WESTERN ENERGY ALLIANCE

June 21, 2021

Submitted via www.regulations.gov

Dominic J. Mancini
Deputy Administrator
Office of Information and Regulatory Affairs
Office of Management and Budget
New Executive Office Building
725 17th Street NW
Washington, D.C. 20503

Re: Notice of Availability and Request for Comment on "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990"

Dear Deputy Administer Mancini:

Western Energy Alliance submits this letter in response to the Office of Management and Budget's (OMB) request for comments on the document entitled "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990," published on February 6th, 2021. The Alliance appreciates the opportunity to comment on elements of the development of the interagency working group's (IWG) estimates for the social cost of the greenhouse gases carbon dioxide, methane, and nitrous oxide ("SCGHG").

Western Energy Alliance represents 200 companies engaged in all aspects of environmentally responsible exploration and production of oil and natural gas across the West. The Alliance represents independents, the majority of which are small businesses with an average of fourteen employees.

There has been a fundamental lack of transparency and public input leading to the development of IWG's initial estimates for the SCGHG, and much more robust public input and dialogue is necessary for the development of a methodology and use for regulatory policy development as broad and impactful as these estimates. In the interest of consistency and accountability, the Alliance encourages the IWG to follow up this initial dialogue with a more formal, transparent, and robust process that includes peer review, public comment opportunities, and use of the best available science and data to inform the ultimate estimates for the SCGHGs, all within a historical docket that tracks and maintains the underpinning science and literature surrounding these highly influential estimates.

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Ultimately, a more transparent process would allow for the SCGHGs to be best suited for use for their intended purpose, namely determining the impact from GHG emissions as they relate to cost-benefit analyses within rulemaking activities. The Alliance also believes a more transparent process would develop a defensible methodology for using SCGHG estimates that best reflect the market influences that result from agency regulatory development and better reflect a reasonable expectation of timelines and discount rates used within the estimates themselves.

I. Background

On January 20, 2021, President Biden issued Executive Order 13990, section 5 of which directed a new IWG to perform the following actions[1]:

(A) Publish an interim SCC, SCN, and SCM within 30 days of the date of this order, which agencies shall use when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions until final values are published;
(B) Publish a final SCC, SCN, and SCM by no later than January 2022;
(C) provide recommendations to the President, by no later than September 1, 2021, regarding areas of decision-making, budgeting, and procurement by the Federal Government where the SCC, SCN, and SCM should be applied;
(D) Provide recommendations, by no later than June 1, 2022, regarding a process for reviewing, and, as appropriate, updating, the SCC, SCN, and SCM to ensure that these costs are based on the best available economics and science; and
(E) provide recommendations, to be published with the final SCC, SCN, and SCM under subparagraph (A) if feasible, and in any event by no later than June 1, 2022, to revise methodologies for calculating the SCC, SCN, and SCM, to the extent that current methodologies do not adequately take account of climate risk, environmental justice, and intergenerational equity.

These executive order directions provide a significantly accelerated timeline for developing estimates for the Social Cost of Greenhouse Gases, which as stated in the published Technical Support Document (TSD), "allow agencies to understand the social benefits of reducing emissions of each of these greenhouse gases, or the social costs of increasing such emissions, in the policy making process."[2] The latest executive order, particularly paragraphs (A) and (C) expanding SCGHGs beyond federal agency rulemakings, is inconsistent with IWG's approach in a 2010 TSD, where SCGHGs, when used with respect to cost-benefit analysis for a proposed regulation, were described as a way to best "assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a

[1] https://www.federalregister.gov/documents/2021/01/25/2021-01765/protecting-public-health-and-the-environment-and-restoring-science-to-tackle-the-climate-crisis
[2] Interim TSD at 1.

reasoned determination that the benefits of the intended regulation justify its costs," as directed by E.O. 12866.[3]

The purpose of the SCGHGs, as presented in the TSD, and now being implemented on an interim basis prior to any solicitation of public comment, is to "allow agencies to incorporate the social benefits of reducing carbon dioxide (CO2) emissions into cost-benefit analyses of regulatory actions that have small, or 'marginal,' impacts on cumulative global emissions." These comments specifically will focus on necessary changes to the IWG's process in developing these estimates and the potential uses for those estimates. Primarily, there are elements of the accelerated timeline and the IWG's current approach that do not adequately allow for the IWG to accomplish the goal of developing new social cost of carbon estimates through a transparent, repeatable and defensible process.

II. Wildly Fluctuating and Inconsistent SCGHG Values Do Not Adequately Accomplish the Goals of the SCGHG or Provide Regulatory Certainty for the Public

The first Interagency Working Group in 2009 was tasked with assessing and developing an estimate for SCGHGs, yet the values developed and used for these SCGHGs have fluctuated wildly since that time.

As stated in the TSD, the Social Cost of Carbon values predating the 2009 working group were first used in Department of Transportation standards during the Obama administration, with various rulemakings using values in a number of ranges, from $0-20, $2, $7, $0-14, $33, $40, and $68.[4] These values, even used within the same agency, were not consistent over a very short time period, and so a consistent, transparent, defensible approach was needed to develop a more reliable and consistent estimate, even at the time. Instead, the value of the SCGHGs has continued to fluctuate from that point on.

