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UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MONTANA
GREAT FALLS DIVISION

CITIZENS FOR CLEAN ENERGY, et al., Plaintiffs, and THE NORTHERN CHEYENNE TRIBE Plaintiff, v. U.S. DEPARTMENT OF THE INTERIOR, et al., Defendants, and STATE OF WYOMING, et al. Defendant-Intervenors.	Case No. 4:17-cv-30-BMM (lead consolidated case) **AMICUS BRIEF ON BEHALF OF PROFESSOR MICHAEL GREENSTONE**
STATE OF CALIFORNIA, et al., Plaintiffs, v. U.S. DEPARTMENT OF THE INTERIOR, et al., Defendants, and STATE OF WYOMING, et al., Defendant-Intervenors.	Case No. 4:17-cv-42-BMM (consolidated case)

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Professor Michael Greenstone, one of the country's leading economists on the social costs of carbon, other greenhouse gases and other air pollutants and the former co-head of the federal Interagency Working Group that developed the Social-Cost-of-Carbon analytical tool, files this amicus brief to assist the Court in determining whether the Department of Interior acted lawfully when it revoked Secretarial Order 3338 and lifted its coal-leasing moratorium without having completed a programmatic environmental impact statement (PEIS) or a supplemental PEIS to evaluate the environmental impacts of resuming the Federal Coal Program.

BACKGROUND

On January 15, 2016, then-Secretary of the Interior Sally Jewell issued Secretarial Order 3338. This order directed the Bureau of Land Management (BLM) to undertake a programmatic environmental impact review of the federal coal-leasing program. See AR 8. BLM prepared a federal coal leasing PEIS in 1979, see AR 87376-88693 ("1979 PEIS"), and supplemented that PEIS in 1985, see AR 88694-90017 ("1985 SEIS"). Secretarial Order 3338 directed BLM to review several aspects of the program, including its effect on climate change, and imposed a moratorium on leasing during that review. See AR 8, 10–11.

On March 29, 2017, Secretary of the Interior Ryan Zinke issued Secretarial Order 3348, revoking Secretarial Order 3338. The new order declared that it was not in the public interest to maintain the leasing moratorium and that a programmatic environmental impact review was not needed. See AR 1. Secretarial Order 3348 directed BLM to resume processing coal lease applications and halted "[a]ll activities associated with the preparation of the Federal Coal Program PEIS." AR 2.

This amicus brief is relevant to the Court's assessment of (i) whether significant new scientific information justifies requiring BLM to prepare a supplemental PEIS for the coal leasing program and (ii) whether the Department's decision to revoke Secretarial Order 3338 constitutes a major federal action that could significantly affect the environment, justifying a PEIS. See Compl. for Decl. J. and Inj. Relief, ECF No. 1, at 30–33.

QUALIFICATIONS

Professor Greenstone is the Milton Friedman Professor in Economics at the University of Chicago and directs the interdisciplinary Energy Policy Institute and the Becker-Friedman Institute for Economics, both at the University of Chicago. In the last decade, Professor Greenstone's work has focused increasingly on understanding the economic effects of climate change and air pollution. While

serving as Chief Economist for the Council of Economic Advisers, Professor Greenstone co-led the federal Interagency Working Group on the Social Cost of Carbon that developed a government-wide approach to evaluating the costs and benefits of releasing greenhouse gases into the atmosphere. See Professor Michael Greenstone's Mot. for Leave to File an Amicus Br., ECF No. 87, at 6–9.

EXPERT INFORMATION

I. The Present State of Climate-Change Science

Integrated assessment models, which are used to predict and to quantify damages associated with emissions of greenhouse gases, have improved tremendously since BLM prepared its 1979 PEIS and 1985 SEIS. Formal integrated assessment models of climate change emerged in the late 1970s from earlier economic and technical models of energy policy. Coincidentally, it was also 1979 when researchers presented the first model that translated carbon dioxide (CO_2) emissions from energy generation into atmospheric concentrations, a critical step in estimating the environmental and related socioeconomic impacts of climate change. See J. Weyant et al., Integrated Assessment of Climate Change: An Overview and Comparison of Approaches and Results, Climate Change 1995 – Economic and Social Dimensions of Climate Change 367, 376 (James P. Bruce et

al. eds., 1996). The first attempt to represent fully the effects of greenhouse gases on changes in climate was not made until 1990 in a model called IMAGE 1.0. Id.

