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Comments on Chapter 11, "Climate Change, the Economy, and the Social Cost of Carbon," in the report produced by the US Department of Energy's Climate Working Group titled *A Critical Review of Impacts of Greenhouse Gas Emissions on the US Climate*

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US Department of Energy
1000 Independence Avenue SW
Washington, DC 20585
Attn: Docket ID No. DOE-HQ-2025-0207-0001
Submitted via: **www.regulations.gov**

Dear Secretary Wright,

On behalf of Resources for the Future (RFF), I am pleased to share the accompanying comments to the US Department of Energy (DOE) on the draft report produced by DOE's Climate Working Group titled *A Critical Review of Impacts of Greenhouse Gas Emissions on the US Climate* (CWG Report).

RFF is an independent, nonprofit research institution in Washington, DC. Its mission is to improve environmental, energy, and natural resource decisions through impartial economic research and policy engagement. RFF is committed to being the most widely trusted source of research insights and policy solutions leading to a healthy environment and a thriving economy. While RFF researchers are encouraged to offer their expertise to inform policy decisions, the views expressed here are those of the individual author and may differ from those of other RFF experts, its officers, or its directors. RFF does not take positions on specific policy proposals.

In this case, RFF expert Dr. Brian Prest has provided technical comments on Chapter 11 of the report, titled "Climate Change, The Economy, and the Social Cost of Carbon." The comments focus on the usage of economic concepts and their application in the report, along with reference to recent advances in the relevant literature.

If you have any questions or would like additional information, please contact Liam Burke at lburke@rff.org.

Sincerely,

Carlos E. Martín

Vice President for Research and Policy Engagement

Comments on Chapter 11, "Climate Change, the Economy, and the Social Cost of Carbon," in the report produced by the US Department of Energy's Climate Working Group (CWG) titled *A Critical Review of Impacts of Greenhouse Gas Emissions on the US Climate* (CWG report)

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1. Technical Comment on Page 119

Page 119 of the CWG report mischaracterizes the results of Newell et al. (2021), which was coauthored by the present author (Newell, Prest, and Sexton 2021). Newell et al. (2021)'s abstract summarizes its results as follows:

> *"The uncertainty is greatest for models that specify effects of temperature on GDP growth that accumulate over time; the 95% confidence interval that accounts for both sampling and model uncertainty across the best-performing models ranges from 84% GDP losses to 359% gains. Models of GDP levels effects yield a much narrower distribution of GDP impacts centered around 1–3% losses, consistent with damage functions of major integrated assessment models. Further, models that incorporate lagged temperature effects are indicative of impacts on GDP levels rather than GDP growth. We identify statistically significant marginal effects of temperature on poor country GDP and agricultural production, but not rich country GDP, non-agricultural production, or GDP growth."*

The conclusion further states,

> *"Models relating temperature to GDP levels yield climate impact estimates that are far more certain. The best such models imply GDP losses by 2100 of 1–3%, consistent with damage functions currently embedded in the major integrated assessment models that underpin the U.S. social cost of carbon (National Academies of Sciences 2017; Nordhaus 2017; Rose et al. 2017; National Research Council 2010). The 95% confidence range for GDP levels models in any model confidence set is −8.5% to +1.8%. Hot temperatures are estimated to cause statistically significant losses to the level of poor country and agricultural GDP, but not to rich-country and non-agricultural production."*

The CWG nonetheless summarizes the same results as follows:

> *"Overall, [Newell et al. (2021)] could not detect a temperature effect on GDP or GDP growth, and they estimated the 95 percent confidence interval for the impact on global growth as of 2100 even under the exaggerated RCP8.5 warming scenario spans −86 percent to +388 percent. In other words the net effect is likely positive but too uncertain to distinguish from zero."*

There are at least three reasons why the CWG summary is inappropriate. The first clause is inaccurate or at best incomplete. The abstract of Newell et al. (2021) states: *"We identify statistically significant marginal effects of temperature on poor country GDP and agricultural production, but not rich country GDP, non-agricultural production, or GDP growth."*