The previously mentioned IWG convened in 2009 and developed an estimate of $19 within a range of $5 to $33. The very next year, the same IWG reconvened and updated the value to $21 within a range of $7 to $65. Then, in 2013, the IWG retroactively updated the values for the social cost of carbon in 2010 to a central value of $33 within a range from $11-90, and released the changes to the Social Cost of Carbon analysis within a Department of Energy (DOE) rule covering the energy conservation standards for microwaves in standby and off mode.[5] None of these changes to the underlying science on the social cost of carbon went through an appropriate notice and comment period for

[3] Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 at 1. ("2010 TSD")
[4] 2010 TSD at 3-4.
[5] https://www.federalregister.gov/documents/2013/06/17/2013-13535/energy-conservation-program-energy-conservation-standards-for-standby-mode-and-off-mode-for#p-80 (page 80)

public input, despite their broad-ranging and pervasive impacts across virtually all industries. These 2013 changes emerged as applied in the final DOE rule for which the proposed rule had included different values.

The Trump Administration, recognizing long-standing executive branch tradition and policy, reverted to OMB Circular A-4 in developing cost-benefit analysis for regulatory impacts. The concepts present in Circular A-4 were consistent with executive administration policy for every president going back decades – Presidents Nixon, Ford, Carter, Reagan, H.W. Bush, and Clinton each used cost-benefit analyses (later expanded under Clinton to include the costs and benefits of not regulating in a particular space). These policies were eventually formalized by the George W. Bush administration in OMB Circular A-4. The reversion by the Trump administration to previous norms changed the value of the social cost of carbon again, now dropping to $1 at a 7% discount rate and $7 at a 3% discount rate.

More recently, with President Biden's Executive Order 13990, the current administration announced a new, immediately implementable central value of $51 for the Social Cost of Carbon within a range of $14 to $260, but also implies that this number may be lower than the number the new IWG might land on later this year. These wild swings in value of the SCGHG estimates over a time frame as short as 12 years leaves no possibility of regulatory certainty for the public and provide excessively divergent results when the values are applied to regulatory cost-benefit analyses.

For Alliance members and the regulated public, when trying to forecast potential activities even just a couple years out, by taking the last 12 years as an example, there is no reasonable expectation that the SCGHG will maintain any sort of consistency. For example, for a class of activity that hypothetically is estimated to release 1,000,000 tons of CO2 per year, the range of values potentially considered in this TSD and used in previous administrative rulemaking analysis could value those emissions as low as $0, or as high as $260,000,000. When evaluating a potential regulation relevant to that activity, how is the public expected to reliably project the SCGHG impacts? This public calculus is only further frustrated and uncertainty is only exacerbated if or when agencies inappropriately attempt to apply those SCGHG values to individual projects rather than regulations.

More importantly, the changes in values between administrations, or between varying new evaluations by the same administration, are not varying due to changes in the underlying science, or advances in understanding of the models or their potential impacts. The Obama Administration, the Trump Administration, and most recently the current administration all claim the backing of published scientific articles and policy justifications for using different figures for the SCGHG. Each administration used the same underlying models and data, but made minor changes in choices of discount rates and time horizons.

These two choices are inherently subjective, and as such are subject to the whim of the executive branch leadership that makes them. These arbitrary choices, instead of

providing a scientifically rational and technical justification for cost-benefit analyses, are instead being used to justify the policy goals of whichever administration developed them under the guise of the scientific method. This misuse of science can be removed by replacing the current methodology for developing estimates with a more transparent process that allows for more public input and removes arbitrary decisions from the equation.

III. A Meaningful Opportunity for Public Comment, and an Objective and Transparent Process Would Enable the Needed Regulatory Certainty and Consistency to Apply SCGHG Estimates Responsibly

Despite these quickly shifting values of the SCGHG and their use in a broad array of rulemakings ranging from appliances to vehicle fuel efficiency, the public has had very little foreknowledge of the rule changes and scientific and policy basis for those changes, and has had even less opportunity to comment. In fact, the first time the IWG accepted comments on its estimates for the Social Cost of Carbon was in 2013, four years after the initial IWG convened and published estimates. By that time, nearly a dozen different estimates had already been used in regulatory analysis.[6]

In that 2013 comment period, initially set for 60 days and extended an additional 30 days, the IWG agreed to accept comments, but provided no docket, no supporting materials used by the IWG in developing their estimates, and no information about how the IWG used the underlying models to develop their final values. However, despite this lack of information provided by the IWG in its request for comments, the IWG received many comments deemed "thoughtful" and "technical" by the administration. The IWG however, did not use these comments to make changes to either its process or the ultimate values.

The IWG rejected all of the comments on modeling, considering them to be out of scope. The IWG then decided not to address any of the comments received or recommendations made on elements other than modeling, instead recommending continued use of the 2013 estimates "until revisions based on the many thoughtful public comments we have received and the independent advice of the Academies can be incorporated into the estimates."[7] No changes were ever made by IWG with respect to those comments. Out of the 140 unique comments received, the IWG adopted none.

