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

A Response to the Manhattan Institute's Critique of Valuing CO_2 Benefits in New York's Clean Energy Programs

by Peter H. Howard, Ph.D[1]

A recent report published by the Manhattan Institute ("Report") criticizing New York's Clean Energy Standard ("CES") incorrectly argues that the CO_2-reduction benefits from these programs are non-existent.[2] The Report claims that the benefits of reducing CO_2 emissions with the CES, which are valued using the Social Cost of Carbon ("SCC"), are "effectively zero."[3] The Report incorrectly asserts that the SCC reflects an average value based on the impact of a large change in CO_2 emissions.[4] Based on this assertion, the Report argues that when the change in global CO_2 emissions is small, the avoided incremental damage is not "even measurable."[5] The Report's author, therefore, concludes that the incremental benefit of the CES policies due to avoided CO_2 emissions are effectively zero.[6] This conclusion and the preceding assertions are incorrect and inconsistent with basic economics.

It is helpful to review some basic economic concepts before discussing the flaws in these arguments. In economics, decisions about how much of a good to produce or consume are made at the margin.[7] The decisionmaker compares the additional cost of producing or consuming one more unit of that good—the marginal cost—with the additional benefit of producing or consuming one more unit of that good—the marginal benefit.[8] The *average* costs and benefits (across total production or consumption) are important in deciding *whether* to produce a good, but are not helpful in deciding *how much* to produce.

Using this foundational economic framework in the clean energy policy context entails comparing the incremental benefits from clean energy policies with the incremental cost of these policies. Both the New York Department of Public Service ("NYDPS") and New York State Energy Research and Development Authority ("NYSERDA") have conducted these analyses for New York's CES.

To ensure the integrity of the policymaking process, it is always important to scrutinize the underlying assumptions of these cost-benefit analyses. But to meaningfully contribute to

[1] Peter H. Howard is the Economics Director of the Institute for Policy Integrity at New York University School of Law. No part of this document purports to present the views of New York University School of Law, if any.
[2] Jonathan A. Lesser, MANHATTAN INSTITUTE, NEW YORK'S CLEAN ENERGY PROGRAMS THE HIGH COST OF SYMBOLIC ENVIRONMENTALISM 2017 [hereinafter "Manhattan Institute Report"].
[3] *Id.* at 5
[4] *Id.* at 27
[5] *Id.*
[6] *Id.*
[7] PAUL KRUGMAN & ROBIN WELLS, MICROECONOMICS 9 (2nd ed. 2009)
[8] *Id.*

policymaking, challenges to these analyses must be grounded in sound economic methodology. The Manhattan Institute's Report relies on incorrect economic reasoning and a faulty interpretation of the SCC.

Specifically:

- Despite the assertion in the Report, the SCC is a monetary estimate of the net damage done by each additional (small) unit of carbon dioxide that is released into the air, and thus, the SCC is indeed a measure of the marginal damages (not the average damages) caused by small CO_2 emissions;
- An SCC value estimated based on the cumulative global emissions is the appropriate metric to monetize the benefits of state clean energy programs due to avoided CO_2 emissions;
- A low, societal discount rate is the appropriate discount rate to use in a societal cost-benefit analysis;
- The current estimate of the SCC almost certainly underestimates the economic damages from climate change; and
- The Report's central economic conclusion that the benefit of CES is effectively zero is based on incorrect economic reasoning. The CES generates significant and crucial environmental benefits.