In 2009, the Interagency Working Group on the Social Cost of Carbon ("Interagency Working Group") selected three of the most advanced models in order to estimate the social costs of CO_2: the Dynamic Integrated Climate-Economy (DICE) model, the Climate Framework for Uncertainty, Negotiation and Distribution (FUND) model, and the Policy Analysis of the Greenhouse Effect (PAGE) model. See Interagency Working Group, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 4 (2010). The Interagency Working Group selected these models, in part, based on their widespread endorsement in the expert community: they are frequently cited in the peer-reviewed literature and were used in the Intergovernmental Panel on Climate Change assessment process. See, e.g., Nat'l Research Council, Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use 248–308 (2010). Each model contributes to the robustness and usefulness of the Social Cost of Carbon estimate, and each has been improved over time.

The DICE model: The DICE model is an optimal growth model, later augmented with an added variable for greenhouse-gas concentrations, which allows the model to account for both climate-change damages and damages

avoided because of investments made in the current period. When researchers at Yale University first presented the DICE model in 1977, it was limited to modeling energy supply and demand and did not include any representation of economic impacts from temperature changes. By 1991, the DICE model could generate a long-run, steady-state representation of the global economy that included estimates of both the long-term impacts of climate change and the costs of abating CO_2 emissions. In 1994, this steady-state model was recrafted to be fully dynamic, allowing calculation of how much money should be invested in a given time period to prevent costlier damages from climate change in a later period. Today, the DICE model separately accounts for three compartments of the earth's climate system—the lower atmosphere, the shallow ocean, and the deep ocean—making the model more accurate than ever before.

The FUND model: Developed in the late 1990s, the FUND model complements the DICE model by using a different data source and capturing already-observed climate-change effects for its calculations of climate-change damages. Updates to the FUND model have enabled it to account for how climate change affects eight sectors: agriculture, forestry, water, energy (based on heating and cooling demand), sea level rise (based on the value of land lost and the cost of protection), ecosystems, human health, and extreme weather. The model includes parameter uncertainty and accounts for both a change in absolute temperature and

the rate of temperature change; changes that happen quickly are much harder to adapt to, resulting in larger damages for a given temperature change, making the model more accurate.

The PAGE model: Created in 1991, the PAGE model includes probability distributions for all major inputs and model parameters, which allows the model to account for uncertainty while still providing bounded estimates of climate damages. Inputs into the model include all major greenhouse gases, and PAGE models results across ten economic sectors until 2100. The Interagency Working Group used the 2002 version of the PAGE model, which included the consequences of unlikely, but potentially catastrophic climate-change damages. Because the PAGE model incorporates probabilistic modeling through utilizing a random selection process for the uncertain variables in each run, the model can properly quantify damages from these low-probability, high-impact events.

Researchers today are working to improve the insights developed from these models. For example, I lead the Climate Impact Lab, a team of economists, climate scientists, data engineers, and risk analysts at the University of Chicago, the University of California Berkeley, Rutgers University, and the Rhodium Group. Our approach combines sets of "historical socioeconomic and climate data, allowing the team to discover how a changing climate has impacted humanity . . . , produc[ing] evidence-based insights about the real-world impacts of future climate

change using projections of temperature, precipitation, humidity, and sea-level changes around the world at a subnational scale." Climate Impact Lab, Our Approach, http://www.impactlab.org/our-approach/ (last visited Aug. 3, 2018). Our research aims to improve the damage functions that underlie these three integrated assessment models. One of our recent papers that I co-authored finds that these models greatly underestimate the costs associated with mortality risk due to climate change. See Tamma Carleton et al., Valuing the Global Mortality Consequences of Climate Change Accounting for Adaptation Costs and Benefits, University of Chicago Becker Friedman Institute for Economics Working Paper 2018–51, at 47 (2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3224365 (finding empirically that the cost of excess mortality risk from a metric ton of CO_2 emissions under RCP8.5 is $39, equal to 26 times the corresponding figure of $1.50 under RCP8.5 used in the Obama Administration's Social Cost of Carbon— meaning that "this paper's excess mortality partial [Social Cost of Carbon] is essentially as large as the Obama Administration's full [Social Cost of Carbon]." (emphasis in original)).