Instead of following in the same manner as the previous 2013 IWG request for comments, the Alliance urges the IWG to carefully consider the input of the public when developing the estimates for 2021, and encourages IWG to fundamentally improve the public input and transparency involved in the development of the estimates and their uses. There exist numerous guidance documents, principles, executive orders, and legislation which suggest

[6] See 78 Fed. Reg. 70,586 (Nov. 26, 2013); 79 Fed. Reg. 4359, 4359 (Jan. 27, 2014)
[7] See Written Statement of Dr. Patrick J. Michaels, H. Comm. On Nat. Resources. Hearing on an Analysis of the Obama Administration's Social Cost of Carbon 2 (July 22, 2015)

that the IWG should follow the charge laid out in President Biden's Executive Order 13990, that "the Federal Government must be guided by the best science and be protected by processes that ensure the integrity of Federal decision-making."

OMB has developed its own set of guidelines under the Information Quality Act that influential information must meet a higher level of transparency with respect to the source of the utilized data, the various assumptions employed, the analytical methods applied, and the statistical assumptions employed.[8] These transparency requirements are placed on the OMB by their guidance with the intent that "if sufficient transparency is achieved on each of these matters, then an analytic result should meet the 'capable of being substantially reproduced' standard." The importance of this reproducibility is paramount to the successful use of the SCGHG and the reliability that the public can place on the business decisions that must be made due to changes in regulations based on the estimates.

But this transparency is not accomplished by public input alone. The underlying data, scientific evidence, assumptions and information upon which the IWG relied to make its recommendations must be provided to the public well in advance of finalizing a new value for the SCGHGs. This very TSD is evidence that the IWG is not upholding OMB's standards for transparency and public input, considering the document itself was released and put into use two months before the IWG decided to take comment on the document and values within. Beyond that, the administrative record used within the TSD is entirely insufficient. It ignores the entire body of science, evidence, and input that should be used to either support or provide criticism of the current TSD and previous 2016 TSD upon which the current framework is based, and in fact there is no docket provided whatsoever. In addition to that, even the list of qualifications of individuals who make up the IWG itself have not been revealed to the public, casting doubt on the credibility, diversity, or neutrality of the IWG work product.

An interagency working group, made up of a secret list of individuals identified only by the agency under which they are employed, developing estimates based on modeling information and assumptions that aren't revealed to the public, relying on scientific studies containing underlying data that is also not revealed to the public, and ignoring all critical comments and literature that would call into question the framing decisions of the IWG, working to develop estimates that potentially impact all regulatory decision-making by the federal government is not even an attempt at transparency.

Instead, the IWG should disclose information about the members in the IWG, develop and provide a charter for their charge and organization, develop a robust docket including all relevant information provided by both the public and the IWG members, including each of the previous publications by the IWG, use open meetings that allow opportunity for public discussion and comment, and implement a structured and transparent process by which

[8] 67 Fed. Reg. 369, 374 (Jan. 3, 2002).

comments received are adequately addressed by the IWG prior to the publication of any change in SCGHG values or potential applications.

These recommendations fall well in line with overall outside expert recommendations within *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (2017), notably recommendation 2-1 and 2-2.[9] Additionally, a more transparent process that adequately addresses public input and the best available science could also meet the National Academies of Sciences, Engineering, and Medicine's (NASEM) recommendation that updates to the estimates take place on a five-year cycle, which would be a significant improvement over the relatively frequent changes to the value over the last 12 years.

IV. The Use of the SCGHGs Should Remain Limited to Their Original Intent – Cost-Benefit Analyses for New Regulatory Policy Changes

The Biden administration's Executive Order (EO) 13990 extends the reach of the SCGHG estimates even further than previous administrations, suggesting that, "An accurate social cost is essential for agencies to accurately determine the social benefits of reducing greenhouse gas emissions when conducting cost-benefit analyses of regulatory ***and other actions***," (emphasis added) and specifically requesting the interagency working group to "provide recommendations to the President, by no later than September 1, 2021, regarding areas of decision-making, budgeting, and procurement by the Federal Government where the SCC, SCN, and SCM should be applied."

These sorts of decisions, on how values derived by an executive branch working group without public input and comment should be used in regulatory and other actions, many of which potentially also may not allow for public input and comment, are proposed by this EO to also be determined without public input or comment, which further betrays the OMB guidelines that influential information be transparent and reproducible. Nonetheless, President Biden's Executive Order 13990 directs the IWG to provide recommendations about "where the SCC, SCN, and SCM should be applied," and it does not direct agencies to avoid using the interim SCGHG values while this comment period is underway.

While authority to apply the SCGHG broadly across federal agency actions appears to be contemplated in EO 13990, there is in fact no such statutory authority. Given the absence of any authorization from Congress to apply the SCGHG in that manner, its use should be limited solely to cost-benefit analyses of agency rulemakings as previous administrations have done. Any attempt to expand the application of this calculation to, for example, individual permitting decisions may be in violation of the law and most certainly will be challenged by impacted parties to an equal or greater extent than affected rulemakings.

[9] National Academies of Sciences, Engineering, and Medicine 2017. *Valuing Climate Damages. Updating Estimates of the Social Cost of Carbon Dioxide.* Washington, DC: The National Academies Press ("NASEM 2017") at 6 & 7.

Furthermore, federal rulemakings potentially impact the climate and GHG emissions at a scale that allows for a comprehensive evaluation of the potential costs of that regulation. However, individual agency actions such as permit approvals typically have at most a de minimis impact on climate change and GHG emissions, so applying the SCGHG does nothing to better inform agency decision-making through the National Environmental Policy Act (NEPA) process.

