Institute for Policy Integrity
NEW YORK UNIVERSITY SCHOOL OF LAW

November 27, 2020

Via Email to ClimateAct@dec.ny.gov

To: Jason Pandich, Office of Climate Change, New York State Department of Environmental Conservation

Re: Draft Guidance on the Value of Carbon

Dear Mr. Pandich,

The Institute for Policy Integrity at New York University School of Law (Policy Integrity)[1] respectfully submits these comments on the New York State Department of Environmental Conservation's (DEC or the Department) draft guidance, Establishing a Value of Carbon.[2] Policy Integrity supports the DEC's adoption of a damage-cost approach to valuing carbon dioxide and the Department's decision to base this value on the Social Cost of Carbon (SCC) produced by the federal Interagency Working Group on the Social Cost of Greenhouse Gases (IWG). In addition, these comments raise a number of points about the appropriate use of discount rates, calculating damages for other greenhouse gases, inclusion of co-benefits in analysis, and further considerations for a marginal abatement cost (MAC) approach.

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 regularly advises federal and state agencies on valuing emissions using the IWG social cost of greenhouse gases.

We thank you for your consideration.

Respectfully,

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[1] This document does not purport to present the views of New York University School of Law, if any.
[2] NYSDEC, Establishing a Value for Carbon: Guidelines for Use by State Agencies (Proposal for Public Review) (Oct. 2020) [hereinafter "DEC Guidance"].

Policy Integrity Supports DEC's Decision to Use a Damage-Cost Approach Based on the IWG's Methodology

On October 20, 2020, Policy Integrity submitted a letter (attached)[3] advising the Department to recommend that New York State agencies use a damage-cost approach to valuing carbon dioxide based on the 2016 IWG social cost of greenhouse gases estimates. As discussed in the letter, the IWG's methodology remains the best available approach for estimating the marginal damage costs for greenhouse gases.[4] Policy Integrity supports the Department's proposal to use a damage-cost approach based on the IWG's methodology and estimates.

The Department correctly identifies the applications for which a damage-cost approach using the IWG social cost estimates are best suited, noting that the IWG social cost of greenhouse gases is "useful for describing the global value of policies, programs, or projects or for estimating global damages in an assessment of benefits and costs."[5] Specifically, DEC gives three illustrative examples for how agencies can use the IWG values: estimating the emission reduction benefits of a plan or goal; assessing net costs and benefits in an environmental assessment or rulemaking; and describing the benefits of a procurement plan.[6] A damage-cost approach is appropriate in all of these applications and can generally be used to set welfare-maximizing policies.[7]

DEC is also correct in choosing IWG social cost estimates based on global damages,[8] noting that "the global cost is the most appropriate value to use due to the global nature of climate change and the economy."[9] For a number of reasons outlined in Policy Integrity's letter,[10] and for those reasons described by the Department in the draft guidance,[11] including to abide by its mandate under the CLCPA, a global estimate is the only appropriate geographic scope for a damage-cost approach value of carbon.

Finally, Policy Integrity supports DEC's proposed range of discount rates of 1-3%. Policy Integrity's letter recommended that the Department use the original range of IWG discount rates with a focus on the lower discount rates of 2.5% and 3%.[12] The letter also explained why a declining discount rate, where the discount rate declines as the timeframe for the policy increases,[13] is the most appropriate approach for climate damages that are considered over

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[3] Letter from the Institute for Policy Integrity at New York University School of Law to Jason Pandich on Draft Guidance from the New York Department of Environmental Conservation on the Value of Carbon (Oct. 20, 2020) [hereinafter "Policy Integrity Letter"].

[4] Richard L. Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 SCI. 655 (2017), https://policyintegrity.org/documents/Science_Revesz_et_al_081718.pdf.

[5] DEC Guidance at 5.

[6] *Id.* at 23–26.

[7] Policy Integrity Letter at 7.

[8] *See also* Institute for Policy Integrity et al., Comments to the Department of Energy on Monetizing Emissions Reductions in the Technical Support Document for the Room Air Conditioners Request for Information (Docket No. EERE-2014-BT-STD-0059) 12-16 (Sept. 8, 2020), https://policyintegrity.org/documents/Joint_SCC_comments_DOE_Rm_AC_RFI_TSD_2020.09.08.pdf.

[9] DEC Guidance at 12.

[10] *See* Policy Integrity Letter at 11.

[11] DEC Guidance at 12–13.

[12] Policy Integrity Letter at 5.

[13] Kenneth Arrow et al. 2013 says that "Uncertainty about future discount rates" can lead to a declining discount rate schedule, when "all benefits and costs occurring in a given year are discounted at the same rate, but this rate declines over time." Kenneth Arrow et al., *Determining Benefits and Costs for Future Generations*, 341 SCIENCE 349, 349 (2013).

hundreds of years.[14] Indeed, there is ample evidence suggesting that a lower discount rate or declining discount rate approach is acceptable for calculating climate damages, some of which the Department has identified in its draft guidance.[15] The following section explains why DEC would be justified to use a 2% discount rate for its central damages-based value of carbon estimate.

