVTL. ECON. & POL'Y 23, 42 (2013); Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014) (co-authored with Nobel Laureate Kenneth Arrow, among others); Richard G. Newell et al., *Carbon Market Lessons and Global Policy Outlook*, 343 SCIENCE 1316 (2014); Bonnie L. Keeler et al., *The Social Costs of Nitrogen*, 2 SCIENCE ADVANCES e1600219 (2016).

[47] Exec. Order. No. 13,783 § 5(b), 82 Fed. Reg. 16,093 (Mar. 28, 2017). The Order instructed agencies to use the "best" estimates of the social cost of greenhouse gases. In fact, the IWG estimates remain the best estimates available.

[48] BUREAU OF LAND MGMT., REGULATORY IMPACT ANALYSIS FOR THE PROPOSED RULE TO RESCIND OR REVISE CERTAIN REQUIREMENTS OF THE 2016 WASTE PREVENTION RULE 71 (2018). Meanwhile, some other agencies continued to use the IWG's 2016 estimates after the Executive Order was issued. In fact, as recently as August 2017, BLM's sister agency in the Department of the Interior (the Bureau of Ocean Energy Management) continued to use the IWG's 2016 numbers.

[49] *See* NAT'L ACAD. OF SCI., VALUING CLIMATE DAMAGES: UPDATING ESTIMATION OF THE SOCIAL COST OF CARBON DIOXIDE (2017); Richard G. Newell, UNPACKING THE ADMINISTRATION'S REVISED SOCIAL COST OF CARBON (Oct. 10, 2017), http://www.rff.org/blog/2017/unpacking-administration-s-revised-social-cost-carbon; Inst. for Policy Integrity, HOW THE TRUMP ADMINISTRATION IS OBSCURING THE COSTS OF CLIMATE CHANGE (2018), http://policyintegrity.org/files/publications/Obscuring_Costs_of_Climage_Change_Issue_Brief.pdf.

[50] Inst. for Policy Integrity, HOW THE TRUMP ADMINISTRATION IS OBSCURING THE COSTS OF CLIMATE CHANGE (2018), http://policyintegrity.org/files/publications/Obscuring_Costs_of_Climage_Change_Issue_Brief.pdf.

[51] DENISE GRAB ET AL., OPPORTUNITIES FOR PRICING CLIMATE IMPACTS IN U.S. STATE ELECTRICITY POLICY 19–20 (2019), *available at* https://policyintegrity.org/files/publications/Pricing_Climate_Impacts.pdf.

While the IWG recommends considering all four social cost of carbon estimates to capture uncertainty, several states selected *one* preferred estimate. Most have applied the central discount rate of 3%. Meanwhile, Washington State's Department of Ecology selected a 2.5% rate to align with the Office of Financial Management's real discount rate, reflect anticipated future increases in the best available estimates, incorporate intergenerational discount rates, reduce the risk of underestimating the social cost of carbon, and take leadership on climate issues.[52] California's Public Utilities Commission has proposed to use both the average value and the 95th percentile estimate for a 3% discount rate to account for omitted impacts like catastrophic damages and wildfires.[53] Best economic practices give some leeway to policymakers to select within or below the range of discount rates included in the IWG analysis.

As discussed, the IWG's 2016 estimates for the social cost of greenhouse gases are currently the best available estimates. At least 10 states have applied these values, and it would be appropriate for New Jersey to do so, as well. One particularly notable reason to apply the IWG's estimates at the present time is that the state would be able to draw on the tremendous analytical efforts of that group, including the involvement of twelve federal agencies and review by the National Academy of Sciences (including fourteen academics at the top of their fields).

Note, however, that the social cost of greenhouse gases is an active area of research. Based in part on recommendations from the National Academy of Sciences, there are three ongoing efforts to develop the next generation of integrated assessment models: (1) Resources for the Future, (2) David Anthoff's decentralized FUND model, and (3) the Climate Impact Lab. These groups may issue updated estimates of the social cost of greenhouse gases in the coming years. As the science and economics evolves, New Jersey's agencies should seek input from academic experts in deciding how to update the state's application of the social cost of greenhouse gases. New Jersey's universities have a wealth of academic expertise on the topic.[54]

The continuing research to update the estimates should not stop New Jersey from applying the social cost of greenhouse gases now. New Jersey should adopt estimates that are consistent with the best available science and economics: at present, the 2016 IWG

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[52] Wash. Dep't of Ecology, PRELIMINARY COST-BENEFIT AND LEAST-BURDENSOME ALTERNATIVE ANALYSIS: CHAPTER 173-442 WAC CLEAN AIR RULE & CHAPTER 173-441 WAC REPORTING OF EMISSIONS OF GREENHOUSE GASES 38 (2016), at 38, https://fortress.wa.gov/ecy/publications/documents/1602008.pdf.

[53] Cal. Pub. Util. Comm'n, Order Instituting Rulemaking to Create a Consistent Regulatory Framework for the Guidance, Planning, and Evaluation of Integrated Distributed Energy Resources 36–40, Rulemaking 14-10-003, Proposed Decision Adopting Cost-Effectiveness Analysis Framework Policies for All Distributed Energy Resources (Mar. 25, 2019), *available at* http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M274/K960/274960797.PDF.

[54] Notably, Rutgers University is home to one of the world's leading experts on the social cost of greenhouse gases: Dr. Robert Kopp, Professor of Earth and Planetary Sciences and Director of the Institute of Earth, Ocean, and Atmospheric Sciences at Rutgers University, is a leading member of the Climate Impact Lab team, a Scientific Advisory Board Member for Resources for the Future's social cost of carbon project, a former member of the National Academy of Sciences' committee assessing the social cost of carbon; and a former member of the 2010 Interagency Working Group on the Social Cost of Carbon.

estimates. When updated estimates are released in the future, New Jersey's agencies should draw on the knowledge of academic experts to review and assess the new estimates before adoption.

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We thank you again for inviting us to testify today, and we would be happy to answer any questions you may have.