Courts have consistently upheld this approach to Social Cost of Carbon calculations. The District Court of New Mexico recently held the following regarding Bureau of Land Management (BLM) environmental reviews:

> NEPA does not require "that agencies weigh the economic costs and benefits of a proposed action. To the contrary, 40 C.F.R. § 1502.23 specifically provides that agencies need not do so, and in fact should avoid such comparisons when, as here, the NEPA analysis in question involves important qualitative considerations." While certain quantitative data needs analyzing, the "regulations preserve ample decision space for federal agencies to use the metrics and methodologies best suited to the issues at hand, consistent with the broad discretion typically afforded to an agency's choice of methodology" . . .
>
> BLM explained why it chose not to apply the SCC protocol. It further noted in one report that applying the SCC protocol is ***"challenging because [the SCC protocol] is intended to model effects at a global scale on the welfare of future generations caused by additional carbon emission occurring in the present."*** (AR at 006618) (emphasis added). The methods that BLM used satisfy NEPA, and therefore, it did not err in avoiding the SCC protocol. (emphasis added)[10]

Similarly, the District Court of the District of Columbia has held:

> BLM here provided reasoned explanations for why it declined to use the social cost of carbon protocol. See, e.g. AR8920–23; AR12993–98. BLM explained that in the context of each lease sale, "calculating the [social cost of carbon] from CO2 emissions from the combustion of an unknown quantity of produced oil and gas would be highly speculative," AR2827, and that the range provided by WildEarth's comments and protests "represents a 4,000% difference in potential [social cost of carbon] estimates." AR12520; see also AR1986 (estimating that "[u]sing 2015 social cost of carbon values, the costs to society of the federal fossil fuel leasing program is between $18 and $177 billion per year"). **BLM reasonably determined that a 4,000 percent range in potential costs would be "less than helpful in informing the public and the decisionmaker."** AR12520; see also AR19285 ('While we agree that some level of uncertainty is unavoidable in assessing impacts from complex environmental

[10] *WildEarth Guardians v Bernhardt*, Case 1:19-cv-00505-RB-SCY

> systems, in this case that uncertainty is compounded by basing any potential [social cost of carbon] estimates on speculative GHG emissions.')"
>
> Accordingly, BLM did not act arbitrarily and capriciously in not utilizing the global carbon budget. "[B]ecause current climate science is uncertain (and does not allow for specific linkage between particular GHG emissions and particular climate impacts) . . . evaluating GHG emissions as a percentage of state-wide and nation-wide emissions . . . is a permissible and adequate approach." WildEarth Guardians v. BLM, 8 F. Supp. 3d at 35 (citing WildEarth Guardians v. Jewell, 738 F.3d at 309). (emphasis added)[11]

Taken together, these rulings make clear that applying the SCGHG calculation to project-specific NEPA documents will provide no useful information for an agency such as BLM. Instead, the courts make clear that this tool is potentially useful only on a broad scale such as an agency rulemaking that will potentially have a significant impact on global emissions, rather than a de minimis result at the project level. We urge OMB to ensure that any decision to apply the SCGHG calculation going forward, regardless of the dollar value assigned, be limited to its original intent: a factor in cost-benefit analyses of agency regulations.

V. The IWG's SCGHG Estimates Should More Accurately Reflect Total Costs and Benefits

Executive Order 13990 instructs agencies that "It is essential that agencies capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account." While at face value this seems reasonable, it includes only a portion of the global impact of executive decision making, causing an imbalance in the decision-making process. The Alliance recognizes that climate change is a global issue, considering the transport of emissions across the global atmosphere and the potential for impacts of climate change to impact not just the country from which emissions are generated. However, by weighing the damages of emissions from a potential action in a vacuum, the use of SCGHG estimates do not actually estimate the functional impact of a federal decision.

To illustrate this by example, imagine there is mineable resource that is essential for the creation of a new category of products produced domestically that are used across the globe. If the federal government restricts the mining of that material in the United States based on the emissions generated during the mining process, by looking solely at the damages from those carbon emissions based on the SCGHG estimates, that restriction could be potentially justified by calculating global damages. However, that analysis ignores the potential result of that activity's restriction.

[11] *WildEarth Guardians v. Zinke,* Case 1:16-cv-01724-RC

The demand for that material resource, in this example, is virtually unchanged by the domestic mining restriction. If the locally sourced material is too expensive due to regulatory restrictions, or that product is uncompetitive compared to others mined overseas, domestic manufacturers and producers would have to source the material elsewhere. Of course, mining that occurs in another country an ocean away also has associated carbon emissions, and in many cases will occur in a nation that doesn't have the robust regulatory protection enjoyed in the United States.

Additionally, that material, instead of being sourced on the same continent as it is used in, instead must now be shipped and transported thousands of miles to reach its ultimate destination, generating even more GHG emissions. These sorts of decisions require the full consideration of the impacts of a regulatory decision to arrive at the intended results – an overall reduction in global GHG emissions. However, market-based impacts from regulatory decision-making are not currently adequately addressed within the models used by the IWG. By looking at the emissions in a vacuum, regulatory cost-benefit analyses may inadvertently restrict activities here in the United States, forcing those activities to instead move overseas, increasing global GHG emissions in the process.