The second clause of the CWG summary above focuses solely on the class of models that the Newell et al. paper's results suggest against relying upon. A key conclusion of Newell et al. (2021) is that estimates of the effect of temperature on the **growth rate** of GDP are very uncertain, but that estimates of the effects on the **level** of GDP are more certain. This suggests that the results from pure GDP growth models should be viewed with considerable skepticism, while results from GDP level models appear more realistic. Yet, the CWG only cites the "*−86 percent to +388 percent*" range that corresponds to the less reliable set of models. The CWG report does not cite the corresponding range from the more realistic models—the ones that specify impacts on GDP levels.

In this context, the final sentence from the CWG's summary is also incorrect. The estimates from GDP levels models are reported in the Newell et al. conclusion: "*The 95% confidence range for GDP levels models in any model confidence set is −8.5% to +1.8%.*" While the paper does not explicitly report other summary statistics of this distribution, it can nonetheless be seen in the bottom panel of Figure 6 in Newell et al. (2021), reproduced below (see blue line). The mean and median values corresponding to those results are both about −2 percent, and the likelihood of a negative impact on GDP is 92 percent, implying an 8 percent likelihood of a negative value. This result contradicts the CWG claim that "*the net effect is likely positive*".

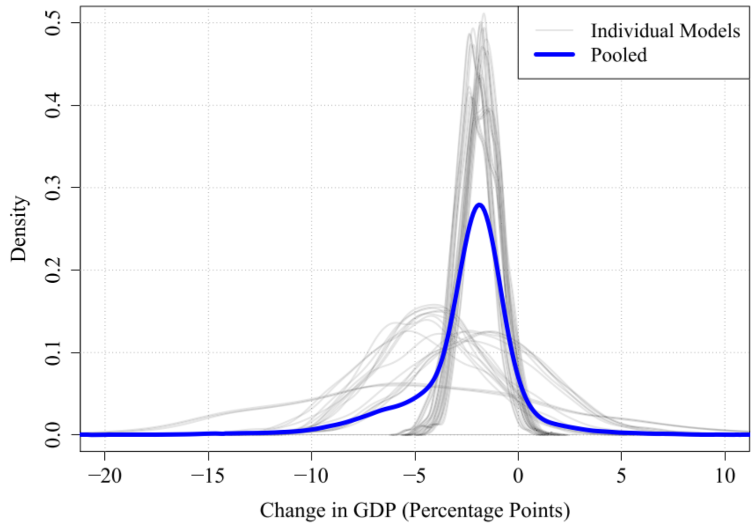

Figure 1. GDP Impact Distributions for Unmitigated Warming in Non-Linear Models that Appear in Any Model Confidence Set, GDP Levels Models

Beyond Newell et al. (2021), the more recent literature (e.g., Nath, Ramey, and Klenow (2025)) suggests a middle ground between the extreme cases considered in Newell et al. (2021). This suggests that temperature's impacts on GDP are not fully persistent (as in growth models) or fully transitory (as in levels models), but partially persistent. Newell et al. (2021) did not consider partially persistent models, but the GDP impacts in such models are generally larger than those in levels models and smaller than those in growth models. The CWG Report fails to mention such studies.

2. Technical Comment on Page 121

Page 121 of the CWG Report claims:

> *"The concepts of estimation and uncertainty do not readily apply to SCC calculations. No amount of data collection can change the fact that many components of the SCC are unknown and rely on judgment and opinion based on knowledge of the underlying literature on the physical effects of climate change. SCC calculations are thus best thought of as 'if-then' statements: if the following assumptions hold, then the SCC is $X per tonne".*

This claim demonstrates a misunderstanding of empirical inference. All estimates rely on both data and assumptions. No estimate is assumption-free. As memorably noted by Charles Manski and coauthors, "Whatever the field of science may be, the logic of empirical inference is summarized by the following relationship: assumptions + data → conclusions. Data alone do not suffice to draw useful conclusions" (Manski, Sanstad, and DeCanio 2020). This emphasizes a key point: no amount of data collection will permit researchers to estimate anything without assumptions. This concept thus needs to be worked into CWG's discussion of the social cost of carbon (SCC).