I. The Social Cost of Carbon is an estimate of the marginal damages caused by small-scale CO_2 emissions

The Interagency Working Group on Social Cost of Carbon ("IWG") defines the SCC as "an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year."[9] Based on three climate-economic models, the IWG calculates the SCC in four modeling steps:

(1) Running each climate-economic model to calculate climate damages under a baseline "business-as-usual" scenario;

(2) Rerunning the model after adding an additional unit of CO_2 emissions in a specific base year to the current baseline to recalculate damages;

(3) Calculating the change in damages in each year between the two model runs to calculate the marginal damages of an additional unit of CO_2 in each year; and

(4) Discounting these damages back to the initial base year, to calculate the net present value of the damages in the base year.[10]

As explained above, marginal cost is defined in economics as the added cost of one additional unit. Therefore, the IWG methodology outlined above exactly calculates the marginal cost of each

[9] The first Technical Support Document of the Interagency Working Group on Social Cost of Carbon (IWG, 2010) lays out the IWG's methodological framework for calculating the SCC using three models: DICE-2007, FUND 3.5, and PAGE2002. Even though the models and the calculations have been updated in 2013 and 2016 by the Interagency Working Group, we cite to IWG (2010), which lays out the underlying methodology for calculating the SCC. In general, see U.S. Interagency Working Group on the Social Cost of Greenhouse Gases (IWG), Technical support document: Technical update of the social cost of carbon for regulatory impact analysis under executive order 12866 (2010).

[10] IWG (2010) at 24; Michael Greenstone et al., Developing a social cost of carbon for US regulatory analysis: A methodology and interpretation. 7 REV. ENVTL. ECON. & POL'Y 23, 36 (2013).

additional unit of emissions consistent with the economic methodology. Furthermore, it is an accepted fact in the field of economics that the SCC measures the marginal cost of CO_2 emissions. The leading economists who have developed the models currently used to estimate damages all define the SCC as a marginal concept.[11]

Therefore, it is not clear why the Report claims that the SCC is an average value. While the lack of citations in the Report's analysis makes it hard to pinpoint the exact reasoning behind this incorrect assertion, the mistake may have arisen for two reasons:

First, to avoid false precision, the IWG (2010) chose a unit of emissions that is greater than a ton (e.g., a kiloton) in step 2 and then scaled down the resulting estimate in step 3 (that is, they divided the change in damages by 1,000 to scale back to a ton) to obtain a cost per ton.[12] However, this rescaling is to ensure the precision of the estimates and does not change the fact that the SCC measures the additional damage imposed by one additional unit of emissions.

Second, the IWG equally weighted and averaged 150,000 model runs to calculate a mean SCC estimate. However, this averaging is done to calculate the central estimate of the marginal cost of CO_2 emissions, in order to account for uncertainty. It cannot be interpreted as an average cost of CO_2 emissions. In other words, the IWG's central estimate is the average (mean) estimate of marginal damages, not the average estimate of average damages.

II. An SCC value estimated based on cumulative global emissions is the appropriate metric to monetize the climate benefits of clean energy programs

Climate change is a global phenomenon. Emissions that occur in one part of the world affect other parts of the world. The same is true for avoided emissions due to clean energy policies. However, the argument that state-level policies are too small to monetize is based on a misunderstanding of the tools available for valuing climate effects.

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[11] The developers of all three climate-economic models used in the official U.S. SCC estimate recognize that the SCC is a marginal concept. Dr. William Nordhaus—a professor at Yale and developer of DICE (the earliest and most prominent model used to estimate the SCC)—states that "it is conventional to measure the SCC as the marginal damage of emissions along the actual path." William Nordhaus, *Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches.* 1 J. OF THE ASS'N OF ENVTL. AND RESOURCE ECON., 271, 274 (2014). Dr. Richard Tol—a professor at the University of Sussex and the founder of the FUND model—notes that "The marginal damage cost of CO_2, also known as the social cost of carbon, is defined as the net present value of the incremental damage due to a small increase in CO_2 emissions." Richard S Tol, *The social cost of carbon*. 3 ANN. REV. RESOURCE ECON., 419, 429 (2011). Dr. Chris Hope—a professor at Cambridge University and the developer of PAGE—states that the SCC is the "monetized value of the marginal benefit of reducing 1 ton of CO_2." Laurie T. Johnson & Chris Hope, *The social cost of carbon in US regulatory impact analyses: an introduction and critique.* 2 J. OF ENVTL STUD. AND SCI., 205, 205 (2012). Finally, the National Academy of Sciences' Committee on Assessing Approaches to Updating the Social Cost of Carbon recently explained that "[i]n order to estimate the SCC, one needs to project both the sequence of future annual incremental changes in the climate and the resulting economic damages from a marginal increase in CO_2 emissions, and then covert the stream of incremental economic damages into a present value equivalent" NAT'L ACAD. SCI., ENG. & MED., *Valuing Climate Damages: Updating Estimates of the Social Cost of Carbon Dioxide* (2017) [hereinafter "NAS, Second Report"] at 9.