To avoid this unintended negative externality, the IWG should restrict its calculations of damages to domestic impacts only, as that is ultimately the jurisdiction that the federal government has the most influence on. By considering global benefits against only domestic costs, the cost-benefit analysis isn't adequately balanced, and will lead to agencies making a decision that not only mistakenly restricts domestic activity that benefits the people they regulate, but also potentially creates more GHG emissions than would result in the absence of regulation.

A focus on domestic impacts also aligns well with principles laid out in the Clean Air Act. In section 101(b)(1) of the Clean Air Act, for example, Congress wrote that the purpose of the Act is to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." This language has led to interpretations used by multiple agencies that the Clean Air Act is limited to covering impacts and benefits of regulation domestically.

Section 115 of the Clean Air Act specifically considers the foreign impacts of domestic emissions. Under Section 115, EPA can require states to address emissions to mitigate impacts to other jurisdictions outside the United States, but importantly it can only do so for "a foreign country which the Administrator determines has given the United States essentially the same rights with respect to the prevention or control of air pollution occurring in that country as is given that country" by Section 115.

In other words, if the United States is able to compel or control greenhouse gas emissions through regulatory action from other countries, then for those countries alone can damages be considered based on those impacts; otherwise, the analysis should be limited to domestic impacts and costs. Additionally, OMB's own Circular A-4 directs agencies that

their analysis "should focus on benefits and costs that accrue to ***citizens*** and ***residents*** of the United States. Where you choose to evaluate a regulation that is likely to have effects beyond the borders of the United States, these effects should be reported separately." (emphasis added). At a minimum, both the domestic and global SCGHGs should be presented separately to fully inform agency rulemakings.

Furthermore, as the Administration considers new actions that incorporate the SCGHG, we encourage the agencies to recognize the social benefits of affordable energy, including oil and natural gas. For example, development of affordable energy resources has vast and broadly applicable benefits for improving quality of life for the public beyond a simple calculation of the estimated benefits to public health and the environment. Oil and natural gas development and other activities should be considered not only for their potential costs with respect to carbon emissions, but also compared against their potential utility for improving people's lives, including the ability to drive climate resilience strategies.

If oil and natural gas development is curtailed in America, economic growth and public health would suffer immediately. In the absence of an alternative that does everything oil and natural gas do (home heating, transportation, industrial energy, electricity generation, electronic components, petrochemicals, etc.), restricting production is not a wise policy. Oil and natural gas not only keep people warm in the winter and cool in the summer, get them to school and work to better their lives, and power all facets of the economy, but put food on the table, medicines in the cabinet, and deliver clean drinking water to the tap.

Providing more oil and natural gas to the world will bring those benefits to the billion people without sufficient energy and help lift them out of poverty. Yet, nowhere in the SCGHG are these important benefits quantified and weighed, meaning the calculation is fundamentally flawed when it analyzes a regulation that impacts domestic oil and natural gas development.

Further, other activities also generate carbon emissions without the same, or any, level of public utility. By essentially treating all GHG emissions the same, regardless of the source or social benefit provided by the source, the cost-benefit analysis overall will always be necessarily skewed. The IWG should develop guidelines in hand with the SCGHG documentation that explain and categorize emissions-bearing activities based on their social utility and the social benefit derived from them, and include those values in cost-benefit analyses as well. Any foregone benefits associated with restricted energy production or use should also appear on the cost side of analyses of regulations that affect energy.

Finally, the SCGHG calculation estimates climate impacts and consequential economic impacts 300 years into the future, a nearly unprecedented and inherently uncertain time horizon. In doing so it fails to account for the degree in which technological innovations will evolve to both mitigate potential climate impacts and perhaps more importantly, the

human potential to perhaps influence climate itself through lower emissions technologies that would change baseline assumptions.

Would a policy maker in the early 1700s familiar with emerging steam power have predicted the development of atomic energy 230 years later or have comprehended the magnitude in harnessed energy associated with this technological revolution? Would a doctor in the mid 1850s using newly developed antiseptics have predicted antibiotics or kidney dialysis 75 to 100 years later or imagined the ability to save lives associated with these medical technology developments? Would a technologist using the telegraph in 1833 have predicted Zoom calls nearly 200 years later in the 2021 Pandemic, or imagined the ability to communicate and see people around the world in real time that has emerged with this technological development?

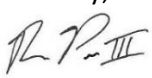
The table in Appendix A below indicates inventions developed over the last 300 years (highlights added). Technological improvements in CO2 sequestration are quite recent, direct air capture of CO2 is just beginning to emerge, and climate engineering technologies of the future are almost certainly far beyond our current ability to imagine. As a result, the use of a 300-year model for future climate impacts has a huge and potentially disqualifying degree of uncertainty, as recognized by the scientific community. Given the major advances in technology over the past three centuries, it is simply beyond our current comprehension to model technological advances that far into the future.

The impacts of future climate changes on economic sectors and hence GDP is also highly speculative and arguably impossible to estimate with any degree of certainty in a manner to reliably inform current policy making. We urge OMB to reconsider its use of a 300-year model given the vast uncertainty associated with such an extended timeframe. BLM, for instance, uses a 100-year time horizon in its climate models, and most of the climate change impacts derived from these models are realized toward the end of the century.