3. Technical Comment on Pages 121 through 123

Sections 11.2.1 through 11.2.3 discuss integrated assessment models (IAMs) used to estimate the SCC. The section focuses heavily on the Framework for Uncertainty, Negotiation, and Distribution (FUND) model. Yet the FUND model is outdated and does not represent the state of the science. The CWG report omits reference to state-of-the-art IAMs, including those developed in two high-profile studies from three years ago: Rennert et al. (2022) and Carleton et al. (2022).

4. Technical Comment on Page 122

Page 122 of The CWG Report claims that:

> *"For example, in 2023 the U.S. Environmental Protection Agency raised its preferred SCC value about 5-fold over the estimates it had issued ten years earlier. This is not because new data had been collected or better mathematical methods had been invented, but because new assumptions had been used, and the validity of those assumptions was a separate question. Tabulations on EPA (2023) p. 81 show that if assumptions similar to earlier analyses had been applied, the results would not have materially differed from before. One new assumption was that global agricultural damages were far higher than previously believed, based on an analysis in Moore et al. (2017)."*

First, the CWG claims that US Environmental Protection Agency's (EPA) updated estimates from 2023 do not owe to the fact that "new data [has] been collected or [that] better mathematical methods [have] been invented" since the federal government's last efforts to update its SCC models in the Interagency Working Group on Social Cost of Greenhouse Gases, or the IWG (2016). This statement is simply false. On the contrary, the EPA's 2023 update is based entirely on new integrated assessment models and meta-analyses that did not exist prior to 2016. These new datasets and methods were developed in studies including Rennert et al. (2021, 2022), Newell et al. (2022), Carleton et al. (2022), Cromar et al. (2022), Clarke et al. (2018), Howard and Sterner (2017), Millar et al. (2017), Wong et al. (2017), and Diaz (2016). All of those new studies are clearly cited and discussed in EPA's 2023 study, yet none of them are mentioned in The CWG Report.

Second, it is unclear which "new assumptions" in the "[t]abulations on EPA (2023) p. 81," the CWG means to refer to. The report vaguely compares the estimates shown there to other "earlier" assumptions and concludes that SCC estimates would "not have materially differed from before." However, the only assumption identified in the quoted paragraph corresponds to updated estimates of the impacts of climate change on agriculture. The CWG argues this portion of the estimates are "unwarranted" in this report. The cited tabulations in EPA (2023) provide the sensitivity that can be assessed from the table cited, as we do now.

4.1. Agriculture's Impact on the SCC

If the CWG is concluding that removing agriculture's contribution to the SCC yields estimates similar to the IWG (2016) estimates of $62 per tonne for the same emissions in the year 2030,[1] then the CWG's statement is demonstrably false, as we show by replicating the cited table from EPA (2023) below.

The EPA's central estimate entails using each of the three noted damage modules and then averaging the "Total" results, as shown in the table below. The average of the results from that table is $230 per tonne CO_2 (resulting from the equation *($233+$219+$238)/3*—also see Table ES-1 of EPA (2023) —in the row corresponding to a 2030 emissions year). Removing the agricultural components of $4 and $103 per tonne CO_2 from the Data-driven Spatial Climate Impact Model (DSCIM) and Greenhouse Gas Impact Value Estimator (GIVE) modules changes this average to $194 per tonne CO_2 (resulting from the equation *($229+$116+$238)/3*). This remains more than 3 times the prior $62 per tonne CO_2 estimate—clearly portraying a material difference.

	Damage Module		
Impact category	DSCIM	GIVE	Meta-Analysis
Health	$179	$104	-
Energy	-$4	$10	-
Labor productivity	$47	-	-
Agriculture	$4	$103	-
Coastal	$3	$2	-
Total	$233	$219	$238

Table 1. Impact Category Disaggregation of the SCC for 2030 Under a 2 Percent Near-term Ramsey Discount Rate (in 2020 Dollars per Metric Tonne of CO_2)

Source: EPA 2023, Table ES-1.