DEC Should Use a 2% Discount Rate as Its Central Estimate

Though the IWG originally chose a 3% discount rate for its central estimate for the social cost of greenhouse gases, it is reasonable for DEC to use a 2% discount rate for its central damages-based estimate. As noted in Policy Integrity's October 2020 letter, historically, evidence indicated that a 3% discount rate was an appropriate estimate of the "real rate of return on long-term government debts," and so an appropriate proxy for the "social rate of time preference."[16] However, recent research—discussed below—finds that the social discount rate is likely lower.

For example, Resources for the Future (RFF) and the New York State Energy Research and Development Authority (NYSERDA) cite evidence in their memorandum, based on both descriptive and prescriptive approaches to discounting,[17] that supports the assertion that a 2% discount rate is preferable to a higher rate when considering climate damages. From the descriptive perspective, RFF and NYSERDA cite a 2017 brief from the Council of Economic Advisers (CEA) that examined trends in interest rate. CEA found that a 2% discount rate was the high-end of discount rates that should be used for consumption discount rate.[18] RFF and

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[14] Policy Integrity Letter at 5; *see also* Martin Weitzman, *Gamma Discounting*, 91 AM. ECON. REV. 260, 266 & 271 (2001) (explaining that "[t]he effective discount rate declines with the passage of time because increasingly greater relative present-value weight is being placed on the states with lower rates," and so should be included in "any serious benefit-cost analysis of long-term environmental projects, like activities to mitigate the effects of global climate change.").

[15] DEC Guidance at 17–18.

[16] Policy Integrity Letter at 5. *See also* OFFICE OF MGMT. & BUDGET, CIRCULAR A-4: REGULATORY ANALYSIS 33–34 (2003) ("The effects of regulation do not always fall exclusively or primarily on the allocation of capital. When regulation primarily and directly affects private consumption (e.g., through higher consumer prices for goods and services), a lower discount rate is appropriate. The alternative most often used is sometimes called the 'social rate of time preference.' This simply means the rate at which 'society' discounts future consumption flows to their present value. If we take the rate that the average saver uses to discount future consumption as our measure of the social rate of time preference, then the real rate of return on long-term government debt may provide a fair approximation. Over the last thirty years, this rate has averaged around 3 percent in real terms on a pre-tax basis."); U.S. ENV'T PROT. AGENCY, GUIDELINES FOR PREPARING ECONOMIC ANALYSIS (2010); INTERAGENCY WORKING GROUP ON THE SOCIAL COST OF CARBON, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12866 17–23 (2010), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf [hereinafter "IWG 2010 TSD"].

[17] *See* IWG 2010 TSD at 18 ("The descriptive approach reflects a positive (non-normative) perspective based on observations of people's actual choices—e.g., savings versus consumption decisions over time, and allocations of savings among more and less risky investments," where as the "prescriptive approach specifies a social welfare function that formalizes the normative judgments that the decision-maker wants explicitly to incorporate into the policy evaluation—e.g., how interpersonal comparisons of utility should be made, and how the welfare of future generations should be weighed against that of the present generation.").

[18] RES. FOR THE FUTURE & N.Y. STATE ENERGY RES. & DEV. AUTH., ESTIMATING THE VALUE OF CARBON: TWO APPROACHES 8 (Oct. 2020) [hereinafter "RFF & NYSERDA"] (citing Council of Econ. Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* (2017), https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf [hereinafter "CEA 2017"]).

NYSERDA also cite a 2015 descriptive study from Giglio et al., which has similar findings.[19] From the normative approach, the RFF and NYSERDA supporting memorandum cites a 2018 survey of over 200 economists by Drupp et al. This study found the median social discount rate to be 2%.[20] The literature cited by the RFF and NYSERDA supports a 2% discount rate as the central discount rate.

Other expert elicitations also support the use of a 2% discount rate. Howard and Sylvan (2020) report similar results to the Drupp et al. 2017 survey for the appropriate social discount rate.[21] Howard and Sylvan surveyed climate experts, whereas Drupp et al. surveyed social discount rate experts. Interestingly, both papers find nearly identical results with mean and median rates of 2.3% and 2%, respectively.[22] Citing Millner and Heal (2018) and their related work on selecting a discount rate under uncertainty,[23] Howard and Sylvan find that a 2% discount rate based on the median survey response is "time-consistent and welfare enhancing."[24] The results of the Howard and Sylvan survey and the evidence cited in that paper further supports DEC's use of a 2% discount rate.

More generally, DEC's selection of a consumption discount rate to calculate climate damages is appropriate on descriptive grounds. As noted by RFF and NYSERDA, "the correct discount rate to apply to [climate change] impacts is the consumption rate of discount,"[25] because climate damages tend to primarily affect consumers' and society's consumption decisions. But even if there were uncertainty over whether climate damages tended to primarily affect social consumption or private capital, a consumption rate would still be appropriate because climate change is an intergenerational problem, as a 2019 paper by Li and Pizer explains.[26] Specifically, Li & Pizer find that looking far into the future—as is the case with climate damages—when it may become unclear to whom the costs of taxation and benefits of government spending accrue, the range of appropriate discount rates for cost-benefit analysis[27] converges to the consumer discount rate within a matter of decades.[28] Li & Pizer further provide evidence against using the private discount rate of investment for decisionmaking over such long time horizons.[29] As the

[19] *Id.* (citing Stephano Giglio et al., *Very Long-Run Discount Rates*, 130 Q. J. ECON. 1 (2015)).