Conclusion

Western Energy Alliance urges OMB to reconsider a broad application of the SCGHG. We also request a more robust process for developing these calculations, which will allow for proper stakeholder and public input as the tool is developed. Finally, we ask that OMB reconsider how the TSD analyzes the total costs and benefits associated with a rulemaking and place them into the proper context as it relates to emissions and other impacts. Thank you for the opportunity to submit these comments, and please don't hesitate to contact me with any questions.

Sincerely,



Tripp Parks
Vice President of Government Affairs

Appendix A – Technological Innovations Since 1700[12]

1709	**Hot Air Balloon**	Portugal	by Bartolomeu de Gusmão
1710	**Rifle**	North America	long range and accurate
1711	**Tuning Fork**	England	by John Shore
1712	**Steam Engine**	England	by Thomas Newcomen
1714	**Temperature Scale**	Netherlands	by Gabriel Fahrenheit
1717	**Diving Bell**	England	by Edmond Halley
1733	**Spinning Machines**	England	by John Kay
1740	**Navigational Clock**	England	by John Harrison
1750	**Jigsaw Puzzle**	England	
1752	**Lightning Conductor**	North America	by Benjamin Franklin
1757	**Sextant**	England	by John Campbell
1764	**Condensing Steam Engine**	Scotland	by James Watt - the first efficient engine
1768	**Carbonated Water**	England	by Joseph Priestley - the first fizzy drink
1769	**Sandwich**	England	by John Montagu
1769	**Steam Wagon**	France	by Cugnoy - first steam vehicle
1770	**Rubber (Eraser)**	USA	using vulcanised rubber
1783	**Steam Boat**	France	by Joffroy d'Abans
1783	**Steam Roller**	England	by Henry Cort - for steel production
1784	**Bifocal Lenses**	USA	by Benjamin Franklin
1795	**Metric System**	France	world wide measuring system

[12] http://www.krysstal.com/display_inventions.php?years=1700+to+1800

1796	**Vaccination**	England	by Edward Jenner
1798	**Gas Liquification**	France	Ammonia liquified by Louis de Morveau
1798	**Lithography**	Germany	by Aloys Senefelder
1800	**Domestic Gas Lighting**	England	by William Murdoch
1800	**Electric Battery**	Italy	by Alessandro Volta
800	**Domestic Gas Lighting**	England	by William Murdoch
1800	**Electric Battery**	Italy	by Alessandro Volta
1804	**Punch Card**	France	by Jacquard - for weaving machines
1804	**Steam Locomotive**	England	by Richard Trevithick - ran on rails
1807	**Arc Lamp**	England	by Humphry Davy
1810	**Precision Lathe**	England	by Henry Maudslay
1810	**Tinned Food**	France England	by N Appert and P Durand
1814	**Spectrocope**	Germany	by Joseph von Fraunhofer for chemical analysis of glowing objects
1815	**Miners' Lamp**	England	by Humphry Davy
1816	**Photography**	England France	by Fox Talbot and Daguerre
1819	**Stethoscope**	France	by René Laënnec
1823	**Electromagnet**	England	by William Sturgeon
1823	**Waterproof Clothes**	Scotland	by Charles Macintosh
1825	**Passenger Railway**	England	by George Stephenson - steam powered
1827	**Microphone**	England?	by Charles Wheatstone

1830	**Lawn Mower**	England	by Edwin Budding
1830	**Sewing Machine**	France	by Barthelemy Thimonnier
1831	**Electric Dynamo**	England	by Michael Faraday
1833	**Electric Telegraph**	Germany	by Gauss and Weber
1834	**Refrigeration**	England	by Jacob Perkins from the USA
1835	**Mechanical Calculator**	England	by Charles Babbage
1835	**Propeller**	England	by Francis Pettit Smith
1835	**Revolver**	USA	by Samual Colt - first multi-shot hand gun
1837	**Morse Code**	USA	by Samuel Morse - for the telegraph
1839	**Fuel Cell**	England	by William Robert Grove
1839	**Vulcanisation**	USA	by Charles Goodyear - for rubber
1840	**Postage Stamp**	England	by Rowland Hill
1843	**Fax Machine**	Scotland	by Alexander Bain
1847	**Antisceptics**	Hungary	by Ignaz Semmelweis
1852	**Airship**	France	by Henri Giffard
1852	**Gyroscope**	France	by Jean-Bernard-Léon Foucault
1852	**Safety Lift**	USA	by Elisha Otis - also called an elavator
1853	**Glider**	England	by George Cayley
1856	**Pasteurisation**	France	by Louis Pasteur
1859	**Internal Combustion Engine**	Belgium	by Jean-Joseph-Étienne Lenoir
1861	**Bicycle**	France	by Pierre Michaux