[1] See IWG (2021) for the IWG (2016) estimates adjusted to 2020 dollars. The central estimate using a 3 percent discount rate in Table ES-1. We focus on the value for emissions year 2030 to correspond with the values in the table in EPA (2023) that CWG cites.

4.2. Discounting's Impact on the SCC

Another important assumption in the SCC is the method for discounting future impacts to present values. Newell et al. (2022) and Rennert et al. (2021) significantly improved upon the methods and data for discounting by incorporating a dynamic, Ramsey-like approach to discounting, in line with recommendations from the National Academies of Sciences (2017). Contrary to the CWG's claims, this improvement indeed represents a "better mathematical method" that improves upon the approach used in the IWG (2016) estimates.

Rennert et al. (2021) emphasize that this improved approach reduces the SCC. Table 1 of Rennert et al. (2021) presents SCC estimates under both an earlier constant discount rate approach and an improved dynamic discounting approach. At a 3 percent central discount rate, the new dynamic discounting method reduces the SCC from $194 (constant discounting) to $61.4 (dynamic discounting) per tonne CO_2. At a 2 percent discount rate, the improved approach reduces the SCC from $1,557 (constant discounting) to $168.4 (dynamic) per tonne CO_2. In summary, for a given level of the discount rate, had the earlier methods been used, the SCC would be higher than presented in EPA (2023) and Rennert et al. (2022), not lower, as the CWG claims when it says that "if assumptions similar to earlier analyses had been applied, the results would not have materially differed from before."

The update of the overall level of the discount rate from 3 to 2 percent reflects secular downward trends in data on real market interest rates over the past several decades, which remain around 2 percent as of August 2025.[2] This demonstrates that the CWG's claim that no "new data had been collected" to inform the updates to the discount rate is similarly false

Even if one were to set aside these data and methodological improvements and deploy the model from Rennert et al. (2022) with 1) damages to agriculture omitted and 2) a constant 3 percent discount rate, the SCC estimate for a 2020 emissions year would be $84 per tonne CO_2,[3] which is 61 percent higher than the IWG (2016, 2021) value of $51 per tonne CO_2 for the same year (IWG 2021).

In summary, the updated approach to discounting reflects both new data on market interest rates and better mathematical methods developed in line with recommendations from the National Academies of Sciences (2017) in the years since the IWG (2016) estimates were developed. Yet even if one were to ignore those improvements, the SCC would nonetheless be 61 percent higher than prior estimates from IWG (2016), demonstrating that the CWG's claim that such estimates would "not have materially differed from before" is false.

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[2] See **https://fred.stlouisfed.org/graph/?g=1LEYv.**

[3] Author's calculations based on Rennert et al. (2022).

5. Technical Comment on Page 122

Page 122 of the CWG report states that the *"[d]*amage function coefficients: IAMs assume CO_2 and warming cause net harms that increase exponentially with temperature." This claim is inaccurate. Most IAMs' damage functions increase quadratically with temperature, not exponentially (e.g., Dynamic Integrated Model of Climate and the Economy (DICE), DSCIM, and the meta-analysis in EPA (2023) based on Howard and Sterner (2017)). Further, in the IAM GIVE (from Rennert et al. 2022), one of the main modules underlying EPA's 2023 update, the damage functions are mostly linear in temperature.

6. Technical Comment on Page 122

Page 122 of the CWG report states that the "IAMs generate SCC estimates that increase as the pre-existing concentration of CO_2 increases. Consequently the value of damages later in the century will be higher, depending on the assumed baseline emissions over the coming decades." This claim is inaccurate. This is not the primary reason SCC estimates increase over time. The primary reason is economic growth. Also, as noted above, GIVE is an example of an IAM with largely linear damage function, where the behavior described is not correct.