[12] IWG (2010) at 24.

The SCC was developed to assess the damage of actions with small-scale impacts on cumulative global emissions.[13] In other words, the SCC was developed to measure the impact of emission changes that are relatively small compared to the global level of emissions, such as state clean energy policies. Therefore, the SCC is indeed the appropriate value to monetize the avoided-emissions benefits of policies such as the CES.

Further, basing clean energy decisions on the SCC, even when the local emissions are only a fraction of global emissions, is strategically the best policy option.[14] If all policymakers around the world set their greenhouse emission levels based on only domestic costs and benefits, ignoring the large global externalities, the aggregate result would be substantially sub-optimal climate protections and economically inefficient policies. For example, basic economic analysis demonstrates that the United States stands to gain hundreds of billions or even trillions of dollars in direct benefits if other countries and local governments apply global social cost of greenhouse gas values in their regulatory decisions and project reviews.[15]

Using the SCC enables regulators and policymakers to take into account the effect of their decisions on society as a whole, as climate change is a global problem. This consideration can encourage reciprocal actions from other actors, including other U.S. states and other countries. In fact, for the U.S. or any individual state to now depart from this collaborative dynamic by no longer considering the wider benefits of state and national policies could undermine the state's long-term interests and could jeopardize emissions reductions underway in other countries and states, which are already benefiting all 50 U.S. states and territories.[16]

The Report wrongly implies that CO_2 emission reductions have value only if we can reduce global emissions all at once, despite the reality that it will take many local, national, and international policies to achieve target emission reduction levels.[17] Though it is challenging to perceive, each additional ton of CO_2 emitted causes real economic damages. The existence of international temperature goals does not imply an emission threshold above which CO_2 policies have no benefit. On the contrary, each additional unit of CO_2 emissions imposes an incremental cost that increases

[13] In fact, when valuing a policy's greenhouse-gas reductions in a cost-benefit analysis using a constant SCC in given time period, the analyst essentially assumes that the marginal damages from decreased emissions will remain approximately constant for small emissions declines relative to gross global emissions.
[14] See generally Peter Howard & Jason Schwartz, Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon, 42 COLUMBIA J. ENVTL. L. 203 (2017) [Hereinafter "Howard & Schwartz 2017"]; Richard Revesz, Kenneth Arrow et al., The Social Cost of Carbon: A Global Imperative, 11 REV. ENVTL. ECON. & POL'Y 172 (2017).
[15] Peter Howard & Jason Schwartz, Foreign Action, Domestic Windfall: The U.S. Economy Stands to Gain Trillions from Foreign Climate Action (2015), http://policyintegrity.org/files/publications/ForeignActionDomesticWindfall.pdf. (Calculating that global actions on climate change—particularly by Europe, and including efforts of the United States and other countries—already benefited the United States by over $200 billion as of 2015. Furthermore, the report finds that, as of 2015, climate policies worldwide—including efforts by Europe, Canada, and many other countries, as well as U.S. policies from the time—could generate upwards of $2 trillion in direct benefits to the United States by 2030.)
[16] See generally Howard & Schwartz 2017.
[17] It is easy to see, using a simple thought experiment, that their argument that the emission reductions by New York's Clean Energy Programs—and even the federal Clean Power Plan and the international Paris Agreements—are too small to value is false. Assume that there is a CO_2 policy that produces one trillion dollars in current benefits by reducing emissions by a large enough amount on the global scale. Now, if instead multiple policies each reduce CO_2 emissions by a fraction of that amount, but the total reductions still add up to the same amount, the total benefits all these policies would still be one trillion dollars. This holds true even as the number of policies become large and the amount of emission reductions per policy decreases, even to a small amount on the global scale. The Report's false logic denies this obvious equality.