[20] *Id.* at 9 (citing Moritz A. Drupp et al., *Discounting Disentangled* (Uni. of Oslo Dep't of Econ., Memo. No. 20/2015, 2015)).

[21] Peter Howard & Derek Sylvan, *Wisdom of the Experts: Using Survey Responses to Address Positive and Normative Uncertainties in Climate-Economic Models*, 162 CLIMATE CHANGE 213, 224 (2020), https://policyintegrity.org/publications/detail/wisdom-of-the-experts.

[22] *See, e.g., id.* at 223.

[23] The intergenerational discounting traditionally based on the simple Ramsey rule is characterized by ethical parameters whose value may never be "known" in the traditional sense, as individuals can and will reasonably disagree now and in the future over their value. In the context of expert elicitation, uncertainty over the appropriate discount rate value should be thought of heterogeneity in ethnical views. In this case, selecting the median response or view on discount rates is the most efficient, time-consistent approach. *Id.*

[24] *Id.* at 216–17 (citing A. Millner & G. Heal, *Discounting by Committee*, 167 J. PUB. ECON. 91 (2018)).

[25] RFF & NYSERDA at 7 (citing NAT'L ACADS. OF SCIS., ENG'G, AND MED., VALUING CLIMATE DAMAGES: UPDATING ESTIMATION OF THE SOCIAL COST OF CARBON DIOXIDE (2017) [hereinafter "NAS 2017"]).

[26] *See e.g.*, Qingran Li & William Pizer, *The Discount Rate for Public Policy Over the Distant Future* (NBER Working Paper 25413, rev. Dec. 2019), http://www.nber.org/papers/w25413.

[27] Specifically, the discount rate of private capital and the discount rate of consumption. *Id.* at 1.

[28] *Id.* at 2, 32–33.

[29] *Id.* ("This result [showing that the social discount rate converges to the consumption interest rate] is important because it provides a strong argument against the idea that it is appropriate to use a rate as high as 7 percent as we

social cost of greenhouse gases is calculated over three-hundred years, clearly the consumption discount rate applies in the climate change context.

In sum, there is robust support for DEC's choice of a consumption discount rate of 2% for a central estimate. The Department should also recommend to agencies to consider using estimates based on a range of discount rates, from 1–3%, to test the sensitivity of any analyses to the choice of discount rate.

In the Future, DEC May Choose to Apply a Declining Discount Rate Approach

In the future, DEC could choose to apply a declining discount rate, centered around its chosen range of 1–3%, to its damages-based value of carbon calculations. As noted in Policy Integrity's October 20202 letter, recent stated- and revealed-preference evidence suggests that a declining rate is appropriate for calculating intergenerational benefits.[30] Additionally, evidence indicates that the uncertain nature of climate impacts—both in terms of future economic growth and physical effects—supports the growing consensus that a declining discount rate should be applied to climate damages.[31] However, because it may be resource-intensive for DEC to implement a declining discount rate approach, the Department could use 2% as the central discount rate as a proxy for a declining rate until directly applying a declining discount rate becomes more feasible, similar to how the IWG used the 2.5% discount rate as a proxy for a declining discount rate.[32]

In short, it is reasonable for DEC to adopt a 2% discount rate for its central damage cost estimates, supplemented by estimated calculated at a range of discount rates from 1% to 3% to use in sensitivity analyses. If the Department chooses to pursue a declining discount rate approach in the future, it may wish to wait until the federal government—or another entity—develops such a methodology, so it can follow suit.

discount benefits further in the future. This is true even when costs displace investment and even over horizons as short as a few decades.").

[30] Kenneth Arrow et al. 2013; Kenneth Arrow et al., *Should Governments Use a Declining Discount Rate in Project Analysis*, 8 REV. ENV'T ECON. POLICY 145 (2014); Christian Gollier & James K. Hammitt, *The Long-Run Discount Rate Controversy*, 6 ANN. REV. RES. ECON. 273 (2014); Maureen L. Cropper et al., *Declining Discount Rates*, 104 AM. ECON. REV. 538 (2014); CEA 2017.

[31] Cropper et al. 2014; Arrow et al. 2013; Arrow et al. 2014.

[32] *See* NAS 2017 at 171 (noting that the IWG's choice of a 2.5% discount rate was based on uncertainty about future discount rate and that this uncertainty "mathematically" leads to declining discount rates); *see also* IWG 2010 TSD at 23 ("The low value, 2.5 percent, is included to incorporate the concern that interest rates are highly uncertainty over time.").