7. Technical Comment on Page 123

Page 123 of the CWG Report argues the following:

> *"It should also be noted that the SCC is focused on the social costs of CO_2 emissions from fossil fuel use. It is not intended to measure the private marginal benefits to consumers and society from the availability of fossil fuels. Public willingness to pay for fuels of all types indicates the value to society of reliable, abundant fossil energy. Tol (2017) estimates that the private benefit of carbon is large relative to the social cost. This can be illustrated by noting that the price of a gallon of gas indicates the marginal value to the consumer of the fuel. Suppose we assume a relatively high Social Cost of Carbon of, say, $75 per tonne. Deflated by a MCPF[4] value of 1.5 that would result in a carbon tax of $50 per tonne, which equates to about 44 cents per gallon of gas (Lavelle, 2019). A pre-tax price of $3.00 per gallon would imply the marginal social benefit of the fuel is nearly seven times the marginal social cost.*
>
> *[4] Marginal Cost of Public Funds: the optimal carbon tax rate is the SCC divided by the MCPF (Sandmo 1977)."*

This paragraph contains an elementary error of economic logic by confusing the "marginal social cost" of gasoline with its "marginal external cost". The social marginal cost (SMC)[4] of producing a good is equal to its private marginal cost (PMC) plus its marginal external cost (MEC), or in mathematical terms, SMC = PMC + MEC (e.g., Tietenberg and Lewis 2015). Yet the paragraph quoted erroneously implies that the social marginal cost of a gallon of gasoline equals the social cost of carbon converted into dollars per gallon equivalent, thereby forgetting the private marginal cost term of the equation.

It is possible that the authors' confusion stems from terminology. While the term "social cost of carbon" contains the word "social," it, in fact, corresponds solely to the marginal external cost (MEC) component of the SMC equation above. It does not include the cost of producing any product that leads to carbon emissions because the SCC is meant to represent the damages, or negative externalities, to society from those emissions, rather than the costs of any particular emissions-producing good. Those costs will naturally vary by good, such as coal, oil, or natural gas.

The omission of production costs from the SCC estimates is an intentional conceptual distinction, but those costs must also be accounted for separately in any calculation of social marginal costs (SMC). We complete CWG's analysis here and update its conclusions accordingly.

In competitive equilibrium, where external costs are not internalized such as by a carbon tax, the market price will equal *both* the private marginal cost *and also* equal the private marginal benefit (P = PMC = PMB). The CWG assumes in the above paragraph that PMB = P = $3 per gallon, which coupled with the equation PMC = PMB similarly implies PMC = $3 per gallon.

Taking CWG's proposed carbon-tax-equivalent value of $0.44 per gallon at face value, the social marginal cost is thus PMC + MEC = $3.00 + $0.44 = $3.44 per gallon, or about 15 percent higher than the $3.00 per gallon in social marginal benefits.[5] This demonstrates that CWG's claim that "the marginal social benefit of the fuel is nearly seven times the marginal social cost" is false and should at minimum be corrected to read "the marginal social benefit of the fuel is about 13 percent smaller than the marginal social cost."[6] An additional, more nuanced point is that the social marginal cost reflects the full $75 per tonne SCC value, not the value after deflating by the marginal cost of public funds (MCPF). This is because the SCC is not only used as a guide for setting carbon taxes—in fact, its primary use is as an estimate of benefits of regulations, which rarely ever take the form of carbon

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[4] The terms "marginal social cost" and "social marginal cost" are interchangeable. Because "social marginal cost" is the more common terminology, we use that term here. An analogous point is also true of social marginal benefits.

[5] The CWG implicitly equates social marginal benefits to private marginal benefits, which is reasonable for purposes of this thought experiment, but it nonetheless does not consider any other uninternalized externalities from the production or consumption of gasoline.

[6] Where −13 percent is $3.00 per $3.44 – 1.

taxes. In such regulatory cases, the MCPF is simply not relevant to the analysis, meaning no deflation of the SCC is warranted.