In sum, climate-damage assessments were barely in their infancy when the Department performed its PEIS for the coal-leasing program in 1979 and supplemented it in 1985. Most of the leading integrated assessment models had not been developed at that time, and all have undergone foundational improvements in

their predictive power and comprehensiveness since then. Furthermore, new evidence that is not yet reflected in these models can help refine further estimates of the costs of climate change.

II. The Social Costs of Carbon, Other Greenhouse Gases, Other Air Pollution and New Federal Coal Leasing

Combusting and mining coal emits greenhouse gases, including CO_2, and other air pollutants. These emissions impact human health, agricultural productivity, property, and the environment more generally. In 2016, the Interagency Working Group estimated the social cost of one ton of CO_2 emissions in 2007 dollars at $42 (for emissions in 2020), see AR 30569, the social cost of one ton of methane emissions in 2007 dollars at $1,200 (for emissions in 2020), and the social cost of one ton of nitrous oxide emissions in 2007 dollars at $15,000 per metric ton (for emissions in 2020), see Interagency Working Group, Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide 7 (2016). Inflating to 2018 dollars using the Consumer Price Index, the social cost of CO_2 emissions in 2020 is approximately $51 per metric ton, of methane emissions is approximately $1,500 per metric ton, and of nitrous oxide emissions is approximately $18,000 per metric ton. Other air pollutants that are emitted from

burning coal, such as particulate matter, impose their own significant additional costs. Because Secretarial Order 3348 lifted the moratorium on new federal coal leasing, coal that would have otherwise been left unused will now be combusted, which will produce significant social costs, as shown below.

A. The Social Cost of Carbon and Other Greenhouse Gases

The Social Cost of Carbon was developed to quantify damages associated with an increase in CO_2 emissions so that policymakers could make informed decisions and the public could be aware of the impacts of those decisions. The Interagency Working Group process ultimately produced a uniform estimate of the damages associated with each marginal ton of CO_2 emissions, commonly known as the Social Cost of Carbon. See Interagency Working Group, Technical Support Document, supra. The Social-Cost-of-Carbon analytic tool incorporates several different variables, including changes in net agricultural productivity, human health effects, property effects, and the value of ecosystem services. The 2010 Interagency Working Group process, which included subject-matter experts from six federal agencies and six offices from the Executive Office of the President, used consensus-based decision making to synthesize the leading academic literature and to calculate the Social Cost of Carbon; the Department of the Interior joined and participated in the group's 2016 process to update the value. The

Social-Cost-of-Carbon protocol has been cited in numerous academic studies, implemented by states and nations, used in more than 80 federal rulemakings and assessments, and has been upheld by courts in the National Environmental Policy Act context. See, e.g., High Country Conservation Advocates v. U.S. Forest Serv., 52 F. Supp. 3d 1174, 1190–93 (D. Colo. 2014); Mont. Envtl. Info. Ctr. v. U.S. Office of Surface Mining, 274 F. Supp. 3d 1074, 1094–99 (D. Mont. 2017); Sierra Club v. FERC, 867 F.3d 1357, 1375 (D.C. Cir. 2017).

While President Trump abolished the Interagency Working Group and withdrew its guidance, see Exec. Order No. 13,783 § 5, 82 Fed. Reg. 16,093, 16,095–96 (Mar. 31, 2017), his administration has not offered a scientifically valid replacement. Moreover, my scientific judgement is that the Social-Cost-of-Carbon protocol developed by the Interagency Working Group represents far and away the most credible approach for policymakers to assess marginal damages from CO_2 and other greenhouse gases.