with the level of CO_2 in the atmosphere. The SCC helps policymakers across multiple national and state institutions achieve efficient temperature levels by internalizing avoided damages.

III. A low, societal discount rate is the appropriate discount rate to use in a societal cost benefit analysis

The discount rate chosen to convert the future costs and benefits into present-day dollars reflects how a federal or state agency treats future generations of Americans. In an intergenerational context, especially given the long lifespan of CO_2 emissions in the atmosphere and the long-term (multiple centuries or more) irreversible consequences of climate change, economic theory requires the use of societal preferences and social discount rates, rather than a discount rate based on returns to private capital investments. Therefore, using a 3% or lower discount rate is consistent with economic best practices.[18]

In the intergenerational context, using a discount rate based on the private return to capital, such as 7%, is inappropriate for three reasons. First, private market participants typically focus on short time horizons. By contrast, climate change affects public well-being for centuries. Therefore, the analysis should be based on low societal discount rates, rather than evaluating an optimal outcome from the narrow perspective of investors alone.

Second, because climate change is expected to largely affect consumption (as it is currently understood and modeled by economists) and not returns to capital, the consumption rate of interest is more appropriate than the opportunity cost of capital.[19] Again, a 7% rate is inappropriate.[20]

Finally, recent research shows that the appropriate discount rate for intergenerational analysis may be even lower than what is currently used in the SCC analysis. A consensus has emerged among leading climate economists that a declining discount rate should be used for climate damages to reflect long-term uncertainty in interest rates.[21] Using a declining discount rate would mean that the SCC values should be even higher. Even if a constant discount rate is maintained, recent work by

[18] IWG, 2010 at 23; NAS, Second Report at 157

[19] Maureen Cropper, *How Should Benefits and Costs Be Discounted in an Intergenerational Context?*, 183 RESOURCES 30, 33.

[20] CIRCULAR A-4, at 33; Council of Econ. Advisers, Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate at 1 (CEA Issue Brief, 2017) [Herein after "CEA Brief"], available at https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf; IWG 2010 at 23; NAS Second Report at 157.

[21] *See* Martin L. Weitzman, *Gamma Discounting*, 91 AM. ECON. REV. 260, 270 (2001); Kenneth J. Arrow et al., *Determining Benefits and Costs for Future Generations*, 341 SCIENCE 349 (2013); Kenneth J. Arrow et al., *Should Governments Use a Declining Discount Rate in Project Analysis?*, 8 REV ENVTL. ECON. & POLICY 1 (2014); Maureen L. Cropper et al., *Declining Discount Rates*, 104 AM. ECON. REV. 538 (2014); Christian Gollier & Martin L. Weitzman, *How Should the Distant Future Be Discounted When Discount Rates Are Uncertain?* 107 ECONOMICS LETTERS 3 (2010); NAS, Second Report; The National Academy of Sciences accepted public comment during its review process. Policy Integrity submitted comments during that process. Institute for Policy Integrity, Recommendations for Changes to the Final Phase 1 Report on the Social Cost of Carbon, and Recommendations in Anticipation of the Phase 2 Report on the Social Cost of Carbon (Apr. 29, 2016).

the Council of Economic Advisors (which is also supported by surveys of economists) finds strong evidence that a discount rate closer to 2% is more consistent with recent empirical evidence.[22]