Correcting for this involves undoing the deflation by CWG's proposed MCPF of 1.5, which changes the $0.44 per gallon value to $0.66 per gallon. The marginal social cost would therefore be $3.66, not $3.44, per gallon. In that case, sentence would correctly read "the marginal social benefit of the fuel is about 18 percent smaller than the marginal social cost."[7]

There are also other externalities associated with gasoline use that should not be forgotten. These include conventional air pollutants aside from greenhouse gases, as well as road congestion and accident risk. For instance, Parry and Small (2005) estimate that these externalities add an additional $0.69 per gallon (in 2000 US$, see their Table 1) to the optimal gasoline tax for the United States. Lin and Prince (2009) estimate this contribution to be $0.60 per gallon (in 2006 US$, see their Table 9) in California. Accounting for these would further increase the estimate of social marginal costs above marginal benefits, implying that the "18 percent smaller" estimate above in fact understates the divergence.

Second, the CWG is correct in its broader conclusion that a carbon tax on the order of $50 per tonne CO_2 would not have an outsized impact on gasoline prices. Yet such a carbon tax is likely to nonetheless yield large reductions in emissions, primarily from other sectors like electric power, where low-cost emissions abatement opportunities are relatively abundant. Chen, Goulder, and Hafstead (2018) estimate that a US economy-wide carbon tax of a similar magnitude ($52 per tonne CO_2) would reduce US emissions by 21 percent while reducing GDP by 0.4 percent.[8] Barron et al. (2018) find similar impacts, estimating that a $50 per tonne CO_2 carbon tax would reduce US emissions by approximately 30 percent (with uncertainty ranges spanning 19 to 48 percent, see Table 1 therein), while having negligible impacts on the economy "equivalent to a change in the rate of GDP growth of less than 0.05 percent points in most models."

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[7] Where −18 percent is $3.00 per $3.66 – 1.

[8] See **https://www.rff.org/publications/data-tools/carbon-pricing-calculator/** for model results for the American Opportunity Carbon Fee Act in year 2020, when the carbon price is assumed to be $52 per tonne CO_2. The model underlying these results was published in Chen, Goulder, and Hafstead (2018).

Third, the CWG's stated calculation for the optimal tax on gasoline, citing Sandmo (1975),[9] is only equal to the optimal gasoline tax if the MCPF is equal to 1. This is internally inconsistent with the CWG's preferred MCPF value of 1.5. Sandmo (1975) states "the optimal tax rate for the externality-creating commodity is a weighted average of the inverse elasticity and the marginal social damage". Those respective weights are given by:

- *(MCPF−1)/MCPF* for the inverse elasticity, and
- *1/MCPF* for the marginal social damage.

The CWG only focuses on the latter term, which is why it deflates the SCC by a factor of *1/MCPF*. Yet this ignores the former term. The full equation can be observed in Sandmo's (1975) equation (25), although it is expressed there using different notation and in terms of tax rates (i.e., in percentage points instead of dollars per gallon). Translating that equation to align with the CWG's calculation approach results in the following equation for the optimal tax rate on gasoline in dollars per gallon, denoted t^*:

$$t^* = \frac{MCPF - 1}{MCPF}\left(-\frac{1}{\varepsilon}\right)P + \frac{1}{MCPF}\left(\frac{0.0088\ tCO_2}{gallon}SCC\right)$$

where ε is the elasticity of demand for gasoline, P is the price of gasoline, MCPF is the marginal cost of public funds, and 0.0088 tCO_2/gallon is CWG's implicit conversion from tonnes CO_2 per gallon of gasoline. We can see that the second term of this equation resolves to the CWG's result of $0.44 per gallon when using $MCPF = 1.5$ and $SCC = \$75/tCO_2$: $\frac{1}{1.5}\frac{0.0088\ tCO_2}{gallon}\frac{\$75}{tCO_2} = \$0.44$ per gallon. This demonstrates that the CWG only considers the second half of the equation, and not the first. For $MCPF$ values above 1, the optimal tax from the formula cited by the CWG is larger than the CWG claims because the first term of the equation is positive.