In the process of developing the Social-Cost-of-Carbon protocol, the Interagency Working Group conducted an extensive review of the literature and identified the DICE, FUND, and PAGE models as the best available scientific tools for quantifying climate-change damages. The Interagency Working Group then set three key input parameters—socio-economic and emissions trajectories, climate sensitivity, and discount rates—across the three models. A range of

population, gross domestic product, and emission trajectories were inputted, and each discrete outcome was given equal weight in the Interagency Working Group's final derivation of the Social Cost of Carbon.

The Interagency Working Group updated the Social Cost of Carbon in 2016 using the same expert methodology described above. The update incorporated advancements in the individual models since 2010 and presented a new schedule of consensus estimates. See AR 30567. Given a central discount rate of 3%, this latest update reported the Social Cost of Carbon as $42 per metric ton of CO_2 in 2007 dollars for emissions in 2020. AR 30569.

While CO_2 is the most prevalent greenhouse gas, methane and nitrous oxide also contribute to climate change. The combustion of coal releases CO_2 and nitrous oxide into the atmosphere, while coal mining releases methane. Recognizing the damage potential of these pollutants, the Interagency Working Group convened in 2016 to quantify the costs associated with emissions of these other greenhouse gases. To calculate these costs, the Interagency Working Group adapted a 2015 peer-reviewed study on the effects of methane and nitrous oxide emissions that used a methodology consistent with the one used by the Interagency Working Group to develop the Social Cost of Carbon in 2010. This analysis estimated the 2020 value of the social costs of methane at $1,200 per metric ton and the social costs of nitrous oxide at $15,000 per metric ton, both in 2007 dollars. See

Interagency Working Group, Addendum to Technical Support Document, supra, at 7.

B. The Social Cost of Other Air Pollutants

The combustion of coal releases other air pollutants that impose significant health and welfare costs in addition to those related to climate change. For example, particulate air pollution, which includes soot, is associated with elevated mortality rates for adults and infants. In 2010, soot from U.S. coal-fired power plants caused an estimated 23,600 premature deaths and more than 500,000 cases of respiratory illness. See Nat'l Research Council, supra, at 154. Other pollutants emitted from coal combustion, such as sulfur dioxide, nitrogen oxide, and carbon monoxide, also pose threats to human health and well-being. The resulting damages include costs from days missed at work due to illness, increases in hospital visits, increases in purchases of prescription drugs to protect people against air pollution, and losses associated with premature deaths. See, e.g., Oliver Deschenes, Michael Greenstone & Joseph Shapiro, Defensive Investments and the Demand for Air Quality: Evidence from the NOx Budget Program, 107 Am. Econ. Rev. 2958 (2017). According to the National Research Council, total non-climate-change-related damages associated with energy consumption and use amounted to more than $120 billion in the U.S. in 2005. See Nat'l Research Council, supra, at

154. Nearly all of these damages resulted from the effects of air pollution caused by coal on our health and wellness.

Another way of thinking of these costs is that each kilowatt-hour of coal-generated electricity imposes 10.3 cents of damages in 2018 dollars to our well-being. This includes about 6.4 cents in climate-change damages and 3.9 cents in adverse health impacts resulting from non-greenhouse-gas air pollution. See Sec'y of Energy Advisory Bd., Report of the Task Force on the Future of Nuclear Power 16 (2016) (adjusting to 2018 dollars the figures of 5.8 cents from the "GHG [Greenhouse Gas] External Cost" column and 3.6 cents from the "Non-GHG External Cost" column for the "Conventional Coal" row for inflation from their original sources using the beginning-of-year Consumer Price Index). These costs are not captured by the market price of a kilowatt-hour and do not show up in the monthly budgets of power consumers, but we all pay for them in the form of shorter life spans, increased respiratory diseases, and a changing climate that threatens our way of life.