DEC Should Separately Account for Co-Benefits, Unquantified Benefits, and Distributional Effects of Greenhouse Gas Emissions Reductions

The CLCPA dictates that the "value of carbon be considered as part of a full assessment of the impacts" of greenhouse gas pollution, including harms "to public health and the environment."[33] However, many of the public health and other ancillary benefits of reducing greenhouse emissions, including distributional benefits, are not included in the recommended value of carbon estimate itself,[34] nor are a number of predicted climate damages.[35] DEC's guidance should make clear that all of these elements should still be taken into account, and must therefore be addressed separately from the value of carbon.

Co-benefits

DEC notes that the CLCPA "encompasses…co-pollutants that are typically associated with greenhouse gas emissions,"[36] and so the Department's value of carbon guidance should provide agencies with clear direction to consider co-benefits of greenhouse gas emission reduction (i.e., benefits from reductions in other pollutants) in any analysis that includes a value of carbon, as well as instructions about how to do so.

In particular, the Department can strengthen the direction to agencies to consider co-benefits. The draft guidance acknowledges the need to value the co-benefits of methane emissions reductions (i.e., health benefits from reductions in ozone) in any comprehensive analysis of the costs and benefits of greenhouse gas emission reduction,[37] and instructs agencies to consider "such estimates if available in the peer reviewed literature."[38] Notably, monetized estimates of some co-benefits of greenhouse gas reductions are well-established and have been used by federal agencies; so, too, are detailed qualitative assessments of ancillary benefits that cannot be monetized.[39] DEC notes in its illustrative example on calculating "Net costs and benefits in an environmental assessment or rulemaking" that methane "damages related to public health…could be included in the overall net cost,"[40] but the Department could go further and specifically advise other agencies to include these costs whenever possible.[41] For examples of how an agency included co-benefits from reduced ozone and other co-pollutants in cost-benefit analysis, DEC can look to the U.S. Environmental Protection Agency's (EPA) 2015 regulatory impact statement for the Clean Power Plan or EPA's 2016 regulatory impact analysis for the new

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[33] DEC Guidance at 10.

[34] DEC Guidance at 24–25 ("[M]ethane emissions are also associated with damages related to public health that are not included in the federal IWG value for methane.").

[35] *See, e.g., See* PETER HOWARD, INST. FOR POL'Y INTEGRITY, OMITTED DAMAGES: WHAT'S MISSING FROM THE SOCIAL COST OF CARBON (2014), https://policyintegrity.org/publications/detail/omitted-damages-whats-missing-from-the-social-cost-of-carbon [hereinafter "OMITTED DAMAGES"] (showing that respiratory illness from increased ozone is omitted from the IWG SCC estimates).

[36] DEC Guidance at 15.

[37] *Id.* at 22.

[38] *Id.*

[39] *See, e.g.,* U.S. ENV'T PROT. AGENCY, REGULATORY IMPACT ANALYSIS FOR THE CLEAN POWER PLAN FINAL RULE (Oct. 2015) [hereinafter "CPP RIA"].

[40] DEC Guidance at 25.

[41] *Id.* at 10.

source emissions standards for the oil and gas sector.[42] DEC should recommend that other agencies treat co-benefits as essential to a complete analysis of the costs and benefits of greenhouse gas emissions reductions.

Unquantified Benefits

As noted by DEC,[43] and as discussed in Policy Integrity's October 2020 letter, a number of critical damages are omitted from the IWG social cost estimates because they are difficult to quantify. These include food insecurity, property damage and adverse health effects from wildfires, lost labor productivity, and more.[44] DEC should be mindful of these exclusions and, in addition to selecting a lower discount rate to reflect uncertainty about climate damages, should recommend conducting a sensitivity analysis using the 95th percentile estimate of the 2% distribution of the social cost of greenhouse gases. The 95th percentile value serves as a methodological shortcut to approximate the uncertainties around outcomes that are low-probability but also high-damage, catastrophic, or irreversible—outcomes that are currently omitted or undercounted in economic models.[45] Use of the 95th percentile value for sensitivity analysis is analytically distinct from choosing an even lower discount rate for the central estimate, and is consistent with the IWG's approach to addressing the myriad unquantified climate effects in their analyses, as the Group applied this technique to its central discount rate (i.e., 3%).[46] DEC could also recommend that agencies could address the myriad unquantified climate effects in a supplemental qualitative analyses.

Distributional Effects

As the language of the CLCPA itself highlights, another important category of effects that are excluded from the IWG social cost estimates, but should not be ignored, are the distributional effects both of climate change itself and of the co-pollutants that accompany greenhouse gases.[47] For example, fossil fuel-combusting power plants emit both carbon dioxide and local pollutants, the latter of which have many negative localized public health and environmental effects.[48] These negative effects can be more harmful in some communities than others, owing to differences in where these pollutants accumulate and in the preexisting air quality and health vulnerabilities in those communities.[49] Because the CLCPA requires consideration of the impacts

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[42] CPP RIA at 4-43; U.S. ENV'T PROT. AGENCY, REGULATORY IMPACT ANALYSIS OF THE FINAL OIL AND NATURAL GAS SECTOR: EMISSION STANDARDS FOR NEW, RECONSTRUCTED, AND MODIFIED SOURCES at 4-1 to 4-37 (2016).

[43] DEC Guidance at 24–25.