IV. The SCC should be interpreted as a lower-bound estimate of likely climate damages

There is consensus among leading climate economists that the current estimates of the SCC likely underestimate climate damages, so the metric is considered a lower-bound estimate. A number of types of damage from climate change are missing or poorly quantified in the federal SCC estimates.[23] For example, current models omit ocean acidification, wildfires, damages to productivity, and climate-driven migration and conflict. Recent surveys of experts have found a consensus that impacts will likely exceed current predictions.[24] In fact, a recent survey of experts on the economics of climate change found that a majority believed that the central IWG estimate was too low.[25]

V. The central economic argument of the report is based on incorrect economic reasoning

The Report explains its central argument with a figure to show that the benefits from the CES are negligible.[26] However, this figure incorrectly characterizes the problem. As noted earlier, the SCC is a marginal concept. Therefore, the IWG's official SCC estimate should be measured on the marginal SCC curve, and not the average SCC curve. Because there is already an existing stock of CO_2 emissions in the atmosphere, the avoided emissions due to CES should be measured starting from the amount of emissions that would have been realized in the absence of CES, the point BAU (business-as-usual) in Figure 1, instead of being measured starting from the origin as assumed in the Report.

Because each additional unit of CO_2 emissions imposes an incremental cost that increases with the level of CO_2 in the atmosphere, the marginal SCC curve is increasing. Therefore, a policy such as the

[22] CEA Brief, supra note 19 at 1; id. at 3 ("In general the evidence supports lowering these discount rates, with a plausible best guess based on the available information being that the lower discount rate should be at most 2 percent while the upper discount rate should also likely be reduced."); id. at 6 ("The Congressional Budget Office, the Blue Chip consensus forecasts, and the Administration forecasts all place the ten year treasury yield at less than 4 percent in the future, while at the same time forecasting CPI inflation of 2.3 or 2.4 percent per year. The implied real ten year Treasury yield is thus below 2 percent in all these forecasts."). Peter Howard & Derek Sylvan, *Expert Consensus on the Economics of Climate Change,* Institute for Policy Integrity Report (Dec. 2015). ("The mean and median estimates were approximately 3% and 2%") [hereinafter Howard and Sylvan, 2015]; M.A. Drupp, et al., Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%).

[23] See, e.g., Richard L. Revesz et al., Global Warming: Improve Economic Models of Climate Change, 508 NATURE 173 (2014) (explaining that current estimates omit key damage categories and, therefore, are very likely underestimates); PETER HOWARD, OMITTED DAMAGES: WHAT'S MISSING FROM THE SOCIAL COST OF CARBON (2014) [hereinafter "OMITTED DAMAGES"]; NAS, Second Report at 129.