C. The Social Costs of New Federal Coal Leasing

BLM decides whether and when billions of tons of federal coal will be mined and ultimately combusted. The United States has the largest coal reserves in the world, with roughly 255 billion tons of recoverable coal. See AR 1552. A

substantial portion of these reserves are located within the 570 million acres of sub-surface mineral estate that fall under Bureau management. AR 1477. As of January 2017, more than 460,000 of those acres were under a total of 306 leases and producing coal at a rate of approximately 375 million tons per year. AR 1552, 1554. Coal mined from these 306 leases accounted for roughly 42% of all domestic coal production and 13% of all U.S. energy-related greenhouse gas emissions. AR 1569. The Bureau expects these 306 leases to produce 7.4 billion tons of coal before recoverable reserves on those lease sites are exhausted. AR 1552, 1554. More specifically, "mines under existing lease in the Powder River Basin, which accounts for nearly 90 percent of the total annual Federal coal production, cumulatively hold approximately 25 years of Federal reserves, assuming current production levels." AR 1553.

In previous analyses, I have found that the climate damages from Powder River Basin coal are about six times greater than the market value of that coal. See Michael Greenstone, There's a Formula for Deciding When to Extract Fossil Fuels, N.Y. Times, Dec. 1, 2015; Kenneth Gillingham, James Bushnell, Meredith Fowlie, Michael Greenstone et al., Reforming the U.S. Coal Leasing Program, 354 Science 1096–98 (2016). This is a shocking finding because it means that for every $1 of coal produced in the Powder River Basin (primarily in Wyoming and Montana), the climate damages alone are about $6. This underscores that Powder River Basin

coal—which comprises 90% of annual federal coal production—is greatly underpriced relative to its social costs. It is almost impossible to find other settings where $1 of economic activity creates $6 of damages, precisely because societies choose not to undertake such bad deals since they are so clearly bad. Put another way, activities where the costs exceed the benefits so substantially are very rarely in the public interest, and, at a minimum, the public interest is likely to benefit from a careful analysis.

Some back-of-the-envelope calculations help illustrate that BLM's leasing decisions have great consequence for society, given the absence of meaningful restrictions on CO_2 emissions in the U.S. power sector. Specifically, as of February 2017, BLM had 44 lease and lease-modification applications pending, requesting authorization to mine an additional 2.9 billion tons of federal coal. AR 92–94. If all of this coal were mined, it would very likely increase carbon emissions. If the electricity generated from this coal would replace electricity from zero-carbon-emission renewable sources such as wind and solar, then it would lead to an additional 4.9 billion metric tons of CO_2 emissions and approximately $250 billion in climate damages at $51 per metric ton of CO_2. See U.S. Energy Info. Admin., Carbon Dioxide Emission Coefficients (Feb. 2, 2016), https://www.eia.gov/environment/emissions/co2_vol_mass.php (stating a coefficient of 1.685 metric tons of CO_2 per one short ton of sub-bituminous coal).

If the coal-fired electricity replaced electricity generated from natural gas, it would lead to climate damages of roughly $135 billion. See William Moomaw et al., Annex II: Methodology, IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation 982 (O. Edenhofer et al. eds. 2011) (showing emissions from coal of 1001 grams CO_2/kilowatt-hour and emissions from natural gas at 469 g CO_2/kilowatt-hour).

These calculations exclude any additional emissions if the increased supply of coal reduced power prices and increased consumption, and they exclude the costs associated with both methane from the mining itself and other air pollutants from the combustion of the coal (which my previous research estimated to be an additional cost of approximately 60% of the cost of greenhouse gas emissions from combustion of coal, see Sec'y of Energy Advisory Bd., supra, at 16). So while these are very much back-of-the-envelope calculations, they illustrate the great consequences that BLM's decisions will have on the public interest. And, of course, these calculations ignore that over time there would likely be many more leases for additional mines and that there is a total of 147 billion metric tons of CO_2 embedded in the 87 billion short tons of untapped federal coal reserves. See Cong. Research Serv., U.S. and World Coal Production, Federal Taxes, and Incentives 6 (2013).