[44] *See* OMITTED DAMAGES; INST. FOR POL'Y INTEGRITY, A LOWER BOUND 5–7 (2019), https://policyintegrity.org/files/publications/Lower_Bound_Issue_Brief.pdf.

[45] *See* Inst. for Pol'y Integrity et al., Comments to EPA on Monetizing Emissions Reductions in the Control of Air Pollution From Airplanes and Airplane Engines: GHG Emissions Standards and Test Procedures (Docket no. EPA-HQ-OAR-2018-0276) (RIN 2060-AT26) (Oct. 19, 2020), https://policyintegrity.org/documents/Joint_SCC_comments_EPA_airplane_GHG_2020.10.19.pdf.

[46] *See* IWG 2010 TSD.

[47] *See, e.g.*, CLCPA § 2, N.Y. ENV'T CONSERV. L. § 75-0109(3)(c) & (d); CLCPA § 2, N.Y. ENV'T CONSERV. L § 75-0111(1)(b); CLCPA § 2, N.Y. ENV'T CONSERV. L § 75-0119(2)(g); CLCPA § 7(3).

[48] *See* JEFFREY SHRADER ET AL., INST. FOR POL'Y INTEGRITY, VALUING POLLUTION REDUCTIONS (2018), https://policyintegrity.org/files/publications/Valuing_Pollution_Reductions.pdf.

[49] *See* MATT BUTNER ET AL., INST. FOR POL'Y INTEGRITY, MAKING THE MOST OF DISTRIBUTED ENERGY RESOURCES (2020), https://policyintegrity.org/files/publications/Making_the_Most_of_Distributed_Energy_Resources.pdf.

of greenhouse gas emissions and co-pollutants on "disadvantaged communities,"[50] DEC should recommend that, in addition to using a value of carbon, agencies should quantify and monetize ancillary harmful effects of local pollutants. The Department can look to Policy Integrity's report, *Valuing Pollution Reductions*[51] and *Making the Most of Distributed Energy Resources,*[52] for a basic methodology for how to calculate location-specific environmental and health effects.[53] The Department can also advise agencies to provide a supplemental qualitative analysis on distributional effects.

As a general matter, DEC should recommend that State agencies include co-benefits, nonmonetized (i.e. unquantified) effects, and distributional consequences in any analysis that uses the value of carbon, to better reflect the true effects of greenhouse gas emissions. The Department should identify or develop materials to help agencies to do so.

DEC Should Use the Best Available Scientific Estimates for Valuing "Other" Greenhouse Gases

The IWG developed methodologies for estimating the social costs of methane and nitrous oxide in addition to carbon dioxide, but did not (yet) do so for additional greenhouse gases. In its October 2020 letter, Policy Integrity briefly discussed what the Department should consider when valuing damages from the greenhouse gases for which the IWG provides no estimate. Specifically, Policy Integrity recommended that DEC's guidance include both the 20-year and 100-year time horizons for global warming potentials (GWP), if the Department chooses to take the GWP-adjustment approach to monetizing damages from greenhouse gases other than carbon dioxide, methane, and nitrous oxide.[54]

If DEC recommends agencies depart from the GWP approach to calculating climate damages from other greenhouse gases, it must ensure that these estimates are based on the same models as the IWG estimates and reflect consistent inputs, and that agencies apply a uniform estimation methodology. The Department correctly notes that using estimates from the literature is acceptable if they are derived from a methodology of rigor comparable to that used by the IWG.[55] But DEC should clarify the importance of using the same methodology for all greenhouse gases to ensure appropriately consistent results. In effect, this means choosing a methodology that uses the same integrated assessment models (IAMs) as the IWG (i.e., DICE, FUND, *and* PAGE—not just a single model). Ideally, the same model version should even be applied as used by the IWG (in 2013 and 2016), as model-specific social cost estimates have

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[50] DEC Guidance at 10.

[51] SHRADER ET AL.

[52] BUTNER ET AL.

[53] This methodology was developed for distributed energy resources and DEC would need to consider how it should be modified for centralized generators.

[54] Policy Integrity Letter at 6.

[55] DEC Guidance at 20 ("For the remaining greenhouse gases, the Department considers the peer-reviewed scientific literature to be the best source of information for supplementing the federal IWG values. In some cases, there may be an estimation of damages for specific gases that may be useful even if the underlying methods are not identical to that used by the federal IWG.…When work on these additional gases is comparable to the work of the federal IWG, the Department may supplement this guidance with additional information that will help State entities apply new research.").

significantly increased for some models continuing past trends from the IWG's 2010 technical support document to its 2013 update.[56]

In addition to using all of these models, DEC should also be aware of how the IWG's research applied the models and should use similar inputs. Key inputs would include: a business-as-usual emissions path (e.g., SRES A2 or RCP 8.5); a constant 2% discount rate; and an equilibrium climate sensitivity value set near the median value of 3°C. Consistency is particularly important for the discount rate, as applying a higher rate will result in drastically different results. If no rigorously developed, multiple-model estimates exist, agencies should consider using both the CLCPA-prescribed 20-year and the 100-year GWP time horizons to approximate the damages from other greenhouse gases.