1862	**Plastic**	England	by Alexander Parkes
1863	**Underground Train**	England	London (Paddington to Farringdon)
1865	**Yale Lock**	USA	by Linus Yale - also called cylinder locks
1866	**Dynamite**	Sweden	by Alfred Nobel
1866	**Torpedo**	Austria	by Robert Whitehead from England
1867	**Typewriter**	USA	by Christopher Latham Sholes
1868	**Air Brake**	USA	by George Westinghouse
1868	**Traffic Lights**	England	by J P Knight in London
1873	**Barbed Wire**	USA	by Joseph Glidden
1873	**Tram**	USA	In San Fransisco (called street cars)
1876	**Carpet Sweeper**	USA	by Melville Bissell
1876	**Four Stroke Engine**	Germany	by Nikolaus August Otto
1876	**Telephone**	USA	by Alexander Bell from Scotland
1877	**Moving Pictures**	USA	by Eadweard Muybridge from England
1877	**Phonograph**	USA	by Thomas Edison - cylindrical
1879	**Light Bulb**	England USA	by Joseph Swan and Thomas Edison
1881	**Metal Detector**	USA	by Alexander Bell
1884	**Cash Register**	USA	by James Ritty
1884	**Machine Gun**	England	by Hiram Maxim from USA
1884	**Steam Turbine**	England	by Charles A Parsons

1885	**Motor Car**	Germany	by Karl Benz - also called an automobile
1885	**Motorcycle**	Germany	by Gotlieb Daimler
1885	**Transformer**	USA	by William Stanley - changes voltage
1886	**Coca Cola**	USA	by John Pemberton
1887	**Contact Lenses**	Germany	by F E Muller
1887	**Gramophone**	USA	by Emile Berliner from Germany played disks at 78 rpm
1888	**Drinking Straws**	USA	by Marvin Stone
1889	**Cordite**	England	by F Abel and J Dewer - smokeless explosive
1889	**Rayon**	France	first artificial fibre
1890	**Electric Train**	England	London Underground
1890	**Jukebox**	USA	in San Fransisco
1891	**Electric Kettle**	USA	for hot tea and coffee drinks
1891	**Escalator**	USA	by Jesse Reno
1892	**Shredded Wheat**	USA	first breakfast cerial
1892	**Tractor**	USA	by John Froehlich
1892	**Vacuum Flask**	Scotland	by James Dewar
1895	**Radio**	England Russia	by G Marconi (of Italy) and A S Popov
1895	**Safety Razor**	USA	by King Camp Gillette
1897	**Diesel Engine**	Germany	by Rudolf Diesel - used for heavy vehicles
1897	**Oscilliscope**	Germany	by Karl Braun - ancestor of the television
1899	**Paper Clip**	Norway	by Johan Vaaler

1900	**Zeppelin**	Germany	by Ferdinand Zeppelin - first manoevarable balloon
1901	**Vacuum Cleaner**	England	by Hubert Booth
1903	**Aeroplane**	USA	by Wilbur and Orville Wright
1904	**Colour Photography**	France	by Auguste and Louis Lumière
1904	**Radar (for Shipping)**	Germany	by Christian Hülsmeyer
1904	**Vacuum Diode**	England	by John A Fleming - also called a valve
1905	**Synthetic Plastic**	USA	by Leo Baekeland from Belgium
1905	**Windscreen Wipers**	USA	by Mary Anderson
1906	**Amplitude Modulation**	USA	by Reginald Fessenden - sound by radio waves
1906	**Triode**	USA	by Lee De Forest - first amplifier
1908	**Assembly Line**	USA	by Henry Ford - mass production of cars
1908	**Geiger Counter**	Germany	by J W Geiger and W Müller
1908	**Haber Process**	Germany	by Fritz Haber - making artificial nitrates
1909	**Bakelite**	USA	by Leo Baekeland - first heat resistant plastic
1909	**Tungsten Filament**	USA	by William Coolidge - for long lasting electric lights
1910	**Neon Light**	France	by Georges Claude
1911	**Electric Car-Starter**	USA	by Charles Kettering

1913	**Brasière**	USA	by Mary Phelps Jacob
1913	**Zip**	Sweden	by Gideon Sundback
1916	**Radio Dials**	USA	by Edwin H Armstrong - for easy tuning
1916	**Sonar**	England	
1919	**Mass Spectrometer**	England	by Francis W Aston
1920	**Hair Dryer**	Germany	
1920	**Sticky Plasters**	USA	by Earle Dickson
1923	**Hearing Aid**	England	
1923	**Television**	Scotland	by John Logie Baird
1923	**Ultracentrifuge**	Sweden	by The Suedberg - separates proteins
1924	**Frozen Food**	USA	by Clarence Birdseye
1926	**Aerosol Sprays**	Norway	by Erik Rotheim
1926	**Liquid Fuel Rocket**	USA	by Robert Goddard
1926	**Popup Toaster**	USA	
1927	**Colour Television**	Scotland	by John Logie Baird
1927	**Quartz Timekeeping**	Switzerland	by Hans Wilsdorf from England
1927	**Talking Pictures**	USA	
1927	**Videophone**	USA	
1928	**Antibiotics**	England	by Alexander Fleming
1928	**Iron Lung**	USA	by Philip Drinker
1930	**Jet Engine**	England	by Frank Whittle
1930	**Sticky Tape**	USA	
1931	**Electric Razor**	USA	by Jacob Schick
1931	**Nylon**	USA	by Wallace Corothers - artificial silk