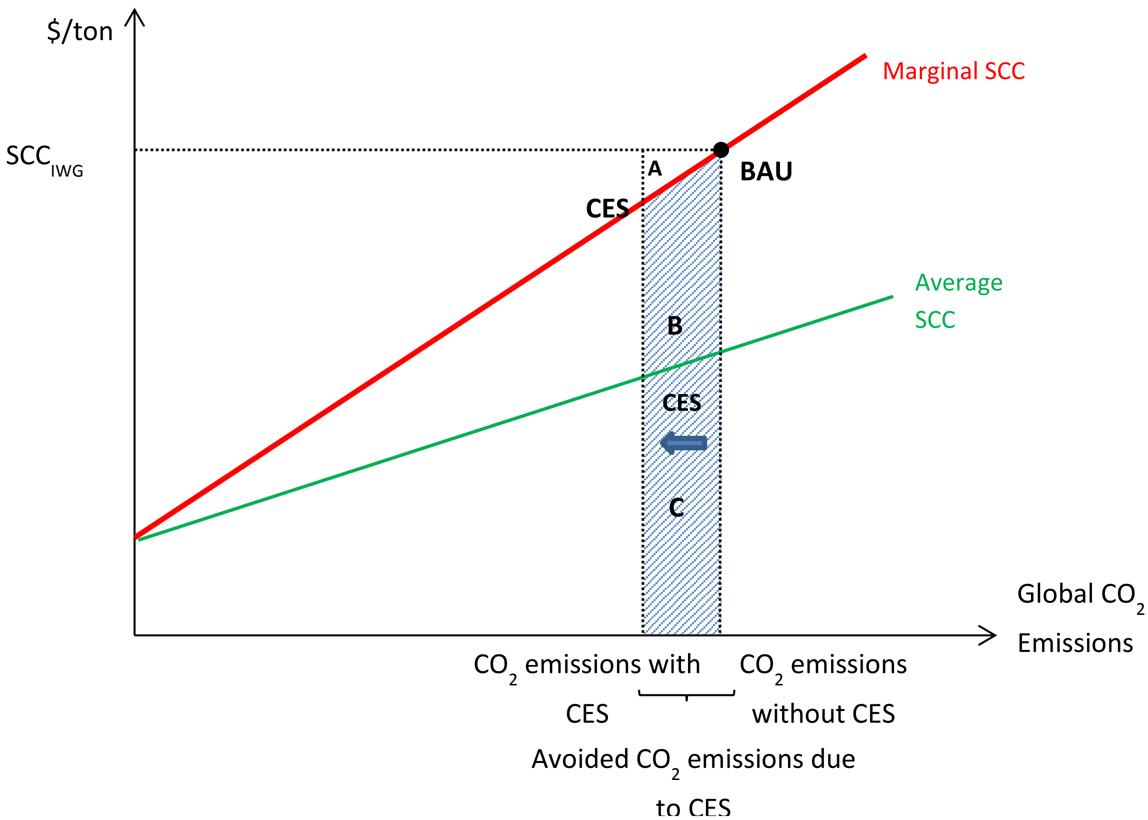
[24] Howard and Sylvan, 2015 at 22; R. Pindyck, The Social Cost of Carbon Revisited (Nat'l Bureau of Econ. Res. No. w22807, 2016. at 25.

[25] Howard and Sylvan, 2015 at 19 ("More than half of respondents believed that $37 is too low of a value for the SCC, and more than two-thirds believed that that actual SCC was equal or greater than $37. Twice as many experts had no opinion (16%) as believed that the SCC is too low (8%).")

[26] Manhattan Institute Report, *supra* note 1 at 28.

CES prevents what would have been the *costliest* CO_2 emissions from being emitted. Graphically, this translates to a representation of a reduction in the stock of emissions starting from the right side of the figure, not from the origin as done in the Report. Figure 1 below is the correct graphical representation of the use of the SCC to value the benefits of a clean energy policy such as the CES in this setting. Calculating the area under the marginal SCC curve between the points BAU and CES would give the damages avoided by the CES, and therefore the benefit of the CES policy.

Figure 1: Average and Marginal SCC Values in a Static CO_2 Emissions Problem[27]



In Figure 1, the avoided emission benefits of the CES are represented by the sum of areas B and C. The cost-benefit analysis, which multiplies the avoided emissions due to the CES by the SCC_{IWG}, calculates to the sum of A, B, and C. If the policy in question is small in its impact on emissions relative to the global stock of CO_2 emissions, such as in the case of the CES, the area A is very small. Thus, the upward bias from using the IWG's SCC estimate is negligible. Therefore, using the IWG's SCC estimate to value the benefits of the CES as done by NYSERDA and NYDPS is clearly the appropriate economic method.

[27] The SCC is calculated using dynamic models, instead of the static representations of the SCC in Figure 1 and Figure 13 of the Report. In a dynamic setting, the above figures can be roughly interpreted as representing one year of the dynamic problem. For simplicity, we use linear marginal and average cost curves. The same results would hold under the same marginal and average cost curves used in Figure 13 of the Manhattan report.