Because Secretarial Order 3348 lifted the moratorium on new coal leasing, and because coal that would have otherwise not been extracted will now be mined and burned, the social cost of new federal coal leases, as calculated above, would be significant. More analysis would be necessary to determine more precisely the marginal emissions and marginal social costs at stake; it is precisely this kind of analysis that BLM should have completed as part of an environmental impact statement before lifting the moratorium.

APPLICATION OF EXPERT INFORMATION TO THE ISSUES IN THIS CASE

Before this Court are the questions of whether the Department should have performed a supplemental PEIS or a PEIS before lifting the moratorium on new federal coal leasing. Tremendous advances in climate-damage science since the preparation of the 1979 PEIS and 1985 SEIS have fundamentally improved the predictive power and comprehensiveness of how we now evaluate climate-change damages and justify requiring the Department to perform a supplemental PEIS. The social costs of CO_2, other greenhouse gases, and other air pollutants that will result from new federal coal leasing will have a significant effect on the environment, the economy and society, which supports requiring the Department to perform a PEIS. The advances in climate-damage science and significance of the social costs of mining and combusting this incremental federal coal are

certainly relevant factors that the Department should have considered before lifting the moratorium. See Professor Michael Greenstone's Mot. for Leave to File an Amicus Br., ECF No. 87, at 13–15.

I. Significant New Information Supports Requiring a Supplemental PEIS.

The National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321-4370h, requires an agency to supplement a final environmental impact statement when there are "significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." 40 C.F.R. § 1502.9(c)(1)(ii). "Significant new circumstances or information" are insights or observations that are "sufficient to show that the remaining [federal action] will affect the quality of the human environment in a significant manner or to a significant extent not already considered." Marsh v. Or. Nat. Res. Council, 490 U.S. 360, 374 (1989). The federal coal program is overdue to be reevaluated in light of the significant advances in climate-damage science.

The 1979 PEIS was based on the rudimentary and now-outdated view that there is uncertainty as to the connection between CO_2 emissions and climatic changes. BLM's 1979 PEIS cites a 1977 Energy and Climate report from the National Research Council that found uncertainties about the carbon cycle and the net effects of CO_2 on temperature and climate. See AR 87765. While the PEIS

presents a very general and cursory description of how atmospheric CO_2 causes a greenhouse effect that could disrupt marine life, ocean circulation, precipitation, winds, humidity, and agriculture, it states that these effects are challenging to predict given the uncertainty surrounding both the ultimate fate of CO_2 released into the atmosphere and how fossil fuel combustion contributes to atmospheric CO_2 levels. AR 87784. As another example, the 1979 PEIS observes that "there are uncertainties about . . . the net effects of carbon dioxide on temperature and climate" and notes "some experts" view that CO_2 increases could lead to higher average temperatures, but did not describe the effects of those potential temperature changes. AR 87765. Summing up this uncertainty, BLM states that "a long-term warming trend in the earth's climate might result from the build-up of carbon dioxide in the atmosphere – the greenhouse effect." AR 87914.

Climate scientists now know not only that "it is extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming since the mid-20th century," but also that this warming trend is causing substantial social and economic harm to the human environment. D.J. Wuebbles et al., Climate Science Special Report: Fourth National Climate Assessment, Volume I, U.S. Global Change Research Program, 10 (2017), https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf. According to the Intergovernmental Panel on Climate Change (IPCC), established

in 1988 to understand better the effects of climate change, "[c]ontinued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems." IPCC, Climate Change 2014: Synthesis Report 8 (2014), https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf. In short, over the last four decades, advances in climate science have eliminated many of the uncertainties in the cursory climate-change discussion in BLM's 1979 PEIS and 1985 SEIS.