To illustrate the importance of consistency, the Department should be aware that variation in damage estimates between IAMs is on par with variation between using a 20-year GWP and a 100-year GWP. For example, IWG's FUND model-based SCC estimates are lower than the overall IWG estimates by -47% to -75%, and the IWG's PAGE model-based SCC estimates are higher than IWG estimates by 56% to 75%.[57] By comparison, social cost estimates adjusted using a GWP of 20-years, which DEC is required to consider under the CLCPA,[58] diverges from the IWG 2016 social cost estimates by approximately the same amount as those FUND-only or PAGE-only SCC estimates diverge from the IWG SCC figures: -46% to -74% for methane and 35% to 53% for nitrous oxide. Likewise, using a 100-year GWP with the IWG 2016 figures yields smaller biases than FUND- or PAGE-only damage estimates: -29% to 48% for methane and 27% to 45% for nitrous oxide.[59] These figures suggest that the variation in GWP-adjusted estimates for greenhouse gases would be comparable to the variation that would result from selecting an estimate drawn from a single IAM. That said, GWP-adjusted estimates have been used in the past, including by the U.S. EPA, and so have the support of regulatory precedent.[60] Selecting an estimate drawn from a single IAM should be avoided, because the IWG specifically chose to average across all three IAMs to balance out the limitations or biases of any one individual model.

For the time being, the GWP approach to calculating damages for the greenhouse gases for which the IWG has not yet developed estimates would yield results most consistent with the IWG social costs of carbon dioxide, methane, and nitrous oxide. However, as DEC and RFF and NYSERDA have noted, the GWP approach is imperfect.[61] If DEC recommends that agencies use estimates from the literature, DEC should stress that those estimates must be in line with the best available science and are consistent with the methodology and inputs that underlie the IWG

[56] William Nordhaus, *Evolution of Modeling of the Economics of Global Warming: Changes in the DICE Model, 1992–2017*,148 CLIMATIC CHANGE 623 (2018).

[57] *See* INTERAGENCY WORKING GROUP ON THE SOCIAL COST OF GREENHOUSE GASES, TECHNICAL SUPPORT DOCUMENT: TECHNICAL UPDATE OF THE SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS (2016) [hereinafter "IWG 2016 TSD"]. While the IWG's DICE SCC estimates happen to be approximately consistent with the IWG estimates, that does not suggest it would be appropriate to use DICE-based estimates alone for other greenhouse gases. Averaging across the three IAMs is essential to the legitimacy of the IWG's methodology.

[58] N.Y. PUB. LAW. § 75-0101(2).

[59] *See* IWG 2016 TSD at 28.

[60] *See, e.g.*, U.S. Env't Prot. Agency, Protection of Stratospheric Ozone: Update to the Refrigerant Management Requirements Under the Clean Air Act, 81 Fed. Reg. 82,272 (Nov. 18, 2016).

[61] DEC Guidance at 20; RFF & NYSERDA at 11.

SCC. Agencies could also consider citing a range of estimates if no single reliable average estimate can be constructed from the literature.[62]

DEC Should Consider Several Issues Before Using a Marginal Abatement Cost Approach

The draft guidance and RFF and NYSERDA memorandum suggest that New York may move forward with a MAC approach to valuing greenhouse gas emissions in the future. Before it does so, the Department should consider the applications for which a MAC may be appropriate, and should also fully consider what developing and updating one or more MACs would entail, given the potentially significant resources required. Unlike the IWG's estimates and methodology, a MAC is not "plug-and-play," and so while it can be useful in certain applications, it may not be worth the time and other resources required to develop and update.

When should the MAC be used?

A MAC-based approach to valuing greenhouse gas emissions can be applied when a target for emissions reductions has been set, as is the case in New York State. Specifically, the MAC provides a cost-minimizing approach to meeting that target. However, the Department would need to further investigate a MAC's usefulness in applications other than determining the least-cost option, for example as a measure of opportunity cost in cost-benefit analysis, and review the literature to ensure the theoretical soundness of these applications.

With respect to policy context, because MAC is the lowest cost required to meet a particular emission reduction goal,[63] it is best suited for situations in which an existing emissions target or constraint is legally *and* "economically" binding (i.e., private industry can only meet the target if it changes its current behavior). This means that it is not sufficient for the CLCPA's targets to be legally binding, but rather that a MAC should be applied only if those targets are also economically binding. Otherwise, the price specified by the MAC will be too low—perhaps essentially zero, and so of little value for policymaking. The Department should consider whether New York's targets are both legally and economically binding before recommending the use of a MAC approach.

Even if DEC is confident that the CLCPA targets are legally and economically binding, it should still also consider whether leakage might compromise the MAC's usefulness for some policy applications. The CLCPA explicitly covers imported sources of emissions, such as electricity and fossil fuels, and the Department emphasizes that "[n]o policy intended to reduce one greenhouse gas should unintentionally increase emissions of other greenhouse gases or result in the 'leakage' of emission sources into other jurisdictions, if avoidable."[64] However, it is not clear whether or how DEC and other agencies could use a MAC-based approach to resolve the serious issue of leakage. A damage-based approach to valuation can straightforwardly adjust to factor in leakage: the social cost of greenhouse gases can simply be applied to total emissions net of leakage (rather than to gross emissions), and so accurately capture climate damages post-leakage. But because the stringency of the target determines how much leakage there is, how MAC might be used to address the problem of leakage is less clear as the target in part dictates the MAC.