Using the CWG's preferred value of $P = \$3/gallon$, completing the optimal tax equation only requires finding an estimate of ε, the elasticity of demand for gasoline. We can infer the implied values for this elasticity using the DOE's Energy Information Administration's 2025 Annual Energy Outlook (AEO). We do this by comparing US gasoline consumption under alternative Oil and Gas Supply scenarios that feature with more or less oil and gas supply and, consequently, lower or higher gasoline prices.[10] The resulting estimates suggest EIA's implicit long-run estimate of the elasticity of demand for motor gasoline falls in the range of −-0.1 to −0.2. Plugging the high-end estimate of this

[9] While the CWG cites Sandmo (1977), no such paper appears in the reference list. The only Sandmo paper in CWG's reference list is Sandmo (1975).

[10] Downloaded from **https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2025** and **https://www.eia.gov/outlooks/aeo/data/browser/#/?id=11-AEO2025**.

elasticity of −0.2 into the adapted formula from Sandmo (1975) alongside the CWG's preferred estimates of $MCPF = 1.5$, $P = \$3/gallon$, and $SCC = \$75/tonne\ CO_2$ yields an optimal tax of:

$$t^* = \frac{0.5}{1.5}\left(-\frac{1}{-0.2}\right)\$3 + \frac{1}{1.5}\left(\frac{0.0088\ tCO_2}{gallon} \cdot SCC\right)$$

$$= \frac{1}{3}\left(-\frac{1}{-0.2}\right)\$3 + \frac{1}{1.5}\left(\frac{0.0088\ tCO_2}{gallon} \cdot SCC\right)$$

$$= \$5 + \$0.44 = \$5.44/gallon.$$

This changes the optimal tax implied by the cited equation from Sandmo (1975) from the CWG's proposed $0.44 per gallon to $5.44 per gallon—a factor of 12 difference. As this equation makes clear, the first term of the Sandmo (1975) equation, which is missing from the CWG's calculation, dominates the equation for the optimal tax.[11] To be clear, this comment does not mean to endorse a gas tax of $5.44 per gallon, but rather to point to an incomplete application of the equation the CWG cites.

In summary, the CWG confuses economic concepts and misapplies the equation from the source it cites. As a result of these mistakes, it reaches conclusions of incorrect signs and magnitudes. The marginal social benefits of gasoline are smaller than its social marginal costs (not larger), and the optimal gasoline tax based on the cited equation is much larger than the CWG suggests.

8. Technical Comment on Page 125

Page 125 of the CWG report states that "When these [climate tipping points such as thawing permafrost] have been considered, the result is only a modest increase in the SCC value in the 21st century." This claim is inaccurate. Kopits et al. (2025) show that including the potential for carbon cycle feedbacks from thawing permafrost and the dieback of the Amazon rainforest into three integrated assessment models increases the US impact-specific SCC by 9 to 50 percent.

[11] This term is larger than the $0.44 per gallon contribution from the $75 per tonne carbon externality for any elasticity larger than −2.27, which is implausibly large.

References

Barrage, Lint, and William Nordhaus. 2024. "Policies, projections, and the social cost of carbon: Results from the DICE-2023 model." *Proceedings of the National Academy of Sciences* 121 (13): e2312030121.

Barron, Alexander R., Allen A. Fawcett, Marc AC Hafstead, James R. McFarland, and Adele C. Morris. 2018. "Policy insights from the EMF 32 study on US carbon tax scenarios." *Climate Change Economics* 9 (1): 1840003.

Carleton, Tamma, Amir Jina, Michael Delgado, Michael Greenstone, Trevor Houser, Solomon Hsiang, Andrew Hultgren et al. 2022. "Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits." *The Quarterly Journal of Economics* 137 (4): 2037-2105.

Clarke, L. et al. 2018. “Effects of long-term climate change on global building energy expenditures.” E*nergy Economics* 72, 667–677.

Chen, Yunguang, Lawrence H. Goulder, and Marc AC. Hafstead. 2018. "The sensitivity of CO_2 emissions under a carbon tax to alternative baseline forecasts." *Climate Change Economics* 9 (1): 1840012.

Cromar, K. R. et al. 2022. *Global health impacts for economic models of climate change: a systematic review and meta-analysis*. Ann. Am. Thorac. Soc. 19, 1203–1212.