The availability of the integrated assessment models described above is a seismic change because those models translate levels of greenhouse-gas emissions to climate-damage impacts. The Bureau did not have access to these models when it completed the 1979 PEIS or 1985 SEIS because the models simply did not exist. BLM presented estimates of the amount of CO_2 emissions and how CO_2 emissions could build-up in the atmosphere, see AR 87765, 87781, 87784, 87788, but emissions themselves are not impacts. Rather, the marginal CO_2 emissions that will result from combustion of federal coal exacerbate or accelerate changes in the climate that will alter agricultural productivity, human health, ecosystem services, property, and other critical determinants of human well-being. Those changes are the actual impacts, the actual damages for which the models account, and the ones which BLM could not account for prior to the development of these models.

Monetized estimates of the economic damages associated with greenhouse gases and air pollution now make it possible for decision-makers and the public to consider the costs and benefits of decisions that are expected to affect the level of these emissions. These monetized estimates of the damages from climate change and other air pollution are an entirely new category of information that was unavailable in 1979 and "provides a seriously different picture of the environmental" impacts of the federal coal program. City of Olmsted Falls v. FAA, 292 F.3d 261, 274 (D.C. Cir. 2002) (describing circumstances when NEPA requires SEIS).

II. The Climatic and Socioeconomic Impacts from New Coal Leasing Are Significant and Support Requiring BLM to Produce a PEIS.

NEPA requires agencies to take a "hard look" at environmental consequences before taking a major action. Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, 462 U.S. 87, 97 (1983). If this "hard look" raises "substantial questions . . . as to whether a project may cause significant degradation of some human environmental factor," then the agency overseeing the project must prepare an environmental impact statement. Mont. Envtl. Info. Ctr. v. U.S. Office of Surface Mining, 274 F. Supp. 3d 1074, 1099 (D. Mont. 2017) (quoting Ocean Advocates v. U.S. Army Corp of Eng'rs, 402 F.3d 846, 864–65 (9th Cir. 2005)).

In this case, the assessment provided above of the social costs of greenhouse gases and other air pollution emissions unequivocally demonstrates that BLM's decision to resume federal coal leasing will significantly affect the environment. If all of 2.9 billion tons of coal that were proposed in February 2017 to BLM to be mined were actually mined, combustion of that coal would very likely increase overall carbon emissions. If the coal-fired electricity replaced electricity generated by renewables, then it would lead to approximately $250 billion in climate damages, while if the coal-fired power replaced electricity from natural gas, it would lead to climate damages of roughly $135 billion. Again, these calculations exclude any additional emissions if the increased supply of coal reduced power prices and increased consumption, and they exclude the costs associated with methane from the mining itself and with other air pollutants from the combustion of the coal. See The Social Costs of New Federal Coal Leasing, supra.

It is clear that BLM's action to resume leasing federal coal has high potential to lead to damages from greenhouse gases and other air pollutant emissions that will cost society billions of dollars. In my opinion, that is certainly an action with significant environmental effects that merits a comprehensive, up-to-date, and technically sound analysis through a PEIS or supplemental PEIS that uses tools like the Social Cost of Carbon and others that account for other greenhouse gas and other air pollutant emissions.

CONCLUSION

Our ability to estimate and to monetize damages resulting from climate change has progressed exponentially since BLM's 1979 PEIS and 1985 SEIS. By combining three of the leading climate models, the Interagency Working Group's social costs of CO_2, methane, and nitrous oxide offer agencies and the public critical tools for assessing the costs of federal actions. Other research has established environmental and public health costs from other air pollution that should be considered too. Using these tools reveals that the Department's decision to resume federal coal leasing—a decision that has not been analyzed with the benefit of the significant scientific advancements of the past four decades—is a major federal action that will significantly affect the human environment.

Professor Michael Greenstone therefore respectfully submits his Amicus Brief in this matter.

DATED this 3rd day of August, 2018.

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CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION

Pursuant to L.R. 7.1(d)(2), I certify that this brief contains 5,000 words. I relied on my Microsoft Word word-processing tool to obtain the word count.

Respectfully submitted August 3, 2018.

s/ Mark Templeton

Mark Templeton

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing was served today, August 3, 2018, via the Court's CM/ECF system on all counsel of record.

s/ Mark Templeton

Mark Templeton