[62] If a study includes results from several models using corresponding inputs, DEC could then perhaps take an average.
[63] Note that DEC mistakenly wrote that a MAC is the "highest cost required" rather than the lowest cost. DEC Guidance at 9.
[64] *Id.* at 10.

Finally, if New York goes ahead with a MAC-based approach, it should provide clear guidance about how to apply the MAC, much like it is now doing for the damage-cost approach. In contrast to Europe, in the United States there is limited policy experience with applying a MAC, and no federal MAC estimate exists. This is unlikely to change anytime soon, and even if it were, New York would still need to develop its own estimate, as the MAC is different for each separate policy that sets an emissions reduction target and such policies often vary by jurisdiction. Thus, any MAC-based estimate would be novel and unique to the State, which would prevent agencies from simply imitating applications of MAC approaches used in other jurisdictions.

How should DEC construct a MAC?

The Department would need to closely follow the IWG's methodology or take a similar approach to develop a sufficiently rigorous MAC-based estimate to value greenhouse gas emissions. The IWG identified—and addressed—three types of uncertainty: structural, parametric, and normative. To address structural uncertainty, the IWG used multiple IAMs.[65] This is critical as there is significant variation in the MAC-based outputs of different models.[66] To address parametric uncertainty, the IWG used Monte Carlo simulations.[67] As the policy-evaluation IAMs typically used to estimate a MAC tend to underrepresent the range of parameter values,[68] it is important that DEC considers which parameters are critical it should treat as uncertain and reviews the literature to ensure an appropriate distribution for each uncertain parameter. Finally, in order to address normative uncertainty, the IWG used a range of discount rates.[69] The Department would likewise need to calculate a MAC with a range of discount rates, but that range will be different than the one employed by the IWG.

Indeed, the acceptable range of discount rates for a MAC-approach may differ from those used by the IWG because a social discount rate may not be as clearly appropriate as it is for the damages-based estimates.[70] The Department can look to a body of literature to determine if it would need to model private discount rates (to accurately reflect the necessary return on investment required to meet the emissions target), as well as taxes, subsidies, and private risk premiums (that impact private investment decisions).[71] DEC should also determine if a social

[65] *See* IWG 2016 TSD at 18 ("[T]he IWG considered various sources of uncertainty through a combination of a multi-model ensemble. … For example, the three IAMs used collectively span a wide range of Earth system and economic outcomes to help reflect the uncertainty in the literature and in the underlying dynamics being modeled.").

[66] *See, e.g.*, Kenneth Gillingham et al., *Modeling Uncertainty in Integrated Assessment of Climate Change: A Multimodel Comparison*, 5 J. ASS'N ENV'T & RES. ECON. 791 (2018), https://www.journals.uchicago.edu/doi/pdf/10.1086/698910.

[67] *See* IWG 2016 TSD at 18 ("The IWG used Monte Carlo techniques to run the IAMs a large number of times. In each simulation the uncertain parameters are represented by random draws from their defined probability distributions.").

[68] John Weyant, *Some Contributions of Integrated Assessment Models of Global Climate Change*, 11 REV. ENV'T ECON. & POL'Y 115 (2017).

[69] *See* IWG 2016 TSD at 19 ("[T]he IWG chose discount rates that reflect reasonable judgments under both prescriptive and descriptive approaches to intergenerational discounting. As discussed in the 2010 TSD, in light of disagreement in the literature on the appropriate discount rate to use in this context and uncertainty about how rates may change over time, the IWG selected three certainty-equivalent constant discount rates to span a plausible range: 2.5, 3, and 5 percent per year.").

[70] *See* Policy Integrity Letter at 10.

[71] For more on why a private discount rate may be appropriate, see, e.g., UNITED NATIONS FOOD & AG. ORG., USING MARGINAL ABATEMENT COST CURVES TO REALIZE THE ECONOMIC APPRAISAL OF CLIMATE SMART AGRICULTURE POLICY OPTIONS 17 (2012), http://www.fao.org/3/a-bq866e.pdf ("In reality, abatement is not achieved by governments, but by a myriad of private and public investors who have different perspectives from

discount rate is appropriate or necessary to discount the final MAC value back to the present in a social welfare analysis (such as a breakeven analysis). The Department should investigate what range of discount rates would be appropriate for calculating—and applying—a MAC.

Should there be one or several MACs?

The Department would also have to determine if agencies could—or should—all use a single MAC or if there should be sector-specific MACs. From an economic efficiency standpoint, the State could consider adopting a single economy-wide MAC to ensure that the overarching emissions reduction target is met at a minimum cost.[72] However, DEC notes that the "electric power sector is best positioned to develop" a MAC "quickly,"[73] which implies that the Department may consider recommending a MAC be used in electricity policymaking in the near future. Moreover, NYSERDA has engaged a consultant to help develop MAC curves for electricity and other sectors,[74] which also suggests New York is interested in exploring sector-specific MACs. Given New York's interest in investigating multiple MAC curves, if DEC were to deviate from the efficient approach by adopting a MAC for a single sector, it should provide strong political or economic reasons for doing so.