Diaz, D. B. 2016. “Estimating global damages from sea level rise with the Coastal Impact and Adaptation Model (CIAM).” *Climate Change* 137, 143–156.

EPA (US Environmental Protection Agency). 2023. “EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances.” November 2023. **https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf**.

Kopits, Elizabeth, Daniel Kraynak, Bryan Parthum, Lisa Rennels, David Smith, Elizabeth Spink, Charles Griffiths, Joseph Perla, Nshan Burns, and Michael Howerton. 2025. “Economic Damages from Climate Change to U.S. Populations: Integrating Evidence from Recent Studies.” **https://www.epa.gov/environmental-economics/economic-damages-climate-change-us-populations-integrating-evidence-recent**.

Howard, Peter H., and Thomas Sterner. 2017. "Few and not so far between: a meta-analysis of climate damage estimates." *Environmental and Resource Economics* 68 (1): 197-225.

IWG (Interagency Working Group on Social Cost of Greenhouse Gases). August 2016. *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under 12866*. US Government. **https://www.epa.gov/sites/default/files/2016-12/documents/sc_co2_tsd_august_2016.pdf**.

—————— . February 2021. *Technical Support Document: Technical Update of the Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under 13990*. US Government. **https://upload.wikimedia.org/wikipedia/commons/4/4e/Technical_Support_Document_-_Social_Cost_of_Carbon%2C_Methane_and_Nitrous_Oxide_Interim_Estimates_under_Executive_Order_13990.pdf.**

Lin, CY. Cynthia, and Lea Prince. 2009. "The optimal gas tax for California." *Energy Policy* 37(12): 5173–5183.

Manski, Charles F., Alan H. Sanstad, and Stephen J. DeCanio. 2021. "Addressing partial identification in climate modeling and policy analysis." *Proceedings of the National Academy of Sciences* 118 (15): e2022886118.

Millar, R. J., Nicholls, Z. R., Friedlingstein, P. & Allen, M. R. 2017. "A modified impulse-response representation of the global near-surface air temperature and atmospheric concentration response to carbon dioxide emissions." *Atmospheric Chemistry Physics* 17, 7213–7228.

National Academies (National Academies of Sciences, Engineering, and Medicine). 2017. *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*. Washington, DC: National Academies Press.

Nath, Ishan B., Valerie A. Ramey, and Peter J. Klenow. 2024. *How much will global warming cool global growth?* No. w32761. National Bureau of Economic Research.

Newell, Richard G., Brian C. Prest, and Steven E. Sexton. 2021. "The GDP-temperature relationship: implications for climate change damages." *Journal of Environmental Economics and Management* 108: 102445.

Newell, Richard G., William A. Pizer, and Brian C. Prest. 2022. "A discounting rule for the social cost of carbon." *Journal of the Association of Environmental and Resource Economists* 9 (5): 1017–1046.

Parry, Ian W. H., and Kenneth A. Small. 2005. "Does Britain or the United States have the right gasoline tax?." *American Economic Review* 95 (4): 1276–1289.

Rennert, Kevin, Frank Errickson, Brian C. Prest, Lisa Rennels, Richard G. Newell, William Pizer, Cora Kingdon, et al. 2022. "Comprehensive evidence implies a higher social cost of CO_2." *Nature* 610 (7933): 687–692.

Rennert, K., Prest, B.C., Pizer, W.A., Newell, R.G., Anthoff, D., Kingdon, C., Rennels, L., Cooke, R., Raftery, A.E., Ševčíková, H. and Errickson, F. 2022a. "The social cost of carbon: Advances in long-term probabilistic projections of population, GDP, emissions, and discount rates." *Brookings Papers on Economic Activity*. Fall 2021, pp.223-305.

Tietenberg, Thomas H., and Lynne Lewis. 2015. *Environmental and Natural Resource Economics*. Routledge, 2015.

Wong, T. E. et al. 2017a. "BRICK v0.2, a simple, accessible, and transparent model framework for climate and regional sea-level projections." *Geoscientific Model Development* 10, p. 2741–2760.