1932	**BBC Television**	England	first regular TV broadcasts (London)
1932	**Polaroid**	USA	by Edwin Herbert Land
1932	**Radio Telescope**	USA	by Karl Jansky
1933	**Electron Microscope**	Germany	by Ernst Ruska
1934	**Catseyes**	England	by Percy Shaw - for lighting roads
1935	**Radar (for Aircraft)**	Scotland	by Robert Watson-Watt
1936	**Helicopter**	Germany	by Heinrich Focke
1936	**Magnetic Recording**	USA	audio tapes
1938	**Ballpoint Pen**	Hungary	by Laszlo Biró - also called a biro (UK)
1938	**Photocopier**	USA	by Chester Carlston
1939	**Frequency Modulation**	USA	by Edwin H Armstrong - sound by radio waves
1942	**Atomic Power**	USA	by Enrico Fermi's team first self-sustaining chain reaction
1942	**Guided Missile**	Germany	by Werner von Braun
1942	**Napalm**	USA	from Harvard University
1943	**Aqualung**	France	by J Cousteau and E Gagnon
1944	**Kidney Dialysis**	Netherlands	by Willem Kolff
1945	**Atomic Bomb**	USA	by Robert Oppenheimer's team
1946	**Automation**	USA	by Henry Ford
1946	**Microwave Oven**	USA	by Percy L Spencer

1947	**Artificial Intelligence**	England	by Alan Turing
1947	**Hologram**	Hungary	by Denis Gabor
1947	**Mobile Phone**	USA	
1947	**Transistor**	USA	from Bell Laboratories
1948	**Computer**	England	by Freddie William's team
1948	**Long Playing Record**	USA	made of vinyl and played at 33 rpm
1948	**Velcro**	Switzerland	by George deMestral
1949	**45 rpm Record**	USA	
1950	**Credit Card**	USA	by Ralph Schneider
1951	**Breeder Reactor**	USA	converted Uranium to Plutonium
1952	**Hydrogen Bomb**	USA	by Edward Teller's team
1953	**Transistor Radio**	USA	from Texas Instruments
1954	**Robot**	USA	by George C Devol Jr
1954	**Solar Cell**	USA	also called photovoltaic cells
1955	**Atomic Clock**	England	
1955	**Hovercraft**	England	by Christopher Cockerell
1956	**Nuclear Power**	England	first power station at Calder Hall
1956	**Video Tape, Video Recorder**	USA	
1957	**Satellite**	Russia	Sputnik I
1958	**Computer Modem**	USA	
1958	**Microchip**	USA	by Jack Kilby
1959	**Lunar Probes**	Russia	Lunik I passed the Moon; Lunik II crashed on the Moon; Lunik III

			photographed the far side of the Moon
1960	**Heart Pacemaker**	USA	by Wilson Greatbatch
1960	**Laser**	USA	by Theodore Maiman
1960	**Weather Satellite**	USA	Tiros I
1961	**Human Space Travel**	Russia	Yuri Gagarin - the first human in space
1962	**Communication Satellite**	USA	Telstar
1962	**LEDs**	USA ?	Light Emitting Diodes - used for displays
1962	**Venus Probe**	USA	Mariner 2 - the first planetary probe
1963	**Tape Cassette**	Netherlands	used to record and play audio
1964	**Computer Mouse**	USA	by Douglas Engelbart
1965	**Hypertext**	USA	for linking text
1965	**Optical Disk**	USA	by James Russell - now Compact Disk
1965	**Space Walk**	Russia	Aleksei Leonov - first person oustide space vehicle
1966	**Fibre Optics**	England	by Charles Keo and George Hockham
1966	**Kevlar**	USA	by Stephanie Kwolek
1966	**Moon Landing**	Russia	Luna 9 lands softly on the Moon
1966	**Space Docking**	USA	Gemini VIII docks with an orbiting satellite

1967	**Portable Calculator**	USA	from Texas Instruments
1969	**Cash Dispenser**	Turkey	by Luther Simjian
1969	**CCDs**	USA	Charge Coupled Device - to capture image
1969	**Internet**	USA	US military
1969	**Manned Moon Landing**	USA	Neil Armstrong and Edwin Aldrin walk on Moon
1970	**LCDs**	England	by George Gray - Liquid Crystal Display
1971	**E-Mail**	USA	
1971	**Floppy Disk**	USA	by Alan Shugart
1971	**Microprocessor**	USA	
1973	**Barcode**	USA	by Norman Woodland
1973	**Genetic Engineering**	USA	by S Cohen and H Boyer
1973	**Space Station**	USA	Skylab
1975	**Laser Printer**	USA	
1975	**Personal Computer**	USA	by Steve Jobs and Bill Gates
1976	**Ink Jet Printer**	USA	
1977	**MRI Scanner**	USA	by Raymond Damadian
1978	**In Vitro Fertilisation**	England	"test tube baby","Medical
1981	**Scanning Tunnelling, Microscope**	Switzerland	produces contour map of molecules
1981	**Space Shuttle**	USA	Columbia was first reusable space vehicle
1986	**High Temperature Superconducto**	Switzerland	works at -196°C
1990	**Space Telescope**	USA	Hubble Telescope
1991	**Clockwork Radio**	England	by Trevor Baylis

1997	**Mammal Cloning**	Scotland	Dolly, the sheep
1999	**Digital TV Recorder**	USA	recording onto a hard disk
2000	**Molecular Transistor**	USA	
2001	**Nano-transistor**	Netherlands	
2004	**Metal Rubber**	USA?	conducts electricity and stretches