Can using a MAC in New York State policy be harmonized with federal policy?

Because it is unlikely that the federal government will adopt a binding economy-wide emissions target in the near future, federal agencies will likely continue to rely on a damages-based approach and use the IWG social cost of greenhouse gases estimates (or updates to those estimates) to value emissions of carbon dioxide and other greenhouse gases. DEC should research and consider any potential problems that could arise if New York State uses a different methodology than the federal government (or than other states). If the Department determines that lack of coordination on approach could pose a problem, it could consider consulting with other New York State agencies, as well regulators in other states, to assess whether it is still desirable to proceed with a MAC-based approach.

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social planners and who pay taxes and receive subsidies" (citing EBRD, SPECIAL REPORT ON CLIMATE CHANGE, EFFECTIVE POLICIES TO INDUCE MITIGATION (2010))); *see also* CLIMATE CHANGE COMM., BUILDING A LOW-CARBON ECONOMY – THE UK'S CONTRIBUTION TO TACKLING CLIMATE CHANGE (2008), theccc.org.uk/publication/building-a-low-carbon-economy-the-uks-contribution-to-tackling-climate-change-2/ (discussing the differences in financial and economic discount rates, and suggesting a hybrid private-social discount rate approach to calculating a MAC). In addition, Lina Isacs et al., *Choosing a Monetary Value of Greenhouse Gases in Assessment Tools: A Comprehensive Review*, 127 J. CLEANER PROD. 37 (2016), https://doi.org/10.1016/j.jclepro.2016.03.163, which is cited by RFF & NYSERDA, also references a number of papers on considerations for calculating a MAC, which could be useful resources for DEC.

[72] The efficiency of most sectors adopting a MAC (or being bound by a single target) is analogous to the efficiency benefits of having more entities participate in cap-and-trade markets. This is described by Christian Flaschland et al., *To Link or Not to Link: Benefits and Disadvantages of Linking Cap-and-Trade Systems*, 9 CLIMATE POL'Y 358 (2009); see also ENV'T DEF. FUND, HOW CAP AND TRADE WORKS, https://www.edf.org/climate/how-cap-and-trade-works (last accessed Nov. 24, 2020) ("[A cap-and-trade market] increases the pool of available capital to make reductions, encourages companies to cut pollution faster and rewards innovation.").

[73] DEC Guidance at 9.

[74] RFF & NYSERDA note that New York has engaged Energy and Environmental Economics "to develop a strategic analysis of the State's decarbonization opportunities," that could "allow [New York State] to accelerate the development of MAC curves for [electricity, transportation, buildings, and industrial sectors]," which also suggests the Department will explore sector-specific MACs. RFF & NYSERDA at 20.

Can a MAC and damage-cost approach be complementary?

DEC will have to consider whether a damage-cost approach and a MAC approach can be truly complementary. The Department specifically notes that the electric power sector "is best positioned to develop [MAC] curves quickly,"[75] which could mean that New York could potentially use one sector-specific MAC alongside a statewide damage-cost value of carbon. DEC should consider the appropriate context for each approach and look at whether policies using different approaches raise any complications.

As the Department notes, MAC approach necessitates a target,[76] which is not necessarily true for a damage-cost approach. As an analytical tool, MAC is best suited to cost-effectiveness/cost-minimization analysis, as the MAC is the lowest cost at which abatement can be achieved. The damage-cost approach may be somewhat less relevant when there is a binding emissions cap, as individual decisions under that framework may not change the net damages. A damage-cost approach is also best suited to cost-benefit analysis, to assess which alternative among many is welfare maximizing. However, welfare maximization may not be at the center of New York State agencies' forthcoming decisionmaking under the CLCPA given the statute's emissions targets.

Given that the electricity sector is the most likely sector to adopt a MAC in the nearterm, DEC could devise some examples of an electricity sector-specific MAC interacting with other state policies that use the damage cost approach to valuing greenhouse gas emissions. This exercise could aid the Department in making its own determination about whether the two approaches are complementary.

Is it worth the required resources to construct and maintain a MAC?

The IWG social cost estimates were developed over a months-long period by experts from a dozen federal agencies and periodically updated. New York may not want to devote comparable resources to the task of constructing a MAC with similar scientific rigor. Moreover, unlike the modeling underlying the IWG social cost of greenhouse gases, which should be updated periodically as climate science evolves, a MAC must be continuously updated to reflect changes in technology and the policy landscape.[77] The Department must determine whether such a commitment is worthwhile and, if so, how it can proceed efficiently.

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[75] DEC Guidance at 9.

[76] *Id.*

[77] *See* RFF & NYSERDA at 21 ("MAC curves, once developed, would need to be maintained and periodically revisited to stay current with both the state of technology and evolution of the policy context.").